broadly oblong, obovate or oblong-obovate, narrowed into a short stout petiole or almost sessile, very thick and coriaceous, veins hardly conspicuous, margins recurved. Inflorescence axillary; peduncles very short, each bearing two to four sessile flowers at the top. Bracts—three at the base of each flower (one bract and two bracteoles), small, concave. Flowers rather large, one and a half to two inches long, reddish, more or less tinged with yellowish-green. Calyx with four minute triangular teeth. Corolla narrow at the base, swollen in the middle, and then contracted just below the limb; lobes four, separating about a quarter of the way down, but the corolla often splits nearly to the base on one side, the four petals then pointing all in one direction. Stamens four; anthers narrow-linear, basifixed. Stigma capitate. Fruit not seen.

Habitat: Thames goldfields, parasitic on *Coprosma*, *Myrsine* and *Melicope*. Flowers in September and October.

According to the elaborate sketch of the genus given by the author of the "Genera Plantarum," our plant must be placed with a group of Indian and Malayan species possessing a corolla with the petals united nearly to the top, and with three bracts at the base of each flower, and which forms the sub-genera *Macrosolen* and *Elytranthe*. *Loranthus flavidus*, so common in the *Fagus* forests of Nelson and Canterbury, is referred to the same group, but is a somewhat anomalous member of it.

Loranthus colensoi has much of the habit and foliage of *L. adamsii*, but is much larger, and can be at once distinguished by the free petals and the absence of bracts.

Search should be made in hilly and wooded districts for *Loranthus tenuiflorus*, of which only a single specimen, preserved in the Kew Herbarium, is known, and the exact locality of which has been lost. It can be distinguished from the other species by the oblong versatile anthers, which place it in a division of the genus almost wholly composed of South American species.

ART. XXXVIII.—*Contributions towards a List of the New Zealand* Desmidieæ.

By W. M. MASKELL, F. Roy. Micros. Soc.

[*Read before the Philosophical Institute of Canterbury, 7th October*, 1880.]

Plates XI. and XII.

THE following catalogue by no means pretends to contain a *complete* list of the Desmidieæ in this country; but it has been compiled because, as I believe, no attempts have yet been made to record the existence here of

European species or the discovery of new ones. And yet, were it not for the extreme minuteness of the plants composing this family (the largest of which is only visible to the naked eye under certain lights), I venture to think that the elegance of form and varied grace which distinguish them would have drawn universal consideration to them. Unfortunately, they cannot be cultivated, and occurring as they do in wayside ponds and amongst masses of water-weeds their very existence is generally despised and probably almost unknown.

I have had occasion already, when treating of the New Zealand Coccidæ,* to remark upon the difficulty experienced here in studying the different classes of animals or plants, a difficulty arising chiefly from the want of books of reference. Geographical obstacles to communication between various parts of the colony stand much in our way, but these might be got over. But in examining any species it is imperative to know, as far as possible, whether it has ever been referred to elsewhere or by anyone else, and to be able, at least approximately, to determine its affinities. For this purpose easy access to works of reference is indispensable if satisfactory knowledge is aimed at; and this is just what is wanting here. The difficulty is still more enhanced in the case of such objects as the Desmidieæ, because it is quite impossible to keep them for any length of time in their original state: so that often, before comparison could be made with species described as existing elsewhere, the specimens would be ruined and lost. And drawings, let them be ever so apparently accurate, cannot, until all specific characters are thoroughly made out, supply the place of the object itself, at least for purposes of study.

The Desmidieæ are, to students in Christchurch, particularly subject to this difficulty. The standard work on them, Ralfs' "British Desmidieæ," is more than thirty years old, and microscopic investigation has made immense strides since its publication. Descriptions, references, and sometimes figures, are scattered in papers by different authors in such periodicals as the "Journal of Microscopical Science," the "Annals and Magazine of Natural History," the "Zoolog-Botanische Gesellschaft" of Vienna, etc. And, independently of the difficulty of searching for and collating these *disjecta membra*, it is the case, unfortunately, that in Christchurch the series of such periodicals is much broken, confused, and difficult of access. Ehrenberg's great work on the Infusoria (a copy of which is, I believe, shortly to be added to our library) is still older than that of Ralfs. It follows from what I have said that, in investigating and describing any such family as that of the Desmidieæ, the student, even after all his pains, has to

* "Trans. N. Z. Inst.," Vol. XII., p. 291.

rely greatly upon his own judgment and observation, and if these should not unfrequently lead him into error he may at least feel relieved from responsibility.

As this paper purports to be only a catalogue, and the Desmidieæ have already received much attention elsewhere, I need not stop to characterize the family here, beyond simply quoting the description given by the "Micrographical Dictionary:"—"A family of Confervoid Algæ, consisting entirely of microscopic flexible organisms inhabiting fresh water." In this general description they differ from the Diatomaceæ in the character of "flexibility," as opposed to "brittleness." Long considered to be animals, (by Ehrenberg and others), they are now universally recognized as plants.

It will be seen by the following list that I believe I have observed at Christchurch sixteen genera of Desmidieæ proper, containing sixty species. I say "proper," because there is also the genus *Pediastrum*, of which three species are common here; but as I think this is not really one of the family, I have paid less attention to it. I have added the three species of *Pediastrum* to the list, as the genus is usually referred to in works on the Desmidieæ, but probably several more species may occur here.

Of the sixty species of true Desmidieæ in the list, six are as I think new or undescribed, and there are also two species of the genus *Ankistrodesmus*, which I could not identify. The lower forms of life, particularly pond-life, seem to be pretty much the same all over the world, and I ought to give here some explanation of my reasons for venturing to add some six new species to those already known. If I am rightly informed, in the kindred family of the Diatomaceæ only one new species has for several years been described in New Zealand, (of the genus *Nitzschia*, by Mr. J. Inglis, lately), and it may be thought unlikely that in the Desmidieæ there should be greater variety. For this reason I think it well to explain why the six plants just referred to seem to me not referable to any known species (always remembering what I said just now as to the dearth of works of reference here.)

The Desmidieæ have two modes of propagation:—1. By conjugation, or the union of two separate plants producing between them what is called a "zygospore." 2. By division, where each frond separates into two parts, and in the process of separation two new parts grow between the old ones, until, as the new segments attain the size and form of the old ones, complete separation takes place, and each old segment floats away accompanied by its new "half." Now, undoubedly, as Mr. Archer remarks,* in order to be absolutely certain as to a species, it ought to be followed throughout all its stages, that is, from the production of a "zygospore," through full

* "Quart. Jour. Micr. Science," Vol. II., New Series, 1862, p. 236.

growth to the production again of another "zygospore." But, as he also very truly observes, this would be practically impossible with the Desmidieæ, for the "zygospores" in very many instances are quite unknown, and in all are difficult of detection. I may observe here that in the course of three years study of these plants I have never met with a single instance of a Desmid with attached zygospore. Scattered bodies, which appeared to be zygospores, I have seen, but, as Ralfs remarks, unless they are actually attached to segments of a frond it cannot be well known to what plant they belong. Moreover, although zygospores have, by other observers, been frequently seen, their ultimate history is in all cases at present obscure; and as the "Micrographic Dictionary" says, "the reproduction of the Desmidiaceæ still offers a wide field for investigation." Conjugation, in its earlier stages, I have seen on a few occasions.

On the other hand, the process of division seems to be much more frequent, and I have myself observed it several times in the genera *Closterium*, *Micrasterias*, *Docidium*, and others. In the filamentous genera, such as *Hyalotheca*, division is less common.

Now, although the actual following-out of the process of *conjugation* may be difficult, or perhaps impossible, I take it that when on several occasions the process of *division* is to be observed; when, in such cases, the resulting frond is identically similar to other and frequently seen fronds; when there is also at different times of the year, and perhaps in different years, complete similarity in the specimens examined; and when no trace can be found, in descriptions of species by authors, of fronds having the same characters—there is at least very strong evidence that the plants under review form a definite species different from the known species. To use Mr. Archer's words, "Constantly recurring identical forms must be assumed to be the descendants of similar progenitors."* Moreover, division, as I imagine, can only take place in *mature* fronds; immature plants could scarcely propagate; consequently any plant seen in process of division must, if no previous record of its characters can be found, be taken as new.

For these reasons I have ventured to set down a few plants as new species, and not merely as varieties. Referring again to the Diatomaceæ, I believe that it has been ascertained that about ninety per cent. of those plants in New Zealand belong to European species. In the Desmidieæ, out of sixty plants I consider six new, and two doubtful; not a larger proportion.

As I have used the word "varieties," it may be well to remark that in many of the species which I have set down here as European, more especially perhaps in the genus *Cosmarium*, I have noticed peculiarities which do

* *Loc. cit.*, p. 238.

not seem to have been mentioned by authors. The discussion of these would lead me beyond the scope of this paper, and perhaps the characters to which I refer would not even suffice to raise the plants even to "varieties."

It will be seen from my list that the following genera are not, as far as I know, represented here (I speak of the neighbourhood of Christchurch) :— *Didymoprium*, *Desmidium*, *Xanthidium*, *Arthrodesmus*, *Tetmemorus*. Also, that *Euastrum* and *Cosmarium* appear to furnish comparatively few species, and *Staurastrum*, out of fifty-six species described, has furnished only seven.

I have not mentioned, as a rule, the locality of each species observed, desiring rather to avoid iteration. In two or three cases where I have obtained specimens from other places, the fact is stated ; but, where no mention is made, the plant was gathered in the neighbourhood of Christchurch, and chiefly in the fish-ponds of acclimatization societies.

I may remark, in conclusion, that I have preserved in slides almost all the plants named in the following catalogue. In the process of preservation the question of the best fluid for the purpose naturally engaged much attention, and I have tried several. No fluid, as my experience goes, is entirely satisfactory. Camphor-water and Thwaites' fluid appear at first to preserve the plants in all their natural beauty and colour, but after a time they fail. Ralfs' fluid has the same objection, and is, moreover, not very clean. Glycerine, to which I have had final recourse, is the best of all. When the plants are first immersed in it they usually, indeed, shrivel into shapeless masses, but after a few minutes they swell out again and regain their proper form. In glycerine, as in all the other fluids, the endochrome is much affected, but I think that the beauty of the cell-walls themselves is brought out better in this than anything else. *Spirotænia* will not stand anything, even distilled water spoils it. As a matter of fact, no Desmid can really be preserved unhurt, and no preserved specimen can equal the natural plant. In the Diatomaceæ the case is quite different. But, taking them all round, I believe that of all preservative fluids glycerine is the best.

CATALOGUE OF DESMIDIEÆ.

1. **Hyalotheca**, Ehrenberg.

H. dissiliens, Smith. (R. I.)*

Common, especially in spring.

This plant seems particularly liable to a disease (?) produced apparently by a species of *Pythium*.

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* The letter R with a figure after the name of a species denotes the plate in Ralfs' work where the plant is figured. Thus (R. XVI.) means, "Ralfs' 'British Desmidieæ,' Plate XVI."

2. Aptogonum, Ehrenberg.

A. undulatum, sp. nov.

Figures 1–4.

The frond is filamentous, somewhat fragile, and without gelatinous sheath. It is plane, or only very slightly twisted, and, as a rule, not long, but with sometimes as many as fifty joints.

Joints bi-crenate at the margins, and on the sides excavated so as to leave between them an oval foramen. Viewed from below the length of each joint is equal to the breadth. In the side view the height is rather more than the breadth. Under-view quadrangular, the angles rounded, and the foramen easily distinguishable. Upper view also quadrangular, but across the foramen two projections are seen, one from each joint, meeting at the centre. Side view quadrangular below, but curvate above, giving a wavy appearance to the margin of the frond. The projecting processes are seen in this view springing from the curve. The lower edge is bi-crenate. End view quadrate below, with a projection at each of the lower angles, convexo-triangular above, with a projection at the apex. In an empty joint the median projecting process is visible. When slightly tilted, the end view shows the quadrangular under-side with bi-crenate edge. Endochrome bright green. Rays in end view inconspicuous.

Not common.

This plant seems to be intermediate between *A. desmidium*, Ehr., the European species, and *A. baileyi*, the American species. In the former the edges of the joints are bi-crenate, but there are no projecting processes between them, and the end view is concavo- instead of convexo-triangular. In the latter there are the projecting processes, but the edges are not crenate but straight, and the end view (as given by Ralfs, Plate XXXV) shows a rectilinear triangle. I find no mention also, in the descriptions of either of these species, of the curvate appearance shown in the side view of my *A. undulatum*, which gives the peculiar wavy edge to the filament. In Dr. Wallich's paper* on Desmidieæ from Bengal, he figures *A. baileyi* clearly without any undulating margin, though he shows the end view more convexo-triangular than in Ralfs' figure.

Length of joint (outside measurement), under or upper view, $\frac{1}{1380}$ inch. Height of joint in side view, $\frac{1}{1140}$ inch.

3. Sphærozosma, Corda.

S. vertebratum, Brébisson. (R. VI.)

Not common.

S. excavatum, Ralfs. (R. VI.)

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* "Annals of Nat. Hist.," 1860.

Very rare, I think. At least I have only seen two specimens in as many years. It is excessively fragile.

S. filiforme, Ehrenberg. (R. p. 209.)

Fig. 25.

Distinguished from the other species of the genus by having the joints united by *double* processes inclosing a quadrate foramen, instead of only a single process.

Rare, but perhaps more frequent than either of the two last.

This plant appears not to exist in England, being referred by Ralfs only to Germany. In specimens which I have preserved in fluid, the joints sometimes seem to diminish and increase in size owing to the twisting of the filament. The same appearance is seen in the American species, *S. pulchrum*, Bailey, (Ralfs, p. 209).

4. **Micrasterias** Agardh.

M. rotata, Greville. (R. VIII.)

Fig. 5.

Common, especially in spring.

M. denticulata, Brébisson. (R. VII.)

Doubtful.

There is great difficulty in satisfactorily distinguishing these two species, and authorities are by no means clear. Ralfs doubts whether the two plants are not really the same; as also does Dr. Wallich in his description of Desmidieæ from Bengal; and Mr. Archer* shows, that often in papers *M. denticulata* has been referred to while *M. rotata* is meant. Mr. Archer, indeed, strongly supports the distinction between the two. I would by no means venture to intrude here in the discussion, beyond observing that almost every specimen which I have seen has the eight subdivisions and the sharp ultimate teeth of *M. rotata;* secondly, that on a few occasions I have found some which could *doubtfully* be referred to *M. denticulata;* thirdly, that I was able once to observe the actual process of division described and figured by Mr. Lobb,† and certainly the old segments of the frond were *M. rotata*, though Mr. Lobb throughout refers to *M. denticulata.* The process is shown in fig. 5; this, taken from a specimen actually observed dividing, shows clearly the teeth of *M. rotata;* but the new segments forming agree exactly with Mr. Lobb's figure. There could be no doubt about it, the whole appearance of the plant was that of *M. rotata;* was there a confusion in Mr. Lobb's mind between the two? On the whole, I believe that *M. rotata* occurs here in profusion; *M. denticulata* perhaps also, but sparingly.

* "Quart. Journ. of Micros. Science," n. series, vol. II., 1862, p. 244.

† "Trans. Micr. Soc. London," n. ser., vol. I., 1861, p. 1, and pl. I.

M. thomasiana, Archer ("Qu. Journ.," 1862).

Doubtful.

This plant I only mention because I have found one specimen, clearly a *Micrasterias*, showing distinctly apiculate elevations on the surface of the frond, disposed circularly about half-way between the centre and the edge, and also some appearance of the median projections of Mr. Archer's species. The plant, from these peculiarities, was certainly not *M. rotata;* but I had not then seen Mr. Archer's paper, and unfortunately also lost the specimen before I could fully examine and figure it, and have never seen one since. The mention of it here may induce search for it. Close investigation will be necessary to distinguish it when the frond is full of endochrome, the peculiar markings can only be well seen in an empty frond. But the plant when found will repay examination, being one of the most beautiful of all this extremely beautiful genus.

M. thomasiana is described and figured in the "Quart. Journ. of Micros. Science," Vol. II., new series, 1862, p. 236, and plate XII.

M. ampullacea,* sp. nov.

Figs. 6–8.

Frond angular-elliptic; segments three-lobed; the end lobe with bipartite angles; lateral lobes bi- or trifid, distinct, deeply divided, sinuous, with apices ending in three minute spines; edges serrated.

The end lobe is exserted, sub-cylindrical for most of its length, then suddenly broadening to the angles which are bifid with long divisions. The cylindrical portion is slightly wider towards the centre of the frond. Of the two divisions at each ultimate angle the outer is the longest, and the inner one is not in the same plane.

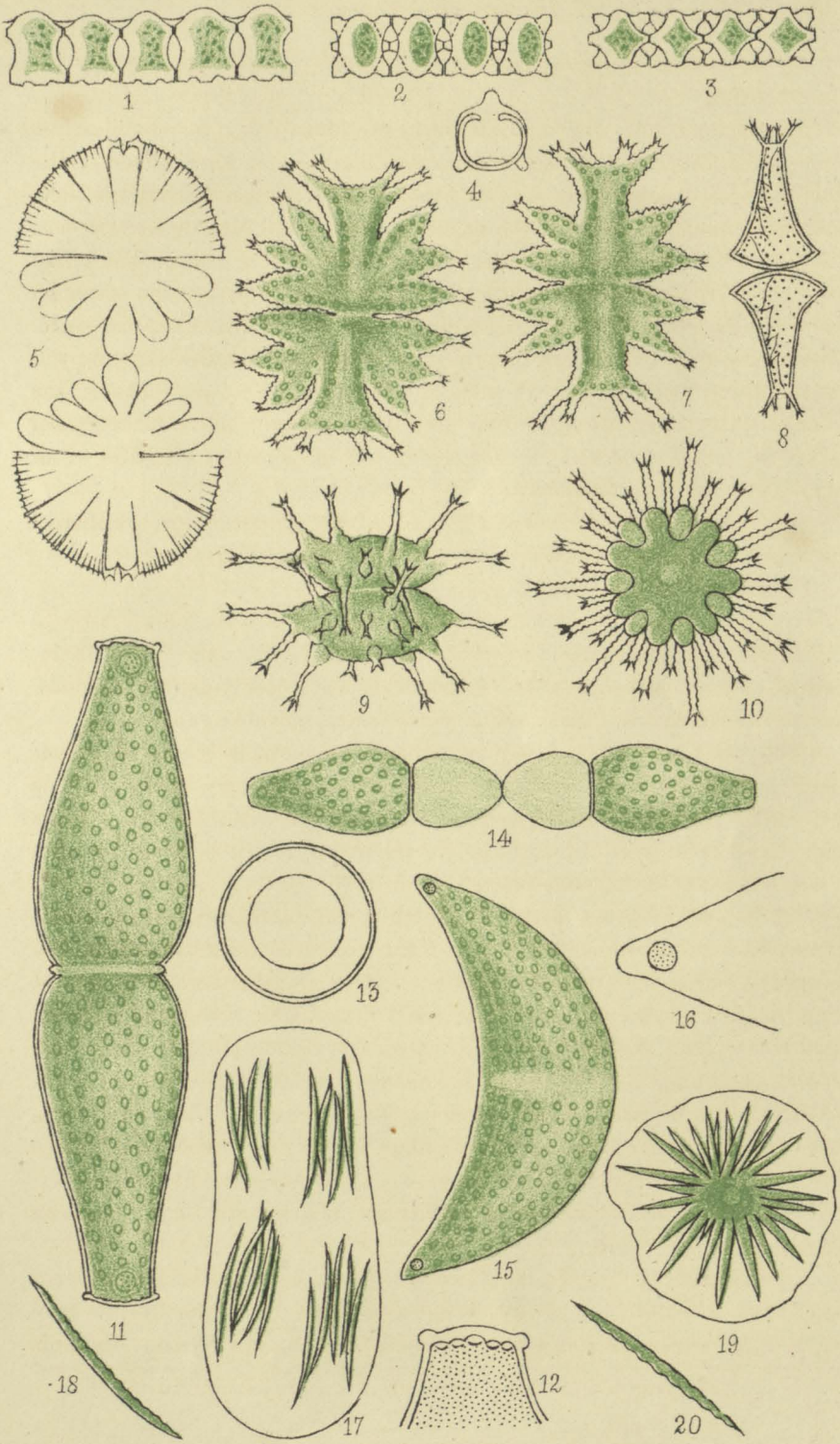
The lateral lobes are deeply divided into two or three (but more commonly two) subdivisions; and when there are three the extra subdivision is caused by the forking of that portion of the original two which is nearest the end of the terminal lobe. Each subdivision is sinuous-edged; narrow at the base, then slightly widening, then suddenly contracting to a long narrow shaft; in fact somewhat after the shape of a flask.

The edges are serrated, and the empty frond punctate. A row of puncta usually follows the edge of each lobe. The apices of the lobes, and of the divisions at the terminal angles, are crowned with three minute spines.

The endochrome is bright green, extending almost to the edges. Vesicles inconspicuous.

In side view, the frond shows like two flasks set with their broad ends together; these are the median or terminal lobes, and the lateral lobes show their edges in perspective. The dilation at the base of the sub-

* This must not be confounded with *Euastrum ampullaceum*, Ralfs.



NEW ZEALAND DESMIDIEÆ.

Maskell, del.

cylindrical median lobes is here well seen, and the divergence of the planes of the processes at the ultimate angles is also clear. The edges, in this view, are smooth.

Zygospore unknown, but I have seen specimens in early stages of conjugation (?).

Length of frond (exclusive of terminal processes), $\frac{1}{150}$ inch; breadth, over all, $\frac{1}{180}$ inch; breadth in side view, $\frac{1}{450}$ inch; breadth at constriction, $\frac{1}{880}$ inch.

Common.

This pretty little plant belongs to that section of *Micrasterias* of which *M. crux-melitensis* may be taken as the type, a section in which the orbicular or sub-elliptical frond is cut into separate lobes by much wider sinuses than in, for example, *M. rotata*. *M. ampullacea*, by its three lobes and the bifid projections at the angles of the terminal lobes, approaches the following described species:—*M. americana*, Ralfs; *M. baileyi*, Ralfs; *M. morsa* variety δ, Wallich (this ought to be *M. americana* var.); and *M. mahabuleshwarensis*, Hobson. But none of these show the peculiar flask-like shape of the lobes in my species. In *M. americana* the lateral lobes widen considerably outwards, whereas in *M. ampullacea* they narrow rapidly outwards. In all the others, unless the figures given are inaccurate, the lateral lobes taper *at once* from their bases, whereas those of *M. ampullacea*, with their sinuous edges, seem to have their widest part a little distant from the base. *M. baileyi* has quite smooth edges, without serrations. Dr. Wallich's variety δ has angular, tapering, strongly spined lobes; and Mr. Hobson's plant (with its fearful and wonderful name) is altogether different in the shape of the lobes; and moreover has, according to the description, serrations *only* in the sinuses of the lateral lobes. None of the authors named have given a side view of his plant.

M. ampullacea, when the lateral lobes are *trifid*, as in figure 6, tends somewhat towards *M. foliacea*, Bailey, but that plant is distinctly quadrangular and otherwise different.

Dr. Wallich, in describing his species from Bengal, proposes to amalgamate almost all the species of *Micrasterias*, and would probably consider the differences between his variety δ and my *M. ampullacea* as only climatic or accidental. But I would venture to observe that, as remarked above, constantly recurring identity of form in large numbers of specimens, obtained under various conditions, must point to something rather more important than mere accidental variety. I would look upon such a difference as bifid or trifid lateral lobes as constituting only a variety (if even it amounted to that); but if, in New Zealand, a plant has *always* sinuous flask-like lobes, and, in Bengal, *always* angular tapering lobes, there is at least great evi-

dence in favour of distinctness of species. And, in fact, taking a gradation from *M. ampullacea*, through *M. foliacea*, *M. americana*, and the rest, to *M. rotata*, why should they not all be simply varieties? When, indeed, it has come to be thoroughly understood what a "variety" is, and what a "species" is, all doubts can be cleared up. Meanwhile, I offer my *M. ampullacea* as a distinct, and, I venture to think, an elegant species of the genus.

5. **Holocystis**, Hassall.

Micrasterias, Ralfs.

This genus is separated from *Micrasterias* by having the lateral lobes almost or quite parallel, not radiant. But the distinction seems scarcely sufficient. Ralfs, who wrote after Hassall, refuses to accept his nomenclature, pointing out that the dentation at the extremity of the lobes is scarcely consistent with the proposed name. However, as Mr. Hassall's name has been accepted by later writers, I leave it here.

H. incisa.

Micrasterias incisa, Kützing.

Figure 24.

I believe this plant to be identical with one from Bengal, described and figured by Dr. Wallich.* It is there called a "variety" of Kützing's species, but I have not seen the original plant. Dr. Wallich makes *two* varieties, in one of which the edge of the terminal lobe is emarginate; in the other it is not so. The plant here, as shown in my figure, exhibits both characters; this is due to the immaturity of the non-emarginate segment. When fully grown, both segments are emarginate.

6. **Euastrum**, Ehrenberg.

E. elegans, Brébisson; or, *E. binale*, Turpin. (R. XIV.)

Rare.

Figure 26.

I have seen two specimens (one of which I have preserved). The plant may be of either of these species, though it may be probably *E. binale*, as the sides of the terminal notch do not extend beyond the lateral spines. Both species are extremely minute, from $\frac{1}{900}$ to $\frac{1}{1400}$ of an inch long, and somewhat variable.

7. **Cosmarium**, Corda.

C. ralfsii, Brébisson. (R. XV.)

Common.

C. meneghinii, Brébisson. (R. XV.)

Not uncommon.

C. crenatum, Ralfs. (R. XV.)

Rare.

* "Ann. and Mag. of Nat. Hist.," Vol. V., third series, 1860.

C. undulatum, Corda. (R. XV.)

Not uncommon.

The difference between these two species is, generally, that the segments of *C. crenatum* are longer than broad, those of *C. undulatum* broader than long; but, in order to thoroughly distinguish them, the sporangia should be observed. Those of *C. undulatum* have long spines divided at the apex; those of *C. crenatum* short spines.

C. botrytis, Bory. (R. XVI.)

Not uncommon.

But I cannot make sure of this plant. My specimens may really belong to the next species, from which *C. botrytis* differs only in the slightly truncate ends, a scarcely satisfactory character.

C. margaritiferum, Turpin. (R. XVI.)

Common.

A very handsome plant, somewhat variable in size. The "swarming" motion of the granules is often very conspicuous in this and the last species.

C. broomeii, Thwaites. (R. XVI.)

Not uncommon.

Chiefly distinguishable from the last by the compressed or straight ends. The slight inflation at the middle, in the end view, is often difficult to make out in the live plant.

C. phaseolus, Brébisson. (R. XXXII.)

Rare.

The characteristic feature is the very small circular inflation at the centre of the segments seen only in the end view. The frond is extremely minute, length $\frac{1}{787}$ inch, breadth $\frac{1}{833}$, according to Ralfs.

C. moniliforme, Turpin. (R. XVII.)

Very rare.

C. granatum, Brébisson. (R. XXXII.)

Very rare.

C. pyramidatum, Brébisson. (R. XV.)

Rare.

C. ornatum, Ralfs. (R. XVI.)

Doubtful. Not uncommon in spring.

I have not been able to satisfy myself as to this species. Some specimens have undoubtedly the truncate projection beyond the margin, but I have not made out the linear arrangement of the puncta on the empty frond.

8. Staurastrum, Meyen.

S. dejectum, Brébisson. (R. XX.)

Common.

S. orbiculare, Ehrenberg. (R. XXI.)

Common.

S. muticum, Brébisson. (R. XXI.)

Not uncommon.

Differs from *S. orbiculare* in having a narrower isthmus between the elliptic segments.

S. polymorphum, Brébisson. (R. XXII.)

Common.

S. gracile, Ralfs. (R. XXII.)

Common.

S. tetracerum, Kützing. (R. XXIII.)

Rare.

S. avicula, Brébisson. (R. XXIII.)

Doubtful. Rare.

Figures 31, 32.

I have a specimen which seems to me to agree in all points with this species, with the exception that the edges of the segments are slightly crenated instead of smooth. The angles end in a forked spine or awn, agreeing thus with *S. avicula*.

9. **Didymocladon**, Ralfs.

D. stella, sp. nov.

Figures 9, 10.

The frond is small; the segments in front view roughly fusiform, with many long projecting processes; two of these processes spring from each of the opposite angles of each segment. Segments united by a rather wide isthmus, so that the terminal separation is somewhat wide and gaping. Of the two angular processes one in each segment is nearly parallel to the corresponding one of the other segment; the other is somewhat widely divergent. Below these, at each end of the isthmus, spring two more projections on each segment, pointing towards the other segment and slightly outwards. Other processes spring from the outer portion of each segment. All the processes have crenate edges, and each terminates in three spines. The appearance of the frond in this view is like two roughly fusiform bodies joined at the sides, and further clasped together by long spiny branches projecting in all directions.

The front view shows a star of many points. Focussed for the extreme end, nearest the eye, it shows seven rays, behind which a number of others are seen a little out of focus. As many of these rays are almost, if not quite, in the same line as some in front or behind them, it is not easy to count the exact number; but I have made out as many as twenty-eight, and probably that is the normal number. The rays (which are the processes seen in the

front view) vary in length. Those at the ends of the segments are shortest, or at least appear so from perspective effect; so that a view of the longest and most numerous rays is obtained by focussing to the middle of the frond.

The processes, or rays, are cylindrical, slightly tapering, being somewhat dilated at the base.

Endochrome bright green; vesicles scattered.

Extreme length in front view, including processes, $\frac{1}{270}$ inch, without processes, $\frac{1}{570}$ inch; length of processes in end view, from centre of the star to tip, $\frac{1}{520}$ inch.

Rare.

This is an extremely beautiful little plant, especially when seen in its star shape from the end view.

I have placed it under *Didymocladon*, although it differs in several particulars from the English species. Ralfs gives the generic characters as follows:—"Frond simple, constricted in the middle, angular, each angle having two processes, one lateral, and in front view nearly parallel to the adjacent one of the other segment, the other superior and divergent." All these characters are found in my species, and I have no doubt that it belongs to *Didymocladon*. But, in the English plant, the end view is either triangular or quadrangular, never more; and in neither case can it present anything like the star form of *D. stella*; moreover, the processes terminate only in *two* spines, whereas *D. stella* has three. Ralfs says that the English species, *D. furcigerus*, is "rough with pearly granules which, being arranged on the processes in transverse lines, produce a crenate appearance on their margins." In *D. stella* the edges, as far as I can make out, are distinctly crenate.

At first sight, in end view, *D. stella* might be mistaken for a zygospore of some other species, from its stellate form. But the front view at once shows this to be incorrect, and an empty frond clearly shows that it is a distinct and full-grown plant.

10. **Penium**, Brébisson.

P. digitus, Ehrenberg. (R. XXV.)

Common in spring.

P. closterioides. (R. XXXIV.)

Rare.

11. **Docidium**, Brébisson.

D. clavatum, Kützing. (R. XXVI.)

Not uncommon.

D. ehrenbergii, Ralfs. (R. XXVI.)

Common.

Distinguished from the last by having three to five small tubercles at the extremities of the segments.

D. baculum, Brébisson. (R. XXXIII.)

Doubtful.

I am by no means sure that I have really seen this plant here.

D. truncatum, Brébisson. (R. XXVI.)

Not common.

A fine large species, not unlike *D. clavatum*, but broader and more tapering towards the ends; indeed, generally a larger plant.

D. dilatatum, sp. nov.

Figs. 11–14.

The frond is large, stout, cylindrical, distinctly constricted at the middle, and the suture forms a thickened ring projecting at each side. The segments are not very broad at the base, but widen considerably immediately after, and at about half their length begin to taper to within a short distance from the end, when they again slightly dilate. At the extreme end there is a minute globular tubercle at each side, and along the edge three to five others, giving it a crenate appearance.

End view circular.

The empty frond is distinctly punctate, and I have seen specimens almost granulate.

In the process of division, the new segments commence as minute orbicular hyaline globules between the original segments; the globules gradually enlarge, becoming after a while elliptical, then slightly tapering; the terminal dilation, visible in the old segment, is not seen until the separation takes place (and, indeed, for a short time after); the terminal edge is rounded, and the coronet of tubercles is absent. It is not uncommon to find fronds apparently almost symmetrical, except that one segment is rounder or more ovate than the other. This is the new segment formed in division.

The endochrome is bright green, the vesicles numerous, scattered, and conspicuous, and at the extremities are seen the moving granules in a circular globule characteristic of the genera *Docidium* and *Closterium*, but this globule is not always clearly visible. I have seen once or twice also a kind of circulation in the endochrome similar to that observed in *Closterium lunula*. In these cases the particles travelled from the middle towards the end along the edge, and a return current (as it might be called) from the end towards the middle was visible nearer the axis of the frond.

Length of frond, $\frac{1}{33}$ inch; greatest breadth, $\frac{1}{260}$ inch.

Rather common in spring.

This fine plant appears to be most nearly allied to *D. truncatum*, Brébisson, but it differs from that (and, indeed, I think all the other species of *Docidium*) in the total absence of all inflations at the base of the segments. The edge of *D. dilatatum* is continuously smooth from the median suture to the terminal angles, whereas even in *D. truncatum* (where the inflations seem to be smallest) there is apparent a slight undulation of outline. It differs also from *D. truncatum* in the presence of the terminal tubercles, absent in that species. Moreover, the bold dilation of the segments near the base, the subsequent tapering, and again subsequent dilation to the end, seem to distinguish the plant from all others of the genus. *D. coronatum*, Brébisson, has similar terminal tubercles, but otherwise is quite different.

12. **Triploceras**, Bailey.

A genus separated from *Docidium* on account of the projecting processes at the ends of the segments. In the American, Indian, and Chinese species these seem to be indifferently set down as being two or three. The generic name implies *three*; my species has two.

T. tridentatum, sp. nov.

Figs. 21–23.

Frond small, slender, depressed, very slightly constricted at the middle. Total length, about twelve times the breadth in front view.

Segments furnished with a number (fifteen to eighteen) of whorls of denticulate projections pointing generally towards the extremity, but those near the middle of the frond project more perpendicularly. Edges between the teeth linear, not curved. Between the last whorl and the terminal projections is a short space without whorls, and at the base of the terminal processes are (at each side) three angular tri-cuspidate smaller processes (fig. 23).

Terminal processes two, sub-rectangular, divergent, ending each in three sharp teeth. Edge of frond between the processes curved.

Lateral denticulations not conical, but somewhat quadrate, like the teeth of a circular saw, pointing forwards.

Endochrome dark green, darkest at the axis. At the middle is a small lighter green space, in which often granules may be seen "circulating," that is, travelling in distinct currents—those near the axis from the extremity of the frond to the middle, those near the edge from the middle towards the extremity of the frond.

The section is rectangular, and in side view the frond is much narrower than in front view.

I think the empty frond is punctate, but the puncta are extremely minute and require a high power to distinguish them.

Length of frond, $\frac{1}{45}$ inch; breadth, front view, $\frac{1}{550}$ inch; side view, $\frac{1}{3000}$ inch.

Rare: from an almost dry ditch near the Fendalton road.

This pretty little plant is evidently closely allied to forms described from America, Bengal, and Hong Kong. From the first-named country, Prof. Bailey describes *T. verticillatum* and *T. gracile*; from Bengal we have *Docidium (Triploceras) pristidæ*, Hobson, and also *T. gracile*, Archer, from Hong Kong. But in none of these can I find the *two tridentate* terminal processes, and the *three* tri-cuspidate processes at their base, of my *T. tridentatum*. The American species, as shown in Ralfs' tab. XXXV., end in simple uni-dentate or bi-dentate processes; so does the Chinese plant figured by Mr. Archer (Quart. Micros. Journal, 1865, Pl. VII.); and Mr. Hobson's figure and description (Quart. Journal, 1863, p. 169) leave very much to be desired. Also the number of teeth in each whorl described in all these plants seems to be less than in *T. tridentatum*, but I lay no stress on this point.

I can scarcely set down as a mere "variety" a plant showing such considerable differences as these. Unless all previous figures are greatly inaccurate, the terminal and sub-terminal processes of *T. tridentatum* are sufficiently distinct to render it, I should say, a new species.

13. **Closterium**, Nitzch.

C. lunula, Müller. (R. XXVII.)

Common.

C. acerosum, Schrank. (R. XXVII.)

Figure 33.

Common; also, from Leithfield, plentifully.

This species seems to vary a good deal in length: some specimens from Leithfield are $\frac{1}{220}$ inch long: some from Christchurch $\frac{1}{24}$ inch. It is distinguished from *C. lunula* by greater slenderness and curvature, and by having its vesicles in a single row. Ralfs states that the empty frond is colourless; many of the species here have a distinct brown tinge. I observed also a tendency in several plants to assume a somewhat sigmoidal shape, the two ends turning opposite ways.

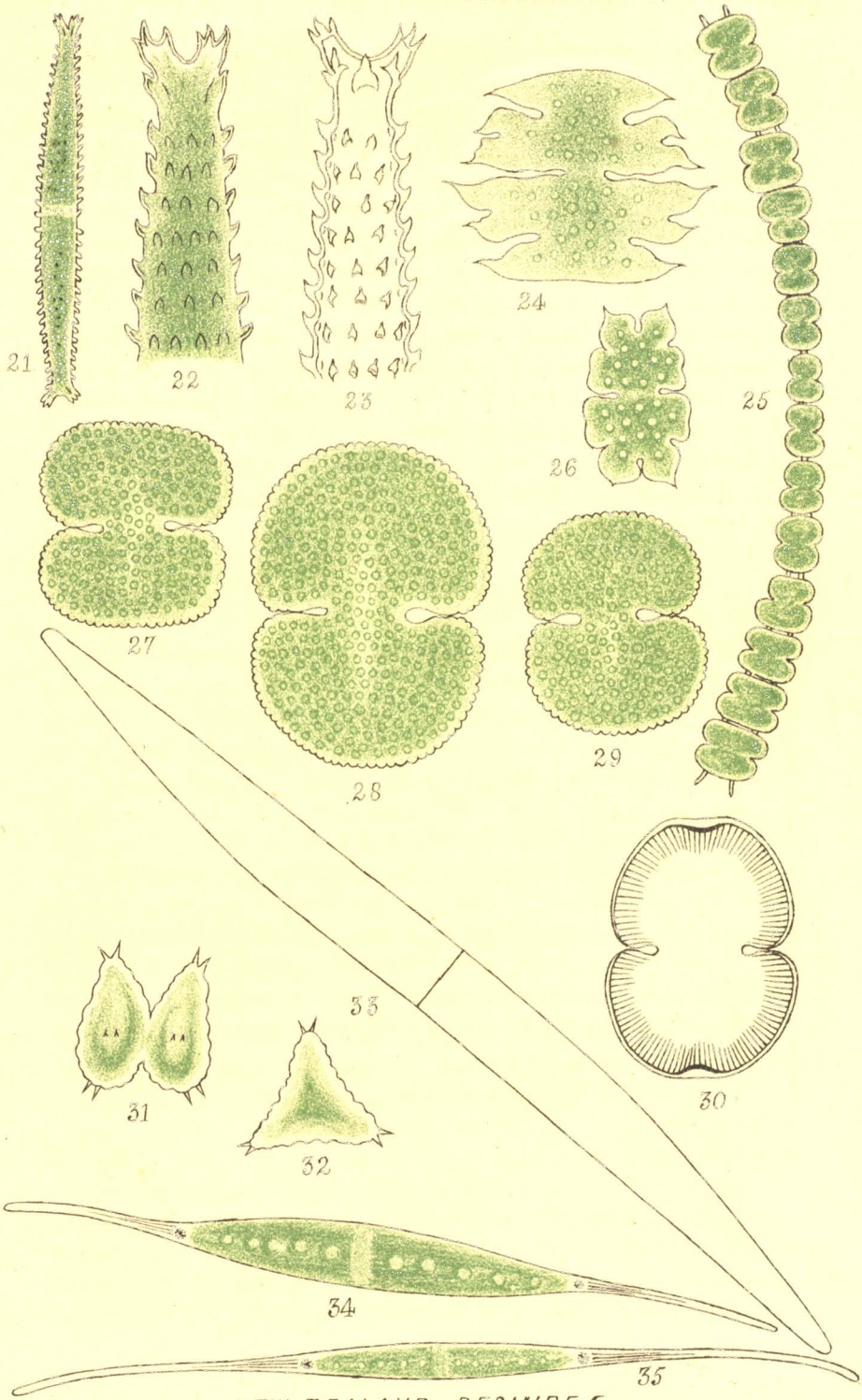
C. lineatum, Ehrenberg. (R. XXX.)

Not common.

C. selenæum, sp. nov.

Figures 15–16.

Frond bright green, large, stout, visible to the naked eye, distinctly lunate, the outer margin forming a bold circular curve, the inner margin also curved but more slightly; no inflation at the middle; ends rapidly tapering, sub-acute, a little rounded, and at the extreme tip turned very



NEW ZEALAND DESMIDEÆ.

Maskell, del.

slightly outwards; no median suture; fillets several, but obscure, sometimes not visible; vesicles numerous, scattered. The empty frond is colourless, with no striæ. The globule of moving granules is very small, and situate quite close to the tip.

Common in spring.

This is a fine handsome plant, and I think not agreeing with the European species. Those which in form approach nearest to it are *C. ehrenbergii*, Meneghini, *C. leibleinii*, Kützing, and *C. moniliferum*, Bory; but it differs from all in the absence of median inflation of the inner margin, which is conspicuous in all three, especially the first. *C. ehrenbergii* also has conspicuous longitudinal fillets, and the ends are thick and round. *C. moniliferum* is too small, and its vesicles are in a single row; and the same may be said of *C. leibleinii*, otherwise this species might agree almost wholly with my *C. selenæum*. However, the outward bending of the extreme tip of *C. selenæum*, mentioned above, would seem to separate it from all other species with acute ends. This bending is very slight, and best distinguishable in the empty frond, but I find no mention of any such character in the European species, with the exception of *C. turgidium*, Ehrenberg; but in that plant the bending is very conspicuous, the ends are thick and round, and the whole plant different. *C. decussatum*, Kützing, is striated.

Length of chord of arc, $\frac{1}{55}$ inch; breadth at the middle, $\frac{1}{300}$ to $\frac{1}{180}$ inch; from tip to middle along the frond, $\frac{1}{80}$ inch.

C. leibleinii, Kützing. (R. XXVIII.)

Fairly common.

C. dianæ, Ehrenberg. (R. XXVIII.)

Common.

These two species may be easily mistaken. Ralfs considers them probably identical. I have judged by the absence or presence of a median inflation.

C. didymotocum, Corda. (R. XXVIII.)

Rare; from Fernside.

C. striolatum, Ehrenberg. (R. XXIX.)

Not common.

C. didymotocum has no striæ; *C. striolatum* has numerous and close but distinct striæ. Both species have a varying number of median sutures. Both are somewhat dark-coloured; indeed *C. didymotocum* is at times almost black.

C. juncidum, Ralfs. (R. XXIX.)

Common.

C. setaceum, Ehrenberg. (R. XXX.)

Fairly common.

C. rostratum, Ehrenberg. (R. XXX.)

Not common.

Differs from *C. setaceum* in its greater size and in having the slender beaks shorter than the body of the frond. I show the two plants in figs. 34 and 35; is the distinction between them sufficient?

C. acutum, Lyngbye. (R. XXX.)

Rare.

14. **Spirotænia**, Brébisson.

S. condensata, Brébisson. (R. XXXIV.)

Not uncommon in spring.

This plant is more affected than any other which I have seen by the fluids used for mounting or preserving. I have tried glycerine, camphor water, Ralfs' fluid, etc.; but they all shrivel up the endochrome considerably, and as the beauty and characters of *Spirotænia* are quite lost unless the endochrome be uninjured, preserved specimens are useless. Distilled water even seems to have a bad effect. Almost all other Desmids stand mounting in glycerine well, but this is quite spoilt by it.

15. **Ankistrodesmus**, Corda.

A. falcatus, Corda. (R. XXXIV.)

Very common.

A. acutissimus, Archer, (Qu. Journ., 1862).

Rare.

I had sometimes observed this plant and was struck by its peculiarities before meeting with Mr. Archer's description,* and had considered it a *Closterium*, but it evidently shows the oblique transverse band, and mediolateral (to coin a word) pale space referred to by Mr. Archer. The plant is very rare, and from its minute size ($\frac{1}{500}$ inch long, $\frac{1}{10000}$ inch broad) requires a high power to examine it.

Ankistrodesmus sp. indet.

Figs. 17, 18.

Common.

I have frequently found specimens clearly belonging to this genus, but am doubtful as to its specific affinities. The cells are aggregated in bundles, but instead of crossing each other as in *A. falcatus*, they are arranged in parallel lines, and they are also only very slightly lunate, often quite straight. In some specimens I observed a definite mucous envelope enclosing four such parallel bundles as in fig. 17.

Length of the cells, $\frac{1}{660}$ inch; breadth, $\frac{1}{7000}$ inch.

Ankistrodesmus sp. indet.

Figs. 19, 20.

* "Quart. Journ. of Micr. Science," Vol. II., New Ser., 1862.

The cells are quite straight, aggregated in a single bundle, and radiating from the centre. A mucous envelope may be made out.

Length of cells, $\frac{1}{350}$ inch.

16. Scenedesmus, Meyen.

S. quadricauda, Turpin. (R. XXXI.)

Common.

S. acutus, Meyen. (R. XXXI.)

Rare.

S. obliquus, Turpin. (R. XXXI.)

Rare.

17. Pediastrum, Meyen.

This is not, I believe, really a genus of Desmidieæ, but as it is referred to in most works on the family I insert it here.

P. tetras, Ehrenberg. (R. XXXI.)

Common.

P. boryanum, Turpin. (R. XXXI.)

Common.

Pediastrum sp. indet.

Common.

Resembling generally *P. boryanum*, but wanting the long points on the marginal cells.

I have added a few figures showing species about which I am doubtful, or in which, as remarked in my introductory sentences, there seem to be peculiarities worthy of observation.

At some future time, if possible, I should wish to enter more fully into the details of these peculiarities, which may have been observed elsewhere but have not been recorded.

Sphærozosma filiforme, Ehrenberg.

Fig. 25.

Ralfs (Tab. XXXV.) gives a figure of *S. pulchrum*, Bailey, an American species. The figure is rough and without much detail, bat shows alternate decrease and increase, "an appearance probably caused by the twisting of the plant." But the English species are not, says Ralfs, twisted. The New Zealand species certainly is, as I have several times observed, and as my figure shows.

Euastrum elegans or *binale*, Brébisson.

Fig. 26.

I give a figure of my plant which, as remarked in the catalogue, may be either of the two European species.

Cosmarium margaritiferum, Turpin.

Figs. 27–29.

I give here three different forms which I believe to be the same plant, on account chiefly of their similar side view, which is *elliptic* in all three.

The first (fig 27) is very much like *Cosmarium broomeii*, Thwaites, (R. XVI.), and for a long time I believed it to be that plant. But *C. broomeii* has, in side view, a very distinct inflation at the middle, which my plant has not.

The second (fig. 28) resembles in outline *C. pyramidatum*, Brébisson, but that species has a smooth instead of a pearly edge. Also, in its slightly truncate ends, it approaches somewhat *C. botrytis*, Bory, (R. XVI.), but I think it is much too large, and the pearly granules are rounder. Besides, the truncation is often almost inconspicuous.

The third (fig. 29) is the normal form of *C. margaritiferum*, occurring here commonly.

On the whole, I would set all three down as the same plant, though fig. 28 *may* be *C. botrytis*.

Cosmarium ralfsii, Brébisson.

Fig. 30.

The figure shows the slight compression of the ends and thickening of the inner surface of the cell-wall, neither of which has been noticed, I think, elsewhere, but which I have observed here somewhat frequently. When first seen I took them to be accidental, but have since seen many examples.

Staurastrum (avicula?).

Figs. 31, 32.

Had I obtained several specimens of this plant I should probably have considered it as new from its crenate edges and double terminal spines; but having only seen one I do not like to make sure of it. Ralfs (tab. XXIII.) figures *S. avicula* with smooth edges and a single mucro. The numerous species of *Staurastrum* are mostly very minute, and I think not very clearly differentiated.

Closterium acerosum, Schrank.

Fig 33.

The figure shows the sigmoid form sometimes assumed here by this plant, and alluded to above in the catalogue.

Closterium rostratum, Ehrenberg.

Fig. 34.

Closterium setaceum, Ehrenberg.

Fig. 35.

The figures are given to show the resemblance between the two plants.

The difference in length of the beaks seems scarcely enough to distinguish them. Ralfs says that the vesicles of *C. setaceum* are "none or indistinct." I have certainly observed them here.

DESCRIPTION OF PLATES XI. AND XII.

Figure 1.	*Aptogonum undulatum*, side view	× 400
2.	,, under view	× 400
3.	,, upper view	× 400
4.	,, end view	× 400
5.	*Micrasterias rotata*, dividing	× 90
6.	*Micrasterias ampullacea*, trifid	× 200
7.	,, bifid	× 200
8.	,, side view	× 200
9.	*Didymocladon stella*, front view..	× 400
10.	,, end view	× 400
11.	*Docidium dilatatum*	× 200
12.	,, end of frond	× 400
13.	,, section	× 200
14.	,, dividing	× 100
15.	*Closterium selenæum*	× 100
16.	,, end of frond	× 350
17.	*Ankistrodesmus*, sp.	× 400
18.	,, single cell	× 800
19.	,, sp.	× 400
20.	,, single cell	× 800
21.	*Triploceras tridentatum*	× 90
22.	,, end of frond	× 350
23.	,, ,, empty	× 350
24.	*Holocystis incisa*, var.	× 350
25.	*Sphærozosma filiforme*	× 700
26.	*Euastrum binale* (?)	× 700
27.	*Cosmarium margaritiferum*	× 350
28.	,, ...	× 350
29.	,, ...	× 350
30.	*Cosmarium ralfsii*, empty	× 200
31.	*Staurastrum (avicula ?)*	× 700
32.	,, ...	× 700
33.	*Closterium acerosum*, sigmoid	× 200
34.	*Closterium rostratum*	× 200
35.	*Closterium setaceum*	× 200