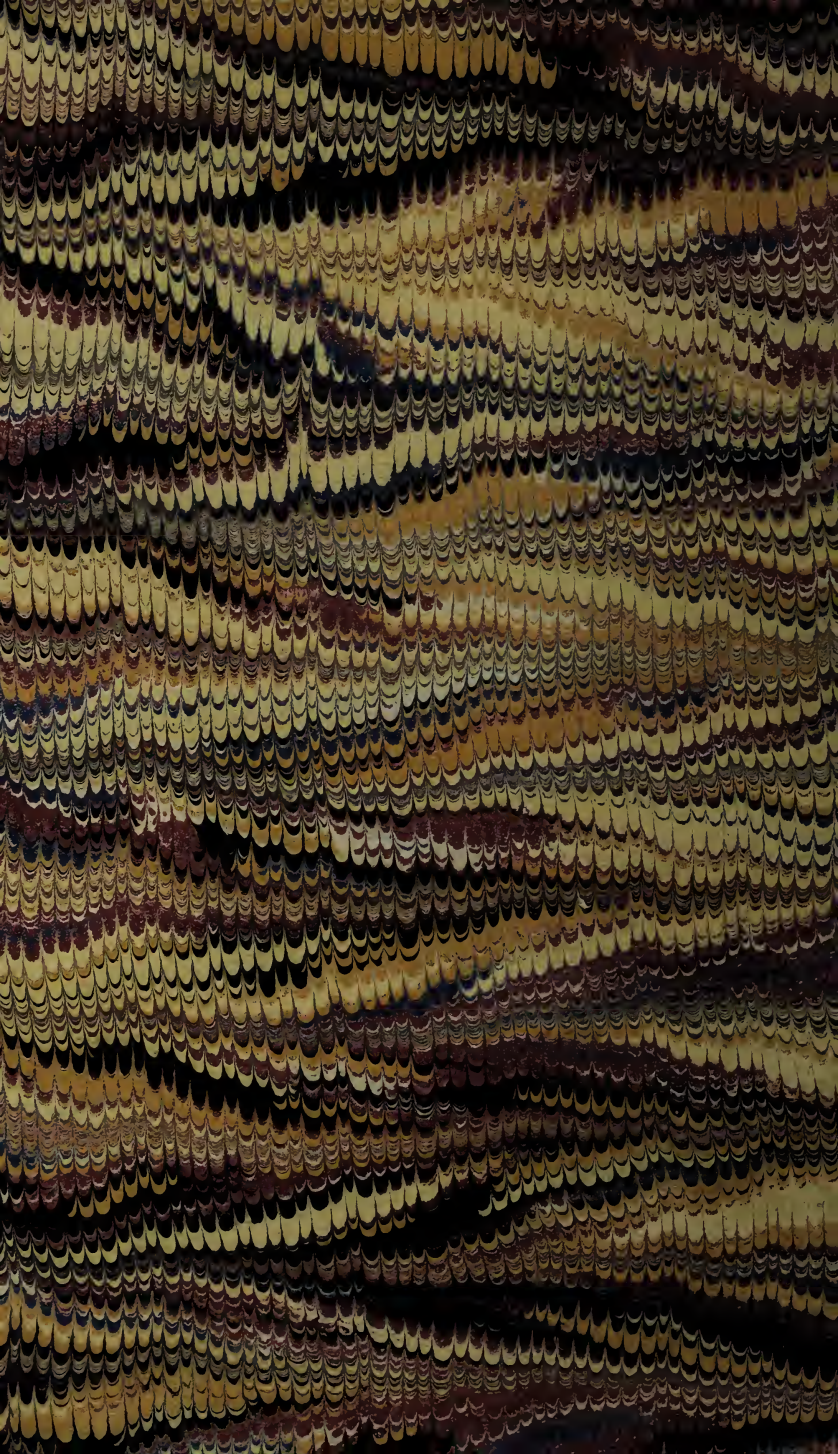

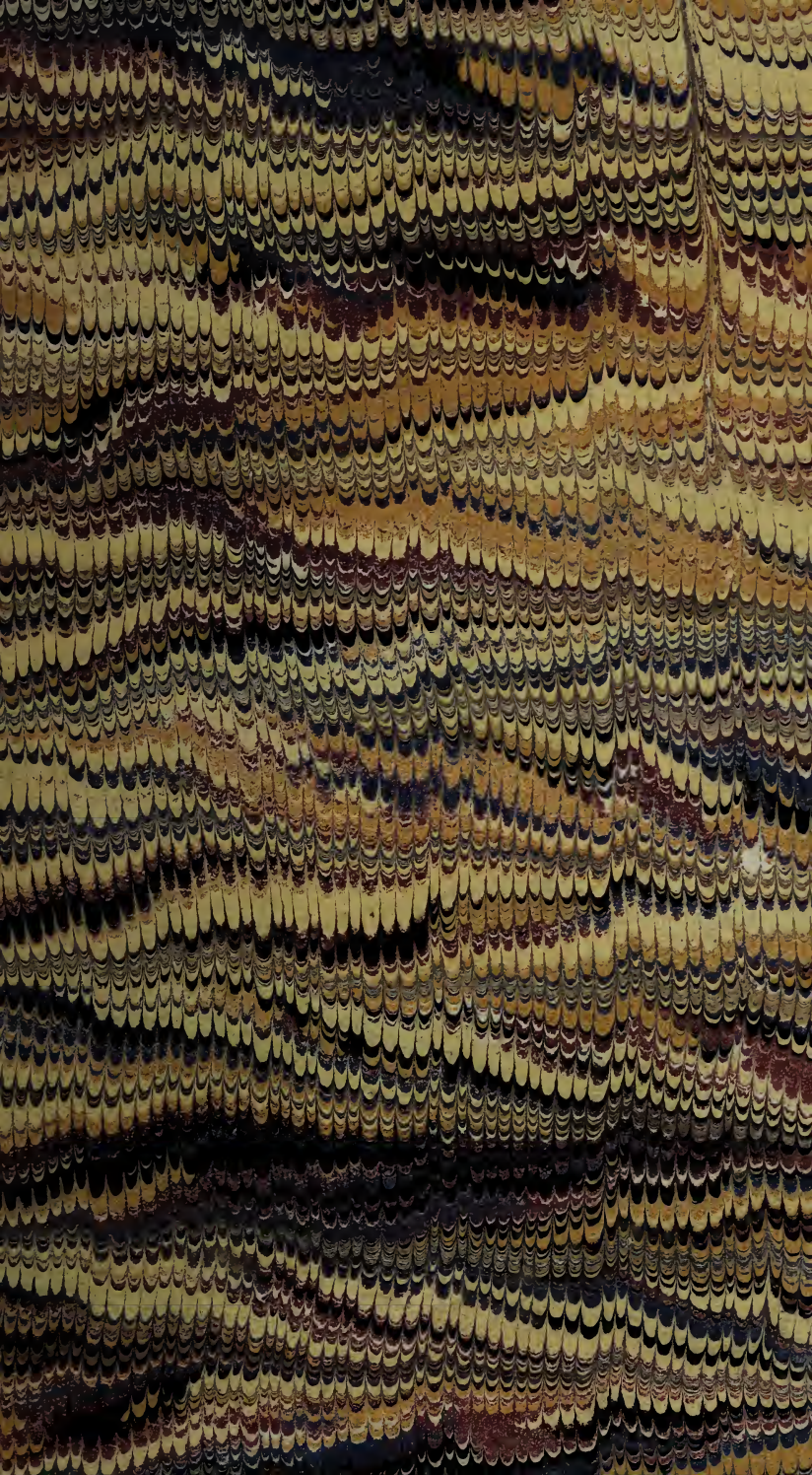

BRITISH ALGÆ.

A

MANUAL

OF

THE BRITISH ALGÆ:

CONTAINING

GENERIC AND SPECIFIC DESCRIPTIONS OF ALL THE KNOWN BRITISH SPECIES OF SEA-WEEDS, AND OF CONFERVÆ, BOTH MARINE AND FRESH-WATER.

BY

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" Vere magna et longe pulcherrima sunt etiam illa, profundissima sapientia hic exstructa opera tua, OH JEHOVAH! quæ non nisi bene armatis nostris oculis patent! Qualia autem erunt denique illa, quæ sublato hoc speculo, remota mortalitatis caligine, daturus es tuis, Te vere sincero pectore colentibus! Eheu qualia!" — *Hedwig.*

INTRODUCTION.

WHOEVER has paid the slightest attention to the classification of natural objects, whether plants or animals, must be aware, that if we desire to follow natural principles in forming our groups,—that is, to bring together such species as resemble each other in habit, properties and structure,—it is a vain task to attempt to define, with absolute strictness, the classes into which we are forced to combine them. At least, no effort to effect this desirable object has yet been successful. Natural groups are so interwoven into each other, and often exhibit such an exaltation and degradation of characters within the limits of an Order or a Genus, that the distinctive marks, as they approach each other, gradually disappear, and two tribes, which in the more highly developed species, scarcely resemble each other, are found, in the lower, to be either undistinguishable or with difficulty distinguished. Thus, to a common observer, the Poppy and the Fumitory would scarcely be supposed to be closely related; yet there is such a perfect gradation between them, through allied genera, that they are now generally referred to the same natural order. Still more unlike in appearance are the *Rose* and the *Shamrock*, yet they belong to orders so closely connected, that the only invariable mark by which they can be distinguished is, that in

one, what is called the *odd* segment of the calyx is posterior, while in the other it is anterior; and till this was pointed out by Mr. R. Brown, botanists were at a loss to *define* the respective orders, though very seldom indeed puzzled as to whether a genus were Rosaceous or Leguminous. If it be thus difficult to *define* groups among highly organized plants, it can be no matter of wonder that when we come to the CRYPTOGAMIA, whose structure is so much more simple and uniform, and whose forms are still more sportive, the difficulties become vastly increased. But it fortunately happens that these difficulties are much more formidable on paper than in the field. Thus, while the systematizer, in his study, may consume the midnight oil till his aching brains are weary with the fruitless task, in attempting to express in words a character which shall include every species of the class ALGÆ, and, at the same time, exclude every denizen of the allied groups, FUNGI and LICHENES; the student, roaming through the fields or along the sea-shore, finds no difficulty whatever in recognising a *sea-weed* as distinct from a *mushroom* or a *Lichen*. The search into structure and affinities among the works of creation is something like that after first principles. We can distinguish and analyse up to a certain point: there we are stopped by that invisible and intangible, but impassable veil, in which the Creator hides his operations. At this point we must rest satisfied with differences which we can *see*, but which we cannot *know* or *define*. Dismissing therefore, speculations on the exact limits between ALGÆ and all other tribes, let us proceed to consider the subject more immediately before us, namely, the *habit, structure, geographical distribution* and *uses* of these plants.

The name ALGÆ is assigned by botanists to a large group or *natural class* of Cryptogamic or flowerless plants, which form the principal and characteristic vegetation of the *wa-*

ters. The sea, in no climate from the poles to the equator, is altogether free from them, though they abound on some shores much more than on others, a subject which will come particularly under notice when we speak of the distribution of their several tribes. Species abound likewise in fresh water, whether running or stagnant, and in mineral springs. The strongly impregnated sulphureous streams of Italy,—the eternal snows of the Alps and arctic regions,—and the boiling springs of Iceland, have each their peculiar species; and even chemical solutions, if long kept, produce Algæ. Very few, comparatively, inhabit stations which are not submerged or exposed to the constant dripping of water; and, in all situations where they are found, great dampness, at least, is necessary to their production.

Thus extensively scattered through all climates, and existing under so many varieties of situation, the species are, as one would naturally suppose, exceedingly numerous, and present a greater variety in form and size than is observable in any other tribe of plants whose structure is so similar. Some are so exceedingly minute as to be wholly invisible, except in masses, to the naked eye, and require the highest powers of our microscopes to ascertain their form or structure. Others, growing in the depths of the great Pacific Ocean, have stems which exceed in length (though not in diameter) the trunks of the tallest forest trees; and others have leaves that rival in expansion those of the Palm. Some are simple globules or spheres, consisting of a single *cellule* or little bag of tissue filled with a colouring matter; some are mere strings of such cellules cohering by the ends; others, a little more perfect, exhibit the appearance of branched threads; in others, again, the branches and stems are compound, consisting of several such threads joined together; and, in others, the tissue expands into broad flat fronds. Only the higher tribes show any distinction into stems and leaves, and even in these, what

appears a stem in the old plant, has already served at an earlier period of growth, either as a leaf, as in *Sargassum* and *Cystoseira*, or as the midrib of a leaf, as in *Delesseria*. A few exhibit leaves or flat fronds formed of a delicate, perforated net-work, resembling fine lace or the skeletons of leaves, a structure which is also found among zoophytes. Of those so constructed the most remarkable are the New Holland genus, *Claudea*, the East Indian *Dictyurus* (*Callidictyon*, Grev.) and a genus still unnamed, lately discovered at Port Natal, in South Africa, by Dr. Krauss, which produces fan-shaped fronds, the lower half of which has the structure and colour of *Nitophyllum*, the upper that of the delicate net-work of *Claudea*. Among British Algæ, the only structure analogous to these exists in *Hydrodictyon*, which grows in the form of a perfect net, with regular meshes.

The *substance* of which the frond consists is as variable as the form. Some are mere masses of slime or jelly, so loose that they fall to pieces on being removed from the water; others resemble, in feel and appearance, threads of silk; some are stiff and horny; others are cartilaginous, or with the aspect and elasticity of gristle; others tough and coriaceous, or resembling leather; while the stems of some of the larger kinds are almost woody. The leaves of some are delicately membranaceous, glossy and transparent; of others, coarse and thick, and either wholly destitute of nerves, or furnished with more or less defined ribs; or beautifully veined. Among the most minute kinds, many (comprising the family *Diatomaceæ*) are cased with organized *silex*, and these cases, which resist the action of fire, are found, in countless myriads in a fossil state, in many countries, covering miles of ground, or forming mountains, and presenting to the naked eye a whitish, powdery substance, known by the name of "mountain meal."*

* See Ehrenberg's discoveries.

In *colour*, the Algæ exhibit three principal varieties, with, of course, numerous intermediate shades, namely, *grass-green, olivaceous, red.* The *grass-green* is characteristic of those found in fresh water, or in very shallow parts of the sea, along the shores, and generally above half-tide level; and is rarely seen in those which grow at any great depth. But to this rule there are exceptions, sufficiently numerous to forbid our assigning the prevalence of this colour altogether to shallowness of water. Several of the more perfect *Conferveæ* and *Siphoneæ* grow beyond the reach of ordinary tides; and others, as the beautiful *Anadyomene*, are sometimes dredged from very considerable depths. The great mass, however, of the green-coloured species, are inconsiderably submerged. The *olivaceous-brown* or *olive-green* is almost entirely confined to marine species, and is, in the main, characteristic of those that grow at half-tide level, becoming less frequent towards low-water mark; but it frequently occurs also at greater depths, in which case it is very dark, and passes into brown or almost black. The *red* also, is almost exclusively marine, and reaches its maximum in deep water. When it occurs above half-tide level it assumes either purple, or orange, or yellow tints, and sometimes even a cast of green, but in these cases it is sometimes brightened by placing the specimens, for a short time, in fresh water. It is rarely very pure much within the range of extreme low-water mark, higher than which many of the more delicate species will not vegetate; and those that do exist degenerate in form as well as in colour, as they recede from it. How far below low-water mark the red species extend has not been ascertained, but those from the extreme depths of the sea are of the olive series in its darkest form. For the colours of these last it has puzzled botanists not a little to account. It is well known that *light* is absolutely necessary to the growth of land-plants, and that the green colour of their

foliage altogether depends upon its supply: and if they be placed in even partial darkness the green quickly acquires a sickly yellowish hue, and finally becomes whitish. But with Algæ it is different. At enormous depths, to which the luminous rays, it is known, do not penetrate, species exist as fully coloured as those along the shore. They therefore, in this respect, either differ from all other plants (FUNGI included), or perhaps, what are called the *chemical* rays, in which seem to reside the most active principles of solar light, may be those which cause colour among vegetables, and these *may* penetrate to depths to which luminous rays do not reach. But this is mere supposition. Lamouroux suggests that "the particles of light, or its elementary molecules combined, or mixed with the water," suffice for this purpose. However this may be, it is worth remarking that this property among Algæ, of producing vigorous growth and strong colour without the agency of light, affords another link between them and the animal kingdom, among the lower tribes of which, light is by no means essential to growth and the most brilliant colour.

There is this difference also in the distribution of colours among Algæ to what obtains among other plants. Among plants in general, nothing is so variable or uncertain as colour; far from serving as a mark to distinguish groups or genera, it does not even aspire to the rank of a specific character, and the utmost to which it can pretend is to separate one variety of a species from another. Among Algæ, on the contrary, it has been ascertained that the classes of colour enumerated above, are, to a great extent, indicative of structure, and consequently of natural affinity. Thus, the *green* species are of the simplest structure, and differ remarkably in their mode of propagation from either of the other tribes, their seeds being endowed at the period of germination with a sort of motion, which some have

called voluntary, but which does not really possess that animal property. The *olivaceous* are the most perfect and compound, and reach the largest size; and the *red* form a group distinguished not less by the beauty and delicacy of their tissue, than by producing seeds under two forms, thus possessing what is called a double fructification. Hence, modern botanists, since the publication of Lamouroux's system, have, whatever their particular views of arrangement may be, almost invariably used *colour* as one of the principal characters on which their systematic arrangement is based, and to a great extent it may be safely trusted.

But the young student must be careful not to place too absolute dependance on this character, in referring plants which he may gather to their place in the system; for some species, which in their healthy state are red, or of that class of colour, become, when growing under unfavourable circumstances, of an orange, yellowish, whitish, or greenish shade. *Laurencia pinnatifida* is particularly variable in this respect. When this species grows near low-water mark, it is of a fine, deep, purple-red; a little higher up it is dull purple-brown; higher still a pale brownish-red, and, at last, near high-water mark, it is often yellowish or greenish. The other species of *Laurencia* vary in similar but less striking degrees. *Chondrus crispus* too, when found in shallow water, is often of a bright herbaceous green; and *Ceramium rubrum* passes through every shade of red and yellow, and at last degenerates into a dirty white, before it ceases to grow. All these species vary in form and size, as they do in colour, and the various anomalous shapes that they assume are almost sure to deceive a young botanist into the belief that the varieties are so many different species.

Many species, whilst growing under the surface of the water, reflect colours which perish almost immediately after they are removed to the air. Of this class are several spe-

cies of *Cystoseira*, especially *C. ericoides*, which, though really of a greenish-olive, appears, when growing under water, to be clothed with the richest phosphoric greens and blues, changing momently, as the branches move to and fro in the water. Similar colours have been observed, though in a less striking degree, on some species of the *red* series. The genus *Iridæa* derives its name from this character, though our *I. edulis* is not remarkable in this respect. *Miss Ball* and *Mr. W. Thompson* have observed *Chondrus crispus* to be occasionally iridescent. At the Cape of Good Hope, *Champia compressa*, and an undescribed species of *Chylocladia* (*C. iridescens*), present very brilliant rainbow colours. *Miss Hutchins* observed that *Conferva Hutchinsiæ* has changeable glaucous tints when fresh, and looks almost white when seen through the water. The cause of these brilliant colours has not been particularly sought after. One may naturally suppose that they arise, like those of mother-of-pearl, from the finely striated or fibrous surface of the plant; but no one has noticed what is the peculiarity in the epidermis of these plants, that other allied species, that are not iridescent, do not possess. The microscope, in careful hands, ought to solve this problem.

There are other species which really change colour shortly after their removal from the water, as the various kinds of *Sporochnoideæ*, which pass rapidly from a clear olive to a verdigris-green. But this is the effect of death and incipient decomposition, for with the colour they lose their crispness, become flaccid, and emit an offensive odour, and, as has been observed by botanists, possess the remarkable property of changing the colour of other small filiform Algæ with which they may come in contact. No doubt this is owing to the development of some active chemical agent, (perhaps *Bromine*). *Professor Mertens*, in describing the circumstance as occurring with *Desma-*

restia ligulata and *D. aculeata*, says, that these species remain unaltered while they cause decay around them. But this I have not found to be the case. The *Desmarestia* always loses its rigidity, and its original olive is changed to verdigris before it possesses any destructive power. The *Fucoideæ* become black on exposure to the air. The *Laminarieæ*, on the contrary, first become green and finally white, under similar circumstances. Many of the *Florideæ* are much brightened in colour after having been cast upon the beach, especially if exposed to rain and sunshine. Amongst those of our own shores, *Plocamium coccineum* and *Dasya coccinea* are conspicuous in this respect. Both are, originally, of a dull, deep pink, but when thrown up and a short time exposed, become of a very rich scarlet-crimson. But *Gelidium cartilagineum*, so common at the Cape of Good Hope, often presents the most splendid gradation of colour in a single specimen, from dull purplish-pink (its original dye) through scarlet, orange, yellow, and verdigris-green to white; to which colour all the red and green species may be bleached after long exposure.

Among the more delicate tribes several are instantly altered by being plunged into fresh water. *Nitophyllum versicolor*, as *Mrs. Griffiths* has observed, is remarkable in this respect; its full pink being instantly changed to a bright orange. *Delesseria hypoglossum* and *ruscifolia* have the same peculiarity, as have many of the *Callithamnia* and *Griffithsiæ*, and other delicate *Florideæ*. All these changes are accompanied by decomposition. In the case of *Griffithsiæ** especially, shortly after the change, the colouring matter of the joints is abundantly discharged with a crackling noise through the ruptured membrane, staining with a beautiful carmine colour, the water or the paper to which the specimen has been removed. No doubt a fine

* See an excellent description of this in a paper by Dr. Drummond, of Belfast, in 'Mag. Nat. Hist.' vol. ii. p. 121.

lake could be prepared either from *G. setacea* or *multifida*, could they be procured in sufficient quantity. Paper stained by them retains its colour after many years in the herbarium. At the Cape of Good Hope there is a species of *Callithamnion* (*C. purpuriferum*), which, when growing, is of a dull, deep, greyish-brown, with but a slightly reddish hue; but the moment it is placed in fresh water it discharges an abundance of fine, brilliant, purple powder, and almost immediately becomes flaccid and putrid. Many of the *Polysiphoneæ* also, which are, when growing, of a brown colour, become, in fresh water, purple or pink. Heat converts the colour of most species to green. If any of the *Fucoideæ* be plunged in boiling water they rapidly assume a bright green, but, on removal, revert to their original olive, and finally to black. The colours of *Florideæ* may be more permanently changed, and also to green, by similar treatment. *Dictyoteæ* perhaps are less affected by fresh water, either cold or hot, than any others. Some of them are nearly unchanged; others assume more or less of a green shade.

Most Algæ are, at some period of their growth, found attached to other substances by means of a *root*, or at least a hold-fast. It has been doubted whether, as no distinct vessels of absorption have been discovered, they receive any nourishment through this organ, but the question is by no means settled. Thus much is at least certain; they appear to be as much influenced by the soil in which they grow as other plants are, for different species of rock afford different kinds in greater perfection, and a large number of those that are parasitical confine themselves to particular species. This selection of habitat would seem to prove that the root is not so sluggish an organ as it has been supposed to be. It does not, however, present much modification, and rarely attains a large size. The usual form is that of a hard, callous disk; sometimes this is

accompanied by fleshy fibres; and occasionally, but rarely, the root consists of an extensive creeping mass of fibres. This latter form is most remarkable in the genus *Caulerpa*, the species of which grow on sand, and consequently, require the support of an extensively ramified, penetrating and compact root. Some species, which, under ordinary circumstances, are attached by roots, occasionally dispense with them, and continue to flourish independently of them. Of these the most remarkable are *Sargassum bacciferum* and *vulgare* (?), which, under the Spanish name "Sargasso," or the English "Gulf-weed," have forced themselves on the notice of all voyagers who have crossed the Atlantic since the time of Columbus. The vast fields of sea-weed which were met with by "the adventurous Genoese" and his early followers, which made the ocean appear like a meadow, and sensibly impeded the course of their small vessels, consisted of these species. According to Humboldt there are two principal banks; one, the largest, extending from the 25th to the 36th degree of north latitude, and a little west of the meridian of Fayal, one of the Azores; the other, which is much smaller, a short way west of the Bahamas, and between the 22nd and 26th degrees of latitude. These localities of the banks, however, can but be considered as approximations, for with plants that float about wherever the winds and currents drive them, no very certain station can obtain. Vessels returning from the Cape of Good Hope, sometimes, in these latitudes, pass through immense fields of it; and others, though steering exactly the same course, and at the same season, meet with scarcely any. I have made the voyage three times, and only once met with sea-weed in sufficient quantity to claim any attention. It did not then occur in strata resembling fields, but rather in ridges, from ten to twenty yards broad and of great length, stretched across the sea. The species invariably found in these was *S. bac-*

ciferum. Of a large quantity that we dredged up for several successive days not a particle belonged to *S. vulgare*, and I am much inclined to suspect that most, if not all, of the stories related by voyagers as of that species, belong to *S. bacciferum*, a plant which has never been found in any other situation than floating about in the deep sea, whereas *S. vulgare* (the *Fucus natans* of Turner), is well known in many tropical countries to grow on the rocks, within the reach of the tide, like others of the genus. It is therefore much to be regretted that the name of *natans* was not retained for *S. bacciferum*, to which it is chiefly, if not only, applicable. Authors who have written on this *Fucus* have much disputed, both respecting its origin and whether it continues to grow whilst floating about. Nothing at all bearing on the former question has yet been discovered, for though species of *Sargassum* abound along the shores of tropical countries, none exactly corresponds with *S. bacciferum*. That the *Ancestors* of the present banks have originally migrated from some fixed station is probable, but farther than probability we can say nothing. That it continues to flourish and grow in its present situation is most certain. Whoever has picked it up at sea, and examined it with any common attention, must have perceived not only that the plants were in vigorous life, but that new fronds were continually pushing out from the old, the limit being most clearly defined by the *colour*, which, in the old frond, is foxy-brown; in the young shoots pale, transparent olive. But how is it propagated, for it never produces fructification? It appears to me that it is by breakage. The old frond, which is exceedingly brittle, is broken by accident, and the branches, continuing to live, push out young shoots from all sides. Many minute pieces that I examined were as vigorous as those of larger size, but they were certainly not seedlings, and appeared to me to be broken branches, all having a piece of *old frond* from

which the young shoots sprung. As the plant increases in size it takes something of a globular figure, from the branches issuing in all directions, as from a centre. On our own shores we have two species analogous to *S. bacciferum* in their mode of growth, namely, *Fucus Mackayi*, and the variety *β. sub-ecostatus* of *Fucus vesiculosus*, (*F. balticus*, Ag.) Neither of these has ever yet been found *attached*, though they often occur in immense strata; the one on the muddy sea-shore; the other in salt marshes, in which situations, respectively, they continue to grow and flourish; and it is remarkable that neither has ever yet been found in fructification, in which respect also they strikingly coincide with *S. bacciferum*. And if it be hereafter shown that *F. Mackayi* is merely *F. nodosus*, altered by growing under peculiar circumstances, may it not be inferred that *S. bacciferum*,—which differs about as much from *S. vulgare* as *F. Mackayi* does from *F. nodosus*, — is merely a pelagic variety of that variable plant?

In *structure*, whilst there is a great variety among the different tribes of Algæ, we find, in material points, a perfect similarity among all. All consist of simple cellular tissue, or of its elements, *gelatine*, *membrane*, and *endochrome*, variously elaborated and perfected. No vessels or ducts have been discovered in any, nor does woody fibre, though of common occurrence among the *Fungi*, exist in them. The *gelatine* is perfectly transparent in all, but differs greatly in consistency in different species, but without much regard, seemingly, to the comparative perfection of the structure of which it forms a part. Thus it is often as lax and as slimy in some plants of the higher tribes, as in those of lower organization, and some of the latter have it as firm and consistent as any of the former. Thus the frond of *Champia* and *Chylocladia* among Floridæ is filled with a watery gelatine; that of *Splachnidium* among Fucoideæ with a loose, slimy matter; whilst *Rivularia*

among Oscillatorieæ has a singularly firm and consistent jelly. In *Mesogloia* it is very loose, investing the threads of which the frond is composed with a lubricous sheath. In *Gigartina*, *Chondrus*, &c., it is so firm as to give those plants the consistence of cartilage, and in these it is immediately dissolved in hot water, opening to us a curious and unexpected affinity between them and *Mesogloia;* for if a branch of any *Gigartina* be plunged into hot water it will be converted, by the dissolving of its gelatine, into one having all the characters of the frond of the former genus. Thus we find that there is no distinction in the structure of the frond between these two apparently dissimilar genera, than what results from one having a firmer gelatine than the other.

The *cellular* tissue of Algæ presents some varieties. The most common form of the cellule is cylindrical, often of very small diameter in proportion to its length; and, in such cases, the cellules always cohere by the ends into threads or *filaments*, bundles of which, either branched or simple, form the *frond* by lateral cohesion. The fronds of many of the simple kinds, *Conferveæ*, *Ceramieæ*, &c., consist of a single thread, or string of cellules or *joints*. Those which are more compound may generally be resolved into such threads by macerating small portions, either in hot water, or if that prove ineffectual, in diluted muriatic acid. If a branch of a *Fucus* (say *F. tuberculatus*), be so treated, and a thin longitudinal slice be then examined with the microscope, it will be found to consist of four distinct portions concentrically arranged, which Lamouroux, who first observed minutely the anatomy of these plants, compares, perhaps too fancifully, to the epidermis, bark, wood, and medullary sheath of exogenous plants. The central portion, corresponding to to the medulla, occupies fully a third of the diameter of the branch, and is composed of densely packed, longitudinal, parallel fibres, or

strings of cellules, firmly cohering into one compact mass. Outside this is a much less dense layer, of a paler colour, composed of branched, anastomosing fibres, partly horizontal and partly vertical, inextricably laced together; and surrounding these, which represent the wood, is a third and much denser and darker coloured layer (bark), which is altogether composed of horizontal, radiating, simple fibres, very densely packed together. Outside this portion, and forming the outer coat of the frond, is a very thin layer of cellules, which is frequently but loosely attached, and separates much in the manner of an epidermis. Something similar to this, which we may call the *analogy* of the Exogenous type among Algæ, is the structure of many of the larger kinds, both of the red and olive series, but minor variations occur in the comparative substance of the different layers. Thus, in some the centre is very loose and gelatinous, with merely a few scattered fibres, while the outer coat is very dense. The second circle (that representing wood) is never, I believe, so dense as the others, and very generally consists of branched, interlacing and colourless fibres, and from it fructification generally, if not always, proceeds. Another common form of the *cellule* is that of an irregular, very rarely regular, polygonal solid, resulting from the lateral and vertical pressure of a mass of sphærical cellules. This form is found generally in the *Ulvæ*, and in most species having large expanded leaves, especially in the *Florideæ*, where both stems and leaves are often composed of a homogeneous mass of such cellules packed together. Such structures, it will at once strike, may be as justly compared to the Endogenous type as the above to the Exogenous, and it may naturally be asked, how far these differences in structure may be made available for purposes of classification? Is it possible to divide Algæ into two tribes, the one simulating Exogens, the other Endogens? I am not

at all prepared to answer this question satisfactorily. Structure certainly ought, in classification, to be regarded as of primary consequence, and if two such groups can be clearly made out our present arrangement should yield to one based upon them. But I fear that too many anomalous appearances exist. Should such a scheme ever be carried out, colour will no longer be regarded as a grouping character, for the peculiarities of structure alluded to exist indifferently in all the series. Thus *Delesseria*, *Nitophyllum*, and *Rhodomenia* are, so to say, endogenous; *Chondrus*, *Gigartina*, *Chylocladia*, &c., exogenous. It would be a difficult task to determine the position of the single-tubed species, unless some other character, as for example, the *form* of the cellules, whether *cylindrical* or *polygonal*, be resorted to.

In *fructification* we find many modifications of structure, without much real difference either in the manner in which the fruit is perfected or in the seed that is produced. The *seed* that is finally formed in all the tribes of *genuine* Algæ, from which I exclude the *Diatomaceæ*, appears pretty nearly to agree in structure, and to consist of a single cellule or bag of membrane, filled with a very dense and dark coloured granular or semifluid mass, called the *endochrome*. This seed, on germination, produces a perfect plant, resembling that from which it sprung. Nothing at all resembling floral organs has been noticed in any, and all that we know of the fructification is, that it takes place with regularity, arising from the same parts of the frond, and having the same appearance in plants of the same kind. Its growth may be watched from the commencement, when what we may call the *ovule*, or germ of the future seed, begins to swell. But nothing whatever has been ascertained that throws the smallest light on the process of fecundation. In some instances, it is true, as for example in *Zygnema*, the seed is formed from the

union of the matter in one filament with that in another, and it has been observed that the joints of one filament uniformly give out, and that those of another uniformly receive; but before conjugation no difference whatever can be perceived between the two filaments. This, which occurs in a tribe of very low organization, affords the nearest analogy that has yet been noticed with what takes place in higher plants. If it have any real affinity with that process, we may fairly expect the discovery of sexes in the more perfect tribes; but nothing at all resembling male flowers has been noticed in these. Some old authors certainly invested the air-vessels of *Fucus*, and others the tufts of hairs that clothe the surface of some species with this character, but both opinions have been long since given up as untenable. That a transmission of the endochrome from one cellule to another, prior to the formation of seed, occurs in all Algæ, seems probable from the fact that the cellules immediately surrounding the seeds are always colourless and empty, but there is nothing as yet known to prove that one cellule is less adapted than another to receive the endochrome, and form the future embryo,—nothing to show that there is any distinction into male and female.

Many Algæ, perhaps all of the *red series* (*Rhodospermeæ*), are furnished with a double system of fructification, called *primary* and *secondary* fruit; terms which are given for convenient distinction, without intending them to mean that one is of more or less importance than the other, for the seed formed in each is equally capable of producing a new plant, as *Mr. J. G. Agardh* has clearly shown. What is called *primary* is generally placed in *capsules*, which are either globose or pitcher-shaped, or at least a large number of seeds are collected into compact, sphærical clusters, and immersed in the frond; in the *secondary*, on the contrary, the seeds, which are commonly called *gra-*

nules, are usually placed in cloud-like or defined patches, called *sori*, or in distorted portions of the frond; but in many genera, as in *Odonthalia*, *Dasya*, *Griffithsia*, &c., proper *receptacles* of various shapes are formed for their reception. The production of *granules* in the plants in which it occurs, seems by the regularity with which it takes place to be as essential to the propagation of the species as that of the *sporules* or primary seeds. However distorted the form of the receptacle may be in which the granules are immersed, there is no reason to suppose that they originate in disease, for they are produced with so much constancy that they furnish us with some of the best distinguishing characters for genera. But there is a really anomalous structure connected with an imperfect attempt at fructification not uncommonly found on several *Florideæ*, especially those of the structure that we have above compared to that of exogens, as *Chondrus*, *Gigartina*, &c. This, to which Agardh gives the name of *nemathecium*, is a wart-like protuberance, of a very irregular figure, and generally large size, consisting entirely of concentric filaments with coloured joints, in all respects resembling those that form the periphery, but much longer. To the naked eye these warts often strongly resemble *capsules*, and as such have been frequently described, but they never contain any seeds. The so-called capsules of *Chondrus dilatatus* are of this nature. It is rare that dependence can be safely placed on bodies of so anomalous a nature as furnishing specific, much less generic characters, but in *Gigartina plicata* and *Griffithsiæ*, plants in which no other effort at fructification has yet been noticed, they afford good specific marks. In *Griffithsia setacea*, bodies (noticed in the description of that plant, p. 103), sometimes occur in the position of capsules, which have apparently the structure of nemathecia, but, judging from their position and size, I am more disposed to consider them

viviparous capsules, in which the sporular mass has been converted into minute filaments whilst attached to the parent. Another anomalous body simulating fruit, if it be not a male flower, frequently occurs in some of the filamentous tribes, especially in the genus *Polysiphonia* (*P. fastigiata*, *fibrata*, *fibrillosa*, &c.), to which Agardh gives the name of *antheridium*. It is a minute pod-like or lanceolate body, of a yellow colour, containing a granular fluid, borne on the colourless, long-jointed fibres, that at particular seasons are found issuing from the tips of the branches in several, if not all, *Polysiphoniæ*. The nature of these minute organs deserves more attention than it has obtained, for they are produced with too much regularity to be regarded as accidental. On *P. fastigiata* they are so abundant as to give the frond a yellow colour to the naked eye.

Experiments on the propagation of Algæ from seed have not yet been so frequently made as the interest of the subject deserves. In our own country, I am not aware that any one since *Mr. Stackhouse*, in 1796, has attempted it. This gentleman attempted to grow some of the *Fuci*, and so far succeeded with *F. canaliculatus* as to witness the germination. The following account of his experiment, which I extract from his '*Nereis Britannica*,' though already more than once published, may prove interesting to those who have not seen it, and perhaps tempt some one whose residence near the sea gives them an opportunity, to repeat the trial. "Having procured a number of wide-mouthed jars, together with a siphon to draw off the water without shaking or disturbing it, on Sept. 7, 1796, I placed my plants (*F. serratus*, *canaliculatus*, and *tuberculatus*), carefully in the jar, with their bases downwards, as in their natural state; on the following morning I decanted off the sea water, and letting it subside in the basin, I found a few particles at the bottom, which on being viewed

with the microscope, appeared to be little fragments detached from the surface by friction in carriage. I then poured a fresh quantity of sea water on the plants, and placed them in a window facing south; on the following morning the jar containing the plants of *F. canaliculatus* discharged into the basin a few yellowish grains, which on examining them, I found to be the actual seeds of the plant; they were rather oval than pear-shaped, but the most curious circumstance attending the observation was, that each individual seed was not in contact with the water, but enveloped with a bright mucilaginous substance. It was easy to guess the wise economy of nature in this disposition, which, as hinted above, serves a double purpose; each equally necessary towards continuing the species. On the following morning a greater quantity of seeds were discharged by this plant, and at this time a few seeds were procured from *F. serratus;* but this latter plant discharged such a quantity of mucous fluid that the sea water in which the plant was immersed was of the consistence of syrup, and consequently, the seeds being kept suspended, it was difficult to separate them. The seeds of *F. canaliculatus,* however, were numerous, and visible to the naked eye, and after letting the water rest for a few minutes it was no difficult matter, by gently inclining the basin, to pour off the water and let the seeds remain. In performing this operation I was witness to an explosion or bursting of one of these seeds or pericarps, which agitated the water considerably under the microscope, and brought to my recollection the circumstance mentioned by *Major Velley* during his investigation of *F. vesiculosus.* I at last obtained a discharge of seeds likewise from *F. bifurcatus* (*tuberculatus*); these perfectly resembling the others. Having established this point, viz. *that marine plants scatter their seeds in their native element without violence when ripe, and without awaiting the decay of the frond,*

I next procured some sea pebbles and small fragments of rock, taken from the beach, and having drained off the greater part of the water in the jar, I poured the remainder on them, and left them dry for some time that the seeds might affix themselves. I then fastened strings to the pebbles, and alternately sunk them in sea water in a wide-mouthed jar and left them exposed to the air, in order to imitate as nearly as possible their peculiar situation between high and low-water mark, and when the weather was rainy I took care to expose them to it. In less than a week a thin membrane was discoverable on the surface of the pebble where the seeds had lodged, with a naked eye; this gradually extended itself, and turned to a darkish olive colour. It continued increasing in size, till at last there appeared numerous papillæ or buds coming up from the membrane: these buds, when viewed with a glass, were rather hollow in the centre, from which a shoot pushed forth: in some instances they seemed on a short, thick footstalk, and in this latter case resembled in some measure the peziza-formed seedling of *F. loreus*, and the others without stems were like the stemless *Pezizæ*. These plants continued to put forth the central shoots for some time, but their growth was not rapid after the first efforts; most probably owing to their confined situation; and as I was six or eight miles from the sea, and had not the opportunity of placing the pebbles in some of those pools which are left by the sea at low water, I discontinued the experiment." It is much to be regretted that *Mr. Stackhouse*, in conducting the above experiment, did not make more use of the microscope. We are not told how the membrane proceeded from the seeds, nor whether the sprouts arose from each single seed, or from several associated.

More recently, on the continent, *Mr. J. G. Agardh*, son of the celebrated Swedish algologist and worthy successor to his chair, has made more minute observations on the

germination both of *seeds* and of *granules* of several species, and has published magnified figures of the young plants in various stages of development. His memoir on this subject will be found in the '*Annales des Sciences Naturelles*,' for October, 1836; and I shall here extract some of its more interesting matter. According to him, whatever may have been the shape of the seed or *sporule* before it issued from the capsule, it soon acquires a sphærical form, and is then undistinguishable from the *granule* of the same species, which likewise germinates in the same manner. In his figures, for I regret to say he has not detailed the whole process, nor given an account of his method of proceeding with the plants, he has represented the first effort of germination as showing itself by the seed acquiring an oval form; a minute papilla then issues from one end, which elongates and becomes the root; the upper end likewise pushes in an opposite direction, gradually elongating, and increasing in diameter by the production of new cellules, till at length it acquires the character of the species. He has figured the germination of the seeds and granules of *Ceramium rubrum* and *Laurencia pinnatifida*, and of the seeds of *Fucus vesiculosus;* to all which the above applies.

But the most interesting part of the memoir is, the account given of some curious circumstances attending the germination of some of the lower Algæ, those belonging to the *grass-green* series, (*Chlorospermeæ*, Nob., *Zoospermeæ*, Ag. fil.). I allude to the peculiar *motion* observed in the seeds of several plants of this group, which has given rise, on the continent, to some very startling theories, which have again produced much warm, not to say angry, discussion. Without entering into all that has been written on the subject, which would occupy too much space for our limits, I shall here transcribe *Mr. Agardh's* account of *Conferva ærea*, translating from his memoir above noticed.

"The filaments of *C. ærea* are, as is well known, articulated or divided at equal distances into little compartments (joints), which have no communication among themselves other than what results from the permeability of the dissepiments. The green matter contained in these joints appears at first altogether homogeneous, as if it were fluid; but in a more advanced state it becomes more and more granular. The granules are, at their formation, found adhering to the inner surface of the membrane, but they soon detach themselves, and the irregular figure which they present at first passes to that of a sphere. These granules congregate by degrees in the middle of the joint, into a mass, at first elliptical, but which at length becomes perfectly sphærical. All these changes are conformable to phenomena known in vegetable life; those which are to follow have more analogy with the phenomena of animal life. At this stage an important metamorphosis exhibits itself, by a motion of swarming (un mouvement de fourmillement) in the green matter. The granules of which it is composed detach themselves from the mass, one after another, and having thus become free, they move about in the vacant space of the joint with an extreme rapidity. At the same time the exterior membrane of the joint is observed to swell in one point, till it there forms a little mamilla, which is to become the point from which the moving granules finally issue. By the extension of the membrane for the formation of the mamilla, the tender fibres of which it is composed separating, cause an opening at the end of the mamilla, and it is by this passage that the granules escape. At first they issue in a body, but soon those which remain, swimming in a much larger space, have much more difficulty in escaping, and it is only after innumerable knockings (titubations) against the walls of their prison, that they succeed in finding an exit. From the first instant of the motion one observes that the granules

or *sporules* are furnished with a little beak, a kind of anterior process, always distinguishable from the body of the seed by its paler colour. It is on the vibrations of this beak that the motion, as I conceive, depends; at least I have never been able to discover any cilia. However, I will not venture to deny the existence of these, for with a very high power of a compound microscope one sees the granules surrounded with a hyaline border, as we find among the ciliated Infusoria on applying a glass of insufficient power. The sporules, during their motion, always present this *beak* in front of their body, as if it served to show them the way; but when they cease to move, by bending it back along the side of their body, they resume the sphærical form, so that before and after the motion one sees no trace of this beak. The motion of the sporules before their exit from the joint consists principally in quick dartings along the walls of the articulation, knocking themselves against them by innumerable shocks; and in some cases we are almost forced to believe that it is by this motion of the sporules that the mamilla is formed. Escaped from their prison they continue their motion for one or two hours, and retiring always towards the darker edge of the vessel, sometimes they prolong their wandering courses, sometimes they remain in the same place, causing their beak to vibrate in rapid circles. Finally they collect in dense masses, containing innumerable grains, and attach themselves to some extraneous body at the bottom or on the surface of the water, where they hasten to develope filaments like those of the mother plant. The sphærical sporules elongate at first into egg-shaped bags, attached to the strange body by the narrowest end. Their development only consists in a continual expansion, without emitting any root. The green internal matter divides in the middle by a partition, which appears at first sight as a hyaline mucilage, but which gradually changes into a

complete diaphragm. It is thus, by successive divisions of the joint first formed, that the young plant increases. The position of the mamilla in each joint is uncertain, at least I have seen it very different in neighbouring joints. The exit of the sporules does not take place at the same time in the different joints. One often sees those of one of the articulations already escaped, while in the neighbouring one they are not yet completely formed. Commonly the uppermost joints empty themselves first, so that it is not rare to see all the upper part of a filament entirely transparent, whilst the lower part continues still to develope. In this manner the formation and dissemination of the seeds continues during the whole summer, and thus a single filament suffices for the formation of an infinite quantity of sporules. If one remembers that each joint contains perhaps many hundreds of spores, it is not astonishing that the water becomes perfectly coloured with them; so that we might readily take for a *Protococcus*, or other simple Alga, what are only the spores of a *Conferva*. I suspect that from such a mistake have arisen the theories of metamorphosis proposed by many modern algologists."

Mr. Agardh then proceeds to detail the results of his examination of *Zygnemata*, *Ulva clathrata*, *Bryopsis Arbuscula*, and other Algæ, in all which he has noticed a motion, apparently spontaneous, among the seeds at the period of germination. Similar observations on other Confervoid Algæ have been made by many continental botanists, particularly by *Unger*, an abstract of whose account of *Vaucheria clavata* will be found in '*Loudon's Mag. Nat. Hist.*' *vol.* i. *p.* 305; by *Meyen*, *Bory St. Vincent*, *Guillon*, *Treviranus*, *Milne Edwards*, and others who have communicated their discoveries in several memoirs inserted in the '*Annales des Sciences Naturelles*,' '*Encycl. Méthodique*,' &c.; in fact experiments have been so mul-

tiplied by independent observers, and the result is so invariably the same, that however difficult it may be to account for these anomalous motions, and however little they may accord with our preconceived notions of the powers of vegetable life, it is not possible to doubt the fact of their existence; for we cannot suppose that all these respectable witnesses have been themselves deceived, or have wished to impose on our credulity. But I am not aware that a single observation has been added by any English botanist, and I mention it in the hope that those who have the opportunity of studying these plants in a living state may attend to this very curious subject. The *fact* of the existence of motion being granted, it will naturally be asked, how we are to account for it? Here we have vegetables producing seeds which exhibit a feature that we have been accustomed to regard as one of the distinguishing characters of animal life. Are these seeds then *animalcules?* This strange opinion is not without its zealous supporters, who contend that an actual metamorphosis takes place; that the seed *becomes* (*how* is not said) a perfect animalcule, which after enjoying an animal existence for a time ceases to live *animally*, and, reverting to its original nature, gives birth to a vegetable. Thus, this seed was first vegetable, then animal, and then again vegetable, and finally giving birth to animals to be again transformed into vegetables, and so on. This opinion found many advocates among continental writers, among which we must number the elder Agardh, who speaks of the disengaged seeds of *Tetraspora lubrica* as "having become animalcules;" whilst others strongly combated it, and in England it was never received. *Mr. Berkeley* ('Hook. Journ. Bot.' i. p. 233), in combating such notions, suggests that this motion may arise from the endosmose or exosmose, caused by the seeds being of a different density with the water into which they are discharged; but, as *Mr. Agardh*

remarks, this cannot be the reason, for the motion equally exists in *Conf. ærea* before the seeds are separated from the frond. He likewise denies the *animal* nature of the seeds, observing, "the sporules have never any opening analogous to the mouth of infusorial animals, and we never perceive them to swallow any food. Their motion, however irregular and capricious it may appear, however like it may be to spontaneous motion, is easily distinguishable from motion truly animal, although this distinction may be difficult to establish by decided characters. And besides, why refuse a locomotive faculty to vegetable life, when each day we discover new indications of it? The researches of *M. Unger* on the anther of *Sphagnum* show analogous motions among the mosses; and the spermadic granules offer an example of it among phænogamous plants." It is scarcely necessary to add that I fully unite in the view taken by this ingenious writer; that we are neither to regard the phenomenon in question as caused by external agency, or as resulting from an animal existence, but receive it as a strictly vegetable peculiarity, which we are to expect will be observed in many more instances, when our insight into the very imperfectly explored regions of vegetable anatomy shall be clearer than it is. A few years ago the circulation of the juices in *Chara* was considered extraordinary; a similar circulation is now found in so many other plants as to lead to the inference that it is universal in the vegetable kingdom. It must be remarked, however, that as yet the motion of the sporules has only been observed in certain families, and *Mr. Agardh*, in the memoir before us, denies its existence in any but those of the series *Chlorospermeæ*, and, with doubt, in *Ectocarpus;* whence he proposes to divide the class into two great groups,—*Zoospermeæ*, having *moving* seeds, and *Fucoideæ*, having *motionless* seeds. But to me it appears that our knowledge of this subject is too much

in its infancy to render any such division safe or expedient. *Zoospermeæ*, as I have before observed, corresponds to our *Chlorospermeæ*, so that, without having recourse to this dubious character, the result of our arrangement is the same.

The relative distribution of plants on the surface of the globe offers a wide and interesting field of enquiry, which has of late years attracted considerable attention from botanists; and though, as we approach lower and less complicated organizations, we find the influence of climate to be less powerful in causing a difference of character among the groups, or even a dissimilarity of species, still among Cryptogamia we may discover evident traces of distinct regions of vegetation, analogous to what obtain among phænogamous plants. With respect to the *Algæ*, little has been done in this department to follow out and correct the views of *Lamouroux*, whose excellent essay, published some time after his death in the seventh volume of the 'Annales des Sciences Naturelles,' I shall take as the ground-work of the observations I am about to offer; but so little is yet, comparatively, known of the vegetation of extra-europæan seas, that we cannot speak with much minuteness concerning it, but must rest satisfied with a few general and hasty remarks. It appears well established among Algæ, as among more perfect plants, that the species of distant seas are, with a few exceptions, different, and this without reference to difference of latitude; thus it would seem probable that certain species had their centres of growth, from which they are disseminated within a limited range, But *Lamouroux* observes that they do not *radiate* from a centre as land plants commonly do, but rather extend in lineal series, following the lines of coast, and influenced by a common depth of water: this is, however, merely a modification of the principle that influences the former. There are, however, exceptions to this limi-

tation of species to particular places among Algæ, as among phænogamous plants; and these are chiefly to be found among the lower tribes, which seem either to have been originally created over the whole surface of the earth, or to possess an unlimited power of dispersion. Of this kind are the species of *Ulva* and *Enteromorpha*, which are equally abundant within the polar circles, as they are under the equator and in temperate regions; nor is there any specific difference observable between plants of these genera from such different localities; they appear to reach an equal degree of perfection in all climates. These belong to a very low organization, but among those a degree higher up in the scale we find *Codium tomentosum* having a range nearly equally wide; being found along all the shores washed by the Atlantic and Pacific oceans, from a high northern to a high southern latitude, as well as in the Mediterranean and Baltic seas; having thus a place in the Flora of every country in Europe; of Africa; of both sides of the American continent; and of Australia. Several of the *Confervæ*, which may be regarded as on a level in organization with *Codium*, have as wide a range. Among the *Rhodospermeæ* and *Melanospermeæ* it is more rare to find species so indifferent to climate or country, and which we may term *pelagic* races; but in the former we observe *Plocamium coccineum* and *Gelidium corneum* common to the Atlantic and Pacific, and even Indian oceans, while *Ceramium rubrum*, *diaphanum* and *ciliatum*, are as widely scattered as the *Ulvæ;* and in the latter, *Fucus tuberculatus* is found from the shores of Connaught (perhaps its northern limit), to the Cape of Good Hope, and *F. vesiculosus* as well on the north-west coast of America as on the shores of Europe, while *Sargassum bacciferum* and *vulgare* are proverbial wanderers, and some species of *Ectocarpus* usually accompany the *Ceramia* and *Ulvæ*. These exceptions sink into insignificance, however, when we

consider the whole series of Algæ, the vast majority of which are strictly limited in dispersion; and in the following observations *Lamouroux* is substantially correct. "I have observed" says he, "that the Atlantic basin from the pole to the 40° of north latitude, offers a peculiar vegetation; that the same is true of the West Indian sea, comprising the Gulf of Mexico; of the east coast of South America; of the Indian ocean and its gulfs; and of the seas of New Holland. The Mediterranean has a system of vegetation peculiar to itself, which extends to the extremity of the Black Sea; and notwithstanding their geographical proximity, the plants of the port of Alexandria or of the coast of Syria differ almost entirely from those of Suez and the Red Sea." To these regions we may add the Chinese and Japanese seas, which contain many remarkable and peculiar forms. Too little is known of the east coast of Africa, or of the southern ocean, to speak positively of them; and of the vegetation of the Caspian we are completely ignorant. The shores of South Africa, while they possess many species peculiar to themselves, exhibit a vegetation in many respects analogous to that of Australia, with however some remarkable deficiencies: thus, among the most curious types of structure, *Splachnidium rugosum* is common to both; a species of *Champia* has lately been brought from Van Dieman's Land; and at Port Natal there is a plant analogous to *Claudea:* and, if we may trust *Von Suhr*, *Phyllophora lucida* and *Rhodomenia Lamberti* occur at Algoa Bay: but with these similarities to the vegetation of Australia, there is a remarkable deficiency at the Cape of the genus *Cystoseira*, a peculiar and extensive group of which forms, as we shall presently see, a prominent feature in the marine vegetation of Australia.

Many powerful causes, independently of climate, undoubtedly tend to limit the distribution of Algæ. The

intervention of great depths of the ocean between localities favorable to their growth, has, as *Lamouroux* aptly remarks, a similar and analogous influence on sea plants, as the existence of high mountain ranges exercises on those of the land; the presence of extensive sand banks, which are as much sub-marine deserts as the sandy tracts of continents, are unfavorable to vegetation; strong currents; projecting capes; the fresh waters of great rivers; and a change of soil; — all these interpose to prevent the wide dissemination of species, whose seeds cannot exist beyond a certain time floating about at the mercy of the waves, but must perish if they do not soon find a congenial soil and situation in which to fix themselves and vegetate. Corallines, if occurring in abundance, are generally fatal to the growth of Algæ; and the reefs of the Pacific are said to be almost destitute of them. But with due allowance for all these and other modifying causes, we must look to *climate* as the grand regulator of forms among Algæ as among land plants, although it be in a less striking degree, because the temperature of the sea is so much less subject to variation, and ranges within a scale so much shorter than that of the land. It is well known that the majority of the Algæ on our own coasts reach perfection, if not of fruit, at least of foliage, in the summer months; and that warm summers have a perceptible influence in causing an abundant and a luxuriant growth of particular kinds; and there is even a marked difference between the vegetation of the opposite sides of a sub-marine rock, if one have a sunny and the other a cold exposure, precisely as we notice between one side of a hill and another. These observations, of course, apply with the greatest force to plants growing within the influence of the tide, or in shallow parts of the sea. It is possible, says *Lamouroux*, that under the Equator the plants of the bottom of the ocean, where the temperature is 4° or 5° (41° or 44° F.), have a resemblance to

those of the Polar seas, and that those that grow at 100—200 fathoms are allied to those of temperate regions; but this is mere conjecture, for we know almost nothing of the deep-sea vegetation. "On the shores of the British Islands," remarks *Dr. Greville*, "it is easy to perceive that some species, *Gelidium corneum*, *Phyllophora rubens*, and *Sphærococcus coronopifolius*, for example, become more plentiful and more luxuriant as we travel from north to south; and, on the other hand, that *Ptilota plumosa*, *Rhodomela lycopodioides*, *Rhodomenia sobolifera*, and several others, occur more frequently and in a finer state as we approach the north. *Odonthalia dentata* and *Rhodomenia cristata* are confined to the northern parts of Great Britain," (the former occurs along the north coast of Ireland), "while the *Cystoseiræ*, *Fucus tuberculatus*, *Halyseris polypodioides*, *Rhodomenia jubata*, *R. Teedii*, *Microcladia glandulosa*, *Rhodomela pinastroides*, *Laurencia tenuissima*, *Iridæa reniformis*, and many others, are confined to the southern parts." Several of these, it is worth remarking, which are in England confined to the coasts of Devon and Cornwall, are found in Ireland along the shores of Clare and Galway, where the *Land Flora*, it will be remembered, contains several species otherwise peculiar to the south of Europe.

If we consider the distribution of the three great series into which we have divided the Algæ, namely, the *olive*, the *red*, and the *green*, we shall find that the first increases as we approach the tropics, where it reaches its maximum of *species*, though perhaps not of *individuals;* that the second chiefly abounds in the temperate zone, being most luxuriant in form and rich in species from the 55th to the 45th degree, and that it rapidly diminishes towards the equator after it has passed the 35th; while the third forms the majority of the vegetation of the Polar seas, is particularly abundant (*Conferveæ*) in the colder temperate zone,

but its lowest forms (*Ulvæ*) equally distributed through all. Owing to the large size and strictly social habit of our common *Fuci* and *Laminarieæ*, a hasty observer might assume that in the British seas the olive series predominates, and such is undoubtedly the case, if we look to individuals and not species. But he will be surprised to find on examination that our sub-marine meadows are composed, in the main, of not more than ten species of this race; while the 300 or 400 others of which the *marine* Flora consists, are scattered like weeds, and often occur in such small quantities as to escape the notice of any but a botanist. When we speak therefore of different types characterizing different latitudes, we mean merely variety of form, not abundance of production. If we exclude fresh-water species, we shall find that on our coasts the *olive* series amount to $\frac{1}{5}$, the red to $\frac{3}{8}$, the green nearly to $\frac{1}{4}$, and the Diatomaceæ to $\frac{1}{5}$ of the whole. Of the olive group only $\frac{1}{5}$ (or $\frac{1}{25}$ of our whole marine Algæ) belongs to *Fucoideæ*, and scarcely $\frac{1}{12}$ (or $\frac{1}{60}$ of the whole) to *Laminarieæ*.

It remains to notice the geographical range of some of the most remarkable genera. Among *Fucoideæ* there are three especially worthy of attention, namely, *Sargassum*, *Cystoseira* and *Fucus*. Of *Sargassum* perhaps nearly 100 species are known to botanists, but I shall confine myself to those described in *Agardh's* "Systema," in which I find 64 enumerated. Of these, 54 are confined to particular countries, and are either tropical or sub-tropical, not extending beyond 42°, and few existing so far from the equator; 2 are of uncertain origin; and 8 are common to widely separated coasts. Of the 54, 11 are peculiar to the East Indies, 12 to China and Japan, 12 to New Holland and Van Dieman's Land, 8 to the Red Sea, 6 to the tropical Atlantic, 2 to the Mediterranean, and 1 to the Cape of Good Hope. Of the 8 scattered species, 2 (*S. bacciferum*

and *vulgare*) are found in every tropical sea, and even occasionally wafted to high latitudes; *S. tortile* is said to be a native of Brazil and of Japan; *S. cristæfolium* of the Indian sea, the Cape of Good Hope, and the Mauritius; *S. heterophyllum* of the Cape, of Japan, and of New Holland; *S. acinaria* of the Red Sea, and of New Holland; *S. piluliferum* of New Holland, Japan, and the Atlantic, near Cumana; and *S. onustum* of New Holland and the Mauritius. Of the Chinese species, 7 form a very peculiar group, confined, as Dr. Greville observes, to those seas, and remarkable for "a terminal fructification, a slender habit, small nerveless leaves, and often elongated vesicles." Another group with a plane, ribbed, pinnatifid frond, and without distinct leaves, is peculiar to New Holland. Of *Cystoseira*, (excluding *C. osmundacea*, which is a species of *Halidrys*), we find 39 species enumerated by *Dr. Greville*, of which 5 are common to the northern Atlantic and Mediterranean, 2 peculiar to the Mediterranean, and 2 to the northern Atlantic, 1 to the Red Sea, 1 to Kamskatka, 1 to the Indian ocean, 3 to Japan, and 22 to New Holland, of which last 19 belong to a very curious group not found in any other part of the world, having compressed stems, the branches springing from the flat surface, not from the edge, and deflexed at their insertion, while the vesicles are solitary and stalked. The remaining 2 species are common to the Red Sea and the shores of Australia, and one of them is said to be found at the Cape of Good Hope. On the whole, *Cystoseira* may be considered characteristic of the warmer temperate regions, being most abundant between the parallels of 34° and 40°; very rare within the tropics; and not extending much beyond 52° north. Three species are found in the north of Ireland, but none have yet been noticed in Scotland. *C. fibrosa*, which is peculiar to the northern Atlantic, is perhaps the most hardy species. Of *Fucus* 14

species are known, 8 of which are nearly confined to the North Atlantic basin; 1 of them (*F. vesiculosus*) straying into the Pacific, along the N.W. coast of America; and 1 (*F. tuberculatus*) into the southern Atlantic, at the Cape of Good Hope. Of the remaining 6, 3 are confined to New Holland and Van Dieman's Land; 1 to Kamskatka; 1 to the N.W. coast of America; and 1 (*F. constrictus*, Harv.) to the Cape of Good Hope. Lamouroux asserts that there are none in the Mediterranean, and assigns from 44° to 55° as the parallels between which they flourish, and that none exist within the 36th degree. At the Cape of Good Hope *F. tuberculatus* and *constrictus* flourish at 34° S., which is certainly colder than a similar parallel of north latitude. The remaining genera of *Fucoideæ*, 12 in number, are, with the exception of *Halidrys* and *Himanthalia*, natives of warm countries, seldom reaching the parallel of 40°. Eight of them are found in New Holland, six of which are peculiar to its shores; the other 2 (*Splachnidium* and *Moniliformia*) occurring at the Cape, and in the Japanese basin.

I shall be more brief with the other genera of the olive series, as they offer fewer peculiarities. The *Lichineæ* are, I believe, confined to the North Atlantic basin, growing generally near high-water mark. Among *Laminarieæ* the largest genus, *Laminaria*, abounds in *individuals* from the 40th to the 65th degrees of latitude, very rarely occurring within the tropics, or showing much luxuriance at a lower latitude than 34°. Ten species are found in the northern Atlantic, 2 of which also occur but rarely, and in a crippled state, at the Cape of Good Hope; 3 or 4 are peculiar to New Holland; 2 to the Cape of Good Hope; and 1 to tropical Africa. *Alaria*, *Costaria*, and *Agarum*, belong to high northern latitudes in the Atlantic and Pacific, the last being found in the Polar seas. *Macrocystis* is the only tropical genus; one of its species, *M. pyrifera*,

whose whip-cord stems are reported by voyagers to reach the enormous length of 1500 feet, being found throughout the Great Pacific ocean, and in the Atlantic from the equator to the 45th degree of south latitude. The *Sporochnoideæ* are chiefly from the northern Atlantic, between the parallels of 40° and 55°; with the exception of *Desmarestia herbacea*, which is found in the North Pacific, as well as at the Cape of Good Hope, and a variety on the coast of France; and of 3 species of *Sporochnus*, which are peculiar to New Holland, and 1 to the Mediterranean. The *Dictyoteæ*, which are rare beyond 52°, and at their northern limits exhibit filiform or tubular, simple or branched fronds, of little beauty, increase both in number of species and in beauty and delicacy of structure, and produce expanded, highly organized fronds, as we proceed southerly. The genera *Padina* and *Halyseris*, which find their extreme northern limits on the south coasts of England, where they are confined to a few stations, abound in the south of Europe, and within the tropics have the majority of their species. The so-called *Padina? deusta* of the north sea, does not really belong to the genus, and must not therefore be considered an exception. *Dictyota*, if we except *D. dichotoma*, which abounds as far perhaps as 55°, and *D. atomaria*, which finds its extreme limit in the Frith of Forth, is quite a genus of warm latitudes, having 4 species in the south of Europe, 2 in the West Indies, 1 in the Red Sea, 1 in Brazil, and 1 or 2 in New Holland.

The *Floridеæ*, which comprise the great bulk of the *red* series, and of which upwards of 30 genera, comprising at least 350 species, are known to botanists, flourish generally in the temperate zones, being rare within the tropics, and still more uncommon in polar latitudes. Among tropical forms *Claudea* and *Amansia* may be noticed, but the last has 3 species in extra-tropical Australia, and 1 in New Zealand. *Hypnea* and *Acanthophora* do not exceed

the 40th parallel, and *Rhodomela*, *Laurencia*, *Gigartina*, and *Chondrus*, all include species natives of high latitudes and of the tropics, and some of them common to both. *Grateloupia* is particularly luxuriant at the Cape of Good Hope, where *G. ornata* and *filicina* are as abundant as *Rhodomenia palmata* on the British shores, and occupy the same stations; the latter is equally common in the Mediterranean, where, as at the Cape, it reaches 6—8 inches in length, while in England, where it has only been found in Devonshire, it rarely forms a frond two inches long. The *Delesseriæ* appear in greatest perfection about 52° or 53°, those from the north of Ireland being much larger than individuals of the same species from the southern coasts of England: of the known species 6 are peculiar to the North Atlantic; 1 (*D. ruscifolia*) common to it and the Cape of Good Hope; 3 to New Holland; 1 to the Cape; and *D. fraxinifolia*, which is perhaps rather an *Amansia*, to the Indian ocean. The *Nitophylla* are also chiefly northern, 6 being found in the Atlantic basin, and in greatest perfection on the north coast of Ireland; while 3 are found widely separated in the southern hemisphere, namely, at the Cape, in Van Dieman's Land, and on the shores of Chili. *Claudea*, *Thamnophora*, *Botryocarpa*, and *Champia*, appear to be exclusively confined to the southern hemisphere, between the parallels of 30° and 40° or thereabouts; while *Sphærococcus*, Grev., and *Odonthalia*, are exclusively northern. *Bonnemaisonia* and *Hymenena* are instances of very small genera with widely separated species; the first having 1 European and 2 Australian species, and the latter occurring at the Cape and in California. *Ptilota* also deserves to be mentioned as a well-marked genus, having 1 European, 2 Cape, and 3 Californian species. On the whole, so far as we know, *Floridea* appear to be much more abundant in the northern than in the southern oceans, a fact to be attributed no

doubt to the paucity of land in high southern latitudes. According to *Mr. Webster*, in the Appendix to the 'Voyage of the *Chanticleer*,' they are particularly luxuriant and abundant at Terra del Fuego and Statenland, but unfortunately the collection made by this gentleman has been, it would appear, unaccountably lost. No doubt the extensive bays of the Faulkland Islands and of New Zealand will afford many novelties, when properly examined. The geographical distribution of the *Ceramieæ* offers little remarkable, nor, as has been said before, do the CHLOROSPERMEÆ affect any particular climate, with the exception of two genera, *Caulerpa* and *Anadyomene*, which are confined to tropical and sub-tropical latitudes, in which the former delights to clothe the sandy shore, about low-water mark, with a brilliant green vegetation.

Thus we have seen that the Creator, while he has scattered the Algæ through the waters of every climate of the globe, has assigned to each country the peculiar kinds best suited to the circumstances under which they are developed; and it would be absurd to suppose that so much bounty and foresight had been wantonly squandered upon objects, from which no direct benefit to his other works was to reciprocate. To preserve a harmony through creation, by giving to the depths of the sea a vegetable clothing, as beautiful and varied, yet as linked together as that of the land, and thus to illustrate his own infinity and indivisibility by works, endless in diversity yet one in plan, may seem, to many minds, a sufficient motive, were there no other, for the exercise of an unlimited creative power; but it will not account for that nice discrimination and foresight with which he has regulated the supply of different kinds to different circumstances. We must therefore look further, and enquire what are the direct *uses* of *Algæ* in the general economy of nature. On land it is only necessary to glance around us to perceive that the animal kingdom

could not exist without the vegetable;—"beasts of the forest and fowls of the air," and countless myriads of the insect tribe; man himself; — all depend more or less on vegetables for their food and clothing. The sea too has its hordes, at least as numerous as those of the land, to which the *Algæ* afford food and shelter, and on whose existence, contemptible as many of them seem, depends in a greater or less degree the preservation of every scale of life in the sea. Many of these little animals are so minute, that at first sight it would seem a matter of very little consequence to *us* (for when we speak of "uses," the words "to man" are too generally understood), whether they should starve or not. But when it is remembered that the principal food of the whale consists of a minute jelly-fish, which is scarcely more than an animal sack moving by contraction, and that by far the greater part of the fishes important as articles of food to man depend on minute marine animals for support, a different estimate will be formed of the importance of the lower links in the chain of creation to the whole, and we shall come to the conclusion that there is such a mutual dependance between one living creature and another, that none but the All-wise can dare to determine whether one, the most minute, can be spared without endangering the destruction of all. The *Algæ* therefore, by supporting the base, support the structure. But besides this, another important function is unquestionably performed by their growth tending to keep pure the waters of the sea, and of lakes, and thus to preserve a healthful atmosphere. Like other plants they discharge a large quantity of oxygen.

If these be some of the direct uses of *Algæ* in the economy of nature, their value to man, whether in agriculture, in the arts, or even as articles of food, must not be overlooked. On many shores the harvest of the deep is anxiously looked after, and as carefully attended to as that of

the land, and indeed the last is often dependant on the former for its abundance. The first and most obvious use of sea-weed is for manure, and to this purpose all kinds are applicable. On many of our coasts, as along the west of Ireland, the poorer classes are almost entirely dependant for the cultivation of their potatoes on the manure afforded by their rocky shores, and frequent gales of wind. After a storm they may be seen congregating in numbers from the surrounding country, with horses and cars, or with panniers ; and the poorest, who cannot afford the assistance of a donkey, are themselves bearers of burdens, eagerly collecting what is thrown up and carrying it beyond the reach of the tide. The kinds preferred for potatoes are the large and succulent *Laminarieæ*, which rapidly melt into the ground, and when these are abundant other kinds are neglected. These are often carried many miles into the interior, and, being mixed with sea-sand, form an excellent manure, which must however be used quickly, as it very soon decomposes, and the gases it gives birth to are consequently lost to the ground if it be suffered to lie open.

But it is for the manufacture of *kelp* that marine plants offer the largest revenue to man. *Kelp* is an impure *carbonate of soda*, mixed with the *sulphate* and *muriate* of the same alkali, and with some combinations of *iodine* and extraneous matter. It is prepared by merely burning the weeds, previously dried, in pits dug along the shore, till they are reduced to hard, dark-coloured cakes, in which state it is sent to market. On our shores the species used for this purpose are *Fucus nodosus*, *vesiculosus* and *serratus*, *Himanthalia lorea*, *Laminaria digitata*, *bulbosa* and *saccharina*, and *Chorda filum ;* but all the large *Fucoideæ* are applicable. The crop is gathered in summer, dried and collected like hay, and toward the end of the season burned. *Dr. Greville* has given us (Introd. to 'Algæ Bri-

tannicæ') an interesting sketch of the introduction and establishment of this branch of industry into the north of Scotland, where it has been most extensively pursued; and I shall take the liberty of extracting the following passages. "The manufacture of *kelp* was introduced into Scotland, according to *Mr. Neill*, half a century subsequent to its establishment in France and England, and the first cargo was exported from Orkney about the year 1722. The employment, however, being new to the inhabitants of Orkney, the country people opposed it with the utmost vehemence. Their ancestors had never thought of making kelp, and it would appear that they themselves had no wish to render their posterity wiser in this matter. So violent and unanimous was the resistance, that officers of justice were found necessary to protect the individuals employed in the work. Several trials were the consequences of these outrages. It was gravely pleaded in a court of law, on the part of the defendants, 'that the suffocating smoke that issued from the kelp-kilns would sicken or kill every species of fish on the coast, or drive them into the ocean far beyond the reach of the fishermen; blast the corn and grass on their farms; introduce diseases of various kinds; and smite with barrenness their sheep, horses and cattle, and even their own families.' The proceedings exist, as I am informed by *Mr. Peterkin*, in the records of the Sheriff-Court; a striking instance of the prejudices, indolence and superstition, of the simple people of Orkney in those days. The influential individuals who had taken up the matter succeeded in establishing the manufacture; and the benefits which accrued to the community soon wrought a change in the public feeling. The value of estates possessing a sea coast well stocked with sea-weed, rose so much in value, that, where the plants did not grow naturally, attempts were made, and not without success, to cultivate them by covering the

sandy bays with large stones. By this method a crop of *fuci* has been obtained, we are informed by *Mr. Neill*, in about three years, the sea appearing to abound every where with the necessary seeds. Upon the authority of Dr. Barry, during the years 1790 to 1800, the quantity sometimes made was 3000 tons, and as the price was then from £9. to £10. per ton, the manufacture brought into the place nearly £30,000. sterling, sometimes in one season. During the eighty years subsequent to its introduction (from 1720 to 1800), the total value will rise to £595,000.' These, and during the war, when the price of kelp rose to £18. or £20. per ton, were the palmy days of the manufacture, but since the peace the demand has gradually slackened, and the price fallen away. This result, so unfortunate for the owners of northern estates and the numerous population, 'in Orkney alone amounting to 20,000,' who found a profitable employment in the manufacture, 'is to be attributed at first to the superior qualities of Spanish *barilla*, for the purposes of glass-making and soap-boiling, but more recently to the almost entire removal of the duty on common salt,' from the decomposition of which *soda* is now so extensively manufactured, as to supersede kelp almost entirely for the above purposes. In this ruinous state of the trade the kelp maker has had recourse to the agriculturist, and experiments have fully succeeded in showing the great value of kelp as a manure, whence an extensive demand may eventually arise; but it is not likely that the price can ever reach its former rate. But here again, soda obtained from rock salt comes into successful competition with it, so that the prospects of the unfortunate kelp grower seem hopelessly sunk. I am not aware, from personal observation, what is the present condition of the population of the north of Scotland, which for so long a time enjoyed a lucrative trade from this source, but in the west of Ireland, which

I visited last year, and where a few years ago large quantities were annually exported, none is now made, except by the poorer cottagers for domestic purposes and local consumption."

Upon the subject of the kelp trade in Scotland, we extract the following highly interesting information from a pamphlet entitled 'Review of the Neapolitan Sulphur Question,' by a British merchant, (George Macintosh, Esq. of Glasgow), published in 1840. "On the shores of the Highlands and Islands of Scotland and Ireland, a branch of manufacture has been prosecuted for centuries, which had afforded employment and a reward for their industry, to British subjects. The manufacture alluded to is that of kelp; an article which contains, in large proportions, soda and potash, requisite constituents in soap and glass making. Kelp is itself made by the incineration of the sea-weeds known to botanists as the *Fucus vesiculosus* and the *F. nodosus*, and one or two others of the same vegetable classes. These are cut from the rocks of the shore, or gathered upon the recession of the tides, by the peasantry of these remote districts; and as they were, in the state of kelp, in constant demand by the soap and glass makers, the persons engaged in the manufacture of this article (kelp) advanced rapidly in affluence and civilization, and were amongst the best customers of any of the inhabitants of the maritime or rural districts, for the manufactures and colonial produce in Britain. The manufacture of kelp was also mainly instrumental in facilitating the agricultural improvements of the Scottish Highlands, by affording the means of removal and of employment (at such seasons as the occupation of fishing was impracticable), to the small tenants and cotters, whose continuance in their farms or croftings, as they are termed, was incompatible with the introduction of sheep farming, and the improved system of agriculture. In the Hebrides, Orkneys, and

other parts of Scotland, exclusive of Ireland, 25,000 tons of this article used to be manufactured annually; and the kelp shores of one island (that of North Uist) were let for £7,000. a year. Since that time the price of kelp has declined from an average of £15. to £2. 10*s*. per ton, and the island of North Uist has been sold to pay the land-tax. The agriculture of the districts in question has been impeded, or rather arrested, and it is only in the costly and melancholy resource of emigration, that the miserable and famished inhabitants of the kelp districts can look for a remedy from the wretchedness with which they are overwhelmed. Such a state of affairs may add to the wealth of those whose estates reap the benefit of the new system of agriculture; but, without the resource of kelp making, many districts of Scotland are threatened with becoming comparatively uninhabited deserts.*

> "Ill fares the land, to hast'ning woes a prey,
> Where wealth accumulates and men decay;
> Princes and lords may flourish and may fade,
> A breath can make them, as a breath has made;
> But a bold peasantry, their country's pride,
> When once destroyed can never be supplied."

Already has Scotland reason to bewail the truths inculcated by the poet. It is found impossible to recruit the army in the Highland districts,—the spirit of the natives has fled, and our national regiments are now composed of materials similar to those in General Evans' redoubtable legion, namely, the scum and off-scourings of the manufacturing towns. In the summer of 1838, a number of the inhabitants of Harris, expelled (necessarily) from their farms on the introduction of the improved system, were furnished by Government, with the means of emigration to

* There is, however, yet another class of individuals who flourish in the ruin of the Highlands of Scotland,—the importers of sulphur, and the acid and alkali makers of Britain.

the Colonies, and vessels were sent for their conveyance to the place of their destination. These poor creatures, however, obstinately refused to embark; and it was only when driven on board by a detachment of the garrison of Glasgow, despatched, per steamers, a distance of several hundred miles for the purpose, that their expulsion from their father-land was effected. Such have been the consequences of the manufacture of alkali from Sicilian sulphur. A shade in the price of the article, as afforded to the consumer, has heaped riches on the heads of the brimstone-merchants, the soap-makers, and the glass-makers; but it has ruined the owners of kelp-shores, and driven the poor Highlanders from their homes. But here we must not pause, but follow our exiles across the Atlantic, where, most strange to tell, we find the same evil influence prevailing. In clearing the forest lands of Canada and Nova Scotia, the occupation of the preparation of potashes was that to which the emigrants were compelled to resort, as a resource, equally essential to the introduction of agriculture into their new locations, as was kelp making to the improved system of farming in their native country; but when alkali came to be obtained in Britain, through the intervention of Sicilian sulphur, the same fate awaited the fabrication of potashes, as had attended the manufacture of kelp."

Many of the species that produce kelp are useful in minor ways. *Fucus vesiculosus*, which is one of the richest in the alkaline salts, affords an abundant and wholesome winter provender to the horses and cattle of the people of Norway, who call it kue-tang or cow-weed, and of the north-west of Scotland and west of Ireland. According to *Linnæus* the people of Gothland boil it, and, mixing it with coarse flour, feed their pigs with it, whence they call it *swine-tang*. In the Channel Islands it is used as fuel, and employed in smoke-drying pork and fish. *F. serratus*

is also used as winter provender in some northern countries, and in Norway is called *bred-tang*, being given to the cattle sprinkled with meal. Its most common use however is to spread over lobsters, shell-fish, &c., in order to keep them fresh when sent into the country. For this purpose it answers better than *F. vesiculosus*, being of a less mucous nature, and consequently less liable to run into fermentation. The very young leaves and stalks of *Laminaria digitata* are eaten in Scotland, under the name of *tangle;* and, according to *Mr. Neill*, the old stems are applied "to rather an unexpected use,—the making of knife-handles. A pretty thick stem is selected, and cut into pieces about four inches long. Into these, when fresh, are stuck blades of knives, such as gardeners use for pruning or grafting. As the stem dries it contracts and hardens, closely and firmly embracing the hilt of the blade. In the course of some months the handles become quite firm, and very hard and shrivelled, so that when tipped with metal they are hardly to be distinguished from hartshorn."

As articles of human food many of the Algæ have, in different countries, been used both as articles of luxury and resources in time of scarcity. Of British species, *Alaria esculenta*, *Rhodomenia palmata*, *Chondrus crispus* and *mamillosus*, *Laurencia pinnatifida*, *Iridæa edulis*, *Porphyra vulgaris* and *laciniata*, and *Ulva latissima*, have been more or less used. *Rhodomenia palmata*, the *dulse* of the Lowland Scotch, *duilliosg* of the Highlanders, and *dillisk* of the Irish, is still much eaten in many parts of Ireland and Scotland. It is prepared by being washed and dried, and is eaten raw, chewed like tobacco. It has a sweetish taste. That which grows on rocks or muscle-shells, called "shell-dillisk," is preferred, as it is less tough and coarse than what grows on *Laminariæ*. In Norway it is greedily eaten by sheep and goats, which

flock to the shore to seek it, whence *Gunner* once named it *Fucus ovinus*. According to *Lightfoot* it is used in Skye as a remedy in fevers, to promote perspiration, being boiled and mixed with butter. It is sometimes, but seldom, fried, a mode of cooking which answers better with *Iridæa edulis*, which is too tough to be eaten raw. *Chondrus crispus* and *mamillosus*, under the name of *Irish moss* or *Carrageen*, were a few years ago in much request, and the collection and preparation of them for market afforded a small revenue to the industrious peasantry of the west coast of Ireland, where these plants grow in great profusion. The price at one time was as high as 2*s*. 6*d*. per lb., but the demand has latterly diminished, and the price, of course, fallen considerably. The frond was boiled down to a gelatine, strained, and used as a substitute for isinglass in the manufacture of blanc-manges and jellies, and was at one time a fashionable remedy in consumptive cases. As the demand slackened for these purposes, it was tried as a size, and has been shipped to England for the use of the calico-printers, but I believe it was not found to answer well for their purposes. *Porphyra vulgaris* and *laciniata* are perhaps, after all, the most valuable of our edible species, being prepared by boiling for several hours till they are reduced to a pulpy substance, which is brought to table under the name of *marine sauce*, *sloke* or *slouk*.

But of all those used for food, *Gigartina lichenoides*, an East Indian species resembling our *G. compressa*, which, if as abundant, would be equally valuable, deserves the first rank. This, under the name of "*Ceylon moss*," is much used in the East as a nutritive article of food, and for giving consistence to other dishes. It is of a very gelatinous nature, and when boiled down is almost wholly convertible into jelly, which is of a purer nature than that obtained from our *Chondri*. Large quantities are annually sold. The famous *edible nests* of China, the finest of

which sell for their weight in gold, are constructed by a species of swallow from some undetermined plant of this genus, allied to *G. lichenoides*. Several other species appear also to be used in the East in a similar manner. *Laminaria potatorum* is said to be used as food by the natives of Australia, and *Labillardière* "observed the natives of the woods round Van Dieman's Land use portions of its great leaves folded into the form of a pouch, for the purpose of keeping fresh water." Similar uses are assigned to *Durvillæa utilis* and other plants of the family, as applied by the people of the coast of Chili.

Some species have been applied in medicine. The mucus of *Fucus vesiculosus*, and other species, has been recommended, by *Dr. Russell*, in diseases of the glands, for which *iodine*, exclusively obtained from plants of this family, and which probably exists in the mucus, is now considered so powerful a remedy. "It is a curious fact," observes Dr. Greville, "that the stems of a sea-weed are sold in the shops, and chewed by the inhabitants of South America, wherever *goitre* is prevalent, for the same purpose. This remedy is termed by them *Palo coto*, (literally goitre-stick), and from the fragments placed in my hands by my friend *Dr. Gillies*, to whom I am indebted for this information, the plant certainly belongs to the order *Laminarieæ*, and is probably a species of *Laminaria*." *Acanthophora muscoides* and *Gigartina helminthocorton* still hold a place in the Pharmacopœia as vermifuges, and are sold in the shops; but they have ceased to be in much esteem.

As highly useful in some of the finer arts I must not forget to mention *Gigartina tenax*, a Chinese species, which is extensively used by the ingenious inhabitants of that country as a glue and varnish. Large quantities of this plant, according to Turner as much as 27,000 lbs. weight, are annually imported into Canton from the pro-

vinces of *Fo-kien* and *Tche-Kiang*, and sold at from 6*d.* to 8*d.* per lb. It is converted by boiling into a vegetable glue of a very tenacious quality, which cools into a stiff jelly, and again liquifies on the application of heat. It is much used in the manufacture of the lanterns and transparencies for which the Chinese are so celebrated. *Mr. Neill* supposes that it forms a principal ingredient in the gummy matter *chin-chou* or *hai-tsai*, of China and Japan, with which "windows framed simply of slips of bamboo crossed diagonally, have their lozenge-shaped interstices wholly filled up." It is surely probable that when we become better acquainted with these plants, similar valuable properties may be discovered in other species of the genus *Gigartina*, and of the allied groups *Chondrus* and *Gelidium*, all of which may be converted into a gelatine by boiling.

I could have wished, before closing this Introduction, to have given a sketch of the History of Algology, or notices of the principal botanists by whose labours our knowledge of the Algæ has been furthered, and of the introduction and gradual progress of a systematic arrangement,—but for this my limits are too narrow. I must content myself therefore with having detailed the *structure*, *habits*, and *uses* of these interesting plants, and shall conclude with a few words explanatory of my design in the present MANUAL. The want of a work in the English language, entirely devoted to the British Algæ, in which fuller descriptions should be given than the scope of '*Hooker's British Flora*' admitted of, and in which all the known species should be included, has long been felt by lovers of this branch of Botany. Had my friend *Dr. Greville* completed, as was once his intention, his admirable '*Algæ Britannicæ*,' no room would have been left for my humble labours, nor should I for a moment wish to take the subject out of such

able hands. But his work has unfortunately stopped short with the "*inarticulate*" tribes, nor has he at present any intention of resuming it. The task has consequently fallen on my shoulders, and my object will be gained and my ambition fully satisfied, if, in the following pages, I have succeeded in affording any assistance to the researches of my fellow students. I could have wished, and indeed had intended, that the work should be illustrated with figures, at least of the genera; but my limited stay in Europe did not afford time to prepare them, and it does not now appear desirable to delay the publication till they could be got ready. However they might have added to the beauty of the book, the student will experience little loss by their omission who takes this MANUAL for what I wish it to be, a companion to the 'ALGÆ DANMONIENSES, *published and sold by Mary Wyatt, dealer in Shells, Torquay;*' a most important work, now extending to 4 volumes, with a Supplement, composed of *specimens* of 234 species, beautifully dried and correctly named. These volumes furnish the student with a help, such as no figures, however correctly executed, can at all equal,—nature's own pencil illustrating herself. The richness of the marine Flora of Devonshire is well known, as well as the zeal with which it has been for many years explored by MRS. GRIFFITHS, who, I am happy to add, takes a warm and benevolent interest in the success of *Mrs. Wyatt's* publication, and what is more important, at least to botanists, exercises a careful oversight over the scientific portion of it. I am allowed to state that every sheet of specimens, of all the species on which there could be the least doubt, is submitted to Mrs. Griffiths' examination before they are inserted in the copies, and it is doing that lady but justice to add, that her unwearied attention to this necessary labour, and the ability with which she has performed it, are above praise. The work already contains by far the greatest portion of the rarest British species,

and generally in the most perfect state of *fructification*, to which great attention is paid, and where it is dicœcious two specimens are given. I have invariably quoted the '*Alg. Danm.*' in the following pages, as an *acknowledged standard*, and I refer to these quotations in proof of the extent of its value. I cannot conclude without warmly expressing my own obligations to my friend *Mrs. Griffiths* for a most liberal supply of all the interesting plants of her beautiful neighbourhood, and for valuable observations on their habits, and especially their fructification; and I may truly affirm that if *Mrs. Wyatt's* volumes owe their chief value to this lady's oversight, *this Manual* is no less to be considered a child of her benevolence, for had she not contributed *the specimens* it would have been impossible for me to have described many of the most interesting plants. My residence has never been, for any length of time, near the sea, and latterly having lived out of Europe, my opportunities of collecting British Algæ have been cut off, and I am consequently wholly dependant on the liberality of my algological friends. Among these Mrs. Griffiths deservedly holds the first place, but I should be most ungrateful did I omit my thanks to others who have favoured me with specimens, and no less valuable notes; and chiefly to Miss Cutler, Miss Ball, Miss A. Taylor, Sir W. J. Hooker, Mr. Borrer, Dr. Greville, Dr. Walker Arnott, Mr. Ralfs, Dr. Pollexfen, Rev. M. J. Berkeley, Mr. W. Thompson and Dr. Drummond, of Belfast, Mr. J. T. Mackay, and Mr. D. Moore. In the herbaria of my friends Sir W. J. Hooker and J. T. Mackay, I have had an opportunity of consulting most of the original specimens collected by Messrs. Turner, Brodie, Dillwyn, Hooker, Borrer, Miss Hutchins, and others, and on which the species figured and described in 'English Botany' and Dillwyn's 'British Confervæ' were founded; and I have thus had ample means of correcting several doubtful synonyms.

The question, *cui bono?* to what useful end are your pursuits? has often been asked of naturalists, but it has been already too often and too triumphantly answered by abler pens than mine, to render it necessary for me to apologise for indulging a love of Natural History, or to defend it from the aspersions of those who either fear or despise it. Happily the audience to which I should address myself is neither so numerous nor so respectable as it was thirty years ago; it is becoming every day less so, and will soon be confined to the ignorant and the sensual. To those few well-informed persons who still, from old prejudices, accuse us

> "——— of dropping buckets into empty wells,
> And growing old in drawing nothing up,"

we may say that till the well of creation be emptied there is no danger of our returning from our labours without abundant food for thought, and if we do not always make the best use of it, the blame must rest with us and not with Natural History. The sportsman, it is true, often pursues his game with intense ardour till it is brought down, and then ceases to regard it with interest. So, I fear, it too often is with naturalists, but it is not necessarily so. Nay, of all men, they who are best acquainted with the works of the Divine finger, and who know how justly it may be said "we are fearfully and wonderfully made," are surely most bound to cling to the truths of revelation, for they have continually before them collateral evidences of the certainty of those "invisible things" which are "clearly seen, being understood by the things that are made, even His eternal power and Godhead, so that they are without excuse." If they too often neglect the true *use* of this knowledge, and rest satisfied with the knowledge itself, the fault and the loss is their own, and must not be charged to Science. It is enough for her if she but furnish

food which is capable of nourishing the well-directed heart; it is not her province either to cleanse that heart, or to give it powers of digestion. For this she must refer her votary to a higher and a holier voice; and if she ever speak of looking

"Through Nature up to Nature's God,"

she does so with a humble deference to her elder sister, whose province it is to lead the heart to that contemplation. Science and Religion must not be confounded: each has her several path, distinct, but not hostile: each in her way is friendly to man, and, where both unite, they will ever be found to be his best protectors:—the one "a light to his eyes," opening to him the mysteries of the material universe;—the other "a lamp to his feet," leading him to the immaterial, and incorruptible, and eternal. The "eye," it is true, will grow dim when the light of this world fails; and happy is he who then has "a lamp," lighted from heaven and trimmed on earth, to guide him through the hours of darkness. But the eye must not be blamed because it is not the lamp; nor should science be disdained because she leaves us far short of just conceptions of the invisible world. Her highest flight is but to the threshold of religion; for what a celebrated writer has said of philosophy generally, is equally applicable to every branch of scientific enquiry. "In wonder all philosophy began; in wonder it all ends: and admiration fills up the interspace. But the first wonder is the offspring of ignorance; the last is the parent of adoration. The first is the birth-throe of our knowledge; the last is its euthanasy and apotheosis."

W. H. H.

Cape Town, Cape of Good Hope,
October 5, 1840.

SYNOPSIS

OF THE

FAMILIES AND GENERA.

Series I. MELANOSPERMEÆ. *Plants* of an olive-green or olive-brown colour, and cellular or filamentous structure; growing in the sea. *Fructification* contained in definite capsules or receptacles, or in distinct sori. *Seeds* dark coloured.

Fam. I. Fucoideæ. *Marine plants of an olive-brown colour, changing to black in the air; of a leathery or woody substance, and fibrous structure, tearing with facility in a longitudinal direction. Root scutate; in some species accompanied with creeping fibres. Frond flat, compressed or filiform, in many producing distinct leaves; and in most, furnished with air-vessels. Fructification: sphærical clusters of opaque seeds, surrounded by a pellucid limbus, imbedded in distinct gelatinous receptacles, and finally escaping by external pores.*

1. Sargassum. Air-vessels stalked. Leaves distinct.

2. Cystoseira. Air-vessels simple, innate in the branches. Receptacles small, having distinct cells in which the seeds are contained.

3. Halydrys. Air-vessels stalked, lanceolate, divided into several compartments by transverse septa.

4. Fucus. Air-vessels (when present) immersed in the frond. Receptacles swollen, containing clusters of seeds imbedded in mucus.

5. Himanthalia. Frond cup-shaped. Receptacles (frond-like) very long, strap-shaped, dichotomously branched.

Fam. II. Lichineæ. *Marine plants of a blackish green colour, changing to black in the air; cartilaginous, minute, branched, without leaves. Fructification: receptacles furnished with a terminal pore, "and filled with a colourless, gelatinous mass of very fine filaments, among which pellucid oval or oblong seeds are disposed in many radiating, moniliform series."—Grev.* I am not at all satisfied about the true situation of this small tribe, but place it immediately after the *Fucoideæ*, in compliance with the ideas of Dr. Greville. In many respects, especially in the structure of the capsules or receptacles, it approaches some genera of *Lichenes*.

6. Lichina. Character the same as the tribe.

Fam. III. Laminarieæ. *Marine plants, of an olive-brown or olive-green colour, becoming rather darker on exposure; coriaceous or membranaceous, fibroso-cellular, not reticulated. Root lobed or fibrous. Frond stalked, terminating in a leaf-like expansion which is often cleft, and occasionally midribbed, or variously costate. Fructification obscure: "as far as hitherto known, either seeds mixed with a mass of vertical, jointed filaments, or roundish granules, without filaments; forming, in both cases, dense, spreading spots or sori, on the surface of some part of the frond."—Grev.*

7. Alaria. Frond membranaceous, with a cartilaginous, percurrent midrib.

8. Laminaria. Frond simple or cleft, without any distinct midrib.

Fam. IV. Sporochnoideæ. *Plants marine, olivaceous or yellowish green, much branched, the branches mostly distichous; foliaceous, compressed or filiform, inarticulate, becoming quickly flaccid on exposure to the air, "in some cases acquiring, under such circumstances, a verdigris-green colour, and then possessing the property of rapidly decomposing other delicate Algæ in contact with them." Fronds generally bearing at some period of their growth, deciduous tufts of bright green filaments. Fructification imperfectly known: "composed of club-shaped, monili-*

form, radiating filaments, either forming sessile warts, or arranged concentrically in little, stalked, club-shaped bodies, terminated by pencils of delicate fibres."—Grev.

9. Desmarestia. Frond plane or compressed, distichously branched; branches set with marginal spines.

10. Dichloria. Frond capillary, cylindrical, excessively branched; all the divisions opposite.

11. Sporochnus. Frond cylindrical, or compressed, irregularly branched. *Fructification:* club-shaped filaments arranged either in sessile *warts* or in stalked *receptacles.*

12. Elaionema. Frond cylindrical, furnished with subdistant whorls of delicate, jointed filaments. *Fructification:* jointed pods, rising on little stalks from the whorled fibres.

Fam. V. Dictyoteæ. *Plants marine, of an olive-green colour, and membranaceous, flexible substance, rarely cartilaginous, and scarcely at all juicy, with a highly reticulated structure. Frond cylindrical or flat, simple or branched, nerveless (except in* Halyseris*), often divided in a flabelliform manner. Fructification: dark-coloured, ovate or pear-shaped seeds, with pellucid cases, which are variously arranged, either in lines, in sori, or covering the whole frond; very rarely enclosed in capsules.*

** Root, a mass of woolly filaments.*

13. Cutleria. Frond ribless, irregularly cleft. *Fructification:* clusters of stalked capsules.

14. Halyseris. Frond with a mid-rib.

15. Padina. Frond fan-shaped, cleft. Seeds ranged in concentric lines.

16. Dictyota. Frond ribless, dichotomous, or irregularly cleft. Seeds scattered over the frond.

*** Root a minute, naked disk.*

17. Dictyosiphon. Frond tubular, branched. Seeds scattered.

18. Striaria. Frond tubular, branched. Seeds in transverse lines.

19. Punctaria. Frond a simple, flat leaf.

20. Asperococcus. Frond an unbranched, cylindrical or compressed tube.

21. Chorda. Frond simple, filiform, cylindrical, furnished at intervals with internal septa.

Fam. VI. Ectocarpeæ. *Plants marine, of an olive-green, or (rarely) full-green colour, filamentous, often capillary or cobwebby, jointed; cartilaginous or flaccid, not very juicy. Frond much branched, mostly of an uniform structure throughout; articulations of the filaments mostly very short, (but very variable in the same filament, and not to be depended on in forming specific characters). Root generally minute, sometimes accompanied by woolly fibres. Fructification double, often produced on the same individuals: 1st, capsules containing dark-coloured seeds; 2nd, granules imbedded in the distended, often colourless, tips of the ramuli.*

22. Cladostephus. Stem inarticulate, branched, whorled with short, jointed ramuli.

23. Sphacelaria. Stem jointed, branched, distichous, pinnated, rigid.

24. Ectocarpus. Stem capillary, generally much branched, flaccid, jointed.

25. Myriotrichia. Stem simple, jointed, flaccid, set with short quadrifarious ramuli, which are tipped with colourless, jointed fibres.

Fam. VII. Chordarieæ. *Plants marine, of an olive-green or olive-brown colour, becoming darker on exposure, of a cartilaginous or gelatinous substance, and celluloso-filamentous structure. Frond filiform (except in* Corynephora, *which is globose and tuberculose), much branched, cylindrical; the centre or axis composed either of longitudinal, aggregated, colourless, jointed filaments, or of a solid, cellular substance; the periphery consisting of coloured, simple or branched, somewhat clavate, moniliform, jointed filaments, disposed in a verticillate manner round the axis. Fructification: (so far as ascertained), ovate or pear-shaped, olive-coloured seeds (capsules?), enveloped in pellucid cases, imbedded among the filaments of the periphery, to the ramuli of which they are laterally attached.*

26. Chordaria. Frond filiform; axis firmly gelatinous, cellular. Circumference composed of simple, club-shaped, whorled filaments.

27. Helminthocladia. Frond filiform; axis loosely gelatinous, filamentous. Circumference composed of branched, coloured, whorled filaments.

28. Corynephora. Frond globose or tuberous, hollow.

Series II. RHODOSPERMEÆ. *Plants* marine (except the genus *Trentepohlia*), of a rose-red, purple, or red-brown colour, leafy, cylindrical or filamentous. *Fructification* mostly double; the primary contained in capsules, receptacles, or immersed in the frond; secondary (when present), minute granules forming sori, or imbedded in distinct receptacles. *Seeds* red or red-brown.

Fam. VIII. Gloiocladeæ. *Plants marine, of a rose-red or purple colour, giving out a red juice on immersion in fresh water, of a gelatinous, lubricous substance, and filamentous, rarely cellular structure. Frond filiform, branched, cylindrical, solid or tubular; the periphery (except in* Naccaria, *in which genus no parts but the ultimate ramuli are so composed) consisting of coloured, branched, verticillate filaments, lying in a loose jelly. Fructification: clusters or globules of red seeds, imbedded among the filaments of the periphery, to which they are attached.*

29. Mesogloia. Frond solid, gelatinous; the axis composed of longitudinal, colourless fibres; the periphery of radiating, coloured filaments.

30. Gloiosiphonia. Frond tubular, gelatinous; the periphery composed of radiating, coloured filaments.

31. Naccaria. Frond solid, subgelatinous; the axis laxly cellular; the periphery membranaceous; ramuli composed of branched, radiating filaments.

Fam. IX. Gastrocarpeæ. *Plants marine, of a pink, purple, or dull red colour, of a fleshy, gelatinoso-cartilaginous or membranaceous substance; "the structure consisting of a cellular, external coat or membrane, and a pellucid, gelatinous, internal mass, mostly traversed by colourless, jointed filaments, arising from the outward membrane." — Grev.*

Frond either cylindrical, compressed or flat, destitute of midrib or veins. Fructification: globules or clusters of minute red seeds, imbedded in the internal substance of the frond.

32. Catenella. Frond filiform, contracted, as if jointed, at intervals.

33. Dumontia. Frond cylindrical, tubular, dull red or greenish. Globules of seeds attached to the inner face of the tube.

34. Halymenia. Frond cylindrical, compressed, or flat, gelatinoso-membranaceous, pinky-red. Globules of seeds imbedded in the central substance of the frond.

35. Iridæa. Frond fleshy, flat, purple. Globules of seeds imbedded in the central substance of the frond.

Fam. X. Spongiocarpeæ. *Marine plants, of a dull, dark purple colour; of a cartilaginous or fleshy substance, and fibrous structure. Frond cylindrical, dichotomous; the central part composed of very slender, closely packed, longitudinal fibres; the circumference formed of radiating, dichotomous filaments. Root scutate. Fructification double* (?); 1, *naked spongy warts, composed of radiating filaments, among which are imbedded globules of red seeds:* 2, *minute granules immersed in the substance of the slightly swollen upper ramuli.*

36. Polyides. Character the same as of the family.

Fam. XI. Furcellarieæ. *Marine plants, of a dull, dark purplish colour, of a fleshy substance and cellular structure. Frond cylindrical, dichotomous; the central part closely cellular; the circumference composed of radiating, simple filaments. Root creeping. Fructification: terminal, pod-like, indehiscent receptacles, within which is imbedded, beneath the outer coat, a stratum of dark red-brown seeds.* Very similar to the preceding family in habit and outward appearance; but decidedly differing in fructification and structure.

37. Furcellaria. Character the same as of the family.

Fam. XII. Florideæ. *Plants marine, of a purplish-red or fine rose colour, of a leathery, a cartilaginous, or a mem-*

branaceous substance, and cellular texture; the cellules often highly developed. Frond either flat, leafy, compressed or cylindrical, occasionally filiform or filamentous, inarticulate. Fructification mostly double, and produced on distinct individuals of the same species: 1, *capsules or tubercles, containing a mass of ovate or pear-shaped seeds:* 2, *granules, either scattered or collected into little groups, and situated either in the substance of the frond or in distinct processes.*

A. *Capsules roundish or sphærical, without a terminal pore, containing angular seeds.*

* *Capsules without an involucre.*

a. Frond leafy or flat.

38. Delesseria. Frond leafy, with a percurrent midrib.

39. Nitophyllum. Frond expanded, delicately membranaceous, without a midrib. Granules forming distinct sori.

40. Rhodomenia. Frond membranaceous, expanded, ribless. Granules forming indistinct, diffused, cloudy spots.

49. Chondrus. Frond cartilaginous, dilating upwards into flat, dichotomously cleft segments, of a purplish or reddish colour.

50. Phyllophora. Frond membranaceous, proliferous from the disk, furnished at the base with an obscure midrib.

β. Frond compressed or cylindrical.

41. Plocamium. Frond filiform, much branched, branches distichous, (ramuli pectinate). Capsules sessile, lateral.

51. Sphærococcus. Frond cartilaginous, two-edged, linear, distichously branched. Capsules on little processes fringing the margin.

47. Chylocladia. Frond filiform, cylindrical (often constricted as if jointed), gelatinoso-cartilaginous, pinky-red.

48. Gigartina. Frond cartilaginous, cylindrical, of a dull red colour.

52. Gelidium. Frond horny or cartilaginous, linear, more or less regularly pinnated or bipinnate, distichous, deep red.

*** Capsules with an involucre of short ramuli.*

42. Microcladia. Frond filiform, irregularly branched, distichous. Capsules sessile, solitary, near the tips.

54. Ptilota. Frond compressed, linear, pectinato-pinnate. Capsules clustered, on the tips of the pectinate ramuli.

B. *Imbedded, aggregated tubercles, furnished with a pore, and containing a mass of free, elliptical or roundish seeds.*

53. Grateloupia. Frond flat, pinnated, linear.

C. *Capsules ovate, with a terminal pore, containing a tuft of pear-shaped seeds.*

43. Odonthalia. Frond flat, dark vinous-red, linear, with an obsolete midrib, alternately toothed at the margin.

44. Rhodomela. Frond cylindrical, cartilaginous, dark red, (apices often involute). Receptacles pod-like, containing ternate granules.

45. Bonnemaisonia. Frond filiform, compressed, rose-red, delicate, much branched; branches set with distichous ciliæ.

46. Laurencia. Frond cylindrical or compressed, gelatinoso-cartilaginous, yellowish or purplish-red. Ternate granules imbedded in the ramuli.

Fam. XIII. Ceramieæ. *Plants marine (with the exception of* Trentepohlia*), of a red, purple or reddish-brown, rarely brown colour, staining fresh water with more or less of a red hue, of a cartilaginous or flaccid substance and cellular texture. Frond filamentous, cylindrical or compressed, jointed. Fructification double;* 1, *capsules containing a mass of seeds;* 2, *granules contained in distorted ramuli or in proper receptacles.*

** Inhabit the sea.*

a. Capsules ovate, with a terminal pore.

55. Polysiphonia. Frond longitudinally striate, with internal, parallel tubes. Granules in distorted ramuli.

56. Dasya. Stem inarticulate; ramuli articulate, single-tubed. Granules contained in lanceolate receptacles, borne by the ramuli.

β. Capsules globose, without a pore.

57. CERAMIUM. Filaments jointed, more or less reticulated; dissepiments opaque. Granules half imbedded in the ramuli.

58. SPYRIDIA. Stems inarticulate, beset with short, setaceous, jointed ramuli. Capsules minute, with wide, transparent borders. Granules contained in stalked, gelatinous, roundish receptacles.

59. GRIFFITHSIA. Filaments mostly dichotomous; dissepiments colourless. Capsules clustered, with wide colourless borders. Receptacles involucrated, gelatinous, roundish, containing minute granules.

60. CALLITHAMNION. Filaments mostly pinnated, rarely dichotomous; dissepiments colourless. Capsules scattered, with wide colourless borders. Receptacles sessile on the branches, lobed, containing large granules.

** *Inhabits fresh water.*

61. TRENTEPOHLIA.

SERIES III. CHLOROSPERMEÆ. Plants growing either in the sea, in fresh water, or in damp situations; either filamentous, membranaceous, or shapeless; either colourless, or (owing to the presence of an internal, granular, sporular mass), of a grass-green, very rarely purple or red colour. Fructification: green or purple sporules, either filling the frond, or collected into sporidia, rarely contained in external capsules.

FAM. XIV. LEMANIEÆ. *Plants growing in fresh water, filamentous, inarticulate, of a cartilagineo-coriaceous substance and cellular structure. Fronds hollow, furnished at irregular distances with whorls of warts, or moniliform. Fructification: tufted, simple or branched, moniliform filaments, attached to the inner surface of the tubular frond, and finally breaking up into elliptical sporules.*

62. LEMANIA. Character the same as of the family.

FAM. XV. BATRACHOSPERMEÆ. *Plants growing in fresh water; filamentous, articulate, invested with gelatine.*

Fronds composed of aggregated, articulate, longitudinal fibres, whorled at intervals with short, horizontal, cylindrical, or beaded, jointed ramuli. Fructification: (*in* BATRACHOSPERMUM) *dense, globular masses, attached to the whorled ramuli, and consisting of minute, radiating, dichotomous, beaded filaments.*

63. BATRACHOSPERMUM. Whorled ramuli moniliform.

64. THOREA. Stems inarticulate; whorled ramuli byssoid, cylindrical.

FAM. XVI. CHÆTOPHOROIDEÆ. *Plants growing in the sea or in fresh water, invested with gelatine, either filiform or (a number of filaments being collected together) formed into gelatinous, branched or shapeless fronds, or masses. Filaments jointed; articulations colourless at each end, coloured in the middle. Fructification: so far as known, minute capsules attached to the ramuli.*

65. BULBOCHÆTE. Filaments free; each articulation bearing, at its truncate apex, either an elongated, inarticulate, deciduous seta, or a sessile capsule. *Aquatic.*

66. DRAPARNALDIA. Filaments free, gelatinous; stems nearly colourless, emitting at the joints pencils of coloured ramuli. *Aquatic.*

67. CHÆTOPHORA. Filaments aggregated, collected into shapeless, incrusting, or branched gelatinous fronds. *Aquatic or marine.*

68. MYRIONEMA. Plants exceedingly minute, parasitical, consisting of a mass of simple, club-shaped, erect filaments bound together by a firm gelatine. *Brown, marine.*

FAM. XVII. CONFERVEÆ. *Plants growing in the sea or in fresh water, filamentous, articulate, without defined gelatine. Fronds very variable in appearance, simple or branched; articulations more or less filled with a green, very rarely brown or purple, granular mass, which affects various forms, and is supposed to be of a sporaceous nature.*

69. CONFERVA. Filaments simple or branched, free (not connected by transverse tubes); articulations containing a granular mass.

70. HYDRODICTYON. Filaments forming a network with regular, polygonal meshes.

71. Mougeotia. Filaments simple, finally irregularly united by transverse tubes. Colouring matter granular, at length forming roundish globules at the point of juncture.

72. Tyndaridea. Filaments simple, finally united by transverse tubes. Colouring matter consisting of two roundish masses in each joint.

73. Zygnema. Filaments simple, finally united by transverse tubes. Colouring matter forming dotted, spiral rings.

74. Sphæroplea. Filaments at first articulated, afterwards filled with green globes which move freely in them.

75. Aphanizomenon. Filaments simple, cohering in flat laminæ, at length separating, oscillating, minute.

Fam. XVIII. Siphoneæ. *Plants found in the sea, in fresh water, or on damp ground, of a membranaceous or horny hyaline substance, filled with a green, granular matter. Frond tubular, filamentous; the filaments free or collected into spongy fronds of various shapes, either crustaceous, globular, cylindrical or flat. Fructification: vesicles (coniocystæ) external, often stalked, containing a granular mass.*

76. Codium. Filaments closely combined into a sponge-like frond. *Marine.*

77. Bryopsis. Filaments free, branched; branches pinnated. *Marine.*

78. Vaucheria. Filaments irregularly branched. Fructification: dark green vesicles attached to the frond. *Mostly in fresh water, rarely in the sea.*

79. Botrydium. Plant a sphærical vesicle, terminating below in root-like fibres. *On damp ground.*

Fam. XIX. Oscillatorieæ. *Plants growing either in the sea, in fresh water, or on damp ground, of a gelatinous substance, and filamentous structure. Filaments slender, tubular, continuous, filled with a coloured, granular, transversely striate matter, seldom branched, though often cohering together so as to appear branched, usually massed together in broad, floating or sessile strata, of a very gelatinous nature; occasionally erect and tufted, and still more rarely collected into radiating series, bound together*

by firm gelatine, and then forming globose, lobed, or plane-crustaceous fronds. Fructification: an internal mass, divided by transverse septa, finally separating into roundish or lenticular sporidia.

80. Rivularia. Frond firmly gelatinous, globose or lobed; composed of filaments set in gelatine, radiating either from a fixed centre or base.

81. Stigonema. Filaments tufted, branched; branches transversely dotted.

82. Scytonema. Filaments brown, branched, flaccid, tough; transversely striated.

83. Calothrix. Filaments short, tufted, green or purple, simple or pseudo-branched.

84. Lyngbya. Filaments green or purple, decumbent, very long, flaccid.

85. Oscillatoria. Filaments rigid, acicular, heaped together in a gelatinous stratum, from which they radiate and oscillate.

86. Belonia. Filaments minute, heaped together, submoniliform, at length dissolved into elliptic sporidia.

87. Petalonema. Flat, branched or simple filaments, the margins membranaceous and striate, containing in the centre, annular, parallel disks.

88. Microcoleus. Filaments minute, rigid, bundled, and enclosed in simple or branched, membranaceous, sheathing fronds.

Fam. XX. Ulvaceæ. *Plants growing in the sea, in fresh water, or on damp ground; of a membranaceous or gelatinous substance, and simple, imperfectly reticulated, structure, Frond either a tubular or flat, filiform or expanded membrane, or a gelatinous shapeless mass; colourless, or, owing to the presence of fructification, of a green, purple, or pinkish colour. Fructification: minute, green or purple granules, scattered through the frond, or arranged in fours.* To this family, as understood by Dr. Greville, I have ventured to add several genera from the "Nostochinæ" of the British Flora. Any one acquainted with these plants must be aware, that though there is much apparent difference between the *extreme* genera, *Porphyra*

and *Protococcus*, yet the line, even of generic distinction, cannot clearly be defined in the medial ones. Thus *Ulva* insensibly passes (through *U. bullosa*), into *Tetraspora;* this into *Palmella;* this again into *Hæmatococcus*, which is scarcely different from *Protococcus*. In the 'Flora Hibernica' I doubtfully referred *Nostoc* to this place also: I now rather regard it as the type of a distinct family, the lowest in organization in the *genuine* Algæ.

* *Plants membranaceous, not gelatinous.*

89. Porphyra. Frond leafy, purple.

90. Ulva. Frond leafy, green.

91. Bangia. Frond linear, capillary, transversely dotted.

92. Enteromorpha. Frond tubular, simple or branched, green.

** *Plants gelatinous.*

93. Tetraspora. Frond gelatinoso-membranaceous, expanded, green. Granules in fours.

94. Palmella. Frond a polymorphous, gelatinous mass, filled with scattered granules, (sometimes arranged in fours).

95. Hydrurus. Frond cylindrical, branched, containing scattered granules.

96. Hæmatococcus. Minute, gelatinous, bag-like fronds, heaped together into a crust, and containing a few scattered granules.

97. Protococcus. Plant consisting of aggregated, minute globules, (filled with granules), and sessile on a gelatinous mass.

Fam. XXI. Nostochinæ. *Plants growing in fresh water, or in damp situations among mosses, &c.; of a gelatinous or sub-coriaceous substance, and simple structure, consisting of variously curved or twisted, moniliform, simple filaments, which are either contained in gelatinous fronds of determinate form, or heaped together without order in a slimy, gelatinous matrix.* Echinella and Eutomia do not strictly belong to this family, but are provisionally placed here until their true position in the system be ascertained. Perhaps the former should range with Aphanizomenon; and the latter be referred to the Diatomaceæ.

** Genuinæ.*

98. Nostoc. Frond coriaceo-gelatinous, globose or lobed, filled with numerous curled, moniliform filaments.

99. Monormia. Frond branched, composed of a single, moniliform thread, following the ramifications, immersed in gelatine.

100. Anabaina. Filaments freely floating in water, simple, moniliform, curved, invested with mucous matter and having a vermicular motion.

*** Spuriæ.*

101. Echinella. Dot-like, sphærical fronds, composed of jointed filaments radiating from a centre.

102. Eutomia. Dot-like, flat fronds, composed of two cloven laminæ cohering by the edges, and finally separating.

Fam. XXII. ? Byssoideæ. *Plants of doubtful affinity, related to the* Fungi. *Filaments jointed, hyaline or coloured. Fructification very obscure.—They are found among mosses, on rotten wood, on damp ground, on glass, or in chemical solutions, and on decaying animal substances; a few are found in fresh water and in the sea.*

103. Byssocladium. Filaments cobwebby, radiating from a centre, with scattered, external granules. *On damp glass.*

104. Mycinema. Filaments membranaceous, opaque, tenacious, coloured. *On rotten wood.*

105. Chroolepus. Filaments rigid, sub-solid, opaque, torulose, falling to powder.

106. Protonema. Filaments sub-articulated, rooting. *Among mosses.*

107. Hygrocrocis. Filaments hyaline, interwoven into an uniform membrane or gelatine. *In chemical solutions.*

108. Leptomitus. Filaments hyaline, erect, parasitical. *Growing in fresh water or in the sea.*

109. Scythymenia. A tough, coriaceous, spreading frond, composed of fibres intermixed with granules. *On rocks.*

SERIES IV. DIATOMACEÆ. *Plants* growing in the sea, in fresh water, or in damp situations; of small size, frequently very minute and parasitical, composed of little bodies called *frustula*, which are either cylindrical, rectangular, wedge-form or elliptical; variously arranged: either disposed in filaments; contained in gelatinous, membranaceous or cartilaginous fronds; or heaped together without order in a mucous matrix. *Frustula* of a rigid, horny substance, fragile, colourless, or containing coloured globes or granules. *Colour* yellow, green, olivaceous, or brown. Smell in the larger species generally very offensive. All appear to be short-lived; some extremely fugaceous.

FAM. XXIII. DESMIDIEÆ. *Cylindrical or angular filaments, at length separating into segments, (frustula.)*

110. MELOSEIRA. Filaments cylindrical, constricted.

111. DESMIDIUM. Filaments angular.

FAM. XXIV. FRAGILARIEÆ. *Filaments plane, generally very fragile, composed of rectilinear frustules; or frustules radiating from a centre.*

112. FRAGILARIA. Filaments band-like, attenuated, densely striated across, separating at the striæ, (not cohering by the angles).

113. STRIATELLA. Filaments stipitate, fragile, composed of transversely striated frustules, which at length separate, cohering by the angles.

114. ACHNANTHES. Frond stipitate, standard-shaped.

115. ISTHMIA. Filaments composed of oblique-angled frustules, cohering at the angles by means of little necks.

116. ODONTELLA. Filaments composed of quadrate frustules, with salient angles; frustules cohering by the angles.

117. DIATOMA. Filaments composed of rectangular frustules, cohering at the angles and finally separating.

118. EXILARIA. Frustules rectangular, radiating from a central fixed point.

119. FRUSTULIA. Frustules free or imbedded in a mucous matrix.

FAM. XXV. STYLLARIEÆ. *Frustula plane, wedge-shaped, arranged in circles or fans.*

120. STYLLARIA. Frustules separate, stemless.

121. MERIDION. Frustules arranged in plane, sessile circles, or segments of circles.

122. LICMOPHORA. Frustules united into fan-shaped laminæ, fixed to the summit of a (usually branched) stipes.

FAM. XXVI. CYMBELLEÆ. *Frustula elliptical, (in* GOMPHONEMA *sometimes wedge-shaped), or lanceolate.*

123. GOMPHONEMA. Frustula solitary or geminate, terminating a very slender, simple or branched, filament.

124. HOMÆOCLADIA. "Frustula arranged in numerous, binate, distant, parallel series, within a tubular frond."—*Ag.*

125. BERKELEYA. Frustula in longitudinal series within simple, mucous filaments, which spring from a roundish, firmly gelatinous mass.

126. SCHIZONEMA. Frustula in longitudinal series or scattered; inclosed within a simple or branched, gelatinous or membranaceous frond.

127. CYMBELLA. Frustula free, or heaped together in a mucous matrix.

BRITISH ALGÆ.

Series I. MELANOSPERMEÆ.

Tribe 1. FUCOIDEÆ.

I. Sargassum. Ag.

Frond furnished with distinct, stalked, nerved *leaves*, and simple, axillary, stalked *air-vessels*. *Receptacles* small, linear, tuberculated, mostly in axillary clusters. *Seeds* in distinct cells.—Name, altered from *sargazo*, the Spanish term for the masses of floating seaweed common in some latitudes.

1. S. *vulgare*, Ag.; stem flat, slender, alternately branched; leaves linear-lanceolate, serrated, dotted with mucous pores; air-vessels few, sphærical, on flat stalks; receptacles cylindrical, racemose. *Grev. Alg. Brit. p.* 2, *t.* 1; *Hook. Br. Fl.* ii. *p.* 264; *E. Bot. t.* 2114.

Occasionally cast ashore. Orkneys, *Mr. P. Neill.*—*Stem* 12—18 inches long, pinnated with simple branches. *Leaves* very variable in breadth. *Colour*, when recent, olive, reddish brown when dry.

2. S. *bacciferum*, Ag.; stem cylindrical, slender, much branched, flexuose; leaves linear, serrated, mostly without pores; air-vessels abundant, sphærical, on cylindrical stalks; receptacles unknown. *Grev. Alg. Brit. p.* 3; *Hook. Br. Fl.* ii. *p.* 264; *E. Bot. t.* 1967.

Occasionally cast ashore with the preceding. Orkneys, *Mr. P. Neill.* Shore of Castle Eden Dean, Durham, *Mr. W. Backhouse.*—*Root* unknown. *Stems* extremely brittle. *Leaves* 1—2 inches long, and about a line wide, of a very pale olive colour when recent. This and the preceding species have no just claim on our Flora, being natives of the tropics, occasionally driven, together with cocoa-nuts and other tropical productions, by the force of the western currents on our Atlantic coasts.

II. Cystoseira. Ag.

Frond much branched, occasionally leafy at base; *branches* becoming more slender upwards, and containing strings of simple air-vessels within their substance. *Receptacles* cylindrical, small, tuberculated or prickly, terminal. *Seeds* in distinct cells. Name, κυστις, a *bladder*, and σειρα, a *chain*;

because the air-vessels are generally arranged in strings or series.

1. C. *ericoides*, Ag.; stem thick, woody, short, cylindrical, beset with numerous, slender, filiform branches, variously divided, and densely clothed with small, spine-like, awl-shaped ramuli (or leaves); air-vessels small, solitary near the apices; receptacles cylindrical, terminal, spiny. *Grev. Alg. Brit. p.* 4; *Hook. Br. Fl.* ii. *p.* 265; *E. Bot. t.* 1968; *Wyatt, Alg. Danm. No.* 1.

Rocks in the sea, chiefly in the S. West of England and West and South of Ireland; common. Yarmouth Beach, *Mr. Turner.* Port Rush, North of Ireland, *Mrs. Ovens.* Perennial. Summer and autumn.—*Root* a large and very hard disk. *Frond* one or two feet long, remarkably bushy, of a fine olive or yellowish green when removed from the water, but appearing, whilst growing beneath the surface, to be clothed with the richest iridescent tints. *Air-vessels* generally solitary, and immediately subtending the terminal receptacles, very small; sometimes scattered along the branches.

2. C. *granulata*, Ag.; stem cylindrical, covered with elliptical knobs, each of which bears a slender, repeatedly divided, dichotomo-pinnated, cylindrical branch, irregularly set with scattered, incurved, awl-shaped, spine-like ramuli; air-vessels small, linear-oblong, two or three together in the upper part of the branches; receptacles elongated. *Grev. Alg. Brit. p.* 5, *t.* 2; *Hook. Br. Fl.* ii. *p.* 265; *E. Bot. t.* 2169; *Wyatt, Alg. Danm. No.* 101.

Rocky pools left by the tide on the South coasts of England and Ireland, not uncommon. Devon and Cornwall, *Mrs. Griffiths, Mr. Rashleigh, &c.* Bantry Bay, *Miss Hutchins.* Youghal, *Miss Ball.* Magilligan, Co. Derry, *Mr. G. Hyndman.* Larne, *Dr. Drummond.* Growing in pools at Ardglass, Co. Down, *Mr W. Thompson.* Perennial. Summer.—*Root* a flattish disk. *Stem* about the thickness of a goose-quill, 7 or 8 inches high; branches very slender, a foot or more in length, very much divided, each having at its base a hard bulbous *knob*, which forms one of the most striking characters of the species. *Colour* a semi-transparent olive-green.

3. C. *barbata*, Ag.; frond cylindrical, stem furnished with elliptical knobs, each producing a branch many times dicho tomo-pinnate and filiform; air-vessels lanceolate, chain-like; receptacles ovate-elliptical, mucronate. *Grev. Alg. Brit. p.* 6; *Hook. Br. Fl.* ii. *p.* 265; *E. Bot. t.* 2170.

In the sea. Said to have been gathered on the Devonshire coast by Hudson; a native, chiefly, of the Mediterranean.—Distinguished from the last species by the receptacles being tipped with a spine-like point.

4. C. *fœniculacea*, Grev.; stem compressed, branches long, slender, rough with hard points, repeatedly dichotomo-pinnate; air-vessels small, solitary or two together, elliptic oblong, near the apices of the branches; receptacles minute,

linear-lanceolate. *Grev. Alg. Brit. p.* 7; *Hook. Br. Fl.* ii. *p.* 265; *Turn. Hist. t.* 252; *E. Bot. t.* 2130 *and t.* 2131; *Wyatt, Alg. Danm. No.* 51.

Coasts of the South and S. West of England and Ireland. Perennial. Summer.—*Frond* 1—2 feet long; stem destitute of knobs, nearly cylindrical, 4—6 inches high, and bearing numerous, long, sub-simple, slender branches, which are generally naked toward the base, but in the upper part closely set with distichous, alternately pinnate or sub-dichotomous, secondary branches. In the young state, and especially when growing in deep water, this plant is furnished with long, flat, pinnatifid leaves, 1—2 lines broad, midribbed, dotted, and irregularly serrated at the margins, and then constitutes the *Cis. discors* of Agardh (*Fucus discors*, L.; *E. Bot. t.* 2131); but these leaves, as was long since shown by Mrs. Griffiths, and has been confirmed by Turner, Greville, and subsequent observers, finally elongate and become branches, and the plant assumes the appearance as above described.

5. C. *fibrosa*, Ag.; stem woody, compressed, bushy, very much branched; branches slender, alternately branched, the upper ones repeatedly divided, and furnished with lineari-setaceous, flattish ramuli; air-vessels elliptical, mostly solitary, immersed in the branches remote from the apices; receptacles filiform, much elongated. *Grev. Alg. Brit. p.* 8; *Hook. Br. Fl.* ii. *p.* 266; *E. Bot. t.* 1969; *Wyatt, Alg. Danm. No.* 52.

In the sea, chiefly on the southern coasts. Perennial. Summer. Coast of Yorkshire, *Hudson*. Yarmouth, rare, *Mr. Wigg*. West of Ireland. Shores of Antrim, *Mr. Templeton*. Portrush, *Mr. D. Moore.—Root*, a hard, spreading disk. *Frond* three feet long or more; *stem* mostly undivided, gradually diminishing upwards, and thickly set with distichous, alternate branches, slightly swollen at base, and furnished with one or two series of smaller ramuli, the terminal ones being long and setaceous. *Air-vessels* larger than in any other British species, and generally occurring near the base of the branches, solitary or two or three together. *Colour* olive-green.

III. Halydrys. Lyngb.

Frond compressed, coriaceous, linear, pinnated with distichous branches. *Air-vessels* lanceolate, stalked, divided into several cells by transverse septa. *Receptacles* lanceolate, stalked, compressed. *Seeds* in distinct cells. *Grev.*—Name, ἅλς, ἅλος, the *sea*, and δρυς, an *oak* or tree.

1. H. *siliquosa*, Lyngb.; branches linear, very narrow; air-vessels compressed, linear-lanceolate, slightly constricted at the septa, mucronate. *Grev. Alg. Brit. p.* 9, *t.* 1; *Hook. Br. Fl.* ii. *p.* 266; *E. Bot. t.* 474; *Wyatt, Alg. Danm. No.* 53. —β, *minor*; smaller in every part, with fewer vesicles. *Turn. Syn.* i. *p.* 61.

On rocky coasts, very common. Perennial. β, in shallow pools left by

the tide.—*Root* an expanded disk, from which spring several fronds 1—4 feet long, alternately branched; branches about a line wide, pinnated with similar ramuli, and in the upper part with air-vessels and receptacles. *Air-vessels* resembling pods or siliquæ, whence the specific name. The beautiful *Fucus osmundaceus*, Turn. Hist. t. 105, appears to be a second species of this genus, but its fruit is still a desideratum.

IV. Fucus. Linn. Ag.

Frond plane, compressed or cylindrical, linear-dichotomous (rarely pinnated), coriaceous. *Air-vessels*, when present, innate in the frond, simple, large. *Receptacles* terminal (except in *F. nodosus* and *constrictus*, Harv.), turgid, containing tubercles immersed in mucus, and discharging their seeds by conspicuous pores. *Grev.*—Name, φυκος a sea-weed.

** Frond flat, with a midrib.*

1. F. *vesiculosus*, L.; frond plane, coriaceous, thick, linear, dichotomous, quite entire at the margin, midribbed; air-vessels globose, mostly in pairs; receptacles elliptical, terminal. *Hook. Br. Fl.* ii. *p.* 267; *E. Bot. t.* 1066; *Grev. Crypt. t.* 319; *Wyatt, Alg. Danm. No.* 152.—β, *balticus;* very small, densely tufted, with an indistinct midrib, and destitute of vesicles or receptacles. *F. balticus, Ag.; Grev. Crypt. t.* 181.

Rocky shores, most abundant. β in salt marshes, occasionally flooded by the sea, chiefly on the western shores of Scotland.—Very variable in size and general appearance, often destitute of air-vessels. β is a remarkable state, 1 or 2 inches high, scarcely a line wide, and of a tawny yellow colour, forming dense masses. This plant is extensively used in the manufacture of *kelp*, and furnishes besides excellent winter food for the cattle in the western islands of Scotland. See *Lightfoot, Fl. Scot. vol.* ii. *p.* 906.

2. F. *ceranoides*, L.; frond plane, coriaceo-membranaceous, linear, subdichotomous, entire at the margin, midribbed, without vesicles; lateral branches alternate, dichotomous, multifid, level-topped; receptacles subcylindrical, acuminated. *Grev. Alg. Brit. p.* 14; *Hook. Br. Fl.* ii. *p.* 267; *E. Bot. t.* 2115; *Wyatt, Alg. Danm. No.* 153.

Sea-shores, less common than the last. Perennial.—Spring and summer. Nearly related to the last species, but "it is far less tough, much thinner and more transparent in every part, both in the growing and the dried state. The midrib is finer and more clearly defined."—*Grev.*

3. F. *serratus*, L.; frond plane, coriaceous, linear, dichotomous, serrated, midribbed, without air-vessels; receptacles flat, solitary, terminating the branches, serrated. *Grev. Alg. Brit. p.* 15; *Hook. Br. Fl.* ii. *p.* 267; *E. Bot. t.* 1221; *Wyatt, Alg. Danm. No.* 2.

Rocky sea-shores, very common. Perennial. Spring and summer.—*Frond* 2—6 feet long, very variable in breadth, dark olive-green. This is sometimes used in the manufacture of kelp, but rarely, as it is far less productive than *F. vesiculosus*. It however forms excellent manure, and in Norway it is used, mixed with meal, as provender for cattle.

** *Frond flat or compressed, without a midrib.*

4. F. *nodosus*, L.; frond compressed, coriaceous, sub-di chotomous; branches linear, somewhat pinnated, attenuated at base, remotely denticulate, here and there swelling into oblong air-vessels; receptacles lateral, globose, stalked, springing from the axils of the serratures. *Grev. Alg. Brit. p.* 16; *Hook. Br. Fl.* ii. *p.* 268; *E. Bot. t.* 570; *Wyatt, Alg. Danm. No.* 154.

Sea-shores, very common. Perennial. Winter and spring.—*Root* a large, hard, conical mass, from which spring several *fronds* 2—4 or even 6 feet long, which are once or twice forked, and irregularly pinnated with alternate simple branches. *Vesicles* large. Substance extremely tough and leathery. *Colour* full olive-green, glossy.

5. F. *Mackaii*, Turn.; frond coriaceous, cylindrical, or subcompressed, linear, dichotomous, the apices blunt; air-vessels elliptical, solitary, often wanting. *Grev. Alg. Brit. p.* 17; *Hook. Br. Fl.* ii. *p.* 268; *E. Bot. t.* 1927.

Sea-shores. Perennial. Cunnemara, Ireland, *J. T. Mackay, Esq.* West shores of Scotland and the Hebrides, *Messrs Borrer and Hooker.*—*Frond* 6—10 inches long, densely tufted, branches crowded, spreading, compressed at base, cylindrical upwards. *Vesicles* wider than the frond. *Receptacles* unknown. *Substance* leathery, when dry somewhat horny. *Colour* dull olive-green.

6. F. *canaliculatus*, L.; frond coriaceous, linear, channelled on one side, dichotomous, without air-vessels; receptacles terminal, oblong-wedge-shaped, swollen, bipartite. *Grev. Alg. Brit. p.* 18; *Hook. Br. Fl.* ii. *p.* 268; *E. Bot. t.* 823; *Wyatt, Alg. Danm. No.* 102.

Rocky coasts, near high-water mark. Perennial. Summer and autumn.—*Frond* 2—6 inches high, densely tufted, several times dichotomous, of an olive-brown or yellowish colour.

*** *Frond cylindrical. Root accompanied by creeping fibres.*

7. F. *tuberculatus*, Huds.; frond cylindrical, dichotomous, the axils rounded; air-vessels rarely present; receptacles terminal, elongate, cylindrical; root accompanied by creeping processes. *Grev. Alg. Brit. p.* 18; *Hook. Br. Fl.* ii. *p.* 269; *E. Bot. t.* 726; *Wyatt, Alg. Danm. No.* 103.

In the sea, rather rare. Perennial. Summer and autumn. Southern

shores of England. North of Ireland, *Dr. Scott.*—West of Ireland, abundantly. *Fronds* gregarious, rising from matted, creeping stems, erect, 12—18 inches high, about two lines in diameter, nearly simple at base, repeatedly dichotomous above; olive-green. When growing in deep water small *air-vessels* are produced at the bases of the lesser branches.

V. Himanthalia. Lyngb.

Frond coriaceous, cup-shaped. *Receptacles* elongated, strap-shaped, compressed, repeatedly forked, springing from the centre of the frond, containing tubercles furnished with a pore. *Grev.*—Name, ἱμας, a *strap*, and ἅλς, the *sea;* a translation of the English name "*sea-thongs.*"

1. H. *lorea*, Lyngb.; frond top-shaped, at length collapsing, plano-concave, stalked; receptacles repeatedly dichotomous, linear, slightly tapering at the extremity. *Grev. Alg. Brit. p.* 20, *t.* 3; *Hook. Br. Fl.* ii. *p.* 269; *E. Bot. t.* 569; *Wyatt, Alg. Danm. No.* 3.

Rocky sea-shores, common. Winter and spring.—*Fronds* gregarious, about an inch high; receptacles 2—10 feet long, coriaceous, thong-like, dark olive-green. According to Greville and Mrs. Griffiths, this is an annual; but Turner and Capt. Carmichael assert that it is perennial. The latter observes; "The cup alone is perennial. The receptacles of the first year issue from its centre, but every part of the disk is equally capable of producing them, and it will be found, accordingly, that in old plants, they are always more or less excentric."—*Carm. Alg. Appin, MS.*

Tribe 2. LICHINEÆ.

VI. Lichina. Ag.

Frond cartilaginous, blackish green, dichotomous. *Fructification:* roundish *capsules* of the same colour, containing radiating moniliform lines of pellucid *seeds*, imbedded in a gelatinous mass of filaments. *Grev.*—Name, an alteration of *Lichen*, from its resemblance to some of that family.

1. L. *pygmæa*, Ag.; frond between flat and compressed, capsules globose. *Grev. Alg. Brit. p.* 22, *t.* 6; *Hook. Br. Fl.* ii. *p.* 270; *E. Bot. t.* 1332; *Wyatt, Alg. Danm. No.* 155.

Rocks in the sea nearer to high than low water mark. Perennial. Autumn.—*Fronds* densely tufted, half an inch high, rigid, dark lurid green. *Capsules* terminal, often clustered, furnished with a pore.

2. L. *confinis*, Ag.; frond cylindrical, capsules terminal, oval. *Grev. Alg. Brit. p.* 23, *t.* 6: *Hook. Br. Fl.* ii. *p.* 270; *E. Bot. t.* 2575.

Marine rocks very near high water mark: less common than the preceding. Perennial. Autumn. Dunbar, *Turner*. Ardthur, *Capt. Carmichael*. Frith of Forth, *Dr. Greville*. Bantry Bay, *Miss Hutchins*. Dublin Bay.—Much smaller than *L. pygmæa*, covering the rocks in large patches like a lichen; but, notwithstanding its apparently distinct characters, perhaps Sir W. J. Hooker is correct in considering it a variety of that species, "whose different appearance is due to a more frequent exposure to a dry atmosphere."

Tribe 3. LAMINARIEÆ.

VII. Alaria. Grev.

Frond membranaceous, furnished with a percurrent, cartilaginous midrib, the stem pinnated with distinct leaflets. *Fructification:* pyriform *seeds*, vertically arranged in the thickened leaflets. *Grev.*—Name, *ala*, a *wing*, from the winged base of the frond.

1. A. *esculenta*, Grev.—*Grev. Alg. Brit. p.* 25, *t.* 4; *Hook. Br. Fl.* ii. *p.* 271; *E. Bot. t.* 1759.

Rocky coasts, in deep water, frequent. Annual. Winter and spring.—*Root* consisting of several cylindrical fibres. *Frond* solitary, 2—12 feet long or more; *stem* 4—8 inches long, pinnated about the middle with several flat nerveless leaflets, and bearing from its summit a long, linear-lanceolate, ribbon-like *frond*, of delicate texture, through which the stem is continued as a midrib. "The midrib stripped of the membrane, and sometimes also the leaflets, are eaten in Ireland, Scotland, Iceland, Denmark and the Faroe Islands. It is called in Scotland *Badderlocks* or *Henware*, and in the Orkney Islands *Honey-ware*. Dr. Drummond informs me that in some parts of Ireland it bears the name of *Murlins*." *Grev. Alg. Brit.* 6.

VIII. Laminaria. Lamour.

Frond coriaceous (rarely membranaceous), plane, expanded, without a midrib. *Fructification*: *seeds* or *granules* forming dense spots and imbedded in the thickened surface of some part of the frond. *Grev.*—Name, *lamina*, a *thin plate*, descriptive of the flat frond.

1. L. *digitata*, Lamour.; stem woody, cylindrical, gradu ally tapering and somewhat compressed upwards, expanding into a leathery, roundish-oblong frond, deeply-cleft into many linear segments. *Grev. Alg. Brit. p.* 27, *t.* 5; *Hook. Br. Fl* ii. *p.* 271; *E. Bot. t.* 2274; *Wyatt, Alg. Danm. No.* 166.

Rocks in the sea, in deep water, common. Perennial.—*Root* consisting of numerous, rigid, woody fibres, 2—3 inches long. *Stem* 1—6 feet high, solid, very tough, expanding into a flat frond, 1—5 feet long and 1—3 feet wide, which is deeply cleft from the apex into an uncertain number of strap-shaped segments. The power of reproducing its frond, noticed by Turner

and Greville in *L. digitata*, has been observed by Mrs. Griffiths (to whom I am indebted for a beautiful series of specimens) to exist also in *L. saccharina* and *bulbosa*: it may therefore, perhaps, be considered characteristic of the mode of growth in the *genuine* Laminariæ. It exists in individuals of all ages. Some of Mrs. Griffiths' specimens of *L. digitata* exhibiting the new frond, are not more than four inches high, and she has traced the process upwards to plants of large size. The new frond at first appears like a roundish expansion between the base of the old frond and the apex of the stem: this gradually enlarges, becoming of an oval form, and in large specimens is frequently cleft into segments long before the apex is free from the base of the old lamina; thus proving that the splitting of the frond in this species does not arise from the fortuitous action of the waves, but from an inherent principle of growth.

2. L. *bulbosa*, Lamour.; stem flat, with a waved margin, once twisted at the base, rising from a roundish, hollow, rough, bulbous root; frond oblong, deeply cleft into many linear segments. *Grev. Alg. Brit. p.* 29; *Hook. Br. Fl.* ii. *p.* 271; *E. Bot. t.* 1760; *Wyatt, Alg. Danm. No.* 4, (young plant).

In the sea, mostly in deep water, frequent. Perennial.—*Young* plant with an oblong, undivided, or slightly cleft frond, 4—12 inches long and 2—3 wide, with a filiform stem about an inch long, furnished with a swelling or dilatation in the centre, and springing from several clasping fibres. As the plant increases in size the stem becomes more and more expanded, and finally waved at the margin, and what was at first a mere knot-like expansion of the stem, results in a large, bulbous, hollow body, which throws out from its surface stout roots, and becomes the main support of the full-grown frond. This bulb, in a specimen measured by Mrs. Griffiths from deep water in Torbay, was a foot in diameter, and supported a frond which, when spread out on the ground, formed a circle of at least 12 feet in diameter. Common specimens are about half these dimensions.

3. L. *saccharina*, Lamour.; stem cylindrical, filiform, expanding into a cartilaginous or subn embranaceous, lanceolate, undivided frond. *Grev. Alg. Brit. p.* 31; *Hook. Br. Fl.* ii. *p.* 272; *E. Bot. t.* 1376; *Wyatt, Alg. Danm. No.* 54.—*β*, *latifolia*; frond very broad, ovate-elliptical, submembranaceous. *L. latifolia, Ag.*

In the sea. Perennial. Very common. *β* at Yarmouth, *Mr. Mason.* Frith of Forth and Isle of Bute, *Dr. Greville.*—*Root* consisting of numerous clasping fibres; stem varying from a few inches to several feet in length, slender; frond 2—12 feet long and 4—16 inches wide, flat, or waved and curled at the margin. *Substance* equally variable; sometimes leathery or cartilaginous, sometimes delicate and membranaceous. *Color* a deep olive green inclining to brown.

4. L. *Phyllitis*, Lamour.; stem somewhat flattened, filiform, expanding into a delicately membranaceous, flat, linear-lanceolate, undivided frond. *Grev. Alg. Brit. p.* 34; *Hook. Br. Fl.* ii. *p.* 272; *E. Bot. t.* 1331.

In the sea, growing either on stones or on the stems of the larger Algæ·

Annual? *Turner;* Biennial? *Greville.* Not uncommon.—I own that I share the doubts entertained by my friends Dr. Greville and Mrs. Griffiths, regarding the claim of this beautiful plant to rank as a species distinct from *L. saccharina.* The more lanceolate form, delicate substance, and pale yellowish green colour, constitute the chief marks of distinction. *Stem* 1—2 inches high; frond 8 inches to 3 feet or more in length, and 1—6 inches in width.

5. L. *debilis*, Ag.; stem very short, setaceous, gradually expanding into a membranaceous, broadly-oblong, wedge-shaped frond. *Grev. Alg. Brit. p.* 35, *t.* 5; *Hook. Br. Fl.* ii. *p.* 272; *Grev. Crypt. t.* 277; *Alg. t.* 5.

In the sea. Annual? very rare. Western Islands of Scotland, *Mr. Chalmers.* Larne, *Dr. Drummond.* North of Ireland, *Mr. D. Moore.* Torbay, *Mrs. Griffiths.—Root* minute, disk-like. *Stem* 1—2 lines high, very slender, compressed. *Frond* 2—10 inches high, 1—3 inches wide, suddenly narrowed below and thence gradually tapering to the base, blunt, of a thin transparent substance and pale olive colour, scarcely adhering to paper. I was formerly* led into an error respecting this species by receiving specimens of *Punctaria latifolia*, gathered by *Mr. Chalmers* and marked *L. debilis;* but numerous examples, since kindly furnished by Mr. Moore and Mrs. Griffiths, of the true *L. debilis*, have convinced me that it is perfectly distinct in structure from every species of *Punctaria*, though it may be doubted whether it be a *true Laminaria.*

6. L. *fascia*, Ag.; frond membranaceous, linear or linear-lanceolate, very narrow, undulate, much attenuated at base, and passing into a setaceous minute stem. *Ag. Syst. p.* 273; *Wyatt, Alg. Danm. No.* 157.

In the sea, on sand-covered rocks. Annual? North of Ireland, *Mr. Brown*, (*Turner*). Carrickfergus, *Mr. Templeton.* Antrim Coast, *Mr. D. Moore.* Sidmouth and Meadfoot, Torbay, *Mrs. Griffiths.—Root* a minute disk. *Stem* setaceous, 1—6 lines high, compressed, insensibly passing into the frond. *Frond* 4—12 inches long or more, and from 2 lines to an inch in breadth, always very much attenuated at base, sometimes tapering at the apex to an acute point, but oftener blunt and somewhat truncate, of a delicate membranous substance and olivaceous colour. *Structure* as in *L. debilis*, closely cellular. There can be no question that our British specimens agree with the continental *L. fascia*, but I much doubt its claim to rank as a species distinct from *L. debilis.* Except in the narrower frond, more remarkably tapering to the base, I know of no distinguishing characters, and these are, I fear, much too variable to be trusted to. Mrs. Griffiths has kindly presented me with a very perfect series of specimens, and some of these seem exactly intermediate between *L. debilis* and *fascia.*

Tribe 4. SPOROCHNOIDEÆ.

IX. Desmarestia. Lamour.

Frond cartilaginous, plane or compressed, distichously branched, while young furnished with marginal deciduous

* Vide *Hook. Journ. of Bot. vol.* i. *p.* 296.

tufts of fine green filaments, the branches set with marginal spines. *Grev.*—Name, in honour of *A. G. Desmarest*, a celebrated French naturalist.

1. D. *ligulata*, Lamour.; frond flat with an obscure midrib, repeatedly pinnate; pinnæ and pinnulæ linear-lanceolate, tapering at base, opposite. *Grev. Alg. Brit. p.* 36, *t.* 5; *Hook. Br. Fl.* ii. *p.* 273; *E. Bot. t.* 1636; *Wyatt. Alg. Danm. No.* 55.

In the sea. Annual. Summer. Frequent on the Southern shores of England, and the South and West of Ireland. Frith of Forth, *Lightfoot.* Orkneys, *Rev. C. Clouston.* Yarmouth, *Mr. Wigg.*—*Frond* 2—6 feet long, of a clear olive brown while growing, but soon fading in the air to a verdigris-green; yellowish when dry. *Branches* variable in breadth, but all linear-lanceolate in outline, and exactly opposite in insertion.

2. D. *aculeata*, Lamour.; stem short, cylindrical, throwing forth numerous slender, flattish branches, which are repeatedly irregularly pinnate; pinnæ and pinnulæ alternate, tapering at base, filiform, either fringed with minute tufts of delicate fibres, or set with erect, awl-shaped, alternate, distichous spines. *Grev. Alg. Brit. p.* 38, *t.* 5. *f.* 2, 3; *Hook. Br. Fl.* ii. *p.* 273; *E. Bot. t.* 2445; *Wyatt. Alg. Danm. No.* 158, *α* and *β*.

In the sea. Perennial. Common on most shores.—*Fronds* 1—3 feet long. In the young plant the branches are soft and flaccid, and furnished along their whole length with tufts of bright green conferva-like filaments, which drop off as soon as the branch has completed its growth. Old plants are rigid, destitute of these fibres, and the branches set with short awl-shaped spines or ramuli; but whenever they shoot out new branches, these are constantly clothed with the green fibres, which seem to be an indispensable accompaniment to the process of growth, and perhaps perform the functions of *leaves*. No fructification has yet been observed either in this species or in *D. ligulata*.

X. Dichloria. Grev.

Frond cylindrical, filiform, cartilaginous, pinnated with opposite branches; becoming flaccid and of a verdigris-green colour on exposure to the air. *Fructification* unknown. *Grev.*—Name, δις, *twice*, and χλωρις, *green*; in allusion to its change of colour.

1. D. *viridis*, Grev.—*Grev. Alg. Brit. p.* 39, *t.* 6; *Hook. Br. Fl.* ii. *p.* 274; *E. Bot. t.* 1669; *Wyatt, Alg. Danm. No.* 56.

In the sea, growing on stones and the larger Algæ. Annual. Summer. —Not uncommon on the British shores. *Root* disk-like. *Frond* 2—3 feet long, excessively branched in a pinnated manner, all the branches and

ramuli exactly opposite; the main stem about half a line in diameter at base, gradually attenuated upwards; the branches becoming in each series more and more slender and capillary; the whole plant having a strikingly feathery and delicate appearance. *Colour*, whilst growing, dark olive or "foxy," (*Dr. Drummond*); quickly becoming a verdigris-green when removed from the water. *Substance* at first harsh and rigid, but soon becoming flaccid on exposure, in which state it closely adheres to paper.

XI. Sporochnus. Ag.

Frond filiform, cylindrical or compressed, cartilagineo-membranaceous. *Fructification:* club-shaped, moniliform filaments, radiating in scattered warts, or concentrical in distinct (mostly clavate, stalked) receptacles, often terminated by a deciduous tuft of filaments. *Grev.*—Name, σπορος, a *seed*, and χνοος, *wool;* from the tufts of fibres often accompanying fructification.

1. S. *pedunculatus*, Ag.; frond cylindrical, filiform, alternately or irregularly branched, branches long and simple, set with stalked, club-shaped receptacles, terminated by a deciduous tuft of slender filaments. *Grev. Alg. Brit. p.* 41, *t.* 6; *Hook. Br. Fl.* ii. *p.* 274; *E. Bot. t.* 545; *Wyatt, Alg. Danm. No.* 104.

In the sea. Annual. Summer and autumn. Not uncommon on the Eastern and Southern shores of England. Prestonpans, Frith of Forth, *Mr. Hasell.* Killiney, Dublin Bay, Belfast Bay, *Mr. W. Thompson.*—*Stem* 6—18 inches long, filiform, quite simple, set throughout its length with long, slender, patent, mostly alternate branches. *Colour* yellowish and semi-transparent.

2. S. *rhizodes*, Ag.; frond cylindrical, filiform, much and irregularly branched, branches subdichotomous, attenuated, more or less furnished with ramuli, and densely covered with the wartlike fructification. *Hook. Br. Fl.* ii. *p.* 275; *E. Bot. t.* 1688; *Wyatt, Alg. Danm. No.* 5.—β, *paradoxa*, Ag. *Chordaria paradoxa, Lyngb. t.* 14. *Striaria Grevilliana, Pollexfen.*

In the sea, on other Algæ. Annual. Summer. Common on the South coast of England; rare in Ireland. Bantry Bay, *Miss Hutchins.* Kilkee, County Clare, Belfast Bay, *Mr. W. Thompson.* Appin, Argyleshire, *Capt. Carmichael.*—*Fronds* 6—18 inches long, filiform, much and irregularly branched, the axils rounded; branches patent, flexuose, partly dichotomously divided; ramuli short and scattered, very patent. *Fructification* wartlike, produced on every part of the frond, which it frequently entirely covers. *Substance* cartilaginous and slippery. *Colour* a pale yellowish brown, becoming olive in drying. β is a very remarkable state, and, at first sight, so unlike the common variety that it is no wonder it has been described as a distinct species by Lyngbye, and more recently by Dr. Pollexfen. When first I met with it, in company with my friend Dr. Harvey,

on the beach near Cove, Cork Harbour, in 1835, I took it, as Dr. Pollexfen has since done, for a *Striaria*, and as such distributed it to some friends and marked it in my herbarium. A careful examination, however, of numerous specimens dredged in deep water in Strangford Lough, by Mr. W. Thompson, has induced me to alter my former opinion, and to refer it to this place. In its most characteristic state the frond is distended, hollow, and considerably broader than in var. *a*, and the fructification is much more sparing, either scattered irregularly and distantly, or disposed in transverse lines. But Mr. Thompson's specimens, a series of which he has kindly presented me with, exhibit a complete gradation of character between these and the normal state, and some are so completely intermediate that they may be referred with equal propriety to one or to the other. The ramification is identical in both varieties. It is perhaps worthy of remark that var. *β* seems, at least in Ireland, confined to deep water in very sheltered, land-locked bays.

3. S. *Cabreræ*, Ag.; frond irregularly dichotomous, linear, narrow, flat; branches here and there constricted, truncate; fruit "terminal, elliptical, solitary." (Turn.) *Harv. in Mack. Fl. Hib. part* iii. *p.* 154. *Fucus Cabreræ, Turn. Hist. t.* 140.

Thrown up at Youghal, Co. Cork, very rare, *Miss Ball.—Root* a shapeless tuber. *Stems* 6—8 inches high, much branched in an irregularly dichotomous manner, flat, nerveless, except near the base, where there is a faint trace of a midrib, coriaceo-cartilaginous. *Branches* erect, with acute axils, distichous, alternate, narrow below, becoming rather broader upwards, here and there constricted, the apices truncate and often discoloured. *Fructification* "placed upon the ends of the branches, which then expand into a small, flat disk, supporting a single cylindrical tubercle, scarcely a line long, of a pale flesh colour, slightly tinged with brown, destitute of any epidermis, and wholly consisting of very thin, parallel, whitish fibres, of a clavate shape, with a rounded tip, mixed with which lie oblong, reddish seeds."—*Turn.* Miss Ball's specimens are unfortunately without perfect fruit, though many of the apices are "*expanded into small, flat disks*," supporting imperfect tubercles or warts.

XII. Elaionema. Berk.

Frond filiform, cylindrical, minutely nodose, with whorls of delicate, articulated filaments, arising from the knobs. *Fructification:* pedicellated jointed pods, (which are finally moniliform, containing a string of elliptical sporules), springing from the filaments. *Berk. 'Gleanings,' p.* 49.—Name, ελαιος, *oily*, and νημα, a *thread*, "in allusion to the curious property observed by Mr. Hasell. The fresh specimens, when spread upon paper, render it transparent, as if it had been touched with oil." I have observed a similar property in *Desm. ligulata* and *herbacea.*

1. E. *villosum*, Berk.—*Grev. Alg. Brit. p.* 42. *Sporochnus villosus, Hook. Br. Fl.* ii. *p.* 274; *E. Bot. t.* 546, (Conf.); *Wyatt, Alg. Danm. No.* 105.

In the sea. Annual. Summer and autumn. Coast of England in several places, chiefly in the South. Yarmouth, *Turner*. Anglesea, *Rev. H. Davies*. Frith of Forth, *Mr. Hasell*. Ardthur, *Capt. Carmichael*. Sidmouth and Torbay, *Mrs. Griffiths*. Wicklow.—*Fronds*, several from the same base, 6 inches to nearly 3 feet long, very slender, once or twice pinnated; pinnæ distant, opposite, or rarely alternate, patent, simple, or again pinnated with similar simple pinnules; all the branches furnished, at intervals of from half a line to a line, with minute joint-like swellings or knobs, which are whorled with very delicate, branched, jointed, confervoid filaments, of a pale green colour. *Substance* of the branches cartilaginous, soon becoming flaccid. *Fructification :* minute, articulated, lanceolate *pods*, which are finally much elongated and contracted at the joints in a moniliform manner, and contain at maturity in each joint a well-formed oval *sporule*, of an olive colour, which finally breaks through the membrane and falls away. These *pods* are borne by the jointed fibres, several often together, in a secund manner. The credit of having first pointed out this fructification, which, now that it has been observed, is found to be very common, is due to the Rev. M. J. Berkeley, who has with much propriety made this plant the type of a new genus.

Tribe 5. DICTYOTEÆ.

XIII. Cutleria. Grev.

Root, a mass of woolly filaments. *Frond* flat, veinless, somewhat fan-shaped, irregularly cleft. *Fructification:* "minute tufts of capsules, scattered on both sides of the frond; the capsules pedicellate, containing several distinct granules." *Grev.*—Named by Dr. Greville in honour of *Miss Cutler*, a distinguished British Algologist.

1. C. *multifida*, Grev.—*Grev. Alg. Brit. p.* 60, *t.* 10; *Hook. Br. Fl.* ii. *p.* 281; *Wyatt, Alg. Danm. No.* 61; *E. Bot. t.* 1913, (Ulva).

In the sea, very rare. Annual. Summer and autumn. Yarmouth, *Turner*. Bantry Bay, *Miss Hutchins*. Seaton and Torquay, *Mrs. Griffiths*. Sidmouth, *Miss Cutler*. Brighton, *Mr. Borrer*. Ballycotton, Co. Cork, *Miss Ball*. Kilkee, West of Ireland.—*Frond* 2—8 inches long, of a broadly wedge-shaped, or somewhat fan-shaped outline, cleft into several segments, often nearly to the base, and these again splitting into others; segments linear, 1—3 lines wide, slightly dilated upwards. *Fructification* scattered over the whole, frond dot-like, prominent. *Substance* between cartilaginous and membranaceous, at first crisp, but becoming flaccid and closely adhering to paper in drying. *Colour* olivaceous, often with a rusty hue: young and perfect plants are frequently fringed with minute fibres.

XIV. Halyseris. Tozzetti.

Root, a mass of woolly filaments. *Frond* flat, linear, membranaceous, with a midrib. *Fructification:* ovate *seeds*, form-

ing distinct *sori* or groups, mostly arranged in longitudinal lines. *Grev.*—Name, *αλς*, the *sea*, and *σεριϛ*, *endive*.

1. H. *polypodioides*, Ag.; frond dichotomous, entire at the margin, spots of seeds linear, elongated, forming a line at each side of the midrib. *Grev. Alg. Brit. p.* 63, *t.* 8; *Hook. Br. Fl.* ii. *p.* 282; *Wyatt, Alg. Danm. No.* 12; *E. Bot. t.* 1758.

In the sea. Biennial?—*Grev.* August to October. Several places in the South of England. Shields beach, *Mr. Winch.* Opposite Quilty Strand, Miltoun Malbay.—*Root* a spreading mass of matted threads. *Fronds* tufted, 4—12 inches high, about half an inch wide, several times dichotomous, with a strong percurrent midrib; segments linear, mostly obtuse, sometimes acute, the margin quite entire; surface dotted with tufts of white hairs issuing from minute pores. Along the midrib are frequently found minute, oval, fleshy protuberances or *buds*, from which new branches frequently spring, so that the frond often appears as if proliferous. *Fructification* of two kinds, on distinct individuals: 1st, oblong spots of seeds, often confluent, arranged along each side of the midrib; 2nd, large oval seeds, scattered irregularly over the surface of the frond; these were discovered by Mrs. Griffiths, in August, 1828. The same accomplished lady has also observed a curious state of frond, probably connected in some manner with fructification, where the membrane is marked, in the portion usually occupied by seeds, with brown, wavy, map-like lines, inclosing spaces which are usually more transparent than the rest of the frond. *Substance* of the membrane thin, somewhat rigid, not adhering to paper in drying, tearing with facility in an oblique direction toward the midrib, the cellules of which it is composed particularly large. *Colour* a brownish olive. *Smell*, when fresh gathered, very powerful and offensive.

XV. Padina. Adans.

Root a mass of woolly filaments. *Frond* flat, highly reticulated, subcoriaceous, flabelliform, undivided or irregularly cleft, marked with concentric lines. *Fructification:* ovate, blackish seeds, fixed by their base, bursting through the epidermis in compact, concentric lines (rarely spots), mostly on one surface of the frond. *Grev.*—Name, of uncertain meaning.

1. P. *Pavonia*, Lamour.; frond wedge-shaped at base, erect, broadly fan-shaped, entire or deeply cleft, mostly powdery on both surfaces, and marked with numerous concentric lines, the margin revolute and fringed. *Grev. Alg. Brit. p.* 62, *t.* 10; *Hook. Br. Fl.* ii. *p.* 281; *Wyatt, Alg. Danm. No.* 11; *E. Bot. t.* 1276.

In the sea, on rocks; along the extreme Southern shores of England in several places, rare. Annual. Autumn.—*Fronds* tufted, 2—5 inches high, stipitate or sessile, broadly fan-shaped or reniform, sometimes entire, sometimes repeatedly and deeply cleft; the segments all fan-shaped. The

whole frond is marked with numerous concentric zones, one or two lines apart, and mostly covered with a whitish powdery substance on one or both sides. The substance in the lower part is somewhat leathery and opaque; above it is delicately membranous and transparent. The margin, which always preserves its circular outline, is rolled backwards, and fringed with extremely delicate, reddish-brown filaments. The *seeds* are produced in lines along the concentric zones, originating beneath the epidermis of the frond, through which they finally burst and drop off. This most beautiful plant, not incorrectly compared to a peacock's tail, is found pretty extensively in the seas of warm countries in both hemispheres, perhaps reaching its highest latitude on our shores.

2. P.? *deusta*, Hook.; frond coriaceous or somewhat crustaceous, deep brown, reniform or orbicular, glabrous, attached by the whole of its lower surface, concentric lines indistinct. *Hook. Br. Fl.* ii. *p.* 281. *Zonaria deusta*, *Ag. Syst. p.* 265.

Marine rocks, probably common. Appin, Argyleshire, *Capt. Carmichael.* Berwick Bay, *Dr. Johnstone.* Miltoun Malbay.—*Fronds* an inch or two in diameter, closely adhering to the rock on which they grow, of a rich brown colour, and thick, fleshy, cellular substance. This is is a very anomalous plant, of very uncertain affinities. I leave it in *Padina* merely because it has been placed there by others, and that I know not to what other genus it is more nearly allied. Its resemblance to *Padina* is, however, merely superficial; its structure is totally distinct, and is not even *dictyoteous.* The fruit is unknown.

3. P. *parvula*, Grev.; frond procumbent, attached by fibres issuing from its lower surface, membranaceous, suborbicular, variously lobed; lobes free, rounded, scarcely marked with concentric lines. *Grev. Alg. Brit. p.* 63; *Hook. Br. Fl.* ii. *p.* 282; *Grev. Crypt. t.* 360.

Rocks in the sea, rare. Annual? Spring and summer. Sidmouth, *Dr. Greville* and *Miss Cutler*, Miltoun Malbay.—*Fronds* spreading over the rocks in patches, one to several inches in diameter, attached by means of whitish fibres, except at the margins, which are free and lobed; the lobes rounded, smooth, entire, often imbricated. The substance is membranous, somewhat transparent, and highly reticulated; the cells quadrangular. The colour is an olivaceous green. No fructificaton has yet been observed.

XVI. Dictyota. Lamour.

Root a mass of woolly filaments. *Frond* flat, highly reticulated, membranaceous, dichotomous or irregularly cleft, (palmato-flabelliform in *D. atomaria*). *Fructification* composed of scattered or variously aggregated, somewhat prominent seeds, on both surfaces of the frond. *Grev.*—Name, δικτυον, a *net;* from the reticulated structure of the frond.

1. D. *dichotoma*, Lamour.; frond regularly dichotomous, linear; the segments becoming gradually narrower towards

the extremities; seeds scattered or irregularly clustered.—*Grev. Alg. Brit. p.* 57, *t.* 10; *Hook. Br. Fl.* ii. *p.* 280; *Wyatt, Alg. Danm. No.* 10; *E. Bot. t.* 774.—*β. intricata*, Grev.; frond very narrow, much branched, twisted and entangled.

In the sea, on rocky shores, both varieties common. Annual. Summer. *Fronds* 3--12 inches long, 1—4 lines wide, of a clear olive-green colour and membranous substance, regularly dichotomous. *Seeds* either scattered over the surfaces, or (in distinct plants), collected into dense spots. Mrs. Griffiths notices a third modification, where the frond is "covered with transparent vesicles," which often contain seeds; these are rarely produced, and were discovered by that lady in 1822.*

2. D. *atomaria*. Grev.; frond membranaceous, broadly wedge-shaped or somewhat fan-shaped, deeply and irregularly cleft and laciniated; seeds forming waved, transverse lines, with intermediate scattered ones. *Grev. Alg. Brit. p.* 58; *Hook. Br. Fl.* ii. *p.* 280; *Wyatt, Alg. Danm. No.* 60; *E. Bot. t.* 419.

Marine rocks, rare. Annual. Summer. Cromer, *Mr. Wigg.* Corton and Gunton, *Mrs. Fowler.* Worm's Head, Glamorganshire, *Mr. Dillwyn.* Coast of Devon, *Mrs. Griffiths*, &c. Sussex, *Mr. Borrer.* Ballycotton, coast of Cork, *Miss Ball.*—*Fronds* tufted, 3—12 inches long, with a broadly wedge-shaped or palmate outline, triangular at base, deeply cleft into numerous segments, which are again divided into lesser ones, the apices truncate. The colour is a brownish-olive; the substance thin and transparent, and the whole surface beautifully marked with broad wavy lines of dark brown seeds, from a quarter to half an inch asunder, the intermediate spaces mottled with scattered groups of seeds.

XVII. Dictyosiphon. Grev.

Root minute, scutate, naked. *Frond* filiform, tubular, continuous, branched. *Fructification:* ovate, scattered seeds, lying beneath the epidermis. *Grev.*—Name, δικτυον, a *net*, and σιφων, a *tube;* from the tubular reticulated frond.

1. D. *fœniculaceus*, Grev.—*Grev. Alg. Brit. p.* 56, *t.* 8; *Hook. Br. Fl.* ii. *p.* 279; *Wyatt, Alg. Danm. No.* 205.

In the sea, on stones, or parasitic on other Algæ. Annual. Spring and summer. Anglesea, *Dillenius.* Cornwall, *Hudson.* Not uncommon on the Western shores of Scotland, *Turner.* Frith of Forth, *Dr. Greville.* Frequent on the Irish coasts. Torbay, rare.—*Fronds* 1 to many feet long, tufted, very much branched and bushy; the main stem nearly a line in

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* "As far as I can judge, the clusters of seeds are always formed under a transparent vesicle, which disappears when the seeds, originating within the substance of the frond, rise above the surface."—*Mrs. Griffiths.*

diameter, undivided, bearing through its whole length alternate, elongate, capillary branches, which again bear a second and a third series, each more slender than the last, and all tapering at the extremity. *Fructification* rare. *Colour* yellowish olive or rusty brown.

XVIII. Striaria. Grev.

Frond filiform, tubular, continuous, membranaceous, branched. *Root* naked and scutate. *Fructification:* groups of roundish *seeds*, forming transverse lines. *Grev.*—Name, from the transverse *striæ* formed by the lines of fructification.

1. S. *attenuata*, Grev. *Hook. Br. Fl.* ii. *p.* 279; *Grev. Crypt. Scot. t.* 288; *Grev. Alg. Brit. p.* 55, *t.* 9; *Wyatt, Alg. Danm. No.* 160.

In the sea, on other Algæ, rare. Annual. Summer. Appin, *Capt. Carmichael.* Bute, *Dr. Greville.* Belfast Lough, *Dr. Drummond.* Strangford Lough, *Mr. W. Thomson.* Torquay, *Mrs. Griffiths* and *Miss Cutler.*—*Fronds* tufted, 3—12 inches high, half a line to a line in diameter, set with many patent, elongate, simple or sub-simple, mostly opposite branches, much attenuated at both extremities, and sometimes bearing a second series of similar branches. When in fructification the branches are marked, at spaces of half a line asunder, with transverse rings or bands composed of clusters of seeds, sometimes accompanied with filaments. The substance is delicately membranaceous, and the colour a pale olive. The branches are sometimes irregularly scattered, sometimes, especially in the Devonshire plants, whorled, 3, 4 or 5 in a whorl.

XIX. Punctaria. Grev.

Frond simple, membranaceous, flat, with a naked scutate root. *Fructification* scattered over the whole frond in minute distinct spots, composed of roundish prominent seeds, intermixed with club-shaped filaments. *Grev.*—Name, *punctum*, a *dot;* from the dot-like fructification.

1. P. *latifolia*, Grev.; frond pale olive-green, thickish, gelatinous and tender, oblong or obovate, suddenly tapering at base. *Grev. Alg. Brit. p.* 52; *Hook. Br. Fl.* ii. *p.* 278; *Wyatt, Alg. Danm. No.* 9.

Rocks in the sea. Annual. Spring and summer. Sidmouth and Torquay, *Mrs. Griffiths.* Near Belfast, *Dr. Drummond.* West of Ireland. *Root* a minute disk. *Fronds* generally tufted, 8—16 inches long, 1—3 wide, oblong or lanceolate, flat or curled, generally obtuse at both extremities, occasionally tapered, delicately membranaceous and semi-transparent, somewhat gelatinous, of a pale olive-green colour. *Dots* of fructification minute, roundish, scattered over both surfaces.

2. P. *plataginea*, Grev.; frond dark brown, coriaceo-membranaceous, obovate, much attenuated at base. *Grev. Alg.*

Brit. p. 53, *t.* 9; *Hook. Br. Fl.* ii. *p.* 278; *E. Bot. t.* 2136; *Wyatt, Alg. Danm. No.* 206.

In the sea, attached to rocks, stones, corallines, or some of the larger Algæ. Annual. Summer. Various places on the South and Eastern coasts of England and Ireland. Belfast, *Dr. Drummond.* Frith of Forth, *Dr. Greville.—Fronds* 4—12 inches long, ½ an inch to 1½ inch wide, obtuse, generally much tapered at the base, of a thickish-membranous, tough, subopaque substance and full brown colour. *Dots* of fructification oblong, larger than in the preceding species, from which this character, with the thicker substance and darker colour, serve to distinguish it. This has very much the outline and general appearance of *Laminaria fascia*, with which it has sometimes been confounded, as *P. latifolia* has with *L. debilis.*

3. P. *tenuissima*, Grev.; frond sub-linear, very thin, transparent. *Grev. Alg. Brit. p.* 54; *Hook. Br. Fl.* ii. *p.* 279.

In the sea, parasitic on *Zostera marina.* Annual. Summer. Bute, *Dr. Greville.* Appin, *Capt. Carmichael.—Fronds* 2—8 inches long, 1—3 lines wide, fringing the plant on which they grow, always tapering at base, and often also at the apex, of an exceedingly delicate, transparent substance, closely adhering to paper; the margin more or less toothed. *Fruit* unknown. According to Mrs. Griffiths this is the young of *P. latifolia.*

XX. Asperococcus. Lamour.

Frond simple, tubular, cylindrical or (rarely) compressed, continuous, membranaceous. *Root* minutely scutate, naked. *Fructification:* distinct spots composed of imbedded seeds, mixed with erect club-shaped filaments. *Grev. emend.* Name, *asper, rough*, and κοκκος, a *seed.*

1. A. *compressus*, Griff.; frond compressed, flat, linear, obtuse, tapering at base into a short stem; dots of fructification oblong. *Hook. Br. Fl.* ii. *p.* 278; *Wyatt, Alg. Danm. No.* 8.

In the sea, rare. Annual. Summer. Sidmouth and Torquay, *Mrs. Griffiths.—Fronds* 6—18 inches long, from a quarter to nearly an inch wide, tapering from within an inch of the base into a minute setaceous stem; thence upwards nearly of equal breadth, obtuse, formed of two membranes closely appressed and cohering together. *Colour* a yellowish or olivaceous green. *Substance* tender and adhering to paper. *Dots* of fructification large, oblong, irregular, densely scattered over both surfaces. The frond is sometimes constricted at intervals. I have gathered at the Cape of Good Hope specimens exactly agreeing with those from Devonshire, except in being of larger size.

2. A. *Turneri*, Hook.; frond inflated, cylindrical, obtuse, oblong or club-shaped, suddenly contracted at base into a short stem, thin and membranaceous; dots of fructification minute, roundish. *Grev. Alg. Brit. p.* 51; *Hook. Br. Fl.* ii. *p.* 277; *E. Bot t.* 2570; *Wyatt, Alg. Danm. No.* 59.

In the sea, on stones and the larger Algæ, rare. Annual. Summer. Coast of Sussex, *Mr. Borrer*. Devonshire, *Mrs. Griffiths*. Appin, *Capt. Carmichael*. Bantry Bay, *Miss Hutchins*. "The Murrough," near Wicklow, Strangford Lough, *Mr. W. Thompson*.—*Fronds* 8—16 inches long, half an inch to 2 or 3 inches in diameter, suddenly contracted at base into a cylindrical stem, inflated, here and there occasionally contracted, of an oblong, linear or club-shaped outline, a semi-transparent, delicately membranous substance and pale olive colour, adhering to paper. *Dots* of fructification very minute, roundish, densely scattered over the surface. Miss Hutchins's specimens are remarkably fine; some of Mr. Thompson's are still larger, two of them measuring $3\frac{1}{2}$ feet in length, and $2\frac{1}{2}$ inches in diameter.

3. A. *echinatus*, Grev.; frond cylindrical, obtuse, linear, gradually tapering at base. *Grev. Alg. Br. p.* 50. *A. fistulosus*, *Hook. Br. Fl.* ii. *p.* 277; *Wyatt*, *Alg. Danm. No.* 7. *Ulva fist. t.* 642.—β. *vermicularis*, *Griff.*; frond setaceous, filiform, twisted. *A. vermicularis*, *Moore*, *Ord. Survey*, *Londonderry*, *Bot. p.* 9; β. *Wyatt*, *Alg. Danm. No.* 207.

Rocks in the sea, common. Annual. Summer and autumn. β. Torquay, *Mrs. Griffiths*.—Very variable in size; the fronds from two inches to two feet in length, and from the thickness of a hog's bristle to half an inch in diameter, linear, more or less tapered at base. *Dots* of fructification crowded, and often completely covering the surface. β, which is usually as slender as a bristle, and at most scarcely a line in diameter, might easily pass, at first sight, for a distinct species, but there are intermediate sizes between it and the normal state. *Encœlium Lyngbyanum*, *Grev. Crypt. t.* 290, represents a large variety of this species.

4. A ? *pusillus*, Hook.; frond setaceous, cylindrical, solid, spuriously articulate; dots of fructification oblong. *Hook. Br. Fl.* ii. *p.* 277; *Wyatt*, *Alg. Danm. No.* 58.

In the sea, parasitical on *Chorda filum*. Annual. Autumn. Appin, *Capt. Carmichael*. Bute, *Dr. Greville*. Torquay, *Mrs. Griffiths*. Ballycotton, coast of Cork, *Miss Ball*. Coast of Down, *Mr. W. Thompson*. Kilkee, Co. Clare.—*Fronds* 2—4 inches long, about as thick as a hog's bristle, straight or curled, beset with pellucid fibres, *solid*, (not tubular), of a cellular substance, transversely striate as if jointed; so closely covering the frond on which they grow as to give it, as Capt. Carmichael aptly observes, "the appearance of a bottle-brush." *Fructification* · oblong, prominent patches of filaments and seeds here and there scattered along the frond, rare.

XXI. Chorda. Stack.

Frond simple, filiform, cylindrical, with an interrupted cavity. *Root* naked, scutate. *Fructification:* external continuous masses of pear-shaped seeds, fixed by their base. *Grev.*—Name, *Chorda*, a *cord*.

1. C. *lomentaria*, Grev; frond membranaceous, the trans-

verse septa remote and at irregular intervals, accompanied with an external constriction, the intervals somewhat inflated. *Grev. Alg. Brit. p.* 50, *t.* 9; *Hook. Br. Fl.* ii. *p.* 276; *Wyatt, Alg. Danm. No.* 6. *Asperococcus castaneus, Carm.; Hook. Br. Fl.* ii. *p.* 277.

Rocks and stones in the sea, not uncommon. Annual. Summer and autumn. *Fronds* 3—16 inches long, 1—4 lines in diameter, attenuated at each extremity, contracted at irregular intervals. *Substance* flaccid. *Colour* a brownish or yellowish olive. "The appearance of the plant is very similar to the intestine of an animal tied at certain intervals."—*Grev. Asperococcus castaneus* of the Br. Flora proves to be the young of this species, as Mrs. Griffiths has satisfactorily shown.

2. C. *filum*, Lamour.; frond cartilaginous, much elongated, the transverse septa not accompanied by external constriction. *Grev. Alg. Brit. p.* 47, *t.* 7; *Hook. Br. Fl.* ii. *p.* 276; *Wyatt, Alg. Danm. No.* 159; *E. Bot. t.* 2487.—*β. thrix;* frond very slender, almost capillary, 2—4 inches in length.

In the sea, on rocks and stones, common. Annual. Summer.—*Fronds* 1—20 feet long, cylindrical, "composed of a simple fillet, one or two lines in breadth, spirally twisted into a filiform tube by the cohesion of its edges," (*Carm.*) dark olive, slimy, covered with pellucid, hair-like fibres. *Fructification* covering the surface of old fronds.

Tribe 6. ECTOCARPEÆ.

XXII. Cladostephus. Ag.

Main filaments cartilaginous, rigid, inarticulate, whorled with short, articulated, sub-simple ramuli. *Fruit* two-fold: 1, ovate *capsules*, furnished with a terminal pore, containing dark seeds; 2, *granules* imbedded in the tips of the ramuli. —Name, κλαδος, a *branch*, and στεφος, a *crown*.

1. C. *verticillatus*, Lyngb.; branches slender, ramuli mostly forked, regularly whorled, the whorls at short intervals.—*Hook. Br. Fl.* ii. *p.* 322; *Wyatt, Alg. Danm. No.* 82; *E. Bot. t.* 1718, and *t.* 2427, *f.* 2.

In the sea, on rocks and corallines, frequent. Summer and winter. —*Filaments* 3—9 inches high, irregularly dichotomous, the lesser branches often opposite. *Colour* a dull olive green. *Capsules* unknown. Mrs. Griffiths notices that in summer the ramuli of this and the following species frequently contain dark grains imbedded in their withered tips, as in the genus *Sphacelaria*.

2. C. *spongiosus*, Ag.; branches thick and clumsy; ramuli mostly simple, irregularly whorled, densely imbricated. *Hook. Br. Fl.* ii. *p.* 322; *Wyatt, Alg. Danm. No.* 169; *E. Bot. t.* 2427, *f.* 1.

In the sea, on rocks and stones, common. Summer and winter.—*Filaments* 3—4 inches high, irregularly branched, the branches thick and flexuous, obtuse, densely clothed with crowded, mostly simple, but occasionally forked ramuli. *Colour* dull brown or dirty olive-green. *Capsules* stalked, scattered on the ramuli.

XXIII. Sphacelaria. Lyngb.

Main filaments jointed, rigid, distichously branched, pinnated, rarely dichotomous or simple. *Fruit* two-fold on the same individual: 1, roundish-ovate *capsules*, furnished with a terminal pore; 2, a dark, granular *mass*, inclosed in the colourless distended tips of the branches and ramuli.—Name, Σφακελος, *gangrene;* from the *withered* tips of the fertile branches.

** Frond beset with woolly fibres at the base or lower part.*

1. S. *filicina*, Ag.; frond shaggy at base, irregularly branched; branches lanceolate, bi-tripinnate; pinnæ alternate; pinnules fasciculato-multifid. *Hook. Br. Fl.* ii. *p.* 323; *Wyatt, Alg. Danm. No.* 170. *S. hypnoides, Grev. Crypt. Fl. t.* 348.—*β. patens*; branches and ramuli horizontal.

In the sea, very rare. Plymouth, *Mr. Sconce.* Ilfracombe, *Mrs. Griffiths* and *Mrs. Hare.* Salcombe, *Mrs. Wyatt.* Belfast Bay, *Mr. W. Thompson.* Kinsale Harbour, *Dr. Harvey.* Whitsand Bay, *Mr. Arnott.* *β.* Brighton, *Mr. Borrer.*—*Stems* 2—4 inches high, covered with curled brown fibres at the base, slender, simple or irregularly branched, often bearing from the summit numerous branches displayed like a fan; the branches of a linear-lanceolate outline, bi-tripinnate; the lower pinnæ short, gradually lengthening upwards, generally producing two pinnules from the upper side, (one of which is axillary), before one issues from the lower, erecto-patent. *Striæ* evident in the lower part of the stem, and in old specimens throughout; wanting in young plants and in the young shoots or branches. *β*, which Mrs. Griffiths regards as a distinct species, differs in having all the divisions patent or very much divaricated, but this character varies in different specimens, and, I fear, cannot be considered of specific value. Specimens sometimes occur, many of whose branches are as bare of ramuli as those of *S. scoparia* in its denuded state, and then they can only be recognised by their greater delicacy.

2. S. *scoparia*, Lyngb.; dark brown, coarse, the lower part shaggy with woolly fibres; upper branches once or twice pinnated; the pinnæ erecto-patent, awl-shaped, alternate, the lower ones slightly divided. *Hook. Br. Fl.* ii. *p.* 323; *Wyatt, Alg. Danm. No.* 36; *E. Bot. t.* 1552. *S. disticha, Lyngb.*? *Harv. in Hook. Br. Fl.* ii. *p.* 323.

Southern coasts of England, frequent. Frith of Forth, *Dr. Greville.* Irish coast in several places, but not common.—*Stems* 2—4 inches high, shaggy at the base, robust, much and irregularly divided or sub-simple, densely set with quadrifarious, pinnate or bipinnate branches, which spread

from the summits of the main divisions in broad, brush-like, rigid tufts; pinnæ either short, simple and spine-like, or long and again pinnate. There is no axillary pinnule as in the last species. *Joints* of the stem and branches longitudinally striate. *S. disticha* of the British Flora is merely the autumn and winter state of this species.

*** Stems naked at the base (without woolly fibres).*

3. S. *plumosa*, Lyngb.; filaments naked at base, elongated, irregularly branched, inarticulate; branches pectinato-pinnate; pinnæ opposite, simple, very close, elongated. *Hook. Br. Fl.* ii. *p.* 324. *Conf. pennata, E. Bot. t.* 2330, (*left hand fig.*); *Wyatt, Alg. Danm. No.* 300.

South coast of England. Frith of Forth, *Drs. Richardson* and *Greville*. Wicklow, Belfast Bay, *Mr. W. Thompson*. Near Caernarvon, North Wales, *Mr. Ralfs*.—*Stems* 2—3 inches high, many springing from the same disk-like base, irregularly branched, as thick as a hog's bristle, opaque, unjointed; branches tufted or scattered, ½ an inch to 1½ inch long, resembling feathers, closely pinnated with opposite, patent, obtuse, simple (or rarely pinnulated) pinnæ, which are often sphacelate at the tips.

4. S. *cirrhosa*, Ag.; filaments naked at base, short, densely tufted, simple or branched, jointed throughout; stem (or branches) pinnate; pinnæ opposite, alternate or irregular, simple. *Harv. in Hook. l. c. p.* 324; *Wyatt, Alg. Danm. No.* 171. *Conf. pennata, E. Bot. t.* 2330; *(right hand fig.)* *β. ægagropila;* forming a dense round ball. *γ. patentissima;* ramuli irregular, issuing at right angles. *Grev. Crypt. t.* 317.

In the sea, on other Algæ and on corallines, very common. *α*, commonest on the South coast of England. *β*, West of Ireland. *γ*, shores of Bute, *Dr. Greville*.—This is a most variable plant. In *α*, the filaments are very slender, simple, forming star-like, fastigiate tufts, or closely investing the stems of Algæ; about an inch long, articulated, pinnated throughout with short, erecto-patent, attenuated, opposite or alternate ramuli, at distances of every second or third joint. These ramuli are either simple or furnished with a few others which are often three-forked. Articulations about as long as broad. This variety something resembles small specimens of *S. plumosa*, but the ramuli are far less close and regular, and the joints of the stem very evident. In *β*, the tufts are globose and very dense. The filaments robust and much branched; the larger branches quadrifariously or irregularly furnished with lesser ones, which are long, erecto-patent, set in a very irregular manner with sub-pinnated or quadrifarious, spine-like ramuli, which are either simple or bearing others. *Capsules* (which I have only seen on this variety), sphærical, containing a dark mass, sessile near the base of the ramuli, one or two together; as correctly figured by Dillwyn. *Colour* a dark brown, and substance rigid. Another variety is found by *Mrs. Griffiths* and *Miss Cutler* on the stems of *Desmarestia aculeata*. It is a very dwarf plant, with curved, simple stems, pretty regularly pinnated, and sometimes hooked at the apex. The filaments of this are rarely half an inch long.

5. S. *fusca*, Ag.; filaments brown, distantly and irregularly branched; branches long and simple, bearing a few clavate,

occasionally trifid ramuli; articulations twice as long as broad, marked by a transverse band; capsules globose. *Dillw. Conf. t.* 95; *Hook. Br. Fl.* ii. *p.* 324.

Shores of Wales, *Dillw.* Sidmouth, *Mrs. Griffiths.* St. Michael's Mt. Cornwall, *Mr. Ralfs.*—Tufts "3 to 5 inches long, varying in colour from a dull to a reddish brown." *Dillw.* A very obscure plant, which I only know through Dillwyn's figure and description, and from a specimen marked "Sidmouth, June, 1827," which I have received from my valued friend, Mrs. Griffiths, and which agrees with Dillwyn's figure very exactly. The filaments in this specimen are an inch and a half long, deep brown, very slender, sub-simple, with a few alternate, long, simple, distant branches, some of which bear near the apex one or two linearo-clavate ramuli, attenuated at the base, and trifid at the apex. The joints are marked with a pale brown band, and about twice as long as broad. After all, perhaps it is merely a variety of *S. cirrhosa*. *Mr. Ralf's* plant, above noticed, is more branched, rigid, and with shorter joints than that of Dillwyn.

6. S. *radicans*, Harv.; filaments decumbent, sending out fibrous radicles in the lower part, with a few irregular, simple, straight, naked branches; capsules clustered, sessile. *Harv. in Hook. Br. Fl.* ii. *p.* 324. *Conf. radicans, Dillw.*; *E. Bot. t.* 2138. *S. cirrhosa, ζ, simplex, Ag. Sp. Alg.* ii. *p.* 29; *Wyatt, Alg. Danm. No.* 301.

In the sea, on sand-covered rocks, in various parts of Great Britain and Ireland; first noticed by the late *Miss Hutchins* at Bantry. Torbay, *Mrs. Griffiths.*

7. S. *olivacea*, Ag.; filaments short, erect, tufted, sparingly branched; branches alternate, very erect, simple. *Hook. Br. Fl.* ii. *p.* 324; *E. Bot. t.* 2172.

On marine rocks. Orkney, *Messrs. Borrer* and *Hooker.* Appin, *Capt. Carmichael.* Dunmore, Ireland, *Miss Anne Taylor.*—Three lines to half an inch high, forming small, dense tufts or patches; branches few and very erect.

8. S. *racemosa*, Grev.; "filaments short, tufted, olivaceous, dichotomous; capsules ovate, racemose, pedunculate." *Grev. Crypt. Fl. t.* 96; *Hook. Br. Fl.* ii. *p.* 325.

Frith of Forth, *Dr. Richardson.*—Allied to the last, but larger, and chiefly distinguished by its racemose capsules.

9. S.? *velutina*, Grev.; "olivaceous, spreading, velvet-like; filaments sub-simple, erect, very short, bearing capsules at the base; joints about equal in length and breadth." *Grev. Crypt. Fl. t.* 350; *Hook. Br. Fl.* ii. *p.* 325.

Parasitical on *Himanthalia lorea* and *Fucus serratus*. Sidmouth, *Dr. Greville.* Appin, *Capt. Carmichael.*—Forming dark-olivaceous, velvety patches of considerable extent. Filaments about a line in height, obtuse, jointed, bearing capsules near the base. A doubtful species of *Sphacelaria*, and perhaps more nearly allied to *Myrionema*.

XXIV. Ectocarpus. Lyngb.

Filaments capillary, jointed, olivaceous or brown, flaccid, without longitudinal striæ. *Fruit:* sphærical, elliptical, or lanceolate *capsules*, and *granules* in swollen ramuli.—Name, εκτος, καρπος, *external fruit;* equally applicable to many other genera.

** Secondary branches alternate, fascicled or secund.*

1. E. *littoralis*, Lyngb.; tufts dense, interwoven, dirty brown; filaments much and irregularly branched, coarse; ultimate branchlets somewhat patent, alternate or tufted; capsules oblong or sub-globose, imbedded in the substance of the branches. *Hook. Br. Fl.* ii. *p.* 325; *E. Bot. t.* 2290; *Wyatt, Alg. Danm. No.* 129.

In the sea, on the larger Algæ, very common.—Tufts 6—12 inches long, coarse, shaggy, entangled, brownish olive or rust-coloured; the main stems somewhat massed together, the lesser divisions free; the ramuli multifid, very irregular in position.

2. E. *siliculosus*, Lyngb.; tufts yellowish or pale olive-green, somewhat gelatinous, soft; filaments slender, excessively branched; ultimate branchlets alternate or secund; capsules stalked, subulate, very acute. *Hook. Br. Fl.* ii. *p.* 325; *E. Bot. t.* 2319; *Wyatt, Alg. Danm. No.* 172.

In the sea, on Algæ, corallines, &c. common.—Tufts 6—18 inches long, cloud-like, of a yellowish or pale colour, occasionally rusty brown. Filaments excessively slender, much and irregularly branched, somewhat gelatinous, quickly decomposing in fresh water; branches irregularly set, of various lengths, bearing a second and third series of multifid ramuli; all the divisions alternate or secund, the extreme ramuli long and very frequently secund, erect. *Capsules* subulate, resembling *pods*, borne on short stalks by the ramuli.

3. E. *fasciculatus;* tufts olivaceous, dense; main filaments slightly branched; branches distant, bearing throughout alternate or secund fascicles of multifid ramuli; capsules sessile, ovato-acuminate, secund on the ramuli; joints very distinct. *Wyatt, Alg. Danm. No.* 302.

In the sea, on the larger Algæ. Mangan's Bay, Co. Waterford, *Miss Ball.* Strangford Lough on *Zostera*, *Mr. W. Thompson.* Torquay, *Mrs. Griffiths.*—Tufts 1—2 inches high, dense, dark olive-green. Filaments less branched than in most of the genus; the branches alternate or subdichotomous, bearing throughout short tufts of multifid branchlets, which are very often secund. *Capsules* sessile.

4. E. *Hincksiæ;* tufted, dark olive; filaments irregularly and distantly branched; branches flexuous, furnished with

secund ramuli pectinated on their upper side; capsules conical, sessile, lining the inner face of the ramuli.

In the sea, parasitical on the larger Algæ. Ballycastle, *Miss Hincks.*—*Filaments* 1—2 inches high, dark olive, somewhat rigid for the genus (substance of *E. littoralis*), irregularly and rather distantly branched, not matted together; branches set in the upper part with secund, spreading or slightly recurved ramuli, bearing on their inner faces a second series of subulate ones, so as to resemble little combs. *Capsules* conical, sessile, borne on the inner face of the ramuli, one rising from almost every joint, giving the ramulus the appearance, under a low power, of being serrated. Of this beautiful plant I have seen but a single specimen, but its characters are so decided that I venture to pronounce it a most distinct species, in which opinion Mrs. Griffiths coincides. It comes nearest *E. fasciculatus*, but differs in fructification and ramification.

5. E. *tomentosus*, Lyngb.; filaments flexuous, very slender, irregularly branched, interwoven into a dense, sponge-like, branching frond; capsules stalked, linear-oblong, obtuse. *Hook. Br. Fl.* ii. *p.* 326; *Grev. Crypt. t.* 316; *Wyatt, Alg. Danm. No.* 37.

In the sea, on rocks and the larger Algæ.—Plant 1—8 inches long, forming an irregularly divided, spongy *frond*, of an olivaceous or dull brown colour. This *frond* is composed of a dense mass of slender filaments, intricately woven together, flexuous and irregularly branched, jointed throughout; the joints mostly colourless, and about twice as long as broad. *Capsules* linear-oblong, pedunculate. The lesser branches are sometimes somewhat free and feathery, when the plant bears some resemblance to certain varieties of *E. siliculosus*.

6. E. *crinitus*, Carm.; filaments decumbent, forming extensive strata, sparingly branched; the branches sub-simple, distant, elongated; capsules globose, scattered, sessile. *Hook. Br. Fl.* ii. *p.* 326.

Muddy sea shores. Appin, *Capt. Carmichael.* Watermouth, Devonshire, *Mrs. Griffiths.*—Spreading over the mud in "extensive fleeces of a bright bay colour." *Filaments* about two inches long, with long, sub-simple, distant branches. *Capsules* rare. When dry it has a slight gloss, and the colour changes to a dull, but rather pleasant green. Mrs. Griffiths' specimens are not in fruit, but in other respects agree very closely with Capt. Carmichael's.

7. E. *pusillus;* filaments sub-simple or sparingly branched, interwoven; branches bearing a few short, flexuous fibres; capsules sessile, roundish-oblong, plentiful, often 2 or 3 together. *Wyatt, Alg. Danm. No.* 303.

Parasitical on *Polysiphonia nigrescens* and other Algæ. Torquay, *Mrs. Griffiths.* Land's End, *Mr. Ralfs.*—"Like a tuft of pale-brown wool. *Filaments* long, slender, simple or slightly branched, set with a few short, flexuous, divaricating fibres, tendril-like, which hold the filaments together." *Griff. Branches* distant, naked. *Capsules* plentifully scattered along the threads, often 2 or 3 together or whorled. *Joints* twice as long as broad.

A smaller and more slender plant than *E. crinitus;* the ramuli different, and capsules more oblong. This comes near *E. simpliciusculus* of Agardh, but is a larger plant.

8. E. *distortus*, Carm.; filaments very much branched, matted together, dark brown, angularly bent; branches spreading at obtuse angles; ramuli divaricated or recurved, obtuse, spine-like; capsules obovate, sessile or sub-sessile. *Hook. Br. Fl.* ii. *p.* 326.

On *Zostera* at Appin, *Capt. Carmichael.—Tufts* 4—8 inches long, dense, matted, deep chesnut-brown. *Filaments* bent here and there at acute angles, zigzag, apparently distorted; the branches long, spreading at obtuse angles, and beset with spine-like, divaricated ramuli. *Capsules* scattered, obovate or elliptical, with a pellucid limbus, containing a dark brown mass, sessile or slightly stalked. The whole plant is remarkably brittle, if moistened after having been dried.

*** Secondary branches and ramuli opposite.*

9. E. *granulosus*, Ag.; tufts greenish or yellowish; main filaments slightly entangled; lesser branches distinct and feathery; upper branches and ramuli opposite, spreading, the apices often transparent; capsules solitary, elliptical, sessile. *Hook. Br. Fl.* ii. *p.* 326; *E. Bot. t.* 2351; *Wyatt, Alg. Danm. No.* 38.

Parasitical on other Algæ. South coast of England, frequent. Bantry Bay, *Miss Hutchins.* Shores of Cork, *Miss Ball.—Tufts* 4—8 inches long, greenish or yellowish; main branches frequently, and lesser ramuli almost constantly opposite, erecto-patent, the extreme ones occasionally secund. *Capsules* large, oblong-elliptical, dark brown, sessile on the ramuli or near the tips of the branches.

10. E. *sphærophorus*, Carm.; filaments slender, short, tufted, much branched; upper branches patent, opposite or in fours, bearing patent opposite ramuli; capsules globose, sessile, either opposite to each other or to a branchlet. *Hook. Br. Fl.* ii. *p.* 326; *Wyatt, Alg. Danm. No.* 173. *E. brachiatus, Ag. (not of E. B.)*

Parasitical on other Algæ. Appin, on *Conf. rupestris*, *Capt. Carmichael.* Sidmouth and Torquay, on *Ptilota plumosa*, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.—Filaments* 1—3 inches long, finely tufted, straight, the main stems somewhat matted, the branches free, repeatedly divided, all the divisions opposite or quadrifarious, spreading. *Colour* olivaceous, or rusty or yellowish brown. *Capsules* abundant on the upper branches, placed either opposite to each other on opposite sides of the stem, or opposite to a ramulus; occasionally in fours, sessile, globose and prominent.

11. E. *brachiatus*, Harv.; finely tufted, feathery, much branched; the branches free, opposite or quaternate; ramuli opposite, patent; capsules imbedded in the filaments, forming

oblong swellings, scattered on the ultimate branchlets or in the axil of two opposite ramuli. *Wyatt, Alg. Danm. No.* 174! *Hook. Br. Fl.* ii. *p.* 326? *Conf. brachiata, E. Bot. t.* 2571?

Parasitical on *Rhodomenia palmata*, at Torquay, *Mrs. Griffiths*. Coast of Norfolk, *Messrs. Turner* and *Hooker.—Filaments* 2—4 inches high, finely tufted, wavy and feathery; the main stems slightly entangled, excessively branched, all the branches and branchlets opposite or quaternate; the lesser branches generally naked at the base, their upper half bearing, at distances of 6—8 joints, a pair of opposite, patent ramuli, which again throw off from their upper half a second and third series. *Capsules* imbedded in the branchlets. *Colour* a pale olive-green. Such is the plant published by Mrs. Griffiths in the "*Algæ Danmonienses*," and which I had formerly confounded with *E. sphærophorus*. From that species, however, it strikingly differs in habit, (as can better be seen by a glance at the specimens in the "Alg. Danm." than understood from the most laboured description), and also, as first pointed out by Mrs. Griffiths, in the fructification. Whether or not it be the same species as the plant figured in 'Eng. Bot.,' the original *brachiatus*, I cannot say, having never seen an authentic specimen of that plant; nor am I aware whether any authentic specimens exist. The figure in 'Eng. Bot.' was taken from a specimen picked up on the Norfolk coast, by Sir W. J. Hooker, many years ago, but no such plant now exists in Sir William's herbarium; and nothing more nearly resembling it than the present has since been found.

12. E. *Mertensii*, Ag.; distichous; branches opposite, of unequal length, linear, mostly undivided, closely set throughout their whole length with slender, subulate ramuli; joints of the stem longitudinally striate, transparent, with a central coloured band, rather shorter than broad; capsules imbedded in the ramuli. *Hook. Br. Fl.* ii. *p.* 327; *Wyatt, Alg. Danm. No.* 130; *E. Bot. t.* 999.

In the sea, very rare. Yarmouth, *Mr. Wigg*. Coast of Durham, *Mr. W. Backhouse*. Torbay, *Mrs. Griffiths* and *Mrs. Wyatt*. Sidmouth, *Miss Cutler*. Strangford Lough, dredged, *Mr. W. Thompson*.—Main stems 2—5 inches long, nearly simple, set throughout with opposite, or by suppression, alternate branches of unequal length; the branches linear and undivided, furnished for their whole length, and at distances of every second or third joint, with slender, spreading, subulate ramuli, one-third the diameter of the branch, and at intervals bearing a larger pinnated ramulus; all the divisions exactly distichous and opposite; the branches resembling delicate feathers. *Joints* of the stem marked with a central, longitudinal, coloured band, those of the ramuli bright green, very short. *Capsules* imbedded in the distended ramuli, transparent, with a dark central mass. *Colour* a fine olive-green. A highly beautiful species, unlike any other of the genus, and in many respects showing affinity with *Sphacelaria*, from which it is chiefly distinguished by its *flaccid* substance.

XXV. Myriotrichia. Harv.

Primary filament olivaceous, flaccid, (simple), beset on

every side with simple, spine-like *ramuli*, which bear from their tips colourless, dichotomous, long-jointed fibres. *Fructification:* ovate capsules, containing a dark mass of seeds. —Name, μυριος, a *thousand*, and θριξ, a *hair;* from the innumerable, hair-like fibres which spring from the ramuli.

1. M. *clavæformis*, Harv.; stem densely beset with quadrifarious ramuli, which gradually increase in length from the base upwards, giving the frond a club-shaped figure. *Harv. in Hook. Journ. of Bot. Vol.* i. *p.* 300, *t.* 138; *Fl. Hib. p.* 182; *Wyatt, Alg. Danm. No.* 131.

Parasitical on *Chorda lomentaria*. Bantry Bay, *Miss Hutchins*. Torquay, *Mrs. Griffiths*. Cable Island, near Youghal, *Miss Ball*. North of Ireland and Ballentrae, Ayrshire, *Mr. W. Thompson*. Probably common. —*Fronds* half an inch long, tufted, flaccid, sub-gelatinous, simple, linear-clavate, olivaceous, surrounded by colourless fibres. *Primary thread* running the whole length of the plant, simple, attenuated at base, articulated, naked below, towards the apex densely clothed with ramuli; the young plants destitute of ramuli, or merely bearing rudimentary processes. *Ramuli* quadrifarious, whorled or irregularly scattered, obtuse, the lower ones short and naked; the upper, (like the *primary thread*), bearing lesser ramuli, from whose tips spring long, colourless, dichotomous, long-jointed fibres, of a very thin membranous texture and flaccid substance. *Joints* of the primary thread very short, transversely dotted, the dots proliferous, (finally becoming ramuli); of the ramuli oblong, with pellucid dissepiments. *Capsules* sessile, elliptical or ovate, with a pellucid limb, and containing a dense olivaceous mass. Miss Hutchins appears to have been the earliest discoverer of this plant, having communicated it to Mr. Mackay more than thirty years ago, as "*a curious new Conferva*."

2. M. *filiformis;* stem filiform, slender, often flexuous or curled, beset at irregular intervals with oblong clusters of minute, papilliform ramuli. *Wyatt, Alg. Danm. No.* 304.

Parasitical on *Chorda lomentaria* and *Asperococcus echinatus*, sometimes accompanying the preceding. Torquay, *Mrs. Griffiths*. Youghal, *Miss Ball*. Kilkee, Co. Clare.—*Fronds* an inch or more in length, very slender, straight, or more usually flexuous, often twisted or several bundled together into rope-like tufts; the stem quite simple, at intervals appearing thickened into dark-coloured knobs, which are found, under the higher powers of the microscope, to consist of very dense, minute, papillæform ramuli, from whose apices issue, as in the last species, long, dichotomous, colourless fibres. The intervals between the *knobs* or papillated portions are cylindrical and jointed, the joints being rather shorter than broad. I have long been acquainted with this plant, but have been hitherto contented to regard it as a state of *M. clavæformis*, with which it is occasionally found mixed. But my acute friend, *Mrs. Griffiths*, having lately found it in great perfection at Torquay, has drawn my attention more closely to it, and the result is, that I am disposed to agree with her in considering it specifically distinct. It is a much taller and slenderer plant than *M. clavæformis*, and easily distinguished by its *interrupted* ramuli, which are besides very much shorter than in that species, and do not increase in length toward the upper

part of the stem. I believe it to be a much more common plant than *M. clavæformis*, and perhaps some of the stations assigned to that species belong to this. In Miss Ball's specimens the two occur together.

Tribe 7. CHORDARIEÆ.

XXVI. Chordaria. Ag.

Frond filiform, much branched, cartilaginous; the *axis* cellular; the *periphery* composed of simple, articulated, club-shaped, verticillate, horizontal filaments. *Fructification:* "obovate, brown *seeds*, (*capsules?*) mixed with the filaments of the periphery." *Carm.*—Name, *Chorda*, a *cord;* the branches resemble small cords.

1. C. *flagelliformis*, Ag.; frond filiform, equal throughout; branches alternate, long and mostly simple. *Grev. Alg. Brit. p.* 44; *Hook. Br. Fl.* ii. *p.* 275; *E. Bot. t.* 1222; *Wyatt, Alg. Danm. No.* 57.

In the sea, on rocks and stones, common. Annual. Summer.—*Root* small, discoid. *Fronds* from three inches to three feet long, slender, about half a line in diameter, with a central stem, which is either simple or irregularly divided in its upper part, and bears numerous lateral, irregularly inserted, long, generally simple *branches*, of equal thickness. The colour is dark olivaceous-green; the substance firm and cartilaginous. The whole frond, if viewed in the water, appears fringed with exceedingly fine colourless fibres, which give to the surface a slimy feel. They have some resemblance to the colourless fibres of *Myriotrichia*.

XXVII. Helminthocladia. Harv.

Frond filiform, much branched, gelatinous; the *axis* composed of longitudinal, sub-simple, interlacing fibres, invested with gelatine; the *periphery* formed of radiating, dichotomous, coloured filaments. *Fructification:* ovate or elliptical olivaceous *seeds* (*capsules?*), attached to the ramuli of the periphery.—Name, ἕλμινς, a *worm*, and κλαδος, a *branch;* the branches resemble worms. I have been obliged to relinquish the name *Trichocladia*, imposed on this genus in the 'Flora Hibernica,' as too nearly approaching in sound and meaning the more ancient *Trichocladus*.

1. H. *vermicularis;* frond clumsy; branches irregularly pinnate, thick, worm-like, lineari-fusiform; ramuli copious, long, flexuous, resembling the branches. *Harv. Gen. S. A. Pl. p.* 397. *Mesogloia vermicularis, Hook. Br. Fl.* ii. *p.* 387. *Riv. verm. E. Bot. t.* 1818; *Wyatt, Alg. Danm. No.* 100.

In the sea, common. Annual. Summer.—*Fronds* 1—2 feet high, gelatinous and flaccid; the branches clumsy, of unequal diameter, generally much attenuated at each end. *Colour* pale olive-green or yellowish. *Capsules* ovate, commonly produced.

2. H. *Griffithsiana;* frond slender, equal throughout; branches alternate or irregular, filiform, long, simple, nearly bare of ramuli. *Mesogloia Griffithsiana, Grev.*; *Hook. Br. Fl.* ii. *p.* 387; *Wyatt, Alg. Danm. No.* 48.

In the sea, rare. Annual. Summer. Sidmouth and Torquay, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.*—*Fronds* 8—16 inches high, of a rather pale olive-green, which becomes greener in fresh water. *Stem* subsimple, beset throughout with very long, slender, simple, opposite or alternate *branches*; the surface covered with long colourless fibres, similar to what occur in *Chordaria flagelliformis*, which make the plant, as it waves in the water, look of much greater diameter than it really is. *Capsules* pyriform.

3. H. *virescens;* frond filiform, gelatinous; branches long, erecto-patent, slender, villous; ramuli numerous, patent, short, flexuous, obtuse. *Mesogloia virescens, Hook. Br. Fl.* ii. *p.* 387; *Wyatt, Alg. Danm. No.* 49; *Berk. Gl. Alg. t.* 17, *f.* 2; (*also M. affinis, Berk., and M. gracilis, Carm.*; *Berk. l. c. t.* 16, 2, *and t.* 17, 1).

Sea shores. Annual. Summer. Not unfrequent. Appin, *Capt. Carmichael.* Sidmouth and Torquay, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.*—*Fronds* 8—12 inches high, olive-green, tender, gelatinous, slippery, excessively branched; branches long, simple or forked, furnished with numerous alternate or secund, spreading, flexuous ramuli. *Frond* to the naked eye appearing villous, owing to the filaments composing the periphery being very much protruded beyond the gelatine, and accompanied also by colourless fibres, similar to those of *M. Griffithsiana.* I have examined the *M. gracilis* of Carmichael, and do not consider it specifically distinct from the present; and though I have not seen specimens of Mr. Berkeley's *M. affinis*, yet, judging from the figure and description given in the "*Gleanings*," I venture to refer it to the young of this species.

XXVIII. Corynephora. Ag.

Frond globose or lobed, carnoso-cartilaginous, hollow, (not filled with gelatine), composed of jointed, colourless, dichotomous filaments, issuing from a central point; their apices, (which constitute the fleshy coating of the frond), coloured and tufted. *Fructification:* oval *seeds* (or *capsules?*) attached to the terminal ramuli.—Name, κορυνη, a *club*, and φορεω, *to bear;* the apices of the filaments are club-shaped.

1. C. *marina*, Ag.—*Hook. Br. Fl.* ii. *p.* 390; *Wyatt, Alg. Danm. No.* 149. *Rivularia tuberiformis, E. Bot. t.* 1956.

In the sea, on rocks, corallines and Algæ, abundantly.—*Fronds* fleshy, forming many hollow lobed or distorted tubers, and spreading over a large surface, olive-brown. "In young plants the central cavity is traversed by a system of very wide, inflated, jointed, hyaline tubes, branching dichotomously, while they radiate in all directions to the surface, where each branch terminates in a tuft of short, club-shaped, moniliform, coloured ramuli; among these last, which by their lateral cohesion form the whole *substance* of the plant, the *sporidia* are found nestling. They are obovate, smooth, and mostly solitary."—*Carm. MSS.*

Series II. RHODOSPERMEÆ.

Tribe 8. GLOIOCLADEÆ.

XXIX. Mesogloia.

Frond filiform, solid; the axis or central part gelatinous, formed of longitudinal, colourless, jointed fibres; the periphery composed of radiating, coloured, branched, jointed filaments. *Fructification:* globules of red *seeds*, imbedded in the filaments of the periphery, to which they are attached. —Name, μεσος, the *middle*, and γλοιος, *viscid;* from the gelatinous axis. This genus is distinguished from *Helminthocladia* by the *red* colour of its endochrome, and by the *structure* of the fruit.

1. M. *multifida*, Ag.; frond dichotomous, slightly branched; dull purple, elastic; the axils rounded. *Hook. Br. Fl.* ii. *p.* 385; *Berk. Alg. t.* 16, *f.* 1; *Wyatt, Alg. Danm. No.* 98.

On shells and stones near low water-mark, not unfrequent. Appin, *Capt. Carmichael.* West of Ireland, Coast of Down, *Mr. Templeton* and *Mr. Thompson.* Torquay, *Mrs. Griffiths.—Fronds* of a dull purplish-brown colour, 3—6 inches high, 1—2 lines in diameter, sub-simple or once or twice dichotomous, sometimes irregularly branched, very elastic. *Axis* much denser than in the following, not clearly filamentous, but rather, as Capt. Carmichael expresses it, "a medullary cord."

2. M. *Hudsoni*, Ag.; frond much branched, filiform, pale reddish; branches mostly opposite, once or twice pinnate; ramuli numerous, irregular, obtuse. *Hook. Br. Fl.* ii. *p.* 386; *Wyatt, Alg. Danm. No.* 99. *Ulva rubens, Huds. Fl. Angl. p.* 571.

On stones and shells, not uncommon. Summer.—Frond excessively branched, slender, filiform, of a pale red or reddish-brown colour; branches once or twice pinnated, with a lanceolate outline; ramuli abundant, 1—4 lines long, patent or divaricated, obtuse. The substance tender and gelatinous. "The structure is very remarkable; the frond appears to be made up of tufts of fibres radiating from a centre, each tuft, when separated in

water under a glass, resembling a double aster or sea-anemone. In the centre of the petal-like fibres are masses of purplish grains."—*Mrs. Griffiths.* Notwithstanding that the opinion of my friend, *Dr. Walker Arnott*, founded on a specimen from *Sir T. Frankland*, is against me, I am unwilling to omit the reference to Hudson, whose description "*U. gelatinosa filiformis ramosissima rubescens, ramis sparsis horizontalibus obtusis*," answers most correctly to the present species, and will not apply to any other. According to Dr. Arnott, *U. rubens, Huds.*, is *Helminthocladia vermicularis.*

3. M. *purpurea*, Harv.; stem undivided, attenuated at base and apex, set with numerous alternate, distichous, elongated, simple branches, which are nearly destitute of ramuli. *Hook. Br. Fl.* ii. *p.* 386; *Wyatt, Alg. Danm. No.* 47.

In the sea, at extreme low water-mark, very rare. Sidmouth and Torbay, *Mrs. Griffiths* and *Miss Cutler.—Fronds* from a foot to 2½ feet high, the main stem 2 or 3 lines in diameter, undivided, alternately branched; the branches patent, sub-horizontal, long, flexuous, simple, either bare of ramuli or furnished with a second series similar to themselves, all much attenuated towards the extremity and somewhat tapering at base. *Colour* "a fine purple-red, which is given out to fresh water; substance tender and gelatinous, slippery to the touch, less elastic than in *M. vermicularis.*" *Mrs. Griffiths.* Axis somewhat compressed, densely cellular; periphery a continuous stratum of very short, dichotomous, deep red or purplish radiating filaments, the terminal joints of which are club-shaped and deeply coloured, sometimes resembling seeds. *Fructification:* very dense, roundish masses of sporules, deeply seated among the radiant fibres. In habit this remarkable plant a good deal resembles the granuliferous state of *Gigartina compressa;* while the substance is more that of *Halymenia ligulata.* The filaments composing the periphery are shorter and more densely set than in any other species of the genus with which I am acquainted. Some of *Mrs. Griffiths'* specimens are much infested with *Ceramium rubrum.* The Irish station given in Flora Hibernica is incorrect. *Mr. Ball's* specimens belong to *Dumontia filiformis.*

4. M. *coccinea*, Ag.; frond fine rose-red, tender and gelatinous, much and irregularly branched; branches alternate, flexuous, moniliform, attenuated towards the apex; ramuli more or less numerous. *Hook. Br. Fl.* ii. *p.* 386; *Wyatt, Alg. Danm. No.* 148. *Rivularia verticillata, E. Bot. t.* 2466.

Southern shores of England and Ireland, very rare. Summer. Brighton, *Mr. Borrer.* Bantry Bay, *Miss Hutchins.* Sidmouth and Torquay, *Mrs. Griffiths* and *Miss Cutler.—Frond*, 4—8 inches high, of a fine rose-red colour, very tender and gelatinous, from a quarter line to a line in diameter at base, gradually attenuated upwards; much and irregularly branched, the smaller branches somewhat pinnated, moniliform, each series becoming narrower. Under the microscope the branches appear composed of numerous jointed, colourless, longitudinal fibres, set at close intervals with dense tufts of rose-coloured, dichotomous filaments, which cause the beaded appearance. The fruit is of two kinds, on distinct individuals: 1st, large dark red masses of minute seeds, (favellæ ?); 2nd, elliptic-oblong or club-shaped capsules, with pellucid pericarps, borne abundantly on the ramuli of the radiating filaments, generally terminating a ramulus. These

capsules I find on a specimen obligingly communicated by Miss Cutler, dated August 28, 1833; the *favellæ* are commonly produced. I am not aware of such capsules having been noticed in any other species, except the following.

5. M.? *moniliformis*, Griff.; frond capillary, brownish-red, gelatinous, moniliform, much branched; main divisions subdichotomous, with wide axils; branches alternate, more or less furnished with ramuli. *Griff. in Wyatt, Alg. Danm. No.* 197. *M. attenuata, Ag. Syst. p.* 51. *Griffitsia nodulosa, Ag. Sp. Alg.* ii. *p.* 136.

Very rare. Parasitical on *Cladostephus spongiosus*, at Salcombe, Devon, *Mrs. Wyatt.* Land's End, *Mr. Ralfs.—Fronds* 1 or 2 inches high, of a brownish or purplish-red colour, excessively slender and gelatinous, much branched, all the branches moniliform or resembling strings of minute beads. The branches consist of a simple-tubed, jointed filament or *axis*, from whose joints issue very dense, globular whorls of dichotomously multifid fibres. The joints of the main thread are sometimes short, sometimes of considerable length; in the former case the globular whorls (or *beads*), conceal the main thread altogether; in the latter they are widely separated, and then the plant, under a low power of the microscope, something resembles *Ceramium diaphanum*. *Fructification:* large *capsules* with pellucid pericarps, resembling those of *Callithamnion*, seated on the whorled filaments, either in pairs, or placed round the branch. This curious and beautiful plant may perhaps, as Mrs. Griffiths suggests, form the type of a new genus intermediate in structure between *Mesogloia* and *Batrachospermum*, with neither of which does it strictly agree. By Agardh it is twice described, first as a *Mesogloia*, afterwards as a *Griffitsia*. Its decided gelatine induces me to agree with Mrs. Griffiths in placing it among the former, until some better place shall be found for it.

XXX. Gloiosiphonia. Carm.

Frond cylindrical, filiform, tubular, somewhat gelatinous; the periphery composed of radiating, coloured, branched, jointed filaments. *Fructification:* globules of red seeds, imbedded in the filaments of the periphery, to which they are attached.—Name, γλοιος, *viscid*, and σιφων, a *tube;* from the gelatinous, tubed frond. This genus, founded on the *Fucus capillaris* of Turner, was originally proposed by the late Capt. Carmichael, in his unpublished "*Algæ Appinenses*," and has been adopted by Mr. Berkeley. Except in the tubular frond it does not differ from *Mesogloia*.

1. G. *capillaris*, Carm. *Berk. Gl. of Br. Alg. t.* 17, *f.* 3. *Fucus capillaris, Turn. Hist. t.* 31; *E. Bot. t.* 2191. *Mesogloia capillaris, Ag.*; *Harv. in Hook. Br. Fl.* ii. *p.* 386.

Sea shores, thrown up, very rare. Summer. Southern shores of England, growing in pools, Sidmouth and Meadfoot, *Mrs. Griffiths* and *Miss Cutler.* Bantry Bay, *Miss Hutchins.* Appin, *Capt. Carmichael.* Near

Glenarm, *Dr. Drummond.*—*Frond* 3—12 inches high, finerose red, of a lanceolate outline, much branched in a repeatedly pinnate manner, the main branches often a line in diameter, ramuli very slender; the branches and ramuli generally opposite, much attenuated at base and apex. Axis, according to Capt. Carmichael, tubular, the walls of the tube composed of jointed, longitudinal, interwoven fibres; the surface of extremely minute, dichotomous, radiating filaments. *Fructification:* large dense masses of granules scattered among the filaments of the periphery.

XXXI. Naccaria. Endl.

Frond cylindrical, filiform, solid, sub-gelatinous, rose-red; the centre (*axis*) laxly cellular; the outer coat or periphery membranaceous. *Ramuli* setaceous, fusiform, composed of jointed, branched, radiating filaments, and containing in their centre a mass of minute red *seeds*.—Name, perhaps from *ναικος*, a *fleece;* from the structure of the ramuli.

The name *Chætospora*, given by Agardh to this genus, and adopted by Greville and in the British Flora, having been already assigned to a genus of *Cyperaceæ* by Dr. R. Brown, it becomes necessary to give a new name to the present plant, which has accordingly been done by *Endlicher*, in his excellent '*Genera Plantarum*.' By Agardh this genus is placed among the *Ceramieæ;* by Dr. Greville it is removed to the *Florideæ*, at the same time that he agrees that "the nature of the ramuli seems to indicate some affinity with *Mesogloia*." In the 'Flora Hibernica' I have ventured to assign it the present position, in unison with the opinions of the late *Miss Hutchins* and of *Mrs. Griffiths*, who have had the best opportunities of examining specimens in a recent state. It is true that the structure, except as regards the ramuli, is more that of the *Gastrocarpeæ* than of the *Gloiocladeæ*, but the habit is completely that of *Gloiosiphonia* and *Mesogloia*. The membrane, too, of the periphery, is formed of exceedingly minute, longitudinal fibres, cohering together. May not *Naccaria*, therefore, be regarded as a *Mesogloia*, wanting the verticillate filaments, except in the ramuli?

1. N. *Wigghii*, Endl. *Chætospora Wigghii, Grev. Alg. Brit. p.* 153, *t.* 16; *Hook. Br. Fl.* ii. *p.* 306; *E. Bot. t.*1165; *Wyatt, Alg. Danm. No.* 124.

Sea shores, very rare. Summer. Annual. Yarmouth, *Mr. Lilly Wigg.* Brighton, *Mr. Borrer.* Folkstone, *Miss Everett.* Sidmouth and Torquay, *Mrs. Griffiths* and *Miss Cutler.* Bantry Bay, *Miss Hutchins.* Belfast Bay, *Mr. W. Thompson.* Kilkee, Co. Clare.—*Frond* 6—12 inches high, cylindrical, filiform, much branched; main stem about half a line in diameter, attenuated upwards, repeatedly divided with alternate branches spreading quadrifariously, the branches thickly set with minute, slender ramuli, tapering to both ends, and from about half a line to a line and a half in length. *Structure* of stem and branches cellular; the ramuli composed of minute, dichotomous, gelatinous filaments, radiating from the centre. *Colour* a fine rose-red, given out to fresh water. *Substance* tender and gelatinous, adhering to paper. *Fructification* situated in the centre of the ramuli, which are then much swollen; consisting of a dark red mass, apparently composed of minute red seeds, but, owing to its small size and gelatinous nature, difficult of dissection.

Tribe 9. GASTROCARPEÆ.

XXXII. Catenella. Grev.

Frond filiform, somewhat compressed, creeping, throwing up numerous branches, contracted as if jointed in a moniliform manner, composed internally of branched filaments radiating from the centre. *Fruit* unknown. *Grev.*—Name, *catenella*, a *little chain*, which the fronds resemble.

1. C. *Opuntia. Grev. Alg. Brit. p.* 166, *t.* 17; *Hook. Br. Fl.* ii. *p.* 309; *Wyatt, Alg. Danm. No.* 126. *Rivularia Opuntia, E. Bot. t.* 1868.

Marine rocks near high-water mark, not uncommon.—*Fronds* densely matted together, half an inch to an inch high, rising from a mass of creeping fibres; branches erect, simple, or slightly branched in an irregular manner, contracted at intervals as if jointed; the *joints* or spaces between the contractions narrow at base, gradually swelling upwards. *Colour* a dull, dark purple. *Substance* membranaceous, tender and soft, more or less full of moisture, imperfectly adhering to paper.

XXXIII. Dumontia. Lamour.

Frond cylindrical, simple or branched, membranaceous, tubular, gelatinous within, of a red or purplish colour. *Fructification:* globules of seeds attached to the inner surface of the membrane of the frond.—Name, in honour of M. Dumont, a French naturalist.

1. D. *filiformis*, Grev.; frond tender, membranaceous, cylindrical, pinnated with long, simple branches, which are, attenuated at each extremity. *Grev. Alg. Brit. p.* 165, *t.* 17; *Hook. Br. Fl.* ii. *p.* 308; *Wyatt, Alg. Danm. No.* 31. *Ulva purpurascens, E. Bot. t.* 641.—*β. crispata;* frond compressed, waved, curled or twisted. *Grev. Crypt. t.* 240.

Rocks and stones in the sea, common. Annual. Summer. *β*, Frith of Forth, *Dr. Greville.* Youghal, *Miss Ball.* Belfast Bay, *Mr. Thompson.*—*Frond* generally undivided, narrowed at each end, bearing numerous, alternate, simple or rarely forked branches, similar to the primary; of a membranoso-gelatinous substance, and yellowish, greenish, or dull purple colour, with intermediate shades. A most variable plant. In some individuals the main stem is 8—18 inches long, a line in diameter, bearing numerous filiform branches, 4 or 5 inches long. In others the stem is very short, 2 or 3 inches; the branches 10—14 inches long, and of twice the diameter of the stem. In others there is scarcely any stem, but 4 or 5 branches rise from a point near the root, and these are 10 or 12 inches long and an inch in diameter. Other varieties are but two or three inches high, both stem and branches filiform. *β* is remarkable for compressed stems, from half an inch to an inch wide, crisped and curled. *Fructification* abundantly scattered over the whole frond, giving it a dotted appearance.

XXXIV. Halymenia. Ag.

Frond nearly flat or cylindrical, gelatinoso-membranaceous, of a pinky-red colour, more or less dichotomous, the segments often laciniated. *Fructification:* punctiform globules of seeds, imbedded in the central substance of the frond. *Grev.*—Name, ἁλς, the *sea*, and ὑμην, a *membrane; sea-membrane.*

1. H. *ligulata*, Ag.; frond gelatinoso-membranaceous, compressed or flat, irregularly dichotomous or palmate, the segments attenuated, often proliferous at the margin. *Grev. Alg. Brit. p.* 162, *t.* 17; *Hook. Br. Fl.* ii. *p.* 308; *Wyatt, Alg. Danm. No.* 125. *Ulva ligulata, E. Bot. t.* 429.

On rocks and stones in the sea, chiefly along the Southern shores of England and Ireland. Annual. Summer.—*Frond* extremely variable in form and ramification, and in substance, but resolvable into three principal varieties. 1, *dichotoma;* frond 6—8 inches long, half a line to 1 or 2 lines broad, compressed, very gelatinous, many times divided in an irregularly dichotomous manner, the divisions nearly of equal breadth, becoming gradually narrower towards the extremities, which are tapering and acuminate. 2, *ramentacea;* frond 12—14 inches long, compressed, divided into three or four principal lobes or branches, from half an inch to an inch in breadth and from 1—4 inches long, attenuated at base, thence cylindrical till near the apex, when they again slightly taper. In substance this closely resembles the first variety, containing a great quantity of gelatine, the external membrane being very thin, and of a pale rose-colour. 3, *latifolia;* frond 12—20 inches long, 2—4 inches wide in the widest part, rising from a minute stem, wedge-form, either simple or forked, or once or twice irregularly cleft in a palmate manner, the segments 1 or 2 inches broad, destitute of ramuli; of a dark red colour, and soft, but not very gelatinous substance, (very similar in feel to *Rhodomenia reniformis*), perfectly flat, the stratum of gelatine interposed between the membranes being very thin. The fructification is abundantly scattered over every part of the frond, and, to the naked eye, resembles minute dark red dots.

2. H. *furcellata*, Ag.; frond tender, gelatinoso-membranaceous, cylindrical, uniformly dichotomous, the segments obtuse. *Grev. Alg. Brit. p.* 163; *Hook. Br. Fl.* ii. *p.* 308; *Wyatt, Alg. Danm. No.* 79. *Ulva furcellata, E. Bot. t.* 1881.

On rocks and stones in the sea, rare. Annual. Summer. On the Eastern and Southern shores of England. Bantry Bay, *Miss Hutchins.* Miltoun Malbay. Glenarm, *Miss Davison.*—*Frond* 2—6 inches long, cylindrical, from a line to nearly half an inch in diameter, repeatedly and regularly dichotomous, of a fine pinky-red colour, and either firmly or laxly gelatinous substance. Irish specimens are much larger than the English ones. Those from *Miss Hutchins* are remarkable for possessing a more or less distinct midrib: in one specimen this is very fully developed. The branches, (particularly in these Bantry specimens), are frequently constricted, as if tied, when the frond assumes a jointed appearance. In a specimen com-

municated by *Mrs. Griffiths*, the apices are truncate as if broken off, with the margins thickened into a disk or ring, from the centre of which spring one or two little ramuli, showing an evident attempt at prolonging the frond after injury. This species seems widely distributed; I have gathered it at the Cape of Good Hope, and possess specimens from New Zealand.

XXXV. Iridæa. Bory.

Frond flat, expanded, carnose or gelatinoso-cartilaginous, more or less of a purplish-red colour. *Fructification:* globules of roundish seeds imbedded between the two coats of the frond. *Grev.*—Named from the *iridescent* hues of some of the species when recent.

1. I. *edulis*, Bory.; frond simple, obovate or wedge-shaped, rounded at the apex, narrowing gradually towards the base into a short stem. *Grev. Alg. Brit. p.* 158, *t.* 17; *Hook. Br. Fl.* ii. *p.* 308; *Wyatt, Alg. Danm. No.* 78. *Fucus edulis*, *E. Bot. t.* 1307.

On rocks and stones in the sea, common. Perennial. Autumn.—*Root* an expanded disk, from which spring numerous, obovate, obtuse, thick, cartilagineo-carnose or somewhat leathery fronds, 4—18 inches long, 2—8 inches wide, which gradually taper towards the base into a short, linear stem; undivided, but frequently cleft by the action of the waves; the margin smooth and even. The colour is a fine deep red, becoming much darker, frequently blackish when dried. *Fructification* near the extremity, in wide patches, frequently spreading over a large portion of the frond, composed of globules of minute seeds imbedded in the substance. The frond of this species is occasionally eaten by the poor, either raw or cooked in the frying pan.

Tribe 10. SPONGIOCARPEÆ.

XXXVI. Polyides. Ag.

Frond cylindrical, dichotomous, with a scutate root. *Fructification:* "naked spongy *warts*, composed of radiating filaments, among which are imbedded clusters of wedge-shaped seeds." *Grev.*—Name, πολυ, *many*, and ιδεα, *form* or *appearance;* but I know not why applied to the present genus.

1. P. *rotundus*. *Grev. Alg. Brit. p.* 70, *t.* 11; *Hook. Br. Fl.* ii. *p.* 284; *Wyatt, Alg. Danm. No.* 161. *Fucus rotundus*, *E. Bot. t.* 1738.

On rocks and stones in the sea. Perennial. Autumn and winter. Southern and Eastern shores of England and Ireland. Rare in Scotland. —*Root* an expanded disk. *Fronds* 4—6 inches high, as thick as whip-cord,

of a dark purplish-brown colour, terete, repeatedly dichotomous, the tips fastigiate, giving the plant a rounded outline when displayed; the axils rounded. *Fructification:* "spongy pale or pink warts on the sides of the upper branches, at first roundish or oblong and scattered, but at length 2—4 lines long and 1 or 2 lines thick, sometimes creeping all round the frond, and occasionally several, becoming confluent, extend for nearly an inch along the branches. The warts are naked or destitute of any epidermis, composed of white articulate filaments, radiating horizontally from the frond, and containing numerous imbedded clusters of seeds, each cluster surrounded by a pellucid limbus." *Grev.* Besides this fructification, *Mrs. Griffiths* communicates specimens from Sidmouth having the upper ramuli slightly swollen and containing imbedded granules. In habit this plant closely resembles the following, and can scarcely be distinguished when out of fruit, except by the root and the rounded axils of the branches.

Tribe 11. FURCELLARIEÆ.

XXXVII. Furcellaria. Lamour.

Frond cartilaginous, cylindrical, dichotomous, with a creeping root. *Fructification:* terminal, elongated, pod-like receptacles, containing a stratum of dark, oblong, pear-shaped *seeds*, in the circumference. *Grev.*—Name, *furcula* or *furcilla*, a *little fork;* from the forked frond.

1. F. *fastigiata*, Lamour. *Grev. Alg Brit. p.* 67, *t.* 11; *Hook. Br. Fl.* ii. *p.* 283; *Wyatt, Alg. Danm. No.* 106. *Fucus lumbricalis, E. Bot. t.* 894.

Rocks and stones in the sea, common. Perennial. Bearing fruit in winter.—*Root* a mass of stout fibres. *Frond* 6—12 inches high, terete, simple at base, repeatedly dichotomous upwards, the apices fastigiate, the axils acute. *Substance* between fleshy and cartilaginous. *Colour* brownish-purple, becoming much darker in drying. When in fruit the branches, in the upper part, are swollen into a lanceolate pod-like figure, and are found on dissection to contain beneath their surface a dense stratum of dark brownish-purple, pear-shaped seeds. These *receptacles* when ripe fall off, leaving the branches truncated. In a state of the plant constituting Turner's var. β, the tips of the branches bear short, ovato-lanceolate, transparent, soft, pod-like bodies, which appear to be imperfect attempts at fructification. These Dr. Greville has sometimes observed to lengthen into healthy branches.

Tribe 12. FLORIDEÆ.

XXXVIII. Delesseria. Lamour.

Frond rose-red, flat, membranaceous, with a percurrent midrib. *Fructification* of two kinds, on distinct individuals: 1, *capsules*, containing a globular mass of seeds: 2, ternate *granules*, forming definite spots in the frond, or in distinct

leaf-like processes. *Grev.*—Named in honour of *M. Benj. Delessert*, a distinguished French naturalist and patron of Botany.

1. D. *sanguinea*, Lamour.; stem cylindrical, cartilaginous, branched, bearing oblong or obovate, transversely veined leaves, entire at the margin; midrib percurrent, strong; capsules stalked, attached to the midrib. *Grev. Alg. Brit. p.* 72; *Hook. Br. Fl.* ii. *p.* 285; *Wyatt, Alg. Danm. No.* 13. *F. sanguineus, E. Bot. t.* 1041.

In the sea. Biennial. Fruiting in winter, after the decay of the leaves. Common.—*Stem* simple or slightly branched, thick, bearing numerous oblong or broadly obovate, obtuse, penninerved leaves, 2—8 inches long, 1—6 inches wide, of a splendid pinky-red colour and delicately membranous substance; the margin waved, but quite entire; the midrib and lateral veins prominent, the former occasionally giving rise to small proliferous leaves. Such is the summer state. In winter the membranaceous portion of the frond almost entirely decays, leaving little but the stems and midribs, which are then found fringed with fructification; the *capsules* raised on little stalks about a line long; the *granules* placed in little leafy processes.

2. D. *sinuosa*, Lamour.; stem elongated, branched, beset with oblong or obovate, deeply sinuate or pinnatifid, toothed, transversely ribbed leaves. *Hook. Br. Fl.* ii. *p.* 285; *Wyatt, Alg. Danm. No.* 62. *Fucus sinuosus, E. Bot. t.* 822.

On the larger fuci, common. Biennial? Summer and autumn. *Stem* in young plants with a decurrent membrane, (the remains of the simple leaf of which the plant at first consists); in old, naked and somewhat pinnatedly branched; the branches or *leaves* of an oblong or obovate form, deeply sinuate, or in many specimens pinnatifid, each lobe having a sinuous, jagged or serrated, sometimes ciliated margin; furnished with a strong midrib, and transverse opposite or alternate veins. *Colour* a fine rose-red, purplish when dry; much duller at all times than that of the preceding. *Fructification:* 1, *capsules* imbedded in the leaves: 2, *granules* placed in minute, slender processes, fringing the margin and resembling ciliæ.

3. D. *alata*, Lamour.; stem excessively branched, somewhat dichotomous, linear, winged with membrane without distinct leaves; branches attenuate; margin entire. *Grev. Alg. Brit. p.* 73; *Hook. Br. Fl.* ii. *p.* 285; *Wyatt, Alg. Danm. No.* 14. *Fucus alatus, E. Bot. t.* 1387.

On the larger Algæ, common. Biennial? Summer.—*Frond* 3—8 inches high, 1—4 lines wide, much branched in a dichotomous manner, linear, the membrane decurrent along the branches, its margin quite entire, its surface marked, in luxuriant specimens, with evident transverse striæ. *Colour* a deep red. *Capsules* sphærical, attached to the midrib, generally near the ends of the branches; *granules* ternate, imbedded in little leafy processes of the midrib, generally at or near the tips; sometimes in the tips themselves. Turner's var. γ, *angustissima*, is *Gelidium rostratum* of this work.

4. D. *Hypoglossum*, Lamour.; frond much branched in a proliferous manner, composed of linear-lanceolate, mid-ribbed leaves, tapering at each end, the younger series springing from the midribs of the older; ternate granules, forming an oblong line at each side of the midrib, near the tips of the leaves. *Hook. Br. Fl.* ii. *p.* 286; *Wyatt, Alg. Danm. No.* 63; *E. Bot. t.* 1396.

On rocks and other Algæ, not uncommon on the shores of England and Ireland; rare in Scotland. Annual. Summer.—*Fronds* several from the same base, at first forming a simple, linear-lanceolate leaf, furnished with a distinct midrib, and faintly marked by pellucid transverse veins; afterwards excessively branched, and forming globose tufts 4—6 inches in diameter; the branches or *leaves* springing from the midrib of those first formed, resembling them in outline, and bearing from their midribs a second and third series. *Colour* a fine pinky red, soon given out to fresh water. *Capsules* globose, seated on the midrib about the centre of the leaflet; *granules* disposed in linear longitudinal lines or sori, at each side of the midrib, often near its end. Some of Miss Hutchins's specimens, gathered at Bantry Bay, are of very large size, the primary leaf being 6—8 inches long, and half an inch wide. In the common varieties the leaves are seldom more than two lines, but frequently only a line in breadth.

5. D. *ruscifolia*, Lamour.; frond branched in a proliferous manner, composed of linear-oblong, obtuse, mid-ribbed leaves, scarcely tapered at base, the younger series springing from the midribs of the older; ternate granules, forming an oblong line at each side of the midrib. *Grev. Alg. Brit. p.* 76; *Hook. Br. Fl.* ii. *p.* 286; *Wyatt, Alg. Danm. No.* 64; *E. Bot. t.* 1397.

On rocks &c. in the sea; rather rare. Annual. Summer and autumn. Yarmouth, *Turner*. Various stations along the South of England, *Mrs. Griffiths*, &c. Bantry Bay, *Miss Hutchins*. West of Ireland, and Shores of Wicklow.—Originating, like the last, in a simple leaf, branched in a similar manner, and with a similar fructification. It differs chiefly in the form of the leaves, which are shorter, broader, obtuse at the apex and not tapering at the base; but specimens are occasionally found presenting intermediate appearances. The colour, too, is generally deeper, the substance rather firmer, and the reticulations smaller than in the last.

XXXIX. Nitophyllum. Grev.

Frond plane, delicately membranaceous, rose-coloured, reticulated, wholly without veins, or with very slight, vague ones toward the base. *Fructification:* hemisphærical capsules, imbedded in the substance of the frond, and ternate granules, forming distinct, scattered spots. *Grev.*—Name, from *nitor*, to *shine*, and φυλλον, a *leaf*. The absence of a nerve distinguishes this genus from *Delesseria*, as do the

thinner, more reticulated substance, and *distinct* spots of granules, from *Rhodomenia.*

1. N. *punctatum*, Grev.; frond very thin and delicate, destitute of nervures, either regularly dichotomous or cleft into two or three principal segments, whose margins are fringed with dichotomous lobes, the axils rounded; spots of granules large, scattered over the whole frond or confined to its segments. *Grev. Alg. Brit. p.* 79, *t.* 12; *Hook. Br. Fl.* ii. *p.* 287. *Fucus punctatus, E. Bot. t.* 1575.—*β. ocellatum;* frond with a roundish outline, cleft nearly to the base, the segments repeatedly dichotomous, linear. *N. ocellatum, Grev. Hook Br. Fl.* ii. *p.* 286; *Wyatt, Alg. Danm. No.* 15. *Delesseria ocellata, Grev. Crypt. t.* 347.

In the sea, attached to various Algæ. Annual. Summer. On the coasts of England, Ireland and Scotland, in many places; the Irish specimens of large size. *β*, coast of Moray, *Mr. Brodie.* Torquay and Sidmouth, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.*—*Frond* primarily of a broadly wedge-shaped form, afterwards dichotomously divided, with rounded axils, the segments preserving their wedge shape, commonly from 4 to 12 inches long and about as broad, but in favorable situations much larger, and in some gigantic specimens gathered by *Mr. D. Moore*, at Cushendall Bay, North of Ireland, 5 feet long and 3 feet wide! In some specimens the frond is nearly simple, with a few dichotomous lobes near the apex; in others it is once or twice forked, with the margin fringed with dichotomous lobes; and in others the whole frond is repeatedly and regularly dichotomous, the segments narrow and linear. This last state constitutes the *N. ocellatum* of authors, a plant which, in its typical form, appears distinct enough; but numerous specimens, kindly communicated to me by *Mrs. Griffiths*, exhibit such intermediate characters, that I no longer hesitate to unite it with *N. punctatum:* with which opinion, I am happy to add, *Dr. Greville* and *Mrs. Griffiths* coincide. In all its varieties the frond of this species is exceedingly thin and delicate, quite destitute of veins. The *capsules* are globose, and thickly scattered over the surface; the spots of *granules* large, 1 or 2 lines long, oblong, oval or linear, scattered over the whole surface or confined to a central portion of the frond.

2. N. *ulvoideum*, Hook.; frond thickish, but tender, faintly veined toward the base, roundish, but very irregular in figure, somewhat cuneate at base, variously cleft into oblong, more or less broad, rounded segments; spots of granules very minute, scattered over nearly the whole frond. *Hook. Br. Fl* ii. *p.* 287; *Wyatt, Alg. Danm. No.* 16. *N. Hilliæ, Grev. Alg p.* 80. *Del. Hilliæ, Grev. Crypt. t.* 351. *Fucus ulvoides, Turn. Hist. t.* 80, *(see Hook).*

In the sea; rare. Annual. July to October. Coast of Moray, *Mr. Brodie.* Bantry Bay, *Miss Hutchins.* Plymouth, *Miss Hill.* Torquay, *Mrs. Griffiths.*—*Frond* 4—8 inches long, broadly flabelliform, slightly dichotomously cleft or lobed, the margin smooth and even, rising from a short, cartilaginous stem, obscurely veined at the base, and sometimes over the

surface, of a thickish membranaceous substance "resembling soft kid-leather" (*Mrs. Griffiths*), and fine, rose-red colour, which becomes orange in fresh water. *Capsules* large, globose, scattered over the surface; spots of *granules* extremely minute, dot-like, abundantly scattered over the upper part of the lobes. *Smell*, when fresh, extremely disagreeable and peculiar. This species is well marked by its thick substance and the minute size of the spots of granules. This last character is not represented in Turner's figure above quoted (which represents *capsular* fruit), whence a doubt existed with reference to Turner's plant. But an original specimen from Mr. Turner, in Sir W. J. Hooker's herbarium, exactly agrees with the specimens now described, and with the *N. Hilliæ* of Dr. Greville. Sir W. Hooker has consequently restored the older name.*

3. N. *Bonnemaisoni*, Grev.; frond shortly stalked, flabellate or palmate, variously cleft into numerous wedge-shaped segments, furnished near the base with irregular vanishing nerves; spots of granules roundish, scattered over the frond. *Hook. Br. Fl.* ii. *p.* 287. *Del. Bonnemaisoni, Grev. Crypt. t.* 322.

In the sea, on rocks and stones; rare. Annual. Summer. Orkney, *Rev. Mr. Clouston.* Bute, *Dr. Greville.* Larne, *Dr. Drummond.* Youghal, *Miss Ball.* Torquay and Ilfracombe, *Mrs. Griffiths.* Tramore, *Miss Taylor.* Miltoun Malbay.—*Frond* with a short, cartilaginous stem, broadly fan-shaped, 2—4 inches long and about as broad, more or less deeply cleft in a dichotomous manner, the segments broadly wedge-shaped, about equal in length. *Substance* very thin and delicate, closely adhering to paper. *Capsules* scattered over the frond; spots of *granules* smaller than in *N. punctatum*, larger than in *N. ulvoideum*, scattered over the surface and segments.

4. N. *Gmelini*, Grev.; frond with a short stalk, more or less fan-shaped, with a roundish outline, variously cleft into broadly wedge-shaped segments, waved, curled, and rather crisp, marked near the base (and sometimes over the surface) with vague vanishing nerves; spots of granules linear, confined to the margin. *Grev. Alg. Brit. p.* 82; *Hook. Br. Fl.* ii. *p.* 288; *E. Bot. Suppl. t.* 2779; *Wyatt, Alg. Danm. No.* 65.

On rocks &c. in the sea. Annual. Summer. Coast of Devon, *Mrs. Griffiths.* Ilfracombe, *Miss Hill.* Whitsand Bay, *Dr. Walker Arnott.* Bantry Bay, *Miss Hutchins.* Several stations on the North-east coast of Ireland, *Dr. Drummond; Mr. W. Thompson; Mr. D. Moore.* Kilkee, West of Ireland.—*Stem* short, cartilaginous, expanding into a broadly fan-shaped or roundish frond, 2—4 inches, or in the Irish specimens 6 inches in breadth, more or less deeply cleft; its surface traversed by vague veins,

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*"Miss Hutchins's plant described in the *Hist. Fu.* being decidedly *N. punctatum* with capsules, of which the figure is an excellent representation, I am still of opinion that *Fucus ulvoides, Turn.* ought to be regarded as a synonyme of *N. punctatum*, and Greville's plant to bear the name that he gave it, *N. Hilliæ*." Mrs. Griffiths, April, 1841.

which are very evident in some specimens, in others faint; the margin smooth and even. *Capsules* scattered over the surface; spots of *granules* confined to the margin, long and linear. *Substance* membranaceous, crisp and somewhat rigid when first gathered. *Colour* a purplish red. Some specimens are scarcely cleft, others are divided nearly to the base into ribbon-like segments, but all preserve a roundish outline.

5. N. *laceratum*, Grev.; frond sessile, much divided in a dichotomous manner, marked with flexuous veins; segments mostly linear, variously cleft, waved at the margin; spots of granules oblong, either marginal or borne on distinct leafy processes of the margin. *Grev. Alg. Brit. p.* 83; *Hook. Br. Fl.* ii. *p.* 288; *Wyatt, Alg. Danm. No.* 107. *F. laceratus, E. Bot. t.* 1067.—*β. uncinatum;* fronds narrow, the lesser segments hooked.

In the sea, attached to Algæ, corallines, &c. common. Annual. Summer.—*Fronds* 2—10 inches in length, much and dichotomously divided, marked in the lower part with vague, flexuous, branching veins; the segments of various lengths, linear wedge-shaped; the margin either smooth and even, or waved, crenate, or fringed with processes. *Capsules* scattered; *granules* either in marginal spots, or in leafy processes. *β* is a much smaller state, having the ends of the branches hooked into the form of a sickle.

Doubtful species.

6. N. *versicolor;* stem cartilaginous, elongated, simple or branched, suddenly expanding into a broadly fan-shaped, variously cleft frond, of a thickish-membranaceous, highly reticulate substance and rose-red colour, becoming golden-orange in fresh water; the segments rounded; the apices generally thickened into hard, expanded calli; fructification unknown.

Thrown up, probably from deep water. June to August. Ilfracombe, *Mrs. Griffiths.*—*Root* unknown. *Stem* somewhat tuberous in its lower part, half an inch to an inch high, simple or branched; the branches suddenly expanding into broadly fan-shaped, more or less deeply cleft fronds; the segments rounded, generally entire, sometimes minutely ciliate; the tips and sometimes the margins of the segments much thickened, producing oblong or oval cartilaginous bodies, one or two lines in diameter, at first smooth, afterwards ciliate, and which, on being dissected, are found to contain innumerable minute granules. No fructification, except these bodies be such, has been detected. The substance is much thicker and the reticulation larger than in *N. Bonnemaisoni*, which it most resembles; and I agree with *Mrs. Griffiths* in regarding it as distinct from that species, although the differences are difficult to be expressed in words, and in the absence of fructification its true relations cannot be determined. In outline it very much resembles some states of *Rhodomenia Palmetta*, but the structure is totally dissimilar. *Mrs. Griffiths* has favoured me with the following remarks; "This plant was known to Mrs. Hare thirty years since, who called it *Fucus Halensis*, I have been told, but I do not think it ever was published. *Dr. Greville* described it in his *Crypt. Flora* as identical with

N. Bonnemaisoni, which, after having known this plant upwards of twenty years, and the other nearly as long, I cannot allow. I have never seen any sort of fruit, except the large wart-like substance of the tips in mature age be such; they, when very old, appear to have a fringed margin. When wetted and cut through under a glass, they are full of minute grains which pour out and cloud the drop of water. The colour, when fresh, is rose-red, but fresh water turns it a most beautiful orange. The substance is thicker than in most, but the stem and branches are also striking. I never saw it growing, nor in plenty, but a few fragments may be found most tides thrown up. The *N. Bonnemaisoni* is sometimes found near it, but rarely." *Griff. MS.*

XL. Rhodomenia. Grev.

Frond plane, membranaceous, fine pink or red, quite veinless, sessile, or with a short stem, which expands immediately into the frond. *Fructification:* 1, hemisphærical, scattered *capsules;* 2, minute, ternate *granules*, spreading over the whole or some part of the frond, (not in distinct spots or *sori*). *Grev.*—Name, ῥοδος, *red*, and ὑμην, a *membrane.*

1. R. *bifida*, Grev.; frond thin and transparent, rose-red, dichotomously divided from the base; segments linear; the apices obtuse; capsules generally confined to the margin, sessile. *Grev. Alg. Brit. p.* 85; *Hook. Br. Fl.* ii. *p.* 289; *Wyatt, Alg. Danm. No.* 66. *F. bifidus, E. Bot. t.* 773.—*β. ciliata;* frond somewhat thicker than usual, opaque, brownish-red, narrow, much divided; the margins fringed with leafy ciliæ.

On rocks and Algæ, in the sea. Annual. Summer. Frequent on the Southern shores of England. Torbay, *Mrs. Griffiths;* several varieties, Yarmouth, *Mr. Wigg.* Tynemouth, *Winch.* Belfast Bay, *Mr. Templeton.* Bantry Bay, *Miss Hutchins.* Malbay, Co. Clare; and Wicklow.—*Fronds.* thin and delicate, 1 or 2 inches high, tufted, irregularly dichotomous, the axils rounded; the segments linear or somewhat wedge-form, 1—3 lines wide; the apices rounded or truncate. The margin is either entire, or fringed with minute processes which sometimes become branches. *Capsules* globose, either marginal, or rarely scattered over the surface of the terminal lobes. *Granules* forming cloudy spots on the upper segments, both marginal and scattered. *Colour* a fine rose red; substance transparent and delicate, nearly as thin as in *Nitophyllum;* but the *cellules* are smaller and denser, and the *granular* fructification very different from any of that genus.

2. R. *laciniata*, Grev.; frond thickish or sub-cartilaginous, opaque, bright red, more or less palmate or flabelliform, cleft into numerous, broad, wedge-shaped segments, which are again divided in a sub-dichotomous manner; the apices obtuse; the margin, when in fructification, fringed with minute ciliæ, in which the capsules are imbedded. *Grev. Alg. Brit.*

p. 86; *Hook. Br. Fl.* ii. *p.* 289; *Wyatt, Alg. Danm. No.* 17. *F. laciniata, E. Bot. t.* 1068.

In the sea, on rocks and stones. Biennial? In fruit from January to July.—*Fronds* rising from a disk, several from the same base, 3—10 inches long, with a short, flat stem, which soon expands into a deeply cleft frond, divided in a dichotomous manner, the segments all becoming broader upwards, varying in width from half an inch to 3 or 4 inches; the apices obtuse, but frequently lacerated. When bearing *capsules* the margin is closely fringed with minute ciliary processes, in which the capsules are placed. *Granules* forming cloudy spots along the margin, which is then smooth and entire. *Substance* soft, between cartilaginous and membranaceous, adhering to paper; *colour* a fine blood red, glossy when dry.

3. R. *polycarpa*, Grev.; frond cartilagineo-membranaceous, tender, semi-transparent, brittle, dull purplish-red, deeply cleft in an irregularly dichotomous or palmate manner; the branches linear-wedge-shaped; the apices acute; capsules sphærical, prominent, scattered over the surface. *Grev. Alg. Brit. p.* 87; *Hook. Br. Fl.* ii. *p.* 289; *Wyatt, Alg. Danm. No.* 108. *Sphærococcus polycarpus, Grev. Crypt. t.* 352.

On rocks and stones in the sea; very rare. Perennial? August and September. Shore under Tait's Hill, Plymouth, *Miss Hill; Mr. R. Sconce*, Whitsand Bay, *Mr. Arnott*. Salcombe Bay, *Mrs. Wyatt.* — *Root* a thin spreading disk. *Frond* 4—12 inches high, cleft nearly to the base in an irregularly dichotomous manner; sometimes vaguely or palmately divided; sometimes having the principal divisions cleft into numerous, secund, jagged segments; the branches lineari-wedge-shaped; apices acute. *Capsules* large, sphærical, prominent, abundantly scattered over the frond. *Granules* very minute, imbedded in the frond over its entire surface. *Substance*, according to Mrs. Griffiths, "when fresh, thick, cartilaginous and tender, semitransparent and very brittle, and most nearly resembling that of *Lau. pinnatifida;*" when dry, it becomes tough and shrinks considerably. *Colour* a dull purple, becoming redder in fresh water, pinky toward the tips. In habit this plant closely resembles *R. palmata*, and still more closely the *Fucus Sarniensis* of Mertens and Roth, which is now considered a variety of that species. This resemblance is so strong that I should have felt no hesitation in adopting the united opinion of *Dr. Walker Arnott* and *Sir W. J. Hooker*, expressed in the Brit. Flora, p. 290, that our *R. polycarpa* was identical with *F. Sarniensis*, had not *Dr. Greville* received an authentic specimen of the latter, with the handwriting of Professor Mertens attached to it, and which proves to be merely a variety of *R. palmata*.

4. R. *Palmetta*, Grev.; stem cylindrical, sub-simple, expanding into a fan-shaped, rose-red frond, which is more or less cleft in a dichotomous manner; the segments wedge-shaped; axils rounded; apices (according to the state of fructification), either erose or rounded; capsules mostly terminal; spots of granules in the expanded tips. *Grev. Alg. Brit. p.* 88, *t.* 12; *Hook. Br. Fl.* ii. *p.* 290; *Wyatt, Alg. Danm. No.* 109. *F. Palmetta, E. Bot. t.* 1120.

On rocks, or the stems of *Laminaria digitata*. Annual. Summer and autumn. — *Stem* cylindrical, filiform, becoming compressed upwards, half an inch to 2 inches long, simple, or with one or two branches, expanding into a fan-shaped frond, 1 or 2 inches in diameter, deeply divided in a dichotomous manner. In specimens communicated by *Miss Cutler*, there is scarcely any stem, and the frond is simply forked, its segments linear and not a line in breadth; and in others from the same lady, once-forked, wedge-shaped fronds rise irregularly from a mass of entangled creeping stems. *Capsules* sessile, on the disk or margin, generally near the tips of the frond; *granules* ternate, forming oval cloudy spots in the expanded tips of the segments. *Colour* a fine pinky red. *Substance* of the stem cartilaginous, of the frond membranaceous, somewhat rigid, imperfectly adhering to paper.

5. R. *cristata*, Grev.; "frond semicircular, membranaceous, sub-dichotomous, the segments somewhat dilated upwards, repeatedly subdivided, the divisions alternate, decurrent, laciniate at the ends; capsules sphærical, imbedded in the margin of the frond." Grev.—*Grev. Alg. Brit. p.* 89; *Hook. Br. Fl.* ii. *p.* 290. *Sphærococcus cristatus, Grev. Crypt. t.* 85.

Parasitical on the stems of *Laminaria digitata;* very rare. Annual. July. Sea-shore at Wick, Caithness, *Messrs. Borrer* and *Hooker*. Frith of Forth, *Dr. Greville*. Berwick, *Dr. Johnston*. —"*Fronds* about an inch long, divided near the base into several main branches, flat and even, entire at the margin, linear or dilated upwards, about a line in width, the branches again dividing once or twice subdichotomously, and then bearing numerous other smaller segments in an alternately pinnatifid manner, decurrent and cleft or laciniated at the apices; every division has a tendency to dilate upwards, so that the circumference of the frond is extended and crowded. *Fructification:* sessile, sphærical, dark red *capsules*, half the size of poppy seed, usually occurring towards the extremity of the branches. *Substance* membranaceous, or very slightly cartilaginous, adhering closely to paper in drying. *Colour* a rose red, nearly similar to that of *Delesseria alata*."—*Grev. Alg. Brit.* p. 90. Quite a northern species, and very rare on our coasts.

6. R. *ciliata*, Grev.; frond thick, sub-cartilaginous, full purplish-red, rising from a short stalk, lanceolate, irregularly pinnated with lanceolate or cleft segments, attenuated at base; margin (and often the disk) furnished with simple, subulate ciliæ, which bear the capsules at their extremity; granules forming cloud-like patches over the disk; root fibrous, creeping. *Grev. Alg. Brit. p.* 90; *Hook. Br. Fl.* ii. *p.* 291; *Wyatt, Alg. Danm. No.* 67. *F. ciliatus, E. Bot. t.* 1069.

On rocks and stones in the sea. Annual. Producing capsules in winter. —*Root* creeping, fibrous. *Frond* at first a simple, oblong or lanceolate leaf, 2—4 inches long, serrate or jagged at the margins, afterwards, from the elongation of the ciliæ into branches, deeply pinnatifid or lobed, the lobes simple or forked, ciliate or foliiferous at the margins and over the surface, narrowed at base, acute at the apex, very variable in breadth. *Substance* thick and cartilaginous, somewhat rigid. *Colour* a full red, generally becoming darker in drying. *Capsules* sphærical, on the ciliæ; *granules* very minute, forming cloudy spots on various parts of the surface.

7. R. *jubata*, Grev.; frond thickish, flaccid, sub-cartilaginous, dull red, linear-lanceolate, much attenuated or cirrhous at the apex, vaguely pinnated with segments of the same form; the margin (and often the disk) beset with subulate or filiform ciliæ, in which both capsules and granules are produced on distinct plants; root fibrous, creeping. *Grev. Alg. Brit. p.* 91; *Hook. Br. Fl.* ii. *p.* 291; *Wyatt, Alg. Danm. No.* 18. *Sph. jubatus, Grev. Crypt. t.* 359.

On rocky or gravelly shores. Annual. Producing fruit in summer. Frequent along the southern shores of England, *Mrs. Griffiths* and *Miss Hill*. Bantry Bay, *Miss Hutchins*. Coast of Clare.—*Root* a mass of creeping fibres, from which spring several fronds. *Fronds* rising with a short cylindrical stem, linear-lanceolate, attenuate, vaguely pinnated, all the branches attenuated at base, and drawn out at the apex into long, filiform points, the margin and disk more or less densely clothed with linear, filiform ciliæ, which, in some varieties, are very much elongated and again branched, when the frond is resolved into a dense entangled mass of cylindrical fibres. *Substance* cartilaginous, soft and flaccid. *Colour* a dull pinky red. *Capsules* hemisphærical, placed on the ciliæ; *granules* confined to the ciliæ, minute. A very variable plant closely allied to the preceding, from which it differs in the softer and more flaccid substance, different colour, and especially in the granular fructification, and in producing capsules at a different season.

8. R. *palmata*, Grev.; frond coriaceous or sub-membranaceous, purple, broadly wedge-shaped, much and irregularly cleft, segments sub-dichotomously divided; margin entire, (often winged with proliferous leaflets); granules distributed over the whole frond in cloud-like spots. *Grev. Alg. Brit. p.* 93; *Hook. Br. Fl.* ii. *p.* 291; *Wyatt, Alg. Danm. No.* 110. *F. palmatus, E. Bot. t.* 1306.—*β. Sarniensis;* frond thinner, laciniated, the segments very narrow. *Grev.—F. Sarniensis, Mert., Turn. Hist. t.* 44.

In the sea, on rocks and the stems of *Laminariæ*, very common.—*Fronds* 2—20 inches long, tufted, of a broad wedge-shape, but very irregular in division, sometimes palmate, sometimes more or less dichotomous, and sometimes cleft into numerous jagged branches. *Substance*, when young, membranaceous, afterwards leathery. *Colour* a dull purplish or brownish red. *Capsules* unknown. This is the *Dulse* of the Scotch, *Dillisk* of the Irish, and is much eaten in both countries, as well as in most of the northern states of Europe, by the poor along the shores, and is transmitted as an article of humble luxury over most parts of the country. It is generally eaten raw, either fresh from the sea or after having been dried, but is sometimes cooked. That is preferred which grows on rocks near low-water mark, being shorter, sweeter, and less leathery than the larger varieties; this is frequently covered with young muscle-shells; whence it is called by the hawkers "*Shell-dellish*." Cattle, especially sheep, are fond of it; whence it has been called *Fucus ovinus* by Bishop Gunner.

9. R. *sobolifera*, Grev.; "frond membranaceous, shortly

stipitate ; stem filiform, dividing into branches, which expand into flat, dilated fronds, much, deeply, and irregularly cleft, the segments linear-wedge-shaped, laciniate at their apex." *Grev. Alg. Brit. p.* 95 ; *Hook. Br. Fl.* ii. *p.* 292. *F. sobolifer us, E. Bot. t.* 2133.

In the sea, on the stems of *Laminaria digitata.* Shores of Orkney Isles, *Mr. C. Fothergill ; Messrs. Hooker* and *Borrer.* Brackish Loch of Stenhouse, Orkney, *Rev. C. Clouston.* Mull of Galloway, *Rev. Dr. Walker.* Glenarm, Ireland, *Dr. Drummond.* Strangford Lough, common, *Mr. W. Thompson.* — *Fronds* tufted, 4—6 inches long, cleft into many laciniated, linear-wedge-shaped segments. *Substance* thin, membranaceous, semi-transparent. *Colour* purplish or pinky red. Closely allied to *R. palmata*, but according to Dr. Greville truly distinct in the thinner substance, brighter and more fugitive colour, and somewhat different structure. Still I have seen some varieties which seem equally referable to *R. sobolifera*, or to the lacerated variety of *palmata.* Dr. Greville has received a specimen from Normandy; it may therefore be expected to occur on the opposite shores of England.

10. R. *reniformis*, Hook.; stem short, cylindrical, simple or branched, suddenly expanding into a carnoso-membranaceous, roundish, sub-simple, or irregularly cleft (occasionally producing new fronds at the margin), somewhat lobed frond; capsules and granules scattered over the surface. *Hook. Br. Fl.* ii. *p.* 292 ; *Wyatt, Alg. Danm. No.* 19. *Iridæa reniformis, Grev. Alg. Brit. p.* 160. *Fucus reniformis, E. Bot. t.* 2116.

On rocks &c. in the sea ; rather rare. Perennial ? Summer and Autumn. Southern shores of England in several places. Torbay and Ilfracombe, very fine, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.* Malbay and Kilkee. Mouth of the Bann, North of Ireland, *Mr. D. Moore.* Glenarm, *Miss Davison.* Bangor (Co. Down), *Mr. W. Thompson.* Orkney, *Mr. Pollexfen.* — *Stem* minute, cylindrical, suddenly expanding into a roundish or reniform, undivided (or accidentally cleft) frond, of a soft, thickish, membranaceous substance, becoming thinner in drying, of a fine blood-red colour, and either simple, or bearing along its margin lobes of a shape similar to the frond. The fronds vary in diameter from 1 inch, to 6, 8, and even 14 inches; and specimens which I have gathered at the Cape of Good Hope, are still larger, but, except where torn by the waves, vary little in form. *Capsules* minute, thickly scattered over the surface of the frond ; *granules* minute, ternate, imbedded in the frond over which they are dispersed. The genus of this plant is somewhat doubtful : it does not well agree in habit with the other *Rhodomeniæ*, and still less, as I conceive, can it be referred to *Iridæa.*

XLI. Plocamium. Lamour.

Frond filiform, compressed, between membranaceous and cartilaginous, fine pink-red, much branched, branches distichous, (alternately secund and pectinate). *Fructification* of

two kinds: sphærical, sessile *capsules*, and lateral minute *processes*, containing oblong *granules*, transversely divided into several parts by pellucid lines. *Grev.*—Name, πλοκαμος, *intertwined hair;* alluding to the finely branched fronds. The exotic genus, *Thamnophora*, agrees with the present in habit, and merely differs in the structure of the granules (which are ternate) of the secondary fructificaton; a character, in my opinion, scarcely of value sufficient to separate plants otherwise so nearly related.

1. P. *coccineum*, Lyngb. *Grev. Alg. Brit. p.* 98, *t.* 12; *Hook. Br. Fl.* ii. *p.* 293; *Wyatt, Alg. Danm. No.* 20. *Fucus coccineus, E. Bot. t.* 1242.

In the sea, common everywhere. Perennial. Summer and autumn.—*Root* fibrous. *Fronds* tufted, 2—12 inches long, excessively branched and bushy, compressed, two-edged, very narrow, main stems half a line in diameter, irregularly divided, thickly set with patent alternate branches, which are throughout furnished with short distichous ramuli, which are either simple and subulate, or bearing a second and third series of similar subulate ramuli from their inner face, the compound ramuli resembling small combs. *Capsules* solitary, sessile on the edge of the upper branches; *granules* oblong, transversely divided into several joints, contained in little lanceolate receptacles borne by the ramuli.

XLII. Microcladia. Grev.

Frond filiform, compressed, sub-cartilaginous, irregularly branched, the branches distichous. *Fructification* of two kinds: sessile, sphærical capsules, accompanied by an involucre, in the form of several short ramuli; and ternate granules in the swollen apices of the branches. *Grev.*—Name, μικρος, *small*, and κλαδος, a *branch*.

1. M. *glandulosa*, Grev. *Grev. Alg. Brit. p.* 99, *t.* 13; *Hook. Br. Fl.* ii. *p.* 293; *Wyatt, Alg. Danm. No.* 68. *Fucus glandulosus, E. Bot. t.* 2135.

In the sea, on other Algæ; very rare. Annual. Producing fruit in September and October. Budleigh, Salterton and Torquay, *Mrs. Griffiths.* —*Fronds* tufted, 1 or 2 inches high, about a quarter of a line in width, compressed, much branched from the base in an alternate or irregularly dichotomous manner, forming roundish fastigiate tufts; branches distichous, with patent axils, preserving nearly an equal breadth throughout, repeatedly divided, the ultimate ramuli short, and either subulate or bifid at the apex, in which case the points are forcipate. Under a low power of the microscope the branches appear marked with large, hexagonal, transverse areolæ, about three of which form the breadth of the frond, an appearance caused by the large cellules of the central part of the frond being seen through those of the surface, which latter, on increasing the magnifying power, are found to be exceedingly small and close. *Colour* a fine rose red.

Substance cartilagineo-membranaceous, adhering to paper. *Capsules* sessile on the margin of the branches, surrounded by two or three short subulate ramuli; *granules* imbedded in the tips of the branches. In habit this plant strikingly resembles a small specimen of *Ceramium rubrum;* and when we consider the involucred capsules common to both genera, the differences between *Microcladia* and *Ceramium* are reduced to the structure of the granules, and in some respects that of the frond, which in *Ceramium* is more or less distinctly jointed. In *Cer. cancellatum*, and especially in *C. obsoletum*, we have a compressed, inarticulate frond, very similar to that of *Microcladia;* the latter species, indeed, almost connects the two genera.

XLIII. Odonthalia. Lyngb.

Frond plane, between membranaceous and cartilaginous, dark vinous red, with an imperfect or obsolete midrib, and alternately toothed at the margin. *Fructification* marginal, axillary or in the teeth: 1, *capsules* containing pear-shaped seeds, fixed by their base; 2, slender processes containing ternate granules. *Grev.*—Name, οδους, οντος, a *tooth*, and ἁλς, the *sea;* a marine plant, with a toothed margin.

1. O. *dentata*, Lyngb.; frond vaguely branched in an irregularly pinnate manner; branches linear-oblong, narrowed at base, pinnatifid; laciniæ alternate, sharply toothed at the truncate extremities; capsules clustered on branched peduncles. *Grev. Alg Brit. p.* 101, *t.* 13; *Hook. Br. Fl.* ii. *p.* 293. *Fucus dentatus, E. Bot. t.* 1241.

On rocks in the sea. Perennial. Fruiting from January to March. Frequent on the shores of Scotland, and of the north of England and Ireland. —*Fronds* rising from a hard disk, tufted, 3—12 inches long, much branched, furnished with an imperfect midrib toward the base, flat and membranaceous above; the main stem simple or forked, 2—4 lines wide, narrower at base, alternately toothed; branches issuing from the axils of the teeth of the main stem, attenuated at base, simple, or somewhat palmately divided, and either toothed or pinnatifid, the lobes in the latter case being toothed, and, as they become larger, pinnatifid. The frond preserves throughout nearly the same breadth, rarely exceeding 4 lines. *Fructification* borne along the margin on very slender pedicels, which are either simple or branched; *capsules* ovate, containing a cluster of pear-shaped seeds, which are finally discharged through a terminal pore; *stichidiæ* lanceolate, containing a double row of ternate granules. *Substance* cartilagineo-membranaceous, scarcely adhering to paper; *structure* densely cellular. *Colour* a deep vinous red, becoming darker in drying.

XLIV. Rhodomela. Ag.

Frond cylindrical or compressed, filiform, much branched, coriaceo-cartilaginous, (the apices sometimes involute). *Fructification:* sub-globose capsules, containing free, pear-shaped

seeds, and pod-like receptacles, with imbedded ternate granules. *Grev.*—Name, *ῥοδος, red*, and *μελας, black ;* because in drying these plants become darker, frequently blackish.

** Tips of the ramuli straight, (not involute).*

1. R. *lycopodioides*, Ag.; frond elongate, mostly simple, densely beset with slender, finely divided ramuli or branches, mixed with the short, rigid, bristle-like remains of a former series; no appearance of articulation. *Grev. Alg. Brit. p.* 102; *Hook. Br. Fl.* ii. *p.* 294. *Fucus lycopodioides, E. Bot. t.* 1163.

In the sea, on the stems of *Laminaria*. Perennial. Summer. Common on the shores of Scotland and of the north of England and Ireland.—*Fronds* 4—18 inches long, tufted, filiform, attenuated upwards, simple or subsimple, clothed, in its winter state, with short, rigid, simple or slightly branched ramuli, half an inch to an inch in length; in summer throwing out from these and the main stem numerous capillary, multifid, slender ramuli, usually 1 or 2 inches long, but which, in some magnificent specimens gathered by my friend *Mr. W. Thompson*, at Bangor, Co. Down, are lengthened into branches 6—14 inches long, and clothed at short distances with broad tufts of multifid ramuli, resembling those usually borne by the main stem. Some of these specimens seem almost intermediate with *R. subfusca*, and strikingly resemble *Polysiphonia Brodiæi* on a large scale. *Fructification* is plentifully produced by the summer ramuli. *Substance* cartilaginous, the summer branches adhering to paper. *Colour* purplish brown, becoming black in drying.

2. R. *subfusca*, Ag.; frond filiform, much and irregularly branched; branches subulate, repeatedly pinnate, the divisions alternate, often clustered; no appearance of articulation. *Grev. Alg. Brit. p.* 103; *Hook. Br. Fl.* ii. *p.* 294; *Wyatt, Alg. Danm. No.* 111. *Fucus subfuscus, E. Bot. t.* 1164.

In the sea, on rocks and other Algæ. Perennial. Summer. Frequent on the English coasts. Orkney, *Rev. C. Clouston*. Frith of Forth, *Dr. Greville*. Bantry Bay, *Miss Hutchins*. Youghal, *Miss Ball*. Belfast Lough, common, *Mr. Templeton* and *Dr. Drummond*.—*Stem* 4—10 inches high, undivided or branched, set throughout with numerous, alternate, long branches, which bear a second or third series of alternately multifid ramuli. In winter these finely divided branches drop off, leaving the frond with the stunted remains of its branches rigid and broken; but early in the following spring a second series of ramuli arises from the branches, and on these the fructification is produced. *Substance* rigid in winter, cartilaginous and rather flaccid in summer, when it adheres to paper. *Colour* reddish or brownish, becoming darker in drying. An extremely variable plant in ramification, and in its summer and winter states presenting a startling contrast.

*** Tips of the ramuli hooked inwards.*

3. R. *pinastroides*, Ag.; frond terete, irregularly branched; branches with numerous, secund, (apparently) jointed ramuli,

whose tips are more or less hooked inwards. *Grev. Alg. Brit. p.* 104, *t.* 13; *Hook. Br. Fl.* ii. *p.* 294; *Wyatt, Alg. Danm. No.* 112. *Fucus pinastroides, E. Bot. t.* 1042.

On rocks in the sea. Perennial. Fruiting in winter. Southern shores of England, frequent. Near Dublin, *Dr. Scott.*—*Frond* 4—8 inches high, cylindrical, subsimple at base, much branched above, the branches alternate or secund, long, spreading in a fan-like manner, much divided, the lesser ones set with secund, erect ramuli, about half an inch long, and either straight, or, more generally, hooked at the extremity. The whole plant marked, at short intervals, with transverse striæ, giving it a jointed appearance. *Capsules* minute, sphærical, scattered on the ramuli; *granules* imbedded in the ramuli of distinct plants. *Substance* cartilaginous. *Colour* a dull red, becoming black in drying.

4. R. *scorpioides*, Ag.; frond cylindrical, slender, attenuated, three or four times pinnated with horizontal branches, the uppermost involute at the extremity. *Grev. Alg. Brit. p.* 105; *Hook. Br. Fl.* ii. *p.* 294; *Wyatt, Alg. Danm. No.* 69. *Fucus amphibius, E. Bot. t.* 1428.

On rocks in the sea, or in salt-water ditches. Annual? Summer. North Wales, *Rev. H. Davies.* Abundant at Shoreham, growing on *Atriplex portulacoides*, *Mr. Borrer.* Mouth of the river Dart, *Mrs. Griffiths.* Tydd Marsh, Cambridgeshire, *Mr. Skrimshire.* Shore of Blackwater at Maldon, *Mr. E. Forster, jun.* Selsea Marshes, *Martyn.* At Portstewart, North of Ireland, *Mr. D. Moore.* — *Fronds* forming entangled tufts, very slender, cylindrical, excessively branched in a distichous manner, the branches very patent or divaricating, alternate, furnished with a second or third series of similar patent ramuli, the apices very much involute. *Capsules* unknown in this country; *receptacles* of granules forming pinnate tufts, either terminal or lateral. *Colour* pale purplish, becoming blackish in drying. *Substance* somewhat cartilaginous, tender. A very curious plant, and certainly an intruder in the present genus. Mr. D. Turner hints its relationship to *Polysiphonia fastigiata*, and Dr. Greville agrees in its affinity with that tribe generally. The plant of all others to which I think it most nearly allied is *Pol. fruticulosa*, which is equally inarticulate, and often bears a striking likeness to the present.

XLV. Bonnemaisonia. Ag.

Frond membranaceous, compressed or plane, filiform, much branched, the branches pectinate with distichous ciliæ. *Fructification:* sessile or pedicellate capsules, containing a cluster of pyriform (compound ?) seeds, fixed by their base. *Grev.*— Named in honour of *M. Bonnemaison*, a French Algologist.

1. B. *asparagoides*, Ag.; frond compressed (or terete), excessively branched, filiform; branches alternate, set with alternate, subulate, distichous ciliæ; capsules stalked, opposite the ciliæ. *Grev. Alg. Brit. p.* 106, *t.* 13; *Hook. Br. Fl.* ii. *p.*

295. *Fucus asparagoides, E. Bot. t.* 571.—*β. teres;* frond capillary, terete; ciliæ very long. *Harv. in Fl. Hib. p.* 197.

On rocks and stones in the sea. Annual. June to September. Yarmouth Beach, *Mr. Wigg.* Cromer, *Turner.* Cornwall Coast, *Stackhouse.* Sunderland, *Mr. Weighell.* Torquay, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.* Donaghadee, *Mr. Templeton.* Belfast Bay, *Dr. Drummond.* Malbay, *Mr. J. Fennell.* Kilkee. *β* at Wicklow, and in Kingstown Harbour, Dublin.—*Frond* 4—12 inches long, compressed or nearly cylindrical, varying in breadth from a capillary fineness to nearly a line, excessively branched; branches distichous, alternate, simple, or bearing a second series, gradually shorter upwards, set throughout at short distances with subulate, distichous ramuli, 1 or 2 lines long and extremely slender. *Capsules* ovate, with a short stalk, placed opposite to the ciliæ, containing a tuft of pear-shaped seeds. Frequently the capsules are abortive, and then a minute process occupies their place. In a specimen communicated by *Mrs. Wyatt*, the place of capsules is occupied by a tuft of ramuli, which do not, however, produce *granules*, but occasionally one of them, thicker than the rest, bears a capsule. *Colour*, a fine transparent crimson, darker in those from the west of Ireland, and in them becoming darker in drying, while in those from the east of Ireland and south of England, the colour fades considerably in drying. *Substance* soft and flaccid.

XLVI. Laurencia. Lamour.

Frond cylindrical or compressed, between cartilaginous and gelatinous, mostly yellowish or purplish-red. *Fructification* of two kinds: 1, ovate capsules, with a terminal pore, containing a cluster of stalked, pear-shaped seeds, fixed by their base; 2, ternate granules imbedded in the ramuli. *Grev.* —Named in honour of *M. de la Laurencie*, a French naturalist.

1. L. *pinnatifida*, Lamour.; frond compressed, cartilaginous, bi-tripinnatifid, divisions alternate, the ultimate ones obtuse, simple or lobed. *Grev. Alg. Brit. p.* 108, *t.* 14; *Hook. Br. Fl.* ii. *p.* 296; *Wyatt, Alg. Danm. No.* 113. *Fucus pinnatifida, E. Bot. t.* 1202.—*β. Osmunda;* frond flat, generally undivided, ramuli short and multifid. *Hook. l. c.* —*γ. angusta;* frond roundish, ramuli cylindrical, thickened upwards, set on all sides of the stem, often clustered and simple. *Hook. l. c.*; *Wyatt, Alg. Danm. No.* 162.—*δ. tenuissima;* frond flat, ramuli very thin and much branched, the branches divaricated. *Hook. l. c.*

On rocks in the sea. Annual. June to September. *α*, *β* and *γ* very common: *δ*, Devon and Cornwall, *Mrs. Griffiths.*—*Fronds* tufted, 1—12 inches high, compressed or subcylindrical, from half a line to 2 lines in breadth, alternately branched, the branches pinnatifid or bipinnatifid. In *γ* the branches and ramuli are nearly or quite cylindrical, very much divided and bushy. *Substance* cartilaginous. *Colour* varying from a yel-

lowish green to a dull purple or brownish red. *Capsules* broadly ovate, placed on the smaller branches; *granules* imbedded in the ramuli. An extremely variable plant in size and general appearance. The taste is often hot and biting, whence it has obtained the name of *Pepper-dulse* in Scotland.

2. L. *obtusa*, Lamour.; frond cylindrical, filiform, twice or thrice pinnate; ramuli mostly opposite, short, patent, wedge-shaped, obtuse. *Grev. Alg. Brit. p.* 111; *Hook. Br. Fl.* ii. *p.* 296; *Wyatt, Alg. Danm. No.* 21. *Fucus obtusus, E. Bot. t.* 1201.

On the larger Algæ. Annual. Summer and autumn. Southern shores of England, frequent. Sunderland, *Mr. Weighell.* Flamborough Head, *Mr. Teesdale.* Frith of Forth, very rare, *Dr. Greville.* Bantry Bay, *Miss Hutchins.* Bangor, Belfast Bay, *Mr. Templeton* and *Dr. Drummond.* Ayrshire, *Mr. Thompson.* Ireland's Eye, *Mr. R. Ball.*—Root somewhat fibrous. *Fronds* generally tufted, 3—6 inches long, about half a line in diameter, cylindrical, filiform, repeatedly branched in a pinnate manner, the branches and ramuli mostly opposite, the latter 1 or 2 lines long, obtuse or truncate, somewhat narrowed at base, or nearly cylindrical. *Substance* tender and flaccid, soon decomposing. *Colour* a fine but fugitive pink, becoming yellowish and whitish in decay. *Capsules* ovate, on the smaller branches; *granules* ternate, immersed in the ramuli.

3. L. *dasyphylla*, Lamour.; frond filiform, terete, irregularly branched; ramuli short, club-shaped, obtuse, very much attenuate at base. *Grev. Alg. Brit. p.* 112; *Hook. Br. Fl.* ii. *p.* 296; *Wyatt, Alg. Danm. No.* 71. *Fucus dasyphyllus, E. Bot. t.* 847.

In the sea, on rocks or stones. Annual. Summer. Frequent on the eastern and southern shores of England. Lossiemouth, in Scotland, *Mr. Brodie.* Bute, *Dr. Greville.* Belfast Lough, *Dr. Drummond.* Bantry Bay, *Miss Hutchins.* West coast of Ireland.—*Root* fibrous. *Fronds* 4—12 inches high, cylindrical, half a line in diameter; *stem* generally undivided, set with more or less frequent opposite or alternate branches, the lower ones being longest, and frequently bearing a second series; all having numerous, linear-club-shaped, obtuse ramuli, 1 or 2 lines in length, and very much attenuate at base, resembling the leaves of a *Sedum:* the whole frond marked, at short distances, with more or less distinct transverse striæ. *Substance* somewhat gelatinous, quickly decomposing. *Colour* a pale fugitive pink, or yellowish. *Capsules* ovate, on the lesser branches: *granules* ternate in the ramuli. Readily distinguished from the preceding by the ramuli tapering towards the base, and from the following by their being obtuse.

4. L. *tenuissima*, Lamour.; frond filiform, terete, irregularly branched; ramuli very slender, tapering to the base and apex. *Grev. Alg. Brit. p.* 113; *Hook. Br. Fl.* ii. *p.* 296; *Wyatt, Alg. Danm. No.* 22. *Fucus tenuissimus, E. Bot. t.* 1882.

In the sea, on rocks and other Algæ; very rare. Annual. Summer and autumn. Weymouth, *Goodenough* and *Woodward.* Isle of Wight, *Rev.*

G. R. Leathes. Torquay, *Mrs. Griffiths.* Cornwall, *E. Bot.* Ballycotton, coast of Cork, *Miss Ball.*—*Root* fibrous. *Fronds* tufted, 6—8 inches long, half a line in diameter, cylindrical, much branched in an irregularly pinnate manner; the main stem generally undivided, having numerous, alternate, spreading branches, of unequal length, some of the longest bearing a second series; and all set, at the distance of one or two lines, with slender, bristle-like ramuli, 1—4 lines long, much attenuated at their insertion, and more or less tapering towards the point. *Substance* very tender, between gelatinous and cartilaginous. *Colour* a pale purplish or pinky red, fugitive, and becoming yellowish. *Capsules* ovate, borne by the ramuli, in which also the granules are imbedded.

XLVII. Chylocladia. Grev.

Frond cylindrical, filiform, (often contracted as if jointed), between gelatinous and cartilaginous, of a pinky-red colour. *Fructification* of two kinds: 1, sphærical, ovate or conical capsules, with wedge-shaped or angular seeds; 2, imbedded ternate granules. *Grev.* — Name, χυλος, *juice*, and κλαδος, a *branch;* in allusion to the succulent frond.

** Frond without contractions.*

1. C. *clavellosa*, Hook.; frond gelatinous, much branched in a pinnate manner, distichous; ultimate ramuli lanceolate, attenuated at base. *Grev. Alg. Brit. p.* 115; *Hook. Br. Fl.* ii. *p.* 297; *Wyatt, Alg. Danm. No.* 23. *Fucus clavellosus, E. Bot. t.* 1283.—*β. sedifolius;* ramuli between oblong and oval, crowded, undivided. *Turn.*

In the sea. Annual. May to September. Various stations on the coasts of England, Scotland and Ireland, but nowhere very common. *β* at Lossiemouth, *Mr. Brodie.*—*Fronds* tufted or solitary, 3—12 inches high, varying from a quarter of a line to more than a line in diameter, gradually widening from the base to the middle, and thence diminishing to the apex, much branched, repeatedly but irregularly pinnate, the branches patent, opposite or alternate, bearing one or more series of linear-lanceolate ramuli, 1—4 lines in length, and closely set; they, as well as the branches, usually distichous, but sometimes springing from all sides of the frond. *Capsules* conical, with a pore, containing a mass of angular seeds; *granules* imbedded in the ramuli. *Substance* flaccid and slippery, closely adhering to paper. *Colour* a brilliant but fleeting pink.

*** Ramuli elliptical, rarely somewhat lengthened and constricted.*

2. C. *ovalis*, Hook.; frond filiform, irregularly dichotomous, naked below, above beset with elliptical, simple (rarely elongated and constricted) ramuli, tapering at the base; capsules sphærical. *Grev. Alg. Brit. p.* 116, *t.* 14; *Hook. Br. Fl.* ii. *p.* 297; *Wyatt, Alg. Danm. No.* 114. *Fucus ovalis, E. Bot. t.* 711.

In the sea, on rocks and other Algæ. Annual. June to August. Frequent on the shores of England and Ireland. Little Isles of Jura, *Lightfoot.*—*Fronds* tufted, 2—10 inches high, cylindrical, from half a line to a line in diameter, irregularly and somewhat distantly dichotomous, naked below; branches above more or less densely set with elliptical or lanceolate, clustered or scattered ramuli, 1—4 lines long, half a line to a line in diameter, much attenuated at base, and either obtuse or somewhat tapering at apex, and either simple, or contracted at intervals as if jointed. *Substance* cartilaginous in the stem; tender in the ramuli, which are filled with a laxly gelatinous fluid. *Capsules* globose, with a pellucid limbus sessile on the ramuli; *granules* ternate, imbedded in the ramuli.

**** Frond constricted at intervals as if jointed.*

3. C. *kaliformis*, Hook.; frond sub-gelatinous, tubular, distantly constricted as if jointed, repeatedly pinnate; branches whorled at the constrictions with chain-like ramuli; capsules sphærical, with a pellucid border. *Grev. Alg. Brit. p.* 117; *Hook. Br. Fl.* ii. *p.* 298; *Wyatt, Alg. Danm. No.* 24. *Fucus kaliformis, E. Bot. t.* 640.

In the sea, on rocks and other Algæ. Annual. June to September. Frequent on the coasts of England, Scotland and Ireland.—*Fronds* tufted, 4—12 or even 18 inches long, 1 or 2 lines in diameter; stem undivided, attenuated at each extremity, and contracted at intervals of half an inch or more. From the contractions spring long, simple, primary branches, similar to the stem, but more slender and more regularly contracted, opposite or in whorls, patent, and bearing at their contractions one or more series of lesser branches and ramuli, all of which taper at each end, and are more or less distinctly contracted, the contractions of the ramuli being very close together. *Substance* tender and gelatinous. *Colour* a fugitive pink or purplish red. *Capsules* sphærical, placed on the young branches; *granules* ternate, in the ramuli.

4. C. *parvula*, Hook.; frond sub-gelatinous, slender, branched in a straggling, sub-dichotomous manner; branches constricted at intervals of equal length and breadth; capsules ovate. *Grev. Alg. Brit. p.* 119; *Hook. Br. Fl.* ii. *p.* 298; *Wyatt, Alg. Danm. No.* 72. *Chondria parvula, Grev. Crypt. t.* 346.

Parasitical on the larger Algæ. Annual. Summer and autumn. Devonshire, *Mrs. Griffiths.* Brighton, *Mr. Borrer.* Bantry, *Miss Hutchins.* Kilkee, Malbay, and Wicklow. Co. Antrim, *Mr. Templeton.* Port Rush, *Mr. D. Moore.*—*Fronds* rising from a mass of fibres, densely tufted, 2 or 3 inches long, half a line in diameter, excessively branched and entangled; branches irregular, opposite or alternate, of various lengths, with or without scattered ramuli, which are slightly attenuated at base; the tips obtuse; the whole frond marked, at distances of nearly equal length and breadth, with external constrictions, and furnished with internal septa. *Capsules* ovate, borne on the smaller branches, and containing a sphærical mass of ovate seeds; *granules* ternate, in the joints of the branches. *Substance* soft, and somewhat gelatinous. *Colour* a fine, but fugitive, pinky red. Well distinguished from *C. kaliformis* by the ramification, the uniformly short

joints, and the shape of the capsules. I have seen specimens from North America agreeing in every particular with British ones.

5. C. *articulata*, Hook.; frond tubular, gelatinoso-membranaceous, strongly constricted throughout, as if jointed, much branched in a fasciculato-dichotomous manner; capsules obtusely conical. *Grev. Alg. Brit. p.* 120; *Hook. Br. Fl.* ii. *p.* 298; *Wyatt, Alg. Danm. No.* 73. *Fucus articulatus, E. Bot. t.* 1574.

In the sea, on rocks and the larger Algæ. Annual. Summer. *Fronds* springing from a mass of fibres, tufted, 1—6, or occasionally 12 inches long, excessively branched and bushy, constricted at regular intervals of 2—4 lines, irregularly divided; main stem somewhat dichotomous, bearing at its constrictions whorls of branches, which again divide dichotomously, and bear from their joints opposite or whorled, lanceolate ramuli. The tips of the branches are somewhat fastigiate and the plant has a rounded outline. *Capsules* conical; *granules* ternate, in the joints of the ramuli. *Colour* a fine pinky red, less fugitive than in others of the genus. *Substance* membranaceous, filled with watery gelatine.

XLVIII. Gigartina. Lamour.

Frond cartilaginous, filiform, cylindrical or compressed, of a dull red colour. *Fructification:* 1, capsules containing a mass of minute, roundish seeds; 2, roundish or oblong simple granules, imbedded in the frond of distinct plants. *Grev.* —Name, γιγαρτον, a *grape-stone*, which the capsules resemble. The *Gracilaria* of Greville is here, as proposed by Mrs. Griffiths and Sir W. J. Hooker, united with this genus. As far as regards British species the genus is a natural one; but exotic forms occur in which it is often no easy matter to decide whether they belong to *Gigartina* or *Chondrus*.

1. G. *purpurascens*, Lamour.; frond cylindrical, filiform, bushy, excessively and irregularly branched; ramuli setaceous, acute, scattered, containing immersed sphærical tubercles. *Grev. Alg. Brit. p.* 122; *Hook. Br. Fl.* ii. *p.* 299; *Wyatt, Alg. Danm. No.* 74. *Fucus purpurascens, E. Bot. t.* 1243.

In the sea, on rocks, stones and Algæ; very common. Annual. Summer.—*Root* fibrous; frond 6 inches to 2 feet high, about a line in diameter; stem generally undivided, naked below, but after the height of 1 or 2 inches, thickly clothed with alternate, patent branches, which are either simple or forked, and in turn bear a third or fourth set, the branches and ramuli exceedingly variable in length; the whole plant with a bushy character. *Capsules* immersed in the ramuli; *granules* imbedded in the lesser branches of distinct plants. *Colour* a pale purplish pink, becoming blackish in drying. *Substance* cartilaginous, imperfectly adhering to paper.

2. G. *confervoides*, Lamour.; frond cartilaginous, cylindrical, filiform, irregularly (often very slightly) branched; branches long, sub-simple; ramuli scattered, attenuated at each end; capsules external, roundish, scattered. *Grev. Alg. Brit. p.* 123; *Hook. Br. Fl.* ii. *p.* 299; *Wyatt, Alg. Danm. No.* 75. *Fucus confervoides, E. Bot. t.* 1668.—*β. procerrima;* branches very long, generally simple and almost naked. *Turn.*—*γ. albida;* frond compressed, mostly dichotomous, ramuli subulate. *Turn.*—*δ. geniculata;* frond distorted and bent as if broken at the tubercles.

Sea-shores, not unfrequent. Perennial. Fruiting in summer and autumn.—*Fronds* 3—20 inches long, cylindrical, as thick as small twine, irregularly branched, generally forked or branched at base, the branches either long and simple or dichotomously divided, either naked, or more or less furnished with short ramuli; all tapering upwards. *Colour* a pale or deep red, becoming paler in decay. *Substance* rigid-cartilaginous, not adhering to paper. *Capsules* large, sessile, abundantly scattered over the branches; *granules* minute, imbedded in the branches of distinct plants.

3. G. *erecta*, Hook.; frond cylindrical, erect, sparingly dichotomous; branches sub-simple; capsules globose, clustered round the apices; granules in terminal, pod-like ramuli. *Grev. Alg. Brit. p.* 124, *t.* 14; *Hook. Br. Fl.* ii. *p.* 300; *Wyatt, Alg. Danm. No.* 115. *Sphærococcus erectus, Grev. Crypt. t.* 357.

In the sea, on sand-covered rocks; very rare. Perennial. Fruiting in winter. Torquay and Sidmouth, *Mrs. Griffiths.* Belfast Bay, *Mr. W. Thompson.* Port Ballantrae, North of Ireland, *Mr. D. Moore.*—*Fronds* numerous, rising from an expanded disk, erect, 1 or 2 inches high, simple or once or twice forked, the branches erect, destitute of ramuli. *Colour* pale or full red. *Substance* cartilaginous and rigid, not adhering to paper. *Capsules* sphærical, clustered about the tips of the branches; *granules* oblong, imbedded in lanceolate, pod-like, terminal receptacles.

4. G. *compressa*, Hook.; frond succulent, brittle, somewhat compressed, alternately or sub-dichotomously branched; branches long and mostly simple, tapering to a fine point; capsules ovato-globose, sessile, scattered over the branches. *Grev. Alg. Brit. p.* 125; *Hook. Br. Fl.* ii. *p.* 299; *Wyatt, Alg. Danm. No.* 25. *Sphær. lichenoides, Grev. Crypt. t.* 341, *(not of Ag.)*

In the sea; very rare. Annual. August. Sidmouth, *Mrs. Griffiths* and *Miss Cutler.*—*Fronds* several from the same disk-like base, 6—12 inches long, from half a line to a line and a half in diameter, cylindrical, or somewhat compressed, either rising with a simple stem, and set with long alternate branches, all of which are much attenuated at base and apex; or divided near the base in a more or less dichotomous manner, the chief divisions alternately branched, and either naked, or furnished with a series of long, subulate, alternate or secund ramuli: thus the frond is partly dichotomous,

partly pinnate. *Capsules* sessile, large and prominent, scattered plentifully over the branches; *granules* minute, imbedded in the branches of distinct plants. *Substance* very tender and fragile, succulent, cartilagineo-gelatinous. *Colour* a transparent, dull red, becoming brighter in fresh water.

5. G. *pistillata*, Lamour.; frond cartilaginous, compressed, filiform, tapering at base, several times forked, the tips acute; the upper branches (in fruit-bearing specimens) pinnated with short, horizontal, subulate ramuli, which bear the capsules at or near their tips. *Grev. Alg. Brit. p.* 146; *Hook. Br. Fl.* ii. *p.* 300. *Fucus gigartinus, E. Bot. t.* 908.

On rocks in the sea; very rare. Perennial. Spring. Coast of Cornwall, *Dr. Wenman*. Mount's Bay, *Dr. Macculloch*. Padstow, *Miss Hill*. Whitsand Bay, *Dr. Walker Arnott.*—*Root* an expanded disk. *Fronds* several from the same base, 3—6 inches long, compressed or subcylindrical, from half a line to a line in diameter, tapering at base, rising with a simple stem for an inch or two, then once or twice forked, the segments elongated and again repeatedly forked towards the extremities; the apices acute, and branches erect, the upper branches, in fruit-bearing specimens, pinnated with short, horizontal, simple or forked, or sometimes pinnated ramuli, from 2 lines to half an inch long. *Capsules* seated on the sides or terminating the ramuli, sphærical, depressed in the centre, of the colour of the frond, with a thick opaque coating, containing a mass composed of several distinct clusters of very minute seeds. *Granules* unknown; but on a continental specimen in my herbarium I find oblong or roundish, raised, deeply coloured, wart-like patches, on the upper dichotomous divisions of the frond, formed of a thick stratum of minute, simple or binate granules. This specimen wants the horizontal ramuli which distinguish the capsular state. *Substance* cartilaginous when recent, horny when dry. *Colour* a dull purple, becoming darker in drying. The Irish station noticed in 'Mag. Nat. Hist.' vol. ix. p. 148, is incorrect.

6. G. *acicularis*, Lamour.; frond cartilaginous, cylindrical, filiform, irregularly branched, sub-dichotomous; branches divaricate; ramuli few, scattered, very patent, subulate; capsules sphærical, scattered on the branches. *Grev. Alg. Brit. p.* 147, *t.* 16; *Hook. Br. Fl.* ii. *p.* 300; *Wyatt, Alg. Danm. No.* 26. *Fucus acicularis, E. Bot. t.* 2190.

On rocks in the sea, rare. Annual? Winter. Several places on the coasts of Devon and Cornwall. At Torquay, in December, with capsules very fine, *Mrs. Griffiths*. Belfast Bay, *Mr. Templeton*, (*Turner*).—*Fronds* tufted, 2—4 inches high, with a simple or forked, arched or wavy stem, set with patent or horizontal, alternate or secund branches of about equal length, and which are either naked or furnished with a second or third series; branches cylindrical, about half a line in diameter, acuminate; ramuli subulate, pinnate or secund, of unequal length. *Capsules* sphærical, sessile on the smaller branches, or occasionally terminating the ramuli, scattered or clustered; *granules* minute, imbedded in the ramuli. *Substance* cartilaginous. *Colour* a dull purple-red, darker when dry.

7. G. *Teedii*, Lamour.; frond membranaceous, flaccid, (horny when dry), flat, linear, acuminate, repeatedly pinnated

with slender, horizontal, distichous, subulate ramuli; capsules globose, on the ramuli. *Grev. Alg. Brit. p.* 96; *Hook. Br. Fl.* ii. *p.* 301; *Wyatt, Alg. Danm. No.* 27. *Sph. Teedii, Grev. Crypt. t.* 356.

On rocks in the sea, very rare. Perennial. Elberry Cove and Tor Abbey Rocks, *Mrs. Griffiths.—Fronds* 2—5 inches high, from half a line to a line in width; *stem* cylindrical, soon becoming compressed, and finally flattened, either forked at the base or simple, set at intervals of about a line with long, horizontal, distichous branches, attenuated at each end, and pinnated with a second or third series of patent, subulate ramuli; the whole forming a broadly ovate or fan-shaped frond. The ramuli are frequently very much lengthened out and filiform. *Capsules* have not yet been found in this country; they occur on the ramuli. *Colour* purplish, becoming brighter in fresh water, and finally yellowish. *Substance* flaccid, but becoming horny when dry, and not adhering to paper.

8. G.? *Griffithsiæ*, Grev.; frond cartilaginous, filiform, dichotomous, simple below, much branched above; branches fastigiate; axils rounded; fructification, oblong warts composed of moniliform filaments, and surrounding the stem. *Grev. Alg. Brit. p.* 149; *Hook. Br. Fl.* ii. *p.* 301; *Wyatt, Alg. Danm. No.* 28. *Fucus Griffithsiæ, E. Bot. t.* 1926.

On rocks in the sea. Perennial. Autumn and winter. Coast of Devonshire, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.* Balbriggan, *Dr. Scott.—Fronds* tufted, entangled, 2—4 inches high, slender and filiform, many times dichotomous, the axils patent, the apices nearly of equal length, giving the plant a rounded outline; branches flexuous, of equal diameter throughout, obtuse. *Fructification*, so far as known, consisting of oblong warts, surrounding the stem, composed of parallel, jointed fibres, resembling strings of red beads. *Substance* cartilaginous, somewhat horny when dry. *Colour* a dull purplish-red.

9. G.? *plicata*, Lamour.; frond horny, cylindrical, filiform, very irregularly branched, entangled, wiry; branches subdichotomous; axils obtuse; ramuli often secund; fructification, oblong warts composed of obscurely jointed filaments. *Grev. Alg. Brit. p.* 150; *Hook. Br. Fl.* ii. *p.* 301; *Wyatt, Alg. Danm. No.* 116. *Fucus plicatus, E. Bot. t.* 1089.

On rocky sea shores. Perennial.—*Fronds* 4—10 inches long, entangled, rigid and wiry, cylindrical, as thick as hogs' bristles, of equal diameter throughout, irregularly branched, more or less dichotomous, with very rounded axils, more or less furnished with horizontal ramuli, which sometimes spread in all directions. *Fruit*, as far as known, oblong warts embracing the stem, and composed of jointed threads. *Colour* a blackish-purple, whitish in decay.

XLIX. Chondrus. Stack.

Frond cartilaginous, dilating upwards into a flat, nerveless, dichotomously divided frond, of a purplish or livid red colour.

Fructification : sub-sphærical capsules in the substance of the frond, (rarely supported on little stalks), and containing a mass of minute free seeds. *Grev.*—Name, χονδρος, *cartilage;* in allusion to the substance of the frond.

1. C. *mamillosus,* Grev.; frond thick, cartilaginous, channelled, irregularly dichotomous; segments oblong-wedge-shaped; capsules sphærical, supported on little stalks, scattered over the disk of the frond. *Grev. Alg. Brit. p.* 127; *Hook. Br. Fl.* ii. *p.* 302; *Wyatt, Alg. Danm. No.* 117; *E. Bot. t.* 1054.

On rocks and stones in the sea, common. Perennial. Autumn and winter.—*Fronds* 3—6 inches high, cylindrical at base, but gradually widening into a compressed, and finally flat, wedge-shaped frond, which is either once or twice forked or repeatedly dichotomous; the segments all wedge-shaped, from a line to half an inch in breadth; the apices acute. *Capsules* roundish, borne on short, filiform processes, produced in great plenty by the surface of the upper segments, and which, in cases of imperfect fructification, become leaflets. *Colour* a dark purple. *Substance* tough.

2. C. *crispus,* Lyngb.; frond thickish, cartilaginous, dichotomous, flat or curled; segments very variable in breadth; capsules hemisphærical, innate in the disk of the frond, concave on one side. *Grev. Alg. Brit. p.* 129, *t.* 15; *Hook. Br. Fl.* ii. *p.* 302; *Wyatt, Alg. Danm. Nos.* 118 *and* 119. *Fucus crispus, E. Bot. t.* 2285.

On rocky sea shores, very common. Perennial. Spring.—*Fronds* densely tufted, 2—10 inches high, narrow and sub-cylindrical at base, but soon becoming flat, repeatedly forked, very variable in breadth; segments from 1—4 lines wide, flat or curled; the axils generally rounded. *Capsules* oval, imbedded in the frond, prominent on one side and concave on the other, containing minute seeds. Another, and apparently diseased fructification, occurs on specimens gathered by *Mr. W. Thompson* on the coast of Down, and by *Mr. D. Moore* at Carrickfergus, consisting of roundish or oblong *warts* resembling capsules, and containing an apparently sporaceous mass, and, on the tips of the ramuli of the same individuals, prominent *granules* resembling pimples, giving the tips a rough appearance under a pocket lens. *Colour*, various shades of purple or greenish; in shallow pools near high-water mark, generally yellow or pale green. *Substance* horny when dry. This is the *Carrigeen* or *Irish Moss* of the shops.

3. C. *norvegicus,* Lamour.; frond cartilagineo-membranaceous, dichotomous, flat, axils patent; segments nearly linear; apices obtuse; capsules sphærical, sessile on the disk. *Grev. Alg. Brit. p.* 130; *Wyatt, Alg. Danm. No.* 120; *E. Bot. t.* 1080.

Rocky shores, rare. Annual? September to March. Dover, *Dillwyn.* Exmouth, *Sir T. Frankland.* Devon, *Mrs. Griffiths.* Swansea, *Dillwyn.* Bantry, *Miss Hutchins.* Youghal, *Miss Ball.* Coast of Sussex, *Mr. Borrer.* Miltoun Malbay.—*Fronds* 2—3 inches high, with a cylindrical

stem from a quarter to half an inch long, thence flat, 1 or 2 lines wide, and repeatedly dichotomous. *Capsules* (very rare, and hitherto only found by *Mrs. Griffiths*), about the size of poppy-seed, imbedded in the frond, containing a mass of minute seeds. *Warts* or *nemathecia* common, roundish, nearly a line in diameter, scattered over the frond, composed of beaded filaments. *Substance* thinner than in *C. crispus*. *Colour* a deep blood-red.

4. C. *membranifolius*, Grev.; stem cylindrical, filiform, branched; the branches expanding into broadly wedge-shaped, membranaceous, two-lobed or dichotomous segments; capsules roundish, on short stalks arising from the stem. *Grev. Alg. Brit. p.* 131; *Hook. Br. Fl.* ii. *p.* 302; *Wyatt, Alg. Danm. No.* 76. *Fucus membranifolius, E. Bot. t.* 1965.

On rocky sea shores, frequent. Perennial. October to March.—*Fronds* 3—12 inches high; stem cylindrical, filiform, irregularly branched, the branches expanding into wedge-shaped or fan-shaped, dichotomously cleft, flat, membranaceous *frondlets*, about an inch in length, and more or less divided. *Capsules* borne on short stalks by the branches. *Nemathecia* also frequently occur on the frondlets, where they form long deep red spots, composed of beaded filaments. The substance of the stem is cartilaginous, of the frondlets membranaceous.

5. C. *Brodiæi*, Grev.; stem cylindrical, filiform, branched, the branches expanding into oblong, simple or forked, flat, membranaceous frondlets, which are proliferous from their extremity; capsules sessile on the tips of the segments. *Grev. Alg. Brit. p.* 133; *Hook. Br. Fl.* ii. *p.* 303. *Fucus Brodiæi, E. Bot. t.* 1966.—*β. simplex;* stem short, expanding into an oblong, mostly simple or once forked, rose-coloured frond. *Grev. Wyatt, Alg. Danm. No.* 121.

On rocks in the sea, rare. Perennial. Spring. Eastern coast of Scotland, frequent, *Mr. Brodie, Mr. Stewart, Dr. Greville, &c.* Mouth of the Bann, Co. Derry, *Mr. D. Moore.* Belfast Bay, *Mr. W. Thompson.* *β*, Devonshire, *Mrs. Griffiths.*—*Frond* 1—8 inches high; *stem* cylindrical, variable in length, simple or branched, its branches expanding into oblong, flat, forked or simple, wedge-shaped leaves, varying in breadth from two to four lines, and in length from one to three inches; the segments somewhat truncate, often proliferous from the apex, the young shoot rising with a cylindrical stem, which soon expands into a frondlet resembling the primary one, and this, in its turn, gives birth to a second or third. *Capsules* large, globose, dark red, sessile on the tips of the frond. *β* is a very beautiful plant, not quite two inches high, once or twice proliferous, and of a fine rose-red colour, the frondlets marked above the middle with a broad, elliptical, dark red, thickened spot, composed of vertical beaded filaments. It bears a striking resemblance to some states of *Rhodomenia Palmetta*. The stations at Larne and Strangford Lough, given by Mr. Mackay in his 'Flora Hibernica,' are incorrect.

L. Phyllophora. Grev.

Frond cartilaginous or membranaceous, of a purple or

rose-red colour, plane, proliferous from the disk, furnished with a more or less imperfect or obscure midrib. *Fructification:* 1, capsules containing a mass of minute, roundish, free seeds; 2, sori of simple granules in little foliaceous processes. (In two species *nemathecia* have been observed, but no granules). *Grev.*—Name, φυλλον, a *leaf*, and φορεω, *to bear;* in allusion to the proliferous frond.

1. P. *rubens*, Grev.; stem very short, expanding into a sub-linear, simple or forked, membranaceous, obscurely midribbed frond, which is repeatedly proliferous from the surface; capsules sessile, wrinkled. *Grev. Alg. Brit. p.* 135, *t.* 15; *Hook. Br. Fl.* ii. *p.* 303; *Wyatt, Alg. Danm. No.* 29. *Fucus rubens, E. Bot. t.* 1053.

On rocks &c., in the sea. Perennial. Winter. Not uncommon on the shores of England and Ireland; more rare in Scotland, and chiefly on the western shores.—*Fronds* tufted, 3—8 inches long; stem minute, cylindrical, gradually expanding into a linear-wedge-shaped, simple or forked frond, furnished at base with a faint midrib, and one or two inches long, from the surface of which, near the tips of the segments, springs a second frond similar to the primary, but generally more repeatedly dichotomous, and this bears from its apices new fronds in like manner; apices blunt. *Substance* membranaceous, rather rigid, not adhering to paper. *Colour* a fine, deep, blood-red. *Capsules* minute, scattered over the frond, with a thick, opaque, wrinkled skin, containing a mass of minute seeds. *Nemathecia* immersed in the bases of little leafy processes, plentifully borne by the surface of distinct plants.

LI. Sphærococcus. Stack.

Frond cartilaginous, compressed, two-edged, linear, distichously branched. *Fructification:* mucronate capsules, containing a mass of ovate, shortly pedicellate, red seeds. *Grev.*—Name, σφαιρα, a *sphære* or *globe*, and κοκκος, *fruit.*

1. S. *coronopifolius*, Ag.; frond cartilaginous, much branched in a distichous and alternate manner, compressed and two-edged below, nearly flat above; the branches acute; capsules sphærical, mucronate, on little stalks, fringing the smaller branches. *Grev. Alg. Brit. p.* 138, *t.* 15; *Hook. Br. Fl.* ii. *p.* 304; *Wyatt, Alg. Danm. No.* 122. *Fucus coronopifolius, E. Bot. t.* 1478.

In the sea. Biennial. Summer and autumn. Not uncommon on the southern shores of England, and the western and southern shores of Ireland. Very rare in Scotland. Bute, *Dr. Greville.* Belfast, *Mr. Templeton.* —*Fronds* 6—12 inches long or more, very much branched, distichous; the main stems compressed, two-edged, thickened in the centre, two lines broad, becoming narrower and flatter upwards, irregularly divided in a manner between dichotomous and alternate, the upper branches once or twice

forked, the segments set with close, alternate branches, which often bear a second series, or branched in a regularly alternate manner; the branches all spreading, giving the plant a fan-like outline; the margin of the upper branches generally fringed with minute, ciliary processes, about half a line in length, in some of which capsules are imbedded. *Capsules* sphærical, imbedded in the ciliæ below the tip, which is slightly produced beyond them and bent, forming "an oblique mucro" to the capsules, the whole not unlike the head of a bird. *Colour* a fine scarlet-red, darker in the main stem. *Substance* cartilaginous, becoming horny in a dry state, and imperfectly adhering to paper under pressure.

LII. Gelidium. Lamour.

Frond between cartilaginous and horny, compressed, linear, more or less regularly pinnated. *Fructification:* 1, capsules imbedded in the substance of the ramuli, containing a mass of minute, roundish seeds; 2, ternate or otherwise compound granules in the ramuli, on distinct individuals. *Grev.*—Name, in allusion to the gelatinous nature of some of the species when macerated.

1. G. *corneum*, Lamour.; frond between cartilaginous and horny, nearly flat, distichously branched; branches linear, attenuated at each end, pinnate and bipinnate; pinnules mostly opposite, patent, obtuse, bearing within their apices elliptical capsules. *Grev. Alg. Brit. p.* 141, *t.* 15; *Hook. Br. Fl.* ii. *p.* 305; *Wyatt, Alg. Danm. No.* 30. *Fucus corneus, E. Bot. t.* 1970.

On rocky shores, very common. Perennial. Summer.—Of this most variable plant the following varieties are enumerated by Dr. Greville, in his excellent '*Algæ Britannicæ*':—

β. *sesquipedale;* frond 4—8 inches high, between compressed and flat, linear, tripinnate, pinnæ attenuated at their base, ramuli linear-oblong, short, obtuse.

Sidmouth, *Dr. Greville.*

γ. *pinnatum;* frond 2—6 inches high, narrow, tripinnate, the pinnæ patent, nearly linear, bluntish. *Turn.*

Coasts of Cornwall, Devonshire, &c., *Hudson.* Bute, *Dr. Greville.*

δ. *uniforme;* all the pinnæ patent, attenuated at the base, obtuse at the points and scattered. *Turn.*

Ilfracombe, *Goodenough.*

ε. *capillaceum;* frond 5 or 6 inches high, narrow, pinnæ clustered towards its summits, nearly setaceous and somewhat erect. *Turn.*

King's Cove, Cornwall, *Turner.* Sidmouth, *Dr. Greville.*

ζ. *latifolium;* frond 2 or 3 inches long, 1 or 2 lines broad, nearly flat, pinnæ linear-lanceolate, mostly simple, set with numerous, short, setaceous pinnulæ.

Trevone Bay, Cornwall; and Torbay, *Mrs. Griffiths.* Sidmouth, *Dr. Greville.* Malbay.

η. *confertum;* frond 2 or 3 inches high, compressed, repeatedly pinnated, pinnæ and pinnulæ long, very thin, acute and irregularly divided.

Devonshire, *Mrs. Griffiths.* Bute, *Dr. Greville.*

θ. *aculeatum;* frond 1 or 2 inches high, compressed, very thin, pinnated very irregularly, pinnæ divaricated, irregularly divided, and set with minute, divaricate, subulate ramuli, crowded toward the summit of the frond.

Mounts Bay, *Mrs. Griffiths.*

ι. *abnorme;* frond 2 inches high, compressed, irregularly branched, branches and pinnæ producing at their extremities little tufts of partly deflexed ramuli.

North of Cornwall, *Mrs. Griffiths.*

κ. *pulchellum;* frond capillary, compressed, tripinnate, pinnæ between linear and clavate, obtuse. *Turn.*

Bantry Bay, *Miss Hutchins.*

λ. *claviferum;* frond sub-cylindrical, capillary, irregularly divided, the ultimate ramuli or pinnulæ obovate, edged with minute, scattered teeth.

Bantry Bay, *Miss Hutchins.*

μ. *clavatum;* frond capillary, between cartilaginous and membranaceous, decumbent, creeping, ramuli in the form of inversely-lanceolate or ovate leaves, much attenuated at their insertion.

South of England, frequent. Frith of Forth, *Dr. Richardson.*

ν. *crinale;* frond setaceous, sub-cylindrical, somewhat dichotomously branched, sometimes three-forked at the top, and bearing a few elliptical-oblong ramuli attenuated at their insertion.

East and south of England. Belfast Lough, *Mr. Templeton.*

2. G. *cartilagineum*, Grev.; frond several times pinnated, the pinnæ horizontal, alternate; capsules elliptical, mucronate, terminating the smaller pinnulæ. *Grev. Hook. Br. Fl* ii. *p.* 304. *Fucus cartilagineus*, *E. Bot. t.* 1477.

On rocks in the sea. Perennial. A very doubtful native of our shores. It was once found by *Dr. Withering* at Freshwater Bay, Isle of Wight, where its presence was probably accidental.—*Frond* 12—18 inches long, rising from a mass of fibres; the stems naked at base, in the upper part bi-tripinnate, the pinnæ and pinnulæ alternate, gradually diminishing in size. *Colour* a fine, dark purple, becoming scarlet, orange, yellow, and finally greenish on exposure. *Substance* cartilaginous, horny when dry.

3. G.? *rostratum*, Griff.; frond membranaceo-cartilaginous, flaccid, compressed, very narrow, much branched; branches alternate, of unequal length, much divided in their upper part, and furnished with sub-dichotomous, patent ramuli; capsules imbedded either in the tips of the frond, or in proliferous, axillary ramuli; granules on distinct plants, similarly situated. *Rhodomenia rostrata, J. G. Agardh, in litt.* "*Gigartina purpurascens, var. rostrata, Lyngb.*" *Fucus alatus, γ. angustissimus, Turn. Hist. Fuc. t.* 160. *Delesseria alata, β. angustissima, Hook. Br. Fl.* ii. *p.* 286.

In the sea. Scarborough, *Mr. Pitchford.* Lossiemouth, Morayshire, *Mr. Brodie of Brodie.*—*Frond* 4—6 inches long, compressed, not half a line in diameter, becoming gradually more slender towards the tips, much branched; branches distichous, irregular, alternate or sub-dichotomous, more or less divided, frequently bare of ramuli in their lower part; above furnished with patent or divaricated, sub-dichotomously-cleft ramuli; the axils rounded and broad, or acute; often, especially in fructifying specimens, having numerous simple or cleft ramuli, about a line long, tapering at base, springing from the axils of the upper branches. There is nothing in any part which can be called a marginal lamina or wing. The colour is a dark red; the substance membranaceous and flaccid. The capsules are sphærical, either imbedded in the frond, near the tips, or placed in the centre of little axillary ramuli. The granules are large, ternate, quaternate, or simple, rather distant, and produced in the same part as the capsules, but on different individuals. Few plants have been the subject of more controversial correspondence among Algologists than the present. Upwards of thirty years ago, *Mr. Brodie* and *Mrs. Griffiths* were of opinion that it was a distinct species; while *Mr. D. Turner*, (who has been followed in this by all succeeding British Botanists), was equally decided that it was merely a variety of *Delesseria alata*, to which it bears a very strong resemblance in colour, ramification, and substance; but altogether wants the membranous margin peculiar to that species. No botanist seems to have met with it since *Mr. Brodie;* but, as he found it in considerable abundance at the above station, it is probable that it only requires to be looked after. To *Dr. Walker Arnott*, the present possessor of Brodie's herbarium, I am indebted for specimens with both kinds of fruit. These I recently submitted to Mrs. Griffiths' examination, who, having compared them with those states of *D. alata* which most nearly resembled them, "is more convinced than ever that the present is a true species." "I admit," says she, "that the fronds toward the tips are compressed, and may be so naturally, but I cannot trace the vestige of a membrane under any circumstances, not even in the youngest part, where it is evidently perfect. The structure also is different from that of *D. alata*, in a way easier to see than to describe. In *D. alata* you can trace the longitudinal veining of the

midrib to the extremity of the leaflets, and they always retain a plain margin beyond the seeds, which margin differs in structure from that of Brodie's plant. The seeds also differ in form from those in Brodie's; in *alata* they rise above the surface; whereas in his they are imbedded, and extend to all parts round the branchlet. I confess the ramification and general appearance are alike, and at first sight, or on slight examination, one would be taken for the other, but after all the trouble I have taken to be convinced, I must remain 'of the same opinion still.'" *Griff. in litt.* — My own opinion on this puzzling matter is not very decided, nor can I venture to pronounce one way or the other without seeing the plant in a recent state, and noting the circumstances which may be supposed to influence it. Certainly no state of *D. alata* that I have ever seen is altogether wanting in the membrane. How that species may occur in Mr. Brodie's locality; whether it may present intermediate states or not, it would be desirable to know. If it do not, I should at once decide in favour of the specific claims of this plant. But granting for the present that it is a good species,—to what genus should it be referred? *Mrs. Griffiths* and *Dr. Walker Arnott* suggest *Gelidium*, with which its fruit and ramification well accord; but its substance is different. The former botanist notices its affinity with *Microcladia* also, and, were the fruit similar, it is near that genus that I should incline to place it. As it is, it may conveniently remain in *Gelidium* till something more is known about it. Differing as it does altogether in structure, I cannot think it at all related to *Gigartina purpurascens*, of which Lyngbye has given it as a variety, as we are assured by Mr. James Agardh. This gentleman himself proposes to place it in *Rhodomenia*, and to call it *R. rostrata;* and by Bishop Agardh it is made a variety of *R. cristata;* but it differs from that genus both in the capsules, and in the granular fructification.

LIII. Grateloupia. Ag.

Frond cartilagineo-membranaceous, plane, sometimes pinnated with branchlets, or fringed with foliaceous processes. *Fructification:* minute, aggregated tubercles, furnished with a pore, and containing a mass of free, elliptical or roundish seeds. *Grev.*—Name, in honour of *Dr. Grateloup*, a French Algologist.

1. G. *filicina*, Ag.; frond linear, attenuated at each extremity, irregularly once or twice pinnated, with branches contracted at the base, and tapering to the apex. *Grev. Alg. Brit. p.* 151, *t.* 16; *Hook. Br. Fl.* ii. *p.* 306; *Wyatt, Alg. Danm. No.* 123. *Fucus filicinus, Turn. Hist. t.* 150.

On rocks and stones in the sea, very rare. Perennial. October to December. Sidmouth and Ilfracombe, *Miss Cutler*. Land's End, *Mr. Ralfs*. Ilfracombe and Torbay, *Mrs. Griffiths*.—*Fronds* tufted, rising from a minute disk, seldom more than two inches high in British specimens, (exotic ones are often 8—10 inches), from half a line to a line in breadth, with an undivided or once forked, flexuous stem, which tapers to the base and apex, naked at base, its upper half, and often its greatest length, more or less set with opposite or alternate, distichous, flexuous branches or *pinnæ*, which

are either simple, or clothed in the upper part with a second series of pinnulæ; all the branches and ramuli linear, attenuated at the apex, and more or less contracted at base. *Substance* membranaceous, more or less perfectly adhering to paper. *Colour* a dull, dark purple or greenish, very like that of *Dumontia filiformis*. *Capsules* minute, immersed in the branches, with a pore; *granules* ternate in the smaller pinnules. This last species of fruit I find in specimens communicated by *Mrs. Griffiths*, from Ilfracombe and Hagington, October, 1836.

LIV. Ptilota. Ag.

Frond compressed or flat, pectinato-pinnate, of a red colour, between membranaceous and cartilaginous. *Fructification:* minute, aggregated capsules, surrounded by an involucre. *Grev.*—Name, πτιλωτος, *pinnated;* from the delicate pinnated frond.

1. P. *plumosa*, Ag.; frond compressed, filiform, much branched, the branches repeatedly pectinato-pinnate; pinnæ and pinnulæ exactly opposite; the latter minute, subulate, and bearing the clustered capsules. *Grev. Alg. Brit. p.* 155, *t.* 16; *Hook. Br. Fl.* ii. *p.* 307; *Wyatt, Alg. Danm, No.* 77. *Fucus plumosus, E. Bot. t.* 1308.—β. *capillaris;* frond very narrow, flaccid; ramuli jointed. *Turn.*

In the sea, on rocky shores, common. α on the stalks of *Laminariæ*; β on the faces of perpendicular rocks. Perennial. Summer and autumn.—*Fronds* 3—14 inches long, much and irregularly branched; branches from a quarter to half a line in width, attenuated upwards, patent, opposite or alternate, closely set with opposite, distichous, pinnated, lanceolate ramuli, from one to four lines in length, the pinnules acute, narrow-lanceolate, simple, or, in luxuriant specimens, again pinnated. *Capsules* clustered, surrounded by an involucre, terminating the ultimate pinnules, the involucre composed of several subulate ramuli. *Substance* cartilaginous. *Colour* a fine dark red. β is much more flaccid, smaller, of a duller colour, often brownish, and almost always infested by parasites, and remarkable for the jointed, conferva-like structure of the extreme ramuli. This genus completely connects the *Floridee* with the *Ceramieæ*.

Tribe 13. CERAMIEÆ.

LV. Polysiphonia. Grev.

Frond filamentous, partially or generally articulate; joints longitudinally striate, composed internally of parallel tubes. *Fructification* double, on distinct plants: 1, ovate *capsules*, furnished with a terminal pore, and containing a mass of pear-shaped seeds; 2, *granules*, imbedded in swollen branchlets.—Name, πολυς, *many*, and σιφων, a *tube;* from the structure of the frond.

1. *Frond rigid, articulated, compressed, distichous, bi-tripinnate.*

1. P. *parasitica*, Grev.; slender, rigid, full-red, alternately branched, distichous; branches bi-tripinnate; pinnæ alternate, erect, awl-shaped; articulations about as long as broad, three-tubed. *Hook. Br. Fl.* ii. *p.* 330; *Wyatt, Alg. Danm. No.* 175. *Conf. parasitica, E. Bot. t.* 1429.

On the larger Algæ, and (more frequently) on rocks at the extreme limit of low-water, not uncommon on many of our coasts, but nowhere very abundant. Coasts of Yorkshire, Dorset and Cornwall, *Hudson*. Bantry, *Miss Hutchins*. Frith of Forth, *Dr. Richardson*. Devonshire, *Mrs. Griffiths*. West of Ireland, and near Wicklow, &c.—*Stems* half an inch to an inch and a half high, somewhat compressed, rigid, simple, distichously branched; branches alternate, short below, longer above, from two lines to three-fourths of an inch long, pinnated or bipinnated with awl-shaped, simple, acute, erecto-patent ramuli. *Articulations* of the branches about as long as broad, of the ramuli much shorter, marked with 3 or 4 broad tubes, with wide, transparent intervals. *Substance* cartilaginous, imperfectly adhering to paper. *Colour* rose-red, becoming brownish when dried. *Capsules* I have not seen; ternate *granules* frequently occur in the ramuli. The habit of this species is very peculiar, and, as Mrs. Griffiths remarks, approaches that of *Rytiphlæa*.

2. *Frond cartilaginous, inarticulate, the surface reticulated with veins; the ramuli only transversely striate, or spuriously jointed.*

2. P. *cristata*, Harv.; stem erect, compressed, sub-simple below, decompound above; branches erecto-patent, more or less regularly bipinnate, (as is also the stem to the base); lower pinnæ very short, their pinnules simple and broadly subulate; upper longer, with pinnato-multifid pinnules; axils all acute; ramuli, as well as the branches, inarticulate, reticulated with veins. *Harv. in Mackay, Fl. Hib. part* iii. *p.* 205. *Fucus cristatus*, γ. *Turn. Rytiphlæa complanata, Ag.*

On rocks in the sea, very rare. Perennial. Bantry Bay, *Miss Hutchins*. Whitsand Bay, Cornwall, *Dr. Walker Arnott*.—*Stem* 2 or 3 inches high, erect, nearly simple below, decompound above, compressed, half a line in breadth, nearly equal throughout; branches erecto-patent, with acute axils, the uppermost becoming rather broader toward the apex, more or less regularly bipinnate; the lower pinnæ very short, with minute, subulate, simple pinnules, the upper much longer, with decompound or sometimes again pinnated pinnules; all the divisions very erect. *Colour* a dark brownish red. *Frond* reticulated with veins, with scarcely any appearance of joints; the ramuli only rarely striated across. Whether or not this be the original var. γ of Turner's *Fucus cristatus*, I have no means of ascertaining, but what I have received under that name from Sir W. J. Hooker, is certainly not our plant. But ours is no less surely the true *Rytiphlæa complanata* of Agardh, which I have received from several continental authorities, and gathered abundantly at the Cape of Good Hope. But I cannot reconcile it to myself to consider it a *Rytiphlæa*, nor to separate it generically from the two following species. The name "*complanata*" is already bestowed on another species of *Polysiphonia*.

3. P. *thuyoides*, Harv.; stems erect, rising from creeping fibres, terete; below simple, and set with short, spine-like ramuli; above, much branched; branches crowded, very erect, bipinnate; pinnæ pinnato-multifid; axils rounded; ramuli marked at short distances with transverse striæ, as if jointed; veins reticulated. *Harv. in Mack. Fl. Hib.* iii. *p.* 205; *Wyatt, Alg. Danm. No.* 305.

On rocks in the sea, frequent. Perennial. Summer and autumn. Bantry Bay, *Miss Hutchins*. Very common in Malbay, west of Ireland. Devonshire, *Mrs. Griffiths*. Portrush Bay, *Mr. D. Moore*. Ayrshire coast, *Mr. W. Thompson.*—*Stems* 3 or 4 inches high, twice as thick as hogs' bristles, cylindrical, erect, below either naked, or furnished with short, spine-like ramuli, or with broken remains of old branches; much branched above; branches long, crowded or fasciculate, quadrifarious or distichous, very erect (with a determinate oblong-lanceolate outline), bipinnate, middle and lower pinnæ pinnato-multifid, ultimate ones simple, or with the tips cloven. *Articulations* obscure, shorter than broad, scarcely obvious in the branches, more conspicuous in the ramuli, reticulated with veins. *Capsules* ovate, scattered or clustered, borne by the ramuli, very rare; *granules* ternate, in distorted ramuli, frequent. *Antheridia* bright yellow, gelatinous, constantly produced in summer. *Colour* a dull brown or brownish yellow, becoming black in drying. In habit this approaches *P. nigrescens*, while its structure is more that of *P. fruticulosa*, with which I formerly confounded it.

4. P. *fruticulosa*, Grev.; stems diffuse, branched from the base; branches divaricating, pinnato-dichotomous, inarticulate, set in the lower part with short, horizontal, multifid ramuli; in the upper, more or less pinnated with larger, similarly divided branchlets; axils rounded; ramuli marked at short distances with transverse striæ, as if jointed; veins reticulated. *Harv. in Mack. Fl. Hib.* iii. *p.* 205; *Hook. Br. Fl.* ii. *p.* 327, *(in part). Fucus fruticulosus, E. Bot. t.* 1686.

In the sea, on sand-covered rocks. Perennial. Summer. Southern shores of England, frequent. Bantry Bay, *Miss Hutchins*. Appin, *Capt. Carmichael*. Black rocks, Portrush, *Mr. D. Moore*. Coast of Down, *Mr. W. Thompson.*—*Fronds* 3—6 inches high, robust, cylindrical, much branched from the base, branches divaricating, with very patent axils, repeatedly divided in a pinnato-dichotomous manner, set in the lower part with short, alternate, horizontal, squarrose, multifid ramuli, about a line in length, in the upper distantly pinnated with similar but larger branchlets. *Articulations* scarcely obvious in the larger branches, very apparent in the ramuli, reticulated with veins; the transverse striæ or dissepiments opaque. *Capsules* ovate, sessile, very rare; *granules* ternate, in swollen ramuli, common. *Antheridia* frequently occur, imparting a yellowish colour to the plant. *Substance* cartilaginous. *Colour* dull reddish brown.

3. *Frond jointed throughout, cartilaginous or somewhat rigid, of a dark red or brownish colour; the joints marked with many (more than two) striæ.*

5. P. *subulifera*, Harv.; stems flexuous, cartilaginous,

flaccid, irregularly branched; branches divaricating, furnished with scattered, subulate, simple, patent ramuli; articulations as long as broad, multi-striate. *Harv. in Hook. Journ. Bot. p.* 301; *Wyatt, Alg. Danm. No.* 178. *Hutchinsia subulifera, Ag. Sp. Alg.* ii. *p.* 97.—*β. Templetoni;* more slender, the joints 2 or 3 times longer than broad.

In the sea; very rare. Perennial? Torquay, *Mrs. Griffiths.* *β*, Belfast Bay, *Mr. Templeton* and *Mr. W. Thompson.*—*Filaments* 4 or 5 inches long, as thick as hogs' bristles, attenuated upwards, subdichotomous or irregularly branched; branches divaricating, flexuous, long, subdivided, beset at distances of 1 or 2 lines with very short, scattered, spinelike, patent, acute, simple, or rarely subpinnated ramuli, the pinnulæ extremely short. *Articulations* of the branches as long as broad, 4—6 striate, the striæ straight and slender; of the ramuli shorter than broad; dissepiments opaque. *Substance* tender and flaccid. *Colour* purplish. *β*, which I find among the late Mr. Templeton's plants under the name of *Conf. spinifera*, and which I have also received from *Mr. Thompson*, differs from the Devonshire specimens in being more slender, the ramuli shorter, more patent and spinelike, with the joints 2 or 3 times longer than broad in the main stems, but variable in this respect. Mr. Thompson's specimens are more robust, and have shorter joints than Mr. Templeton's, thus approaching the Devonshire plant. *P. subulifera* is nearly allied to *P. fruticulosa*, of which it has the habit, but differs in substance, in the less-divided ramuli, and above all in the filaments being *distinctly* jointed to the very base, without *reticulated veins.*

6. P. *spinulosa*, Grev.; "dark red; branches divaricate, somewhat rigid; the ramuli short, straight, subulate, divaricate; articulations about equal in length and breadth, three-tubed." *Grev. Crypt. Fl. t.* 90; *Hook. Br. Fl.* ii. *p.* 330.

In the sea; extremely rare. Annual? Appin, *Capt. Carmichael*, who only found one specimen. Torquay, *Mrs. Griffiths.*—*Frond* 1 or 2 inches in length, of a dark red colour, much branched, with a rigid and spinulose habit; main branches rather remote, irregular, much divaricated, somewhat flexuous; ultimate ramuli straight, subulate, almost thorn-like, divaricated like the rest, sometimes minutely divided at the apex, and each of the divisions terminated by a long, hyaline, jointed filament. *Articulations* about as long as broad, striated, with three internal tubes, of a pale brown-pink under the microscope. *Tubercles* (young) "very minute, quite sessile, round, dark red, scattered freely on the branches, and containing several dark granules." *Grev. l. c.* The tubes are generally three, and the spaces between the tubes remarkably broad and transparent. The "*tubercles*" above noticed are very characteristic of the plant, but are anomalous in the genus, unless they be young capsules. *Dr. Greville's* figure is very correct.

7. P. *atro-rubescens*, Grev.; filaments sparingly or much branched, somewhat rigid, dark brownish-red; branches long, alternate, very erect, furnished with short, sub-fasciculate or scattered, subulate ramuli; articulations variable; the lower, 2 or 3 times, — the upper, once and a half as long as broad, marked with several spirally curved tubes; capsules ovate,

stalked or sessile. *Harv. in Hook. Br. Fl.* ii. *p.* 331. *Conf. atro-rubescens, Dillw. t.* 70. *Conf. nigra, E. Bot. t.* 2340. *P. Agardhiana, Grev. Crypt. t.* 210, *and Harv. l. c.*; *Wyatt, Alg. Danm. No.* 134. *Also P. badia and P. denudata, Grev. and Harv. l. c.*

On rocks in the sea; not uncommon. Perennial. Summer and autumn. —*Stems* densely tufted, or covering the rocks in wide patches, 2—6 inches high, thicker than horsehair, sub-simple, more or less furnished with long, alternate, erect, simple branches, which sometimes bear a second series, and are in greater or less abundance clothed with short, subulate, or spindle-shaped, erect ramuli. The joints vary considerably in length, but seldom exceed thrice their diameter. The *tubes* are very frequently, but not constantly, spirally curved. *Colour* deep red or brownish, becoming blackish in drying. *Substance* rigid, not adhering or but slightly to paper. *Capsules* with a very wide aperture, subglobose. With consent of Dr. Greville and Mrs. Griffiths, I gladly unite *P. Agardhiana*, *badia* and *denudata*, with the present species.

8. P. *purpurascens;* filaments flaccid, much and fasciculately branched upwards; branches sub-dichotomous or alternate, patent; ramuli alternate, scattered, elongated, sub-simple; middle articulations 3 or 4 times longer than broad; upper twice as long as broad; capsules ovate, on short stalks. *P. violacea, Carm. Harv. in Hook. Br. Fl.* ii. *p.* 332, *(not of Greville, nor of Alg. Danm.)*

On marine rocks. Appin, *Capt. Carmichael.—Filaments* 3 or 4 inches high, sparingly branched at base, much and somewhat fasciculately branched upwards; branches long, patent, subdichotomous, the secondary ones very erect, with rounded axils, in their upper half pinnated with long, alternate, distant, straight, simple ramuli, or with a few processes near the tip, often ending in a tuft of fibres. *Articulations* 5—7 striate, the basal ones very short, the middle ones three or four times longer than broad. *Colour* a dull red. *Substance* flaccid and adhering to paper. *Capsules* on short stalks, ovate or somewhat urceolate, scattered. Nearly allied to *P. nigrescens*, from which it differs in colour, substance, the length of the joints, and somewhat in ramification. The above description is taken from Capt. Carmichael's specimen; it is the *P. violacea* of his '*Algæ Appinenses*,' and of 'British Flora,' but very different from the plant of Agardh.

9. P. *nigrescens*, Grev.; filaments robust, rigid, and generally rough, with broken branches below, much branched and bushy above; branches alternate, repeatadly divided in a pinnate manner; ramuli distant, elongated, awl-shaped, alternate, the upper ones sometimes having a few processes near the tips; lower articulations short; upper, rather longer than broad; capsules ovate, sessile. *Harv. in Hook. Br. Fl.* ii. *p.* 332; *Wyatt, Alg. Danm. No.* 135. *Conf. fucoides and Conf. nigrescens, E. Bot. t.* 1743 *and* 1717.

On rocks &c. in the sea; common. Perennial. Summer. — *Fronds*

tufted, 6—8 inches high. *Stems* below rigid, subsimple, and either naked or rough with the remains of broken branches; above more or less soft and flaccid, much branched and bushy, the branches short or long, erect or spreading, repeatedly divided in a somewhat pinnate manner, the different series of ramuli gradually more slender; ramuli alternate, 2 or 3 lines long, erecto-patent, distant, the uppermost occasionally crowded, subulate, mostly simple. *Capsules* ovate, with a narrow aperture; *granules* ternate in the ultimate ramuli. *Colour* a dull brown, becoming darker in drying. Mrs. Griffiths finds an extraordinary plant at Lardenham, Torbay, which, for the present, I consider a variety of this species. It is distichously branched, about triply pinnate, with the pinnæ and pinnulæ extremely patent, almost horizontal. The colour, when fresh, was "a pale straw," but becomes brownish when dried; the substance "stiff, and when recent resembled that of a *Sertularia;* the branches compressed." *Mrs. Griffiths. P. nigrescens* varies considerably in size, and in the comparative rigidity and greater or less division of the branchlets.

10. P. *atro-purpurea*, Moore; filaments robust, elongated, rigid below, flaccid above, much branched; branches below naked; in their upper part clothed with alternate, finely divided branchlets; tips of the branches, (including ramuli), truncate or corymbose; ramuli fibrilliferous; lower articulations shorter than broad; upper, twice or thrice as long as broad. *Moore in Ord. Surv. Co. Lond. cum icone.*

On rocks and stones in the sea. Belfast Lough, *Dr. Drummond.* Larne, *Mr. Moore.* Coast of Down, *Mr. W. Thompson.— Fronds* 6—10 inches high, tufted, the main stem as thick as hogs' bristles, sparingly and irregularly divided, naked below, the branches either alternate or opposite, all of them bare of ramuli below, 3—5 inches long, bearing in their upper part alternate or secund, finely divided, flaccid branchlets, which are once or twice somewhat pinnatedly branched in an alternate manner; the ultimate ramuli very erect, the lower ones longest, the upper gradually shortening, so that the tips of the branches (including ramuli) have a truncate or corymbose appearance; the tips of the ramuli fibrilliferous. *Substance* of the stem and branches somewhat rigid, imperfectly adhering to paper; of the ramuli flaccid. *Colour* a blackish purple, paler in the ramuli. *Fruit* unknown. *Joints* many-tubed, those of the stem shorter than broad, of the ramuli twice or thrice as long as broad. This description is taken from a specimen communicated by *Mr. Moore*, on whose authority, chiefly, I introduce this and the following. Both border closely on *P. nigrescens.*

11. P. *affinis*, Moore; filaments robust, elongated, cartilaginous below, flaccid above, irregularly divided; branches patent, naked at base, multifid and with an ovate outline above; ramuli very erect, simple or divided, acute; articulations multi-striate, the lower 2 or 3 times longer, the upper as long as broad; capsules ovate, stalked. *Moore l. c. cum icone.*

On rocks &c. in the sea. Carnlough, near Glenarm, *Dr. Drummond.* Cushendall, *Mr. Moore.—Fronds* 4—8 inches high, as thick as bristles, either divided in an irregular or subdichotomous manner, into a few principal

branches, or alternately branched; branches patent, naked at base, multifid and with a fan-like outline above, the lesser branchlets all naked at base, branched above with a few alternate or secund ramuli, very erect, the lowest longest, the apices somewhat fastigiate or corymbose, contracted at base, acute. *Substance* of the stem cartilaginous, adhering to paper; of the ramuli flaccid. *Articulations* of the stem 2 or 3 times longer; of ramuli as long as broad: those of the stem sometimes obscure. *Capsules* ovate or subglobose, stalked; *granules* large, in the ultimate ramuli. Described from *Mr. Moore's* specimens.

12. P. *furcellata*, Harv.; filaments elongated, tufted, entangled, flexuous, repeatedly and closely dichotomous; axils broad, rounded; ramuli erect, their points hooked in; middle articulations 3—5 times longer than broad. *Harv. in Hook. Br. Fl.* ii. *p.* 332. *Hutchinsia furcellata*, *Ag. Sp. Alg.* ii. *p.* 91.

Floating in the sea, at Sidmouth; *Mrs. Griffiths* and *Miss Cutler*. Dredged in Torbay, *Mrs. Griffiths*.—*Filaments* slender, 5 or 6 inches long, much entangled, and excessively branched, flexuous, the divisions dichotomous, very close towards the extremities. *Articulations* with several slender striæ, which sometimes cross each other, variable in length; those of the larger branches 3—5 times, of the ramuli about twice as long as broad. *Colour*, when recent, "a bright brick-red" (*Mrs. Griffiths*), changing in the herbarium to a deep umber-brown. *Substance*, according to the same lady, "at first firm, but becoming flaccid immediately." *Capsules* unknown. A most distinct and beautiful species.

13. P. *fastigiata*, Grev.; filaments rigid, setaceous, of equal diameter throughout, forming globular tufts, many times dichotomous; axils patent; articulations shorter than their diameter, multi-striate. *Hook. Br. Fl.* ii. *p.* 333; *Wyatt, Alg. Danm. No.* 177. *Conf. polymorpha*, *E. Bot. t.* 1764.

Parasitical on *Fucus nodosus* and *vesiculosus*, especially the former; very common.—*Filaments* 2—4 inches long, rigid, forming globose, dense, bushy tufts of a brown or yellowish colour. The above characters abundantly distinguish this from every other species.

14. P. *Richardsoni*, Hook.; stems cartilaginous, setaceous; branches alternate, elongated, divaricate, beset in the upper part with very patent, straight, sub-dichotomous ramuli; articulations of the stem and branches 2 or 3 times longer than broad, irregularly veined; of the ramuli, shorter; capsules sessile, globose. *Hook. Br. Fl.* ii. *p.* 333.

At Colvend, Dumfries, *Dr. Richardson*.—*Stems* 3 or 4 inches high, rigid, nearly as thick as a hog's bristle at base, branched throughout; branches alternate, often issuing at right angles. *Colour* a dull red, becoming darker in drying. *Main articulations* marked with numerous, anastomosing, irregular tubes, those of the lower branches 3—5 tubed, of the ramuli 2 or 3 tubed. *Capsules* sessile, scattered, subglobose, with a very wide aperture.

A very little known plant, of which I have only seen Dr. Richardson's specimens in Sir W. J. Hooker's herbarium.

15. P. *Griffithsiana;* stem rigid, attenuated, alternately branched; branches long, patent, sub-simple, furnished with numerous sub-dichotomous or alternate, slender, patent, flaccid ramuli; articulations of stem, branches and ramuli, about once and a half as long as broad, with straight veins; capsules broadly ovate, sessile.

Parasitical on *Polyides rotundus* at Torquay, *Mrs. Griffiths.*—*Stems* 3 or 4 inches high, as thick as a bristle, gradually attenuated upwards, alternately branched, the branches long, patent, simple or divided, furnished with numerous, subdichotomous or alternately divided, slender, patent ramuli, the ultimate ones often recurved, having a feathery character. *Articulations* of the stem visible to the base; they, as well as those of the branches and ramuli, about once and a half as long as broad, unusually equal in all parts of the plant. *Substance* rather rigid in the stem and branches, imperfectly adhering to paper, flaccid in the ramuli, not decomposing, nor giving out colour in fresh water. *Colour*, below brownish, above rosy or pink. Nearly allied to *P. Richardsoni*, but in Mrs. Griffiths' opinion distinct. It is chiefly remarkable for the *equality* of its short joints, and for its property of resisting fresh water; "though kept long in fresh water it gave out neither colour nor smell, nor did it decompose as others would in the time." *Mrs. Griffiths in litt.*

4. *Main stems inarticulate, or imperfectly jointed, cartilaginous; ramuli jointed, very slender and flaccid. Decompose rapidly in fresh water.*

16. P. *Carmichaeliana*, Harv.; filaments tufted, rigid, branched from the base; branches alternate, inarticulate, divaricating; ramuli sub-dichotomous, very patent, their articulations as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 328. *P. divaricata, Carm. (not of Ag.)*

Parasitical on *Desmarestia aculeata* at Appin, *Capt. Carmichael.*—*Filaments* tufted, 4 inches high, rigid, thicker than hogs' bristles; branches scattered, issuing at right angles, ramuli sparingly divided, patent and divaricating. *Stem* and principal branches longitudinally striated, inarticulate, or towards the apex having an obscure appearance of joints; articulations of the ramuli 2—4 striate, somewhat swollen at the joints. *Colour* reddish brown, changing to black in drying, in which state it adheres very imperfectly to paper. Of this plant I have only seen the single specimen found by Capt. Carmichael, and preserved in Sir W. J. Hooker's herbarium.

17. P. *Brodiæi*, Grev.; stems inarticulate, robust, cartilaginous, alternately branched; branches pinnated with spreading, pencilled, multifid, delicate, flaccid ramuli; articulations of the ramuli 3 or 4 tubed, rather longer than broad; dissepiments transparent. *Hook. Br. Fl.* ii. *p.* 328; *Wyatt, Alg. Danm. No.* 83. *Conf. Brodiæi, E. Bot. t.* 2589.—*β. subsimplex. Hutchinsia penicellata, Ag. Sp. Alg.* ii. *p.* 65.

In the sea, on rocks and the larger Algæ. Annual. Summer. Common on most of our shores; first noticed by the late *Mr. Brodie* of Brodie, near Forres.—*Frond* 6—14 inches long, generally with an undivided, inarticulate, robust stem, furnished with numerous alternate branches, which are set at short distances with short, multifid, pencil-like ramuli, from half an inch to an inch long; the ramuli jointed, and repeatedly divided in an alternate manner. *Colour* a dark brownish purple. *Substance* gelatinous, instantly decomposing and giving out a disagreeable smell if immersed in fresh water. *β*, which we have from Capt. Carmichael, who gathered his specimens at Staffa, differs from the usual state of the plant in being less branched, more rigid, of a darker colour and with more dense ramuli.

18. P. *fibrillosa*, Grev.; pale straw colour; stems inarticulate, robust, alternately branched; branches patent, resembling the stem, but somewhat jointed, sub-simple, thickly set with very slender, finely divided, short ramuli, whose tips are fibrilliferous; articulations of the ramuli 2 or 3 tubed, rather longer than broad. *Hook. Br. Fl.* ii. *p.* 334; *Wyatt, Alg. Danm. No.* 136.

On rocks and stones in the sea. Brighton and Shoreham, *Mr. Borrer.* Seaton and Torquay, *Mrs. Griffiths.* Bantry Bay, *Miss Hutchins.* Sidmouth, *Miss Cutler.*—*Frond* 6—10 inches long. *Main stem* sometimes nearly half a line in diameter, always thicker than a bristle, attenuated upwards, furnished with several long, alternate or irregular, patent branches, of nearly its own thickness, which sometimes issue horizontally, sometimes are erecto-patent, but generally form considerable angles with the stem. These branches are usually simple, in luxuriant specimens furnished with a second series, somewhat naked at base, in the upper part clothed with slender, finely divided, irregular ramuli, which are either short, and giving the branches a squarrose appearance, or elongated and divided, then giving them the feathery character of *P. violacea*. *Articulations* of the stem indistinct, of the branches somewhat nodose, many-striate and about as long as broad, of the ramuli 2 or 3 tubed, rather longer than broad. *Apices* splitting into numerous byssoid fibres. *Colour* a pale straw or somewhat rosy when recent, becoming purplish in drying. *Substance* tender and gelatinous, very fragile and soon decomposing. *Capsules* generally stalked; *granules* in distorted ramuli. Nearly allied to *P. Brodiæi*, from which, as Mrs. Griffiths remarks, it is not always easy to distinguish it, except when in a growing state. According to Mr. Borrer it is more closely allied to *P. byssoides*, which, in the dry state, some of its varieties resemble.

19. P. *violacea*, Grev.; brownish-red or purple; stem inarticulate, marked with irregularly-broken tubes, rather robust, alternately branched; branches quadrifarious, several times divided in an alternate manner, bushy or feathery, the ultimate ramuli exceedingly slender, fibrilliferous; articulations of the ramuli few-tubed, 2—4 times longer than broad. *Wyatt, Alg. Danm. No.* 176. *Hutchinsia violacea, Ag. Sp. Alg.* ii. *p.* 76.

On rocks and stones in the sea. Elberry Cove and Torquay, *Mrs. Griffiths.* Salcombe, *Mrs. Wyatt.* Belfast Lough, *Dr. Drummond.*—*Frond* 6—8 inches high, with a principal stem, sometimes much more slender than

a hog's bristle, set from top to bottom with long, alternate or irregular, quadrifarious branches of unequal length, but gradually diminishing upwards, which again bear a second, third or fourth series, gradually lessening in diameter and length, so that the plant has a singularly feathery or finely bushy character, the ultimate ramuli exceedingly slender, naked at base, with a few divisions near the summit, erecto-patent, the tips splitting into byssoid fibres. *Articulations* of the stem generally indistinct, irregularly tubed; of ramuli 2 or 3 tubed, twice or four times as long as broad. *Colour* a brownish red, often assuming a fine purple in drying. *Substance* tender, gelatinoso-cartilaginous, quickly decomposing in fresh water. *Capsules* ovate, sessile or shortly stalked; *granules* large, binate or ternate, in the ramuli. Some specimens from Salcombe differ from the Torquay plant in being more slender and less finely coloured, but agree in the essential features. Specimens from both stations have been compared by Dr. Greville with authentic ones from Agardh, and have also been seen by Mr. Agardh, jun., and acknowledged to be the plant of his father. The *P. violacea* of 'Brit. Flora,' is a different species,—*P. purpurascens* of this work.

20. P. *Grevillii;* stems inarticulate, marked with broken tubes, thick, cartilaginous, irregularly branched; branches subdivided, rather bare below, above densely clothed with long, irregularly dichotomous, very slender, pencilled, crimson ramuli; axils acute; articulations of the ramuli 3—6 times longer than broad, two-tubed. *P. Lyngbyæi, Harv. in Hook. Br. Fl.* ii. *p* 328, *(not Hutchinsia Lyngbyæi of Agardh).*

Shores of Bute, on the larger Algæ, *Dr. Greville.—Frond* 6—10 inches high; *stem* as thick as that of *P. elongata*, cartilaginous, inarticulate, marked with short, flexuous veins, and wholly destitute of joints. Branches irregular, patent, sparingly divided, their lower part almost bare, the upper densely clothed with long, very slender, crimson ramuli, which spread in broad pencils, are much branched, straight, irregularly dichotomous, not in the least attenuated at base, their axils very acute; articulations marked with two striæ, rosy under the microscope, 2—4—6 times longer than broad; dissepiments pellucid. This beautiful species is not, I understand, the *Ptilosa Lyngbyæi* of Agardh, as I had formerly supposed. In its *outward* characters it bears much resemblance to his *H. Ruchingeri*, and to *P. elongata*, γ, but, under the microscope, these plants are very different. I consider the present a most distinct, as it is a very beautiful plant. *Mr. Moore's* specimens, noticed in 'Fl. Hib.' I find, on re-examination, to belong to *P. elongata*, γ.

5. Articulated throughout; the joints marked with two striæ.

21. P. *fibrata*, Harv.; stems setaceous, flaccid, gelatinous, simple or alternately branched, bearing at greater or less distances, dichotomously divided, more or less pencilled or tufted ramuli, whose tips are fibrilliferous; axils patent; articulations bi-striate, varying greatly in length; capsules ovate, generally stalked. *Harv. in Hook. Br. Fl.* ii. *p.* 329; *Wyatt, Alg. Danm. No.* 39. *Conf. fibrata, Dillw.! Conf. Syn. p.* 84, *t. G.*

On rocks, stones, and Algæ, in the sea, not uncommon. Annual. Summer and Autumn.—*Stems* 2—10 inches long, densely tufted, dark red-brown, tender and gelatinous, decomposing rapidly in fresh water; *main* thread alternately or sub-dichotomously branched, rather stouter than the branches, which are frequently long and much divided; *lesser* divisions more or less furnished with pencil-like tufts of dichotomously divided ramuli. *Joints* bi-striate, the striæ frequently crossing, those of the main thread sub-opaque, very short at base, becoming longer upwards, in the middle 4—8 times longer than broad, in the lesser ramuli 2 or 3 times. *Tips* of the ramuli truncate, bearing byssoid fibres and antheridiæ. *Capsules* ovate or globose, plentifully scattered over the ramuli; *granules* large, imbedded in the upper ramuli. Mrs. Griffiths finds at Ilfracombe, and Mr. D. Moore at Island Magee, Co. Antrim, a variety which I was once disposed to consider a species, and have distributed it under the MS. name, "*P. fasciculata.*" It differs from the common state in being less branched, the branches more distant, with much denser and more finely divided pencils of ramuli.

22. P. *stricta*, Grev.; filaments densely tufted, setaceous, flaccid, bi-striated, dichotomous; branches and ramuli straight, erect; axils acute; upper articulations 4 or 5 times longer than broad; capsules ovate, sessile. *Hook. Br. Fl.* ii. *p.* 329. *Conf. stricta*, *Dillw. t.* 40.

In the sea, on sand-covered rocks. Not uncommon; *Dillw.*—*Filaments* 2—10 inches high, rising from a mass of creeping fibres. *Colour* dull red or purplish. A very ill-defined, confused species, which I confess I do not understand.

23. P. *pulvinata*, Ag.; filaments rising from a mass of creeping fibres, tufted and interwoven, short, very slender, flexuous, sparingly and irregularly dichotomous, more or less furnished with very patent or recurved, simple ramuli; articulations variable in length, bi-striated; capsules pitcher-shaped, very large, scattered. *P. macrocarpa*, *Harv. in Fl. Hib.* iii. *p.* 296; *Wyatt*, *Alg. Danm. No.* 215.

On rocks and Algæ in the sea. Port Stewart, *Mr. D. Moore.* Miltoun Malbay. Ilfracombe and Torbay, *Mrs. Griffiths* and *Mr. Ralfs.*—*Tufts* dense, intricate, about an inch in height, composed of very slender, capillary, flexuous filaments, variously branched. *Colour* a dull brownish-red or purplish. *Capsules* very large for the size of the plant, several times the diameter of the filament from which they spring. *Substance* soft and flaccid, soon decomposing in fresh water.

24. P. *formosa*, Suhr.; threads exceedingly slender and flaccid, much divided; branches long, flexuous, bearing a second or third series; ramuli scattered, spreading; joints of the main branches many times longer than broad; capsules globose or ovate. *P. formosa*, *Suhr. (I know not where published).* *P. gracilis*, *Grev. MSS.*; *Wyatt*, *Alg. Danm. No.* 216.

On rocks, &c., in the sea. Mouth of the River Dart, *Mrs. Griffiths.* Bute, *Dr. Greville.* Salcombe, *Mrs. Wyatt.* Belfast Bay, *Mr. W. Thompson.*—*Filaments* 6—10 inches high, exceedingly slender and flaccid, much divided, with many long, slender, wavy branches, bearing a second or third series, and ultimately a few irregular, spreading, or erect ramuli. *Joints* of the main branches very long, those of the ramuli shorter, two-tubed. *Capsules* sessile or shortly stalked; *granules* large, in the ramuli, often in beaded strings. I have received specimens nearly agreeing with the British ones, under the name here adopted, from Mr. Senator Binder, of Hamburgh. This species has many points in common with *P. urceolata*, but is a much more slender and flaccid plant, and the capsules are different. Whether it be the *Hutchinsia arachnoidea* of Agardh, I know not.

25. P. *urceolata*, Grev.; threads rigid, setaceous, much branched, loosely entangled; branches dichotomous, erecto-patent, more or less furnished with short, patent, or recurved ramuli; joints bi-striated, those of the main branches 3—5 times longer than broad; of the ramuli, very short; capsules pitcher-shaped, with a produced, contracted mouth, generally stalked. *Hook. Br. Fl.* ii. *p.* 330; *Wyatt, Alg. Danm. No.* 133. *Conf. urceolata, E. Bot. t.* 2365.—*β. patens. P. patens, Grev. Hook. l. c. Conf. patens, Dillw. t. G.*

On rocks, and the larger Algæ, often covering the stems of *Laminaria digitata*. Annual. Summer.—*Stems* 3—9 inches high, dark red, as thick as horse-hair at the base, loosely entangled in large bundles, scarcely attenuated, rigid, not collapsing on removal from the water, and very imperfectly adhering to paper. *Articulations* very variable in length, in different parts of the plant; dissepiments broad and colourless. *β* is less branched, with shorter joints, the branches beset throughout their length with short, recurved ramuli. It is the *P. patens* of authors, and of 'British Flora,' in which work I have expressed doubts whether it be specifically distinct from *P. urceolata*. A longer acquaintance with the subject induces me, unhesitatingly, to unite them. *β* is generally found on the stems of *Laminaria digitata*; *a* on rocks, but not invariably so.

6. *Main stems rigid, cartilaginous, jointed, multi-striate; ramuli flaccid, slender.*

26. P. *elongata*, Grev.; stems robust, cartilaginous, irregularly branched, beset, especially toward the tips, with slender, tufted, multifid ramuli, which are attenuated at base; joints about as long as broad, those of the stem reticulated with veins. *Harv. in Hook. Br. Fl.* ii. *p.* 333; *Wyatt, Alg. Danm. No.* 40. *Conf. elongata, E. Bot. t.* 2429.—*β. denudata;* filaments nearly opaque, distorted, beset with wart-like excrescences and bare of ramuli. *Ceramium brachygonium, Lyngb. Hyd. Dan. t.* 36.—*γ. sanguinolenta;* ramuli forming broad, dense tufts, of a fine crimson, mostly at the tips of the branches. *Ag. Sp. Alg.* ii. *p.* 85. *P. rosea, Grev.! Fl. Edin. p.* 310.

In the sea, on stones, shells, corallines, &c. Biennial. Spring. β and γ are perhaps rather *states* of the plant than distinct varieties. *Stems* 6—12 inches high, as thick as whip-cord, tapering to the base and apex, irregularly branched; the branches erect or spreading, producing the first season but few ramuli. In the winter these ramuli fall off, leaving the branches bare, and the tips broken; but early in spring, broad tufts of crimson, multifid ramuli, 1 or 2 inches or more in length, issue from the tips and upper part of the branches, and on these the fruit is borne. *Capsules* ovate, sessile, either in clusters or scattered; *granules* either imbedded in the ramuli, or borne in minute, pod-like processes of the branches. *Stems* scarcely adhering to paper; ramuli very flaccid, and closely adhering.

27. P. *elongella*, Harv.; stems setaceous, rigid, sub-dichotomous; branches very patent, beset with flaccid, somewhat tufted, elongated, multifid ramuli, not tapering at base; joints of the branches about as long as broad, those of the ramuli rather longer, both marked with three parallel veins; dissepiments pellucid. *Harv. in Hook. Br. Fl.* ii. *p.* 334; *Wyatt, Alg. Danm. No.* 84.

On rocks, &c., in the sea. Biennial. Spring. Sidmouth and Torbay, *Mrs. Griffiths* and *Miss Cutler*. Dublin Bay, *Miss Ball*. Belfast Bay, *Dr. Drummond* and *Mr. Thompson*. Larne, *Mr. D. Moore*.—*Stems* 2—4 inches high, in the lower part rigid, cartilaginous, and as thick as hogs' bristles, attenuated upwards to a capillary fineness; main branches distant, very patent or divaricated; ramuli more or less crowded, sometimes densely tufted, straight, dichotomous, somewhat tapering to the apex, not at all contracted at the base. *Articulations* distinctly visible in all the main branches, obscure towards the root; veins *all parallel*. *Colour* of the stems brownish, of the ramuli rose-red. *Capsules* large, ovate, scattered on the ramuli. This closely resembles small specimens of *P. elongata*, but is easily and clearly distinguished by the distinctly jointed branches, and the *parallel* (not *reticulated*) veins which they contain. It probably undergoes similar changes.

28. P. *byssoides*, Grev.; stems rigid, setaceous, cartilaginous, alternately or distichously branched; branches decomposito-pinnate, patent; more or less densely clothed with minute, slender, dichotomous, single-tubed, byssoid ramuli; joints of the stem variable in length, 3 or 4 striate; the striæ parallel. *Harv. in Hook. Br. Fl.* ii. *p.* 334; *Wyatt, Alg. Danm. No.* 85. *Conf. byssoides, E. Bot. t.* 547.

On rocks, &c., in the sea. Annual. Summer. Abundant on the eastern and southern shores of England and Ireland; rare in Scotland and the west of Ireland. Frith of Forth, *Dr. Richardson*. Ayrshire, *Mr. W. Thompson*. Bantry, *Miss Hutchins*. Malbay.—*Frond* 4—12 inches long; *stem* undivided, branched in a pinnate or bi-tripinnate manner; branches simple, attenuated, the lower ones longest, gradually diminishing upwards; the lesser divisions more or less densely clothed with slender, single-tubed, once or twice forked, spreading, byssoid fibres or ramuli, which give the frond a beautifully feathery appearance. *Substance* sometimes rigid, and the byssoid ramuli squarrose; sometimes soft and flaccid. *Capsules* ovate,

generally solitary. *Colour* a fine clear red, which quickly becomes brown on exposure to the air, or in drying.

LVI. Dasya. Ag.

Frond filamentous; main stems inarticulate, cartilaginous, beset with jointed, pencilled or pinnate, single-tubed ramuli. *Fructification* double: 1, ovato-acuminate capsules, furnished with a terminal pore, and containing pear-shaped seeds; 2, lanceolate *receptacles* (*stichidia*), containing granules ar ranged in transverse bands.—Name, δασυς, *hairy;* the ramuli being capillary.

1. D. *coccinea*, Ag.; stems robust, distichously branched; branches bipinnate; pinnulæ multifid, their articulations as long as broad. *Hook. Br. Fl.* ii. *p.* 335; *Wyatt, Alg. Danm. No.* 41. *Conf. coccinea, E. Bot. t.* 1055.—β. *tenuior;* more slender in all its parts. *Dillw.*—γ. *denudata;* branches naked, ramuli squarrose, minute, sub-simple. *Ceramium patens, Grev. Crypt. t.* 261

In the sea, frequent; more rare in Scotland. Frith of Forth, *Dr. Greville.* β, Devonshire, *Mrs. Griffiths.* Bantry, *Miss Hutchins.* Not uncommon. γ, Appin, *Capt. Carmichael.* Bute, *Dr. Greville.* Whitsand Bay, *Mr. Arnott.* Annual. Summer.—*Stems* 6—8 inches high, as thick as small twine, rough with minute, hair-like fibres, a quarter of a line in length, generally undivided, set with alternate, distichous, bipinnated branches, which gradually become shorter upwards; pinnulæ multifid. Stem and branches inarticulate, the lesser pinnæ imperfectly jointed; composed of several tubes; ultimate ramuli subulate, acute, single-tubed, jointed, the joints short. *Capsules* at the base of the ramuli, ovate, slightly acuminate, containing a round mass of unequal seeds. *Stichidia* oblong-acuminate, containing one or two rows of ternate granules. *Colour* a fine crimson, becoming scarlet. *Substance* cartilaginous, imperfectly adhering to paper.

2. D. *ocellata*, Harv.; stems sub-simple, beset on all sides with long, erecto-patent, dichotomous, pencilled ramuli; articulations 3 or 4 times longer than broad; receptacles lanceolate, attenuated, marked with transverse bands of granules. *Harv. in Hook. Br. Fl.* ii. *p.* 335; *Wyatt, Alg. Danm. No.* 179. *Ceramium ocellatum, Grateloup. Dasya simplicius cula, Ag. Sp.* ii. *p.* 122.

On mud-covered rocks in the sea, rare. Abundant on the Pier at Torquay, *Mrs. Griffiths.* Whitsand Bay, *Dr. Arnott.* Wicklow.—*Stems* tufted, 1 or 2 inches high, simple or with 3 or 4 branches, setaceous, opaque, inarticulate, striate with veins, densely covered with ramuli, which are specially crowded round the tips of the branches, giving them a strikingly obtuse appearance. *Ramuli* 3—5 lines long, slender, erect, several times forked, the apices elongated. *Joints* of the ramuli long. *Colour* a brown.

ish or bright purple. *Receptacles* lanceolate, acuminate, nearly as long as the ramuli, sessile or shortly stalked, containing dark purple granules, closely set in transverse bands. These receptacles are commonly produced; the *capsules* have not yet been found in this country.

3. D. *Arbuscula*, Ag.; stems much and irregularly branched, beset on all sides with short, divaricating, dichotomous ramuli, whose articulations are about twice as long as broad; receptacles oblong, with a mucro. *Ag. Sp. Alg.* ii. *p.* 121. *Conf. Arbuscula, Dillw. t. G. (excl. syn. Brownii, and Dillw. t.* 85*). D. Hutchinsiæ, Harv. in Hook. Br. Fl.* ii. *p.* 335.

On rocks in the sea. Not uncommon on the shores of Ireland and Scotland. Remarkably fine at Bantry, *Miss Hutchins.—Stems* 2—4 inches high, tufted, much branched; branches alternate, bearing a second or third series, and densely clothed with dichotomous, divaricate ramuli, about a line in length, which give the plant a rounded appearance; tips of the branches blunt. *Colour* generally a pale reddish-brown, sometimes deep red; substance flaccid. *Capsules* ovate, with a much-produced, sub-cylindrical point, containing pear-shaped seeds. *Receptacles* oblong, suddenly acuminate, or obtuse with a mucro, containing two or three rows of ternate granules. Very distinct from the last in habit and character. Much confusion has been caused by Dillwyn's having, in the Synopsis to his *Confervæ*, confounded the present plant with *Conferva Arbuscula* of Brown, which he had already figured and described at t. 85 of his work, and which is the *Callithamnion Arbuscula* of 'Brit. Flora.' Of Mr. Brown's plant, the *original Conf. Arbuscula*, Dillwyn appears to have had but one specimen, while of the present plant he had many, which he seems to have almost exclusively distributed as the *Conf. Arbuscula* of his work. As such he communicated specimens to Agardh, who thereon founded his *Dasya Arbuscula*, quoting Dillwyn's figures of *both* plants; thus perpetuating the confusion. Deceived by this double quotation, I rather hastily inferred in the 'British Flora,' that Agardh's *Dasya Arbuscula* must be regarded as a synonyme of *Callithamnion Arbuscula*, and accordingly gave the name of Miss Hutchins, its discoverer, to the present plant. I am indebted to Mr. Agardh, jun., for having set me right on this point, and for a specimen of his father's plant, which exactly agrees with ours.

LVII. Ceramium. Adans. Ag.

Filaments articulated, mostly dichotomous, reticulated with veins; dissepiments opaque. *Fructification* double: 1, *capsules*, with a membranaceous pericarp, simple or lobed, generally subtended by one or two short ramuli, and containing numerous angular seeds; 2, oblong *granules*, partially imbedded in the joints of the lesser ramuli.—Name, κεραμος, a *little pitcher;* in allusion to the shape of the capsules in the original species, but, as the genus now stands, the resemblance is not striking.

1. C. *rubrum*, Ag.; filaments setaceous, cartilaginous, irregularly branched, reticulated with veins; joints coloured;

dissepiments contracted. *Hook. Br. Fl.* ii. *p.* 336; *Wyatt, Alg. Danm. No.* 42. *Conf. rubra, E. Bot. t.* 1166.

On rocks and other Algæ in the sea, very common.—*Frond* 6—12 inches long, as thick as a hog's bristle, exceedingly variable in ramification, the main stems sub-dichotomous, beset more or less with alternate or secund, simple, forked, or dichotomous ramuli, of various lengths, more or less distinctly jointed, the joints generally coloured, cellular. *Capsules* globose or lobed, subtended by short ramuli, borne on the lesser branches. *Granules* prominent in the joints. *Colour* varying from a full to a pale red, or near high-water mark, to yellowish. A most variable plant, whose endless forms the young botanist is sure to gather as so many species.

2. C. *diaphanum*, Ag.; filaments setaceous, irregularly branched, set with lateral, slender, dichotomous ramuli; joints colourless, those of the main stems 3 or 4 times as long as broad, of the ramuli short; dissepiments swollen, opaque; apices hooked inwards; capsules near the tips of the branches, subtended by ramuli. *Hook. Br. Fl.* ii. *p.* 336; *Wyatt, Alg. Danm. No.* 87. *Conf. diaphana, E. Bot. t.* 1742.

On rocks, &c., in the sea, common. Winter and summer.—*Stems* tufted, 2—6 inches high, from the thickness of hogs' bristles to finer than hair, irregularly or sub-dichotomously branched, the branches set at greater or less intervals with short or long dichotomous ramuli, two lines to half an inch long, which are constantly greatly more slender than the branches from which they spring, generally not more than a quarter their diameter; the tips either straight, or far more generally hooked inwards. The whole frond is distinctly jointed, the dissepiments darkly coloured, the intervals (which vary greatly in length) pellucid, giving the filament a beautifully variegated appearance. *Capsules* near the tips of the branches, roundish or somewhat lobed, generally subtended with one or two short ramuli; *granules* prominent, large, with a pellucid case, seated in the coloured portion of the joints. This species varies greatly in the length of the joints and in the comparative diameter of the filament.

3. C. *fastigiatum*, Harv.; filaments capillary, equal throughout, dichotomous, level-topped; dissepiments opaque; lower articulations colourless, 3 or 4 times longer than broad, upper coloured, short. *Harv. in Hook. Journ. Bot. p.* 303; *Wyatt, Alg. Danm. No.* 87.

On rocks, &c., in the sea. Torquay, &c., *Mrs. Griffiths.*—*Filaments* 4 or 5 inches high, very slender, nearly of equal diameter throughout, regularly dichotomous from the base; the lower axils distant, the upper very close, many times forked; the apices fastigiate and hooked inwards. *Lower articulations* generally 3 or 4 times as long as broad, colourless; upper very short, rosy; dissepiments opaque, swollen, purple. *Substance* tender and flaccid. *Colour* of the tuft, dark purple. This is usually a much more slender plant than the preceding, but, in all cases, it is well distinguished by the regularly dichotomous ramification, and the fastigiate tips. The merit of distinguishing it correctly is due to *Mrs. Griffiths.*

4. C. *Agardhianum*, Griff.; filaments sub-setaceous, rigid,

irregularly dichotomous, the branches set with simple or forked, slender ramuli, with straight, spreading points; joints colourless, variable in length; dissepiments dark coloured; capsules large and irregular in form, scattered over the main branches. *Wyatt, Alg. Danm. No.* 218.

On rocks in the sea. Pier, Torquay, *Mr. J. G. Agardh* and *Mrs. Griffiths.* Belfast Bay, *Mr. Templeton.*—*Stems* 3 or 4 inches high, much branched in an irregularly dichotomous manner, the branches more or less furnished with simple or forked, slender ramuli, about one third the diameter of the part from which they spring; the tips spreading, not hooked in. The whole frond variegated with dark purple; the joints transparent. To the naked eye the tuft has a blackish look; the substance is rigid, cartilaginous, and it adheres pretty fully to paper. *Capsules?* very irregular in form and size, having a distorted appearance, usually lobed, bursting from the stems over which they are thickly scattered, destitute of involucral ramuli; *granules* large and very prominent, seated in the joints, *often of the same plant which bears "capsules."* I introduce this with much hesitation, on the authority of *Mrs. Griffiths*, supported I understand by *Dr. Greville* and *Mr. Agardh, jun.* (to whom it is dedicated). It is distinguished from *C. diaphanum* by its blackish colour; the straight tips of the ramuli, a character which, however, sometimes occurs in *diaphanum;* and especially in the *fructification*, which to me has a diseased appearance. I fear it can only be looked on as a variety of *C. diaphanum.**

5. C. *ciliatum*, Ducluz.; filaments rigid, dichotomous, fragile; articulations colourless; joints furnished with whorled or solitary prickles; apices remarkably involute. *Harv. in Hook. Br. Fl.* ii. *p.* 336; *Wyatt, Alg. Danm. No.* 180.—*β. acanthonotum*, Carm.; ciliæ unilateral, solitary on the outer side of the articulations.

On rocks, corallines, &c., in the sea. Both varieties frequent on rocky shores.—*Stems* tufted, somewhat fastigiate, dichotomous, the divisions rather distant below, very close above, the tips strongly hooked inwards. Occasionally the lower part of the stem is beset with short, dichotomous ramuli, like those of *C. diaphanum*, which this plant strongly resembles, but from which it may at all times be known by its rigid, harsh substance, and, microscopically, by the thornlike ciliæ which spring from the joints, either whorling them or confined to one side. *Capsules* large, globose or lobed, near the tips, subtended by short ramuli. *Granules* prominent, in the coloured part of the joints.

LVIII. Spyridia. Harv.

Main filaments inarticulate, cartilaginous, beset with jointed ramuli; dissepiments opaque. *Fructification:* 1, trisporous *capsules*, with colourless margins, clustered round

* "This has been described by French Algologists under the name of *Cer. Deslongchampii.*"—*Mr. Agardh, jun., in a letter to Mrs. Griffiths, received since the above was written.*

the bases of the ramuli; 2, stalked, gelatinous *receptacles*, with membranaceous pericarps, often surrounded by an involucre of short ramuli, containing two or three masses of roundish granules.—Name, Σπυρις, a *basket;* in allusion to the appearance of the receptacles.

1. S. *filamentosa. Harv. in Hook. Br. Fl.* ii. *p.* 337; *Wyatt, Alg. Danm. No.* 88. *Conf. Griffithsiana, E. Bot. t.* 2312.

Southern shores of England. Southampton, *Miss Biddulph.* Torquay and Sidmouth, *Mrs. Griffiths.*—*Stems* tufted, many rising from a broadly expanded disk, thick, 2—8 inches high, irregularly branched, cartilaginous, densely cellular, with an obscure appearance of articulation; branches beset with short, hair-like, simple or subdivided, scattered ramuli. *Colour* a dull red, fading to brownish. A curious plant, and extensively distributed over the world. It is found in the Indian and Pacific Oceans, and in the Mediterranean.

LIX. Griffithsia. Ag.

Frond rose-red, filamentous; *filaments* articulated throughout, mostly dichotomous; ramuli single-tubed, often whorled; dissepiments hyaline. *Fructification* double: 1, clustered *capsules*, with colourless borders; 2, roundish, gelatinous, involucrated *receptacles*, (*favellæ*), including minute granules. —Named in honour of *Mrs. Griffiths*, of Torquay, Devonshire, to whose numerous discoveries and accurate observations, the marine botany of Great Britain is indebted for much of its present advancement.

* *Branches set with short ramuli.*

1. G. *equisetifolia*, Ag.; stems robust, cartilaginous, whorled throughout with closely imbricated, incurved, many times dichotomous ramuli. *Hook. Br. Fl.* ii. *p.* 337; *Wyatt, Alg. Danm. No.* 181. *Conf. equisetifolia, E. Bot. t.* 1479.

On the shores of England and the west of Ireland, frequent. Rare in Scotland. Frith of Forth, very rare, *Mr. Yalden.* Perennial. Summer. —*Stems* 3—8 inches high, a quarter of a line to nearly a line in diameter, inarticulate, much and irregularly branched; the chief divisions more or less beset with shorter branches, of half an inch to an inch in length, simple, and (including their ramuli) fusiform, tapering to the apex and base; the whole frond beset at distances of about half a line with incurved, dichotomous, jointed ramuli, about a line long and overlapping each other. The joints of these ramuli about 4 times as long as broad, swollen upwards. *Colour* a fine rose-red, sometimes brownish. The fructification remains imperfectly known.

2. G. *simplicifilum*, Ag.; stems slender, irregularly branched,

whorled with imbricated, straight, once-forked ramuli. *Harv. in Mack. Fl. Hib. pt.* iii. *p.* 212.

On rocks in the sea, very rare. On rocks near Black Castle, Wicklow, and among *rejectamenta* at Ardinairy Point, Co. Wicklow.—*Stems* 4—8 inches long, cartilaginous, more slender than those of *G. equisetifolia*, irregularly branched; branches long and mostly simple, much attenuated at the point, densely clothed with short, straight, overlapping, jointed ramuli, 1 or 2 lines long, and once-forked near the base. Occasionally the branches bear, together with these ramuli, jointed, slender branchlets, of the thickness of *G. setacea*, and either naked or beset near the summit with forked ramuli; and in other specimens the principal branches are covered with short rudimentary branches, resembling the larger ones. *Colour* a fine pinky red, very much brighter than in *G. equisetifolia*. *Fructification* unknown.

3. G. *multifida*, Ag.; stems setaceous, distichously branched, pinnate or bipinnate, articulated, each joint bearing a pair of opposite, slender, pinnato-multifid or sub-dichotomous, incurved ramuli; joints many times longer than broad. *Hook. Br. Fl.* ii. *p.* 338; *Wyatt, Alg. Danm. No.* 43. *Conf. multifida, E. Bot. t.* 1816.—*β. pilifera;* ramuli very long, subsimple and hair-like.

On rocks in the sea, rather rare. Frequent on the south coasts of England, in many places. Bantry, *Miss Hutchins*. West of Ireland. Belfast Bay, *Mr. W. Thompson*. *β*, Torquay, *Mrs. Griffiths*.—*Stems* 4—6 inches long, as thick as bristles, undivided, pinnated or bipinnated with one or two series of long, simple, distichous, patent branches, articulated; the joints very variable in length in different specimens, 5—10 times longer than broad, single-tubed, each bearing an opposite pair of slender, pinnato-multifid or sub-dichotomous ramuli, 1 or 2 lines long, which in *β* are much drawn out, half an inch long, and either simple or pinnate. *Colour* a fine transparent rose-red, perishing quickly in the air or in fresh water. *Capsules* minute, elliptical, with a wide border, sessile on the lower part of the ramuli, opposite or secund, occasionally tufted. *Favellæ* roundish, stalked and involucrated, containing minute granules. The ramuli are generally described as dichotomous, but they are only so by abortion; the true mode of branching is pinnate. They are sometimes whorled, but more usually opposite.

*** Stems dichotomous, naked.*

4. G. *barbata*, Ag.; filaments dichotomous, setaceous; articulations 5 or 6 times as long as broad, the uppermost emitting long, opposite, multifid, byssoid fibres. *Hook. Br. Fl.* ii. *p.* 338. *Conf. barbata, E. Bot. t.* 1814.

Thrown up by the sea, extremely rare. Beach at Brighton, *Mr. Borrer*, who, I believe, only found it once, and who has had the kindness to send me a portion of his specimen on talc. Judging from this fragment, which is much faded, *G. barbata* has many points in common with *G. corallina*, from which it chiefly differs in the cobwebby fibres which issue from the upper joints. On these the *capsules* are borne, which are minute, stalked, and clustered about the tips; a strikingly beautiful microscopic object.

5. G. *corallina*, Ag.; filaments dichotomous, incrassated, gelatinous; axils patent; joints 2—4 times longer than broad, swollen upwards. *Hook. Br. Fl.* ii. *p.* 338; *Wyatt, Alg. Danm. No.* 89. *Conf. corallina, E. Bot. t.* 1815.

On rocks, &c., in the sea, rare. South of England, not uncommon. Hartly, Northumberland, *Mr. Winch.* Appin, *Capt. Carmichael.* Dublin Bay. Black Rocks, Portrush, *Mr. D. Moore.* Cork Harbour, *Dr. Harvey.* Belfast Lough, *Mr. W. Thompson.*—*Stems* 2—4 inches high, tender and gelatinous, repeatedly and nearly regularly dichotomous, thicker than bristles, sometimes nearly half a line in diameter, jointed, the joints 2 or 3 times longer than broad, swollen upwards, contracted below, giving the frond the beaded appearance of a coralline. *Fruit:* minute, densely aggregated *capsules*, (?) with wide borders, forming a band or whorl round the joints, near the tips of the branches, and roundish *favellæ*, (?) disposed laterally on the ramuli.

6. G. *setacea*, Ag.; filaments dichotomous, setaceous, rigid, straight; axils acute; joints cylindrical, 5 or 6 times longer than broad. *Hook. Br. Fl.* ii. *p.* 338; *Wyatt, Alg. Danm. No.* 137. *Conf. setacea, E. Bot. t.* 1689.

On rocks, &c., in the sea; not uncommon near low-water mark.—*Stems* 3—6 inches long, setaceous, rather rigid, irregularly dichotomous, jointed; joints cylindrical, 3—6 times longer than broad, either bare of ramuli, or, rarely, throwing out from the joints simple, horizontal, root-like fibres. *Colour* a fine transparent crimson, which is instantly given out with a crackling noise, occasioned by the bursting of the membrane, on coming in contact with fresh water. It stains paper of a fine carmine, which keeps unaltered for many years in the herbarium. *Involucres* raised on lateral, club-shaped stalks, 2 or 3 lines long; their ramuli simple or forked, bearing, on the inner faces, minute, sphærical, crowded, trisporous capsules, with very wide borders. *Favellæ* I have never seen; but *Mrs. Griffiths* finds at Torquay specimens in which the place of the capsules is occupied by minute, ovate bodies, composed of whorls of extremely slender, beaded filaments, invested with jelly. *Mr. Borrer* informs me that specimens in a similar state were many years ago observed by *Miss Biddulph*, a drawing of which he has kindly communicated.

LX. Callithamnion. Lyngb.

Frond filamentous; filaments articulated, mostly pinnate, one-tubed; dissepiments hyaline. *Fructification:* 1, trisporous *capsules*, with colourless borders, scattered on the ultimate ramuli; 2, roundish or lobed, gelatinous *receptacles, (favellæ)*, containing large granules, seated in the main branches.—Name, καλος, *beautiful*, and θαμνος, a *shrub*. In the following descriptions, the term *plumule* is sometimes applied to a pinnated or bipinnated ramulus.

Clavis.

A. *Erect, much branched, not rising from creeping fibres.*

a. Ramuli opposite.
b. Ramuli alternate.

1. *Secondary branches pinnate or plumulate.*

† *Main stems inarticulate (or imperfectly jointed).*

†† *Main stems jointed; joints occasionally veiny.*

* *Plumules subsimply pinnate.*

** *Plumules bipinnate.*

2. *Secondary branches dichotomous.*

B. *Small parasitical species rising from creeping fibres.*

C. *Minute species, parasitical or otherwise, not rising from creeping fibres.*

* *Growing on rocks.*

** *Parasitical on other Algæ.*

A. *Erect, much branched, not rising from creeping fibres.*

a. Ramuli opposite.

1. C. *plumula*, Lyngb.; stems distichously branched, articulated; each joint bearing a pair of short, recurved ramuli, pectinated on their inner margin. *Hook. Br. Fl.* ii. *p.* 339; *Wyatt, Alg. Danm. No.* 138. *Conf. plumula, Dillw. t.* 50. *C. Turneri, E. Bot. t.* 1637, *(not t.* 2339*).*—β, smaller in every part.

In the sea, from Orkney to Devon, not uncommon. β, Devonshire, *Mrs. Griffiths.* Dublin Bay. — *Fronds* 2—5 inches long, distichously branched; the branches alternate or irregular, the upper ones longest and most divided, slender, articulated throughout; every articulation having a pair of opposite, horizontal or recurved ramuli, from a quarter to half a line in length, and about a quarter the diameter of the stem, whose upper margin is pectinated with a second series of subulate branchlets, which, in luxuriant specimens, are often again and again pectinated along their inner faces. *Capsules* minute, sphærical, borne on the tips of the abbreviated pectinate ramuli. *Favellæ* large, lobed, dark red, on the main branches. *Joints* of the stem 3 or 4 times longer than broad, of the ramuli shorter. *Colour* a fine rose-red. *Substance* flaccid and tender.

2. C. *cruciatum*, Ag.; irregularly divided; branches linear, sub-simple, articulated, each joint having two or four opposite or quaternate, slender, erect, pinnated ramuli. *Hook. Br. Fl.* ii. *p.* 339; *Wyatt, Alg. Danm. No.* 182.—β. *pumilum;* much smaller, the ramuli more dense, and joints shorter. *Cal. pumilum, Harv. in Hook. Br. Fl.* ii. *p.* 339.

On mud-covered rocks in the sea, rare. Abundant on the Pier, Torquay, *Mrs. Griffiths.* Salcombe, *Mrs. Wyatt.* Cork Harbour, *Dr. Harvey.* Coast of Down, *Mr. W. Thompson.* β, at Miltoun Malbay.—*Stems* 1 or

2 inches high, irregularly divided into a number of long, sub-simple branches, which sometimes bear a second or third series; branches linear, jointed, each joint furnished with two opposite or four cruciate, slender, pinnate or occasionally simple, erecto-patent ramuli, from a quarter of a line to a line in length, crowded at the tips of the branches, which, to the naked eye, have a peculiar thickened and darkened appearance. *Colour* a brownish red. *Substance* flaccid. *Capsules* elliptical, dark red, seated on the shortened pinnules of the ramuli. *Favellæ* unknown. Having lately had an opportunity of studying this species in its habitat at Torquay, and finding it to vary much in size, and in the length and composition of the ramuli, I do not hesitate to reduce *C. pumilum* to it as a variety.

b. Ramuli alternate.

1. *Secondary branches pinnate or plumulate.*

† *Main stems inarticulate, or imperfectly jointed.*

3. C. *Arbuscula*, Lyngb.; stems naked below, robust, cartilaginous, main branches set with shorter branches, which are densely clothed on all sides with minute, imbricated, pinnated ramuli (or plumules); ultimate pinnules simple or forked, recurved, acute, their joints twice as long as broad; capsules lining the inner faces of the pinnules. *Harv. in Hook. Br. Fl.* ii. *p.* 340. *Conferva Arbuscula, R. Brown! Dillw.! t.* 85; *E. Bot. t.* 1916? *Dasya spongiosa? Ag.*

On rocks and stones in the sea. Perennial. Common on the northern and western shores of Scotland and Ireland. Very rare on the eastern shores of Scotland. Frith of Forth, *Drs. Greville* and *Arnott.*—*Stem* cartilaginous, inarticulate, as thick as crow-quill at base, 3—8 inches long, shaggy with fibres, but destitute of branches below, more or less divided above, the branches set with a second and third series similar to themselves, but shorter, the smallest about two lines long; all quadrifarious and densely clothed on all sides with minute, pinnated ramuli or plumules. These latter are not a quarter of a line long, simply pinnate, the pinnæ long, subulate, very patent or falcato-reflexed. *Joints* of the ramuli once and a half or twice as long as broad. *Capsules* sphærical, with wide borders, lining the inner face of the ramuli. *Favellæ* roundish or lobed, mostly in pairs. *Colour* a very dark vinous-red. *Substance* of the stem cartilaginous, of the ramuli flaccid. This is the original *Conferva Arbuscula* of Brown, whose specimens I have examined. The figure in 'Eng. Bot.' is not very characteristic: that of Dillwyn is better, except the colour, which is far too bright.

4. C. *Brodiæi*, Harv.; stem sub-opaque, spuriously articulated, slender, simple; branches laxly set with short, quadrifarious plumules; ultimate pinnules erecto-patent, obtuse, sub-simple; capsules roundish, sessile near the tips of the ramuli, mostly solitary. *Hook. Br. Fl.* ii. *p.* 340; *Wyatt, Alg. Danm. No.* 184.

In the sea, on other Algæ, rare. Forres, *Mr. Brodie.* Coast of Northumberland, *Mr. Robertson.* Torquay, *Mrs. Griffiths* and *Miss Cutler.*

Cornwall, *Mr. Ralfs*. Annual. Spring.—*Stems* 1—3 inches high, generally undivided, as thick or thicker than hogs' bristles at base, attenuated upwards, inarticulate or with imperfect joints, (which are about twice as long as broad, and full of veins), closely beset throughout its whole length with long, simple, quadrifarious branches, of which the lowest are longest, becoming gradually shorter upwards, often again furnished with a second or even third series, and all furnished at the (more or less perfect) joints with short, pinnated ramuli or plumules; the pinnules erecto-patent, either simple or having a few secund or alternate pinnulæ, tapering upwards, but not to an acute point. *Joints* of the ramuli about twice as long as broad. *Capsules* globose, on the inner face of the ramuli near the tip, generally solitary, occasionally 2 or 3 together. *Favellæ* roundish, large, solitary, or in pairs, borne by the lesser branches. *Colour* a brownish-red. *Substance* cartilagineo-membranaceous, flaccid. The general outline of the frond is ovate. Specimens bearing *favellæ* are more delicate and transparent in the stem than the others.

5. C. *Hookeri*, Ag.; stem setaceous, inarticulate or spuriously jointed, simple, set with one or more series of alternate, spreading, flexuous branches, the smaller of which are jointed; all furnished with very patent, pinnated ramuli or plumules; ultimate pinnules divaricating, their joints twice or thrice as long as broad; capsules along the inner faces of the ramuli near the base. *Harv. in Hook. Br. Fl.* ii. *p.* 341. *Conf. Hookeri, Dillw. t.* 106. *C. lanosum, Harv. l. c.*; *Wyatt, Alg. Danm, No.* 139.

On rocks and Algæ in the sea. Annual. Spring and summer. Cawsie, *Messrs. Hooker* and *Borrer*. Belfast Lough, *Mr. Templeton*. Holyhead, *Rev. H. Davies*. Torquay and Ilfracombe, *Mrs. Griffiths*. Killiney. Youghall, *Miss Ball.*—*Stem* 1—3 inches high, setaceous, inarticulate or spuriously jointed, (the joints short and filled with veiny fibres), closely furnished throughout with long, simple branches, similar to itself, which again bear a second or third set, either quadrifarious or sub-distichous, flexuous; the lesser ones jointed, and at the joints bearing very patent, pinnated ramuli or plumules, which are sometimes naked at the base, and either simply or bipinnated above, all the pinnules very patent or divaricating. *Joints* twice or thrice as long as broad. *Capsules* along the inner face of the ramuli near the base, either solitary or 2 or 3 together. *Favellæ* large, on the branches, irregular. *Colour* a brownish or rosy-red, in some states preserved in drying, at other times very fugacious. The specimens of this plant from North Devon and from the south of Ireland, are much more robust and deeper coloured, and of a less delicate substance than those from Torbay and the east of Ireland, and, at first sight, strikingly resemble *C. Brodiæi*, while the latter come nearer *C. roseum*. A re-examination of the original *Conferva Hookeri*, and comparison with various varieties of *Cal. lanosum*, 'Br. Fl.' induce me to unite the latter to the former. It is certainly a very variable plant, but the varieties run insensibly into each other.

†† *Main stems more or less distinctly jointed.*

* *Plumules simply pinnate.*

6. C. *roseum*, Ag.; stems much and loosely branched;

secondary branches long, flexuous, sub-distichously plumulate; plumules lax, with a roundish outline, crowded towards the tops of the branches; pinnules long, patent, sub-simple and flexuous; main joints 4 or 5 times, those of the pinnæ 2 or 3 times longer than broad; capsules elliptical, scattered, near the base of the pinnæ. *Harv. in Hook. Br. Fl.* ii. *p.* 341; *Wyatt, Alg. Danm. No.* 44. *Conf. rosea, E. Bot. t.* 966.

In the sea, on mud-covered rocks and Algæ. Annual. Summer. Yarmouth, *Messrs. Turner* and *Borrer*. Torquay, *Mrs. Griffiths*. Bantry Bay, *Miss Hutchins*. Arran, Co. Clare, *Mr. Mackay*.—*Stems* 3 or 4 inches long, setaceous, in young plants jointed, in older opaque and full of veins, set throughout with long, more or less quadrifarious, patent branches, which are several times irregularly pinnated, till the plant acquires an excessively branched, entangled character; branches furnished more or less abundantly with long, simply or sub-simply pinnated plumules, which are usually crowded in the upper part of the branches, giving the tips (especially of young plants) a dense appearance; the ultimate ramuli elongate, slender, the lower ones usually simple, the upper occasionally pinnulate in the upper part. *Capsules* elliptical or sphærical, on the inner faces of the ramuli, 2 or 3 together or solitary. *Favellæ* two or more together on the branches. *Colour* in young specimens a fine purple-red, in old brownish, becoming brighter in fresh water.

7. C. *byssoides*, Arnott; stems extremely slender, flaccid and byssoid, much divided; branches linear-lanceolate, set with long, slender, flexuous, sub-simply pinnate plumules; joints of the branches eight times, of the ramuli four times longer than broad; capsules solitary, sessile on the pinnæ. *Harv. in Hook. Br. Fl.* ii. *p.* 342; *Wyatt, Alg. Danm. No.* 185.

In the sea, on other Algæ. Whitsand Bay, *Dr. Arnott*. Devonshire, *Mrs. Griffiths*. Salcombe, *Mrs. Wyatt*. Portaferry, Strangford Lough, *Mr. W. Thompson*.—*Stems* extremely tender, flaccid and gelatinous, much divided from the base, either with several principal branches thicker than the rest, which bear a great number of lesser branches, or wholly composed of slender, byssoid branches, inextricably entangled together, the main stems in the coarser specimens full of veins; branches having a linear-lanceolate outline, tapering to a point, clothed with long, slender, sub-simply pinnate ramuli, either quadrifarious or distichous, all the divisions alternate. *Joints* of the stem many times longer than broad, of the ramuli about four times longer than broad. *Capsules* elliptical, solitary near the base of the ramuli. *Favellæ* sessile on the stems, frequently three-lobed. This species has the habit and substance of *Cal. corymbosum*, with which, at one time, I was disposed to unite it: the branching is different.

8. C. *polyspermum*, Ag.; tufts globose; filaments slender, delicate, loosely branched, somewhat naked below, distichously plumulate above; plumules linear-oblong (in outline); pinnæ short, simple, patent, acute, spine-like; articulations

of the branches 4 or 5 times, of the ramuli twice as long as broad; capsules lining the inner faces of the pinnæ. *Harv. in Hook. Br. Fl.* ii. *p.* 342; *Wyatt, Alg. Danm. No.* 140.

On rocks in the sea, not uncommon. Annual. Spring and summer. Torquay, *Mrs. Griffiths*. Sussex Coast, *Mr. Borrer*. Appin, *Capt. Carmichael*. Mt. Edgecombe, *Mr. Arnott*. Dunree, Donegal, *Mr. R. Brown*. Youghal, *Miss Ball*. North of Ireland, *Dr. Drummond*, *Mr. Thompson*, and *Mr. Moore*.—*Tufts* globose, 1—3 inches in diameter, dense; stems sub-simple below, much branched above in a fan-like manner; the branches several times divided and set with lesser branches, all the larger ones having spine-like, alternate, subulate, short ramuli, the larger pinnated with a second series, the uppermost ones occasionally still more compound; all the ramuli spreading, sometimes reflexed. *Joints* of the stem and branches torulose, with a narrow tube. *Capsules* profuse, sphærical. *Favellæ* large, roundish or ovate, binate. *Colour* a dull rose-red or purplish. In drying it adheres less perfectly than some others to paper.

9. C. *tetricum*, Ag.; rigid; branches densely ramulose, shaggy below, plumulate above; plumules crowded, quadrifarious, simply pinnate; pinnæ acute, basally attenuate, erecto-patent; articulations 2 or 3 times longer than broad; capsules elliptical, minute, on short, lateral processes of the pinnules. *Harv. in Hook. Br. Fl.* ii. *p.* 342; *Wyatt, Alg. Danm. No.* 141. *Conf. tetrica, E. Bot. t.* 1915.

In the sea, generally growing on the perpendicular faces of rocks, at half-tide level. Perennial. Common on the rocky coasts of England, and of the west and south of Ireland.—*Fronds* 2—8 inches long, divided into several principal branches, closely covered with long, peculiarly straight and rigid, pinnated ramuli, mixed with simple or irregularly branched ones; the branches having a coarse, ropy character. *Plumules* simply pinnated, the pinnæ erecto-patent, contracted at base, attenuated upwards. *Colour* a dull brownish-red. *Substance* more rigid than in most, imperfectly adhering to paper, very fragile if moistened after having once been dried. *Articulations* uniformly about once and a half as long as broad. *Capsules* 1—3 on each lateral process. *Favellæ* generally in pairs, minute, seated on the pinnæ, and nearly terminal, figured and described as *capsules* by Dillwyn.

10. C. *tetragonum*, Ag.; stem robust, naked below, simple, pinnate or bipinnatedly branched; branches patent, set with short, alternate, spreading plumules, which are pinnate below, and fasciculately multifid above; joints once and a half as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 334; *Wyatt, Alg. Danm. No.* 90. *Conf. tetragona, E. Bot. t.* 1690. *Cal. granulatum, Harv. l. c. (not of Agh.)*

In the sea, on the larger Algæ, frequent; often on *Codium tomentosum*. Annual. Summer.—*Fronds* 3—6 inches long, stem thicker than a hog's bristle at base, gradually attenuated upwards, repeatedly branched alternately, the branches irregularly quadrifarious, the lowest longest, and set with one or more series of lesser branches, the upper gradually shorter and

more simple; the general outline of the frond being ovate, with its principal divisions tapering to the apex. *Stem* more or less obscurely jointed, naked or clothed with squarrose ramuli; branches set with quadrifarious or sub-distichous, alternate, pinnato-multifid, minute ramuli, about half a line in length, contracted at base and acuminate at apex. *Substance* firm, cartilagineo-membranaceous. *Capsules* excessively minute, sessile, elliptic or roundish, secund, on the upper ramuli. *Favellæ* solitary or in pairs, large. *Colour* full or brownish-red, becoming darker in drying. The *Cal. granulatum* of 'Br. Flora,' (not of Agardh), differs from the common state in being more slender, having more erect and level-topped plumules, awl-shaped pinnules, and rather longer joints. It generally grows on *Codium tomentosum*.

11. C. *purpurascens*, Sm.; "purplish-red, repeatedly branched, very slender and tufted, joints slightly turned, thrice as long as broad, with pellucid partitions, those of the main stems compound; capsules lateral, sessile." *Smith. E. Bot. t.* 2465; *Hook. Br. Fl.* ii. *p* 343.

"Gathered on the beach at Brighton by *Mr. W. Borrer*, who thinks it may be *C. purpurascens* of Hudson." *Sm.*—With this I am quite unacquainted. Mrs. Griffiths informs me she has specimens gathered in Cornwall, so named by *Dawson Turner* and *Dr. Goodenough*, that are identical with *Cal. Brodiæi*.

12. C. *fasciculatum*, Harv.; tufted; branches erect, flexuous, level-topped; plumules elongate, erect, linear-obovate, truncate; pinnæ long and flexuous, the lowermost simple, appressed, the upper erecto-patent, ramulose at the tip; articulations of the branches thrice, of the pinnæ once or twice as long as broad, sub-torulose. *Harv. in Hook. Br. Fl.* ii. *p*. 343.

At Yarmouth, *Mr. Borrer.*—2 or 3 inches high, nearly naked at the base, much branched and tufted upwards, bushy, very slender; the apices of the branches looking, to the naked eye, as if truncated or corymbose; branches long and flexuous, very erect, their upper half closely plumulate, the plumules long and appressed. *Colour* a fine purple-red. *Articulations* of the main stem nearly opaque, composed of jointed fibres. *Capsules* rare, sub-solitary, elliptical, at the base of the pinnæ. This description, which I now transfer from '*Br. Fl.*' was taken from a specimen in Sir W. Hooker's herbarium, marked *C. Borreri*. It did not appear to me to be the same with *Borreri*, a species with which, at that time, I was but little acquainted, but having in the interval seen many anomalous varieties of the latter, I fear that the present must be looked on as a very doubtful species. I have never seen more than Mr. Borrer's specimen.

13. C. *Borreri*, Ag.; sub-simple below, much branched in a fan-like manner above, rigid or flaccid; upper branches set with distichous plumules which are bare of ramuli below, closely pinnate above; pinnæ long, patent, simple (or ramulose at tip), the lowermost longest; articulations of the branches 2—5 times, of the ramuli about twice as long as broad;

capsules minute, solitary near the base of the pinnæ. *Harv. in Hook. Br. Fl.* ii. *p.* 344. *Conf. Borreri, E. Bot. t.* 1741. *Cal. seminudum, Ag.! Harv. l. c.*; *Wyatt, Alg. Danm. No.* 187.

On rocks in the sea, rare. Yarmouth, *Mr. Borrer.* Pier, Torquay, *Mrs. Griffiths.* Ilfracombe, *Mr. Ralfs.*—*Filaments* sub-simple and somewhat bare of branches, or merely set with short ramuli below, much branched in a fan-like manner above, the branches having a roundish general outline, the tips even of the lesser divisions being singularly blunt and rounded; upper branches furnished with distichous, alternate plumules, which are bare of ramuli below, and closely pinnate in their upper half, the lowermost pinnæ being longest, and some of them occasionally pinnulate towards the tips. *Substance* either rigid or very flaccid and membranaceous, a difference which probably depends on age and situation. *Colour* a full or pale rose-red, given out to fresh water. Some specimens have a very straggling look, the chief divisions being set with irregular ramuli, having something the character of a young plant of *C. tetricum*, the uppermost branches only having a few plumulate ramuli. On examination of numerous specimens, in different states, and from various localities, I am induced to unite *C. seminudum* of Agardh and of 'Br. Fl.' with the older species *C. Borreri*. The chief differences I can find are, that the state called *Borreri* is more flaccid, of paler colour, more laxly branched, and having rather longer joints; differences which, in such variable plants, are not of much value. The Irish station, doubtfully given by Mr. Thompson in "Mag. Nat. Hist.' ix. p. 149, is incorrect.

14. C. *affine*, Harv.; much branched; secondary branches of a roundish outline, long, alternately plumulate; plumules very narrow, linear-clavate, simply pinnate; pinnæ short, erect, increasing in length upwards, attenuate, crowded at top; articulations of branches 3 or 4 times, of pinnæ once and a half as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 344.

Shores of Bute, on Fuci, *Dr. Greville.*—Excessively branched, 2 or 3 inches high, bushy; main filaments much divided, set with very numerous, alternate, secondary branches, of a roundish or ovate figure, alternately plumulate; plumules short, very narrow; lowermost pinnules distant, short and somewhat spine-like, uppermost elongated and crowded. *Colour* a deep red. *Articulations* of the stem four times as long as broad, closely filled with very slender, longitudinal veins. *Capsules* either in the axils of the pinnæ or on the first joint.

15. C. *Grevillii*, Harv.; slender, sparingly and distichously branched; plumules linear-obovate, round-topped; pinnæ erect, the lower ones short and spine-like, the upper long, branched at top; articulations of branches 2 or 3 times, of pinnules once and a half as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 345. *C. roseum, Grev. Edin. p.* 311. *C. purpurascens, Johnston, Berw. Fl.* i. *p.* 240 *?*

On Algæ near low-water mark. Frith of Forth, *Dr. Greville.* Berwick, *Dr. Johnston.* Bantry Bay, *Miss Hutchins.*—1 or 2 inches high, forming

small tufts: branches long, their lower part furnished with short irregular ramuli, their upper half distichously plumulate; plumules long, narrow, obovate; upper pinnæ alternately or secundly branched at top. *Colour* dull purplish red. *Articulations* of the stem with a narrow tube, and swollen joints. *Capsules* sub-solitary, sphærical. On moistening this plant, after having once been dried, it is very fragile, and in common with many other species, exhales, as Dr. Greville remarks, an odour somewhat resembling that of violets. Mrs. Griffiths considers it the young of *C. polyspermum*.

*** Plumules bipinnate.*

16. C. *spinosum*, Harv.; stems sub-simple, obscurely articulated; plumules linear-oblong, compact, spreading, round-topped; pinnæ short, with several spine-like, patent pinnulæ; articulations of stem veined, 2 or 3 times, of pinnæ once and a half as long as broad; capsules on the inner face of the pinnæ. *Harv. in Hook. Br. Fl.* ii. *p.* 345.

Sidmouth, *Mrs. Griffiths.—Root* scutate, hairy. *Stems* half an inch to 1 inch high, sub-simple, thickly and closely set with quadrifarious or alternate plumules. *Plumules* linear oblong; pinnæ very short, patent; pinnulæ mostly secund, divaricating and spine-like. *Colour* dull red, brownish when dry. *Capsules* sessile, sub-solitary on the inner face of the ramuli. A very doubtful plant, perhaps the young of *C. Brodiæi*.

17. C. *gracillimum*, Ag.; frond distichously branched, fan-shaped; filaments capillary, decomposito-pinnate; upper plumules long, narrow-ovate or lanceolate, patent, bi-tripinnate; articulations of the stem cylindrical, 3 or 4, of pinnæ 2 or 3 times longer than broad; capsules on the tips of the pinnules. *Harv. in Hook. Br. Fl.* ii. *p.* 345; *Wyatt, Alg. Danm. No.* 45.

On mud covered rocks near low water mark. Pier, Torquay, *Mrs. Griffiths.—Filaments* 1—4 inches high, irregularly branched, exceedingly slender, distichous; main branches few, unequally plumulate for their whole length; lower plumules short, vaguely pinnate; upper from half an inch to an inch long, narrow-ovate or lanceolate, acute, patent, bi-tripinnate; outline of the principal branches broadly ovate. *Colour* rose-red. *Capsules* minute, elliptical, on the tips of shortened pinnulæ. *Favellæ* roundish, lobed, on the principal branches.

18. C. *thuyoides*, Ag.; repeatedly branched in an alternate manner, distichous; branches set with alternate, lanceolate, narrow, bipinnate plumules; articulations of the stem 2—6 times longer than broad; capsules on the tips of the pinnulæ. *Harv. in. Hook. Br. Fl.* ii. *p.* 346. *Conf. thuyoides, E. Bot. t.* 2205. *Cal. tripinnatum, Harv. l. c. (not of Agardh). Wyatt, Alg. Danm. No.* 186.

On rocks in the sea, rare. Yarmouth, *Mr. Borrer*. Plymouth, *Mr. Sconce*. Pier, Torquay, *Mrs. Griffiths*. Wicklow. Portaferry, *Mr. W.*

Thompson.—Frond 1 or 2 inches high, sub-simple below, alternately branched above, the branches distichous, generally having two or more series of lesser branches, which are also alternate; the minor branches, and sometimes all the divisions of the frond, set at every joint with alternate, patent, closely bipinnate plumules, of a very narrow, linear-oblong figure. *Articulations* of the stem very variable in length, in different specimens; in some twice, in others six times as long as broad, more or less swollen at the joints. *Capsules* on the tips of shortened pinnulæ. *Colour* a fine rose-red. *Substance* soft and flaccid. The first plumule of the branches or pinnule of the plumules, frequently rises from the axil, especially in a variety having shorter joints to the stem than usual, which led me in 'Br. Fl.' to regard this variety as the *Cal. tripinnatum* of Agardh, a species, one of whose chief characters is this axillary ramulus. Agardh's plant proves, however, on inspection of authentic specimens, to be very different, and has not yet been found on our shores.

2. *Secondary branches dichotomous.*

19. C. *corymbosum*, Ag.; capillary, flaccid, gelatinous, entangled; secondary branches alternate, excessively dichotomous, sub-flabellate, level-topped; ramuli irregularly multifid, byssoid; articulations of the branches 8—10 times longer than broad; capsules solitary, axillary. *Harv. in Hook. Br. Fl.* ii. *p.* 346; *Wyatt, Alg. Danm. No.* 92. *Conf. corymbosa, E. Bot. t.* 2352, *(joints too short).*

On Algæ in the sea, not uncommon.—1—3 inches high, frond with a more or less evident principal stem, which is capillary below, byssoid above, and closely set with long, alternate branches, which are more or less divided; the penultimate ones having alternate, dichotomous, multifid branchlets of an obovate outline, rounded at top, or somewhat level-topped. The branching of these ramuli is subject to much variation, sometimes being nearly regularly dichotomous, at other times having an alternate character, but the plant is well marked to the naked eye by the peculiar level-topped or corymbose appearance of the smaller branches, joined to their slender, byssoid aspect. *Capsules* minute, either in the dichotomies or on the sides of the ramuli. *Favellæ* binate, in the axils of the branches. *Colour* a rose, or purplish-red. *Substance* exceedingly flaccid and gelatinous, adhering most closely to paper, and having a fine gloss when dried.

20. C. *versicolor*, Ag.; filaments setaceous at base, capillary above, distichously branched in a pinnate manner; penultimate branches naked below, dichotomous above, level-topped; ultimate dichotomies spreading; main articulations 4—6 times longer than broad; capsules solitary, axillary. *Harv. in Hook. Br. Fl.* ii. *p.* 346; *Ag. Sp. Alg.* ii. *p.* 170.

On Algæ in the sea. Devonshire, *Mrs. Griffiths.* Bangor, Belfast Bay, *Mr. Templeton.* Dublin Bay.—1—3 inches high, with a principal setaceous stem, set with alternate, sub-simple or divided branches, which are more or less densely clothed with dichotomo-multifid, byssoid ramuli, of an oblong, obovate outline, somewhat level-topped. *Capsules* elliptical, solitary. *Favellæ* binate. *Colour* a fine rose-red, rapidly changing in fresh water, becoming green in decay. Nearly allied to *Cal. corymbosum*, from

which it differs chiefly in having a stouter and more evident main stem and branches, with something of a pinnated habit. Specimens however occur which it is difficult to decide to which species they should be referred.

21. C. *seirospermum*, Griff.; stems setaceous, opaque and veiny, distichously branched in a pinnate manner; branches simple, alternate, closely set with long, dichotomo-multifid ramuli; articulations of the stem 4 or 5 times longer than broad; capsules forming beaded strings, in tufts, at the tips of the branchlets. *C. versicolor*, *β. seirospermum*, *Harv. in Fl. Hib.* iii. *p.* 216; *Wyatt*, *Alg. Danm. No.* 91.

In the sea, very rare. Torquay, *Mrs. Griffiths*. Salcombe, *Mrs. Wyatt*. —*Stem* 2 or 3 inches high, setaceous, generally undivided, more or less opaque and veiny, set with numerous, sub-distichous, long, simple, alternate, patent branches, the lowest of which are longest, giving the plant, when displayed, a broadly-ovate outline; the largest frequently bearing a second set of similar branches. All are more or less furnished with sub-dichotomo-multifid, level-topped ramuli, of a narrow obovate outline. *Capsules* globose, in beaded strings at the tips of the branchlets, several strings generally tufted at each tip. This character, which is alone sufficient to distinguish it from every other of the genus, I was at first disposed to regard as a diseased mode of fruit, but it is produced so constantly and with such regularity, that I yield to Mrs. Griffiths' strongly-expressed opinion, that this is the *regular* method of capsular fructification, and consequently, that the present is a good species. In ramification there is a striking resemblance to *C. versicolor*, but the present species is generally, but not invariably, more robust. The *colour* is a fine rose-red; the substance gelatinous, and it adheres closely to paper.

22. C. *spongiosum*, Harv.; stems robust, cartilaginous, branched in every direction; branches thickly set with dense, quadrifarious, repeatedly dichotomous, round-topped branchlets; axils patent; apices short, bifid; articulations of the branches swollen at the joints, thrice as long as broad. *Harv. in Hook. Br. Fl.* ii. *p* 346; *Wyatt*, *Alg. Danm. No.* 93.

On rocks in the sea, generally such as are perpendicular, and on other Algæ. Dunleary, 1802, *Mr. Templeton*. Larne, *Dr. Drummond*. Torquay, *Mrs. Griffiths*. Kingstown Harbour and Killiney. Salcombe, *Mrs. Wyatt*.—*Fronds* 2—4 inches high, flaccid, soft, holding water like a sponge; *stems* shrubby; branches long, spreading in every direction, thickly clothed with short, secondary branchlets, about half an inch in length, which are again covered with a third set, which are dichotomously divided, and, spreading on all sides, give the plant a rounded, bushy character. Main articulations veined. *Capsules* solitary, axillary. *Favellæ* roundish or lobed. To the naked eye this plant has something the habit of *C. Arbuscula*, while, in its microscopic characters, it comes nearer *C. corymbosum*. It is, however, a much coarser plant than the latter, void of gloss when dry, and of a duller colour. The joints uniformly shorter, the ramuli more regularly dichotomous, dense and quadrifarious, and the axils more patent. It was originally discovered by *Mr. Templeton*, in the station in which I afterwards gathered it 30 years later, a fact of which I was ignorant when I first described it in '*British Flora*.'

23. C. *pedicellatum*, Ag.; stems setaceous, loosely and irregularly branched; branches naked, or set with short, alternate, somewhat tufted, sparingly dichotomous branchlets; apices obtuse; articulations variable, mostly very long; capsules solitary, elliptical or pear-shaped, axillary, stalked. *Harv. in Hook. Br. Fl.* ii. *p.* 347; *Wyatt, Alg. Danm. No.* 94. *Conf. pedicellata, E. Bot. t.* 1817. *Cal. interruptum, Ag., Harv. l. c. Conf. interrupta, E. Bot. t.* 1838.

On rocks, &c., in the sea, rather rare. Summer. Brighton, *Mr. Borrer*. Devonshire, *Mrs. Griffiths*. Bantry Bay, *Miss Hutchins*. Miltoun Malbay. Portaferry, and at Bangor, Belfast Bay, *Mr. W. Thompson.—Filaments* 2—8 inches high, rather flaccid, as thick as horse hair; branches long, and little or much divided, springing near the base, beset with short, dichotomous ramuli, which are often crowded at the tips, so as to give the plant a pencilled appearance; apices always rounded and obtuse. *Articulations* extremely variable in length in different specimens, in some four, in others twelve times longer than broad. *Colour* a fine red, which is rapidly given out in fresh water, and becomes in the herbarium a dull dingy brown. *Capsules* elliptical or pear-shaped, very dark, raised on little colourless stalks situated in the axils of the branches. *Favellæ* large, single or in pairs, on the stems. *Cal. interruptum* merely differs in having the capsules "with a transverse separation," that is, the mass of seeds divided into *two* portions instead of *three*, as in the common state when ripe; a character surely of no importance.

B. *Small parasitical species, rising from creeping fibres.*

24. C. *Turneri*, Ag.; stems rising from creeping filaments, erect, simple or slightly branched, pinnated with opposite, spreading, simple ramuli; articulations of the stem 5—10 times longer than broad; capsules clustered; favellæ involucrated, stalked. *Harv. in Hook. Br. Fl.* ii. *p.* 339; *Wyatt, Alg. Danm. No.* 183. *Conf. Turneri, E. Bot. t.* 2339, *(not t.* 1637*). Cer. Turneri, Grev. Crypt. t.* 355.

Parasitical on several marine Algæ, common.—*Stems* rising from creeping fibres, erect, forming a dense globular or elongated tuft, from an inch to an inch and a half high, very slender, once or twice pinnated with opposite branches similar to the stem, which are occasionally, by abortion, alternate. *Articulations* variable in length, but generally many times longer than broad. *Capsules* globose, with wide borders, seated along the upper sides of the pinnæ at the joints, either stalked or sessile, clustered or solitary; *favellæ* stalked, furnished with an involucre, and resembling those of *Griffithsia*. *Colour* a fine rose-red.

25. C. *barbatum*, Ag.; stems rising from creeping filaments, tufted, much and irregularly branched; branches opposite or alternate, either simple or pinnulated for half their length with minute, opposite, spine-like, erecto-patent ramuli; articulations 2 or 3 times longer than broad; capsules elliptic-oblong, sessile on the sides of the pinnulæ.

On mud-covered rocks in the sea. Ilfracombe, and on the quay at Penzance, *Mr. Ralfs.—Filaments* densely tufted, 1 or 2 inches high, rising from creeping fibres, much and irregularly branched; branches opposite or alternate, of various lengths, and either simple or bearing others, patent, the upper and lesser branches pinnulated for half their length with minute, opposite, spine-like, erecto-patent ramuli, not a quarter of an inch in length, which are deciduous in winter. *Articulations* 2 or 3 times longer than broad, deeply coloured. *Substance* membranaceous and somewhat rigid, imperfectly adhering to paper. *Colour* a brownish or full red. *Capsules* elliptic-oblong, with wide borders, sessile on the sides of the pinnulæ. Under the microscope this presents many of the characters of the larger and more branched specimens of *C. Pluma*, but it is a very much larger, coarser, and more rigid plant, to the naked eye resembling *C. Turneri;* the *pinnulæ* are proportionally much shorter and more regular, and the *capsules* are of a different shape. Mr. Ralfs says, "If I am right, it is a perennial plant, but in winter it loses the small, opposite ramuli. The plant, both at Penzance and Ilfracombe, grows in tufts, and is generally covered with mud." The habitat, it may be observed, is very different from that of *C. Pluma.*

26. C. *Pluma*, Ag.; stems rising from creeping filaments, erect, sub-simple or alternately branched; branches naked below, the upper half pinnated with short, erect, close-set, opposite ramuli; articulations 2—4 times longer than broad; capsules globose, stalked. *Harv. in Hook. Br. Fl.* ii. *p.* 340. *Conf. Pluma, Dillw. Suppl. t. F.*

In the sea, on other Algæ, generally on the stems of *Laminaria digitata.* Bantry Bay, *Miss Hutchins.* Appin, *Capt. Carmichael.* Malbay.—*Stems* rising from creeping fibres, a quarter to half an inch in height, either simple or divided into a greater or less number of alternate, or sometimes opposite branches, which are naked below, their upper half pectinato-pinnate. *Pinnæ* opposite, short or long, simple, very erect. *Capsules* globose, with wide borders, stalked or sessile, sometimes clustered, often terminating the pinnulæ. *Joints* of the stem and branches 2—4 times longer than broad. *Colour* a full rose-red. Nearly allied to *C. Turneri*, but much smaller and with shorter joints.

27. C. *repens*, Ag.; stems rising from creeping filaments, erect, sparingly branched; branches alternate, patent, with a few short ramuli; articulations of the stem 3—6 times longer than broad. *Hook. Br. Fl.* ii. *p.* 348. *Conf. repens, E. Bot. t.* 1608.

In the sea, parasitical on the larger Algæ.—*Tufts* 1 or 2 inches high, densely investing the plant on which it grows. Except that the branches are *alternate*, not *opposite*, this species differs in no respect from *C. Turneri.* But specimens frequently occur partly referable to one, partly to the other. The *C. variabile* of Agardh seems completely to unite them.

C. *Minute species, parasitical or otherwise, not rising from creeping fibres. (Trentepohliæ pars. Harv. in Mack. Fl. Hib.)*

** Growing on rocks.*

28. C. *Rothii*, Lyngb.; widely spreading, densely tufted;

filaments slender, short, erect, dichotomous; branches long, straight, appressed; articulations twice as long as broad; capsules clustered, borne on short, terminal, sub-corymbose ramuli. *Harv. in Hook. Br. Fl.* ii. *p.* 347; *Wyatt, Alg. Danm. No.* 188. *Conf. Rothii, E. Bot. t.* 1702.

On marine rocks, above half-tide level. Perennial. Fruiting in winter. —*Filaments* a quarter of an inch to nearly an inch in height, forming large velvetty patches, of a deep red or purple colour. *Branches* few and very erect, either dichotomous or alternate, equal. *Fructification*, as first pointed out by the late *Capt. Carmichael*, frequently produced in the winter months.

29. C. *floridulum*, Ag.; filaments short; densely tufted, fastigiate, sparingly branched; branches alternate or sub-dichotomous, nearly simple, appressed; articulations thrice as long as broad; capsules minute, oval, borne on very short, closely appressed pedicels, ranged in a secund manner along the upper branches. *Harv. l. c. p.* 348. *Conf. floridula, Dillw. Suppl. t. F; Wyatt, Alg. Danm. No.* 219.

On marine rocks, near low-water mark. Galway Coast, *Mr. J. T. Mackay*. Antrim, *Dr. Scott*. Orkney, *Dr. Pollexfen*. Land's End, *Mr. Ralfs*. —*Filaments* about an inch high, forming dense, fastigiate tufts, very slender and of equal diameter throughout, furnished with a few long, simple, alternate, very erect or appressed branches, some of which bear, near the apex, several alternate or secund, closely appressed ramuli, the lowest of which are longest, the upper gradually shorter, giving the apices of the branches a corymbose or level-topped character. *Joints* fully thrice as long as broad, sometimes rather longer. The fortunate discovery of the fruit by Mr. Ralfs, in April, 1840, affords at length a satisfactory character by which this long-doubtful plant may be distinguished from *C. Rothii*.

30. C. *purpureum*, Harv.; filaments erect, very minute, forming continuous, velvetty patches, slightly branched; branches dichotomous; articulations twice as long as broad. *Trentepohlia purpurea, Ag., Harv. l. c. p.* 382. *Byssus purpurea, E. Bot. t.* 192.

On maritime rocks, within the influence of the spray, but beyond the reach of ordinary tides. Perennial. Icolumbkil, *Lightfoot*. Anglesea, *Rev. H. Davies*. In a cavern at Swansea, *Dillwyn*. Fingal's Cave, Staffa; and caves near Torquay. Dunmore, *Miss Taylor*. Belfast Bay, *Mr. W. Thompson*.—This forms exceedingly thin, undefined patches, of a dull red or purple colour, resembling a mere stain on the surface of the rocks. The filaments are scarcely a line high, and very sparingly branched. It has many points in common with *C. Rothii*, and I am almost inclined to think it may be that species, altered by growing in situations where it is only occasionally wet with salt water.

31. C. *mesocarpum*, Carm.; "filaments minute, cæspitose; branches virgate, erect; articulations 4 or 5 times longer

than broad; capsules elliptical, on long pedicels." *Carm. MS. Harv. l. c. p.* 348.

Rocks at the extremity of low-water mark. Appin, *Capt. Carmichael.* —"*Tufts* contiguous, forming a broad, shaggy, purple crust. *Filaments* 2 or 3 lines long, sparingly branched; branches long, straight, erect, simple and sub-secund. *Capsules* crowded about the middle of the filaments, secund or opposite, on long, single-jointed or forked peduncles; the capsules, in the latter case, either in the axils or substituted for a branch of the fork. I could not discover that it sprung from creeping filaments." *Carm. MSS.* This appears to come very near *C. strictum* of Agardh.

*** Parasitical on other Algæ.*

32. C. *sparsum*, Harv.; filaments minutely tufted, scattered, sparingly branched; branches spreading, unequal; articulations twice or thrice as long as broad; "capsules obovate, sessile, mostly axillary." (*Carm.*) *Harv. l. c. p.* 348.

On old stems of *Laminaria saccharina*, at Appin, *Capt. Carmichael.* On *Conf. rupestris* at Miltoun Malbay.—Scarcely a line high, forming minute, scattered tufts. *Stems* nearly simple, erect, slightly branched beyond the middle; branches erecto-patent, alternate or secund, of unequal length; the apices obtuse. This is probably the *C. floridulum* of *Lyngbye*, *Hyd. Dan. p.* 136. It is better distinguished from *C. Rothii* by its minute size and scattered habit than by any peculiarity of branching. The fruit, however, is very different.

33. C. *Daviesii*, Ag.; rose-red, minute, tufted, much branched; branches flexuous or straight, scattered or close, erect, more or less furnished with short, sub-secund ramuli; articulations 3 or 4 times longer than broad. *Harv. in Hook. Br. Fl.* ii. *p.* 348; *E. Bot. t.* 2329. *C. virgatulum*, *Harv. l. c. p.* 349; *Wyatt*, *Alg. Danm. No.* 189.

Parasitical on the smaller Algæ, generally on *Ceramium rubrum.—Filaments* 2 or 3 lines high, forming elegant, pencilled tufts, much branched; branches straight or somewhat flexuous, erect or slightly spreading, close or distant, the upper ones often closely set with minute, bud-like, 1 or 2 jointed ramuli. *Capsules* minute, elliptical, solitary or clustered. I fear the distinctions pointed out in 'Br. Fl.' between *C. Daviesii* and *virgatulum* cannot be depended on; the latter appears to be merely a more advanced state of the former.

34. C. *secundatum*, Ag.; rose-red, very minute, tufted, flexuous, sparingly or much branched; ramuli short, secund, close, spreading, obtuse; articulations 3 or 4 times longer than broad. *Harv. l. c. p.* 349.

On the larger Algæ. On *Zostera*, Appin, *Capt. Carmichael.* On *Porphyra laciniata*, *Alaria esculenta*, and *Rhodomenia palmata.*—A line or less in height, forming minute tufts, or spreading in continuous velvetty patches. Perhaps only a variety of *C. Daviesii.*

35. C. *lanuginosum*, Lyngb.; nearly simple, exceedingly

minute, brownish-red; ramuli short, obtuse, secund; articulations thrice as long as broad, pellucid in the centre. *Harv. l. c. p.* 349. *Conf. lanuginosa, Dillw. t.* 45.

Common on decaying Algæ, especially *Cer. rubrum*.—This forms a minute, brownish fringe to the affected plant. Perhaps it is merely the young of *C. Daviesii*. Dillwyn's figure is characteristic.

LXI. Trentepohlia. Ag.

Frond filamentous; filaments minute, erect, coloured, articulated; dissepiments hyaline. *Fructification:* tufted, mostly terminal capsules. *Growing in fresh water.*—Name, in honour of a German botanist. (Except for its *fresh-water* habitat, this genus does not differ from the preceding section of *Callithamnion*, which, in the 'Irish Flora,' I ventured to unite to it. At *Mrs. Griffiths*' instance I now give up this point, but must still observe that *Cal. Daviesii* and *T. pulchella*, when the latter is well coloured, are scarcely distinguishable under the microscope).

1. T. *pulchella*, Ag.; filaments minute, blood-red, virgate, tufted, much branched; branches erect, alternate, beset with short, opposite or secund ramuli; articulations four times as long as broad; capsules racemose. *Harv. in Hook. Br. Fl.* ii. *p* 382. *Conf. nana, Dillw. t.* 30, *(not characteristic); E. Bot. t.* 2585.—*β. chalybea;* dark bluish-grey. *Conf. chalybea, Dillw. t.* 91. *Conf. corymbifera, E. Bot. t.* 1666, *f.* 1.

In mountain streams, growing on rocks, stones, or on aquatic mosses.—*Filaments* from one-eighth to three quarters of an inch long, tufted, or forming a wide shaggy stratum; branches erect, long and virgate, more or less furnished with short ramuli. *Colour* in *α*, rose or blood-red; in *β* dark bluish-grey. A most beautiful plant. None of the above figures are very characteristic; that of *Conf. corymbifera* in 'E. Bot.' is the best, but it represents the discoloured variety.

Series III. CHLOROSPERMEÆ.

Tribe 14. LEMANIEÆ.

LXII. Lemania. Bory.

Frond filiform, tubular, coriaceous, cellular, torulose. *Fructification:* pencilled tufts of colourless, beaded filaments, attached to the inner surface of the tubular frond, finally

dissolved into sporules.—Named in honour of a French Algologist, *M. Leman*.

1. L. *fluviatilis*, Ag.; filaments branched, olive-green, torulose, attenuated; intervals between the swellings cylindrical, much longer than they are broad. *Hook. Br. Fl.* ii. *p.* 322. *Conf. fluviatilis, E. Bot. t.* 1763.

Rocky beds of rivers, in sub-alpine districts; frequent.—*Frond* 6—8 inches long, as thick as, or rather thicker than a hog's bristle, more or less branched in a very irregular manner; the branches long and sub-simple, tapering to a fine point, bearing, at distances of about a line, whorls of roundish warts. *Fructification* within the tube of the frond. *Substance* cartilaginous, somewhat slippery to the touch, and imperfectly adhering to paper.

2. L. *torulosa*, Ag.; filaments nearly simple, moniliform. *Hook. Br. Fl.* ii. *p.* 322. *Conf. fluviatilis, β. torulosa, E. Bot. t.* 1763.

Mountain streams near Ludlow, *Dillenius*. Anglesea, *Rev. H. Davies*. Of this I have never seen British specimens. Sir W. J. Hooker fears that "the more or less beaded appearance of the fronds will hardly afford a permanently distinguishing character between this and the preceding."

Tribe 15. BATRACHOSPERMEÆ.

LXIII. Batrachospermum.

Main filaments invested with gelatine, colourless, tubular, longitudinally striated, (composed of jointed fibres, agglutinated together), beset with whorls of moniliform, branched ramuli. *Fructification:* globules of dense filaments attached to the ramuli. — Name, βατραχος, a *frog*, and σπερμα, *frog-spawn;* which the species resemble.

1. B. *vagum*, Ag.; frond very gelatinous, sub-dichotomous, cylindrical, equal; whorls close together. *Harv. in Hook. Br. Fl.* ii. *p.* 388.

In Alpine bogs and lakes.—*Tufts* globose, extremely gelatinous. *Filaments* 2—4 inches long, very irregularly branched; the branches very patent, somewhat dichotomous, more or less furnished with branchlets. *Whorls* of ramuli very close together, giving the frond a cylindrical appearance. *Colour* varying from brownish-green to a bluish or glaucous-green: under the microscope it appears colourless.

2. B. *moniliforme*, Ag.; frond very gelatinous, irregularly branched; branches beaded; whorls of ramuli sub-distant. *Harv. l. c. p.* 388. *Conf. gelatinosa, E. Bot. t.* 689.

In bogs and rivulets.—*Filaments* 4—6 inches long, much branched in

an irregular, repeatedly pinnate manner; the branches flexuous, more or less furnished with branchlets. *Whorls* of ramuli rather distant, globose, giving the branches the appearance of strings of beads. *Colour* brownish-green or purplish. *Fructification* commonly produced. *Capt. Carmichael* found a plant at Appin which he thus describes; "*B. proliferum;* fronds solitary or in small clusters, 1 or 2 inches long, irregularly branched; branches divaricate, curved or flexuous, opaque, and very dark coloured, beset with short ramuli, which issue out from the joints among the whorls of eccentric filaments, and are themselves beset with whorls; colour grey." *Carm. MSS.* It ought perhaps to be considered rather a peculiar state of this species than a distinct variety.

3. B. *atrum;* frond rigid, scarcely gelatinous, irregularly pinnate or bipinnate; whorls distant, the filaments that compose them minute. *Bat. moniliforme, β. detersum, Ag. Harv. l. c. Conf. atra, E. Bot. t.* 690.

In streams and rivulets in alpine districts.—*Tufts* 1—3 inches high; fronds irregularly pinnate or bipinnate; the branches of various lengths, scarcely gelatinous compared to the former, but, as Mr. Moore observes, "hard and rigid to the touch." *Whorls* distant, globular, composed of minute, inextricable filaments. Agardh regards this as a variety of the preceding, with the whorled fibres sub-obliterated, but Mrs. Griffiths and Mr. Moore are of the opinion of older authors, that it is a distinct species. It is at least a permanent variety. The peculiar character of the whorls does not arise from age or detersion, for the youngest branches and buds have the same structure as the old. It seems to me to be a good species, and, in some measure, to connect *Lemania* with *Batrachospermum.*

LXIV. Thorea. Bory.

Frond cylindrical, filiform, inarticulate, densely clothed with minute, articulated, byssoid fibres. *Fruit* unknown. —Name, in honour of *M. Thore,* a French naturalist.

1. T. *ramosissima,* Bory; frond much branched, dark green, becoming purple in drying. *Ag. Sp. Alg.* ii. *p.* 124; *Bory, Ann. Mus.* xii. *t.* 18, *f.* 1. *Th. Lehmanni, Lyngb. t.* 13.

In alpine streams and pools, very rare. "Found in a pool in a bog in the Co. Donegal Mountains, going from Letterkenny to Dunfanaghy; July," *Mr. Templeton.—Frond* 6—12 inches long, filiform, sub-simple, more or less pinnated with long, simple, patent branches, which often bear a second series, the whole frond densely clothed with minute, exceedingly slender, cylindrical, whorled fibres, about half a line in length. *Joints* of the fibres about four times as long as broad. *Substance* gelatinous, tough. *Colour* dark grey, assuming more or less of purple in drying. It closely adheres to paper. Of this beautiful plant I have seen no British specimen. I introduce it on the authority of a note in the late *Mr. Templeton's* MSS. whose well-known accuracy leaves no room to doubt his correctness in this instance, though he has not preserved a specimen in his herbarium. Agardh has in his last work, (*Species Algarum*), removed this genus, but, as it ap-

pears to me, most unhappily, to the *Ceramieæ*, on the grounds of its supposed affinity to *Dasya*. It is surely more nearly related to *Batrachospermum* than to any other genus.

Tribe 16. CHÆTOPHOROIDEÆ.

LXV. Bulbochæte. Ag.

Filaments free, articulated, branched; each articulation bearing, at its truncate apex, either an elongated, inarticulate, deciduous *seta*, or a sessile, sphærical *capsule;* base of the seta scutate, amplexicaul.—Name, βολβος, a *bulb*, and χαιτη, a *bristle;* in allusion to the setaceous ramuli with swollen bases.

1. B. *setigera*, Ag. *Harv. in Hook. Br. Fl.* ii. *p.* 350. *Conf. vivipara, Dillw. t.* 59.

On fresh-water plants, &c., in lakes and ponds.—*Tufts* a quarter to half an inch high, forming dense, villous tufts. *Filaments* irregularly and slightly branched, the branches sub-alternate or dichotomous, either erect or recurved, jointed. *Joints* 3 or 4 times as long as broad, swollen upwards, from their upper part bearing a long, inarticulate, deciduous bristle, whose base is expanded, and half clasping the joint. *Substance* sub-gelatinous when recent, somewhat horny when dry. *Colour* dull greenish-brown, fading to grey in the herbarium. A curious plant, of doubtful affinity, under the microscope resembling a *Sertularia* set with herring bones.

LXVI. Draparnaldia. Bory.

Filaments free, gelatinous; stems nearly colourless, emitting at the joints pencils of coloured ramuli. *Fructification*, so far as known, a mass of granules, forming a band across the joints of the stem.—Name, in honour of *M. Draparnaud*, a French naturalist.

1. D. *plumosa*, Ag.; decomposito-pinnate; pencils of ramuli linear-lanceolate, acute. *Harv. in Hook. Br. Fl.* ii. *p.* 388. *Conf. lubrica, E. Bot. t.* 2087, *(not of Dillw.)*

In streams and wells.—*Fronds* extremely gelatinous, 4—6 inches long, somewhat pinnatedly branched, repeatedly divided; branches transparent, jointed, the joints either colourless or having a transverse band of granules in the centre, throwing out either opposite or alternate, narrow pencils, of bright green, multifid ramuli.

2. D. *glomerata*, Ag.; irregularly branched; pencils of ramuli ovate, obtuse, patent. *Harv. l. c. p.* 388. *Conf. mutabilis, E. Bot. t.* 1746.

In streams and wells, common.—Less regularly branched than the preceding, more massed together, and of a paler colour, with broadly-ovate, generally alternate pencils of ramuli. Perhaps only a variety.

3. D. *tenuis*, Ag.; irregularly branched; ramuli simple, sub-fasciculate; primary filaments partially coloured. *Harv. l. c. p.* 388. *Conf. lubrica, Dillw. t.* 57. *Conf. protensa, Dillw. t.* 67.

On the rocky bottoms of rivulets.—*Filaments* very slender, 4—6 inches long, irregularly or sub-alternately branched, more or less furnished with scattered or sub-fasciculate ramuli, whose tips are either acute or drawn out into long, setaceous, colourless points. *Joints* of the main filaments and ramuli partially coloured, or transversely banded. At first the filaments are enclosed, in the manner of a *Chætophora*, in a common, somewhat definite gelatine; afterwards, on this bursting, they issue from it like a *Conferva*, but are at all times very gelatinous. *Colour* a fine rich green, fading to yellowish in the herbarium.

LXVII. Chætophora. Ag.

Frond gelatinous, globose or lobed, rarely plane and crustaceous, composed of numerous filaments aggregated together, and issuing from a common base. *Filaments* articulated, branched; articulations of the branches nearly colourless, of the ramuli coloured. *Capsules* globose, attached to the ramuli.—Name, χαιτη, a *bristle*, and φορεω, *to bear;* the ramuli are, in some stage of growth, tipped with long, setaceous points or bristles. Fructification has only been found on *C. pisiformis* and *C. pellita.*

** In fresh water. (Genuinæ).*

1. C. *endiviæfolia*, Ag.; frond elongated, filiform, somewhat compressed, sub-dichotomously branched. *Harv. in Hook. Br. Fl.* ii. *p.* 389. *Ulva incrassata, E. Bot.* 967.

In lakes and streams, not uncommon.—*Frond* 1 or 2 inches high, much branched, and resembling a stag's horn; branches 1—4 lines in diameter, either cylindrical or compressed. *Colour* a yellow-green. A beautiful microscopic object.

2. C. *tuberculosa*, Hook.; frond at first globose and firm, afterwards much lobed, fragile and hollow; filaments very slender, flexuous, hyaline; ramuli coloured, palmato-fasciculate. *Harv. l. c. p.* 382. *Rivularia tuberculosa, E. Bot. t.* 2366.

In boggy pools, on sticks and aquatic plants.—*Fronds* bright green, an inch or more in diameter.

3. C. *elegans*, Ag.; "frond sub-globose, gelatinous, solid, green; filaments sub-dichotomous; ramuli fastigiate, atten-

uate ; the apices produced beyond the gelatine." *Carm. Harv. l. c. p.* 389.

On sticks, &c., in stagnant pools.—*Fronds* a quarter to half an inch in diameter, bright green.

4. C. *pisiformis*, Ag. ; " frond sub-globose, fleshy, green ; filaments sub-dichotomous, obtuse ; sporidia globose, axillary." *Carm.—Harv. l. c. p.* 389 ; *Berk. Alg. t.* 1. *f.* 1. *C. elegans, Grev. Crypt. t.* 150.

On sticks, &c., in sub-alpine lakes.—" *Sporidia* globular, green, scattered among the upper branches of the filaments." *Carm.* Similar fruit is figured by *The Rev. M. J. Berkeley*, in the first number of his '*Gleanings of British Algæ*.' This scarcely differs from the preceding.

5. C. *longæva*, Carm. " frond indefinitely effused, incrusting, gelatinous, green ; filaments sub-dichotomous ; ramuli produced, proliferous towards the apex." *Carm.—Harv. l. c. p.* 389.

In a boggy streamlet at Appin, *Capt. Carmichael.*—" *Fronds* continuous, or so closely set as to have that appearance, of a delicate green colour, and more flaccid than those of *C. elegans*, apparently from a deficiency of gelatine ; *filaments* in all respects similar to those of the other species, except in being mostly proliferous." *Carm.*

*** Marine. (Spuriæ).*

6. C. *Berkleyi*, Grev. ; " frond depressed, brown, subhemisphærical ; main branches somewhat anastomosing, ultimate ones fasciculate." *Berk. Gl. Alg. t.* 1, *f.* 2 ; *Harv. l. c. p.* 390 ; *Wyatt, Alg. Danm. No.* 231.

On limestone rocks in the sea. Torquay, *Rev. M. J. Berkeley.* Tor Abbey Rocks, *Mrs. Wyatt.*—" *Frond* depressed, brown, spongy, sub-hemisphærical or irregular, from two or more individuals becoming confluent.—*Filaments* very closely packed, branched and somewhat anastomosing below ; the upper ramuli darker and fasciculate, some of the lateral ones being very much drawn out and diaphanous. *Articulations* not exactly cylindrical, in the main branches about three times as long as broad, greenish in the centre, diaphanous at the two extremities ; in the upper fasciculate branches scarcely so long as broad, and entirely filled with dull greenish granules." *Berk. Alg. p.* 5.

7. C. *pellita*, Lyngb. ; frond purple-brown, crustaceous, gelatinoso-coriaceous, indefinitely spreading. *Harv. l. c. p.* 390 ; *Berk. Alg. t.* 1, *f.* 3.

On rocks and stones in the sea, about half-tide level. Winter. Appin, *Capt. Carmichael.* Oban, *Rev. M. J. Berkeley.* Miltoun Malbay. Forming roundish crusts on the surface of rocks, from one to three inches in diameter, of a dark reddish-brown colour.—*Filaments* minute, erect, tufted, sub-simple, elegantly variegated. " *Sporidia* between obovate and clavate, lodged at the base of the filaments. On being disengaged, they separate,

as in some of the *Fuci*, into three or four roundish portions." *Carm.* This fructification appears to be of rare occurrence. It was not till after an examination of more than 100 specimens, that *Capt. Carmichael* was so fortunate as to discover it in the month of February.

LXVIII. Myrionema. Grev.

Mass gelatinous, (exceedingly minute), effused, composed of very short, clavate, erect, mostly simple filaments, "fixed at their base to a thin expansion." (*Grev.*) *Fruit:* capsules at the base among the filaments.—Name, μυριος, a *thousand*, and νημα, a *filament*. A genus of minute parasites, of doubtful affinity. It rather belongs to the series *Melanospermeæ*.

1. M. *strangulans*, Grev.; "sub-convex, confluent; filaments sub-cylindrical, simple; capsules shortly pedicellated, affixed to the basal lamina." *Grev. Crypt. t.* 300; *Hook. Br. Fl.* ii. *p.* 391.

In the sea, parasitical on several *Ulvæ*.—Forming dark brown spots, 1 or 2 lines in diameter, often, when growing on *Enteromorphæ*, forming a ring round the branches.

2. M. *punctiforme*, Harv.; very minute, plane, scattered; filaments attenuate at the base, simple; capsules sessile, affixed to the filaments. *Harv. l. c. p.* 391. *Linkia punctiformis, Lyngb. t.* 66; *Carm. MSS. cum icone.*

On *Chylocladia clavellosa*, at Appin, *Capt. Carmichael.* On *Ceramium rubrum*, at Torquay, *Mrs. Griffiths.*—Forming a brown spot, half a line in diameter. A beautiful microscopic object.

3. M. *clavatum*, Harv.; very minute, rather convex; filaments clavate, mostly bifid; capsules pedicellate, affixed to the filaments. *Harv. l. c. p.* 391. *Linkia clavata, Carm. MSS. cum icone.*

"On a thin, purplish crust, which covers the pebbles at the half-tide level. The parasite is so much of the colour of the crust, that it requires a microscope to detect it." *Capt. Carmichael.*

Tribe 17. CONFERVEÆ.

LXIX. Conferva. Ag.

Filaments articulated, free, distinct, uniform, simple or branched. *Fruit* an internal, coloured, granular mass, *(endochrome). Colour* green, rarely purple.—Name, from *conferruminare, to consolidate;* some of the species having

been considered by the ancients useful in the healing of fractured limbs.

Clavis.

A. *Filaments simple.* (*Sp.* 1—36).

a. Filaments decumbent, forming strata of a purple colour. Alpine bogs. (1—3).

b. Filaments elongated, floating, forming green strata in fresh water, rarely attached. (4—15).

c. Filaments forming crisped, entangled strata, green; growing in the sea or in salt-water ditches. (16—23).

d. Filaments tufted, straight, green; inhabiting the sea. (24—30).

e. Filaments parasitical, olivaceous, forming pencil-like tufts, on marine Algæ. (31—35).

f. Filaments purple or pink, tufted. (36, 37).

B. *Filaments branched.* (*Sp.* 38—61).

a. Inhabiting fresh water, or on damp ground. (38—44).

b. Inhabiting the sea. (45—61).

A. *Filaments simple.*

a. Filaments decumbent, very slender, forming strata of a purple colour. Alpine bogs.

1. C. *ericetorum*, Roth.; filaments very slender, simple, forming a thin, dull purple stratum; articulations a little longer than broad; endochrome dark coloured, filling the tube, finally bipartite, unaltered in drying. *Harv. in Hook. Br. Fl.* ii. *p.* 350; *E. Bot. t.* 1553; *Grev. Crypt. t.* 261, *f.* 1.

On dry heaths, abundant; occasionally in water.—Forms a dense stratum of indefinite extent.

2. C. *purpurascens*, Carm.; filaments very slender, simple, forming a cloudy, floating, purple stratum; articulations once or twice as long as broad; endochrome collapsed, pale, rarely filling the tube. *Harv. l. c. p.* 350. *C. ericetorum*, *β. aquatica*, *Ag. Syst. p.* 87.

In old turf pits and boggy pools.—"At first occurring as a dusky-green cloud, diffused throughout the water, gradually changing to a pretty bright purple, and rising in a bullated stratum to the surface. Granular mass collapsed into a great variety of forms, generally attached to one side of the tube. It adheres firmly to paper. With *C. ericetorum* it has no affinity, except in colour." *Carm. MSS.*

3. C. *alpina*, Bory; filaments simple, very slender, purple, floating; articulations four times as long as broad; endo-

chrome collapsed, rarely filling the tube. *Harv. l. c. p.* 350; *Grev. Crypt. t.* 261, *f.* 2.

In sub-alpine rivulets. Abundant in the Highlands of Scotland, *Dr. Greville.—Filaments* very fine, of a bright purple colour, forming floating strata of considerable extent.

b. Filaments elongated, floating, rarely attached, flaccid, forming green strata. Inhabit fresh water.

4. C. *bombycina*, Ag.; filaments excessively fine, forming a cloudy, floating, yellow-green stratum; articulations 3—5 times longer than broad. *Harv. l. c. p.* 350. *Conf. sordida, Dillw. t.* 60.

In stagnant waters, about the leaves and stems of aquatic plants, common.

5. C. *floccosa*, Ag.; filaments very slender, forming pale green, floating strata; articulations once or twice as long as broad. *C. fugacissima, Dillw. Suppl. t. B.*

In ditches and pools, with the preceding.—Very nearly related to *C. bombycina*, but "much more robust, fine as it is; besides the great disparity of the articulations." *Grev.*

6. C. *zonata*, Web. and Mohr.; filaments unequal, forming bright green, lubricous masses; articulations rather longer than broad, marked in the centre with a full green band. *Harv. l. c. p.* 351. *Conf. lubrica, Dillw. t.* 47.

On stones in rivulets.

7. C. *subimmersa*, Berk.; threads simple, crisped; articulations three times as long as broad; joints pale, with a few scattered, darker dots. *Berk. Gl. Alg. t.* 13, *f.* 2.

On moist, spongy ground, at the roots of different *Junci*, at Cotterstock, Northamptonshire, but not immersed in the water, though, like a sponge, always saturated with it. *Rev. M. J. Berkeley.*

8. C. *fontinalis*, Ag.; threads short, straight, simple, adnate, rather obtuse, sub-fasciculate; articulations 3—5 times as long as broad, the green masses lighter in the middle. *Berk. Gl. Alg. t.* 14, *f.* 1.

In ponds, on grass, rushes, &c. Thornhaugh, Northamptonshire, *Rev. M. J. Berkeley.* Walworth, near Darlington, *Mr. W. Backhouse.—Filaments* half an inch long, clothing the plants on which it grows with a fine green fringe.

9. C. *ochroleuca*, Berk.; threads fragile, extremely slender, flexuous, shining; articulations ten times as long as broad, filled in the centre with an ochraceous mass, the extremities pellucid. *Berk. Gl. Alg. t.* 14, *f.* 2.

"This elegant species is very common in summer, covering the stems

and leaves of aquatic plants, in company with *Fragilaria pectinata*, with a loose tawny crust. It belongs to the same tribe as *Conferva hyemalis*, but is evidently distinct from the three species enumerated by Agardh. Gathered at Stibbington, Hunts, July 21, 1827." *Rev. M. J. Berkeley.*

10. C. *vesicata*, Ag.; filaments very slender, forming dull green strata; articulations variable in length, 2—5 times longer than broad, here and there inflated. *Harv. l. c. p.* 351. *C. alternata, Dillw. Suppl. t. B. C. tumidula, E. Bot. t.* 1670. *C. vesicata, tumidula, Candollii and Borisii, Ag. Syst. p.* 93, 94.

In stagnant water, common.—In uniting the above four species of Agardh, I gladly follow *Capt. Carmichael*, who remarks that, "in a genus so notoriously variable in the length of the articulations, the differences indicated in the definitions will hardly entitle them to rank even as varieties."

11. C. *rivularis*, Linn.; filaments slender, very long, straight, bright green, silky, forming tufted bundles; articulations 2—4 times longer than broad. *Harv. l. c. p.* 361. *E. Bot. t.* 1654. *Dillw. t.* 39.

In rivers and streams, common.—*Filaments* 2 or 3 feet long, tufted. I have never seen the joints so short as represented by Dillwyn, but his figure is, in other respects, characteristic.

12. C. *capillaris*, Linn.; filaments pale green, void of lubricity, much curled and interwoven into sub-rigid, extensive strata; articulations 3 or 4 times longer than broad. *Harv. l. c. p.* 352. *E. Bot. t.* 2364. *C. crispa, Dillw. Sup. t. B.*

In streams and rivulets.—This forms extensive, crisped strata, many feet in diameter. In drying the articulations are often, but not invariably, alternately compressed. It does not adhere to paper.

13. C. *mucosa*, Mert.; filaments forming a floating, bright green stratum, extremely gelatinous, invested with definite mucus; articulations about as long as broad. *Harv. l. c. p.* 351. *Dillw. Syn. t. B.*

In stagnant water, rare. Bantry, *Miss Hutchins.* Appin, *Capt. Carmichael.*—"*Filaments* about the thickness of those of *C. dissiliens*, cylindrical, by no means fragile, surrounded by a mucous envelope, twice their own diameter. *Articulations* about as broad as long. *Sporular mass* sometimes filling the whole joint, sometimes about two-thirds. In the latter case, the contrast between the opaque and transparent parts of the joint, gives the filament a remarkably beautiful appearance. In drying it discharges a profusion of large granules, and becomes slightly contracted at the joints, but without any sensible diminution of its diameter." *Carm. MSS.*

14. C. *polita*; filaments elongate, straight, fragile, gelati

nous, forming floating masses; articulations twice as long as broad, filled with a very dense mass of granules.

In a streamlet near the Seven Churches, Glendalough, Co. Wicklow, *Mr. D. Moore.*—This beautiful plant was sent to me by Mr. Moore, marked *C. dissiliens*, to which it is, externally, nearly allied, but the joints are four times as long as in that species.

15. C. *dissiliens*, Dillw.; filaments elongated, straight, very fragile, slimy and gelatinous, forming bright green floating masses; articulations half as long as broad, marked by a green band. *Harv. l. c. p.* 352. *Dillw. Conf. t.* 63. *(not of E. Bot.*

In streams and ditches; *Dillw.* Alpin, *Capt. Carmichael.* Glendine Wood, Youghal, *Miss Ball.—Filaments* very fragile, often separating at the joints and adhering by the angles as in *Diatoma.* It scarcely belongs to the present genus, but is perhaps rather a *Lyngbya.* The colour is a bright green.

C. *Filaments forming crisped, entangled strata, green, growing in the sea or in salt-water ditches.*

16. C. *arenicola*, Berk.; threads soft, simple, extremely fine, matted, somewhat crisped, at first uniform pale green, at length distinctly jointed; articulations once and a half as long as broad, dotted; interstices pellucid. *Berk. Gl. Alg. t.* 13. *f.* 3.

Creeping on the sandy margins of pools in a salt-marsh periodically flooded, forming a thin, soft, delicate, crisped web, of a pale yellow-green. *Threads* extremely slender, flexuous, at first self-coloured with a few scattered dots, then with manifest dissepiments, and finally the granules contract and form a distinctly defined mass of a darker green in the centre, with pellucid interstices. When dry the articulations are slightly contracted." *Rev. M. J. Berkeley.*

17. C. *sutoria*, Berk.; threads setaceous, extremely long, flexuous, equal, dark green; articulations once and a half as long as broad; interstices pellucid. *Berk. Gl. Alg. t.* 14. *f.* 3.

Floating in ditches and pools subject to the influence of the tide, at Wisbeach, *Rev. M. J. Berkeley.* April. Near *C. Linum* and *C. crassa*, " from both which, however, it differs in being a much more slender plant, and of a closer habit, and by no means variegated." *Berk.*

18. C. *Linum*, Ag.; filaments thick, rigid, crisped, forming loose, extensive bundles of a dull green colour; articulations once and a half as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 352. *Wyatt, Alg. Danm. No.* 220.

In salt-water ditches, along the muddy sea shore.—" Forming distinct, loosely interwoven, sub-cylindrical tufts of a yellowish green colour, which in a more advanced state, changes to a dark olive; attached at one end, and resting at the bottom of the pool. *Filaments* as thick as those of *C.*

ærea, rigid, brittle, and variously curved. *Articulations* filled with green matter, intermixed with large granules, irregularly contracted and compressed in drying." *Carm. MS.*

19. C. *crassa*, Ag.; filaments very thick, of great length, deep glossy green, much curled, rigid, forming loosely entangled, harsh masses; articulations as long as broad. *Harv. l. c. p.* 352. *Conf. capillaris, Dillw. t.* 9.

In salt-water ditches, near the coast. Very abundant in the ditches by the North Wall, Dublin.—*Filaments* many feet long, twice as thick as hogs' bristles, remarkably rigid and fragile when recent, but soon becoming flaccid on exposure to the air.

20. C. *tortuosa*, Dillw.; filaments rigid, slender, much curled and twisted, forming broad, closely interwoven strata; articulations 2 or 3 times longer than broad. *Harv. l. c. p.* 352; *Dillw. t.* 46; *Wyatt, Alg. Danm. No.* 190.—*β. perreptans;* filaments bent at acute angles and throwing out creeping radicles; colour dull green. *C. perreptans, Carm.—Harv. l. c. Zygnema littoreum, Lyngb. t.* 59.

In the sea, on rocks and Algæ; common. *β*, Appin, *Capt. Carmichael.* Miltoun Malbay. Torquay, *Mrs. Griffiths.*—This forms extensive strata, often several feet in diameter, of a pale or full green colour. *β* is found near high-water mark, and is usually of a duller colour, singularly bent and distorted, and from the angles throwing out tubular, indistinctly jointed, partially colourless radicles, "which adhere to particles of sand and other matters within their reach, often to a neighbouring filament." *Carm.*

21. C. *implexa*, Dillw.; filaments very slender, capillary, rather flaccid, forming extensive, much entangled, bright green strata; articulations rather longer than broad. *Harv. l. c. p.* 352; *Dillw. Suppl. t. B.; Wyatt, Alg. Danm. No.* 142. *C. intricata, Grev. Edin. p.* 315. *Bangia Johnstoni, Grev. in Johnst. Berw. Fl. p.* 260.

On marine rocks and attached to Algæ. Bantry, *Miss Hutchins.* Berwick, *Dr. Johnston.* Frith of Forth, *Dr. Greville.* Miltoun Malbay. Torquay, *Mrs. Griffiths.—Filaments* half as thick as those of *C. tortuosa*, with shorter joints, forming densely interwoven strata, or little tufts among the branches of other Algæ. *Bangia Johnstoni*, as Dr. W. Arnott first pointed out to me, differs in no respect from this species.

22. C. *ulothrix*, Lyngb.; "filaments slender, flexuous, entangled, somewhat rigid; articulations rather shorter than broad." *Carm.—Harv. l. c. p.* 353; *Lyngb. t.* 50.

In rocky pools in the sea, attached to small Algæ. Appin, *Capt. Carmichael.* Bantry Bay, *Miss Hutchins.*—"*Filaments* slender, curled and convoluted into a small, elastic, green tuft. *Articulations* hardly so long as broad. It is the preceding species in miniature, with the exceptions above stated." *Carm.*—Miss Hutchins' specimen is mixed with *C. implexa*, of which species, perhaps, this should be considered a variety.

23. C. *arenosa*, Carm.; filaments slender, rigid, interwoven into broad strata; articulations 3—5 times longer than broad. *Harv. l. c. p.* 353.

On the flat sandy shore about half-tide level. Appin, *Capt. Carmichael.* Bantry Bay, *Mr. R. Ball.*—"This species occurs in fleeces a yard or more in extent, and of a peculiar structure. They consist of several exceedingly thin layers, placed over each other; but so slightly connected that they may be separated like folds of gauze, to the extent of many inches, without the least laceration. *Filaments* 5 or 6 inches long, about the thickness of *C. bombycina*, rigid, possessed of a peculiar roughness; feeling, when pulled asunder, as if hair were drawn over a piece of rosin. *Articulations* 3—5 times as long as broad; sporular mass assuming a great variety of forms. When old the filaments become exceedingly rough and often tubercular." *Carm.*

d. Filaments tufted, with a scutate root, straight, green, inhabiting the sea.

24. C. *melagonium*, Web. and Mohr.; filaments elongate, scattered, straight, thick, erect, stiff and wiry, dark green; articulations twice as long as broad. *Harv. l. c. p.* 354; *Dillw. Conf. Sup. t. B.*; *Wyatt, Alg. Danm. No.* 221.

In the sea, growing on rocks at the extreme verge of low-water mark; found on many parts of the coast, but not common anywhere. —*Filaments* 5—8 inches high, thicker than bristles, scarcely tufted, generally but three or four together or solitary, remarkably rigid and wiry, tenacious and difficult to break; dissepiments somewhat contracted, very narrow, but pellucid.

25. C. *ærea*, Dillw.; filaments elongated, tufted, straight, harsh, brittle, yellow-green; articulations as long as broad. *Harv. l. c. p.* 354; *Wyatt, Alg. Danm. No.* 191; *E. Bot. t.* 1929.

In the sea, on sand-covered rocks, frequent. — *Filaments* 3—12 inches long, tufted, as thick as hogs' bristles, harsh to the touch, of a beautiful yellow-green colour, fading in the herbarium to a dirty white. Colouring matter of the joint finally parted in the centre. The articulations are visible to the naked eye.

26. C. *collabens*, Ag.; filaments elongated, straight, tufted, very thick, gelatinous and flaccid, of a splendid æruginose green; articulations once and a half as long as broad. *Harv. l. c. p.* 354. *C. ærea, β. lubrica, Dillw. Syn. p.* 48.

At Yarmouth, on a floating piece of deal, *Sir W. J. Hooker.—Filaments* 3 or 4 inches long, twice as thick as those of *C. ærea*, of a splendid verdigris-green colour, which is fully preserved in drying, very gelatinous, adhering most closely to paper. Dissepiments much contracted. A highly beautiful plant, which, I believe, has never been found more than once.

27. C. *bangioides;* filaments elongated, very slender, soft and lubricous, wavy; joints about twice as long as broad,

containing a compact, dark green mass, which is frequently bipartite; dissepiments broad, pellucid.

In the sea, on rocks, &c. Breakwater, Plymouth, *Mr. Blatch.* Torquay, *Mrs. Griffiths.* Port Ballantrae, North of Ireland, *Mr. Moore.*— *Tufts* 3—6 inches long, of a dark green colour, lubricous, and resembling *Bangia fusco-purpurea.* Mixed with this plant Mrs. Griffiths frequently finds *Lyngbya speciosa* and a *Conferva* twice the diameter of *C. bangioides*, with contracted, bead-like joints, having most of the characters of *C. Youngana*, but much larger than that species usually is.

28. C. *Youngana*, Dillw.; filaments short, tufted, straight, bright green, somewhat rigid; articulations once or twice as long as broad, dissepiments finally contracted. *Harv. l. c. p.* 354; *Dillw. t.* 102. *Conf. isogona*, *E. Bot. t.* 1930.

On rocks &c. near high-water mark; first discovered by *Mr. W. W. Young*, on rocks near Dunraven Castle, Glamorganshire. — *Filaments* an inch long, forming small tufts, somewhat rigid (as compared with *C. collabens*), obtuse. *Articulations* variable in length, at first cylindrical, afterwards becoming contracted in a beaded manner.

29. C. *flacca*, Dillw.; filaments short, tufted, straight, bright green, flaccid; articulations half as long as broad. *Harv. l. c. p.* 354; *Dillw. t.* 49; *E. Bot. t.* 1943.

On Fuci and floating timber.—*Filaments* half an inch to an inch long, forming broad, bright green tufts. It adheres closely to paper. Can this be the young of *Lyngbya Carmichaelii*?

30. C. *clandestina*, Berk.; "threads articulated, free, distinct, uniform; bearing reproductive granules within the joints." *Berk. Gl. Alg. t.* 13, *f.* 1.

"On the under side of stones in mud highly impregnated with putrifying marine substances, at Weymouth," *Rev. M. J. Berkeley.* — *Filaments* very minute, about a line long, at first appearing "of an opaque white upon the dark mud-stained stone, gelatinous and flexuous, nearly equal throughout. Under the lens they are hyaline, and are furnished with joints about thrice as long as broad, with very evident and rather broad dissepiments and distinct granules. Sometimes the granules are wanting, probably through age." *Berk.*—Probably, as Mr. Berkeley observes, this obscure plant belongs rather to the *Leptomiti*, or at least "makes a very natural transition from the more distinctly articulated *Leptomiti* growing on decayed vegetables to the real *Confervæ*."

*e. Filaments parasitical, olivaceous, forming pencil-like tufts on marine Algæ, rising from a disk-like tubercle, common to the whole tuft.**

31. C. *fucicola*, Velley; filaments rising from a minute tubercle, pencilled, flaccid, membranaceous; articulations

* This tribe forms a natural genus, very distinct from *Conferva* and more properly belonging to *Ectocarpeæ*. *C. scutulata* forms the genus *Elachistea* of Duby, whose character might be extended to the others.

about twice as long as broad. *Harv. l. c. p.* 354; *Wyatt, Alg. Danm. No.* 192; *Dillw. Conf. t.* 66.

On Fuci, especially *F. nodosus* and *vesiculosus*, common.—"*Filaments* branched at the base, within the tubercle. *Tubercles* variable in size; in tufts of the first year hardly perceptible, from this period they increase by degrees, until at length they become globular, with a slender neck, and then drop off. In autumn many of the tufts assume a yellowish or ochry colour, the effect of age and long exposure to the sun, and in this state they constitute the *C. ferruginea* of Agardh." *Carm.—Tufts* about an inch long, olivaceous or rust-coloured.

32. C. *flaccida*, Dillw.; tubercles small, filaments pencilled, flaccid and tender; lower articulations half as long as broad, upper of equal length and breadth. *Dillw. Conf. t. G.*; *Harv. l. c. p.* 355; *Wyatt, Alg. Danm. No.* 222.

On Fuci, especially *Cystoseira fibrosa.—Filaments* half an inch long, dull olive brown; tubercle of the same structure as in *C. fucicola*, from which species, except in the shorter and more flaccid filaments, and short joints, the present does not differ.

33. C. *curta*, Dillw.; filaments minute, rising from a tubercle, rather rigid, pencilled; articulations about as long as broad. *Dillw. t.* 76; *Harv. l. c. p.* 355.

On Fuci.—*Filaments* 1—3 lines long, rising from a small tubercle formed of dense branching filaments, brown, tapering towards the base, obtuse. Dissepiments contracted. Perhaps only a variety or the young of *C. fucicola*.

34. C. *stellulata;* filaments exceedingly minute, forming hemisphærical tufts, radiating from a point; curved, obtuse; colourless below, olivaceous above; articulations about as long as broad.

Parasitical on the fronds of *Dictyota dichotoma*. Torquay, *Mrs. Griffiths.—Tufts* a quarter of a line in diameter, hemisphærical, composed of radiating filaments. Whether or not this be a true parasite, or a diseased state of the fructification, I am doubtful. On its first appearance it resembles a minute, brownish, dot-like stain; afterwards it is of the size and form of the *single seeds* of the *Dictyota*, but presents to the microscope the aspect of the *sorus* of that plant, being composed of numerous minute, erect, oblong bodies of a dark olive colour; finally these elongate into the filaments above described. They are not at all unlike the filaments which accompany the fructification in *Asperococcus:* Mrs. Griffiths is, however, of opinion that it is a true parasite.

35. C. *scutulata*, Sm.; "olive-brown; filaments branched at the base, densely combined into a depressed, peltate mass, rooted in the centre; joints as long as broad." *Sm.—E. Bot. t.* 2311; *Harv. l. c. p.* 355; *Wyatt, Alg. Danm. No.* 223.

Parasitical on the strap-shaped receptacles of *Himanthalia lorea*, on which it forms broad, wart-like tubercles.

f. Filaments purple or pink, tufted.

36. C. *carnea*, Dillw.; "filaments simple, slender, short, pale red; articulations torulose, 2 or 3 times longer than broad, endochrome contracted into a solitary globule." *Dillw. Conf. t.* 84; *Harv. l. c. p.* 355.

On *Confervæ* in the river near Loughor, Glamorganshire, near its confluence with the sea, *Mr. W. W. Young.*

37. C. *ceramicola*, Lyngb.; filaments very slender, flaccid, rosy; articulations equal in length and breadth; endochrome at length globular, and escaping through the tube. *Harv. l. c. p.* 355; *Lyngb. Dan. t.* 48?

In rocky pools on various small Algæ, at Appin, *Capt. Carmichael.*—"*Filaments* very slightly tufted, or rather gregarious, about an inch long, very slender and flaccid, of a purplish rose-colour. *Articulations* about as long as broad, becoming at length gibbous, when the internal mass, which was at first square, assumes a globular form and bursts through the tube." *Carm.* The bursting of the tube and the discharge of the endochrome in globular masses, seem to indicate some affinity with *Lyngbya.*

B. *Filaments branched.*

a. Inhabiting fresh water, or damp ground.

38. C. *nigricans*, Roth; "filaments dichotomous, somewhat rigid, blackish-green; branches long, remote, patent; articulations four times as long as broad." *Dillw. Conf. Syn. t. E.*; *Harv. l. c. p.* 356. *C. aspera, Ag.?*

In a pond at Wimbledon, Surrey, *Mr. Dickson.*—A very obscure plant.

39. C. *crispata*, Roth; "green, branched, crisped and entangled; branches alternate, copious, acute; joints even, several times longer than broad, alternately contracted when dry." *Sm.—E. Bot. t.* 2350; *Harv. l. c. p.* 356.

"Collected in pools in Sussex, by *Mr. Borrer.*" *Sm.*—I cannot distinguish this from a not unfrequent state of *C. fracta.*

40. C. *flavescens*, Roth; forming pale yellowish strata; filaments slender, sparingly branched; branches alternate or sub-dichotomous, erecto-patent, with scattered, elongate, alternate or secund ramuli; articulations 8 or 9 times longer than broad. *Harv. l. c. p.* 356; *E. Bot. t.* 2088; *Wyatt, Alg. Danm. No.* 224.

In ditches of brackish or fresh water, not uncommon.—This forms extensive strata of a light yellowish colour, which finally rise to the surface. It is allied to *C. fracta*, but the filaments are more slender, the joints longer, and the colour is different. It has a silky appearance when dry, and does not adhere to paper.

41. C. *fracta*, Fl. Dan.; forming entangled, dull green strata; filaments somewhat rigid, much branched; branches divaricating; ramuli scattered and very patent; articulations 4—6 times longer than broad. *Dillw. Conf. t.* 14; *E. Bot. t.* 2338; *Harv. l. c. p.* 356.

In ditches, lakes, &c. common. — This forms globose or long entangled tufts, frequently cohering into extensive strata and finally rising to the surface. The filaments are much and very irregularly branched, all the branches very patent.

42. C. *glomerata*, Linn.; filaments rising from a scutate root, finely tufted, bushy, somewhat rigid, bright green; branches crowded, irregular, erect; the ultimate ramuli secund, sub-fasciculate; articulations 4—8 times longer than broad. *Dillw. Conf. t.* 13; *E. Bot. t.* 2192.

In clear streams, wells, &c.— This forms beautiful bushy tufts. It varies much in the length of the joints and in the amount of branching. Some varieties are subsimple, with a few distant branches and nearly bare of ramuli; others are very much branched.

43. C. *ægagropila*, Linn.; filaments issuing from a central point, forming dense, roundish balls; branches erect, sub-secund, straight; articulations 3 or 4 times longer than broad, the uppermost cylindrical, the lower swollen upwards. *E. Bot. t.* 1377; *Dillw. Conf. t.* 87; *Harv. l. c. p.* 357.

In lakes, rare. North Wales, *Rev. H. Davies*. North of Scotland, *Mr. Brodie*. Prestwick Car, *Mr. Winch*. Culmere Pool and Whitemere, Shropshire, *Rev. E. Williams*. Cunnemara, *Mr. J. T. Mackay*.—A highly curious plant, forming a compact, green, spongy ball, varying in diameter from half an inch to 2—4 inches. The filaments issue from a central point, and are subdichotomous. The name is derived from its resemblance to the balls that are found in the stomachs of goats.

44. C. *Brownii*, Dillw.; filaments forming dense, cushion-like tufts, erect, rigid, flexuous, elastic, slightly branched; branches few, long, sub-simple, secund; axils acute; articulations 4 or 5 times longer than broad, the lower ones thickened upwards, the upper cylindrical. *Harv. l. c. p.* 356; *Dillw. Suppl. t. D. C. pulvinata, Brown M.S.; Wyatt, Alg. Danm. No.* 225.

On wet rocks in a cave near Dunree, North of Ireland, *R. Brown, Esq.* On shady rocks at the entrance of a small cave beyond Black Castle, Wicklow, where it is exposed to the dripping of fresh water, and the occasional overflow of the sea. Cornwall Coast, near Land's End, *Mr. Ralfs*.—This forms exceedingly dense, very rigid tufts, of a black-green colour when growing, but, on having the water expressed, and being held to the light, exhibits a beautiful yellow-green tint. *Filaments* so matted together that it is difficult to separate a single thread. They appear to originate in a mass of creeping, branched, densely matted fibres, which form the base of the tufts. They are erect, from half an inch to an inch high, flexuous, very

rigid and elastic; the branches few and nearly simple, almost always secund, very erect. A very curious and distinct plant, having, to the naked eye, a good deal the appearance of *Vaucheria terrestris*, but totally different in structure. It is perhaps allied to *C. ægagropila*. I have examined a specimen from *Mr. Brown* in the late *Mr. Templeton's* herbarium, and find it to agree in every respect with my Wicklow plant.

b. Inhabiting the sea.

45. C. *pellucida*, Huds.; filaments cartilaginous, rigid, erect, bright green; di-trichotomous, the axils very acute, branches erect; articulations many times longer than broad. *Harv. l. c. p.* 357; *Wyatt, Alg. Danm. No.* 193; *E. Bot. t.* 1716.

In the sea, on rocks near low-water mark. Yarmouth, *Sir W. J. Hooker*. South of England. Several places in Ireland; very fine in Belfast Lough, *Mr. Thompson.—Root* a mass of fibres. *Filaments* 4—6 inches high, setaceous, extremely rigid, tough and wiry, tufted or subsolitary, rising with an undivided stem for half an inch to an inch, then forked or trifurcate, and afterwards repeatedly branched in a di-trichotomous or somewhat umbellate manner, the uppermost branches more or less furnished with di-trichotomous or tufted ramuli. Joints of the stem and branches very long, the dissepiments rarely occurring except at the divisions of the branches; in the ramuli short, 3 or 4 times longer than broad. *Colour* a fine, glossy, transparent green, fading much in drying. It scarcely adheres to paper.

46. C. *rectangularis*, Griff.; filaments setaceous, rigid, irregularly branched; branches distant, patent, set with short, opposite, horizontal ramuli; articulations twice or thrice as long as broad. *Harv. in Hook. Br. Fl.* ii. *Addenda, p.* 10; *Wyatt, Alg. Danm. No.* 145.

In the sea, thrown up; very rare. Summer. Torquay, *Mr. Borrer* and *Mrs. Griffiths.—Filaments* as thick as horse hair, 8—12 inches long, divided in an irregular manner into a few principal branches; branches patent, more or less furnished with subdistant, horizontal, opposite ramuli, from a line to an inch in length, and either simple or bearing a second series; very rarely, by abortion, they are alternate. *Colour* a full green, fading in the herbarium. *Substance* rigid, very imperfectly adhering to paper. *Joints* uniform throughout the plant, generally 2 or 3 times longer than broad. One of the most beautiful and distinct, as it is the rarest, of the genus.

47. C. *Hutchinsiæ*, Dillw.; filaments setaceous, cartilaginous, rigid, glaucous-green, flexuous, tufted, bristly; ramuli curved, simple or furnished on the interior face with processes of one articulation; articulations twice as long as broad, joints contracted. *Dillw. t.* 109; *Harv. l. c. p.* 357; *Wyatt, Alg. Danm. No.* 226.

On rocks &c. in the sea, near low-water mark; rare. Bantry Bay, *Miss Hutchins*. Larne, 1802, *Dr. Drummond*. Tor-Abbey, *Mrs. Griffiths*. Belfast Bay, *Mr. Thompson.—Filaments* thicker than horse-hair, 6—8 inches long, flexuous, repeatedly divided in an alternate manner; branches rather

distant, spreading or divaricated, more or less furnished with short branchlets having a few short, secund ramuli along their upper faces. *Colour* deep glaucous green, "with changeable tints when fresh, and under water appearing almost white," (*Miss Hutchins*). *Substance* rigid and tough, more or less perfectly adhering to paper. *Joints* uniform throughout the plant. Nearest *C. pellucida* in texture, and *C. diffusa* in habit and character: from the latter it is not always easy clearly to distinguish it.

48. C. *diffusa*, Roth; filaments sub-setaceous, rigid, dark or full green, flexuous, much branched; branches distant, elongated, furnished towards the top with a few short, patent, secund ramuli; articulations 3 or 4 times longer than broad. *Dillw. t.* 21; *E. Bot. t.* 2289; *Harv. l. c. p.* 358; *Wyatt, Alg. Danm. No.* 144.

On rocks &c. in the sea, not uncommon. Southern shores of England and Ireland: West of Ireland. Port Rush, *Mr. Moore.—Filaments* 6—10 inches long, as thick as horse-hair, loosely tufted, generally so rigid as to bristle out when removed from the water, but occasionally flaccid, very flexuous, distantly branched; branches alternate, much divided, either bare of ramuli, or furnished toward the end, or sometimes generally, with short, secund branchlets. *Joints* 3 or 4 times longer than broad, nearly uniform in all parts of the frond. *Colour* either grass-green or dark green.

49. C. *nuda*, Harv.; filaments sub-rigid, slender, very straight, dull green or olivaceous (when dry), sparingly dichotomous; ramuli few and scattered, appressed, the uppermost often opposite; articulations many times longer than broad. *Harv. in Mack. Fl. Hib.* iii. *p.* 229.

On basalt rocks, in the sea. Portstewart, *Mr. D. Moore.— Filaments* loosely tufted, 2 or 3 inches high, sparingly branched, very straight, set with a few, scattered, very erect and appressed ramuli, the uppermost ones often opposite, which makes the apices of the branches appear three-forked. *Articulations* very long. This differs from any species with which I am acquainted, but may, perhaps, be the *C. aspera* of Agardh, which, in the 'British Flora,' I have doubtfully referred to *C. nigricans*. To avoid confusion, I think it better to give a new name to our present plant. In the straight filaments and erect ramuli it resembles *C. rupestris*, but differs in colour and in the great length of the joints. Perhaps it may be only a variety of the latter.

50. C. *rupestris*, Linn.; filaments slender, rigid, dark green, straight, tufted, bushy; branches erect, crowded, densely clothed with appressed ramuli; articulations 3 or 4 times longer than broad. *Dillw. t.* 23; *E. Bot. t.* 1699; *Harv. l. c. p.* 357; *Wyatt, Alg. Danm. No.* 95.

On rocks in the sea, about half-tide level, very common. — *Tufts* 3—6 inches long, very dark or blackish green. *Filaments* rigid, densely and closely branched, thickly clothed with very erect or appressed ramuli, scarcely adhering to paper.

51. C. *lætevirens*, Dillw.; filaments much branched, bushy,

forming fine tufts of a transparent yellow-green colour, greyish and without gloss when dry; branches erecto-patent, crowded, repeatedly divided; ultimate ramuli secund; joints of the chief divisions long, of the ramuli about thrice as long as broad. *Dillw. t.* 48; *E. Bot. t.* 1854. *C. glomerata, β. marina, Ag.—Harv. in Hook. Br. Fl.* ii. *p.* 357; *Wyatt, Alg. Danm. No.* 143.

On rocks, stones and Algæ, in the sea; very common.—*Tufts* 4—8 inches long. Except in its marine habitat, I cannot distinguish this from *C. glomerata* (No. 42), with which Agardh unites it, as it appears to me, justly. *Mrs. Griffiths*, however, than whom no one has studied this genus more carefully, is of a different opinion, and to her judgment I yield.

52. C. *flexuosa*, Dillw.; filaments very flexuous or angularly bent, jointed, often sub-opaque, rather rigid, dull green, but slightly branched; branches variable in number and length, more or less divided, furnished with long, patent branchlets, whose inner edge is pectinated with a few secund ramuli; articulations thrice as long as broad. *Dillw. t.* 10; *E. Bot. t.* 1944. *Conf. fracta, β. flexuosa, Ag.—Harv. in Hook. l. c. p.* 356; *Wyatt, Alg. Danm. No.* 227.

In salt-water ditches near Yarmouth, *D. Turner, Esq.* In the sea, not uncommon. Torquay, *Mrs. Griffiths.* Ballycastle, *Miss Hincks.* Several other parts of the east coast of Ireland. — *Filaments* 4—8 inches long, remarkably flexuous, rather harsh to the feel. This really seems distinct from *C. fracta*, habitat out of the question.

53. C. *gracilis*, Griff.; filaments capillary, flexuous, silky, much branched, bright yellow-green; main branches entangled, sparingly divided, angulato-flexuous; ultimate ramuli pectinato-secund, much attenuated, straight and very long; articulations about 3—5 times longer than broad. *Griff. in Wyatt Alg. Danm. No.* 97; *Harv. Fl. Hib.* iii. *p.* 230.

In the sea, on rocks and Algæ. Torquay, *Mrs. Griffiths.* Youghal, *Miss Ball.* Belfast Bay, and at Ballantrae, Ayrshire, *Mr. W. Thompson.* —*Filaments* forming soft, silky tufts, 6—12 inches long, with something of a main stem, from which spring very numerous, long, and more or less divided, very flexuous or angularly twisted branches, plentifully clothed with elongated, pectinate, secund branchlets, of which the ultimate ramuli are very long, slender, and straight or slightly curved. *Colour* a fine, rich yellow-green, somewhat faded in the herbarium, but preserving a silky gloss. *Substance* soft, imperfectly adhering to paper. Nearly allied in character to *C. flexuosa*, but with a very different habit.

54. C. *refracta*, Ag.; filaments capillary, sub-rigid, tufted, bright green, very much branched; secondary branches spreading on all sides, repeatedly divided, thickly clothed with very patent or reflexed, short branchlets, which are pec-

tinated with ramuli on their upper surface. *Wyatt, Alg. Danm. No.* 228.

In the sea; in rocky pools left by the tide. Dunlecky Castle, Kilkee. Ilfracombe, *Mrs. Griffiths.* Mangan's Bay, Co. Cork, *Miss Ball.* Giant's Causeway, *Mr. W. Thompson.*—*Filaments* 3 or 4 inches long, slender, tufted; the main stems somewhat woven together or ropy, the secondary branches free, spreading on all sides and much divided; the ultimate branchlets very patent or reflexed, pectinato-secund, opposite or alternate. *Colour* a brilliant yellowish green, which is partially preserved in a dry state. *Substance* rather rigid, imperfectly adhering to paper. This beautiful plant is nearly allied to *C. albida*, but the filaments are coarser and far more rigid, the ultimate branches shorter and more patent, often strongly reflexed, and the habit by no means spongy.

55. C. *albida*, Huds.; filaments exceedingly slender, flaccid, pale yellow-green, (whitish when dry), forming dense, silky, or somewhat spongy, intricate tufts; branches crowded, irregular, the uppermost patent and mostly opposite; ramuli opposite or secund; articulations 4 or 5 times longer than broad. *E. Bot. t.* 2327; *Harv. l. c. p.* 358; *Wyatt, Alg. Danm. No.* 96.

On rocks and the larger Algæ in the sea, below half-tide level; frequent. —*Tufts* 2—6 inches long, pale green, exceedingly dense or spongy, flaccid. *Filaments* extremely slender, excessively and intricately branched; the branches very irregular: ultimate ramuli short, patent, opposite or secund, issuing from almost every joint, and occasionally bearing a second set. In the herbarium it fades to a pale yellowish, wholly without gloss, by which character it is best marked from its allies. *Joints* short. *Mrs. Griffiths* finds a beautiful plant at Torquay, having many characters with *C. albida*, but 12 inches long and of a bright yellow-green colour, which is partially preserved in drying. For the present I regard it as a variety of this species.

56. C. *lanosa*, Roth; filaments slender, short, yellow-green, forming dense tufts; branches virgate, erect, sub-distant, straight, alternate or opposite, with a few alternate or secund ramuli, axils very acute; lower articulations twice, upper six times longer than broad. *E. Bot. t.* 2099; *Harv. l. c. p.* 358; *Wyatt, Alg. Danm. No.* 194.

In the sea, on rocks or, more frequently, on the larger Fuci.—*Filaments* forming small, entangled, woolly tufts, an inch long, pale green, stoloniferous below, branches straight and erect, all the axils very acute. In a dry state it is wholly without gloss, faded, except near the tips, where it generally preserves a glaucous green colour.

57. C. *uncialis*, Ag.; tufts very short, spongy, simple below, above divided into numerous fastigiate, woolly segments; filaments flexuous, sparingly branched, densely interwoven; ramuli distant, secund, somewhat pectinate, long, patent or incurved; articulations 2—4 times longer than broad. *Ag*

Syst. Alg. p. 111; *Fl. Dan. t.* 771, *f.* 1; *Harv. in Hook. Journ. Bot. p.* 304; *Wyatt, Alg. Danm. No.* 146.

On rocks in the sea. Torquay, *Mrs. Griffiths.* New Castle, coast of Down, *Mr. W. Thompson.* Rathlin, Antrim, *Mr. D. Moore.*—*Tufts* an inch high, dark green, spongy, with something the habit of *Ectocarpus tomentosus*, composed of slender, irregularly branched filaments, densely entangled. Certainly nearly allied to the preceding, with some states of which it may, without careful examination, be confounded.

58. C. *glaucescens*, Griff.; tufts dense, glaucous green, sub-fastigiate; filaments very slender, excessively branched; branches straight and erect, the lesser ones furnished with close, very erect, straight, elongated ramuli; joints very short. *Wyatt, Alg. Danm. No.* 195.

On rocks in the sea, not uncommon. Torquay, *Mrs. Wyatt.* Mangan's Bay, *Miss Ball.* Portmarnock, *Mr. Moore.* Coast of Down, *Mr. W. Thompson.*—*Tufts* 2 or 3 inches high, dense, somewhat level-topped, of a glaucous green colour. *Filaments* very slender (but more robust than in *C. refracta*), much branched upwards, the branches straight and erect, the lesser ones furnished with close, very erect and appressed, elongated, straight setaceous ramuli. *Joints* very short. *Colour* preserved in drying, and more or less perfectly adhering to paper. This comes near *C. arcta*, but Mrs. Griffiths is of opinion that it is distinct.

59. C. *arcta*, Dillw.; filaments forming broad, somewhat starry tufts, of a full green colour, much branched; branches straight, crowded, erect; ramuli sub-appressed, opposite or alternate; articulations either uniformly twice as long as broad, or with the lower joints short, the upper very long. *Dillw. t. E.*; *E. Bot. t.* 2098; *Harv. l. c. p.* 359. *C. centralis, Lyngb., Harv. l. c. p.* 358; *Wyatt, Alg. Danm. No.* 46.

On rocks in the sea, generally above half-tide level, frequent.—*Tufts* rising from a broad disk formed of dense fibres. *Filaments* spreading in a circle, fastigiate, much branched: in the young specimens the branches are somewhat separate, all remarkably erect or straight (when it is *C. arcta* of Dillwyn and of 'Brit. Flora,' and in a still younger state *C. vaucheriæformis* of Agardh); in the older they are more or less matted together or interwoven by means of rootlike fibres which issue from the joints of the main branches, the apices only, in these specimens, produced beyond the spongy tuft, long, slender, straight, of irregular length and slightly branched; all the ramuli extremely erect and close-pressed (forming the *C. centralis* of Lyngbye and of 'Brit. Flora'). *Joints* extremely variable, sometimes uniformly twice as long as broad throughout, but more frequently the lower joints are short, those of the upper branches very long. *Colour* a fine, deep, glaucous green, partially discharged in fresh water or fading in the herbarium. *Substance* soft and retaining water. In the dry state young specimens have a glistering appearance; old ones, on the contrary, are without gloss, except the young shoots toward the summit, woolly, and considerably faded. In the 'Brit. Flora' I expressed my doubts whether *C. arcta* and *centralis* of authors, however dissimilar in their typical states, were really distinct. Since then, numerous specimens in every stage, from the

extreme young to the old and battered form, kindly furnished by *Mrs. Griffiths*, have clearly shown such a gradation of character, that I no longer hesitate to unite them.

60. C. *æruginosa*, Huds.; "filaments branched, flexuous, short, æruginose; branches scattered, patent, obtuse; articulations rather longer than broad." *Dillw. Syn. t. E.—C. marina;* capillacea, brevis, viridissima, mollis. *Dill. Hist. Musc. t.* 4, *f.* 20; *Harv. l. c. p.* 359.

On Fuci; *Dillenius*. Of this I know nothing.

61. C. *riparia*, Roth; filaments elongated, slender, decumbent, pale green, forming wide strata, flaccid, entangled, angulato-flexuous, slightly branched; lower branches short, tentacular; upper long, sub-simple, with rounded axils; articulations 2—4 times longer than broad. *E. Bot. t.* 2100; *Harv. l. c. p.* 359.

On sand-covered rocks near high-water mark. Bantry, *Miss Hutchins*. Appin, *Capt. Carmichael*. Sunderland, *Mr. W. Backhouse*. Yarmouth, *Dillwyn*. — Forming decumbent, dense strata of some extent. *Filaments* very slender, with a few root-like branches below, and once or twice branched above. *Colour* light green, much paler and without gloss when dry. This connects the simple, stratified species with the branched ones.

LXX. Hydrodictyon. Roth.

Filaments forming a net-work, with regular, polygonal meshes; articulations viviparous. — Name, ὑδωρ, *water*, and δικτυον, *net-work*.

1. H. *utriculatum*, Roth; meshes pentagonal. *Harv. in Hook. Br. Fl.* ii. *p.* 359. *Conferva reticulata*, *E. Bot. t.* 1687; *Dillw. t.* 97.

In ditches and pools in the midland and southern counties of England; not found in Scotland or Ireland: rare. This forms a beautiful tubular net, floating freely in the water. The meshes are pentagonal or hexagonal, varying in diameter from half a line to half an inch, and the filaments from the width of a human hair to that of the coarsest hog's bristle. I have fine specimens from *Prof. Henslow*, gathered in a pond in the Botanic Garden at Cambridge, where the plant has existed for many years.

LXXI. Mougeotia. Ag.

Filaments articulated, simple, at length united in pairs by transverse tubes. *Endochrome* filling the joint, granular, after conjugation forming roundish globules at the point, where the filaments unite.—Name, in honour of *M. J. B. Mougeot*, an excellent German botanist.

1. M. *genuflexa*, Ag.; filaments slender, fragile, at length bent at acute angles, and irregularly united by short transverse tubes; endochrome half filling the articulation; globules sphærical. *Harv. in Hook. Br. Fl.* ii. *p.* 360. *Conf. genuflexa, Dillw. t.* 6.

In ditches and ponds, very common. This forms vast, yellowish-green or dull yellow masses, often 30 feet in diameter. The filaments are very fragile, the colouring matter at first filling the tube, but soon contracted into a longitudinal stripe.

2. M. *compressum*, Ag.; filaments very fragile, curved, irregularly united by transverse tubes; endochrome compressed; globules sphærical. *Harv. l. c. p.* 360; *Lyngb. Hyd. Dan. t.* 58.

In pools and ditches. Appin, *Capt. Carmichael.*—This has the habit of the preceding. "*Filaments* about as thick as those of *Zygnema quininum*, and remarkably fragile, flying asunder in single joints, which then become more or less curved; articulations 3—6 times longer than broad. The internal mass occupying about two-thirds of the articulation, is collapsed or compressed, appearing, when its edge is presented to the eye, as a slender line running through the centre of the filament. *Sporidia* globular, lodged in the dilated, transverse tubes." *Carm.*

3. M. *cærulescens*, Ag.; filaments slender, fragile, inosculating without tubes, angularly bent; globules green, cruciform. *Harv. l. c. p.* 360. *Conf. cærulescens, E. Bot. t.* 2457.

Pools and ditches, rare. Boggy pool on Henfield Common, Sussex, *Mr. Borrer.* Appin, *Capt. Carmichael.*—"Where this plant occurs in quantity and unmixed with *Confervæ*, it forms a greyish cloud in the water. *Filaments* extremely slender; articulations 5 or 6 times as long as broad, filled with a bluish fluid, through which passes a slightly spiral line of granules, joining without the intervention of transverse tubes, generally breaking off in pairs and then assuming the form of a cross, connected by the central, cruciform sporidium." *Carm.* This curious plant I have never seen.

LXXII. Tyndaridea. Bory.

Filaments simple, finally united in pairs by transverse tubes. *Endochrome* consisting of two roundish, star-like masses, which, after conjugation, unite and form a roundish globule (*sporidium*), lodged either in one of the articulations, or in the connecting tube.—Name, *Tyndaridæ;* the constellation, so called, of *Castor* and *Pollux*, in allusion to the *twin, star-like* masses, contained in each joint. It is incorrectly spelled "*Tendaridea*," by Bory, in '*Dict. Class. d'Hist. Nat.*'

1. T. *cruciata*, Harv.; joints about twice as long as broad,

containing two roundish masses; sporidia sub-globose, lodged in one of the filaments. *Harv. l. c. p.* 361. *Zygnema cruciatum, gracile* and *decussatum, Ag. Conf. bipunctata, Dillw. t.* 2, and *C. decussata, Syn. p.* 51.

In ditches and pools, common. — This forms extensive masses of a yellow-green colour, finally rising to the surface. The articulations vary in length, and are marked by two roundish starry masses.

2. T. *pectinata*, Harv.; joints shorter than their diameter, containing two linear, transverse masses; sporidia contained in the swollen, transverse tubes. *Harv. l. c. p.* 361. *Conf. bipunctata, E. Bot. t.* 1610. *C. bipartita, E. Bot. t.* 2302?

In stagnant water, common. — "This, like *T. cruciata*, occurs in large, yellowish, floating masses. They are often found intermixed, nor is there anything to distinguish them from each other in their usual state, but the transversely oblong shape of the internal dots, which results probably from the shortness of the articulations. In a state of junction, however, the position of the sporidia leaves no doubt that they are distinct species." *Carm.*

3. T. *epigæa*, Harv.; "filaments interwoven into a crisped stratum; articulations once and a half as long as broad; granular mass dense, scarcely bipartite; sporidia globose, lodged in one of the filaments." *Carm.—Harv. l. c. p.* 361. *Zygnema epigæum, Carm. Alg. App. ined.*

On road-sides and frequented paths. Spring to autumn. Appin, *Capt. Carmichael.*—"*Filaments* an inch or more in length, as thick as those of *T. cruciata*, spreading to an indefinite extent in a thin, intricate, yellowish fleece over the dry, naked earth; here and there grouped and curled in a most characteristic manner. *Articulations* 1--3 times longer than broad, and remarkably opaque; internal mass partially separating into two square smooth portions. *Sporidia* sphærical, lodged in one of the filaments." *Carm.*

4. T.? *bicolor*, Harv.; "filaments simple, slender, straight, bright green; joints thrice as long as broad, white-edged, even, several of them together here and there empty, white and pellucid." *Sm.—Conf. bicolor, E. Bot. t.* 2288.

On stones in a rapid streamlet at Henfield, Sussex, *Mr. Borrer.* I am not acquainted with this plant.

LXXIII. Zygnema. Ag.

Filaments articulated, simple, finally united in pairs by numerous transverse tubes. *Endochrome* consisting of granules arranged in spiral rings or in a simple row, which, after conjugation, are condensed into a globule in one of the filaments, or in the transverse tubes.—Name, ζυγος, a *yoke*, and νημα, a *thread*; the threads, which are at first separate, being afterwards yoked together.

1. Z. *nitidum*, Ag.; filaments dark green, parallelly joined; articulations containing numerous, arched spires of granules *Harv. l. c. p.* 362. *Conf. nitida, Dillw. t.* 4, *f. C, (bad).*

In ditches &c. frequent. *Filaments* dark green, very lubricous, as thick as horse-hair, rigid, forming large masses. *Articulations* usually a little longer than broad, but *Capt. Carmichael* sometimes found them six times as long as their diameter. After conjugation the filaments, in this and the following species, become crisp, fragile, and lose much of their lubricity; the spires are soon after deranged and the contents of one articulation discharged through its tube into the opposite one, where they form a dark-coloured globule.

2. Z. *deciminum*, Ag.; filaments dark green, parallelly joined; spires two, crossing each other. *Harv. l. c. p.* 362. *Conf. jugalis, Dillw. t.* 5, and *C. nitida, t.* 4, *f. A, B.*

In ditches &c. very common.—Forming large, glossy and slippery strata resembling the preceding. *Filaments* more slender, but varying much in this respect and in the length of the joints, on which characters but little dependance can be placed. *Z. elongatum, Berk. Alg. t.* 12, *f.* 2, represents one of these varieties. The spires are constantly double, crossing each other, like a continual series of the Roman numeral X, whence the specific name; in the long-jointed varieties they are very lax; in the short-jointed dense.

3. Z. *quininum*, Ag.; filaments pale yellow-green, parallelly joined; spires simple. *Harv. l. c. p.* 362. *Conf. spiralis, Dillw. t.* 3.

In ditches and pools, very common; forming pale, cloudy, yellow-green masses.—*Filaments* glossy, varying much in diameter and in the length of the joints, marked with a spiral line resembling a continual series of the Roman numeral V.

4. Z. *curvatum*, Ag.; "filaments green, unbranched, very slender, here and there slightly bent and combined by their angles; joints cylindrical, four times as long as broad; colouring matter in a triple, irregular series of dots." *Sm.*—*Harv. l. c. p.* 362. *Conf. stictica, E. Bot. t.* 2463.

Ditches in Henfield level, Sussex; and pools on Chy-an-Hâl Moor, near Penzance, *Mr. Borrer*.—This species seems to be intermediate between the genera *Zygnema* and *Mougeotia*. "When young, the colour is a dull pale green, and about three imperfectly spiral lines of granules are with difficulty distinguishable: afterwards these lines become more conspicuous, the rest of the filaments being now perfectly colourless, and their component granules larger, but their arrangement is still irregular. The threads subsequently unite here and there, not by every joint, and their connecting processes are usually nearer to one end of the joints than to the other. Such filaments are divaricated at the points of connection, rather less abruptly than in *M. genuflexa*. In some of the combined joints, the contents appear unchanged, in others they form a mass of larger granules than in the lines; and some have a large oval seed, which often swells the joints. Traces of unchanged lines occur, now and then, in the fructifying joints." *Eng. Bot.*

5. Z. *ordinarium*, Berk.; "articulations 4—6 times as long as broad, filled with sporaceous matter, through the centre of which runs a single series of granules; seeds globose, in the transverse tubes." *Berk. Gl. Alg. t.* 12, *f.* 1.

In ditches and pools, rare. Glapthorn, Northamptonshire, *Rev. M. J. Berkeley.*—Forming green masses floating freely in the water.

LXXIV. Sphæroplea. Ag.

Threads at first articulated, at length filled with sporaceous globes which move freely in them. *Berk.*—Name, σφαιρα, a *globe*, and πλεος, *full;* full of globes.

1. S. *crispa*, Berk.; "threads erect, short, green, mucous, crisp, simple, at first with articulations as broad as long, filled with minute, distinct granules, then with parallel rings, which at length become globular, and escape in moniliform threads." *Berk. Gl. Alg. t.* 3, *f.* 1.

Growing on stones, aquatic plants &c., in early spring, not uncommon; *Rev. M. J. Berkeley.—Tufts* half an inch to an inch in length, deep green. "*Filaments* at first of a uniform green, either dotted without any appearance of joints, or divided by dark lines into articulations scarcely so long as broad, which contain a few granules larger than the rest. A few threads have them scarcely broader than in some *Oscillatoriæ*, but as these are colourless, they are probably abortive. The sporaceous mass at length assumes the form of annular disks, which are sometimes dark, sometimes light in the centre, and the articulations are invisible. This is the most usual appearance; but occasionally the ring is formed in the centre of the joint, and there becomes globular without any rupture or absorption of the dissepiment. In general the globules float freely in the tube, and at length escape in moniliform filaments." *Berk.*

2. S. *punctalis*, Berk.; "floating, pale green; threads very slender, mucous, flexuous; articulations about as broad as long, containing a dotted, sporaceous mass." *Berk. Gl. Alg. t.* 3, *f.* 2. *Conf. punctalis, Dillw. t.* 51.

Floating on the surface of fresh-water pools, *Rev. M. J. Berkeley.*—Forming crisped masses of a light green colour. *Filaments* very slender, mucous, flexuous. *Articulations* as long as broad, at first containing a square, at length a globular coloured mass.

LXXV. Aphanizomenon. Morren.

Filaments simple, cylindrical, flexile, membranaceous, glassy, articulated; cohering together in flat laminæ, laciniated at the apex, straight, or here and there inflated, full of green matter, oscillating, spontaneously falling to pieces. *Mor.*—Name, αφανιζομενον, a *vanishing thing.*

1. A. *incurvum*, Morren. *Mem. cum. icone.*

In lakes and ditches, floating on the surface. Ballydrain Lake, near Belfast, *Mr. W. Thompson.*—"*Lamella* flat, light green, incurved, composed of united threads; articulations 2—8 times longer than broad, discrete, bluish green." *Morren.*—For a more detailed account of this curious little plant, I must refer to Dr. Morren's Memoir read before the Royal Academy of Brussels in December, 1837; published, I believe, in their Transactions, but to be had in a separate form. Mr. Thompson's specimens were seen by Dr. Morren.

Tribe 18. SIPHONEÆ.

LXXVI. Codium. Stackh.

Frond spongy, dark green, (crustaceous, globular, cylindrical or flat), composed of an interwoven mass of tubular, continuous filaments. *Fructification:* opaque vesicles attached to the filaments, near the surface of the frond. *Grev.*—Name, κοδιον, the *skin* of an animal; from the soft substance.

1. C. *tomentosum*, Stackh.; frond cylindrical, dichotomous. *Grev. Alg. Brit. p.* 185, *t.* 19; *Hook. Br. Fl.* ii. *p.* 318; *Wyatt, Alg. Danm. No.* 35. *Fucus tomentosus, E. Bot. t.* 712.

On rocks in the sea; frequent. Perennial. Summer.—*Frond* rising from a spreading spongy base, cylindrical, from a quarter to nearly half an inch in diameter, 6—12 inches long, more or less regularly divided in a dichotomous manner; sometimes regularly dichotomous; sometimes palmato-partite, the segments forked; sometimes beset with short lateral branches. *Structure* filamentous, the centre composed of longitudinal, interlaced, colourless fibres, the circumference of radiating, horizontal, club-shaped, deep green filaments, invested by a viscid gelatine. *Fructification:* dark green ovate vesicles, borne by the club-shaped filaments.

2. C. *Bursa*, Ag.; frond sphærical, hollow. *Grev. Alg. Brit. p.* 186; *Hook. Br. Fl.* ii. *p.* 318. *Fucus Bursa, E. Bot. t.* 2183.

On rocks in the sea, very rare. Perennial? Summer. "Coast of Sussex, plentifully, *Pallas;*" *Turner.* Shores of Cornwall, *Mr. Rashleigh.* Near Torquay, *Mrs. Griffiths.* Belfast, *Mr. Templeton.*—*Frond* a globular, spongy, hollow ball, 1—8 inches in diameter. *Structure* similar to the preceding.

3. C. *adhærens*, Ag.; frond forming a velvetty crust on the surface of rocks. *Harv. in Hook. Journ. Bot. p.* 305; *Wyatt, Alg. Danm. No.* 127.

On rocks in the sea, near low-water mark; very rare. Annual? At Torquay, *Mrs. Griffiths.*—Spreading over the rock in irregular patches of two feet or more in extent, resembling "fragments of beautiful green velvet." *Substance* gelatinous, dense, closely adhering to paper. Mrs. Griffiths, who has watched this plant from its first appearance till it had

considerably extended itself, remarks "that it does not show the least tendency to throw up a frond. It has an uneven surface from taking the form of the rock, or even roots of coarse weeds, over which it crosses." She considers it a true species.

LXXVII. Bryopsis. Lamour.

Frond membranaceous, filiform, tubular, cylindrical, glistening, branched; the branches imbricated, or distichous and pinnated, filled with a fine green, minutely granuliferous fluid. *Grev.*—Name, *βρυον*, a *moss*, and *ωψις*, an *appearance*.

1. B. *plumosa*, Ag.; frond filiform, branched, naked below, the branches scattered, spreading, twice or thrice pinnated, the pinnæ pectinated. *Grev. Alg. Brit. p.* 187, *t.* 19; *Hook. Br. Fl.* ii. *p.* 318; *Wyatt, Alg. Danm. No.* 128. *Ulva plumosa, E. Bot. t.* 2375.

On rocks &c. in the sea. Annual. Summer and autumn.—*Frond* 1—4 inches high, more or less branched, sometimes with a nearly simple stem, set with numerous close branches; at other times much divided in a subdichotomous or irregular manner. *Branches* naked at base, in the upper part closely pinnated with subopposite, slender, distichous or rarely irregular ramuli, which gradually diminish in length to the apex. *Colour* a fine deep green. *Substance* lubricous and adhering to paper. A beautiful plant, whose branches resemble beautiful, glossy, bright green feathers.

2. B. *hypnoides*, Lamour.; frond slender, very much branched; the branches long; the ramuli capillary, irregularly inserted, somewhat erect, the lower ones elongated. *Grev.—Hook. Br. Fl.* ii. *p.* 318; *Wyatt, Alg. Danm. No.* 81.

On rocks and stones in the sea, rare. Southerness, Kirkcudbright, *Sir W. Jardine, Bart.* Frith of Forth, *Dr. Hasell.* Appin, *Capt. Carmichael.* Torquay, *Mrs. Griffiths.* Portrush, North of Ireland, *Mr. D. Moore.*—*Frond* 2—4 inches high, much branched, the branches repeatedly divided in an alternate or irregular manner; lesser branches set with irregularly scattered, somewhat pinnate, more or less dense ramuli. *Colour* a fine yellow green. This is a more slender, very much more branched plant than the preceding, and the ramuli are irregularly scattered, sometimes issuing from all sides of the filaments.

LXXVIII. Vaucheria. De Cand.

Fronds aggregated, tubular, continuous, capillary, coloured by an internal, green, pulverulent mass. *Fructification:* dark green, homogeneous *vesicles (coniocystæ)*, attached to the frond. *Grev.*—Named in honour of *M. Vaucher*, a distinguished writer on fresh-water *Confervæ*.

* *Vesicles solitary.*

1. V. *dichotoma*, Ag.; frond setaceous, dichotomous, fastigiate; the vesicles solitary, globose, sessile. *Grev.—Hook. Br. Fl.* ii. *p.* 319. *Conf. dichotoma, E. Bot. t.* 932.

In ponds and ditches, frequent. Annual. Spring and summer.—*Fronds* setaceous, a foot or more in length, dichotomously branched, forming wide strata at the bottom of pools, and frequently filling them. *Colour* a pale yellowish green, occasionally dark.

2. V. *submarina*, Berk.; frond capillary, forked, fastigiate; vesicles scattered, ovate or lanceolate, sessile. *Berk. Gl. Alg. t.* 8. *V. dichotoma*, β. *submarina*, *Ag.—Hook. Br. Fl.* ii. *p.* 319.

On the muddy sea-shore, rare. Weymouth, *Rev. M. J. Berkeley.—Tufts* 2 or 3 inches high, not diffused, fastigiate; *filaments* much more slender than in *V. dichotoma*, less branched, the branches more irregular. *Vesicles* numerous, scattered over the upper branches.

3. V. *marina*, Lyngb.; filaments loosely tufted or distinct, branches few, very long, obtuse; vesicles solitary, obovate, pedicellate, lateral. *Carm.—Hook. l. c. p.* 319; *Lyngb. t.* 22; *Wyatt, Alg. Danm. No.* 168.

In the sea. Annual. Summer. Parasitical on *Furcellaria lumbricalis*, Appin, *Capt. Carmichael*. On mud at Torbay and Salcombe, *Mrs. Griffiths* and *Mrs. Wyatt.—Fronds* tufted or somewhat spreading, erect, very slender and flaccid, irregularly branched, somewhat forked; the branches erect. *Vesicles* few, scattered, broadly obovate and very obtuse, by which character it is easily distinguished from *V. submarina*, subpedicellate. *Colour* bright green, becoming rather brownish, but retaining a gloss in drying. *Mrs. Griffiths* has kindly presented me with specimens in fructification.

4. V. *velutina*, Ag.; filaments creeping; branches fastigiate, woven into a velvetty stratum; capsules solitary, globose, lateral. *Carm.—Hook. l. c. p.* 319.

On the muddy sea-shore, flooded by the tide. Annual. Spring and summer. Appin, *Capt. Carmichael*. Miltoun Malbay. — "*Filaments* exceedingly tough, interwoven into a dense, velvetty, green stratum, pellucid below and creeping over the mud; branches near the extremity, erect, fastigiate, and more or less crooked. *Vesicles* solitary, globular, on short lateral peduncles." *Carm.*

5. V. *Dillwynii*, Ag.; fronds flexuous, forming a thin, terrestrial stratum; the vesicles lateral, sessile, globose. *Grev. Alg. Brit. p.* 191, *t.* 19; *Hook. l. c. p.* 320. *Conf. frigida, Dillw. t.* 16.

On the ground, in damp shady places, clayey ground, &c. Annual. Spring and autumn.—Forming a thin, bright green, velvetty stratum over the surface of the ground; *filaments* little branched and flexuous. *Vesicles* numerous, scattered, dark green.

6. V. *terrestris*, De C.; fronds straight, forming a lax, somewhat bristly, terrestrial stratum; the vesicles lateral, hemisphærical, on the side of a horn-shaped peduncle, or rather receptacle. *Grev. Alg. Brit. p.* 191; *Hook. l. c. p.* 320; *Berk. Gl. Alg. t.* 9.

On the ground, in moist shady places; common. Annual. Spring.—"*Fronds* more straight and rigid than in the preceding species, forming a more lax and less interwoven stratum, the summits of the little branches often erect, and giving the whole a bristly appearance." *Grev.*—Nearly related to the preceding, but easily distinguished by the fructification.

** *Vesicles two or more together.*

7. V. *sessilis*, De C.; fronds entangled in floating masses, vesicles oval, sessile in pairs, with an intermediate, little, horn-like process. *Grev. Alg. Brit. p.* 192; *Hook. l. c. p.* 320; *E. Bot. t.* 1765.

In pools and ditches. Annual. Autumn and early spring. Sussex, *Mr. Borrer.*—*Fronds* capillary, several inches long, irregularly branched, forming wide fleeces, of a dull green colour, which finally rise to the surface.

8. V. *ornithocephala*, Ag.; fronds capillary, loosely branched, entangled in dense, floating masses; vesicles unilateral, binate or quaternate, oblique, upon short, straight peduncles, with a short beak and pellucid border. *Grev. Alg. Brit. p.* 193; *Hook. l. c. p.* 320. *Conf. vesicata*, *Dillw. t.* 74.

In pools and ditches. Annual. Autumn. Near Bristol, *Mr. W. W. Young.* About Edinburgh, *Dr. Greville.*—This also forms dull green floating masses, of considerable extent.

9. V. *geminata*, De C.; fronds dichotomous, very slender, forming dense, floating masses; vesicles ovate, opposite, laterally pedunculate on a horn-shaped process or receptacle. *Grev. Alg. Brit. p.* 193, *t.* 19; *Hook. l. c. p.* 320; *E. Bot. t.* 1766.

In pools and ditches. Annual. Summer.—Easily distinguished by its fructification.

10. V. *cæspitosa*, Ag.; fronds sub-dichotomous, forming dense, spongy masses; vesicles in terminal pairs, the summit of the branch projecting beyond them. *Grev. Alg. Brit. p.* 194; *Hook. l. c. p.* 320. *Conf. amphibia*, *Dillw. t.* 41.

On the margins of streams, pools, &c., very common. Annual. Spring.—*Fronds* densely interwoven into cushion-like tufts or strata of indefinite extent, irregularly branched, the tips erect, giving the surface the appearance of bright green velvet. *Vesicles* situated in pairs near the extremity of the branches.

11. V. *racemosa*, De C.; fronds capillary, forming dense, entangled, floating masses; vesicles in pedunculate, racemose clusters. *Grev. Alg. Brit. p.* 195.

In pools and ditches. Annual. Summer. About Edinburgh, *Dr. Greville.*—"*Fronds* very slender, several inches in length, floating in large entangled masses, flexuous, subdichotomously branched. *Vesicles* ovate, dark green, five or more in number, sessile or subsessile in a clustered manner upon a common peduncle or receptacle, given off at a right angle from the branches. *Colour* a bright green." *Grev. l. c.*

**** Apices of the branches clavate, vesicular.*

12. V. *clavata*, De C.; cæspitose, branched, fastigiate, the extremities of the branches club-shaped, including an ovate or globular, reproductive, green mass, which bursts through the coat, and moves about like an animal. *Berk. Alg. t.* 10; *Loudon, Mag. Nat. Hist.* i. 305.

In pools and ditches. Annual. Yarwell, Northamptonshire, *Rev. M. J. Berkeley.*—"Forming round tufts, not an inch high, of a beautiful green, composed of slender, mucous threads, variously branched; the apices dilated, containing a dark sporaceous mass." *Berk. l. c. p.* 27.

Doubtful species.

13. V? *multicapsularis*, Ag.; "filaments minute, creeping, olivaceous; branches erect, sub-simple, short, towards the apex thickened and bearing capsules; capsules sphærical, crowded." *Dillw.—Conf. multicapsularis, Dillw. t.* 71.

On clayey banks, in high and exposed situations about Swansea, *Mr. W. W. Young.* Near Belfast, *Mr. Templeton.*— It is described as forming small irregular patches, of a dark olive colour, often approaching to black; the filaments creeping, thickly entangled and very minute; they throw out a number of sucker-like branches, from which numerous, short, upright branches arise, for the most part simple, but sometimes once or twice branched; these are thickest toward their apices, and are there frequently divided into two or more short, palmated segments, on each of which a capsule is placed. The joints are very long in the creeping stems; they vary in the upright branches, being shortest at the base and longest toward the summit. The *capsules* are disposed at the end of the upright shoots, without order; either solitary or in clusters, and, not unfrequently, two or three may be seen issuing from each other. *Dillw.*— There is a drawing of this plant in the MSS. of the late *Mr. Templeton.* It appears to belong to this genus, though the jointed threads are anomalous. No one seems to have met with it of late years, and it is omitted by Greville in his *Alg. Brit.* and by Hooker in the *Brit. Flora.*

LXXIX. Botrydium. Wallr.

Plant a sphærical, vesicular receptacle, filled with a watery fluid, dehiscent at the apex, terminating below in a radica-

ting tuft of fibres. *Grev.*—Name, *βοτρυς*, a *bunch of grapes;* which the clustered fronds something resemble.

1. B. *granulatum. Grev. Alg. Brit. p.* 196, *t.* 19; *Hook. l. c. p.* 321. *Tremella granulata, E. Bot. t.* 234. *Conf. multicapsularis, Dillw. t.* 71 ?

On damp clayey ground, in dried up ponds, &c. Annual. Spring and autumn. Camberwell, *E. Bot.* Perpendicular banks of rivers, frequent, *Lightfoot.* Botanic Garden, Glasgow, *Sir W. J. Hooker.* Near Belfast, *Mr. Templeton.* Moist ground near Cloughmills, Co. Antrim, *Mr. D. Moore.* — *Fronds* minute, densely clustered on the surface of the ground, spreading in patches. *Vesicle* containing a watery fluid, in which a few granules are sometimes found. In dry weather the upper part of the vesicles collapses, when they become cup-shaped.

Tribe 19. OSCILLATORIEÆ.

LXXX. Rivularia. Roth.

Frond globose or lobed, rarely incrusting, green or olivaceous, fleshy or gelatinous, firm, composed of continuous, inarticulate filaments, annulated within, and surrounded by, or set in, gelatine.—Name, in allusion to the fresh-water habitat of some of the original species; many, however, are found in the sea.

Sect. 1. (Rivularia, *Roth.* Linkia, *Lyngb.*) *Frond wart-shaped, rarely incrusting. Filaments close-set, sparingly annulated within, mostly dichotomously branched, radiating from a common, fixed base.*

* *Found in fresh water.*

1. R. *pisum*, Ag.; frond globose, smooth, soft, shining, dark green; filaments dichotomous. *Harv. in Hook. Br. Fl.* ii. *p.* 392; *Berk. Gl. Alg. t.* 2, *f.* 2.

On aquatic plants in subalpine streamlets.—"*Fronds* a line in diameter, scattered or confluent, of a dark green colour and fleshy firmness. *Filaments* radiating from the base, dichotomously branched and attenuate, the apices free." *Carm.*

2. R. *botryoides*, Carm.; fronds minute, aggregated, roundish, wrinkled, ferruginous, cartilaginous; filaments dichotomous. *Harv. l. c. p.* 392.

In streamlets, attached to rocks and stones. Appin, *Capt. Carmichael.* —"*Fronds* about a line in diameter, hemisphærical, wrinkled and cartilaginous, scattered or running together like a bunch of grapes. *Filaments* cohering firmly, obscurely striated, dichotomous. *Colour* when fresh, black; on drying, darkly ferruginous." *Carm.*

3. R. *calcarea*, Sm.; fronds large, orbicular, convex, at

length aggregated into a broad, spongy crust, zoned within, at length petrified. *E. Bot. t.* 1799; *Harv. l. c. p.* 392.

On rocks and stones in streamlets, and the borders of subalpine lakes.—"*Fronds* one fourth or half an inch in diameter, circular, slightly convex, sometimes greenish, but oftener of a dark chesnut colour. After a time they run together into a flat, spongy crust, of indefinite size. On the smooth face of a rock, exposed to the trickling of water, I found a sheet of it, upwards of a foot in diameter. When broken, the crust appears zoned within, so as to indicate the age of the plant, each zone being equal to a year's growth. At this stage it is always more or less stony, from the absorption of calcareous matter." *Carm.*

4. R. *granulifera*, Carm.; frond large, convex, becoming hollow underneath, fleshy, lubricous, brownish-olive, often including stony particles (never petrified). *Harv. l. c. p.* 393.

On cliffs, exposed to the trickling of water, common. Annual, (*Capt. Carmichael*).—"*Fronds* from a line to half an inch in diameter, often confluent, convex and at length concave underneath, fleshy, dusky, olive green, and extremely slippery. *Filaments* rather thick, repeatedly dichotomous. In the substance are generally enclosed a number of stony particles. This species comes nearest in size and form to *Riv. calcarea*, but is never, like that, petrified with calcareous matter; the *filaments* also are much thicker and more decidedly branched; and it is moreover an annual plant, whereas the other exists for several years." *Carm.*

5. R. *crustacea*, Carm.; crust very thin, widely spreading; filaments attenuated at the base, fastigiately branched above the middle, olive-green. *Harv. l. c. p.* 393.

On rocks exposed to the spray of cascades in the Hill Streams at Appin, *Capt. Carmichael.*—"*Crust* of no determinate extent, extremely thin and slimy, black. *Filaments* one fourth of a line in length, attenuated at the base, fastigiately branched above the middle, of an olive green colour." *Carm.*

** *Growing in the sea, or on maritime cliffs.*

6. R. *plicata*, Carm.; fronds rather large, densely gregarious, gelatinous, compresso-plicate, often hollow and ruptured, dark green; filaments many times dichotomous, attenuated. *Harv. l. c. p.* 392. *Lichen corrugatus, Dicks.*, according to a specimen given by Dickson himself to Mr. Borrer.

On the rocky sea-shore, about high-water mark, or in situations where it is only occasionally inundated with salt water. Appin, *Capt. Carmichael.* Torbay, *Mrs. Griffiths.* Eyrmouth, *Dr. Johnston.* Ballantrae, Ayrshire, *Mr. W. Thompson.* Innischerig Island, Co. Clare; and elsewhere.—"*Fronds* growing from a smooth gelatinous stratum, from a line to half an inch in diameter, mostly confluent and distorted by mutual pressure, gelatinous, and in their more advanced state often hollow and ruptured. *Filaments* dichotomous, tapering to a fine point, obscurely striated. *Globules* few in number, pellucid, lodged within the filaments, which at length break

off, leaving the globule attached to the base of the dismembered branch." *Carm.*

7. R. *atra*, Roth; fronds minute, scattered, globose, smooth, firm, glossy black; filaments deep green, slender, dichotomous. *Harv. l. c. p.* 392; *E. Bot. t.* 1798.

In the sea, on rocks, corallines, Algæ, &c. — *Fronds* 1 or 2 lines in diameter, very hard; *filaments* densely packed.

8. R. *applanata*, Carm.; fronds minute, gregarious, orbicular, depressed, black; filaments simple, attenuated, the apices free. *Harv. l. c. p.* 392.

"*Fronds* a line in diameter, gregarious, often confluent, circular, depressed, spongy, of an opaque black colour, shrinking, splitting, and becoming greyish in drying. *Filaments* one fourth of a line in length, simple, attenuated to a point, loose at the apex, of a bluish green colour." *Carm.* This differs from *R. atra* in its depressed form and simple filaments. It is probably not uncommon.

Sect. 2. (Scytochloria, *Harv.*) *Frond gelatinoso-coriaceous, lobed and bullated, or incrusting. Filaments close, densely and conspicuously annulated, set in a firm gelatine and pointing towards the periphery, (not radiating).*

9. R. *nitida*, Ag.; frond large, gelatinoso-coriaceous, lobed and plaited, often bullated, lubricous, shining, deep green; filaments simple or pseudo-branched. *Harv. l. c. p.* 393; *Wyatt, Alg. Danm. No.* 50. *Riv. bullata, Berk. Gl. Alg. t.* 2, *f.* 1.

On rocks in the sea. Torquay, *Mrs. Griffiths.* Miltoun Malbay. Torquay and Weymouth, *Rev. M. J. Berkeley.* —*Fronds* tremelloid, tufted or gregarious, much lobed, the lobes sinuous; in a young state compressed and filled with gelatine, in age hollow and distended; from half an inch to an inch in diameter. *Colour* a deep but very vivid olive green, lubricous and subgelatinous to the touch. *Substance* firm, elastic, not easily lacerated. *Filaments* either simple or pseudo-branched, waved, laxly set in the interior of the lobe, but closely packed together on the exterior. *Striæ* closely set and conspicuous.

10. R. *plana*, Harv.; frond crustaceous, plane, widely spreading, dull green, lubricous, darker towards the centre. *Harv. l. c. p.* 394. *Chætophora plana? Ag. Syst. p.* 28.

On marine rocks. Miltoun Malbay.—*Fronds* crustaceous, spreading in suborbicular or irregular patches of indefinite extent, from 1 inch to 2 feet or more in diameter, of a dull green colour towards the edges, but darker in the centre, with more or less of an olive cast, smooth, lubricous, gelatinous, fragile, easily torn, subtransparent. *Filaments* erect, straight, tufted, pale green, simple, or very sparingly pseudo-branched; *striæ* tolerably evident, close. I never met with this plant but once, several years ago. It may probably occur on other rocky shores.

Sect. 3. (Raphidia, *Carm.*) *Frond gelatinous, subglobose, bullated. Filaments few (compared with the quantity of gelatine), subulate, moniliform within, scattered through the gelatine or radiating from a central point.*

11. R. *angulosa*, Roth; fronds gregarious, roundish, gelatinous, hollow; filaments distant, simple, subulate, moniliform within. *Harv. l. c. p.* 394. *Raphidia natans, Carm. MSS. cum. icone. Ulva pruniformis, E. Bot. t.* 968.

Attached to aquatic plants in ponds and still waters.—"*Fronds* gregarious, often confluent, one fourth to three fourths of an inch in diameter, roundish, gelatinous, vesicular, and, when detached, rising to the surface of the water with the velocity of an air-bubble. *Filaments* at the distance of 4 or 5 diameters from each other, radiating in all directions from the centre of the vesicle; rising from a colourless globule, inflated for about one third of their length, thence tapering to a long, slender, often curved point. Internal mass moniliform, occupying about one half the diameter of the inflated part of the filament. *Colour* pale chesnut, inclining to olive." *Carm.*

LXXXI. Stigonema. Ag.

Filaments tufted, cylindrical, cartilaginous, branched, inarticulate, containing granules ranged in transverse dotted rings.—Name, στιγων, *dotted*, and νημα a *thread.*

1. S. *atrovirens*, Ag.; tufted; branches slightly divided, slender, attenuated, sub-acute; rings three-dotted. *Harv. in Hook. Br. Fl.* ii. *p.* 363. *Conf. atrovirens, Dillw. t.* 25. *Lichen pubescens, E. Bot. t.* 2318.

On wet rocks in subalpine glens, common.—This forms broad, rigid, very dark, loose tufts. *Filaments* divaricately branched, the branches much narrower than the stem, often furnished with a few slender, secund ramuli, the larger divisions opaque, the smaller translucid, and marked with close, transverse rings.

2. S. *mammillosum*, Ag.; branches simple, incrassated, spindle-shaped, densely mamillose on all sides. *Harv. l. c. p.* 363. *Bangia mamillosa, Lyngb. t.* 25, *(very bad).*

Rocky bottoms of subalpine rivulets. Appin, *Capt. Carmichael.* Eagle's Nest, Killarney.—Forming continuous tufts some inches in diameter, softer and more flaccid than the last; branches of various lengths, simple, fusiform, their diameter in the middle 2 or 3 times that of the stem, densely beset on all sides with short mamillæ, which appear to be viviparous elongations of the granules. This supposed species, notwithstanding its very peculiar character, is perhaps only a variety of the preceding occasioned by a moister habitat. Lyngbye's figure is very defective. Under the microscope the mamillate branches resemble small cucumbers or "girkins."

3. S. *panniforme*, Harv.; filaments dark brown, densely packed together, much branched; branches long, flexuous,

obtuse ; rings three-dotted. *Harv. l. c. p.* 363. *Scytonema panniforme, Carm. MS. ; Ag. Syst. p.* 39 ?

On rocks at the mouth of the Spar-cave, Skye, *Capt. Carmichael.—Patches* indeterminate, crust-like, velvetty. *Filaments* so closely packed that only their tips are visible above the crust, very tough when dry, gelatinous when moist, cohering strongly together, much branched ; branches long and flexuous, divaricating, cylindrical, quite obtuse, not tapered. *Granules* ternate, very obvious in all the main branches, less distinct towards the tips. This entirely agrees in external character and ramification with the *Scytonema panniforme* of Agardh, with an authentic specimen of which I have compared Carmichael's specimen. The only difference I can perceive lies in the generic character, and this I suspect depends on age, for I find the apices of the branches simply striated, like a *Calothrix* or *Scytonema*, and the smaller branches, for at least part of their length, have the semipunctate appearance of *S. ocellatum ;* and it is only in the larger and main branches that the punctated character is clearly visible.

LXXXII. Scytonema. Ag.

Filaments branched, (very rarely simple), flaccid, tough, continuous, tubular. *Endochrome* brown or olivaceous, transversely striated, at length separating at the striæ into lenticular seeds.—Name, σκυτος, a *skin*, and νημα, a *thread ;* in allusion to the toughness of the filaments.

1. S. *ocellatum*, Harv. ; filaments long, gelatinoso-cartilaginous, pale brown, flexuous ; branches solitary, divaricating, slightly constricted at the base ; sporidia distant, beaded. *Harv. l. c. p.* 364. *Conf. ocellata, E. Bot. t.* 2530.

In alpine bogs, rare.—*Filaments* tufted, erect or decumbent, gelatinous, pale yellow-brown, twice or thrice as thick as those of *S. myochrous*, branched ; branches irregularly disposed, issuing from the central substance of the filament, somewhat attenuate at their base, very obtuse and slightly thickened at the extremity, erecto-patent, solitary, or extremely rarely in pairs, the larger ones with a few short ramuli. *Sporidia* distant, broad, at first square, but becoming round and finally longitudinally divided into two portions ; margin of the threads very broad. Agardh is surely not acquainted with the true *Conf. ocellata* of British authors, or he would scarcely have confounded it with *S. myochrous*, from which it differs in every, save the generic, character. Dillwyn well remarks that it is most nearly allied to *Stigonema atrovirens*, and it seems indeed to be intermediate between *Stigonema* and *Scytonema*, the division of the sporidia in old filaments assimilating it to the former genus. Lyngbye's figure and description belong to *S. myochrous.*

2. S. *compactum*, Ag. ; "filaments decumbent, branched, densely interwoven into blackish tufts ; branches sub-erect, dichotomous and fasciculate, within furnished with transverse rings." *Grev.—Harv. l. c. p.* 364.

Moist rocks in the Pentland Hills, *Messrs. Arnott* and *Greville.*

3. S. *minutum*, Ag.; filaments minute, erect, rigid, flexuous, fastigiate, collected in a dark crust, branches short. *Harv. l. c. p.* 365.

On rocks and crustaceous lichens; common in alpine districts. Appin, *Capt. Carmichael.* Caroigataha, near Caher and at Killarney.—*Plant* either spreading in a black suborbicular crust, or scattered in little tufts: *filaments* erect, minute, closely packed, olivaceous; branches irregular, obtuse, ascending.

4. S. *myochrous*, Ag.; filaments elongate, mostly decumbent, sub-rigid, flexuous, slender, yellow-brown; branches issuing in pairs at right angles with the stem. *Harv. l. c. p.* 365; *Lyngb. t.* 27, and *S. ocellatum*, *Lyngb. t.* 28. *Conf. myochrous*, *Dillw. Conf. t.* 19; *E. Bot. t.* 1555. *Conf. mirabilis*, *E. Bot. t.* 2219, *(not of Dillw.)*

In alpine bogs and rivulets.—*Filaments* decumbent, rarely tufted, closely interwoven into a dark brown stratum, very flexuous; branches simple, issuing in pairs at right angles, often adhering together throughout their whole length, but more generally soon divaricating, very rarely solitary. *Striæ* distant. The manner in which the branches are given off in this species is very curious, and quite unlike what takes place in *S. ocellatum*, so that this, were there no other characters, would afford abundant grounds of distinction between them. At first sight, they appear to be *appositional*, or resulting merely from the lateral coherance of two simple filaments. This, however, is not the case, as is proved by the tube above and below the point of ramification being continuous and unbroken, at the opposite side from the branches, as well as by tracing the various stages of the plant with a good microscope. The threads are at first simple continuous tubes, containing a coloured sporaceous mass (*endochrome*), which is closely marked with transverse striæ and broken, as if by dissepiments, at uncertain distances. Opposite these *dissepiments* a rupture takes place on one side of the *sheath*, and the *endochrome* issues in two columns, at first resembling mamillæ, but finally elongating into branches. Can this be the origin of the *appositional* branches of the *Calothrices? Conferva mirabilis*, 'English Botany,' *t.* 2219 (*not of Dillwyn*), which Agardh in his last work makes a variety of *Sphacelaria cirrhosa*, I can refer with confidence to the present, having examined Miss Hutchins' specimens, from which Sowerby's figure was taken. Much confusion has arisen by Sir J. E. Smith's stating that the plant was gathered "in Bantry Bay" instead of "near Bantry." The specimens are parasitical on *Orthotrichum rivulare*, and their fresh-water locality is thus clearly proved.

5. S. *cirrhosum*, Carm.; "tufts widely spreading, filaments floating in bundles, spuriously (?) branched; branches beset with fragments towards the top." *Carm. MS. cum. icone.; Harv. l. c. p.* 366.

Borders of lakes at Lismore Island, *Capt. Carmichael.*—"It occurs in continuous fleeces, parallel to the water's edge, of a deep chesnut colour when lying flat, dark olive when floating. The fleeces are made up of small, contiguous fasciculi of interlaced filaments. The filaments are from half an inch to an inch in length, simple or spuriously (?) branched, and

prolonged by the successive adhesions of portions, seemingly of broken filaments, which at length coalesce and form a knot at the point of adhesion. The transverse spires are close and conspicuous." *Carm.*— I suspect that what Carmichael terms *spurious* branches have the same origin as the branches of *S. myochrous*, of which this species is perhaps a variety, though the habit is very different.

6. S. *contextum*, Carm.; "filaments mostly simple, interwoven into a tough, olivaceous stratum, which turns to a dull green in drying. *Carm. MS.*

On the moist earth, *Capt. Carmichael.* Rocks at the foot of Turk Mountain, Killarney.— "This species occurs in a thin, closely matted, blackish fleece, of indeterminate extent. *Filaments* 2 or 3 lines in length, simple or rarely furnished with one or two branches," (which are occasionally geminate as in *S. myochrous*) "interwoven into an almost inextricable stratum. *Sporidia*, when visible, which rarely happens, globular and rather distant. Besides the comparative shortness of the filament, and the more intimate contexture of the stratum, this species differs from *S. myochrous* in becoming, when dry, of a light greyish-green colour, instead of black." *Carm. MSS.*

7. S. *byssoideum*, Ag.; filaments minute, erect, simple, flexuous, fasciculate, forming an unequal, blackish crust. *Harv. l. c. p.* 366; *Berk. Gl. Alg. t.* 19, *f.* 1.

On the trunk of a living elm, at Oundle, Northamptonshire, *Rev. M. J. Berkeley.*—This forms a very thin, effused, blackish, velvetty crust. *Filaments* exceedingly short, olivaceous, equal, very obtuse, erect, flexuous, often joined together laterally into little compressed, tooth-like fascicles. *Annuli* close and evident.

LXXXIII. Calothrix. Ag.

Filaments destitute of a mucous layer, erect, tufted or fasciculate, fixed at the base, somewhat rigid, without oscillation. *Tube* continuous; endochrome green, densely annulated, at length dissolved into lenticular *sporidia.*—Name, καλος, *beautiful*, and θριξ, a *hair;* the filaments being very slender and delicate. Scarcely to be distinguished from *Scytonema* but by the green colour and more membranous texture of the filaments.

* Confervicolæ: *parasitical, minutely fasciculate.*

1. C. *confervicola*, Ag.; filaments minute, glaucous, erect, subulate, rigid, tufted. *Harv. l. c. p.* 367. *Conf. confervicola, Dillw. t.* 8; *E. Bot. t.* 2576; *Wyatt, Alg. Danm. No.* 229.

On marine, filamentous Algæ; very common.— *Filaments* 1 or 2 lines high, rigid, forming scattered or continuous tufts. "Internal mass at length consolidated into lenticular sporidia, which escape at the end of the tube, either singly or cohering in short cylinders." *Carm. MS. cum icone.*

2. C. *Berkleyana*, Carm.; filaments minute, bright grass-green, flaccid, flexuous, tufted. *Harv. l. c. p.* 367.

In fresh water, adhering to aquatic plants. Oban, *Rev. M. J. Berkeley.* —"*Tufts* scattered, about a line in diameter, of a vivid green colour: *filaments* 20—30 in each tuft, radiating horizontally from a central point, exceedingly slender, flaccid, tapering to a hyaline point, variously curved or flexuous. It comes very near *C. confervicola;* but the filaments are much shorter and more slender, and possess nothing of the rigid, erect habit of that species." *Carm. MS. cum icone.*

3. C. *Mucor*, Ag.; "filaments hyaline, rigid, straightish, erect; forming olivaceous-green tufts." *Ag. Syst. Alg. p.* 70; *Harv. l. c. p.* 367.

On marine Algæ, at Brighton, *Mr. Borrer.*

4. C. *luteola*, Grev.; "filaments hyaline, yellowish, exceedingly slender, elongated, flexible, scattered." *Grev. Crypt. Fl. t.* 299; *Harv. l. c. p.* 367.

On marine filiform Algæ, rare. Appin, *Capt. Carmichael.*—"Plant of a pale yellowish colour, investing the stems of the filiform Algæ with its numerous filaments, and giving them a most delicate, feathery appearance." *Grev.* — Capt. Carmichael thus describes the plant in his MSS. under the name of *C. melaleuca.* "Filaments in small tufts, a line or two in length, exceedingly slender, tortuous, tapering, of a snow-white colour, and so opaque as to appear intensely black when viewed against the light. Most of them are variegated with pellucid fasciæ, caused by the destruction or escape of the colouring matter. In the water, this minute parasite gives a downy appearance to the plants on which it grows." *Carm. MS.*

5. C. *nivea*, Ag.; filaments exceedingly slender, rigid, white, forming dirty yellow, continuous tufts. *Harv. l. c. p.* 367. *Conf. nivea, Dillw. t. C; E. Bot. t.* 2529.

In sulphur-springs. Yorkshire and Durham, *Dr. Willan.* Near Darlington, *Mr. W. Backhouse.*—"Dr. Willan assures us that this species is found below the spring, no further than as the water retains the sensible sulphureous qualities, as if the hepatic gas were necessary to its production and nourishment." *Dillw.*

** Velutinæ; *forming a continuous velvetty stratum on the surface of rocks.*

6. C. *scopulorum*, Ag.; filaments minute, erect, curved, flexuous, simple, sub-attenuate, dirty green, agglutinated at the base, forming a continuous, velvetty stratum. *Harv. l. c. p* 368. *Conf. scopulorum, Dillw. t. A; E. Bot. t.* 2171.

On marine rocks, near high-water mark, common; spreading in dark green, slippery patches.—The filaments are a line in height, flexuous, slightly attenuated to a subacute point, simple, slimy at the base, and under the microscope of a dull yellowish green; striæ indistinct.

7. C. *fasciculata*, Ag.; filaments erect, very straight, dark green, subulate, with a setaceous point, fasciculately pseudo-

branched, forming a continuous, velvetty stratum. *Harv. l. c. p.* 368.

Marine rocks, below high-water mark. Miltoun Malbay.—*Stratum* very dark shining green. *Filaments* 2 or 3 lines high, tufted, erect, straight, attenuated to a long setaceous point. They are sometimes simple, but more generally furnished with 2—6 erect, closely pressed, pseudo-branches; the striæ are strongly marked and very closely set. The filaments, in my specimens, are longer, straighter, more acuminated, and of a darker colour than I find them in an authentic specimen from Agardh.

8. C. *rufescens*, Carm.; filaments very minute, reddish, spreading in a very thin, slimy, purplish stratum. *Harv. l. c. p.* 368.

On rocks, under the spray of cascades. Appin, *Capt. Carmichael.*—"Crust or stratum of indefinite extent, and so thin as to seem a mere discolouration of the rocks, until the finger is passed over it, when a certain sliminess detects the presence of the plant. *Filaments* half a line in length, and so slender as to appear mere lines under the highest power of the compound microscope." *Carm. MSS.*

*** Cæspitosæ: *forming large tufts, filaments pseudo-branched.*

9. C. *interrupta*, Carm.; filaments thick, subulate, coriaceous, glaucous-green, short, cohering in tooth-like fascicles, and forming broad tufts. *Harv. l. c. p.* 368.

On mosses and lichens. Appin, *Capt. Carmichael.* Turk Cascade, Killarney; and Tobermorey in the Isle of Mull.—"*Filaments* about a line in length, of a glaucous green colour, united into close, erect tufts, spreading over the moss, thick, tapering, cohering at the base, and sometimes through their whole length. *Internal mass* here and there interrupted, leaving short, pellucid spaces, resembling articulations. *Striæ* close and conspicuous." *Carm. MS. cum icone.* The texture is decidedly coriaceous, and the filaments so strongly agglutinated together in tooth-like fascicles, that it is with some difficulty they can be separated on the table of the microscope.

10. C. *hydnoides*, Harv.; filaments elongated, flexuous, cylindrical, obtuse, interwoven at the base, the tips cohering in rigid, erect, tooth-like fascicles. *Harv. l. c. p.* 369. *Scytonema hydnoides, Carm. MS. cum icone.*

On the clayey sea-shore, at the flood level. Appin, *Capt. Carmichael.*—"This species occurs in thin, dark, olive-coloured (black-green under the microscope) patches, from half an inch to 2 or 3 inches in diameter. *Filaments* much branched, the lower part interwoven into a thin stratum mixed with the clay over which they creep; while the terminal branches stand erect in close conical tufts, resembling the teeth of a *Hydnum*." *Carm. MS.* This plant is allied to *C. scopulorum*, but has a very peculiar habit.

11. C. *distorta*, Ag.; filaments elongated, bluish-green, forming large tufts, mucous, somewhat rigid, branched; branches erect, flexuous. *Harv. l. c. p.* 369. *Conf. distorta, Dillw. t.* 22; *E. Bot. t.* 2577.

In fresh water, on stems &c., rare. — *Filaments* half an inch to an inch high, forming continuous tufts about the stalks on which they grow, of a dark green hue (when dry of an intense verdigris or blue green colour), slender, bundled, curved and tortuous, more or less branched by apposition, the branches subsimple, elongated. *Striæ* more or less evident, in some specimens inconspicuous.

12. C. *atroviridis;* filaments densely tufted, flexuous, with a few irregular appositional branches, of a very dark green colour; internal mass deep glaucous-green, here and there broken, but indistinctly striated.

In spring wells near Penzance, *Mr. Ralfs.* — *Filaments* forming rather dense, continuous tufts, a quarter of an inch or more in height, clothing the stems of mosses &c. for spaces of an inch or more, appearing deep glaucous green under the microscope. They are nearly twice the diameter of those of *C. distorta* and *mirabilis*, and of much deeper colour. But this is one of those plants whose characters are more easily seen than described.

13. C. *mirabilis*, Ag.; filaments short, dark bluish-green, curvato-flexuous and geniculate, variously united, forming lax, globular tufts. *Harv l. c. p.* 369. *Conferva mirabilis, Dillw. t.* 96, *(not of E. Bot. t.* 2219*)*.

On mosses &c. in small streams, rare. Stream which runs through the wood at Penllegare, near Swansea, *Dillwyn.* Near Swansea, *Mr. Ralfs.*— *Filaments* forming minute tufts, half an inch in diameter, of a dark bluish green colour, here and there appositionally branched in a vague, net-like manner; apices obtuse.

14. C. *cæspitula*, Harv.; filaments forming close, convex tufts, blackish-green, flexuous, flaccid, obtuse, here and there spuriously branched. *Harv. l. c. p.* 369.

Marine rocks near high-water mark. Miltoun Malbay, rare.—*Tufts* very convex, ¼—1½ inch in diameter, deep blackish green, flaccid, growing on the naked rock, or attached to corallines &c. *Filaments* densely packed together, often twisted round each other in small bundles, either simple or pseudo-branched, obtuse, cylindrical; branches erect. *Striæ* very strongly marked and closely set.

LXXXIV. Lyngbya. Ag.

Filaments destitute of a mucous layer, free, flexible, elongated, continuous, decumbent. *Endochrome* (green or purple) densely annulated, and finally separating into lenticular *sporidia.*—Name, in honour of *H. C. Lyngbye*, author of an excellent work on the Algæ of Denmark. Distinguished from *Oscillatoria* by its long, flexile filaments, and from *Calothrix* by its stratified habit.

* *Terrestrial.*

1. L. *muralis*, Ag.; filaments somewhat rigid, thickish, tortuous, interwoven into a bright grass-green stratum. *Harv. l. c. p.* 370. *Conf. muralis, Dillw. t.* 7; *E. Bot. t.* 1554.—*β. conjugata;* filaments united in pairs. *Carm. MS.*

On damp walls, banks &c. very common. *β*, near the sea-shore at Appin, *Capt. Carmichael.*—This forms an intensely green stratum of indefinite extent, very conspicuous after a shower of rain. The filaments are often much curled, the striæ strongly marked.

** *Growing in fresh water.*

2. L. *prolifica*, Grev.; "filaments exceedingly slender, entangled, purple, very broadly effused, floating." *Grev. Crypt. Fl. t.* 303; *Harv. l. c. p.* 370.

In the loch of Haining, Selkirkshire, October to April.—"Plant extensively diffused, forming a floating stratum of a rich purple colour. *Filaments* extremely slender, entangled, somewhat rigid, yet flexible, entirely destitute of attachment and free from any mucous layer. *Annuli*, from the minuteness of the filament, almost inconspicuous." *Grev.*

*** *Marine.*

3. L. *majuscula*, Harv.; filaments very thick, issuing in long, crisped bundles from a blackish-green stratum, tortuous, simple or slightly pseudo-branched. *Harv. l. c. p.* 370; *Wyatt, Alg. Danm. No.* 147. *Conf. majuscula, Dillw. Conf. t. A.*

Thrown up by the sea. Santon Sands, *Miss Hill.* Bantry Bay, *Miss Hutchins.* Torbay, *Miss Griffiths.* Belfast Bay, *Dr. Drummond.* Portrush, *Mr. D. Moore.*—*Filaments* forming blackish green, interwoven strata, from which they issue in crisped bundles, 1 or 2 inches long, very tortuous, simple, or occasionally agglutinated together so as to appear branched. Diameter greater than that of any of the genus, twice or thrice as great as that of *L. muralis.* *Endochrome* dull green, annuli difficult to observe, close set; border of the tube broad and colourless. A fine species, erroneously referred by Agardh to his *L. crispa*, which, according to an authentic specimen, is a very different plant, of a verdigris-green colour and thrice as slender.

4. L. *ferruginea*, Ag.; filaments slender, flaccid, forming a lax stratum, of a verdigris-green colour, which gradually changes to a pale chesnut. *Harv. l. c. p.* 370. *L. ferruginea, β. versicolor, Ag. Syst. p.* 73. *L. subsalsa, Carm. MS.*

In small mud-bottomed pools by the sea-side, filled at spring-tides. Appin, *Capt. Carmichael.*—"*Stratum* exceedingly thin and lax, extensive, at first of a vivid green colour, but passing gradually into a pale chesnut." *Carm. Filaments* an inch long, flaccid, bent in various curves but scarcely

tortuous, of a pale verdigris colour under the microscope; striæ rather evident and subdistant. Capt. Carmichael's plant is of a dull verdigris hue, without gloss. I have compared it with an authentic specimen from Agardh, and can detect no difference, except in colour, which, according to Carmichael, varies with the age of the individual. Agardh's β appears to answer to the British plant very exactly.

5. L. *Carmichaelii*, Harv.; filaments very long, thickish, curled and tortuous, cylindrical, floating under water, and forming extensive, grass-green strata. *Harv. l. c. p.* 371. *L. crispa, Carm. MSS. cum icone, (not of Agardh); Wyatt, Alg. Danm. No.* 230.

On marine rocks and Fuci. Appin. *Capt. Carmichael.* Plymouth and Torbay, *Mrs. Wyatt.*—"*Stratum* almost co-extensive with the object on which it grows. On *Fucus vesiculosus* it may be found upwards of a foot in extent, on the rocks, of 20—30 yards, covering them with an intensely green fleece. *Filaments* fixed at the base, but fluctuating freely with the agitation of the water; several inches long, flaccid, at length becoming curled and convoluted, when the sporidia, bursting through the tube, leave it partially empty and pellucid." *Carm.*—Transverse striæ very evident and subdistant. When dry it is of a dull green, without gloss or any glaucous or verdigris hue, and to the naked eye strongly resembles *Conferva rivularis.*

6. L. *speciosa*, Carm.; filaments long, thick, flaccid, straight, at length curled, the margin crenate, freely floating in the water and forming extensive, bright green strata; glossy when dry. *Harv. l. c. p.* 371; *Wyatt, Alg. Danm. No.* 196.

On marine rocks and Fuci. Appin, *Capt. Carmichael.* Torquay, *Mrs. Griffiths.*—"This plant covers the whole surface of the rock or stone, floating loosely in the water; but, when left by the tide, spreading over it in a thin, intensely green fleece. The filaments are twice as thick as those of the former species, 3 or 4 inches long, straight and flaccid, at length becoming curled and crenated by the marginal protrusion of the sporidia. These are of a very flat, lenticular form, and when ripe burst through the sides of the tube, leaving it here and there colourless." *Carm. MSS.*—When dry it is of a deep, glossy green. Mrs. Griffiths' and Mrs. Wyatt's specimens are intermixed with *Conferva bangioides.*

LXXXV. Oscillatoria. Vauch.

Filaments invested by a common, mucous matrix, rigid, elastic, oscillating, simple, continuous. *Endochrome* divided by close, parallel, transverse striæ.—Named from the curious motion observed in the filaments, which resembles the *oscillation* of a pendulum. The species of this genus are very numerous, and it is almost impossible to lay down characters by which they may at all times be distinguished. In the following descriptions, the *colour* of the *strata* always refers

to the appearance presented to the naked eye; that of the *filaments*, to what they appear in a dry state.

* Fasciculatæ; *filaments collected into close, rigid, tufts or fascicles.*

1. O. *Friesii*, Ag.; stratum bright green, bristling with the elongated, rigid, erect, tooth-like fascicles of filaments. *Harv. l. c. p.* 373. *Scytonema Bangii, Lyngb. Dan. t.* 28; *Grev. Edin. p.* 303.

On mosses in shady subalpine situations; not uncommon. Near Edinburgh, *Dr. Greville.* Appin, *Capt. Carmichael.* Killarney.—*Stratum* 2 or 3 inches broad, bright æruginous green. *Filaments* closely interwoven into erect, elongated, tooth-like fascicles, an inch or more in height, pale green (under the microscope), annulated within, with a broad limb or border. Well marked by its erect, spinulose habit.

2. O. *lucifuga*, Harv.; stratum blackish-green, bristling with minute, tooth-like fascicles of filaments. *Harv. l. c. p.* 373. *Calothrix lucifuga, Carm. MSS.*

"On the decayed trunk of an alder, lying in a ravine and buried under a heap of rubbish" at Appin, *Capt. Carmichael.*—*Stratum* spreading, dull blackish green, bristling all over with minute, erect fascicles about one third of a line high. *Filaments* thickish, flexuous, strongly agglutinated together, annulated within, pale yellowish. Almost like the last species in miniature.

3. O. *tenuissima*, Ag.; dark green, ascending, tufted; filaments simple, cylindrical, even, without any visible joints. *Sm.—E. Bot. t.* 2584; *Harv. l. c. p.* 373.

In the celebrated warm waters of Bath, spreading, rather unequally, in broad, velvet-like patches, of a dark green colour, *Rev. H. Davies.*—"The irregularity of its appearance arises from the filaments being collected together into little ascending tufts, apparently rooted in the muddy deposit of the water. Each tuft proves, on examination, to consist of simple, uniform, even filaments, crowded together and quite pellucid, and equally destitute of joints and branches; their diameter is not more than an eight or ten-thousandth part of an inch." *Sm.*

** Virescentes; *stratum of an æruginose or blue-green colour.*

4. O. *limosa*, Ag.; stratum rich dark green, glossy, gelatinous, with long rays; filaments green, thick, straight and rigid; striæ strongly marked and very closely set. *Harv. l. c. p.* 374, *(not of Grev. Fl. Edin. p.* 303, *or Hook. Scot. part* ii. *p.* 79*).*

In ditches and pools.—*Stratum* of very rapid growth, and intensely rich dark green colour, sending out long radii, equally or in bundles, of scarcely a paler hue than the stratum. *Filaments* thicker than in any other British species, bluish green (under the microscope), rapidly oscillating. This fine species is apparently alluded to by Dillwyn, in his description of *Confer-*

va fontinalis, t. 64; but the figure is more like *O. nigra*. In drying it adheres closely to paper. From *O. major*, it differs in the much greater diameter of its filaments, and darker colour; and from *O. princeps* (apparently) in the smaller size and brighter colour. It is therefore intermediate between these species.

5. O. *tenuis*, Ag.; stratum rich dark green, very thin, gelatinous, with short rays; filaments pale green, straight and rigid; striæ distant, not strongly marked. *Grev. Edin. p.* 303; *Harv. l. c. p.* 374. *O. limosa, Hook. Scot.* ii. *p.* 79. *Conf. limosa, Dillw. t.* 20. *O. viridis, Johnst. Berw. Fl. p.* 264.

In muddy ditches, at first resting on the bottom, but gradually rising in bullated strata to the surface; common.—*Stratum* extensive, glossy when dry, in which state it fully preserves its colour. *Filaments* half the diameter of those of *O. limosa*, pale green; striæ distant and indistinct. It adheres strongly to paper.

6. O. *cyanea*, Ag.; glaucous-blue; filaments simple, entangled, cylindrical, even, with a deciduous coat; joints obsolete, about as broad as long. *Sm.—Harv. l. c. p.* 374. *Conferva cyanea, E. Bot. t.* 2578.

Damp walls on the inside of several Suffolk churches; at Icklingham and Hengrave, also in Lancashire, *Sir Thos. Gage, Bart.*—"On the wall it is conspicuous for its light sky-blue colour, like some sort of *Mucor*. Under a high magnifier, and when moistened, it is found to consist of minute, even, simple, entangled threads, one five-hundredth part of an inch in diameter, coated with a frequently interrupted covering, of a dull glaucous green hue, under which the thread itself appears of a lighter glaucous bluish colour, very even in thickness and surface, consisting of scarcely distinguishable joints, about as broad as they are long." *Sm.*

7. O. *ærugescens*, Drummond; stratum a fine deep green, when dried æruginous-blue and glossy; filaments exceedingly slender, opaque green; striæ evident. *Drum. in An. Nat. Hist. vol.* i. *p.* 1.

Lake of Glaslough, Co. Monaghan, Ireland, *Dr. Drummond.*—"*Filaments* exceedingly slender, opaque green, conglomerated in large, toughish, glutinous masses, in sheltered, calm situations, and nearly floating on the surface; in more open exposures, broken into innumerable fragments and suspended, like cloudy flocculi, in the water. *Striæ* numerous, at distances of about half a diameter apart from each other. *Oscillatory* motion often lively. *Colour*, when dried, a beautiful æruginous blue; adheres strongly to paper, exhibiting a glossy surface; filaments expanding by moisture so as to seem recent, and sometimes resuming the oscillatory motion." *Dr. Drummond;* to whose interesting memoir, above quoted, I must refer for further information respecting this curious species. He has kindly presented me with a dried specimen.

8. O. *splendida*, Grev.; stratum bright æruginous or bluish-green, thin, with short rays; filaments arachnoid, straight

or curved; striæ wholly invisible. *Grev. Fl. Edin. p.* 304; *Harv. l. c. p.* 375.

In tubs of water, in the stove of the Botanic Garden, Edinburgh, *Dr. Greville.*—"*Filaments*, under the highest power of the microscope, appearing not larger than a human hair, and of a very pale bluish colour. It has the colour and external characters of *O. major*, but cannot be confounded with it when magnified." *Grev.*

9. O. *muscorum*, Ag.; stratum dark æruginous-green, shortly radiating, creeping over mosses; filaments thickish, pale blue-green, striæ distant. *Ag. Syst. p.* 375; *Harv. l. c. p.* 375.

On *Hypnum ruscifolium*, in rapid streams, *Capt. Carmichael.*—"*Stratum* 3 or 4 inches in extent, closely interwoven with the branches and leaves of mosses, of a bluish green colour and slightly lubricous. *Filaments* a line or two in length, variously curved and radiating; *striæ* at the distance of a diameter from each other." *Carm. MSS.*

10. O. *turfosa*, Carm.; stratum pale verdigris-green, glaucous, with an ochraceous substratum; filaments very slender, curved, hyaline, striæ distant. *Harv. l. c. p.* 375.

On floating sods in old turf-pits. Appin, *Capt. Carmichael.* Near Dolgelly, *Mr. Ralfs.*—"This species grows in a thick, intensely green layer, over a tough, slimy, ochre-coloured substratum. It entirely enveloped the sods, some of which were a foot and a half in diameter. *Filaments* very slender, more or less curved, and mostly hyaline at the point." *Carm.*—It does not adhere well to paper in drying.

11. O. *decorticans*, Grev.; stratum smooth, glaucous-green, membranaceous; filaments very slender, curved, pale bluish-green, striæ distant. *Grev. Fl. Edin. p.* 304, *(excl. syn. Lyngb.) Conf. decorticans, Dillw. t.* 26.—*β. corticola;* stratum blackish-green. *O. corticola, Carm. MSS.*

Damp walls, rotten timber, often on pumps, &c., common. *β.* "on the trunk of an old sycamore, where the rain water trickled down." *Capt. Carmichael.*—*Stratum* membranaceous, not very gelatinous, peeling off in large flakes, and imperfectly adhering to paper.

12. O. *limbata*, Grev.; "filaments thick, flexuous, æruginous, with a broad, pellucid margin, loosely interwoven in a dense, dull æruginous-green stratum." *Grev. Crypt. Fl. Syn. p.* 40 and *t.* 246, *(O. rupestris). Harv. l. c. p.* 375.

On perpendicular rocks, exposed to the trickling of water. Pentland Hills, *Dr. Greville.*—"Plant covering the face of the rock for several inches together, and when old, peeling off in rather large pieces. Externally, it is mostly of a dull and often brownish green colour, but within, more of a verdigris-green, differing in intensity in different parts; here and there gelatinous and semitransparent. *Filaments* thick for their length, very flexuous, with a pellucid colourless limb, equal in breadth to the coloured, striated portion, which is of a pale verdigris-green." *Grev.*

13. O. *littoralis*, Carm.; stratum vivid, æruginous-green,

filaments thick, deep green, curved ; striæ conspicuous, close. *Harv. l. c. p.* 375.

In pools, along the muddy sea-shore, flooded by spring-tides. Appin, *Capt. Carmichael.*—" *Stratum* exceedingly thin, slimy, bullated by the extrication of air-bubbles, of a dark green colour, spreading to an indefinite extent over the muddy bottom of the pool. *Filaments* 1 or 2 lines long, much thicker than those of *O. nigra*, straight or slightly curved, radiating very irregularly and generally in twisted bundles. *Striæ* strongly marked, at intervals of about one-third the diameter of the filament." *Carm. MSS.* Most allied to *O. limosa.* In a dry state it is membranaceous, and scarcely adheres to paper.

14. O. *subsalsa*, Ag. ; stratum membranaceous, æruginous-green, smooth ; filaments slender, densely interwoven ; striæ distant, indistinct. *Harv. l. c. p.* 376 ; *Ag. Syst. Alg. p.* 66 ?

At Brighton, " on a plank, between high and low water mark," *Mr. Borrer.*—*Stratum* æruginous or bluish green, smooth, without gloss when dry, peeling off in membranaceous flakes; *filaments* hyaline, slender, densely packed, either straight or curved; *striæ* not very evident. In habit, it somewhat resembles *O. littoralis ;* but the filaments are much more slender, and the stratum more membranaceous.

*** Nigrescentes; *stratum of a dull indistinct green, or inclining to purple, black or brown.*

15. O. *nigra*, Vauch. ; stratum blackish-green (when dry bluish-black), with long radii ; filaments pale bluish-green, thick ; striæ very distinct and close. *Hook. Scot.* ii. *p.* 79 ; *Harv. l. c. p.* 376. *Conf. fontinalis, Dillw. t.* 64. *O. limosa, Grev. Edin. p.* 303, *(not of Ag.)*

Ditches and ponds, common.—*Stratum* extensive, blackish, with a shade of green, when dry blue-black, very rapid in its growth, and sending out long, vividly oscillating rays. Dillwyn's figure of *Conferva fontinalis* answers to this species pretty correctly ; but his description seems to take in many others.

16. O. *autumnalis*, Ag. ; stratum purplish or greenish-black, very lubricous, shortly radiating ; filaments pale bluish-green, striæ sub-distant. *Ag. Syst. p.* 62 ; *Grev. Fl. Edin. p.* 305 ; *Harv. l. c. p.* 376.

On damp walls, the ground &c., abundant in autumn and winter.—*Stratum* extensively spreading, very dark and lubricous, glossy when dry; *filaments* remarkably pale; *striæ* not very evident. A variety is common on clayey ground, which occurs in small circular patches about an inch or two in diameter.

17. O. *contexta*, Carm. ; stratum glossy black, strongly striated ; filaments thickish, pale green ; striæ sub-distant. *Harv. l. c. p.* 376.

On moist ground. Appin ; *Capt. Carmichael.*—" *Stratum* of indefinite extent, 3 feet and upwards, exceedingly thin, and peeling off in large flakes

in dry weather, of a deep but shining black colour, scored or striated in all directions. These striæ are caused by thick fasciculi of filaments, shooting out either parallel to or across each other, changing their course from time to time, and sending off lateral fasciculi. The *filaments* are rather thick, about a line in length, straight or variously curved, of a greyish green colour, and they radiate with great rapidity. A portion of the stratum, not more than a line in diameter, placed in a watch-glass filled with water, overspread the whole area of the glass with filaments in the course of a night." *Carm. MSS.*—A fine species; in a dry state resembling black satin.

18. O. *Corium*, Ag.; stratum thick, sub-coriaceous, opaque, dull brownish, streaked with pale green; filaments yellowish, slender, striæ indistinct, distant. *Grev. Fl. Edin. p.* 303; *Harv. l. c. p.* 377.

On the rocky bottoms of alpine rivulets, common.—*Stratum* thick, tough, dull brownish, occasionally streaked with pale green, which, in some varieties, is the prevailing colour, slightly glossy when dry; filaments slender. In some situations it radiates in fascicles from its whole upper surface, in others it is found almost denuded of radii and forming a compact leathery stratum.

19. O. *subfusca*, Vauch.; stratum dull greyish-brown, somewhat streaked with green, soft, fragile; filaments very slender, hyaline, straight; striæ inconspicuous. *Lyngb. t.* 26; *Harv. l. c. p.* 377.

Rocks and stones in subalpine rivulets.—*Stratum* extensive, "soft, slimy, void of tenacity, wrinkled, of a dusky grey colour," (*Carm.*); when dry greyish brown, streaked with green towards the edges; filaments very slender, striæ invisible. Differs from the last chiefly in being more gelatinous and fragile.

20. O. *violacea*, Johnst.; "mass gelatinous, dark purple; filaments very slender, straight, without perceptible transverse striæ, laid on a thin, compact, greenish substratum." *Johnst. Berw. Fl.* ii. *p.* 264. *Harv. l. c. p.* 377.

Rapid streams. Near Berwick-upon-Tweed, *Dr. Johnston*, who considers this the "*Conferva* mucosa, confragosa, rivulis innascens" of Dillenius.

21. O. *rupestris*, Ag.; stratum blackish-green, thick, opaque, extremely tough; filaments rigid, straight, pale green, slender; striæ not evident. *Ag. Syst. p.* 63; *Harv. l. c. p.* 377. *O. tenax, Carm. MS.*

On the precipitous face of cascades. Appin, *Capt. Carmichael.*—"*Stratum* extensive, slimy, remarkably tough and elastic, black on the surface, ash-coloured underneath (when dry greenish black); filaments pale green, straight or variously curved, radiating, but not equally, in all directions," *Carm. MSS.*—Differs from *O. subfusca* in habitat, colour, and toughness of the stratum, which last peculiarity is very characteristic. When dry it is difficult to separate the filaments on the table of the microscope.

22. O. *spiralis*, Carm.; stratum coriaceous, greenish-black, without lubricity; filaments spirally twisted, radiating in all directions. *Harv. l. c. p* 377.

On rocks by the sea-side, where birds are in the habit of resting. Appin, *Capt. Carmichael.*—"It spreads over the dry, naked earth. *Stratum* several feet in extent, firm, coriaceous, of a glossy black colour, void of lubricity. *Filaments* about half a line in length, twisted like a corkscrew, radiating in all directions." *Carm.*

23. O. *spadicea*, Carm.; stratum dark chesnut colour, very thin, spreading; filaments yellowish-brown, thick, variously curved and twisted; striæ conspicuous and very close. *Harv. l. c. p.* 378.

On damp, mossy earth, rare. Appin, *Capt. Carmichael.*—It occurs as a very thin, dark brown stratum, spreading to the extent of several feet, and is hardly to be distinguished from the mossy earth on which it grows. *Filaments* short, straight, curved or spirally twisted, radiating in all directions and possessed of all the movements peculiar to the tribe." *Carm.*—A very distinct species. The filaments strongly resemble those of a *Scytonema*, in which genus I should not hesitate placing it, had not Carmichael observed its oscillatory character.

24. O. *ochracea*, Grev.; forming floating, cloud-like, very fragile masses, of an ochrey colour; filaments scattered, very slender, acicular. *Grev. Edin. p.* 304. *Conf. ochracea, Dillw. t.* 62.

In boggy pools, common. This occurs in cloud-like masses, scarcely to be called strata; the filaments are very slender and scattered without order. Dillwyn's figure incorrectly represents the filaments as branched. Agardh is probably correct in saying that this is some other species in decay.

LXXXVI. Belonia. Carm.

Filaments minute, acicular, heaped together, sub-moniliform, finally dissolving into elliptic sporidia.—Name, βελονη, a *needle;* which the filaments resemble. This differs from *Oscillatoria* in the absence of a gelatinous stratum, and from *Lyngbya* in the nature of the filaments.

1. B. *torulosa*, Carm. MSS. *Harv. l. c. p.* 379.

On decaying marine Algæ about half-tide level. Appin, *Capt. Carmichael.*—"In the beginning of autumn, vast quantities of the filamentous Algæ (*Dictyosiphon, Ectocarpus*, &c.) are detached from their places of growth, and deposited here and there along the shore in extensive fleeces. When these fleeces begin to decay, the *Belonia* makes its appearance in the form of a very thin gelatinous pellicle, of a vivid green colour, spreading over the surface of the decaying mass. The pellicle is made up of straight, brittle, slightly moniliform *filaments*, one fourth of a line in length, and tapering at both ends. The intervals between the striæ are considerably longer than their diameter, and the green matter becomes at length conso-

lidated into elliptical sporidia, of a brownish colour, beginning at the middle of the filament." *Carm.*

LXXXVII. Petalonema. Berk.

Flat, branched or simple *threads*, the margins membranous and striate, containing in the centre annular parallel discs. *Berk.*—Name, πεταλον, a *leaf* or *lamina*, and νημα, a *thread;* in allusion to the singularly winged filaments.

1. P. *alatum*. *Berk. Gl. Alg. p.* 23, *t.* 7, *f.* 2. *Oscillatoria alata, Carm.—Grev. Crypt. Fl. t.* 222; *Harv. in Hook. Br. Fl.* ii. *p.* 378.

On wet calcareous cliffs. Appin, *Capt. Carmichael.* Oban, *Rev. M. J. Berkeley.*—Forms a brownish or chesnut-coloured, thin, subgelatinous stratum. *Threads* linear, simple, or irregularly branched, decumbent, consisting of a cylindrical *midrib* which is closely and distinctly annulated, and a broad, membranous, transversely striated *margin* or lamina: apices obtuse. A highly curious plant, and, it would appear, extremely rare. I believe it has never been met with save in the above localities.

LXXXVIII. Microcoleus. Desmaz.

Filaments minute, rigid, straight, transversely striated, bundled, and inclosed within membranaceous, simple or branched *fronds;* from the apices of which they oscillate.—Name, μικρος, *small*, and κολεος, a *sheath*.

1. M. *marinus;* fronds erect, tufted, filiform, slender, subdichotomously branched; branches swelling upwards, apices club-shaped, obtuse or truncate. *Oscillatoria chthonoplastes, α. Harv. in Hook. Br. Fl. p.* 373.

In the sea, on rocks or mud. Appin, *Capt. Carmichael.* Torquay and Ilfracombe, *Mr. Ralfs.—Fronds* fixed at base, floating freely in the water, an inch long, tufted, dichotomously branched; branches slender, capillary, widening upwards, with club-shaped tips. *Colour* olivaceous green or yellowish. When ruptured the branches discharge innumerable needle-shaped filaments, which, when the plant is growing, radiate and oscillate from the tips of the branches.

2. M. *repens;* fronds decumbent, radiating from a centre; branches diverging, curled and twisted, gradually tapering to the extremity. *Oscil. chthonoplastes, β. Harv. in Hook. Br. Fl.* ii. *p.* 373. *Oscil. repens, Ag. Syst. p.* 61. *Conf. vaginata, E. Bot. t.* 1995. *Vaginaria vulgaris, Gray, Br. Pl.* i. *p.* 280.

On the naked soil, by road-sides &c., frequent.—This forms a dull green, decumbent, slimy stratum. The frond consists of numerous curled branch-

es, diverging from a centre in a starry manner, and gradually tapering from a broad base to a fine point; containing numerous, deep green filaments, which radiate and oscillate from the tips, and, on laceration, issue in bundles.

3. M.? *Dillwynii;* "filaments branched, cylindrical, articulate, bluish-green, branches inclosed in bundles within a sheath; joints very short." *Conf. vaginata, Dillw. t.* 99.

On rocks and stones in the stream which runs through the wood at Penllergare, near Swansea, *Dillw.*—"*Conferva vaginata* grows in small tufts, of which the diameter of the largest that I have gathered does not much exceed the quarter of an inch, and the greater part of them are in fragments of a still smaller size. The filaments resemble those of *C. limosum* (*Oscil. nigra*), except that they are branched, and that they are enclosed in bundles within a membranous sheath. These sheaths are themselves branched or divided repeatedly into smaller ones, at irregular distances, of various sizes: they are narrowest at their origin, and become swollen upwards, as the filaments increase by branching, so as sometimes to resemble a series of Cornucopiæ." *Dillw. l. c.* I am not acquainted with this species.

Tribe 20. ULVACEÆ.

LXXXIX. Porphyra. Ag.

Frond plane, exceedingly thin, and (owing to the fructification) of a purple colour. *Fructification:* 1, scattered *sori* of oval seeds; 2, roundish *granules,* mostly arranged in a quaternate manner, and covering the whole frond. *Grev.*—Name, πορφυρος, *purple.*

1. P. *laciniata,* Ag.; fronds deeply and irregularly cleft, with broad segments; margin variously cut and lobed. *Grev. Alg. Brit. p.* 168; *Hook. Br. Fl.* ii. *p.* 310; *Wyatt, Alg. Danm. No.* 32. *Ulva umbilicata, E. Bot. t.* 2296.

In the sea, on rocks, stones &c. very common. Annual. Spring to autumn.—*Fronds* clustered, 4—8 inches long or more, very irregularly cleft, often fixed by the centre, when dry transparent, very glossy and of a fine purple. This and the following species constitute the *Laver* of many parts of England, the *Sloke* or *Slokaun* of Scotland and Ireland. When stewed for several hours they are reduced to a sort of pulp, which is brought to table, served with lemon-juice, and is a favourite article of food with many persons.

2. P. *vulgaris,* Ag.; frond simple, broadly lanceolate, the margin much waved. *Grev. Alg. Brit. p.* 169; *Hook. l. c. p.* 310.

In the sea, on rocks &c. with the preceding.—*Fronds* 1 or 2 feet long, and 2 or 3 inches wide, of a lanceolate figure, often much waved. Except that the frond is undivided, this does not differ from the preceding.

3. P. *linearis,* Grev.; frond linear or linear-lanceolate,

acute, the margin nearly flat. *Grev. Alg. Brit. p.* 170, *t.* 18; *Hook. l. c. p.* 310; *Wyatt, Alg. Danm. No.* 163?

On rocks and stones in the sea, near high-water mark. Annual. Winter and Spring. Sidmouth, *Dr. Greville.* Dunmore, near Waterford, *Miss Taylor.* Miltoun Malbay, November.—*Root* a minute disk. *Fronds* with a minute stem, which suddenly expands into a linear or lanceolate leaf 3—6 inches long, and 2—4 lines wide, obtuse at base, tapering to a fine point, the margin generally flat. *Substance* tender. *Colour* a fine reddish purple, generally paler or discharged near the tip. At first sight this appears a very distinct plant, yet I have seen varieties—as in some copies of 'Algæ Danmonienses'—which seem intermediate with *P. vulgaris.*

4. P. *miniata*, Ag.; frond solitary, plane, oblong, gelatinous, rose-red. *Hook. l. c. p.* 310.

In the sea; coast of Appin, *Capt. Carmichael.*—"My only authority for claiming this plant as a native of these shores, was a fragment found floating in the sea. It was 3 inches in diameter, plane, curled on the margin, of a bright sanguineous colour, extremely gelatinous and filled with close-set roundish sporidia. When laid on paper to dry it, it dissolved into a reddish sanies, being probably in a state of putrescence, and nothing remained but a mere stain. From its texture and fructification, it evidently does not belong to this genus." *Carm.*

XC. Ulva. Linn.

Frond membranaceous, of a green colour, plane, (in some cases saccate, and inflated in the young state). *Fructification:* minute *granules*, mostly arranged in fours.—Name, supposed to be from *Ul, water* in Celtic.

* *Growing in the sea.*

1. U. *latissima*, Linn.; frond broadly-ovate or oblong, flat, delicately membranaceous, of a full green colour. *Grev. Alg. Brit. p.* 171; *Hook. l. c. p.* 311; *Wyatt, Alg. Danm. No.* 33. *U. Lactuca, E. Bot. t.* 1551.

In the sea, on rocks, stones, &c., very common. Annual. All the year round.—*Fronds* tufted, 6—18 inches long or more, and several inches wide, variously waved and lobed. *Fructification* covering the whole frond.

2. U. *Lactuca*, Linn.; frond at first obovate, saccate, inflated, at length cleft down to the base, the segments plane, unequal, laciniated, semi-transparent. *Grev.—Hook. l. c. p.* 311; *Grev. Crypt. Fl. t.* 313.

On rocks, stones, corallines &c., in the sea. Annual. May and June. —"*Fronds* 3—6 inches in length, in the young state obovate and saccate, but very soon bursting and lacerating, at length cleft irregularly to the base." *Grev.*—A smaller and far more tender plant than the preceding, and of a pale yellow-green colour. It adheres closely to paper in drying.

3. U. *Linza*, Linn.; frond linear-lanceolate, acute, undulate at the margin, composed of two membranes closely applied. *Hook. l. c. p.* 311; *Wyatt, Alg. Danm. No.* 164.

Rocks and stones in the sea. Annual. Summer.—*Fronds* clustered, 6 inches to 2 feet in length, half an inch to an inch and a half wide, linear-lanceolate, tapering to each extremity, much curled, of a fine grass-green colour. This species, as Dr. Greville observes, shows by its double membrane a transition to *Enteromorpha.*

** *Growing in fresh water.*

4. U. *bullosa*, Roth; frond very delicate, somewhat gelatinous, at first saccate, afterwards becoming expanded into a broad, waved or torn, floating membrane. *Hook. Br. Fl.* ii. *p.* 312; *E. Bot. t.* 2320.

In stagnant fresh-water pools and ditches.—*Fronds* clustered, at first fixed, afterwards floating, very thin and gelatinous, of a pale green colour, becoming yellowish. This species scarcely differs, in its frond and fructification, from *Tetraspora*, and, indeed, there are some varieties very difficult to be distinguished from *Tet. lubrica.* Sir W. J. Hooker hints that it may be only *U. Lactuca*, altered by growing in fresh water. It is impossible to say whether or not this opinion be correct, for in plants of such low organization, where *place of growth* constitutes a specific character, the difference between *species* and *varieties* is often so vague, that we are forced, in many cases, to rest content with a random guess.

*** *Growing on damp ground, walls, rocks, palings &c.*

5. U. *crispa*, Lightf., fronds saccate, firm, densely tufted, plaited and wrinkled, of a roundish form. *Grev. Alg. Brit. p.* 175; *Hook. Br. Fl.* ii. *p.* 312.

On damp ground, rocks, thatched roofs, &c.: very common. Annual. Winter and spring.—*Fronds* from a quarter of an inch to nearly an inch long, densely tufted, and forming widely spreading, dark green patches. *Fructification:* quaternate granules arranged in parallel lines.

6. U. *furfuracea*, Horn.; fronds very minute, roundish, ovate, distinct, sub-erect, forming a thin, crowded stratum; seeds large, mostly in fours. *Hook. l. c. p.* 312; *Grev. Crypt. t.* 265.

On damp walls &c., rare. Rocks near the sea, Appin, *Capt. Carmichael.* On the walls of King's College, Cambridge, *Rev. M. J. Berkely.* Several places near Limerick. Near Ballycastle, *Mr. D. Moore.* Roger's Tower on Castle an Dinas, near Gulvall; and Bosigran Castle, near Morvah; in both places on granite: *Mr. Borrer.*—"*Fronds* closely tufted, forming a vivid green stratum, a yard or more in extent, 2 or 3 lines in length, erect, obovate, truncated and usually eroded at the top, tapering at the base into a longish claw, margin inflected, substance firm and void of lubricity. *Sporidia* in fours. It does not adhere to paper." *Carm.*

7. U. *calophylla*, Spreng.; fronds densely tufted, plane,

lineari-ligulate, attenuated at base, often stipitate, longitudinally striate, each stria marked with a series of bi-quaternate granules. *Hook. Br. Fl.* ii. *p.* 312. *Bangia calophylla, Carm. in Grev. Crypt. Fl. t.* 220.

On damp stones, rocks &c. Lismore Island, Appin, *Capt. Carmichael.* Near Limerick. North of Ireland, *Mr. D. Moore.*—This forms a bright green, thin stratum. *Frond* minute, 3 or 4 lines long, linear strap-shaped, obtuse, tapering at base, or suddenly contracted into a cylindrical stipes, much waved and curled, very variable in breadth. *Granules* quaternate, closely covering the frond, set in longitudinal rows, of which two or more (sometimes half-a-dozen) form the breadth of the frond; interstices colourless.

XCI. Bangia. Lyngb.

Frond flat, capillary, membranaceous, of a green, reddish or purple colour. *Fructification:* granules arranged more or less in a transverse manner. *Grev.*—Name, in honour of *Hofmann Bang*, a Danish botanist.

1. B. *fusco-purpurea*, Lyngb.; filaments elongated, capillary, decumbent, nearly straight or somewhat curled, equal, forming a brownish-green or purple stratum, glossy; granules few (about five) in each transverse line. *Grev. Alg. Brit. p.* 177; *Hook. Br. Fl.* ii. *p.* 316; *Wyatt, Alg. Danm. No.* 167. *Conf. fusco-purpurea, Dillw. t.* 92; *E. Bot. t.* 2055. *Conf. atro-purpurea, Dillw. t.* 103; *E. Bot. t.* 2085.

On rocks and wood in the sea, near high-water mark; not uncommon. —Forming a lubricous, blackish-purple, occasionally greenish stratum. *Filaments* several inches long, straight or curled, variable in breadth; the narrow ones appearing to be cylindrical, and containing often but a single row of granules; the broader, flat or compressed, containing 4 or 5 rows. *Granules* large, dark purple, square, closely set. Mrs. Griffiths, who remarks the affinity of this plant with *Lyngbya*, "always finds it cylindrical." In such minute objects it is not always easy to judge, from the appearance presented by the microscope, whether a thread is round or not. To my eye the *wider* threads appear to be flat, the narrower cylindrical and consisting of a single row of cellules. These latter are strikingly similar to *Lyngbya*.

2. B. *ciliaris*, Carm.; "filaments gregarious, very minute, simple, straight, compressed, purple; granules binate, globose." *Carm. MSS.; Hook. Br. Fl.* ii. *p.* 316.

On the old leaves of *Zostera marina*, Appin, *Capt. Carmichael.* Annual. Spring.—"This, the minutest of all the *Bangiæ*, grows on the edges of the leaves in the form of a delicate pink-coloured fringe. *Filaments* half a line in length, gelatinous, straight, compressed, rather torulose. *Granules* large, globular, arranged in pairs." *Carm.*— The granules are occasionally in a single series.

3. B.? *Laminariæ*, Lyngb.; filaments tufted, short, rigid,

cylindrical, obtuse, olive-green; granules (often indistinct), set in double rows, each of about four. *Hook. l. c. p.* 316.

In the sea, parasitical on *Alaria esculenta*. Frith of Forth, *Drs. Greville* and *Arnott*. Arran, Clare, *Messrs. Ball* and *Thompson*. Antrim, *Mr. Moore*. On *Ulva Lactuca* at Appin, *Capt. Carmichael.—Tufts* minute, stellate or pencilled. *Filaments* from a quarter to half an inch long, straight, cylindrical, equal, or slightly broader upwards, very obtuse, of a dull olive-brown colour, transversely banded. *Bands* more or less evident, containing a double row of granules. *Mr. Moore* correctly remarks that this plant has no natural affinity with *Bangia*, but rather belongs to the *Dictyoteæ*, where it has many points in common with *Asperococcus ? pusillus*, a plant whose generic affinities are equally doubtful. Perhaps a genus might be formed of these two. For the present, however, I leave them where my predecessors have placed them, as the fructification of neither seems very clearly made out.

4. B. ? *lætevirens*, Harv.; filaments minute, tufted, flexuous, attenuated upwards, bright green, flat; fasciæ close, composed of innumerable minute granules. *Hook. Br. Fl.* ii. *p.* 317.

On old fronds of *Enteromorpha intestinalis*, at the extreme verge of high-water mark, Miltoun Malbay, Ireland. Annual. Summer.—*Filaments* minute, simple, 2 or 3 lines in height, tufted, many in the same tuft, lubricous, bright yellow-green, tapering to a subacute point, flaccid and slightly curved. Transverse *bands* rather broad, close, evidently containing granules, but so minute and numerous, that it is impossible accurately to examine them. It is conspicuous on the old dull-coloured fronds of the *Enteromorpha*, by its bright green hue. This, too, is a very doubtful species of *Bangia*, but I know not where else to place it.

5. B. ? *lacustris*, Carm.; "filaments scattered, decumbent, branched, deep green, the branches divaricated, acute; fasciæ of ternate, globose granules." *Carm. MSS. cum icone; Hook. l. c. p.* 317.

On the submerged leaves of aquatic plants, Appin, *Capt. Carmichael*. Annual. Summer.—"*Filaments* not exceeding a line in length, of a deep green colour, scattered, tortuous, creeping, and apparently fixed at or near the centre, attenuated at both ends and divaricately branched; *sporidia* globular, arranged in transverse series of 3 in the same filament, and 2 in the branches." *Carm.*—This is a very doubtful production, which I believe Capt. Carmichael only once found. Perhaps it belongs to the animal kingdom. With *Bangia* it has only an artificial connection.

XCII. Enteromorpha. Link.

Frond tubular, hollow, membranaceous, of a green colour and reticulated structure. *Fructification:* three or four roundish granules, aggregated in the reticulations. *Grev.*—Name, εντερον, the *entrail*, and μορφη, a *form* or *appearance*.

1. E. *Cornucopiæ*, Carm.; gregarious, small; fronds tubular at the base, dilated upwards, plaited, laciniated and torn at the margin. *Carm. MSS.; Hook. Br. Fl.* ii. *p.* 313. *Scytonema intestinalis*, β. *Cornucopiæ*, *Lyngb. p.* 67.

On corallines &c. in rocky pools left by the tide. Annual. Spring and summer.—"*Fronds* gregarious, about an inch long, funnel-shaped, from a short, tubular base, expanding into a plaited, laciniated membrane, torn and jagged at the extremity. *Granules* in fours, all over the frond. *Colour* dark green below, pale above." *Carm.*

2. E. *intestinalis*, Link; fronds elongated, simple, inflated, (often floating). *Grev. Alg. Brit. p.* 179; *Hook. l. c. p.* 313; *Wyatt, Alg. Danm. No.* 80.—β. *crispa;* frond compressed, the margin crisped and curled. *Grev.*

In the sea, and in brackish and fresh-water ditches, very common. Annual. Summer.—*Fronds* often 2 feet long or more, and from a line to 2 or 3 inches in diameter, tapering at base, at first fixed by a minute root, afterwards detached and freely floating, inflated, variously waved or curled, of a full green colour, fading to yellowish and finally white.

3. E. *compressa*, Grev.; fronds elongated, branched, cylindrical or sub-compressed; the branches simple or nearly so, long, and much attenuated at their base. *Grev. Alg. Brit. p.* 180, *t.* 18; *Hook. l. c. p.* 314; *Wyatt, Alg. Danm. No.* 165. —β. *prolifera;* frond somewhat inflated, throwing out capillary branches on all sides. *Grev.*

On rocks &c. in the sea, very common. Annual. Spring and summer. —*Fronds* 6—12 inches long, either capillary or several lines in diameter, more or less branched, sometimes nearly simple, sometimes very much divided and bushy; branches generally springing near the base, much attenuated below, gradually widening upwards and obtuse at the tips, by which character this variable plant is easily recognised from the four following.

4. E. *Linkiana*, Grev.; "frond cylindrical, tubular, filiform, reticulated, pellucid, of a very pale green colour, membranaceous, (rigid when dry), much branched; branches attenuated." *Grev. Alg. Brit. p.* 182; *Hook. l. c. p.* 314.

In the sea. Appin, *Capt. Carmichael.* Annual. Summer.—"*Fronds* 6—12 inches in length, filiform, cylindrical, tubular, inflated, rising with a main stem about 1 line in diameter, on all sides of which, and along the whole length, the branches are inserted: branches 2—6 inches long, smaller in diameter than the stem, between erect and spreading, set with a second series, 1 or 2 inches long, which, in their turn, bear a third, which are quite capillary. The *structure* distinctly reticulated, the reticulations roundish, but angular. *Fructification:* 3 or 4 subglobose granules within many of the reticulations. *Substance* membranaceous, but firm and somewhat cartilaginous when dry, adhering very imperfectly to paper. *Colour* a very pale, yellowish green." *Grev. l. c.*

5. E. *erecta*, Hook.; frond cylindrical, filiform, slender,

highly reticulated; branches erect, opposite or alternate, set with capillary ramuli, all attenuated to a fine point. *Hook. Br. Fl.* ii. *p.* 314; *Wyatt, Alg. Danm. No.* 166. *E. clathrata*, β. *Grev. Alg. Brit. p.* 181. *Conferva paradoxa, Dillw., (authentic specimen); Griff. MS.*

In the sea, about half-tide level. Annual. Spring and summer. Appin, *Capt. Carmichael.* Frith of Forth, and Bute, *Dr. Greville.* Torquay, in deep water, *Mrs. Griffiths.*—*Frond* 4—8 inches high, cylindrical, from the thickness of a hog's bristle to half a line in diameter; stem generally undivided, closely set with opposite or alternate, simple branches, which diminish in length upwards; these are gradually attenuated to a point, and set throughout with sub-distichous, slender, setaceous, erecto-patent ramuli, 1 or 2 lines long, and all tapering at the tips, which give the plant a feathery appearance. Such is the *normal* state of this species, but there are numberless varieties, which seem to connect it with the following, as that in like manner is connected with *E. ramulosa;* and I quite agree with Sir W. J. Hooker, who, in adopting Capt. Carmichael's descriptions, says, that however distinct typical individuals of the three supposed species may appear, still "that there are intermediate states of these plants which would rather lead me to coincide with Dr. Greville, and to unite them." Few plants are so sportive in size and ramification, and if all the varieties were described the species might easily be multiplied till we should have one for almost every marine pool!

6. E. *clathrata*, Grev.; frond cylindrical, filiform, slender, highly reticulated; branches spreading, much divided, set with divaricated or recurved ramuli. *Grev. Alg. Brit. p.* 181; *Hook. Br. Fl.* ii. *p.* 315; *Wyatt, Alg. Danm. No.* 34? *E. clathrata*, α. *Grev. l. c. Conf. paradoxa, E. Bot. t.* 2328.

In the sea. Annual. Spring and summer. Belfast Bay, *Mr. Templeton.* Appin, *Capt. Carmichael.* Brighton, *Mr. Borrer.* Torquay, *Mrs. Griffiths.* Not uncommon.—*Frond* 4—12 inches high, cylindrical, from the thickness of a bristle to 1 or 2 lines in diameter, generally with an undivided stem set with close branches, which spread in all directions and bear a second, third, or fourth series, till the plant assumes a very bushy appearance; the ramuli slender, abundantly scattered, either spreading or curved back, occasionally tangled and interwoven, their apices always acute and tapering. Carmichael describes this plant as prostrate, "forming a thin, inextricable fleece," a state evidently approaching the following.

7. E. *ramulosa*, Hook.; frond compressed, highly reticulated, very much branched and interwoven, twisted, every where covered with spine-like branchlets. *Grev. Alg. Brit. p.* 181; *Hook. l. c. p.* 315; *E. Bot. t.* 2137. *E. clathrata*, γ. *Grev. l. c. E. ramulosa*, var. *minor, Wyatt, Alg. Danm. No.* 208.

In the sea. Annual. Spring. Bantry Bay, *Miss Hutchins.* Plymouth, *Mr. Sconce.* Appin, *Capt. Carmichael.*—"*Fronds* 5 or 6 inches to 1 or 2 feet long, half a line in diameter, compressed, curled and twisted, much and repeatedly branched, and interwoven into a (more or less) thick and inex-

tricable mat, and beset on all sides with short, spine-like branchlets, or rather apiculi, which render it harsh to the touch. *Substance* membranaceous, green. This species can be at once distinguished from *E. clathrata*, with which alone there is any risk of its being confounded, by mere handling, the one feeling harsh to the touch, the other soft and silky." *Carm. MSS.*

8. E.? *percursa*, Hook.; "frond very slender, capillary, compressed, marked with spurious reticulations, and a central longitudinal line." *Carm. MS.; Hook. l. c. p.* 315.

On the oozy sea-shore, above the half-tide level, and giving it a greenish hue to an indefinite extent: Appin, common, *Capt. Carmichael.* Annual. Spring and summer.—I am not acquainted with this plant, which seems an intruder in the genus.

XCIII. Tetraspora. Link.

Frond either tubular, inflated or flat, gelatinoso-membranaceous, of a green colour. *Fructification:* minute granules, mostly arranged in fours.—Name, τετρα, *four*, and σπορα, a *seed;* in allusion to the distribution of the seeds.

1. T. *gelatinosa*, Desv.; frond ovate, inflated, very gelatinous. *Hook. Br. Fl.* ii. *p.* 313.

In fresh-water streams, attached to aquatic plants. Mucruss, Killarney. Botanic Garden, Belfast, *Dr. Drummond.—Fronds* exceedingly lubricous and gelatinous but firm, delicately waved and plaited, of an ovate outline. *Sporules* bright green, arranged in fours, or scattered.

2. T. *lubrica*, Ag.; frond quite simple, tubular, sub-gelatinous, waved and sinuated. *Hook. Br. Fl.* ii. *p.* 313.

In gently running streams, at first attached to water-plants. Hellesdon, Norfolk, *Sir W. J. Hooker.* Appin, *Capt. Carmichael.* Castlemartyr, Cork, *Miss Ball.* — *Frond* larger than in the preceding, less gelatinous, and with a more distinct membrane; the tube finally ruptures and the plant becomes flat, with an irregular outline. Agardh has observed the seeds to have, at the moment of being discharged, a spontaneous motion resembling that of animalcules, and of the seeds of various other fresh-water Algæ.

XCIV. Palmella. Lyngb.

Plant a shapeless gelatinous mass, filled with scattered globular or elliptical granules.—Name, παλμος, *vibration;* from the loosely gelatinous nature of these plants. The granules are sometimes arranged in fours, in which case the line of distinction between *Palmella* and *Tetraspora* vanishes.

* *Fronds green.*

1. P. *protuberans*, Ag.; frond thick, irregularly lobed,

very soft, green, the granules elliptical. *Hook. Br. Fl.* ii. *p.* 396; *Grev. Crypt. t.* 243, *f.* 1. *Ulva protuberans*, *E. Bot. t.* 2583.

On moist rocks, among mosses. Spring to autumn. Sussex, *Mr. Borrer*. Camsie Glen, near Glasgow, *Sir W. J. Hooker* and *Dr. Greville* Pentland Hills, *Dr. Greville*.—*Frond* spreading among mosses, in irregular masses, half an inch to 1 inch or more in breadth, thick, roundish, lobed, somewhat diaphanous, very soft and gelatinous, easily destroyed: *colour* green, but varying in shade, sometimes olivaceous. *Sporidia* elliptical, dispersed throughout the whole mass. *Grev. Crypt. Fl. l. c.*

2. P. *Grevillei*, Berk.; minute; fronds densely crowded, globose or somewhat lobed, green, decidedly gelatinous. *Berk. Alg. Br. p.* 16, *t.* 5, *f.* 1.—*α*, granules elliptical. *P. botryoides*, *Grev. Crypt. t.* 243, *f.* 2; *Harv. in Hook. Br. Fl. l. c. p.* 396.—*β*, granules globose. *P. botryoides*, *Lyngb. Dan. p.* 205.—*γ*, frond smaller, more hyaline, and with larger globose granules. *Berk. l. c. t.* 5, *f.* 2.

On heathy places in moist situations: frequent. *γ*, on decaying stems of *Asparagus officinalis*, in a hot-bed, *Rev. M. J. Berkeley*.—"*Fronds* minute, densely crowded, globose, green, composed of pale-green jelly, in which are numerous darker granules, elliptic in var. *α*; in var. *β* globose, and accompanied with smaller globose granules collected more or less into little round heaps, the largest of which are of the size of the larger granules. After it has been dried, the jelly is nearly colourless, and the granules are scattered, and all of the same size." *Rev. M. J. Berkeley*; who remarks also that Agardh's *P. botryoides* is a very different species.

3. P. *hyalina*, Lyngb.; "frond globose or somewhat elongated, pellucid, green; the granules globose, green." *Grev. Crypt. Scot. t.* 247; *Harv. in Hook. l. c. p.* 397.—*β. muscicola*; frond of no determinate figure, spreading over mosses, of the same pale green colour as the aquatic variety. *Carm. MS.*

In fresh-water streams &c.—"*Fronds* from a quarter of an inch to an inch in diameter, somewhat globose, but at length frequently more or less elongated into an ovate or even cylindrical form. *Substance* gelatinous and very tender, of a pellucid, watery appearance. *Granules* numerous, globose, green. The fronds are produced at first on rocks and stones at the bottom of streams, and afterwards become disengaged, and float on the surface." *Grev. l. c.*—When dried it forms a very pale greenish stain on the paper, without gloss.

4. P. *rivularis*, Carm.; fronds adnate, hemisphærical, tuberculose, often confluent, bright green; granules small, globose, scattered. *Harv. in Hook. l. c. p.* 397.

In a mountain streamlet, attached to the rocks and stones, Appin, *Capt. Carmichael*.—"*Fronds* one fourth to half an inch in diameter, hemisphærical, tubercular, firmly adhering, sometimes cohering into a broad crust. *Granules* small, globular, scattered. *Colour* vivid green. It bears a strik-

ing resemblance to *Chætophora tuberculosa*." *Carm. MSS.*—When dry it shrinks considerably, and fades to a dirty brown.

5. P. *Mooreana;* fronds large, globose or lobed, of a rich deep green colour (which is preserved in drying), and firm substance; granules closely set, roundish, dark green.

In a boggy hole at Shane's Castle, the seat of Lord O'Neill, near Lough Neagh, *Mr. D. Moore.* — "The *fronds* are of an irregular globose form, about an inch in diameter, tuberculated, and inclining to become hollow in the centre when old, at which time it floats on the surface; the *colour* is dark green, and the *substance* firm, and resembling that of an animal's liver." *Moore, MSS.*—When dry it preserves its fine green colour, and retains a considerable gloss, and to the naked eye resembles *Rivularia nitida*. It is allied to *P. hyalina*, but is a far firmer plant, and of a different colour; and still more to *P. rivularis*, but that species fades in the herbarium to a dingy brown. I have much pleasure in inscribing it to its acute discoverer, *Mr. D. Moore*, Curator of the Royal Dublin Society's Botanic Garden, who has added many interesting plants to the Irish Flora.

6. P. *furfuracea*, Berk.; fronds diffuse, irregular, granulated, scarcely gelatinous, composed of minute, globose, or somewhat angular granules. *Berk. Alg. p.* 18, *t.* 5, *f.* 3.

"Forming a thin mealy stratum of a light yellowish green, on the walls of a large frame at Milton, Northamptonshire," *Rev. M. J. Berkeley.*— "*Fronds* aggregate, diffuse, irregular, granulated, rather rigid, under the knife falling down into a mass of minute, more or less rounded granules, with scarcely any appearance of jelly." *Berk.*

7. P. *depressa*, Berk.; fronds sub-hemisphærical, depressed, green; granules globose or irregular. *Berk. l. c. p.* 19, *t.* 5, *f.* 4.

Growing on an old pump at Cotterstock, Northamptonshire, and constantly moistened by the dripping from the spout, *Rev. M. J. Berkeley.*— "*Fronds* bright yellow-green, gelatinous, subhemisphærical, depressed, crowded together, filled with more or less globose or angular, very minute granules." *Berk.*

** *Fronds brownish or yellowish olive, or grey.*

8. P. *rupestris*, Lyngb.; frond shapeless, rugose, yellowish-olive; granules globose, associated in fours, (sometimes scattered. *Harv. in Hook. Br. Fl.* ii. *p.* 397; *Lyngb. t.* 69.

On moist, overhanging cliffs. Appin, *Capt. Carmichael.*—"It occurs as a dirty yellowish, gelatinous crust, often hanging down in flakes from the face of the rock. The granules in my specimens are mostly solitary, with a dot in the centre; but everything connected with these imperfect, not to say doubtful, vegetables, is liable to the widest variations." *Carm.*

9. P. *livida*, Carm.; widely incrusting; fronds polymorphous, lobed, granulated, livid; granules globose, small. *Harv. in Hook. l. c. p.* 397.

On overhanging cliffs, covering them to an indefinite extent with a dirty black scurf, *Capt. Carmichael.*—"*Fronds* of an indeterminate form, lobed and granulated on the surface, of a livid-grey colour, and filled with exceedingly small granules." *Carm. MSS.*

10. P. *adnata*, Lyngb.; fronds depressed, moderately firm, irregular, confluent, shining, yellow-brown, consisting of globose, pellucid, colourless vesicles, immersed in gelatine, and containing one or more elliptic, tawny granules. *Berk. Alg. p.* 40, *t.* 15, *f.* 2; *Harv. in Hook. Br. Fl. p.* 398.

"Forming a thin, yellow-brown, suborbicular, depressed stratum, on chalk cliffs about high-water mark. The individual plants, which are from 1—6 lines in diameter, are but very little thicker in the centre than at the margin. The surface is rugulose and shining; the substance firm, between gelatinous and coriaceous." *Berk. l. c.*

**** Frond red.*

11. P. *cruenta*, Ag.; frond spreading in a thin, blood-red crust over walls, gelatinous, here and there uneven. *Harv. in Hook. Br. Fl.* ii. *p.* 396; *Grev. Crypt. Fl. p.* 205. *Tremella cruenta, E. Bot. t.* 1800.

On damp walls, chiefly such as are whitewashed; often in cellars. — It forms extensive patches of a blood-red or purple colour, appearing like a mere stain on the wall. "Under the microscope the structure is very obvious; the gelatinous frond swells into globose portions, unequal in size, filled with a multitude of roundish or oval granules." *Grev.*

12. P. *montana*, Ag.; between gelatinous and coriaceous, much and variously lobed, curled, dark purple; granules unequal, crowded, frequently in fours. *Harv. in Hook. l. c. p.* 396. *Ulva montana, E. Bot. t.* 2193.

On the mountains of the Isle of Skye and west coast of Scotland. Glen Catcol, *Dr. MacCulloch.* Lying on the ground, but not attached to it, in stony, moist places on Goat Fell, Arran, *Sir W. J. Hooker.*—According to Lightfoot this is the "Mountain Dulse" of the Scotch, and "the Highlanders wash it, and rub it between their hands in water, so as to make a paste, with which they purge their calves." On the mountains of Arran this lies unattached among loose wet stones, covering them in a straggling manner to a considerable extent. Each frond is an inch or an inch and a half in diameter, flattish, somewhat orbicular, between coriaceous and gelatinous, when dry almost horny, of a deep but dull purple colour, much lobed and curled, like some *Gyrophoræ*, filled with crowded clusters of granules, which, if minutely examined, are found to be mostly arranged in fours. *Hook.*

13. P. *Ralfsii;* frond minute, thin, gelatinous, hyaline, somewhat areolate; each areole containing 2—8 large, globose, blood-red granules.

Spreading over mosses on Cader Idris, *Mr. Ralfs.*—*Fronds* a few lines in diameter, gelatinous, somewhat areolate, or as if composed of numerous

small vesicles massed together, each of which contains 2—4 or 8 large blood-red granules, which are much larger and of a far deeper red than *P. montana*, which in some respects they resemble in miniature. The granules occasionally appear double or tripartite; they are pretty regularly in fours.

14. P. *grumosa*, Carm.; frond widely expanded, clotted, brick-red, floating; granules globose, red, here and there aggregated.

On a rock at the sea-side, in a small cavity filled with rain-water, at Appin, *Capt. Carmichael.*— "This species forms a clotted gelatinous mass, upwards of a foot in diameter and half an inch thick, of a brick-red colour, floating in the water. *Granules* mostly arranged in pairs, rather large, globular, with a pellucid limbus." *Carm.*

XCV. Hydrurus.

Frond gelatinous, cylindrical, branched, filled with scattered, globose, bright green granules.—Name, *ὑδωρ*, *water*, and *ουρα*, a *tail*.

1. H. *Ducluzelii*, Ag.; frond very gelatinous, branched, plumose. *Ag. Consp. Crit. Diat. p.* 27. *Batrachospermum myosurus, Ducluz. Palmella myosurus, Lyngb. Dan. t.* 68.

In alpine rivulets on stones &c. In the river Walkam, near Tavistock, *Mr. Ralfs.* Summer.—*Root* scutate, blackish, rather hard. *Fronds* clustered, solid, very gelatinous, 2—6 inches long or more, 2—4 lines in diameter, cylindrical, freely waving in the water, attenuated towards the apex, branched; branches scattered, alternate, elongate, slender, beset with other more slender, short ramuli. *Gelatinous mass* pellucid, viscid, colourless under the microscope, without apparent margin, unless as the granules imbedded within its substance indicate such; these are globose, green, fewer in the stem and primary branches, most densely set in the ramuli, especially towards the margin. *Colour* of the recent frond brownish-olive, or dark brown, in drying green; of the granules both recent and dry, green. The *odour*, in a recent state, is very offensive, and as Lyngbye remarks, only to be submitted to by an Algologist. In a dry state it shrinks much, and most closely adheres to paper. Having only seen this very interesting plant in a dry state, I have thought it better to copy the above description from Lyngbye. Our specimens, so far as they can be examined, well agree with his figure. The affinities of the genus are doubtful. By Agardh it is now placed near *Schizonema*, to which its offensive smell certainly allies it. But the *form* and *appearance* of the granules are so totally unlike the frustules of any Diatomaceous plant, that, for the present at least, I retain it near *Palmella*, to which it seems to me about as much allied as *Chætophora endiviæfolia* to the shapeless species of that genus. If a true Diatomaceous plant, it ought, as Agardh suggests, to form the type of a new *series*, of which, perhaps, our *Cymbella lætevirens* might represent the lowest form.

XCVI. Hæmatococcus. Ag.

Fronds minute, vesicular, transparent, aggregated into a

friable crust; each vesicle containing a few scattered granules. —Name, *αιμα, blood,* and *κοκκος, fruit;* many of the species are of a red colour.

* *Granules red.*

1. H. *sanguineus,* Ag.; crust spreading, soft, friable, of a brick-red colour; fronds polymorphous, containing 1—3 granules. *Harv. in Hook. l. c. p.* 395; *Ag. Ic. Alg. Europ. t.* 24. *Palmella? cryptophila, Carm. MS. cum icone.*

"On a stalactitic incrustation, lining the vault of a cavern in a quartz rock, Appin," *Capt. Carmichael.* On shady rocks at Tobermorey, in Mull. —This forms wide patches, of a brick-red colour externally, but somewhat whitish within, uneven, breaking up into innumerable, minute, vesicular fronds. "It is moist, but not gelatinous, very friable, and, under the microscope, is found to consist of small pellucid bodies, of various shapes, in each of which are lodged 1—3 minute, sphærical granules." *Carm.*

** *Granules grey or greenish.*

2. H. *frustulosus,* Harv.; crust widely spreading, friable, dark grey; fronds exceedingly minute, transparent, roundish, containing numerous, scattered, minute granules. *Harv. l. c. p.* 395. *Palmella frustulosa, Carm. MSS. cum icone.*

On irrigated cliffs, perennial, Appin, *Capt. Carmichael.*—"It occurs in the form of a greyish black, fragmentary scurf. On the slightest pressure it separates into corpuscles of various forms, but mostly sphærical, hyaline under the microscope, surrounded by a membranous envelope, and including several granules." *Carm.*—The granules are exceedingly minute, dust-like, forming a cloudy spot in the centre of the frond.

3. H. *granosus;* crust widely spreading, granulated, pale green; fronds polymorphous, containing 2—4 green, elliptical granules. *Palmella granosa, Berk. l. c. p.* 20, *t.* 5, *f.* 5.

Growing in great abundance on sub-immersed *Hypnum stellatum,* in the bogs bordering on Whittlesea Mere, summer, *Rev. M. J. Berkeley.*—"Pale green, or, when preserved in the herbarium, with a pale brownish tint. Growing in large masses of no certain or distinct form, but broken into many angular faces, having a very granulated appearance, and crumbling beneath the fingers. The whole plant is made up of innumerable, subelliptic, hyaline, colourless, jelly-like bags, containing from two to four, green, elliptical granules, which in some lights appear as if surrounded with a pellucid border. Nothing can be more similar in structure than the present plant and *H. sanguineus:* the only difference is in colour." *Berk. l. c.*

XCVII. Protococcus. Ag.

Plant consisting of aggregated, naked *globules,* filled with minute *granules,* and sessile on a transparent, gelatinous

mass. — Name, πρωτος, *first* or *primary*, and κοκκος, *fruit*; from its elementary organization. Agardh states that the globules of his *Protococcus* are perfectly *simple*, or consisting merely of a hyaline cellule inclosing an uniform, coloured mass, and he regards our British plant as a different species, belonging to *Hæmatococcus*. Having minutely examined a specimen from Agardh himself, submitted to me for that purpose by Dr. Greville, and finding exactly the same compound structure as in our British specimens, I do not hesitate to pronounce the two plants identical.

1. P. *nivalis*, Ag.; globules exactly sphærical, very minute, fine purple-red; gelatinous mass pale, spreading. *Grev. Crypt. Fl. t.* 231; *Ag. Ic. Alg. Europ. t.* 21, and *Hæm. Grevillii, Ag. l. c. t.* 23; *Harv. l. c. p.* 395. *Palmella nivalis, Hook. in Parry's 2nd Voy. App. Uredo nivalis, Bauer, in Journ. of Science and Arts, vol.* vii. *p.* 222, *t.* 6.

On the borders of the lakes of Lismore, spreading over decaying leaves &c.; but in greater perfection on the calcareous rocks, within the reach of occasional inundation, *Capt. Carmichael.* Near Miltoun Malbay on schist; Limerick on limestone; and about Dublin on granite; in most cases slightly inundated.—This curious little plant, which, under the name of *Red Snow*, has excited so much interest among botanists, is usually found in this country in the form of a thin, stain-like stratum, on the surface of rocks, or investing decayed vegetable substances with a purplish crust. On examination under the microscope it is found to be composed of innumerable sphærical bodies, seated upon a gelatinous substratum. The *globules* are of various sizes, probably depending upon age. At first they are furnished with a wide pellucid border, and contain a deep red homogeneous mass. As they increase in size, this border gradually becomes narrower and at length altogether disappears, while the internal mass, which at first was simple, becomes broken into numerous distinct *granules* or *seeds*, which are finally discharged.—*Red snow*, we are informed by Prof. Agardh in his interesting memoir on the Protococcus,* was first observed by De Saussure in the year 1760, on Mount Beven in Switzerland, and subsequently so frequently among the Alps, that he was surprised how such a phenomenon should have escaped the attention of other travellers, especially Scheuchzer. Ramond found *Red snow* on the Pyrenees, and the botanist Sommerfeldt in Norway. At the beginning of the century it was noticed on several of the mountains of Italy, along the chain of the Apennines; and in March, 1808, the whole country round Cadore, Belluno and Feltri, was covered in one night, to the depth of twenty centimetres, with "a rose-coloured snow," a pure white snow having fallen before and after, so that the coloured snow formed an intermediate stratum. The same fact is recorded at the same time in several other Italian localities. Still *Red snow* excited little attention among botanists, and had not obtained a place in our sci-

*'Nova Acta Phys.-Med. Academiæ Cæs. Leop. Car. Nat. Cur.' vol. xii p. 737. Translated in Grev. 'Crypt. Fl.' vol. iv. sub t. 231.

entific arrangements until Capt. Ross discovered it in Baffin's Bay, covering tracts of some miles in extent, and penetrating in some places to the depth of ten or twelve feet. The specimens brought home by this celebrated traveller, were submitted to *Mr. F. Bauer* and *Mr. R. Brown*, to be examined botanically; the latter of whom, with his usual acumen, decided that it was "*Algarum genus ? ? Confervis simplicissimis et Tremellæ cruentæ (Eng. Bot. t.* 1800*) quodammodo affine ? ?*" The "local habitation" thus assigned has been acknowledged by all succeeding botanists; and Agardh has completed its history by giving it "a name."

Tribe 21. NOSTOCHINÆ.

XCVIII. Nostoc. Vauch.

Frond gelatinous or coriaceous, globose or lobed, filled with curled, beaded, simple *filaments*, which are finally dissolved into sporules. Here and there one bead is colourless, and rather larger than the others.—The name is unexplained; it was first used by Paracelsus, and adopted by Vaucher for the present group, which, before that time, was included in *Tremella*.

* *Olive-green, terrestrial.*

1. N. *commune*, Vauch.; terrestrial, frond expanded, membranaceous, plaited and waved or curled, olive-green, irregular in shape. *Harv. in Hook. Br. Fl.* ii. *p.* 399. *Tremella Nostoc, E. Bot. t.* 461.

Gravelly soils, garden walks, rocks, pastures, &c., very common in autumn and winter.

2. N. *variegatum*, Moore; terrestrial; frond expanded, gelatinous, livid, variable in shape; filaments rather distant.

"This singular plant I first collected in 1836, growing on the face of a moist bank over which water trickled. When recent it formed a soft, gelatinous mass, of a livid colour, bearing the closest resemblance, both in substance and colour, to those gelatinous *Medusæ* which are cast ashore along the coast, and called by the country people "fallen stars." I again collected it on the same spot in 1838, when I sent Dr. Greville specimens, who thinks it different from anything he knows, and coming nearest to *N. commune*." *Moore, MS.*—When dried it has much the appearance of *N. commune*, but is a much more gelatinous plant, and the filaments are larger, more distinctly beaded and more laxly set.

3. N. *muscorum*, Ag.; frond variable in shape, mostly orbicular, convex above, hollow underneath, tuberculated, somewhat coriaceous. *Hook. Br. Fl.* ii. *p.* 399.

On calcareous rocks and the mosses which cover them, Appin, *Capt. Carmichael.*—"*Fronds* gregarious, an inch or more in diameter, of various forms, but inclining more or less to the orbicular, convex above and con-

cave in an equal degree below, of a firm, dry consistence, and made up of small, roundish lobes or papillæ. It bears a strong resemblance to *Collema crispum;* but is much firmer and less gelatinous." *Carm. MSS.*

4. N. *vesicarium*, De C.; "terrestrial; frond vesicular, cartilaginous, full of viscid juice." *Ag.* — *Hook. Br. Fl.* ii. *p.* 399.

Road-side near Perth, *G. A. W. Arnott, Esq.*—I am unacquainted with this plant.

5. N. *foliaceum*, Ag.; cæspitose, membranaceous, plaited and wrinkled, somewhat erect. *Ag. Syst. p.* 19; *Hook. l. c. p.* 399.

On clayey ground kept constantly damp by the oozing of water. Appin, *Capt. Carmichael.*—"The fronds grow in circular tufts, 5 or 6 inches in diameter. They are about an inch broad, membranaceous, plaited, wrinkled, of a dirty umber colour." *Carm. MSS.*

6. N. *microscopicum*, Carm.; fronds densely aggregated, very minute, globose or oblong, immersed in a blackish crust; filaments few. *Hook. l. c. p.* 399.

On exposed calcareous rocks among mosses. Appin, *Capt. Carmichael.* Near Youghal, *Miss Ball.* "Wilderness" near Clonmel.—*Fronds* gregarious, from a line to the twentieth part of an inch in diameter, and varying in form from globular to linear, of an olive or fulvous colour. In the immature fronds there are no more than one or two filaments." *Carm. MSS.* A curious and very distinct species, very beautiful under the microscope.

7. N. *humifusum*, Carm.; fronds very minute, sub-globose, fleshy, brownish-green, densely aggregated in a widely spreading stratum. *Harv. l. c. p.* 399.

On rocks exposed to the sea-spray, spreading over the naked earth. Appin, *Capt. Carmichael.* — "*Frond* not more than one fourth of an inch in diameter, spreading over the naked soil in a dark green crust, firm, fleshy, and rather opaque.

** *Olive-green, submersed.*

a. *Globose.*

8. N. *pruniforme*, Ag.; unattached, globose or compressed, coriaceo-gelatinous, smooth. *Harv. l. c. p.* 399.

In fresh-water pools, near the coast. Rivulet near Torquay, *Sir W. J. Hooker.* Appin, *Capt. Carmichael.*—"*Fronds* unattached, scattered at random in the clefts of the rocks, globular, smooth, olive-green, diaphanous, from $\frac{1}{4}$ to $1\frac{1}{2}$ inch in diameter, the larger ones generally compressed, hollow, and sometimes ruptured." *Carm.* — Of this I possess specimens from both the above localities, and there can be no doubt of their identity with each other and with Agardh's plant; but the Nostoc which *now* (1840) grows in the "rivulet near Torquay," pointed out to me by Miss Griffiths as Hooker's habitat, is *N. verrucosum.*

9. N. *sphæricum*, Vauch.; densely aggregated, minute, globose, solid, smooth, olivaceous. *Harv. l. c. p.* 400. *Ulva pisiformis, Huds.*

In fresh water. On mural rocks exposed to the trickling of fresh water, *Capt. Carmichael.* Pools near Barmouth, *Mr. Ralfs.*—"*Fronds* from ½ a line to 2 lines in diameter, globular, firm, smooth, solid, heaped on each other like a parcel of small shot. Internal filaments rather thinly scattered through the mass." *Carm.*—A very pretty and distinct species.

b. *Variable in shape.*

10. N. *verrucosum*, Vauch.; fronds large, gregarious, confluent, sub-globose, plaited, at length hollow, blackish-green. *Harv. l. c. p.* 400.

On stones in alpine streams, common.—"*Fronds* half an inch or more in diameter, confluent (into wide patches), adhering firmly to the rock, roundish, plaited, at length hollow. *Filaments* short, curled and fragile." *Carm.*

*** *Bluish, small.*

11. N. *cæruleum*, Lyngb.; frond minute, globose, solitary, solid, smooth, pale blue, sub-pellucid; filaments simple, curved, moniliform. *Grev. Crypt. Fl. t.* 131; *Harv. l. c. p.* 400.

In flowing water, or in very moist places, attached to mosses. Near Calendar, *Dr. Greville.* Co. Antrim, *Mr. D. Moore.*—"*Plants* 1 or 2 lines in diameter, gelatinous, globose, gregarious, but distinct, subpellucid, of a delicate pale blue colour, rarely almost colourless: solid, and filled with simple, curved, moniliform filaments, the joints of which appear to separate spontaneously, and probably supply the place of sporules. In drying they shrink almost to nothing." *Grev.*—Mr. Moore's specimens are rather larger than Dr. Greville's, but in other respects perfectly agree. This is the most delicate and least tenacious of the genus.

XCIX. Monormia. Berk.

Frond branched, composed of a single, moniliform thread, following the ramifications, immersed in gelatine. *Berk.*—Name, μονος, *one*, and ορμος, a *necklace*.

1. M. *intricata. Berk. Gl. Alg. p.* 46, *t.* 18.

In ditches of the marsh to the south of Frindsbury canal, near Gravesend, in great abundance in June, 1832, *Rev. M. J. Berkeley.*—"Forming small, roundish, gelatinous masses, floating amongst different species of *Lemna* in fresh water, but probably within the influence of the tide, and also amongst *Enteromorpha intestinalis*, and even within the frond in brackish water. The plant is at first of an olive-yellow, gradually assuming a greener tint, and when dried, of a deep verdigris. Very gelatinous, delicately branched; the branches very flaccid. Under a high magnifier, the whole plant is evidently composed of gelatine, in the centre of which runs

a single, moniliform filament, following the ramifications, and in its progress curling to and fro repeatedly across the thread; the joints being nearly globular. The specimens from the interior of *Enteromorpha* are paler, and have often longer joints amongst the globular ones." *Berk.*—A most interesting and beautiful plant, forming a clear link between *Nostoc* and *Anabaina*. I am indebted to Mr. Berkeley for specimens.

C. Anabaina. Bory.

Filaments freely floating in water, simple, moniliform, curved, invested with mucous matter, and "having a vermicular motion." One of the moniliform joints here and there larger than the rest. — Name, *αναβαινω*, to *mount upwards;* because the filaments rise to the surface of the water by a species of voluntary motion, "resembling that of worms." *Bory.*

1. A. *flos-aquæ*, Bory; mass spreading on the surface, of a bluish-green colour, slimy, composed of variously curved, simple, moniliform threads; one articulation occasionally larger than the rest. *Nostoc flos-aquæ, Lyngb. Dan. p.* 201, *t.* 68. *Byssus flos-aquæ, Huds. Fl. Ang. p.* 604; *Lightf. Scot. p.* 999.

In stagnant water and small lakes, probably common. Lochmaben, Dumfriesshire, *Mr. W. Thompson.*—Spreading on the surface in gelatinous masses of a fine glaucous or blue-green colour. *Filaments* elegantly curved, moniliform, the joints coloured, with here and there a colourless articulation, which is rather larger than the rest. When dry it forms a mere stain on the paper, of a verdigris colour and without gloss.

2. A.? *spiralis*, Thompson; plant either diffused through the water or spreading on the surface in gelatinous masses, consisting of extremely minute, moniliform threads, of a rich green colour and regularly spiral; articulations of equal size. *Thomp. in An. Nat. Hist. vol.* v.

Colouring the waters of Ballydrain lake, near Belfast, *Mr. W. Thompson.* July to October.—"This species at first, when mingling with the water, is of a dark green colour; when in calm weather it ascends to the surface in *separate* particles, it appears pale green; when it does so *en masse* (the earliest symptom of decay), it is of a pale blue, and in the last stage of decomposition ferruginous." *Thomp. in litt.*—When occurring in masses these are about an inch in thickness, very slippery, and of considerable consistence, "more so than the Medusæ generally are, and on being lifted out of the water in a wire-gauze net, remain there without diminution by dripping off or otherwise; the smell is offensive, and something resembles that of water in which flax has been steeped." When examined with the highest power of the microscope, the whole appears to consist of exceedingly minute, spirally twisted, beaded threads; the longest about the fiftieth of an inch in length. The joints generally contain a bright green granular mass, which is finally discharged. This curious plant is very distinct from the preced-

ing, than which it is vastly more minute. Its nearest affinity seems to be with *Anab. impalpabilis* of Bory, with which Mr. Thompson contrasts it; but that is described as forming on the paper on which it is dried, a *glossy* verdigris-green stain, while ours in this state is dull green and wholly without gloss. For an interesting account of its various changes &c., see Mr. Thompson's paper in the 5th vol. of the 'Annals of Natural History.'

CI. Echinella. Ach.

Exceedingly minute, dot-like, sphærical *fronds*, composed of jointed filaments radiating from a centre. — Name, *Echinus*, the *hedgehog;* in allusion to the bristly appearance of the radiating particles.

1. E. *articulata*, Ag.; glaucous; filaments jointed, spreading every way from a centre, and forming a globe. *Sm.*—*Harv. in Hook. Br. Fl.* ii. *p.* 398.

In a lake in Anglesea, *Rev. H. Davies.* — *Fronds* exceedingly minute, covering the surface of the water in June and July, with a thin, glaucous-green scum. Under the microscope this is found to be made up of sphærical bodies, composed of jointed, straight filaments, of equal length, radiating in all directions from the centre.

CII. Eutomia. Nov. Gen.

Exceedingly minute, dot-like, flat fronds, composed of two cloven laminæ cohering by the edges, and finally separating. —Name, εὖ, *well*, and τεμνω, to *cut;* the frustules being elegantly cloven in a radiating manner. This genus is proposed for *Echinella radiosa* of Lyngb., together with the two following species; none of which can be included in *Echinella*, either as defined by Agardh, or as above; but in what part of the system to place them I confess myself at a loss to decide. To the *Diatomaceæ* they bear a very close affinity, but among them present the anomalous feature of dichotomously-cloven frustules. The nearest approach to such a structure is in *Desmidium*, and perhaps they might be placed in Desmidieæ, as related in the same manner to that genus as *Styllaria*, *Frustulia*, and *Cymbella* are to the more compound genera in their respective tribes. I need hardly add that their relationship to the animal kingdom is almost as strong as to the vegetable.

1. E. *rotata;* "frond plane, circular, divided by a line passing through the centre, each portion composed of radiating segments cleft nearly to the central line." *Grev.*—*Echi-*

nella rotata, Grev. in Hook. Br. Fl. ii. *p.* 398. *E. radiosa, Carm. MSS. (not of Lyngb.)*

In fresh water, among *Confervæ* and aquatic mosses. Appin, *Capt. Carmichael.* Near Dolgelly, *Mr. Ralfs.*—"Minute, scattered, bright transparent green." *Grev.*—Of Carmichael's plant I have seen no specimens, and therefore think it better to retain Dr. Greville's description, adding the following, taken from Mr. Ralfs's. — *Fronds* plane, circular or sub-elliptical, composed of two semicircular frustules cohering by their *chords* and finally separating. Each deeply five-lobed; the central lobe narrowest and simply emarginate; the lateral ones deeply bifid, with the apices of their segments crenulate. *Colour* a bright yellow-green, colourless at the edges.

2. E. *oblonga;* "frond compressed, oblong, crenato-pinnatifid and lobed, divided transversely in the middle almost to the centre." *Grev.* — *Echinella oblonga, Grev. in Hook. l. c. p.* 398.

With the last, at Appin, *Capt. Carmichael.*—Pale transparent green. These are animals, instead of plants, if the faculty of locomotion will entitle them to that rank. *Carm. MSS.*

Tribe 22.? BYSSOIDEÆ.*

CIII. Byssocladium. Ag.

Filaments cobwebby, issuing from a centre, with scattered, external granules. — Name, βυσσος, a kind of *fungus,* and κλαδος, a *branch.*

1. B. *fenestrale, Ag. Syst. p.* 31; *Harv. l. c. p.* 379. *Conferva fenestralis, Dillw. t.* 94.

On windows and damp glass, on which it forms roundish, dirty white spots.

CIV. Mycinema. Ag.

Filaments membranaceous, opaque, tenacious, coloured. —Name, μυκης, a *fungus,* and νημα, a thread. Decumbent, cobwebby plants, growing on rotten wood; probably only imperfect fungi.

1. M. *arachnoideum,* Ag.; filaments branched, slender, pale yellow, laxly interwoven into a cobwebby membrane; branches scattered, remote, simple; articulations variable, about four times as long as broad. *Harv. l. c. p.* 379. *Conf. arachnoidea, Dillw. t. C.*

On rotten wood.

2. M. *fulvum,* Ag.; filaments decumbent, elongate, mem-

* Probably imperfect Fungi.

branaceous, equal, branched, loosely interwoven into a soft, expanded, tawny stratum; articulations thrice as long as broad. *Harv. l. c. p.* 379; *Loud. Encycl. Pl. No.* 15061.

On dead trees; but I do not know where found.

3. M. *rubiginosum*, Ag.; filaments much branched, rigid, sub-erect, reddish, interwoven into a sub-solid mass; articulations about four times as long as broad. *Harv. l. c. p.* 380. *Conf. rubiginosa, Dillw. t.* 68.

On rotten wood, *Dillw.*

4. M. *phosphorea*, Ag.; filaments branched, ascending, very short, violet-blue, densely interwoven into an uniform crust; articulations once and a half as long as broad. *Harv. l. c. p.* 389. *Conf. phosphorea, Dillw. t.* 88. *Auricularia phosphorea, Sow. Fung. t.* 350.

On decaying wood.

CV. Chroolepus. Ag.

Filaments rigid, sub-solid, opaque, falling to powder, erect, minute; joints often contracted.—Name, χροος, the *skin*, and λεπω, to *decorticate;* from the change which the filaments undergo. Small as this genus is it contains two distinct tribes; the first, or legitimate *Chroolepus*, is intermediate between *Mycinema* and *Protonema;* the second includes some minute objects which ought surely to be removed to the byssoid fungi, perhaps to the genera *Monilia* or *Helmisporium.* Dr. Walker Arnott, indeed, is of opinion with Fries, that the whole should form the modified genus *Byssus*, and be removed from the Algæ.

1. *Orange, red, or yellow, rarely greenish,* (Amphiconium, *Spr.*)

1. C. *aureus*, Harv.; filaments forming soft, cushion-like tufts, flexuous, irregularly branched, yellow-green or orange; articulations twice as long as broad. *Harv. in Hook. Br. Fl.* ii. *p.* 380. *Conferva aurea, Dillw. t.* 35. *Byssus aurea, E. Bot. t.* 212. *Trentepohlia aurea, Ag. Syst. p.* 36. *Ectocarpus aureus, Lyngb. t.* 44. *Amphiconium aureum, Spr. Conferva ilicicola, E. Bot. t.* 1639.

On rocks and trees, very common.— This forms beautiful velvetty cushions, of a chlorous, orange, or brick-red colour, fading, after long keeping in the herbarium, to a dull ash-grey.

2. C. *Jolithus*, Ag.; filaments tufted, erect, very short,

orange-red, dichotomous; articulations once and a half as long as broad. *Harv. l. c. p.* 380.

On rocks in woods &c.— Dr. Arnott suggests that this is merely a state of the preceding. I fully agree with him, and would willingly add the two following also, as mere varieties depending on habitat.

3. C. *odoratus*, Ag.; filaments branched, tufted, short, erect, fulvous; branches patent, rigid; articulations as long as broad. *Harv. l. c. p.* 380. *Amphiconium Linnœi, Spr. Johnst. Berw. Fl.* ii. *p.* 245.

On the bark of ash trees. About Berwick, *Dr. Johnston.*

4. C. *lichenicolus*, Ag.; tufts red-orange; filaments erect, tufted, alternately branched, rigid; articulations slightly tumid, as long as broad. *Harv. l. c. p.* 381. *Conf. lichenicola, E. Bot. t.* 1609.

On lichens and old trees, not uncommon.

2. *Black, torulose; bearing club-shaped bodies resembling sporidia,* (Helmisporium ?)

5. C. *ebenea*, Ag.; filaments branched, erect, tufted, rigid, sub-cartilaginous, black, obtuse; articulations as long as broad. *Harv. l. c. p.* 381. *Conf. ebenea, Dillw. t.* 101. *Byssus nigra, E. Bot. t.* 702.

On rocks and trees in alpine districts, frequent.—"*Tufts* of indefinite extent, velvetty black. *Filaments* scarcely more than a line (or two) in length, interwoven, slightly branched, extremely fragile. *Articulations* about as broad as long, rather translucent. I have found specimens of this plant bearing *pod-shaped branches* or *appendages*, thicker than the main filament, with the articulations twice as broad as long, and readily separating into single joints." *Carm. MSS.*—These *pod-shaped appendages* are surely of the same nature as what are called "*sporidia*" in the genus *Helmisporium* of Link; to which genus the black species of *Chroolepus* ought, perhaps, to be removed.

6. C. *melœnus*, Carm.; filaments slightly branched, erect, forming a jet-black stratum; articulations oval, twice as long as broad; joints contracted. *Harv. l. c. p.* 381. *Syncollesia ? melœna, Ag. Syst. p.* 32. *Conf. melœna, Lyngb. t.* 57.

On old beech trees at Appin, *Capt. Carmichael.*—"*Stratum* several inches in diameter, of a deep, velvetty black colour. *Filaments* about a line in length, slightly branched, exceedingly fragile; *articulations* about twice as long as broad, oval, moniliform, subdiaphanous." *Carm. MS.*—Lyngbye's figure, though rude, is very characteristic. I do not see how this differs from *Monilia attenuata* (*Grev. Crypt. t.* 255) except in being branched.

7. C. *mesomelas*, Carm.; filaments slightly branched, erect, forming a jet-black stratum; articulations globose, opaque, the uppermost pellucid. *Carm.—Harv. l. c. p.* 381.

On decaying stems of *Urtica dioica*, *Capt. Carmichael*.—" *Stratum* half an inch in length, of a deep black colour. *Filaments* erect, slightly branched; branches divaricate at the base, ascending. *Articulations* globular, moniliform, perfectly opaque, with the exception of one or two of the terminal ones. Siliquæform appendages scattered, as in *C. ebenea*." *Carm. MSS.*

8. C. *Arnottii*, Hook.; filaments very short, heaped together, fragile, moniliform, slightly branched; branches simple, subulate, spine-like, divaricate; articulations rather shorter than broad; joints contracted. *Harv. l. c. p.* 381.

On yews, at Cleish Castle, Kinrosshire, *Dr. Walker Arnott*, of Arlary.—"This singular plant resembles none other that I know. It is found only on yew-trees: these are of great age, and have, in general, near the root, a very irregular outline, exhibiting deep cracks or clefts: from these fissures exudes the juice of the tree; this soon afterwards thickens and becomes covered with a soft filamentous substance, that might be mistaken for *Racodium cellare*, or rather *R. vulgare*, Fries, if indeed it has not been frequently passed over for that plant. Such is its first state. The sap of the tree continues to flow through the plant, which also increases in size and thickness, at last becoming a firm, corky, almost hemisphærical substance, losing nearly all trace of the filamentous surface, and slightly resembling specimens of *Sphæria deusta;* presenting like them, when broken, though generally very indistinctly, the appearance of concentric layers, which, from the observations I have made, mark pretty nearly the number of years the specimen has been in forming. This I have no doubt is caused by the inspissation, at the close of each season, of the sap of the tree absorbed by the parasite. I may add, that when well dried, this species takes fire very readily from a spark, and burns like tinder." *Arn. in litt.*

CVI. Protonema. Ag.

Filaments sub-articulated, branched, rooting, mostly green. —Name, πρωτος, *first*, and νημα, a *thread*. The following obscure productions are probably rudimentary mosses. *P. velutinum*, Ag. (the well-known *Byssus velutina*), having been proved to be merely the commencement of *Polytrichum aloides*, I have omitted.

1. P. *umbrosum*, Ag.; stratum velvetty green; filaments erect, obtuse, fastigiate, fragile; articulations gibbous. *Ag. Syst. p.* 43; *Harv. l. c. p.* 383. *Conf. umbrosa, Dillw. t.* 61.

On damp ground.

2. P. *cryptarum*, Ag.; filaments dichotomous, green; branches divaricating, acuminate; articulations thrice as long as broad. *Harv. l. c. p.* 383. *Conf. cryptarum, Dillw. t. E; E. Bot. t.* 2588.

In caves; first discovered by *R. Brown*, *Esq.*—Agardh suspects this to be the young of some *Phascum*.

3. P. *Acharii*, Ag.; filaments brownish-green, branched, erect; articulations twice or thrice as long as broad; joints contracted. *Harv. l. c. p.* 383. *Conf. Acharii, Dillw. t.* 69.

On damp shady banks.

4. P. *Orthotrichi*, Ag.; filaments olivaceous, minute, branched, obtuse, erect; articulations about as long as broad. *Ag.* — *Harv. l. c. p.* 383. *Conf. Orthotrichi, Dillw. t.* 89. *Conf. muscicola, E. Bot. t.* 1638.

On the leaves of various *Orthotricha;* common.

5. P. *muscicola*, Ag.; filaments brown, branched; branches alternate, divaricate, subulate; articulations thrice as long as broad. *Harv. l. c. p.* 383. *Conf. castanea, Dillw. t.* 72; *E. Bot. t.* 1701. *Conf. muscicola, Web. and Mohr.*

In shady places among mosses.

CVII. Hygrocrocis. Ag.

Filaments colourless, interwoven into an uniform membrane or gelatine.—Name, ὑγρος, *belonging to water*, and κροκις, a *little tuft*. Obscure byssoid productions, found in chemical solutions and various infusions. They are probably, as Mr. Berkeley suggests, imperfectly developed *moulds*.

1. H. *barytica*, Ag.; tufts globose; filaments very slender, cobwebby, colourless, densely interwoven, inarticulate, flexuous, branched; branches divaricating. *Ag. Syst. p.* 45; *Loud. Encycl. Pl. No.* 15087; *Harv. l. c. p.* 384.

In a solution of muriate of Barytes.

2. H. *atramenti*, Ag.; filaments dichotomous, branched, minute, decumbent, densely interwoven in a white stratum; articulations longer than broad. *Ag. Syst. p.* 48; *Harv. l. c. p.* 384.

On the surface of ink; very common.

3. H. *typhloderma*, Ag.; filaments slightly branched, densely interwoven in an olivaceous pellicle; articulations as long as broad. *Ag. Syst. p.* 46; *Harv. l. c. p.* 384. *Conf. typhloderma, Dillw. t.* 83.

In water containing a solution of gum dragon, *Mr. W. W. Young.*

4. H. *pallida*, Ag.; filaments dichotomous, curvato-flexuous, fastigiate, ochraceous, interwoven in a gelatinous, cori-

aceous pellicle; axils rounded; articulations very long. *Ag. Syst. p.* 46; *Harv. l. c. p.* 384. *Conf. pallida, Dillw. t.* 78.

"My friend *Mr. W. W. Young* having let some yellow ochre remain about a fortnight in a pot of isinglass size, found the surface of the ochre nearly covered by the present minute and interesting *Conferva*." *Dillw. l. c.*

5. H. *Rosæ*, Ag.; filaments colourless, slightly branched, interwoven into a cloud-like, olive-grey, bullated membrane, or compact, dull grey gelatine. *Ag. Syst. p.* 46.

In distilled rose-water, *Miss Trevelyan.*

6. H. *sanguinea*, Ag.; filaments branched, densely interwoven in a blood-red, gelatinous pellicle; branches divaricate; articulations rather longer than broad. *Ag. Syst. p.* 46; *Harv. l. c. p.* 384. *Conf. sanguinea, Dillw. Conf. Syn. p.* 55.

"*Mr. Young* discovered the present species, forming a densely matted membrane on the surface of some isinglass size, in which he had put some patent yellow to dissolve; but we have since repeatedly endeavoured to produce it in the same manner without success." *Dillw.*

7. H. *vini*, Ag.; brownish-yellow; filaments colourless, interwoven, much branched; branches attenuate, acute; articulations twice as long as broad. *Ag. Syst. p.* 47; *Harv. l. c. p.* 384; *Loud. Encycl. Pl. No.* 15093.

In Madeira wine.

CVIII. Leptomitus. Ag.

Filaments colourless, erect, parasitical, growing in fresh water or in the sea.—Name, λεπτος, *slender*, and μιτος, a *thread.*

1. L. *minutissimus*, Ag.; filaments slightly branched, very minute, colourless; branches scattered, forked, obtuse; joints imperfectly visible and of variable length. *Ag. Syst. p.* 47; *Harv. l. c. p.* 385. *Conf. minutissima, Dillw. Conf. Syn. t. F.*

On the smaller Algæ, in the sea.

2. L. *lacteus*, Ag.; filaments branched, clustered in a shapeless, gelatinous mass, dirty white; branches from each dissepiment; articulations very long. *Ag. Syst. p.* 48; *Harv. l. c. p.* 385. *Conf. lactea, Dillw. t.* 79.

In ditches and rivulets, chiefly such as contain a quantity of decaying vegetable matter.

3. L. *clavatus*, Ag.; filaments simple, hyaline; apex club-shaped. *Ag. Syst. p.* 49; *Harv. l. c. p.* 385. *Vaucheria aquatica, Lyngb. t.* 22.

On fishes and dead flies.

4. L. *pisidicola*, Berk.; threads short, fasciculate, fastigiate; branches horizontal or even; the apices swollen, and containing a denser mass of granules than the rest of the plant. *Berk. Gl. Alg. p.* 30, *t.* 11, *f.* 1.

Growing on the putrefying body of *Pisidium amnicum* (*Tellina amnica*, L.), *Rev. M. J. Berkeley.*

CIX. Scythymenia. Ag.

Frond tough, leathery, spreading, its surface reticulated with raised, irregularly anastomosing veins; entirely composed of byssoid fibres, intermixed with granules.—Name, σκυτος, *leather*, and ὑμην, a *membrane*. This appears to me to be an unquestionable fungus, but whether described as such by authors I am unable to say.

1. S. *rupestris*, *Ag. Syst. p.* 30. *Ulva rupestris*, *E. Bot. t.* 2194, *(not characteristic).*

"On the nearly upright face of a rock, bathed with a perpetual trickling rill, at some distance above Fyloge bridge, near Hafod, 2 or 3 feet wide, spreading like a piece of very wet leather," *Sir J. E. Smith.*—In a dry state this curious production strongly resembles a piece of thickish, light brown leather. The upper surface is very prettily reticulated with raised, irregularly anastomosing veins, which form areolæ from 1 to 3 lines in diameter. Under the microscope it is found to be composed of densely packed, slender, byssoid fibres, irregularly connected, mixed with minute granules. I possess a specimen from *Sir W. J. Hooker*, who, I believe, obtained it from *Sir J. E. Smith.*

Series IV. DIATOMACEÆ.

Tribe 23. DESMIDIEÆ.

Cylindrical or angular filaments, at length separating into segments, (frustula). Grev.

CX. Meloseira. Ag.

Filaments cylindrical, very fragile, jointed, separating into single joints or frustula.—Name, μελος, a *membrane*, and σειρα, a *chain;* not exactly applicable, as the plant is not a string of *membranes*, but of cylindrical bodies.

* *In fresh water.*

1. M. *nummuloides*, Grev.; filaments fragile, very slender, nearly of equal diameter; joints about twice as long as

broad, containing a pair of globules which are either simple or divided by a transverse line. *Grev. in Hook. Br. Fl.* ii. *p.* 401, *(not of Agardh). M. discigera, Ag. Syst. p.* 8, *(omitted in Ag. Consp. Diat.) Conf. nummuloides, Dillw. Syn. p.* 45, *t. B.*

Streams. Among the leaves of water-plants, in the river Lea at Walthamstow, *Mr. Dillwyn.* Near Margate, *Rev. M. J. Berkeley.*—Grey and powdery in a dry state.

2. M. *lineata*, Ag.; filaments very fragile, nearly of equal diameter, dark brown; articulations 2 or 3 times as long as broad, at first containing a mass divided by a central line, afterwards this is separated into two globules. *Grev. l. c. p.* 402; *Ag. Syst. p.* 8, *(omitted in Ag. Consp. Diat.) Conf. lineata, Dillw. Syn. p.* 44, *t. B.*

Streams and ditches containing brackish or fresh water. In the river Lea, at Walthamstow, *Mr. Dillwyn.* Near Limerick, in fresh-water ditches.—*Filaments* $\frac{1}{8}$ to $\frac{1}{2}$ an inch long, forming a dark brown stratum of considerable extent, ochre-coloured under the microscope. Is this distinct from the preceding?

3. M. *varians?* Ag.; filaments very variable in diameter, fragile; joints once and a half to twice as long as broad, pellucid, or containing a dark ochrey mass divided by a transverse line. *Ag. Consp. Crit. Diat. p.* 64*?*

In a stream that issues from a coal-pit near Ballycastle, Co. Antrim, *Mr. D. Moore.*—This forms a brown cloud in the water. The *filaments* are extremely variable in diameter, some being more than twice as broad as others. When dry it is of a dull, greenish grey colour, without gloss, and powdery. I am not quite sure of the reference to Agardh, having seen no specimens of his plant. He describes the joints as usually about as long as broad, sometimes twice as long, and then marked with a band in the middle. I have only seen it in a dry state.

4. M. *Thompsoni;* filaments exceedingly slender, equal, brilliant yellow-green, glossy, very fragile; joints 2—4 times longer than broad, green in the centre, and having near each extremity a transparent globule.

Growing on stones in a mountain rivulet at Ballantrae, Ayrshire, *Mr. W. Thompson.*—*Filaments* attached, forming beautiful, glossy, dark green tufts. At the slightest touch they break into separate joints; and in a dry state preserve both their colour and lustre, a very unusual circumstance with plants of this group, and abundantly sufficient, were there no other marks, to distinguish this species from all its British congeners. It is not half the diameter of *M. nummuloides;* and there is a perfect equality among the threads. In this respect, and in the length of the joints, it approaches *M. æqualis* of Agardh (*Consp. Diat. p.* 64), but that plant is hyaline. I have much pleasure in dedicating it to its discoverer, from whom I have received many interesting plants and much valuable information, during the course of this work.

** *In the sea.*

5. M. *Borreri*, Grev.; filaments very fragile; the joints rather longer than broad, at length converted into a series of circular globules. *Grev. l. c. p.* 401. *M. nummuloides, Ag. Consp. Diat. p.* 65. *Conf. nummuloides, E. Bot. t.* 2287, *(not of Dillw.); Wyatt, Alg. Danm. No.* 232.

Parasitic on marine filiform Algæ. Shoreham Harbour, and at Southwick, *Mr. Borrer.* Near the Land's End, *Mr. Ralfs.*—"The filaments of Mr. Borrer's plant are short, somewhat tortuous, and beautifully moniliform; greyish-green." *Grev.*

6. M. *lentigera;* filaments gregarious, affixed; joints strongly contracted, as long as broad, each containing two lenticular bodies. *Rosaria lentigera, Carm. in Hook. Br. Fl.* ii. *p.* 372.

On various small Algæ. Appin, rare, *Capt. Carmichael.*—"*Filaments* gregarious, 1 or 2 lines in length, curved, of an olive colour, regularly contracted at equal distances to one fourth the diameter of the tube; cells as long as broad, containing two lentiform sporidia. At first the sporidia are in one mass, marked only by a transverse stria." *Carm.*

7. M. *globifera;* filaments scattered, affixed; joints twice as long as broad, slightly contracted, each containing two globular bodies. *Rosaria globifera, Carm. l. c. p.* 372.

On *Enteromorpha percursa*, Appin, extremely rare, *Capt. Carmichael.*—"*Filaments* scattered, 1 or 2 lines in length, of a fulvous colour, not above half the diameter of the preceding species. Cells slightly contracted, twice as long as broad, containing two globular sporidia." *Carm.*

CXI. Desmidium. Ag

Filaments simple, angular, articulated, finally separating into single joints or frustula.—Name, δεσμος, a *bond.*

1. D. *Swartzii*, Ag.; filaments triangular; the angles of the joints bicrenate. *Grev. l. c. p.* 402; *Crypt. Fl. t.* 292.

In fresh-water pools and ditches, in spring and the beginning of summer. Appin, *Capt. Carmichael.*—"Plant forming a fine green, thin, gelatinous fleece. *Filaments* simple, about the thickness of the human hair, equal, flexible, an inch or more in length, triangular, more or less twisted, the angles pellucid and colourless, while the centre is green. *Joints* mostly half as broad as they are long, bicrenate at each of the three angles, separating from each other with facility. Before separation the two crenatures of each joint appear to contract, and the articulation to be dissolved from the circumference to nearly the centre, so that the filament has, for some time, a pinnatifid character." *Grev. Crypt. Fl.*

2. D. *cylindricum*, Grev.; filaments cylindrical, with two

prominent angles; the angles of the joints bicrenate. *Grev. l. c. p.* 402; *Crypt. Fl. t.* 293.

At the bottom of shallow pools and ditches of fresh water Spring. Appin, *Capt. Carmichael.*—"*Plant* forming a thin, fine green, gelatinous fleece like the preceding species. *Filaments* an inch or more in length, about the thickness of a fine hair, flexible, often varying in diameter in the same filament, green, nearly cylindrical, with two slightly prominent, colourless, pellucid angles, opposite to each other. *Joints* not so long as broad, bicrenate at each of the two angles, separating readily at the articulations." *Grev. Crypt. Fl.*

Tribe 24. FRAGILARIEÆ.

Filaments plane, generally extremely fragile, composed of rectilinear frustula. (Frustula occasionally radiating from a centre, and not presenting the appearance of a filament). *Grev.*

CXII. Fragilaria. Lyngb.

Frustula forming plane, pseudo-articulated, densely striated, fragile *filaments*, separating at the striæ, (not cohering at their angles). *Grev.*—Named from their *fragile* character.

* *In fresh water.*

1. F. *pectinalis*, Lyngb.; filaments rigid, attenuated, densely striated; the joints 3 or 4 times broader than they are long. *Grev. l. c. p.* 403. *Conf. pectinalis, Dillw. t.* 24; *E. Bot. t.* 1611.

Rivers and stagnant waters, frequent. Near London, *Dillwyn.* Sussex, *Mr. Borrer.* Appin, *Capt. Carmichael.* Edinburgh, *Dr. Greville.* Near Limerick, and Gilford, Co. Down.—Forming a light brown, lubricous cloud in the water. *Filaments* pale greyish green, often nearly pellucid, very fragile, densely striated, tapering much to one end. In the dry state it fades to a light grey, is powdery and glistening, but unaltered in its microscopic character.

2. F. *confervoides*, Grev.; filaments elongated, attenuated, compressed, excessively fragile; the joints about half as long as they are broad. *Grev. l. c. p.* 403.

Streams. In a rivulet on the Pentland Hills, attached to sticks and stones, *Dr. Greville.* April.—"Tufted, 2—4 inches in length, of a rather bright green hue, but pellucid and colourless under the microscope. On account of its excessive fragility it is almost impossible to obtain perfect specimens." *Grev.*—Easily known from the last by the greater length of the joints, but closely approaching *F. hyemalis*, Lyngb. t. 63.

** *In the sea.*

3. F. *aurea*, Carm.; mucous; filaments very fine, gradu-

ally attenuated; the joints 2 or 3 times broader than they are long, often punctated in the centre. *Carm. MSS.; Grev. l. c. p.* 403.

Parasitic on Algæ, in the sea. Appin, *Capt. Carmichael.* Coast of Antrim, *Mr. D. Moore.*—"*Filaments* half an inch or more in length, not fragile, of a golden or bright olivaceous yellow colour, apparently of a mucous substance, adhering very closely to paper. The joints have sometimes the appearance of being traversed by a fine transverse line, and in a drawing by Capt. Carmichael, are represented as either marked with two minute globules, or with a single, pellucid, white, oval spot." *Grev.*—I have found this pretty plant at the Cape of Good Hope, precisely agreeing with Scotch and Irish specimens. This and the following belong to Agardh's genus *Grammonema.*

4. F. *diatomoides*, Grev.; filaments adnate, bright yellow-green, flaccid, tenacious, flexuous, attenuated; the joints about 4 or 5 times broader than they are long, sometimes marked with four or five green granules. *Grev. l. c. p.* 403; *Wyatt, Alg. Danm. No.* 233.

Parasitic on Algæ, in the sea. Frith of Forth, *Dr. Greville.* At Torquay, on *Enteromorpha*, *Mrs. Griffiths.*—*Filaments* ¼ to ½ an inch long, pale green, densely covering the plant on which they grow with a feathery coat, flaccid and tenacious, not breaking in pieces like others of the genus, attenuated, flexuous or curled, either colourless or marked with green granules disposed in transverse rows, about four in each row. *Joints* four or five times broader than long.

5. F. *Carmichaelii;* filaments brownish-green, elongated, fragile, gradually attenuated; the joints about as long as broad, transversely striate. *F. striatula, Grev. l. c. p.* 403, *(excl. Syn.)*

Parasitic on the smaller filiform Algæ, Appin, *Capt. Carmichael.*—*Filaments* tufted, exceedingly slender, of unequal diameter, attenuated, very fragile, greenish under the microscope; the frustules or joints about as long as, or sometimes a little longer than broad, densely striate transversely, the striæ (in a dried state at least) most evident towards the margin. This plant, as Dr. Greville remarks, seems intermediate between *Fragilaria* and *Diatoma*, but does not accord with Agardh's *Grammonema*,* in which the filaments are tenacious. Here they are very fragile. In the striated joints it bears some resemblance to *Striatella arcuata*, but is in other respects very different. Capt. Carmichael and Dr. Greville consider this the *F. striatula* of *Ag. Syst.*, and of *Jurg. Dec.* 11, *No.* 7, and I will not say that it is not the plant intended under that name by Agardh, having seen no specimens: but, judging from his placing it in his *Grammonema* (*Gr. Jurgensii, Ag. Consp. Crit. p.* 63), I presume it is something different. In this last work he informs us that the plant published by Jurgens, in some of his fasciculi at least, under this name, is *Diatoma marinum.* In this uncertainty I think it far better to give a new name to our British plant.

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* *Grammonema:* fila plana, flexilia, striata, non soluta. *Ag. Consp. Crit. Diat. p.* 63.

CXIII. Striatella. Ag.

Filaments stipitate, plane, fragile, composed of transversely striated, rectangular *frustules* or joints, which at length separate, cohering by the angles, and finally break up.—Named from its *striated* joints.

1. S. *arcuata*, Ag.; stipes very short; filaments somewhat curved, pellucid at the articulations; the joints about as long as broad, densely striated transversely. *Ag. Consp. Crit. Diat. p.* 61. *Diatoma striatulum, Grev. l. c. p.* 405. *Conf. striatula, E. Bot. t.* 1928. *Diat. arcuatum, Lyngb. t.* 62.

On the marine filiform Algæ, frequent. Covering the plant on which it grows with an olivaceous green or yellowish, glistening coat, with something of a metallic cast when dried. *Filaments* about half an inch long, thick, curved, densely striated, and affixed at base by one angle to a minute, transparent stipes. They are sometimes marked with two longitudinal stripes, and are generally strap-shaped, the interstices between the frustules being transparent. Rarely the joints are seen cohering by the angles.

2. S. *unipunctata*, Ag.; stipes elongate; filaments composed of square, transversely striate joints, cohering by the angles, and marked in the centre with a rose-coloured spot. *Ag. l. c. p.* 61. *Diat. unipunctatum, Ag. Syst.; Grev. l. c. p.* 405. *Fragilaria unipunctata, Lyngb. t.* 62. *Achnanthes unipunctata, Grev. Crypt. Fl. t.* 287.

Parasitic on the filiform marine Algæ; rare. Appin, *Capt. Carmichael.* —*Filaments* very minute, giving a pubescent appearance to the plant on which they grow. *Stipes* long and slender, bearing a few square frustules cohering by their alternate angles, marked with slender, transverse striæ, extending from the margin half way towards the centre on each side, and having a central rose-coloured or orange spot. I have gathered specimens at the Cape of Good Hope.

CXIV. Achnanthes. Ag.

Frond stipitate, standard-shaped, composed of a few curved frustules, which at length separate (without cohering at their angles). *Grev.* — Name, ἀχνε, the *froth of the ocean*, and ἀνθος, a *flower*.

1. A. *brevipes*, Ag.; joints with two coloured spots; stipes very short. *Grev. in Hook. Br. Fl.* ii. *p.* 404; *Crypt. Fl. t.* 295.

Parasitic on the smaller filiform marine Algæ. Appin, *Capt. Carmichael.* —"*Plant* very minute, composed of 4 or 5 joints, the lowermost one furnished with a stipes, scarcely longer in general than the smaller diameter of one of the joints. *Joints* curved, or forming a very obtuse angle in the

centre, so short that each may be said to be transversely linear, four of them forming nearly a square: they are pellucid, and marked with two oval or oblong orange spots; they separate readily at the articulations, and therefore individuals are frequently observed with three, two, or even a single joint only remaining, attached by its stipes." *Grev. Cr. Fl.*

2. A. *longipes*, Ag.; joints with a single coloured spot, striated, and traversed with a white band; stipes long. *Grev. l. c. p.* 404. *Conf. stipitata, E. Bot. t.* 2488.

On the filiform marine Algæ. Near Southampton, *Miss Biddulph* and *Miss Hill*. Torquay, frequent, *Mrs. Griffiths*. Cornwall, *Mr. Ralfs*.—Forming a golden pubescence to the plant on which it grows; ash-grey and without gloss when dry. *Joints* similar in shape to those of *A. brevipes*, traversed through their greatest diameter by a colourless band, in the centre of which is a coloured spot; the spaces between the band and the margins densely striated across their shorter diameter. No spot is visible in dried specimens.

3. A. *Carmichaelii*, Grev.; joints plane, spotless (at least when dry), without striæ; stipes much elongated. *Grev. l. c. p.* 404.

Parasitic on the smaller marine Algæ. Appin, *Capt. Carmichael*.—"A very distinct species; the joints wanting the striæ and white transverse band of *A. longipes*, and the stipes is much longer. I have only seen it in a dry state, and can find no trace of a coloured spot." *Grev.*—This I have never seen.

CXV. Isthmia. Ag.

Filaments composed of oblique-angled frustules, cohering at the angles by means of little pedicels or necks. — Name, ισθμιον, a *neck*, or ισθμος, an *isthmus*

1. 1. *obliquata*, Ag.; joints marked with a broad, central, transverse band, reticulated; each end with arched, transverse striæ. *Ag. Consp. Crit. p.* 55. *Diatoma obliquatum, Ag. Syst. p.* 6. *Grev. in Hook. Br. Fl.* ii. *p.* 405. *Conf. obliquata, E. Bot. t.* 1869.

Parasitic on the filiform Algæ; frequent on the shores of England and Ireland. Southampton, *Miss Biddulph*. Torquay &c., *Mrs. Griffiths*. Cornwall, *Mr. Ralfs*. North of Ireland, *Messrs. Moore, Thompson*, &c. Wicklow.—*Filaments* forming a golden pubescence to the plant on which they grow, 2 or 3 lines long; with a metallic lustre when dry. *Joints* very variable in comparative length and breadth, either rhomboidal or trapezoidal, divided by two transverse lines into three portions, of which the central is a parallelogram, the others of irregular figure, somewhat obliquely triangular, the salient angle being either at the same or at different sides of the joint. Each portion is most elegantly reticulated; the central one, in which the cellules have a longitudinal direction, more finely than the others, in which they are disposed in arched, transverse rows or striæ.

Agardh has most judiciously removed this beautiful plant from *Diatoma*, with which genus it has, comparatively, little in common. He describes a second species (*I. vesiculosa*) from the coast of Spain, distinguished by wanting the transverse band. *I. obliquata* is found also at the Cape of Good Hope, on the shores of Van Dieman's Land, and in California: it is therefore probably diffused over the world.

CXVI. Odontella. Ag.

Filaments composed of quadrate frustules, with salient angles; frustules cohering by the angles.—Name, a diminutive of οδους, οντος, a *tooth;* the produced angles of the frustules resembling teeth.

1. O. *aurita*, *Ag. Consp. Crit. p.* 56. *Diatoma auritum*, *Lyngb. Dan. t.* 62; *Grev. l. c. p.* 404.

Parasitic on marine filiform Algæ, generally mixed with other parasites. Frith of Forth, *Dr. Greville.* On *Calithamnion polyspermum* at Youghal, *Miss Ball.—Filaments* scattered, exceedingly minute, requiring the highest power of the microscope for their examination, composed of a few nearly square frustules, containing a few granules, and having their angles produced into little horns. Dr. Greville aptly compares them to "microscopic wool-packs." I have found it at the Cape of Good Hope.

CXVII. Diatoma. Ag.

Filaments composed of rectangular frustules, cohering at the angles, and finally separating.—Name, διατομη, *incision;* the plant looking like a band cut into portions, which cohere by mere points.

* *In the sea.*

1. D. *Biddulphianum*, Ag.; filaments unequal; the joints longitudinally striated and traversed with a white band, bearing a central, red, punctated mass. *Grev. in Hook. Br. Fl.* ii. *p.* 405. *Conf. Biddulphiana*, *E. Bot. t.* 1762.

Parasitic on filiform marine Algæ. Southampton, *Miss Biddulph.* November and December.—No one appears to have met with this but the lady whose name it bears. The filaments are said to be half an inch long, and variable in breadth. But more than one distinct species seem included in the Eng. Bot. plate.

2. D. *marinum*, Lyngb.; filaments unequal; the joints longer than they are broad, with a transverse, granular, yellow mass. *Grev. l. c. p.* 405. *Conf. teniæformis*, *E. Bot. t.* 1683.?

Parasitic on the marine Algæ, in spring. Very common.—This forms a greenish covering to the plants on which it grows, powdery and pale in a

dry state. The joints vary much in length, being sometimes twice as long as broad, sometimes of equal length and breadth.

3. D. *brachygonum*, Carm.; filaments very minute; the joints 4 or 5 times longer than they are broad. *Carm. MSS.; Grev. l. c. p.* 406.

On small marine Algæ; rare. Appin, *Capt. Carmichael.*—I am not acquainted with this plant. Except in its longer joints it does not seem to differ from the preceding.

** *In fresh water.*

4. D. *fenestratum*, Lyngb.; filaments very minute, yellowish; the joints four times longer than they are broad, with a transverse band of granules. *Lyngb. t.* 61; *Grev. l. c. p.* 406.

In streams, intermixed with *Confervæ*. Appin, *Capt. Carmichael.*—*Filaments* pale yellow under the microscope, with pellucid articulations. Two filaments are often seen joined together lengthwise, and consequently the whole then seems to separate both longitudinally and transversely. *Grev.*

5. D. *tenue*, Ag.; filaments of an uniform structure (not striated), the joints 3 or 4 times longer than they are broad. *Ag. Syst. p.* 4; *Grev. l. c. p.* 406; *Crypt. Fl. t.* 354; *Berk. Alg. t.* 6, *f. c.—h.*

Pools and lakes. Northamptonshire, *Rev. M. J. Berkeley.*—"*Plant* forming a pale brownish stratum, or covering over various substances, such as dead leaves, mosses, sticks &c. in fresh water, changing, when dry, to whitish green. *Filaments* simple, pale yellowish, even (not marked with transverse striæ), the joints about three to four times longer than they are broad, sometimes dilated at each extremity, changing their form very considerably and it would appear very irregularly in age." *Grev.*—Mr. Berkeley has observed that the joints, at a certain period, lose the squareness of their figure, are attenuated at the extremities and dilated in the centre; become cylindrical and opaque, containing a purple mass. This appearance is represented in the figures quoted above.

6. D. *elongatum*, Ag.; filaments with a longitudinal line, the joints ten times longer than they are broad. *Ag. Syst. p.* 4; *Berk. Alg. p.* 21, *t.* 6, *f. a. b; Grev. l. c. p.* 406.

Pools and ditches, "forming ochraceous masses with other *Diatomaceæ*, or scattered amongst various *Confervæ*," *Rev. M. J. Berkeley.* Summer.—This is readily distinguished by the great length of the joints.

7. D. *flocculosum*, Ag.; filaments with a longitudinal, pellucid line; the joints transversely striated, nearly equal in length and breadth. *Grev. l. c. p.* 406. *Conf. flocculosa, Dillw. Conf. t.* 28; *E. Bot. t.* 1761.

Pools, ditches, &c.; parasitic on *Confervæ*. Spring and Summer.—*Filaments* pale green; joints variable in diameter and length.

CXVIII. Exilaria. Grev.

Frustules rectilinear, fasciculate, or spreading in fan-shaped series, fixed at base to a receptacle or stipes.—Name, perhaps from *exilio*, to *issue forth;* in allusion to the radiating frustules. This genus was founded by *Dr. Greville*, in his beautiful work, the 'Scottish Crypt. Flora,' but has been reduced to a section of *Diatoma* by *Agardh*. *Dr. Greville*, in yielding to *Agardh's* opinion in the 'Br. Flora,' remarks, "As I have adopted *Prof. Agardh's* arrangement of the *Diatomaceæ*, I have retained this little group in the genus *Diatoma*. My own views led me formerly to separate it, and I have not hitherto seen reasons to change them. A patient investigation of the whole, with the allied genera, foreign as well as British, would be necessary to determine the question." From this it is evident that *Dr. Greville*, if I may say so, *mentally* retains his genus, and, I believe, most British botanists who have attended to these minute plants will concur with me in restoring it to a place in the system.

1. E. *crystallinum*, Grev.; frustula linear, very many times longer than they are broad, truncate. *Diatoma crystallinum*, *Ag. Syst. p.* 3; *Grev. in Hook. Br. Fl.* ii. *p.* 407; *Lyngb. t.* 70.

Parasitic on marine filiform Algæ. Devonshire, *Mrs. Griffiths*. Appin, *Capt. Carmichael*.—*Frustules* pale yellow when recent, colourless and with a glassy lustre when dry, more than twenty times longer than they are broad, radiating from a minute base.

2. E. *fulgens*, Grev.; frustula truncate, golden-yellow, arising in a flabelliform manner from a crystalline, often elongated base. *Grev. Crypt. Fl. t.* 291. *Diatoma fulgens*, *Grev. in Hook. Br. Fl.* ii. *p.* 407.

Parasitic on various filiform marine Algæ. Appin, *Capt. Carmichael*.—"*Plant* investing small Algæ, orange when recent, colourless and glistering when dry. *Frustules* placed side by side in a plane, radiating, or flabelliform manner, easily separating laterally from each other, but, though divided into several parcels, adhering by the base to the receptacle. *Receptacle* pellucid, mostly hemisphærical, but sometimes so elongated as to equal the length of the frustule it supports." *Grev. in Crypt. Fl. sub t.* 291.

3. E. *fasciculata*, Grev.; frustula linear, somewhat acuminate at each extremity. *Grev. Crypt. Syn. p.* 37. *Echinella fasciculata*, *Grev. Crypt. t.* 16, *f.* 1—3. *Diatoma fasciculatum*, *Ag. Grev. in Hook. Br. Fl.* ii. *p.* 407.

Parasitic on filiform marine Algæ, very common. Imparting a dull yel-

lowish, downy aspect to the plants on which it grows. The frustules are attached to a minute crystalline base.

4. E. *truncata*, Grev.; frustula linear, truncate at the extremity. *Grev. Crypt. Syn. p.* 37. *Echinella fasciculata*, β. *l. c. t.* 16, *f.* 4. *Diatoma truncatum*, *Grev. in Hook. l. c. p.* 407.

In pools and ditches, parasitical on various *Confervæ* &c.; frequently on *C. glomerata*.

CXIX. Frustulia. Ag.

Frustules linear, free or imbedded in a shapeless mass, solitary or binate. *Ag.* — Name, *frustula*, small crumbs or fragments.

1. F.? *obtusa*, Ag.; frustula short, truncate at each extremity, about three times longer than they are broad. *Grev. in Hook. l. c. p.* 407; *Berk. Alg. p.* 14, *t.* 4, *f.* 2.

Rivulets, *Agardh.* On wet rabbit-dung, *Rev. M. J. Berkeley.*—Forming a thin brownish stratum. *Frustules* hyaline, with two yellowish bands. *Mr. Berkeley* finds some of the frustules of an elliptical form, when they scarcely differ from those of *Cymbella*.

2. F. *fasciata*, Ag.; frustula 8—10 times longer than broad, binate or solitary, terminated at each end by a colourless globule; dull ochre-colour, with a central, hyaline band. *Ag. Consp. Crit. p.* 15; *Harv. in Fl. Hib.* iii. *p.* 251.

In fresh-water ditches and pools, mixed with other Algæ. Plassey, near Limerick.

3. F. *Ulva*, Ag.; frustula linear, exceedingly slender, acicular, obtuse, marked with interrupted ochraceous bands. *Ag. Consp. Crit. p.* 45; *Harv. l. c. p.* 251.

In fresh water, mixed with other Algæ. Plassey, near Limerick.—The frustules are often of an uniform ochraceous colour, except the ends, which are always hyaline. Under the highest power of the microscope they resemble small needles.

Tribe 25. STYLLARIEÆ.

Frustula plane, wedge-shaped.

CXX. Styllaria. Ag.

Frustula wedge-shaped, separate, stemless, not united into plane laminæ.—"Name, probably from στυλος or *stylus*, a *co-*

lumn, pillar, or *support;* since, according to Bory, who invented the name, the species which he considered to belong to it are 'stipitate echinella.' If so, the word should be *Stylaria*." *Hook.*

1. S. *cuneata*, Ag.; frustula with a transverse band of yellow granules, the extremities crenato-dentate. *Ag. Consp. Crit. p.* 38; *Grev. in Hook. l. c. p.* 408. *Echinella cuneata, Lyngb. t.* 70.

Parasitical on the filiform marine Algæ. Appin, *Capt. Carmichael.* Torbay, *Mrs. Griffiths.*—This little parasite is found generally scattered among others: it is extremely minute, and may easily be overlooked.

2. S. *bidentata*, Ag.; frustules narrow-wedge-shaped, very minute, marked with a green, longitudinal stripe, which is bifid at the apex. *Ag. Consp. Crit. p.* 38.

Parasitic on filiform marine Algæ. At Torquay, on *Ectocarpi*, *Mrs. Griffiths.*—Still smaller than the last.

3. S. *minutissima;* frustules exceedingly minute, wedge-shaped, green, toothless.

In fresh water, on *Conferva glomerata*, Co. Antrim, *Mr. D. Moore.*

CXXI. Meridion. Ag.

Frustula wedge-shaped, in plane, sessile circles, or segments of circles. *Ag.*—Name, μερις, a *portion* or *particle;* in allusion to the fragments that compose it.

1. M. *circulare*, Ag.; mucous stratum scarcely any; frustula united into numerous, nearly complete circles. *Ag. Consp. Crit. p.* 40; *Grev. in Hook. l. c. p.* 409. *Echinella circularis, Grev. Crypt. Fl. t.* 35. *Exilaria circularis, Grev. l. c. Syn. p.* 37.

In fresh-water ponds, rivulets and ditches, forming a pale green covering to stones &c., or mixed with *Confervæ.* Near Edinburgh, *Messrs. Arnott* and *Greville.* Plassey, near Limerick.—When dry this forms a glistening, powdery, greyish mass. Under the microscope it is seen to consist of minute, linear-wedge-shaped frustules, united by their edges more or less into portions of circles; of a yellowish green colour when fresh, nearly colourless after having been dried.

CXXII. Licmophora. Ag.

Frustula wedge-shaped, united into fan-shaped laminæ, fixed to the summits of a (usually branched) stipes.—Name,

λικμοφορος, *fan-bearer;* highly expressive of the form of these minute, but beautiful objects. *Hook.*

1. L. *Jurgensii*, Ag.; "stipes very short, frustula subternate, bipartite." *Ag. Consp. Crit. p.* 42; *Grev. in Hook. l. c. p.* 408.

Parasitic on the smaller marine Algæ. Appin, *Capt. Carmichael.*—This I have never seen, and Agardh's description is very imperfect.

2. L. *splendida*, Grev.; "tufted, when dry green and glistening; stipes elongated, much branched, the branches alternate; frustula wedge-shaped, both the lateral and terminal ones flabelliform." *Grev. in Hook. l. c. p.* 408.

Parasitic on marine Algæ and *Zostera*. Appin, *Capt. Carmichael.*—"A very fine species; nearly allied to the following one, but smaller, less divided, and the frustula more broadly wedge-shaped. The tufts are two or three lines in height, and often invest the whole surface of the plant on which it grows." *Grev.*—Of this I have seen no specimen.

3. L. *flabellata*, Ag.; densely tufted, when dry green and glistening; stipes elongated, very much branched; branches alternate, the frustula linear-wedge-shaped, flabelliform. *Grev. in Hook. l. c. p.* 408. *Exilaria flabellata, Crypt. Fl. t.* 289; *Wyatt, Alg. Danm. No.* 234.

Parasitic on marine Algæ, *Zostera*, &c. Bantry Bay, *Miss Hutchins.* Appin, *Capt. Carmichael.* Devonshire, *Mrs. Griffiths.* Antrim, *Mr. D. Moore.* Strangford Lough, *Mr. W. Thompson.—Tufts* half an inch high, dense, deep green; when dry shining with a glistering lustre. *Stem* very much branched, the branches spreading, more or less divided, somewhat broader at the tips, on which the frustules are arranged in elegant miniature fans. Under the microscope they appear pale yellowish or orange, marked by one or two darker spots. *Dr. Greville's* figure of this charming plant is in every respect admirable.

Tribe 26. CYMBELLEÆ.

Frustula elliptical (in Gomphonema *sometimes wedge-shaped).*

CXIII. Gomphonema. Ag.

Frustula solitary or geminate, elliptical, urn-shaped or cuneate, terminating a very slender, simple or branched filament.—Name, γομφος, a *wedge*, and νημα, a *thread.* This genus borders very closely upon *Licmophora*, and may with equal propriety be referred to the *Styllarieæ*, as to the *Cymbelleæ.*

* *In fresh water.*

1. G. *minutissimum*, Grev.; minute, ochraceous, somewhat scattered, entangled; stipes sub-ramose; frustula linear-wedge-shaped. *Grev. in Hook. l. c. p.* 409; *Crypt. Fl. t.* 244, *f.* 1.

Pools and lakes, on the stems of water-plants. Duddingston Loch, *Dr. Greville.* Spring.—"The presence of this plant gives a yellowish appearance to the water. The stipes is sometimes simple, sometimes once or twice divided; the frustula united or separated, hyaline at the base and apex, but containing a green, granular mass in the centre. The whole is scarcely more than a line in height." *Grev.*

2. G. *Berkeleyi*, Grev.; tufted, tawny; stipes sub-ramose; frustula wedge-shaped, truncate. *Grev. l. c. p.* 409. *Exilaria minutissima, Berk. Alg. p.* 22, *t.* 7, *f.* 1.

Attached to sticks, stones, grass &c. in fresh water, *Rev. M. J. Berkeley.* Spring and early summer.—"*Tufts* or masses several lines thick, of a tawny colour; when dry of a lively green, *Mr. Berkeley* thinks it may be the same as the preceding, which, however, is a much smaller plant, less tufted, and whitish or slightly ochraceous when dry. I have therefore ventured to keep it distinct." *Grev.*

3. G. *minutum*, Ag.; plant forming an apparently pulverulent stratum; stipes sparingly branched; the frustula linear-conical, globuliferous at tip. *Grev. in Hook. l. c. p.* 410.

Streams, attached to *Confervæ* &c. Appin, *Capt. Carmichael.*—"*Stratum*, according to Agardh, having a pulverulent appearance to the naked eye when recent; the stipes branched or nearly simple; the frustula hyaline, with a green globule at the apex. The only specimens I have seen are those in a dry state, from *Capt. Carmichael*, and the globule is not visible. It is therefore possible that I may not be correct in referring it to this place." *Grev.*

4. G. *geminatum*, Ag.; densely tufted, pale tawny; stipes elongated, dichotomous; frustula at first cuneate, solitary or in pairs, becoming somewhat urn-shaped. *Grev. in Hook. l. c. p.* 410; *Crypt. Fl. t.* 244, *f.* 2.

On stones &c. in the beds of alpine streams and rivulets, frequent. Scotland, *Dr. Greville.* North of Ireland, *Mr. D. Moore.* Wales, *Mr. Ralfs.* —This forms roundish tufts, often an inch in diameter, of a soft, flaccid substance, and brownish colour. The filaments are very slender, several times forked, bearing on their tips a pair of wedge-shaped or somewhat urn-shaped frustules, which are hyaline, containing a granular mass. When dry it is grey and powdery.

5. G. *ampullaceum*, Grev.; densely tufted; stipes elongated, dichotomous; frustula in pairs, but distinct, urn-shaped,

rounded at the apex. *Grev. l. c. p.* 410. *Echinella ampullacea, Carm. MSS. cum icone.*

On rocks and stones in the river of Glenstockdale, abundant, *Capt. Carmichael.* Spring and summer. — Nearly allied to the last, from which it seems to differ by the more distinctly urn-shaped frustules. I have seen no specimens.

** *In the sea.*

6. G. *paradoxum*, Ag.; aggregated, yellow, very minute; stipes erect, sparingly dichotomous; frustula wedge-shaped, somewhat corymbose. *Grev. in Hook. l. c. p.* 410. *Echinella paradoxa, Lyngb. Grev. Crypt. Fl. t.* 25.

Parasitical on the smaller marine Algæ; very common. Spring and summer. — This is less than a line in height, and forms a yellowish, downy, coating to various filiform Algæ, often completely obscuring the colour of the plant on which it grows. The stipes is rarely more than once or twice branched.

7. G. *majusculum;* densely tufted, yellowish-green; stipes erect, very much branched; frustules broadly-wedge-shaped, truncate, bright green (when dry).

On timber floating in the sea, at Port Rush, Co. Antrim, *Mr. D. Moore.* — This comes near *G. paradoxum*, but is a much larger plant, ¼ to ½ an inch in length, and the stipes very much more branched; but in a dry state, in which only I have seen it, it is impossible to separate the filaments sufficiently to see how they are branched. It is green when dry.

CXXIV. Homæocladia. Ag.

Frustula arranged in numerous, binate, distant, parallel series, within a tubular frond. *Ag.* — Name, ὁμοιος, *like*, and κλαδος, a *branch*.

1. H. *Anglica*, Ag.; filaments tri-dichotomous. *Ag. Con. Crit. p.* 25; *Grev. in Hook. l. c. p.* 411.

In the sea. Plymouth, *Agardh.*—"*Frond* an inch and a half or more in length, tubular, terete, erect, filiform, a line in diameter at base, gradually attenuated, containing numerous, distant, parallel series of frustula, trichotomous below, dichotomous above, obtuse at the apices. *Colour* when dry, opaque olivaceous green. *Substance* firm. It does not adhere to paper." *Ag.*—No British botanist seems to be acquainted with this plant, and Agardh does not mention from whom he received his specimens.

CXXV. Berkeleya. Grev.

Frustula in longitudinal series, within simple, mucous *filaments*, which are free at the extremity, but united below

into a roundish, gelatinous mass. *Grev.* — Named in honour of the *Rev. M. J. Berkeley*, an assiduous and accomplished British botanist, author of '*Gleanings of British Algæ*,' of the article '*Fungi*' in 'Hooker's Brit. Flora,' and of several admirable memoirs on the fructification, &c., of that extensive class of plants.

1. B. *fragilis*, Grev. *Grev. Crypt. Fl. t.* 294; *Grev. in Hook. l. c. p.* 416; *Ag. Consp. Crit. p.* 24.

Parasitical on *Zostera* and the smaller marine Algæ. Appin, *Capt. Carmichael.* Near the Land's End, *Mr. Ralfs.*—"*Plant* of a reddish brown colour, and roundish or oval form, consisting of a rather firm *gelatinous mass* or receptacle, less than half an inch in diameter, and a number of filaments which seem to spring from its surface. This gelatinous receptacle is firmly attached to the plant on which it grows, sometimes surrounding the small branches of *Furcellaria fastigiata.* The filaments are immersed for half their length in the receptacle, the extremities being free. They are gelatinous, exceedingly tender and fragile, simple, attenuated towards the apex, apparently destitute of external membrane, and containing a number of oblong or rather fusiform frustules, arranged longitudinally, but without order." *Grev. Cr. Fl.* — *Mr. Ralfs'* plant exactly agrees with a specimen in my possession from *Capt. Carmichael.*

CXXVI. Schizonema. Ag.

Frustula in longitudinal series or scattered, and inclosed within a simple or branched, gelatinous, mucous, or membranaceous frond, composed of one or several tubes. — Name, σχιζω, to *divide*, and νημα, a *thread;* the branches of the typical species being formed, as it were, by cleaving the frond.

* *Fronds erect, branched, robust*, (Schizonema).

1. S. *obtusum*, Grev.; frond robust, cartilagineo-gelatinous, elastic, firm, ultra-setaceous, laxly tufted, fastigiate, many times dichotomous; axils rounded; apices obtuse; frustules minute, very numerous, oblong, binate. *Grev. in Hook. l. c. p.* 413; *Crypt. Fl. t.* 302.

Parasitic on small Algæ, in the sea. Frith of Forth, *Dr. Greville.* Appin, *Capt. Carmichael.* Torquay, *Mrs. Griffiths.* Salcombe, *Mrs. Wyatt.* Coast of Antrim, *Mr. D. Moore.*—*Frond* 2 or 3 inches high, robust, thicker than a hog's bristle, and nearly of equal diameter throughout; laxly tufted, irregularly dichotomous; the lower divisions somewhat distant, the upper closer, frequently very close, in which case they are somewhat entangled. *Substance* firm and elastic. *Colour* yellowish green, not much changed in drying. *Odour* somewhat offensive. *Frustules* very minute, closely packed in a transparent jelly. A handsome and distinct species, well marked by the rounded axils and obtuse apices. *Mrs. Griffiths* finds it "dark brown" when recent; in other respects her specimens accord with the Scotch ones, and in a dry state their colour is identical.

2. S. *apiculatum*, Ag.; frond robust, ultra-setaceous, cartilaginous, very tenacious, scattered or slightly tufted, irregularly dichotomous, sparingly divided; branches thickened upwards, suddenly acuminate at the apex; frustules very numerous, minute, green. *Ag. Syst. p.* 11. *Micromega apiculatum, Ag. Consp. Crit. p.* 23; *Grev. in Hook. l. c. p.* 411. *Gloionema apiculatum, Grev. Crypt. t.* 30.

In the sea, on rocks in small pools left by the tide; rare. Frith of Forth, *Messrs. Arnott* and *Greville*. March.—*Fronds* either slightly tufted or scattered, about half an inch high, thicker than hogs' bristles, erect, very firm and tenacious, irregularly branched or dichotomous, the branches erect, with acute axils, swollen upwards, especially just below the tips, ending in a sudden point.

3. S. *ramosissimum*, Ag.; frond robust, setaceous at base, cartilaginous, firm, excessively branched in a sub-dichotomous manner, fastigiate; branches slender at their insertion, swelling upwards, especially towards the tip, which is suddenly acuminate; frustules very dense, minute. *Ag. Syst. p.* 11. *Micromega ramosissimum, Ag. Consp. Crit. p.* 22. *Sch. apiculatum, Chauv.! Alg. Norm. (excl. Syn. Grev.); Wyatt, Alg. Danm. No.* 235.

On rocks in the sea. Waldon rocks, *Miss Amelia Griffiths*. On the Harbrick, in Torbay, *Mrs. Wyatt*.—*Fronds* tufted, 1—1½ inch high, very firm and elastic, expanding in water, very much branched. *Colour*, when dry, greyish olive without gloss. I have compared *Mrs. Wyatt's* specimens with one from Chauvin, and find them to agree exactly.

4. S. *helminthosum*, Chauv.; frond robust, ultra-setaceous at base, elastic, firm, much branched; branches flexuous, variously twisted, divided into many lacerated segments, capillary above; the apices acute; frustules large, rather dense, oblong. *Ch. Alg. Norm. Exsicc. No.* 77; *Grev. in Hook. l. c. p.* 412; *Wyatt, Alg. Danm. No.* 198.

On rocks in the sea. Frith of Forth, *Dr. Greville*. Torquay, *Mrs. Griffiths* and *Mrs. Wyatt*.—*Fronds* tufted, 2 or 3 inches high, half a line in diameter at base, much but very irregularly branched, the branches cloven into many segments, which gradually taper to a fine point. The colour is olivaceous brown, becoming greenish grey and wholly without gloss in drying. The frustules are larger than in *S. Smithii*, longer and blunter, double, and rather densely set.

5. S. *laciniatum;* fronds robust, setaceous below, increasing in diameter upwards, very tender and gelatinous, elastic, cleft into very numerous, irregularly divided or simple branches, which taper to a fine point; frustules very minute, closely packed.

On rocks in the sea. On the Harbrick, in Torbay, *Mrs. Griffiths*. March.

—*Fronds* 2 or 3 inches high, "bright full brown," fading in the herbarium to olive-green, "extremely tender and elastic, gelatinous, running together into a shapeless mass" (*Griff. in litt.*), subsimple and setaceous below, gradually widening upwards to 2 or 3 lines, and then cleft into very numerous, irregular, jagged branches. *Frustules* very minute and exceedingly numerous. This has something the habit of the last species, but the substance and frustules are very different.

6. S. *Smithii*, Ag.; fronds robust, tufted, ultra-setaceous, gelatinous, elastic, firm, much but very irregularly branched; branches spreading, gradually attenuated, fastigiate; apices acute; frustules oblong, bright green, disposed in sub-distant rows, immersed in the colourless jelly of the frond. *Grev. in Hook. l. c. p.* 413; *Crypt. Fl. t.* 298; *Wyatt, Alg. Danm. No.* 151. *Ulva fœtida, E. Bot. t.* 2101.—*β. torquata;* tufts globose, fronds very much branched, the branches and ramuli remarkably curled.

In the sea, on rocks and various Algæ; not uncommon. Salt marshes, Norfolk, *Hooker*. Bantry Bay, *Miss Hutchins*. Appin, *Capt. Carmichael*. Coast of Devonshire, *Mrs. Griffiths* and *Miss Cutler*. Antrim, *Mr. D. Moore*.—*Fronds* yellowish olive or greenish, tufted, 1 or 2 inches long, from the thickness of bristles to half a line in diameter at base, separating with elasticity in water, much branched in a subdichotomous manner; branches often palmate at the tips. *Frustules* large, binate, oblong or sublanceolate, disposed in subdistant lines. *β.* is remarkable for having all the branches curled and entangled; the frustules more distinctly in chains, and of a brighter colour than in the common state. It may perhaps prove to be a distinct species, but in the dry state it closely approaches acknowledged states of *S. Smithii*. It was found at Torquay, by *Mrs. Griffiths*.

7. S. *corymbosum*, Ag.; "filaments laxly tufted, branched; branches divided towards the extremity in a penicillato-corymbose manner." *Ag.*—*Grev. in Hook. l. c. p.* 413.

On various small marine Algæ, corallines &c. Devonshire, *Mr. Sconce*. —"*Tufts* lax, about an inch in length, pale yellowish or reddish green. *Filaments* slender, irregularly branched, but generally at intervals in a fasciculate manner, the extremities corymbose." *Grev. l. c.*—I am unacquainted with this plant; and both Agardh and Greville are dubious respecting it. The latter remarks that it has an air of monstrosity. Perhaps it may be a variety of *S. Smithii*.

8. S. *Wyattiæ;* frond setaceous at base, capillary upwards, fastigiate, firmly cartilaginous, cleft to the base into several principal branches, each of which is again divided into others; branches very erect and straight, with acute axils, tapering to a fine point; frustules somewhat lanceolate, densely packed.

On rocks &c. in the sea. Torquay, *Mrs. Wyatt*. — *Fronds* setaceous at base, capillary upwards, an inch or more in height, fastigiate, forming globose tufts, firmly cartilaginous, opening with elasticity in fresh water after

having been dried; and if dried without pressure, all the branches and segments lie separate (not massed together) on the paper: divided to the base into several principal branches, each of which is repeatedly cleft into 5, 6, or more segments, which are all very erect and straight, with acute axils, and are again, toward their upper part, similarly cleft; the segments becoming gradually narrower upwards, till the last are finer than hairs; the apices all much attenuated. *Colour* when recent "a fine chesnut-brown," olivaceous when dry. *Frustula* densely packed in a transparent jelly, somewhat lanceolate. This beautiful plant comes near *S. Smithii*, but is much more slender, and opens far more readily, and with greater elasticity after having been dried. I wish it to bear the name of Mrs. Wyatt, whose admirable '*Algæ Danmonienses*' are so deservedly popular.

** *Fronds slender, capillary, densely tufted,* (Monema).

9. S. *spadiceum*, Grev.; "filaments capillary, tufted, much branched; ramuli much divaricated." *Grev. in Hook. l. c. p.* 412.

On rocks and Algæ, in the sea. Appin, *Capt. Carmichael.*—"*Tufts* 2—4 inches in length, of a reddish olivaceous green colour, and often with a faint metallic lustre when dry. *Filaments* very slender, and nearly of the same thickness throughout, much branched; the branches divaricated, the ultimate ones patent. *Frustula* linear-oblong, elongated." *Grev.*

10. S. *Dillwynii*, Ag.; fronds capillary, slender, densely tufted, fastigiate, much branched, dichotomous; branches flexuous or curled, transparent; frustula linear-oblong, with a longitudinal line. *Grev. in Hook. l. c. p.* 412; *Wyatt, Alg. Danm. No.* 199. *Monema Dillwynii, Grev. Crypt. Fl. t.* 297. *Conf. fœtida, Dillw. t.* 104.

On rocks, stones &c. in the sea. Appin, *Capt. Carmichael.* Frith of Forth, *Dr. Greville.* Devonshire, *Mrs. Griffiths.* North of Ireland, frequent, *Mr. D. Moore.*— *Tufts* bright brown when fresh, dark olive-green and generally glossy in a dry state, sometimes rust-coloured. *Fronds* exceedingly slender and very much branched. *Frustula* rather dense, minute.

11. S. *virescens;* fronds very slender, densely tufted, tenacious, very much branched from the base; branches set with numerous, curled ramuli, the uppermost of which are longest, swelling towards the tips, where they are dark coloured, and ending in a sudden point; frustula very minute.

On rocks &c. in the sea. Trenteshoe, North Devon, *Miss Amelia Griffiths.*— *Tufts* 2 or 3 inches long, dense, brownish olive, "not much altered in drying," fastigiate; fronds slender, divided to the base into several flexuous segments, from which spring innumerable, curled, capillary branchlets, which are longer and more divided upwards; these gradually swell towards the summit, are darker and opaque, and end in a sudden point. Under the microscope it has much the character of *S. Dillwynii*, but the thickened, dark-coloured tips are very remarkable.

12. S. *dubium;* fronds very slender, densely tufted, sub-

simple below; branches long and naked, having towards the summit numerous, somewhat curled, divided ramuli; the apices acute; frustules very minute and densely packed.

On rocks &c. in the sea. Torquay, *Mrs. Griffiths.*—*Tufts* 1 or 2 inches high, unequal-topped (not fastigiate), brownish olive. *Fronds* nearly simple below, or divided into a few long, naked branches, which end in a bushy cluster of much-divided, somewhat curled, patent ramuli; the tips acute and unequal. *Frustules* pale green, very minute and densely packed.—This approaches *S. Dillwynii*, but is differently branched, and in its microscopic character sufficiently distinct.

13. S. *implicatum;* fronds rising from a mass of creeping fibres, densely tufted, slender, excessively branched; branches irregular, curled and entangled, opaque; apices acute; frustules very minute and closely packed. *Wyatt, Alg. Danm. No.* 236.

Salcombe, *Mrs. Griffiths.* Plymouth, *Mr. Borrer.*—*Tufts* widely spreading, 2—4 inches high, dark brown when recent, but becoming olive-green when dry. *Fronds* very slender, but coarser than in *S. Dillwynii*, much but irregularly branched, generally much entangled, and (in the dry state at least) inextricable. Certainly nearly allied to *S. Dillwynii*, but in Mrs. Griffiths' opinion distinct.

14. S. *parasiticum*, Griff.; fronds exceedingly slender, tufted, much and intricately branched from the base; the branches sub-dichotomous, irregular, with rounded axils, very flexuous; the tips acute. *Wyatt, Alg. Danm. No.* 201.

On various Algæ in Torbay, *Miss Amelia Griffiths* and *Mrs. Wyatt.* Sidmouth, *Miss Cutler.*—*Tufts* 1 or 2 inches long, rusty brown or foxy, rather glossy when dry, and in that state but slightly changed in colour, not fastigiate. *Fronds* very slender and much branched; the axils rounded and patent.

15. S. *comoides*, Ag.; fronds finely tufted, capillary, much branched; branches flexuous or curled, of unequal length, opaque, gradually attenuated; frustules oblong, rectangular, in several rows. *Grev. in Hook. l. c. p.* 413; *Wyatt, Alg. Danm. No.* 150. *Conf. comoides, Dillw. t.* 27, *(not of E. Bot.)*

On rocks &c. in the sea. Swansea, *Mr. Dillwyn.* Devonshire, *Mr. Sconce.* Torquay, *Mrs. Griffiths.* Youghal, *Miss Ball.*— *Tufts* 2 or 3 inches long, dense, of a reddish brown colour when fresh, brownish grey and wholly without gloss when dry. *Filaments* very slender, much, but rather irregularly branched, the branches of unequal length (not fastigiate). This is a much coarser and more opaque plant than *S. Grevillii*, with larger frustules, and has a harsh feel when dry, often imperfectly adhering to paper.

16. S. *Grevillii*, Ag.; fronds densely tufted, capillary, much branched, sub-dichotomous, fastigiate; branches attenuated; frustules densely packed, oblong, geminate. *Grev.*

l. c. p. 413; *Wyatt, Alg. Danm. No.* 200. *Monema comoides, Grev. Crypt. t.* 358.

On rocks, piles &c. in the sea. Sidmouth, *Dr. Greville.* Torquay, *Mrs. Griffiths.*—*Tufts* dense, spreading, fastigiate; filaments 1 or 2 inches high, very slender and much branched. *Colour* brown, assuming a dirty green or foxy hue, without gloss, and powdery when dry. The filaments are remarkably level-topped.

17. S. *quadripunctatum*, Ag.; fronds densely tufted, fastigiate, very slender, much branched, sub-dichotomous, membranaceous; frustula large, at first arranged in fours, afterwards scattered. *Grev. l. c. p.* 412. *Monema quadripunctatum, Grev. Crypt. t.* 286.

On rocks and stones in the sea. Appin, *Capt. Carmichael.* Frith of Forth, *Dr. Greville.* Torquay, *Mrs. Griffiths.* Brighton, *Mr. Borrer.*—Densely tufted, 1 or 2 inches high, fastigiate; filaments extremely slender, much branched, subdichotomous, of a light brown colour when recent, becoming rusty in drying; branches apparently composed of a single, hyaline, membranaceous tube, containing a row of large, green, oblong, obtuse frustules, which are at first in fours, afterwards scattered. The frustules are larger than in any other British species. The aspect of Mrs. Griffiths' specimens is, in the dry state, somewhat different from that of *Capt. Carmichael's*, but the structure is very similar.

18. S. *crinoideum;* filaments exceedingly slender, attenuate, very flexuous, sub-simple, or slightly branched at base; the branches long and quite simple; frustules very minute.

In the sea, on mud-covered rocks. Sidmouth, *Miss Cutler.*—This is the most slender of the genus. I have only seen it in a dry state, and cannot perfectly satisfy myself of the nature of the branching. It is described as being brown when recent; when dry it is olive-green and glossy.

19. S.? *prostratum*, Grev.; "threads brown, procumbent, simple, flexuous, obtuse, containing a single row of granules, which are either simple, sub-elliptic with one margin more curved, or cylindrical with obtuse ends, or double; of two cylindrical portions." *Berk. Alg. p.* 15, *t.* 4, *f.* 3; *Grev. l. c. p.* 414.

In fresh water. On the boards of a sluice, forming a very thin, brown, mucous stratum, *Rev. M. J. Berkeley.*—"The filaments are simple, obtuse, flexuous, colourless, extremely fine, containing a single row of granules, which are of two kinds; either *simple*, in which case they are subelliptic, with one of the sides more curved than the other, so as to appear almost like the segment of a circle; or *double*, and cylindrical with very rounded apices. Both are pellucid, marked in the middle with a tawny spot, which has a pale accurately defined band in the centre. Sometimes the single ones are cylindrical. It adheres imperfectly to talc, and is greenish when dry." *Berk. l. c.*

CXXVII. Cymbella. Ag.

Frustula elliptical, binate, free, or imbedded in a mucous mass.—Name, the diminutive of *cymba*, a *boat;* in allusion to the form of the frustules.

1. C. *hyalina*, Ag.; frustula simple, colourless, lanceolate, and acute at each extremity. *Grev. in Hook. l. c. p.* 414.

In shallow ditches. Near Edinburgh, *Dr. Greville.*—Forming a yellowish scum on the water.

2. C. *minor*, Ag.; frustula simple, lanceolate and acute at each extremity, with a narrow band; the ends somewhat opaque. *Grev. l. c. p.* 414. *Frustulia lanceolata, Berk. Alg. p.* 13, *t.* 4, *f.* 1.

In pools and quiet streams, *Rev. M. J. Berkeley.*—Plant forming a soft, spongy, yellowish brown, mucous stratum, entirely composed of frustula. *Frustula* very pale yellow, with a central, transverse, hyaline band, which, however, is sometimes wanting. *Grev.*

3. C. *cymbiformis*, Ag.; frustula binate, cymbiform, obtuse, somewhat curved, hyaline, with a dorsal and central yellow globule. *Grev. l. c. p.* 414.

Moist rocks and on the ground. Appin, *Capt. Carmichael.* Pentland Hills, *Dr. Greville.*—This forms a thin, pale, ochraceous stratum. The frustules are very minute, at first united by pairs, afterwards separate.

4. C. *reniformis*, Ag.; "frustula reniform, adhering in pairs." *Ag. Consp. Crit. p.* 10; *Grev. l. c. p.* 415.

On reeds, in ponds and streams, *Dr. Arnott.*—This I have never seen.

5. C. *Hopkirkii*, Moore; frustula lanceolate, acute at each end, straight or curved, dark green, with a light band in the centre. *Moore in Ord. Survey. l. c.*

Floating in stagnant water. Near Glasgow, *Mr. Hopkirk.* About Lisburn and in one of the caves, Cave Hill, Belfast, *Mr. D. Moore.*—Mr. Moore considers this to be the *Conferva ovalis* of Hopkirk's 'Flora Glottiana,' and remarks that the frustules are "Six times larger than those of any British species." It preserves its rich green colour in a dry state.

6. C. *marginatum;* frustules tawny or hyaline, oblong, thrice as long as broad, obtuse, the angles rounded, margined at each side with a row of bead-like dots.

Among *Confervæ* in a mountain streamlet, Ballantrae, Ayrshire, *Mr. W. Thompson.*

7. C. *lineata;* frustules cymbiform, binate, cohering into a lanceolate figure, each containing a full green, longitudinal band, at length separating.

In stagnant water. Dolgelly, *Mr. Ralfs.*

8. C.? *lætevirens;* frustules oblong, 3 or 4 times longer than broad, rounded at each extremity, distinct, free, filled with a very dense, homogeneous, granular, bright yellow-green matter.

In fresh water, near Penzance, *Mr. Ralfs.*—This forms a bright green scum on the water. I refer it with some doubt to this genus, or even to the tribe.

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