FRESHWATER ALGÆ OF THE LISMORE DISTRICT: WITH AN APPENDIX ON THE ALGAL FUNGI AND SCHIZOMYCETES.

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(Plates xli.-xlvi.; and 11 figures in the text.)

In a previous paper,* I gave some account of the freshwater algæ and algal fungi of the Richmond River at Lismore. The following pages are concerned with forms found on land.† The majority of the latter were collected, during 1914, from lagoons, swamps, rainwater-pools, and roadside-ditches almost entirely within the boundaries of the city of Lismore. The following Table shows the general character and composition of the alga-flora of these swamp-waters compared with that of the River.

Algæ.	Land.	River.	Additional.	Total.
Phæophyceæ	7	—	7	7
Chlorophyceæ........ ...	82	57	62	119
Desmidiaceæ	116	57	99	156
Heterokontæ	2	—	2	2
Bacillarieæ................	36	134	14	148
Myxophyceæ	30	38	11	49
	273	286	195	481
Algal Fungi.				
Chytridiaceæ	12	6	9	15
Schizomycetes	13	13	3	16
	308	305	207	512

The first column gives the total number of forms observed on land, the second the total from the river (*l.c.*, p.95). Records

* "Contributions to a Knowledge of the Biology of the Richmond River," These Proceedings, 1914.

† Six additional forms, four new, are included from the River.

for the district additional to those from the river occupy the third column, and the fourth shows the totality of the forms recorded from the Lismore district. As the latter, for the purposes of this paper at any rate, is all included within a circle two miles in diameter, I think the grand total of 512 may be considered indicative of a very rich area.

Samples.—Nos.176-178, 186-188, 190-193, 195-197, 201, 225, are out of weeds in the river or creeks; 185, 240, swamp on Woodlawn Road; 223, 241, 260, 261, lagoon behind Foley's; 227, ditto at Woodburn; 236, 237, 259, ditto near North Lismore Station; 238, 254, 255, 258, ditto near Cemetery, Goolmangar Road; 233, rainwater pools, Woodlawn Road; 242, 243, ditto near Girard's Hill; 244, 246, 251, ditto near Drill Hall; 245, 247, ditto in Conway Street; 248, 249, ditto on Wyrallah Road; 250, ditto near Convent; 253, ditto North Lismore. The following are in the form of mucous strata : 202, river-bank, Coraki; 199, 208, open drain, Keen Street; 206, on curbstone at Nisbet's; 207, open drain near Cathedral; 211, 221, 228, 229, 232, ditto in Carrington Street; 226, ditto in Terania Street; 231, 252, ditto near Presbyterian Church; 210, on zinc-footwasher; 205, 209, horse-trough near Post Office; 212, ditch in Conway Street; 213, 230, ditch in Magellan Street; 256, 257, on rocks, New Cut.*

Chlorophyceæ.—There is the same extraordinary dearth of *Protococcaceæ* in the swamps and lagoons of the district as in the river-system, in striking contrast to their prevalence round Sydney, where I have obtained them in such quantities as to make the water, in which they were, quite gelatinous. All the usual genera, however, were observed. On the other hand, the *Volvocaceæ* are well represented and plentiful (in the rainy season especially), as was the case also with the green flagellate infusoria. Out of a total of 82 forms of *Chlorophyceæ* noted, no less than 31 (or nearly 40%) belong to the *Volvocaceæ*, representing nine genera, viz., *Carteria*, *Chlamydomonas*, *Phacotus*, *Pteromonas*, *Gonium*, *Pandorina*, *Eudorina*, *Volvulina* gen.nov., and *Volvox*. Indeed, the predominance of the green flagellates (both

* The numbers, 176 to 261, correspond to samples preserved in the National Herbarium, Botanic Gardens, Sydney.

algal and infusorial) is characteristic of the district, just as the predominance of the diatoms is of the river. Not a sign of the *Phytheliecæ* was seen, though repeated gatherings were made from shallow meres on grassland, which are said to be their favourite haunt. Out of a total of 119 forms of *Chlorophyceæ* from swamp and river, only 20 were common to both.

Phæophyceæ.—The absence of *Dinobryon*, which was remarked in the river, is noticeable also in the swamp-waters. Only two small fragments were observed. *Synura* was plentiful. *Chloromonas*, as usual, frequently present in gatherings but always sparsely discributed. The most interesting item in this Class, however, is the discovery* of a large and handsome flagellate resembling *Volvox*, but corresponding in structure and characteristics more to my new genus *Volvulina* in the *Volvocaceæ*. To receive this form, it has been necessary to propose a new genus of *Syngeneticæ*, to which I have given the name *Tessella*.

Desmidiaceæ.—The desmids attain to the respectable total of 156 for the whole district, including the river; but, in no case, were they found in abundance. I am inclined to attribute this, as also the deficiency of *Protococcaceæ*, to the character of the soil, which is a fine loam, very deep, so that water does not lie very easily, and the surface dries very rapidly. Most promising lagoons here yield next to nothing in the way of desmids, while in the Parramatta district and the coastal district of Sydney (Botany, Coogee, Centennial Park) where the soil is clay, or sand with rock underlying at no great depth, little patches of swampy ground, where water lies regularly after rain, will often yield a certain set of desmids in profusion. It is noteworthy that the desmids of the river are almost entirely different from those found on land. Out of 156 forms, only 17 are common to both, and of these 11 are varieties of *Closterium*, a genus whose forms seem to flourish equally well in almost any habitat. The 116 forms noted on land represent 13 genera, but only the very commonest. *Netrium*, *Tetmemorus*, *Sphærozosma*, *Phymatodocis*, and *Triploceras* even were not observed. The absence of the last is re-

* Or rather re-discovery, for I noted it first in Sydney, on August 1st 1909.

markable, as its forms are frequent round Sydney, and *Phymatodosis* also is found there locally. As in the river, forms of *Closterium* (29) and *Cosmarium* (30) form the bulk of the desmid-flora, accounting for exactly half, *Euastrum* and *Staurastrum* (11 each), *Penium* and *Xanthidium* (7 each), *Docidium* (6), *Micrasterias* (5), and *Gonatozygon* (4) make up the bulk of the remainder.

Bacillarieæ.—It is strange that the swamp-waters should be so poor in diatoms (plentiful enough round Sydney), especially considering that they bulk so largely in the river. Only 36 forms were met with, representing 13 genera, as against 134 in the river, with 27 genera. Only 22 were common to both, viz., *Pinnularia* (5), *Nitzschia* (4), *Vanheurckia* (3), *Gomphonema* (3), *Cocconema* (2), *Navicula*, *Achnanthes*, *Synedra*, *Stenopterobia*, and *Hantzschia* (1 each). It is curious and interesting to note that, out of 21 forms of *Navicula* (including *Diadesmis*), only one, *Nav. mutica* var. *Göppertiana*, is common to both land and river.

Myxophyceæ.—The township of Lismore is rich in these, chiefly forms of *Oscillatoriaceæ*. In roadside-ditches and concrete water-tables, and wherever there is a regular dribble of water, mucilaginous strata are sure to form. Enmeshed in them may be found certain diatoms in some quantity, sometimes, indeed, in such abundance as to give to the stratum their own distinctive yellow-brown colour. In general also, while consisting principally of one species, they contain others in lesser quantities, *e.g.*:

(26).*L. Lismorensis*, *L. Kützingii* var. *distincta*, *O. formosa*, *O. splendida* var. *amylacea*, and var. *limnetica*, *Ph. tenue*, *Spirulina laxissima*.

Nitzschia palea var. *debilis*, *N. vermicularis* var. *vialis*, and var. *minuta*.

Nav. lanceolata, with var. *curta* and var. *arenaria*.

(27).*Spirulina major*, *O. formosa*, *O. Corakiana*, *O. acuminata*, *O. splendida* var. *amylacea*, and var. *limnetica*, [*O.*] *amphibia* (*Spirillum* filament), *Spirillum volutans*, *Spirulina Corakiana*, *Nitzschia obtusa* var. *scalpelliformis*.

(30). *Phorm. corium*, *Ph. tenue*, *Plect. nostocorum*, *L. Lismorensis*, and var. *nigra*, *Calothrix Braunii*, *Nitzschia subtilis*, and var. *palacea*, *Syn. ulna*.

The first-named, in each case, is the prevailing form.

New forms.—In the following notes, two new genera have been proposed, and 17 species, 33 variations, and 8 forms (58 in all) have been described as previously unrecorded. These are allocated as follows, Algæ(53):—*Phæophyceæ* 5, *Chlorophyceæ* 20 (all but one are *Volvocaceæ*), *Desmidiaceæ* 18, *Bacillarieæ* 4, *Myxophyceæ* 6. Algal fungi (5):—*Chytridiaceæ* 4, *Schizomycetes* 1.

PHÆOPHYCEÆ.

Genus SYNURA Ehr.

SYNURA UVELLA Ehr. (Pl. xlv., f.1, 2.)

Cell. long. 22, lat. 11 μ.

Lismore (242); Wyrallah.

Lemmermann, Plankt. Schwed. Gewass., p.119, describes the test of *Synura uvella* Ehr., as membranous ("membran hautartig") which implies that it is smooth. I have restricted the name, therefore, to such specimens.

SYNURA GRANULOSA, n.sp. (Pl. xlv., f.3.)

Testæ ovato-claviformes, fronte rotundatæ, a tergo attenuatæ; granulis minutis sparsis ornatis.

Cœn. diam. 55-100; cell. long. 35, lat. 10 μ.

Lismore (223, 241, 249, 260, 261).

Synura granulosa is the common *Synura* of this country. The test shows as a granulate hyaline border even in living specimens. In all our forms of *Synura*, setæ are very rarely present. G. S. West, Br. Frw. Alg., p.46, gives the colour of the chromatophores as brownish-green in European specimens of *Synura*, but here they are yellow-brown.

Var. PUSILLA, n.var.

Testæ subglobosæ, minute granulatæ. Cœnobia parva, cellulis paucis.

Lismore (260).

This is a young form of the species, the cœnobia being smaller, the cells few and suborbicular. The cœnobia are formed, of course, by the self-division of (originally) a single individual. It is not uncommon to find specimens consisting merely of two cells tail to tail. In such, the subglobose shape is very distinct; as the cœnobia become larger, the cells become more fusiform.

SYNURA AUSTRALIENSIS, n.sp. (Pl. xlv., f.4, 5.)

Testæ fusiformes, fronte truncatæ, membrana tenui glabra.

Cœn. diam. 70-140; cell. long. 45, lat. 5-8, ap. $2\frac{1}{2}$-3 μ.

Lismore (260, 261).

A very beautiful and distinct species; some magnificent clusters were noted. The membrane is thin and quite smooth; the test does not show as a hyaline border. No marginal setæ, apparently two contractile vesicles on each side below the centre.

Genus DINOBRYON Ehr.

DINOBRYON SERTULARIA Ehr.

Dinobryon is very rare in this district; after over two years' thorough search, I have noted two isolated sprays.

Wyrallah, lagoon.

Var. CONICUM, nom.nov.

Testæ hyalinæ, conicæ, inferne acuminatæ, lateribus leviter arcuatis, ore non everso.

Lismore (260).

Syn., *Dinobryon sertularia* Ehr., forma, Plankt. Syd. Water, p.515, Pl.57, f.5.

TESSELLA, gen.nov.

Character idem ac speciei.

TESSELLA VOLVOCINA, n.sp. (Pl. xlv., f.6, 7.)

Cœnobium molle, mucosum, sphæricum, cavum; e strata unica cellularum exstructum, integumento mucoso, minute granuloso, investitum. Cellulæ (ut videtur) pulviniformes, a vertice visæ inæqualiter circulatæ vel polygoniæ, pæne contingentes; a latere depressæ, flagellis binis præditæ. Chloroplastides binæ(?), aut singulæ genuflexæ(?), luteo-fuscescentes vel luteo-virides, granulis magnis (pyrenoidibus ?) aliquot plerumque 3, vesiculis contractilibus aliquot (3-5 ?), instructæ. Stigma rubrum non vidi.

Cœn. diam. 30-170; integ. crass. 4; cell. diam. 10 μ.

Lismore (260).

This interesting Volvox-like flagellate, all the more interesting because it does not seem to belong to the green algæ, is found in lagoons. I first noted it many years ago, at Pott's Hill, near Auburn, but it is distinctly rare. The cœnobium is hollow and flaccid; even when revolving freely, it cannot retain the spherical shape, but gets dented in here and there. It is formed of a single layer of large, cushion-shaped cells, irregularly circular or polygonal when seen from above, and nearly touching. The chloroplasts are yellow-brown or yellow-green in colour, as in *Synura*, in company with which it is often found. The protoplasmic contents of the cells are homogeneous and refractive, and I have never been able to make certain of the shape of the chloroplasts. From above, the cell shows a central clear strip with a parietal chloroplast, or fold of a chloroplast, on each side. There are several large granules present, acting, perhaps, as pyrenoids. A number of rather large pulsating vesicles were observed in each cell; the cystole and diastole are both very slow and gradual. Two flagella noted, but no stigma. I have arranged this form near *Synura* on account of the colour of the chloroplasts.

CHLOROPHYCEÆ.

Fam. ZYGNEMACEÆ.

Genus ZYGNEMA Ag.

ZYGNEMA PECTINATUM (Vauch.) Ag., forma.

Fil. diam. 26; cell. alt. 60 μ.

Lismore (240).

A form in which the outer sheathing membrane has been ruptured, and the cells are merely adherent by the apices. It seems to throw some light upon the formation of *Debarya*. I have noted the same form from Kogarah (diam. 24, cell. alt. 50-70 μ). The broken sheath may be seen at the angle of one of the cells (Pl. xlii., f. 1).

Genus SPIROGYRA Link.

SPIROGYRA CRASSA Kütz.

Cell. veg. diam. 160-180, alt. plerumque 120-190, interdum 50; membr. crass. 2 μ.

Lismore (249).

Six, narrow, smooth chloroplasts making one turn each. Pyrenoids very numerous, large for the size of the chloroplast, taking up the full breadth or a little more.

SPIROGYRA GREVILLEANA var. AUSTRALIS, n.var. (Pl. xlii., f.2.)

Forma zygosporis ellipticis acuminatis, præ longitudine valde latioribus.

Cell. veg. diam 30, alt. 160-230. Zygo. long. 75, lat. 50 μ.

Lismore (248).

Cf. *Sp. Grevilleana* (Hass.) Kütz. in Petit, Spir. d. Paris, p.10 Pl. ii., f.1-6, (fig.6 has pointed zygospores); also Borge, Zygnemales, in Pascher, Süssw. Fl. Deutschl., p.17, f.4. The chloroplasts of the vegetative cells are sometimes single, making 5 to 7 turns, sometimes double, making only 2½ turns, the edges scalloped, and pyrenoids very small. Ends of cell reflexed. The zygospores are elliptic with pointed ends, not oval, and much broader in proportion than in the type. Sporangial cells very much swollen.

DESMIDIACEÆ.

Genus GONATOZYGON DeBary.

GONATOZYGON MONOTÆNIUM DeBy.

Long. 101-144, lat. centr. 11-12, ap. 12 μ.

Lismore (223, 254, 260).

Var. TENUE, n.var. (Pl. xli., f 1.)

Cellulæ quam forma typica angustiores; apicibus haud expansis in cellulis liberis arcuatis nec planis.

Long. 80-150, lat. centr. 8, ap. 8 μ.

Lismore (223).

The dimensions agree with the lowest of those given by W. & G. S. West, Monog. i., p.30, but the shape of the cells is unusual, the diameter the same from centre to apices, the extreme ends in free cells not flat and incrassate but strongly arcuate and thin-walled as in loose cells of *Mougeotia*. This is most unusual in *Gonatozygon*, and is probably the result of rapidly repeated division.

GONATOZYGON BREBISSONII var. MINUTUM W. & G. S. West. (Pl. xli., f.2.)

Long. 65, lat. 4, ap. 3 μ.

Lismore (261).

Cf. W. & G. S. West, Br. Desm., i., p.33, Pl. i., f.15. The type also noted. Pl. i., f.16 of the Monograph should be placed under var. *Kjellmanni*(Wille) Rac.; (*Gon. Kjellmanni* Wille, *l.c.*).

Genus PENIUM Bréb.

PEN. MARGARITACEUM var. PULVERULENTUM, n.var. (Pl. xli., f.3.)

Forma puncta-granulis minutissimis sparsis nec in seriebus ordinatis ornata.

Long. 147, lat. 21, isth. 20, subap. 18 μ.

Lismore (185).

The type, with small but distinct granules in longitudinal series, is very rare in this country; I have seen it only once. Var. *irregularius* W. & G. S. West, Alg. fr. Orkneys and Shetlands, p.14, Pl.i., f.23 (by clerical error, var. *irregulare* in G. S. West, Alg. Yan Yean Res., p.53) has larger granules irregularly disposed. In this form, on the other hand, the granules are minute, indeed hardly noticeable at the edges. Membrane very faintly rufescent, almost hyaline.

Var. INDIVISUM, n.var. (Pl. xli., f.4, 5.)

Forma haud constricta, isthmo nullo, polos versus leviter attenuata; lateribus planis parallelis, vel levissime arcuatis, apicibus rotundatis subtruncatis; membrana puncta-granulis minutissimis sparsis ornata, dilutissime luteola vel hyalina; chloroplastidibus in medio interruptis.

Long. 74, lat. 20, ap. 17 μ.

Lismore (185). Cum priori.

This form is the result of repeated self-division. A specimen is figured with one end expanded.

PEN. CUCURBITINUM var. SUBPOLYMORPHUM f. CRASSIOR, n.f.

Forma paullo major quam forma typica, præ longitudine paullo latior; apicibus rotundatis nec subtruncatis.

Long. 25, lat. 50 μ.

Lismore (185).

A form somewhat larger and slightly broader than Nordstedt's type, Frw. Alg. N.Z., p.71, Pl.7, f.20. For a length of 95 μ, his figure gives a breadth of 42½ μ, which agrees with specimens gathered by Lütkemüller in Austria (Desm. d. Attersees, p.8). The latter gives long. 96-100, lat. 40-42, lat. constr. 36 μ. In the very slight constriction, however, our form resembles the type. (Pl. xli., f.6.)

Genus CLOSTERIUM Nitzsch.

CLOSTERIUM SPETSBERGENSE var. PALUSTRE, n.var. (Pl. xli., f.7.)

Forma gracilior, juxta polos acutior; latere dorsali plano pæne usque ad polos, quam levissime recurvato in extremis; latere ventrali arcuato polos versus pæne recto; apicibus truncatis incrassatis; membrana hyalina, glabra, punctis nullis nec striis.

Long. 275, lat. 34, ap. 7-8 μ.

Lismore (185).

Cf. *Cl. Spetsbergense* Borge, Süssw. Alg. Spets., p.8, fig.5, of which the author remarks that a very closely connected form is *Cl. lanceolatum β coloratum* (Klebs) Playf., Some Syd. Desm., p.604 Pl. xi., f.1. From the figures in W. & G. S. West, Brit. Desm., i., however, it is evident that the latter is not *Cl. lunula β coloratum* Klebs, which it was supposed to represent. It might stand, therefore, as *Cl. Spetzbergense* var. *australe* mihi. For the type, Borge gives: Crass. cell. 40-46 μ, crass. apic. 6-7 μ, crassitudine 5-6·5-plo longius. The Sydney specimen figured, *l.c.*, measured 270 x 45, ap. 7-8 μ. Cf. *Cl. lanceolatum* Kütz.(?) in Cleve, Sveriges Söttv. Alg., T. iv, f.7.

CLOSTERIUM ACEROSUM var. CASINOENSE Playf.

Long. 440, lat. 40 μ. Membrana dilute luteola, obscure striata.

Lismore (248).

Cf. Biol. Richm. River, these Proceedings, 1914, p.101, Pl. iii., f.5.

CLOSTERIUM GRACILE Bréb.

Long. 166, lat. 6, ap. 2 μ.

Lismore (254, 260); Wyrallah.

The breadth of our specimens of *Cl. gracile* is nearly always 6 μ, occasionally 7 μ. It is evident from Brébisson's note (Liste, p.155) that the generally accepted type of this species is not what its author had in view. He says "peu attenué aux sommets qui sont légèrement courbés et obtus." The blunt-ended form, therefore, is, strictly speaking, Brébisson's type, and this accounts for the curious shape of the apices in his figures. This point, however, is not mentioned in the Latin description.

Var. ELONGATUM W. & G. S. West.

Long. 300, lat.7, ap.2 μ.

Lismore (223).

Cf. Monog., i., p.168; the authors give lat. 3-4 μ, but, in this country, its breadth ranges from 5 to 8 μ.

Var. BICURVATUM (Delp.) mihi.

Forma *Cl. gracilis* sæpissime bi-undulata, apicibus obtusis truncatis.

Long. 265-400, lat.6, ap.3 μ.

Lismore (260). Cum f. typica.

I first obtained this form many years ago in profusion, from weeds out of a tank in the Botanic Gardens. There is no doubt of its being *Cl. bicurvatum* Delp., Desm. Subalp., ii., p.209, T.18, f.37-39. The hollow back, which makes it bi-undulate, and the blunt ends sufficiently characterise it. It is also certainly a form of *Cl. gracile*, cf. Borge, Feuerland u. Isla Desolacion, p.30, fig.6. *Cl. toxon* West, in Monog. i., p.160, Pl.20, f.13, 14, is really a *forma crassior* of this variation.

Var. SUBSTRIGOSUM (Rac.) mihi. (Pl. xli., f.8.)

Forma *Cl. gracilis* apicibus subrostratis, extremis acutis.

Long. 114-250, lat. 5-6, rarius 8 μ, ap. $1\frac{1}{2}$-2 μ.

Lismore (260).

Syn., *Cl. macilentum β substrigosum* Rac., Desm. Ciast., p.9, T.1, f.38; *Cl. substrigosum* W. & G. S. West, Alg. fr. Burmah, p.192, Pl. xiii., f.19. In this form, the sides do not converge evenly to the apices, but, when a short distance from the tip, the concave side becomes more or less parallel to the other, making the end subrostrate. Not at all uncommon round Sydney, generally mixed with the type. Quite certainly a form of *Cl. gracile*.

Closterium pronum Bréb. (Pl. xli., f.9.)

Long. 300, lat. 8-10, ap. 2 μ. Membrana luteola, striis nullis. Kyogle.

Brébisson, Liste, Pl. ii., f.42. Not *Cl. pronum* W. & G. S. West, Monog., i., Pl.23, f.1-3(= *Cl. acutum* forma *major*), nor *Cl. pronum* Klebs, Desm. Ostpreuss., p.19, T. ii., f.12a (= *Cl. linea* Perty, f. *major*. The extremities of the cell, it should be noted, are *filiform*, shorter, however, than the part of the semicell in which the chloroplast lies. These details agree exactly with Brébisson's note (Liste, p.157). Moreover, he unites *Cl. pronum* with *Cl. setaceum*, *Cl. Kützingii* and others, in a group characterised as "Corpuscules fusiformes terminés par un long bec sans endochrome (Stauroceras Kütz.)." *Cl. pronum* is quite unlike the forms of *Cl. acutum* with which Klebs classes it; the membrane also is of quite a different character.

Closterium Kutzingii var. capense Nord.

Long. 285, lat. 15 μ.

Lismore, Kyogle, cum priori.

Desm. Lugduno-Batavi, p.1, f.1, including *Cl. Kützingii* Bréb., *ibid* A small form having, in length, the same range as *Cl. pronum*, in company with which it is nearly always found here. It is more inflated, however, in the centre, the breadth varying generally from 14-16 μ, with about the same relative proportions of body and rostrum as in *Cl. pronum*. Biologically, indeed, it is a form of that species. The membrane is usually faintly yellowish and clear, occasionally distinctly striate.

Cl. prælongum Bréb. (Pl. xli., f.10.)

Long. 565-770, lat. 14-20, ap. 4-5, subap. 6 μ.

Lismore (223, 225, 254, 259, 260).

This species is characterised by W. & G. S. West, Monog., i., p.165, as one of the rarest species of the genus. It is not uncommon, however, at Lismore, especially in shallow meres and pools on grassland, and is not infrequent round Sydney. Australian forms differ from the European in being less regularly arcuate, much straighter in the back, and suddenly bent in, about one-third of the distance from the ends. Also particularly in the tip, which is only the very slightest bit recurved (not at all as in Monog. i., Pl.21, f.1-3). The membrane is nearly always pale yellow or pale buff, and not striate.

Forma BREVIOR West.

Long. 162-345, lat. 18, ap. 4 μ. Membrana dilute luteola.

Lismore (223, 236, 254).

Cf. *Cl. prælongum* var. *strigosum* (Bréb.)(?), these Proceedings, 1908, p.605, Pl. xi., f.3; which gives a good idea of Australian forms of *Cl. prælongum*, but the extreme tip should be very slightly recurved. I doubt very much if the form figured, *l.c.*, is identical with *Cl. strigosum* Bréb.; it is a specimen of *Cl. prælongum* f. *brevior* West, in which the tips are quite straight, not recurved at all. The dimensions may be taken as including f. *brevior*, as my description says "apicibus . . . . nonnunquam levissime reflexis." There is no real difference either between f. *brevior* and *Cl. tumidum* Johnson; they are only degrees in reduction; the recorded length of *Cl. tumidum* overlaps that of f. *brevior*, and the length of the latter runs right up to the type. They all three have the same range of breadth; *Cl. prælongum* lat. 14-24, f. *brevior* 16-24, *Cl. tumidum* 18-24 μ are my records.

CLOSTERIUM TUMIDUM Johnson.

Long. 150-180, lat. 23-24, ap. 5-6 μ. Membrana dilute luteola.

Lismore (236). Cum priori.

Cl. tumidum Johnson (syn., *Cl. cornu* in Wille, Fersk. Nov. Semlja, T. xiv., f.80, 81) is biologically a form of *Cl. prælongum* very much reduced by repeated self-division. I find it always in company with forms of that species. The membrane and apices also are of the same character in both. Repeated division immensely reduces the length of the cell without alteration of the breadth.

Genus Cosmarium Corda.

Cos. rectangulare var. nodulatum f. minor Playf.

Long. 40, lat. 31, ap. 12, isth. 10 μ. Noduli apicales abfuerunt.

Lismore (185).

Cf. Polym. and Life-hist., p.476, Pl.iii., f.5. The apical nodules are sometimes wanting in these forms of *Cos. rectangulare.* (Pl. xli., f.11*a*).

Cos. rectangulare var. Boldtii f. minor, n.f. (Pl. xli., f.11*b*.)

Forma minor, angulis basalibus magis rotundatis; lateribus e basi levissime divergentibus.

Long. semic. 12, lat. 22, ap. 10, isth. 10 μ.

Lismore (185).

Found only as companion-semicell to one of the previous form (nodules present, however). *Cos. rectangulare* forma, Boldt, Desm. Grönl., T. i., f.18, to which I gave the name var. *Boldtii* in Some Syd. Desm., p.613, measured 43-44 x 34-36 μ. This form, though only about one-half the size, is almost exactly like Boldt's figure.

Cos. rectangulare var. biretum, n.var. (Pl. xli., f.12.)

Forma parva; semicellulæ inæqualiter hexagonæ; e basi plana lateribus levissime divergentibus (paullo magis quam in var. *Boldtii* f. minore) ad apices rapide convergentibus; apicibus truncatis paullulo productis; angulis lateralibus latissime-rotundatis, basalibus obtusis; isthmo angusto. Membrana levis infra apicibus papillis singulis interdum ornata.

Long. 25, lat. 22, basis 19, ap. 8-9, isth. 6 μ.

Lismore (185).

Forma rectilinearis, n.f. (Pl. xli., f.13).

Forma lateribus rectis, apicibus non productis, angulis lateralibus obtusis nec rotundatis.

Long. 27, lat. 22, basis 19, ap. 8, isth. 6 μ.

Lismore (185).

Forma angustior, n.f. (Pl. xli., f.14.)

Forma angustior, parte superiore laterum retusa.

Long. 26, lat. 20, basis 16, ap. 8, isth. 6 μ.

Lismore (185).

Something like *Cos.* (*Eu.*) *leiodermum* Gay, Conj., p.58, Pl. i., f.16, which itself is a form of *Cos. rectangulare* Grun. Differs from *Cos. rect* var. *africanum* W. & G. S. West, Alg. Centr. Afr., p.377, Pl.361, f.14, in having the upper part ot the sides retuse. Var. *biretum* and its forms are all closely connected with var. *Boldtii*. f. *minor*, *supra*, indeed are merely modifications of it; and their association, in the same gathering with the mixed form of var. *nodulatum* and var. *Boldtii* f. *minor*, shows quite plainly how smaller forms, with new characteristics, are produced from a very different type by repeated self-division.

COS. RECT. var. QUADRIGEMINATUM f. LATIOR, n.f. (Pl. xli., f.15.)

Forma paullo minor. Semicellulæ quam f. typica paullo latiores; apicibus nodulis 4 (fronte cernendis 2) aut infra marginem, aut protrusis, instructis; a latere globosæ apicibus nodulis 2 (cernendis) ornatæ.

Long. 36, lat. 28, basis 23, ap. 12, isth. 9 μ.

Lismore (185).

Syn., *Cos. rect.* var. *Cambrense* (Turn.) W. & G. S. West, forma, Polym. and Life-hist., p.476. This form falls better here than under var. *Cambrense*, as the latter is a form with square semicells.

COS. RECT. var. ANGUSTIUS f. MINOR, n.f. (Pl. xli., f.16.)

Forma dimidio minor. Semicellulæ inæqualiter hexagonæ, parte superiore arcuata angulata; angulis lateribus pæne centralibus; lateribus haud retusis; apicibus truncatis angustis. Vertice visæ ellipticæ polis acuminatis.

Long. 16, lat. 12, basis 10, ap.4, isth. 2 μ.

Lismore (185).

Cf. Nordstedt, N.Z., Pl. vi., f.15, 16. The figures of *Cos. pseudoprotuberans β angustius* Nord., contain two distinct types. Of these, the lower semicell of f.15 and the upper semicell of f.16 are identical with *Cos. rect.* var. *Finmarkiæ* Playf., Polym. and Life-hist., p.478, Pl. xiii., f.13. The other semicells, with angular apices, I have arranged as *Cos. rect.* var. *angustius* (Nord.), *l.c.*, p.477.* The latter is certainly a form of *Cos. rectangulare*. The

* The note at the top of p.478—" this really goes under var. *repandum*. . . . . . Its sides are not so sloping as in var. *Finmarkiæ* "—is evidently erroneous. I must have had some other form in mind. Var. *angustius* is quite close to var. *Finmarkiæ*.

form under consideration somewhat resembles *Cos. sexangulare* f. *minima* Nord. It is of the same size, but the apices are narrower, and the sides not at all retuse; the lateral angles also opposite the centre of the semicell, higher rather than lower. Cf. Nordstedt, N.Z., p.60, Pl. vii., f.26, 27; W. & G. S. West, Monog. iii., p.82, Pl.72, f.4, 5. It should be remembered that *Cos sexangulare* Lund., and *Cos. sulcatum* Nord., are themselves, biologically, forms of *Cos. rectangulare* Grun., cf. Polym. and Life-hist, p.481-2, Pl. xiii, f.20-22. All the above forms, with *Cos. rect.* var. *cyclopeum* Playf. (30 x 24, basis 16, isth. 5 μ)., *l.c.*, Pl. xiii., f.7, were found together in the same gathering; compare my remarks, *l.c.*, p.475.

COS. PSEUDOPROTUBERANS var. AUSTRALE, n.var. (Pl xli., f.17.)

Forma major validor. Semicellulæ papillis binis infra apices a fronte non cernendis; a vertice ellipticæ apicibus acuminatis, utrinque in medio papillis binis instructæ.

Long. 50, lat. 42, basis c. 28, isth. 9 μ.

Lismore (185).

With the type, 34 x 28, isth. 6 μ. This large form is not at all uncommon round Sydney, in shallow waters where *Xan. hastiferum* is to be found. It is practically a spineless form of the latter. *Cos. pseudoprotuberans* forma, Borge, Austral. Süssw. Alg., p.23, T.3, f.39, is certainly a form of *Cos. rectangulare*, probably near to, if not identical with, var. *australe*, Playf., Polym. and Life-hist., p.480, Pl. xiii., f.14, 15.

COS. MONILIFORME var. SUBQUADRATUM, n.var. (Pl. xli.,f.18.)

Semicellulæ subquadratæ ubique rotundatæ, apicibus paullo deplanatis; a vertice visæ, orbiculatæ. Membrana glabra.

Long. 30, lat. 18, isth. 3 μ.

Lismore (185).

One semicell was very slightly produced and angulate at each side, a little above the centre. This indicates a connection with *Cos. pseudoprotuberans*. Var. *subquadratum* is intermediate between *Cos. moniliforme* and Jacobsen's form (*Cos. Jacobsenii* Roy). It shows that Nordstedt was right in making the one a f. *elliptica* of the other (Norges Desm., p.22). W. & G. S. West, Monog. ii., p.171, Pl.61, f.26, have just as correctly arranged *Cos. Jacobsenii* as a variation of *Cos. contractum*, as the latter is the base of the whole series. It is an instance of the difficulties that attend the arranging of a lot of closely connected, polymorphic forms, not one of which can be definitely particularised as the direct outgrowth of any other; on a basis, too, partly of outline, and partly of a biological connection which cannot be evaded.

COS. OBSOLETUM var. SITVENSE f. DENTATA, nom.nov. (Pl. xlii., f.3.)

Long. 54-56, lat. 58-60, isth. 28, crass. 34 μ.

Lismore (185).

Cf. *Cos. obsoletum* var. *Sitvense* Gutw., in W. & G. S. West, Monog. ii., Pl.56, f.4. Neither of Gutwinski's figures, however, (Alg. in Java coll., T.38, f.39, 40) has a tooth at the basal angle, nor is it mentioned in his description, *l.c.*, p.594. The authors of the Monograph are in error, also, in considering the basal angles to be incrassate, with a central pore. The hyaline tip is formed by an extension of the fine outer primordial membrane of the cell, and the supposed pore is a true conical tooth. Cf. Nordstedt, De Alg. Lugd.-Bat., p.7, fig.9. In Gutwinski's figures, this outer membrane is shown separated from the cell-wall all round. The sloughing of this membrane is well known in *Doc. trabecula*. I have observed it also in *Cos. glyptodermum* W. & G. S. West, in which case the marks of the large depressions were plainly visible on it Not only is there a decided tooth at the basal angle in this form, but occasionally from two to four teeth form in a vertical line at the extreme edge, bursting the outer membrane, and giving rise to *Cos. auriculatum*, which is, therefore, a form of *Cos. obsoletum*. A mixed form of f. *dentata* mihi and *Cos. auriculatum* forma was observed. Cf. Pl. xlii., f.5. There is nothing extraordinary either in *Cos. obsoletum* having a tooth at the basal angle; it is found just as decidedly in *Cos. Smolandicum* Lund. Gutwinski's description of var. *Sitvense*, l.c., p.594, says "membrana granulata"; this is a mistake, as his own figures show. The membrane is covered with very coarse puncta-scrobiculæ.

Cos. AURICULATUM Reinsch. (Pl. xlii., f.4,5.)

Long. 57, lat. 57, isth. 25, crass. 30 μ.

Lismore (185).

As I have not access to Reinsch, Contributions, I have had to depend on Turner, Alg. E. Ind., p.50, Pl. vii., f.35, and Pl. ix., f.8. The latter is said by the author to be verrucose, but, as his figure does not show any verrucæ at the margin, the membrane had probably the coarse puncta-scrobiculæ of *Cos. obsoletum* var. *Sitvense* Gutw. Although *Cos. auriculatum* is certainly a form of *C. obsoletum*, yet, on account of its distinct shape, it is best kept separate. *Cos. laticollum* Delp., Desm. subalp., ii., p.116, T.8, f.20-23, *C. erosum* Delp., *l.c.*, Pl.8, f.24-27, and *Cos. suberosum* Gutw., Alg. in Java coll., p.592, T.38, f.36, might all be very well arranged as variations of this type.

Cos. VENUSTUM var. BORGEI, nom.nov. (Pl. xli., f.19.)

Forma lateribus e basi plana ad apices truncatos sensim convergentibus, valde undulatis; lobis lateralibus nullis; lobo apicali rectangulari, lateribus verticalibus parallelis; supra medium granulo instructa.

Long. 30, lat. 22, isth. 4; lob. apic. lat. 12, alt. 6 μ.

Lismore (185).

Syn., *Cos. venustum*, forma, Borge, Nordamerik. Süssw. Alg., p 8, fig.5. The latter gives long. 31-32½, lat. 19-19½, ap.13-14½ μ as the dimensions. Cf. *Cos. venustum*, forma, Borge, Austral. Süssw. Alg., p.23, T.3, f.40, which is somewhat larger, but is a form of this variety. It is the common Australian form.

Cos. ASKENASYI var. CRATERIFORME, n.var. (Pl. xlii., f.6.)

Semicellulæ crateriformes adpressæ; sinu lineari extrorsum ampliato; basi plana; angulis basalibus latissime rotundatis, granulis paucis sparsis ornatis; lateribus convexis ad apicem convergentibus; apicibus angustis levissime deplanatis. Inflatione(?) supra isthmum.

Long. 158, lat. 126 μ.

Lismore (240).

For the type, see Schmidle, Alg. Sumatra, p.304, T. iv., f.7. This form is very close to the *forma* in Borge, Austral. Süssw.

Alg., p.21, T.3, f.35, but form more regular, base flatter, semicells more adpressed, apex flattened, fewer granules (spines in his form). Cf. also Bernard, Protococc. et Desm., p.113, f.175, and f. *javanica* Gutw., Alg. in Java coll., p.596, Pl.38, f.45(= *Cos.* spec., Möbius, Austral. Süssw. Alg., ii., p.340, T. ii., f.20; long. 110, lat. 94, isth. 43 μ), which is broader in proportion.

Cos. Blyttii var. Lismorense, n.var. (Pl. xlii., f.7.)

Semicellulæ fere rectangulares; apicibus productis, truncatis 4 granulatis; lateribus e basi plana verticalibus, parallelis, 4 granulatis, infra marginem granulis paucis; angulis basalibus superioribusque fere rectis; a vertice visæ, ellipticæ, papillis nullis.

Long. 17, lat. 16, ap. 8, isth. 4 μ.

Lismore (185).

The body of the semicell is transversely rectangular, the apex suddenly produced above, with a marked hollow on each side between it and the upper angles, sides of semicell almost vertical, basal and upper angles almost square, just rounded off; sides and apex 4-granulate, with inner series as in the type. No papilla above isthmus.

Cosmarium Woodlawnense, n.sp. (Pl. xlii., f.8.)

Semicellulæ subtriangulares; basi plana (sinu lineari extrorsum ampliato); angulis basalibus rotundatis; lateribus levissime arcuatis, 5-6 crenulatis, ad apices rapide convergentibus; apicibus angustis, levissime deplanatis, 4 crenulatis. Membrana hyalina, infra marginem serie granulorum, inter apicem et inter mediam semicellulam papillis 3 in triangulo dispositis, ornata. A vertice anguste-oblongæ, granulis minutis in seriebus transversis ornatæ; apicibus late-rotundatis; lateribus arcuatis; utrinque in medio papillis 3.

Long. 32, lat. 34, ap. 10, isth. 10μ.

Woodlawn, river.

The semicells are triangular, with flat base, and slightly depressed narrow apex. Across the sides, run 5-6 rows of minute granules, the margins and apex crenulate. Three large papillæ in a triangle between the apex and the middle of the semicell.

Cos. THOLIFORME Cohn.

Long. 100, lat. 75, isth. 42 μ.

Lismore (185).

Cf. Cohn, Desm. Bongoenses, p.9, T. xi., f.9, semicell inferior. This desmid belongs to a small group of *Cosmaria* which have depressions in the membrane alternating with verrucæ. In this form, the markings on the membrane are arranged in vertical and decussating lines. They are of two kinds; the larger, with indistinct edges, appear to be depressions; the smaller, which focus sharply, smooth verrucæ. Cohn classes them all together as conical papillæ, but the markings on the upper semicell of his figure seem to contradict this. The depressions are first triangular, then irregularly hexagonal, finally circular.

Genus EUASTRUM Ehr.

EU. SINUOSUM var. CAMPANULATUM mihi.

Long. 100, lat. 55-57, ap. 20-21, isth. 12 μ.

Lismore (185, 240).

Syn., *Eu. campanulatum* Playf., Desm. N.S.W., p.176, Pl. iii., f.16.

EU. TURGIDUM var. MOEBII (W. & G. S. West) Playf.

Long. 114, lat. 95, lob. apic. 74, isth. 32 μ.

Lismore (185, 250).

Syn., *Micr. Möbii* W. & G. S. West, Desm. Singapore, p.162. The figures of *Eu. turgidum* Wallich, Desm. Bengal, T.14, f.17, 18, show that the type has a simple apical lobe (not bifid at each side as in var. *Möbii*), Wallich's side-view agrees exactly with mine (for var. *Auburnense* Playf.) in Some Sydney Desm., Pl. xii., f.2. In forms with bifid apical lobes, the apex, in side-view, is much broader.

Genus MICRASTERIAS, Ag.

MICRASTERIAS TROPICA Nord.

Long. max. 125, centr. 114; lat. max. 100, lob. pol. 44, coll. 20, isth. 18; crass. 33 μ.

Lismore (185).

Cf. W. & G. S. West, Alg. fr. Burmah, Pl.14, f.23, and Nordstedt, Desm. C. Braz., Pl.2, f.15*b*. *Micr. tropica* is a form of *M. Mahabuleshwarensis* with a single lateral lobule. Raciborski's three forms, Desm. Tapakoomasees, f.7, 15, 16, also belong to that species. The forms with two lateral lobules are the direct outgrowth of those with one, and those with three are developed from those with two. The peculiar polar lobe with its apical prolongations is characteristic, and every *Micrasterias* having such belongs, biologically, to the same species. *M. euastroides* Joshua, Burmese Desm., Pl.22, f.14, is another variant of *M. Mahabuleshwarensis*, and its *β indivisa* Nord., might, from the point of view of its form alone, be placed under *M. tropica*. Having regard, however, to the variability of all these forms, and especially of *M. Mahabuleshwarensis*, it is perhaps better to keep them as three distinct conventional types.

M. Mahabuleshwarensis var. ampullacea (Maskell) Nord.

Long. max. 174, centr. 142; lat. max. 154, lob. pol. 86, coll. 28, isth. 22 μ.

Lismore (187, 193).

Micr. ampullacea Maskell, Trans. N.Z. Inst., 13, Pl. xi., f.6, 7, differs only from *M. Hermanniana* Reinsch, Spec. generibusque, Pl.2, f.B, in having the three lateral lobules thicker, shorter, and more stumpy. A form with the third lateral lobule just started, as figured by Hardy, Vict. Natural., 1905, f.3, is common in this country, and is found here in the river along with the full-grown form.

Genus Xanthidium Ehr.

Xanthidium inchoatum Nord. f. (Pl. xlii., f.9*a*.)

Long. semic. 18, lat. 32, isth. 8 μ. Spinis nullis.

Lismore (240).

Cf. Nordstedt, Frw. Alg. N.Z., 1888, Pl. 4, f. 30*a*, semicell. superior. Synonyms of *Xan. inchoatum* are *Ar. Incus* Bulnh., Desm. Sachs., Pl.ix., f.3; *Ar. Incus* forma *a*, Lund., Desm. Suec.; *Ar. Bulnheimii* Rac., Desm. Nowe, 1889, p.23, T. ii., f.17; *Ar. Incus*, "large form," Wolle, Desm.U.S, Pl.24, f.1.

Var. MAMMILLATUM Playf. (Pl. xlii., f.11*b*.)

Long. semic. 20, lat. 40, isth. 6, ap. 28, basis 25 μ.

Lismore (240).

Cf. Some Sydney Desm., p 619, Pl. xii., f.6.

Var. CRACOVIENSE (Rac.) mihi. (Pl. xlii., f.9*b*, 10.)

Forma semicellulis *Cos. pseudoprotuberanti* similibus, latioribus autem; sinu lineari, aut angusto introrsum ampliato; angulis superioribus magis subapicalibus.

Long. 36-44, lat. 32-44, basis 20-24, isth. 8 μ.

Lismore (240). Cum prioris duabus.

Syn., *Cos. contractum* var. *Cracoviense* Rac., Desm. Polon., p.28, T. x., f.10. Found also as a mixed form with *X. inchoatum*, f., *supra*. However much this may resemble *Cos. pseudoprotuberans*, it is quite certainly a spineless form of *X. inchoatum*, produced, as were the forms with it, by repeated self-division. We are here faced by a serious difficulty in the nomenclature, viz., what to do with these pseudo-*Cosmaria*, a large number of which are included in the genus *Cosmarium*, but are, biologically, forms of *Xanthidium*, and can be found as *formæ mixtæ* with semicells of that genus.

Var. ALPINUM (Rac.) mihi. (Pl. xlii., f.11*a*.)

Long. semicell. 18, lat. 38, basis 25, isth. 6 μ.

Lismore (240). Cum precedentibus quattuor.

Syn., *Cos. pseudoprotuberans* var. *alpinum* Rac., Desm. Polon., p.27, T. x., f.11. The latter is very much smaller (long. = lat. = 10·5-12·5, isth. 6·5 μ, Rac.), but agreeing so exactly in shape with our form that I thought it best to accept the name. The equality of length and breadth also is characteristic of *Xan. inchoatum* and its forms.

Genus STAURASTRUM Meyen.

ST. TONSUM (Nord.) mihi.

Long. 46-54, lat. 70-88, bas. infl. 18-20, isth. 11 μ.

Lismore (185).

Syn., *St. pseudosebaldi* tonsum* Nord., Frw. Alg. N.Z., p.36, T.4, f.4. The form agrees almost exactly with the lower semicell of Nordstedt's specimen. Others with more slender processes were noted also. The inflation in the centre of the semicell shows that it is a reduced form of *St. assurgens.* The *formæ immaturæ* figured by me, Desm. N.S.W., p.192, Pl.v., f.31, are very similar forms; the dimensions there given, viz., long. 36-42, lat. 50-70, taken with those above, exactly tally with Nordstedt's.

Genus ONYCHONEMA Wallich.

ONYCHONEMA FILIFORME (Ehr.) R. & B. Bisset. (Pl. xli., f.20.)

Long. cell. 12-16, lat. 16-22, isth. 2-3 μ.

Lismore (185).

Syn., *Sphærozosma filiforme* (Ehr.) Ralfs; *Onych. Nordstedtianum* Turner, Alg. E Ind., p.139, Pl.17, f.17. Forms, much broader than generally given, were observed. Filaments are occasionally seen with the cells separated from one another, attached only by the tips of the clasper-processes.

ONYCHONEMA LÆVE var. MICRACANTHUM Nord. (Pl. xli., f.21.)

Long. cell. 20, lat. 30 μ.

Lismore (185).

Cf. Nordstedt, Desm. C. Brazil, T.3, f.34; Alg. Lugd.-Bat., p.3. This species is, biologically, the fully developed form of *O. filiforme.*

PROTOCOCCOIDEÆ.

Fam. VOLVOCACEÆ.

Genus CHLAMYDOMONAS Ehr.

Including *Chloromonas* Gobi. Gobi has segregated forms of *Chlamydomonas* which have no pyrenoids, into the genus *Chloromonas.* But, in all the *Protococcoideæ*, the presence or absence of pyrenoids depends entirely on the nutrition of the cell. Moreover, even when absent, the pyrenoids are often represented by a greater or less number of scattered, irregularly-shaped, amylaceous granules which seem to carry on the functions of a pyrenoid.

CHLAMYDOMONAS GLOBULOSA Perty. (Pl. xlii., f.12.)

Diam. 14-28 μ.

Lismore (236, 237, 242, 244, 247, 253, 258).

Chl. pulvisculus Stein (*non* Ehr.), Flagellaten, Pl. xiv., f. vii.; *Chl. Pertyi* Goroschankin, Chlamydomonaden, Pl. ii., f. 13. Spherical, generally without anterior papilla, pyrenoid circular, quadrate or transversely oblong. Occasionally, the enveloping membrane grows faster than the body, and shows as a rim all round. Mother-cells with 4, more rarely 8, autospores observed. Goroschankin, quoting Rabenhorst, gives the diameter as 32-42 μ; the dimensions of our specimens are just half these figures. Wille, Gatt. Chlamyd., p.150, gives diam. 9-22 μ, generally 14 μ.

CHLAMYDOMONAS MONADINA (Ehr.) Stein. (Pl. xlii., f.13.)

Diam. 26 μ.

Lismore (248). With *Chl. globulosa* (258).

Syn., *Chl. Braunii* Gorosch., Chlamyd., T. xiv., xv. Spherical, generally without a papilla, pyrenoid band-shaped. Probably a form of *Chl. globulosa* Perty. Cf. Stein, Pl xv., f.39. Very much rarer than the foregoing.

CHLAMYDOMONAS INTERMEDIA Chodat.

Long. 20, lat. 15 μ.

Lismore (242).

Oval or oblong-oval in shape, generally without papilla. Cf. Chodat, Hist. d. Protococc., Pl. 22, 23; Wille, Gatt. Chlamyd., T. iv., f.15; Playfair, Syd. Water-Supply, Pl.57, f.14, 15 (size 13 x 10 μ). Chodat, Alg. Vertes, p.135, gives dimensions (length?) 18-20 μ.

CHL. GLŒOCYSTIFORMIS var. AUSTRALIS, n.var. (Pl. xliv., f.10.)

Membrana oblonga, hyalina; cellula ipsa ovata, fronte angustata, pyrenoidibus singulis sphæricis.

Membr. long. 20, lat. 14; cell. long. 12, lat. 9 μ.

Lismore (230).

Cf. *Chl. glœocystiformis* Dill, in Chodat, Alg. Vertes, p.133, f.61-ix., and in Wille, Algol. Notizen xi., T. iv., f.17. I observed the type in Sydney. Bernard notes it from Java.

CHL. PISIFORMIS Dill. (Pl. xliv., f.11.)

Long. 20-25, lat. 12-13, papill. long. 1-2, lat. 2 μ.

Lismore (236).

Cf. Dill, Chlamyd., p.14, T.5, f.13-19; Wille, Gatt. Chlamyd., p.138, T. iv., f.8. The latter gives dimensions, long. 18-24, lat. 11-14 μ. The papilla in this species is apt to mislead. From the front, it is sometimes very indistinct, showing as a short truncated cone, but, from the side, it is quite evident and appears as a short, rod-like projection (long. 1-2, lat. 1 μ) unlike that of any other species. All the forms of *Chl. pisiformis* were alike in this respect.

Var. CYLINDRACEA, n.var. (Pl. xliv., f.12.)

Cellulæ oblongæ vel cylindraceæ nec postice attenuatæ; angulis rotundatis; ceteris ut in f. typica.

Long. 16-26, lat. 11-16 μ.

Lismore (236, 246, 247, 248, 260).

Probably the mature form of the type, which is more or less cylindrical in front but attenuate behind. As in all species of *Chlamydomonas*, the pyrenoid is sometimes wanting. This form is too short for *Chl. grandis* Stein, Flagellaten, Pl. xv., f.47, 49, (long. 28-40, lat. 8-12 μ in Wille, *l.c.*, p.146) which is the only strictly cylindrical species, and which besides has two pyrenoids to the cell. From *Chl. Steinii* Goroschankin, (founded on Stein's *Chl. grandis*, Pl. xv., f.48, cf. Goroschankin, Chlamyd, Pl. ii., f.1, 2) it is distinguishable by the absence of the longitudinal ridges in the chloroplast.

Var. OVALIS, n.var. (Pl. xliii., f.1; Pl. xliv., f.13.)

Forma ovalis; ceteris ut in f. typica.

Long. 16-22, lat. 12-17 μ.

Lismore (236, 247). Wyrallah. Cum priori.

Var. OBESA, n.var. (Pl. xliv., f.14, 15.)

Forma oblonga præ longitudine latior, angulis late-rotundatis; ceteris ut in f. typica.

Long. 12-22, lat. 10-16 μ.

Lismore (236, 248, 260). Cum prioris duabus.

This and the preceding form are certainly growing forms of the type.

CHL. DEBARYANA Gorosch., f. (Pl. xliv., f.16.)

Long. 14, lat. 12 μ. Pyrenoidibus nullis visis.

Lismore (236).

Cf. Gorosch., *l.c.*, p.106, Pl. i., f.9; Wille, *l.c.*, p.141, T.iv., f.14. *Chl. DeBaryana* is ovate, with a large protruding papilla in front; long. 12-20 μ Gorosch. As found here, it is certainly a young growing form of *Chl. pisiformis* Dill.

Genus Carteria Diesing.

Carteria ovata, n.sp. (Pl. xliv., f.17.)

Cellulæ ovatæ fronte late-rotundatæ non excavatæ, postice attenuatæ acutæ; chloroplastidibus non observatis; endochromate denso granulato; pyrenoidibus (ut videtur) nullis.

Long. 16, lat. 12, flagell. 4, circa 15 μ long.

Lismore (259).

Obtained, as usual in this genus, from rainwater pools, in some quantity.

Genus Pteromonas Seligo.

Pteromonas alata var. australis, n.var. (Pl. xlii., f.14)

Cellulæ ipsæ ovatæ, fronte attenuatæ acuminatæ, postice late-rotundatæ. Membrana investiens, tenuis, hyalina, modice rect-angularis lateribus parallelis, a tergo latissime rotundata angulis nullis, a fronte medio producto atque angulis etiam. Endo-chroma densum, granulatum.

Membr. long. 21, lat. 16; cell. long. 18, lat. 12 μ.

Lismore (247).

Genus Phacotus Perty.

Phacotus rectangularis, n.sp. (Pl. xlii., f.15; Pl. xliii., f.2.)

Cellulæ a fronte visæ circulares; margine scabra; papilla parva inter setas duas; jugis humilibus arcuatis 3-4 decussatim dis-positis ornatæ; a latere rectangulares apicibus truncatis; lateribus levissime arcuatis jugis humillimis 3 notatis. Membrana aspera, dilute luteola. Autosporæ ovales.

Long. = lat. = 18-22; crass. c. 10 μ. Cell. matric. long. 22, lat. 24 μ.

Lismore (244, 246).

Differs from *Ph. lenticularis* (Ehr.) Stein, and *Ph. Lendneri* Chodat, in its rectangular side-view, and the more or less regular curved ridges across the face Cf. Chodat, Alg. Vertes, p.147, f.71, 72.

PHACOTUS RETICULATUS, n.sp. (Pl. xlii., f.16.)

Cellulæ a fronte visæ circulatæ; margine glabra; papilla humillima inter setas; membrana inæqualiter reticulata, colore dilute rufescente; a latere ovales (ut videtur).

Long. = lat. = 22 μ.

Lismore (246)

The lenticular form of the type is only a specific distinction, and not characteristic of the genus.

Genus GONIUM Müller.

GONIUM PECTORALE Müller.

Cœn. long. 40, lat. 44 μ.

Lismore (236, 237, 239, 260).

Genus PANDORINA Bory.

PANDORINA MORUM (Müll.) Bory.

Cœn. long. 31-36, lat. 25-32 μ.

Lismore (221, 237, 244, 246, 249).

Var. TROPICA, n.var. (Pl. xliv., f.18.)

Forma magna, cœnobio ovali; cellulis magnis conicis disjunctis.

Cœn. long. 52-70, lat. 44-60; cell. diam. 9-14 μ.

Lismore (242).

Our Australian specimens of *Pandorina morum* seem to differ somewhat from the European. G. S. West, Br. Frw. Alg., p.192, says: "The cœnobia are spherical or subspherical . . ." and, with this, his fig.76A agrees. So also Chodat, Alg. Vertes, p.150, "Colonies globuleuses ou subglobuleuses . . . ." and his fig.58,xi., p.123. Our forms are invariably oval, cf. Stein, T.xvi., f.14, 15; I have never seen a spherical specimen. Var. *tropica* is rare, twice as large as usual, and the cells more isolated. The latter are arranged in three layers, whose planes are parallel to the long axis of the cœnobium, viz., a central ring of 10, above and below which is a rosette of 6 + 1. The cells do not reach the centre. Were it not that the sexual reproduction and germination of the zygotes are reported to be different (G S. West, *l.c.*, pp.193-4), I should consider var. *tropica* to be an intermediate form between the two genera *Pandor na* and *Eudorina*, especially since the oval form of *Eudorina* (very rare here) was found in company with *P. morum* var *tropica* in the same gathering (both in profusion).

Genus EUDORINA Ehr.

EUDORINA ELEGANS Ehr.

Cœn. ovale, long. 110-128, lat. 95-110, cell. diam. 20-22 μ. Cœn. sphæric. diam. ad 100 μ.

Lismore (223, 241, 242, 249, 260).

Eudorina elegans here is generally spherical. In sample No. 242, however, the oval form was present in company with *P. morum* var. *tropica*, supra, and showing a great likeness to it. The cells were certainly globose, but were arranged (7 + 10 + 7) in three planes *parallel* to the *long axis* of the cœnobium (as in *Pandorina*), not across the axis as shown by Chodat, *l.c.*, p.151, f.76A.

VOLVULINA, gen.nov.

Character idem ac speciei.

VOLVULINA STEINII, n.sp. (Pl. xliii., f.3, 4.)

Cœnobium sphæricum vel ovale, cavum, *Volvoci* simillimum; integumento tenui, hyalino, membranaceo (ut videtur) nec mucoso; intus cellulis æqualiter dispersis, integumento adhærentibus instructum; cellulis tholiformibus magnis, a vertice circulatis, a latere semicirculatis vel rotundato-conicis, fronte planis, postice rotundatis; stigmate rubro distincto juxta flagella posito; flagellis distinctis 2 quam in *Volvoce* vel in *Eudorina* paullo latius inter se distantibus; vesiculis contractilibus aliquot (3 visis) circa marginem anteriorem dispositis. Cytoplasma densum, granulosum; endochromate dilute viridi in granulis minutis ut videtur disperso; chloroplastidibus nullis distinctis nec pyrenoidibus.

Cœnob. sphær. diam. 50-58; cell. diam. 10-15, alt. 8-12 μ.

Lismore (244, 246).

Eudorina elegans Stein (*non* Ehr.), *l.c.*, T. xvi., f.8. Obtained in abundance on June 26th, 1914,(winter) from rainwater pools on grassland (once a swamp, I am told) alongside the Drill

Hall. Stein's figure would seem to suggest a *mucous* investment; probably, however, it is merely an incrassate membrane. The integument of our specimens is quite thin, and appeared to be membranous. Stein gives two contractile vesicles at the base of the flagella, as in *Chlamydomonas*; but my observations showed several, at least three, at intervals round the anterior margin. The flagella, also, were more widely apart than I have ever seen them in any bi-flagellate form. The difference in the cell-contents is merely a matter of nutrition. A central nucleus, x 3 μ, was noted.

Var. SUBRENIFORMIS, n.var. (Pl. xliii., f.5, 6.)

Cellulæ subreniformes, fronte planæ, a tergo subreniformes depressæ, in cœnobii ambitu circa 12-15; ceteris ut in f. typica.

Cœn. subsphær. long. 88-126, lat. 78-94; sphær. diam. 110-114; cell. diam. 10-14, inter se distant. 6-8 μ.

Lismore (246).

Cf. *Eudorina elegans* Stein, *l.c.*, T. xvi., f.9, peripheral cells. This form was gathered in abundance from the same place as the type, but a month later (July 8th, 1914).

Var. PARVICELLULA, n.var. (Pl. xliii., f.7-9.)

Cœnobium plerumque minus interdum minimum; cellulis ut in f. typica vel in var. *subreniformi* sed minoribus.

Cœn. subsph. long. 64-100, lat. 60-90; cell. diam. 6-8 μ.

Cœn. sphær. diam. 20-64; cell. diam. 5-6, inter se distant. 8-12 μ.

Lismore (244, 246).

This variation was formed to include the small spherical cœnobia with cells ⅓ size of the type, of which any quantity were observed, of all dimensions. Cœnobia were occasionally noted, however, of almost the largest size, with cells just as small; and both in cœnobia, and in cells, a complete series was exhibited, from the very smallest to the very largest. Cells of two sizes were often present in the same cœnobium.

Var. LENTICULARIS, n.var. (Pl. xliii., f.10.)

Cellulæ paucæ, latissimæ, lenticulares, integumento intus adhærentes; ceteris ut in f. typica.

Lismore (244).

This interesting flagellate combines, in itself, some of the characteristics of *Volvox*, *Eudorina*, and *Chlamydomonas*. The likeness to *Volvox* is more apparent than real. The organism looks, at first sight, exactly like a minute *Volvox*, with relatively large cells. No trace of parthenogonidia was observed, however, which are almost always present in *Volvox*, and the construction of the cœnobium is entirely different. The latter is hollow, and built up of a single layer of Chlamydomonadine cells of the Pteromonas-type, having a loose membranous investment. These are so closely adpressed as to show, generally, a regular even margin in optical section; but cœnobia were observed (Pl. xliii., f.11) in which the component cells had worked loose, the cœnobium being glœocystiform and irregular at the edge. The peripheral cells, however, have the same relative position to the membrane as in the type—*there is no integument to the cœnobium other than the loose investing membrane of the cells.* In this, *Volvulina* differs from *Eudorina* and *Pandorina.* Nevertheless, it is like them in its vegetative multiplication. Each cell, when mature, forms an 8-16-32-celled daughter-cœnobium. The latter are set free by the breaking up of the mother-cœnobium, and the solution of the membrane of the mother-cell. Such broken cœnobia were noted (cell. matric. diam. 36, cœn. filial. 24, cell. 3-4 μ) in which it could be noted that there was a single layer of cells without any investing mucus or membrane.

Genus Volvox (Linn.) Ehr.

Volvox tertius Meyer.

Syn., *Volvox Bernardii* Playf., Biol. Richm. R., p.106, Pl. ii., f.5-11. Too late for correction, I came across a casual note by Lemmermann in Plankt. Schw. Gewäss., p.105, on *Volvox.* He says, "*V. aureus* Ehr., and *V. tertius* A. Meyer,* seem in many ways to be interchangeable with one another, as they both possess round cells; these in *V. aureus* Ehr., are connected with one another by protoplasmic threads, in *V. tertius* A. Meyer, on the other hand, they are not." As the absence of these threads is

* Janet, Le Volvox, p.143, gives the reference: Arthur Meyer, Die Plasmaverbindungen und die Membran von *Volvox globator*, *aureus*, und *tertius* mit Rücksicht auf die Thiereschen Zellen. 1896.

characteristic of *V. Bernardii*, it is evident that the latter must be identical with *V. tertius* Meyer.

While there is no doubt that, biologically, *V. aureus* and *V. tertius* belong to the same species, since their zygotes are identical (*vide infra*), the latter seems to be a distinct permanent variety, and worth keeping separate (as a conventional species) for that reason, and also on account of the forms connected with it. In Europe, it would appear that *V. aureus* is common, while *V. tertius* is hardly known. Neither Chodat in Alg. vertes de la Suisse, 1902, nor G. S. West, Br. Frw. Algæ, 1904, mention the latter, nor have I seen any reference to it. On the other hand, in this country, to judge at any rate from the Richmond River district, *V. aureus* is very rare (I have only one record of it), while *V. tertius* is common and widespread. It is probably a permanent tropical and subtropical variety.

Cœn. sphær. diam. 214, 220, 300, 320, 325, 360, 450, 500, 635, 700, 800, 950; membr. crass. 2-8, vulgo 2-3 μ; cell. diam. 5-8, plerumque 8, inter se distant. 5-20 μ. Cœn. filial. sphær. diam. ad 250, rarius oval. long. 123-247, lat. 105-180 μ, numero 2-10 plerumque 6-8; cell. diam. 4 μ. Oosporæ (usque ad 17) diam. 30 μ.

Lismore (223, 241, 249, 259, 260, 261), Wyrallah, Kyogle.

Var. OVALIS, n.var. (Pl. xliv., f.4.)

Cœnobium ovale vel oblongum, paullo minus; cœnobiis filialibus paucis; plerumque ovalibus vel oblongis.

Cœn. long. 114-475, lat. 101-425; cœn. membr. crass. 2-4 μ; cell. diam. 4-8 plerumque 6 μ. Cœn. filial. long. 86-114 μ(numero 1-5). Oosporæ (numero 9-20) diam. 42-55, membr. crass. 3-4 μ. Androgonidia immatur. diam. 10-15, matur. diam. 20-22. Antheroz. long. 8-10, lat. 2-2½ μ.

Woodburn (227), Lismore (241, 259).

A very rich gathering of this form was brought me by Mr. Dan Jolly from a lagoon at Woodburn. On examining the cœnobia in the living state with the aid of a Coddington lens, it was noticeable that, in a large majority of cases, the specimens were smaller than usual and quite distinctly oval or oblong, as also were the daughter cœnobia. The number of the latter also in the mother-conobium was less, 2-3 were common, 4 were frequent, and in no case were there more than 5. Male, female, and vegetative cœnobia were observed. The oospores correspond exactly to the description given for *V. aureus* by Overton, Gatt. *Volvox*, p.33, (*V. minor*), and by Janet, Le Volvox, p.99. They are smooth, with a thick outer and thin inner membrane, and (apparently) a mucilaginous packing between the two. The membrane is first hyaline, then yellow, orange, and finally red-brown (Pl. xliv., f.4).

Var. GUTTULOSA, n.var. (Pl. xliv., f.1.)

Cellulæ subpyriformes, postice subglobosæ, fronte in rostro angusto acuto productæ; stigmate rubro in extremo rostro posito; cytoplasmate granuloso, chloroplastibus etiam; pyrenoidibus nullis, granulis autem paucis magnis.

Cell. long. max. 16, rostra. ca. 6; cell. lat. max. 6, ap. $1\frac{1}{2}\,\mu$. Cell. inter se distant. 12 μ. Cœn. integum. crass. 6 μ.

Lismore (250).

A very rare form, interesting, however, as showing how the cells may vary in shape.

Var. TESSELLATA, n.var.

Cellulæ a vertice visæ dense congregatæ, inter se distantes 1-2 μ, interdum fere contiguæ, ambitu inæqualiter orbiculatæ, subpolygoniæ, dimensionibus variis.

1. Cœn. matric. diam. 475-600; cell. diam. 2-6 vulgo 4 μ. (Pl. xliv., f 2.)

Lismore (242).

2. Cœn. filial. diam. 180; cell. diam. circ. 3 μ. (Pl. xliv., f.3.)

Lismore (242),

This form is found both in the free mother-cœnobia and in daughter-cœnobia; in the latter case, the mother-cœnobium very often conforms to the type. The variation was plentiful in No. 242, a gathering taken out of roadside rainwater-pools on June 2nd, 1914, (winter) after heavy rains.

VOLVOX GLOBATOR (Linn.) Ehr. (Pl. xliv., f.5, 6.)

Cœn. diam. 450-600; integum. crass. 1-8; cell. diam. 4-6, vel 6-8, filis connect. crass. ca. 1 μ, inter se distant. 2-3 μ. Zygotæ, numero circ. 200, diam. max. 50-60, cell. diam. 34-36, membr. s.sp. circ. 3, spin. long. ad 8 μ.

Lismore (260, 261).

V. globator is only a little less rare in the district than *V. aureus.* The cells, of the specimens I have noted, did not show as distinctly stellate as the European forms, and as figured in Overton, Gatt. Volvox, T. i., f. 4, rather than in Klein, Gatt. Volvox, 1889, T. x., f.2, or in Janet, Le Volvox, p.39, f.3. The connecting filaments (for they can hardly be termed arms) are very faint and indistinct, and not more than 1 μ thick, hyaline; while the cells are very irregular in outline, but apparently more compact than in European specimens, and rather closely packed. The chloroplast is sometimes pale yellow-green, but just as often the same pale green colour as in *V. aureus.* The oospores are yellow or green, with a hyaline integument consisting of an inner and an outer membrane separated by a mucous zone, the outer membrane covered with conical spines somewhat longer and more pointed than generally figured.

Var. AUSTRALIS, n.var.

Cœnobium cellulis a vertice visis inæqualiter polygoniis, densissime ordinatis indiciis filorum solis cernendis; cellulis a latere (sectione opticali) *globosis.* Chloroplastides dilute virides.

Cœn. diam. 500; cell. diam. 3-4, vel 4-6, inter se distant. 1 μ.

Lismore (261). Cum priori.

This form is almost indistinguishable from *V. tertius* var. *tessellata*; the cells are of the same colour, *globose* in sideview, very closely packed, almost touching in places, and the connecting strands are absent. The cells, seen from above, however, are, in this variation, a little more irregular in outline, and here and there, at the angles, a slight point indicates the position of the missing filaments.

VOLVOX LISMORENSIS, n.sp. (Pl. xliv., f. 7, 8.)

Cellulæ a vertice visæ inæqualiter polygoniæ nec stellatæ, filis tenuissimis, sæpe inter se reticulatis, conjunctæ; stigmate rubro distincto. Cellulæ a latere ut in *V. globatore*, pyramidales, a tergo pæne planæ, angulis lateralibus productis, filis tenuissimis conjunctæ, stigmate ad apicem. Chloroplastides luteo-virides, pyrenoidibus nullis visis.

Cœn. diam. 790; cell. diam. 8, inter se distant. 20 μ. Cœn. filial. diam. 215-275, cell. diam. 6, inter se distant. 2 μ.

Lismore (250).

This species resembles *V. globator* in the colour of the chloroplasts, and in the shape of the cells in optical section. From above, however, the cells are not stellate, but only irregularly polyhedral, with a minute point at the angles sometimes. They are connected by extremely delicate threads, much more delicate than in *V. aureus*, sometimes hardly visible. Generally, the threads are double, rarely triple, and, instead of running directly between the cells, they have a habit of anastomosing with one another.

Var. GLOBULIFERA, n.var, (Pl. xliv., f.9.)

Cœnobium cellulis a vertice inæqualiter polygoniis, filorum indiciis solis raro cernendis; cellulis a latere *globosis*.

Cœn. diam. 290-500; cell. diam. 7-8, inter se distant. 6-20 μ. Cœn. filial. diam. 150, cell. diam. circ. 8, partic. ultim. circ. 3 μ.

Lismore (250). Cum priori.

The cells, from above, are irregularly polygonal, with the angles occasionally drawn out a little; here and there, but only rarely, one of the very delicate filaments might be noted. In sideview, the cells are globose. A figure (Pl. xliv., f.9) is given of the surface of one of the daughter-cœnobia; the cells were large, 8 μ in diameter, and indistinctly outlined with smaller cells of many shapes and sizes between. The large cells seemed to be fragmenting into 4-6 smaller cells, 3 μ in diameter—the "*partic. ultim.*", *supra*.

Genus HYDRODICTYON Roth.

HYDRODICTYON RETICULATUM (L.) Lag.

Cell. long. 200, lat. centr. 32, ap. 40 μ.

Lismore (255).

Genus INEFFIGIATA W. & G. S. West.

INEFFIGIATA NEGLECTA W. & G. S. West.

Small pieces, up to diam. 90 μ, plentiful, of a brownish- or yellowish-green colour.

Lismore (185, 223, 260, 261).

Botryococcus Braunii very rare, only just recorded.

[For genus *Trochisia*, see Appendix, under *Chytridiaceæ.*]

BACILLARIEÆ.

Genus AMPHORA Ehr.

AMPH. LAGERHEIMII var. MINUTA, n.var. (Pl. xlv., f.8.)

Forma minima, striis nullis visis.

Long. 15-20; lat. frust. 7-9, ap. 3; lat. valv. 4-5 μ.

Lismore (211).

Cf. *A. Lagerheimii* Cleve, Diatomiste ii., p.99, Pl. vii., f.2; Synopsis ii., p.118. The latter is a very rare form, known only from Ecuador. Characteristic of the species is the short, stauriform mark in the centre of the dorsal margin. The type measures 50-70 μ in length, and was obtained from rocks moist with fresh water. Var. *minuta* was found, alive, in some quantity, in a mucous stratum of *Phorm. corium*, at the edge of an open concrete water-table in Carrington Street. The chloroplasts were very distinct, with four minute elæoplasts as figured.

Genus STAURONEIS Ehr.

STAURONEIS FULMEN Brightwell. (Pl. xlv., f.9.)

Long. 114-196; lat. valv. 30, subapic. circ. 12; crass. frust. 30-33 μ.

Lismore (185, 240, 249).

Known only from Java, Australia, and New Zealand. Cf. Brightwell, Micr. Journ., vii., p.180, Pl. ix., f.6. Widespread in swamps throughout this country. There is a double columella, with a true raphe (undulate) in the space between. Cleve, Syn. i., p.150, gives this form as capitate. I have never noted it, however, with more than a rostrate apex. Here, the apices are exactly those of *Staur. acuta.* of which Cleve considers it a variety.

Genus PINNULARIA Ehr.

PINN. STREPTORAPHE var. GIBBOSA A. Cleve. (Pl. xlv., f.10.)

Long. 140, lat. 20 μ. Striæ 7 in 10 μ.

Lismore (185).

Cf. Astrid Cleve, Diat. Lule Lappmark, p.6, T. i., f.1; P. T. Cleve, Diat. Finland, p.23. Ends conical, frustule only very slightly inflated in the middle. P. T. Cleve gives striæ 5 in 10 μ; A. Cleve, 7 in 10 μ.

P. DIVERGENS var. ELLIPTICA Grun. (Pl. xlv., f.11.)

Long. 70, lat. 16 μ. Striæ 7 in 10 μ.

Lismore (185).

Grunow, Diat. Fr. Josefs Ld., p.98, Pl. i., f.19; Cleve, Syn. ii., p.79; the latter gives 75 x 15 μ, striæ 8-10 in 10 μ. The larger sizes of *P. Brébissonii* type and the smaller of *P. divergens* var. *elliptica* seem to be identical in appearance, cf. Lagerstedt, Diat. Spetsb., Pl. i., f.2*a*, which is accepted by Cleve as *P. Brébissonii*; the figure gives long. 62, lat. 17 μ

Genus NAVICULA Bory.

NAVICULA SUBTILISSIMA Cleve. (Pl. xlv., f.12.)

Long. 38, lat. 8, ap. 5 μ.

Lismore (185).

Syn., *Stauroneis linearis* Lagerstedt, Sötv. Diat. Spetsb., 1873, Pl. ii, f.13. Cf. Cleve, Diat. Finland, 1891, Pl. ii., f.15, who gives 32 x 5 μ; Lagerstedt, long. 30-34, lat. 7-8 μ. *Nav. linearis* Grun., 1860, prevents the adoption of Lagerstedt's specific name. A rare diatom, known only from Lappland, Sweden, and Spitzbergen. There is a faint pseudostauros on either side of the central nodule.

DIADESMIS-forms.

N. CONFERVACEA var. PEREGRINA (W. Sm.).

Long. 15-20; lat. valv. 8, crass. frust. 4-8 μ.

Lismore (178, 187, 188, 190, 192, 193, 195, 197).

Diadesmis confervacea var. *peregrina*, Biol. Richm. R., Pl. v., f.25. The frustules are so strongly agglutinated together, that the filaments always break by the valves coming apart. The following species, which were also found in long ribbons, I have arranged as *Diadesmis*; but the ribbons seem of a different nature from those of *Nav. confervacea*, being very fragile; and, in gatherings, the frustules are generally found separate, or in groups of 4-8.

NAVICULA MINIMA Grun. (Pl. xlv., f.13.)

Long. 14-16, lat. valv. 5-6; crass. frust. 3 μ.

NAVICULA ATOMUS Näg. (Pl. xlv., f.14, 15.)

Long. 6-9, lat. valv. 3-4, plerumque 4; crass. frust. 3 μ.

NAVICULA EXILISSIMA Grun. (Pl. xlv., f.16.)

Long. 10-14, lat. valv. 4-5; crass. frust. 3 μ.

NAVICULA FLOTOWII Grun. (Pl. xlv., f.17.)

Long. 14-22, lat. valv. 5-6, ap. 2-3; crass. frust. 3 μ.

Lismore, all four forms (178, 186); the last three (176, 178); *Nav. atomus* (176, 178, 186, 192, 196).

Cf. Van Heurck, Diatomaceæ, pp. 227-230, Pl.5, f.229, 231, 234, 238. *Nav. Flotowii* is the only one of these four that is recognised by either Cleve or Van Heurck as *Diadesmis*. Here, however, I find them all in long ribbons(diam.6, 8, 10, 11, 12, 13, 14 μ in sample No.186). Also, they all exhibit a similar appearance under the microscope, and are all found in quantity associated together. There seems, therefore, to be some connection between them.

Genus VANHEURCKIA Bréb.

VANHEURCKIA RHOMBOIDES (Ehr.) Bréb. (Pl. xlv., f.18.)

Long. 68, lat. 16, ap. circ. 4 μ.

Lismore (185).

Cf. Donkin, Brit. Diat., Pl. vi., f.11. A very rare form of the genus; this is only my second record of it. The other specimen, from the Sydney Water Supply, measured 90 x 16 μ. The apex is simply rounded, not rostrate at all.

VANH. VULGARIS (Thw.) Van Heurck. (Pl. xlv., f.19-21.)

Long. 40-50, lat. 10-14, ap. 3-4 μ.

Lismore (185).

Thwaites, Ann. Mag. Nat. Hist., Ser. 2, Vol. i., Pl.xii., f.H1-5. Not Van Heurck, Diatom., p.239, f.39 (= *V. viridula*) nor Pl.5, f.252. Thwaites says "lanceolate, suddenly narrowed near the apices," and his figures show a plump little frustule, not at all slender, elliptic-lanceolate, with sides well arched, not parallel, suddenly constricted near the ends into a short rostrate apex. Forms of this genus are common enough in the swamp-waters of this country, but I have never yet seen them in mucous tubes.

Var. RICHMONDIÆ, n.var. (Pl. xlv., f.22.)

Forma fasciâ transversâ, usque ad margines valvæ non pertinente, utrinque ad nodulum centralem instructa.

Long. 54-58, lat. 12-14 μ.

Lismore (185). Cum priori.

This form is more like those given for the type by Van Heurck.

VANH. CUSPIDATA var. AMBIGUA (Ehr.) Cleve.

Long. 66-80, lat. 19-20, ap. 4-5 μ.

Lismore (213, 221, 253).

Nav. ambigua Ehr., in Donkin, *l.c.*, Pl. vi., f.5. Cleve, Synopsis i., p.109. This form is very like *V. vulgaris*, from which it may be distinguished by its larger size, and specially by a very slight angularity here and there in the arched sides. It is frequent at Lismore in waterholes and swamps, and in the mucous strata of the *Myxophyceæ.*

Forma.

Forma fasciâ transversâ utrinque ad nodulum centralem instructa.

Long. 76, lat. valv. 20, ap. 6; crass. frust. 10 μ.

Lismore (223).

Compare *V. vulgaris* var. *Richmondiæ*, supra.

Genus GOMPHONEMA Ag.

GOMPH. LANCEOLATUM var. INSIGNE Greg. (Pl. xlv., f.23.)

Long. 62, lat. 10 μ. Striæ 8 in 10 μ.

Lismore (185).

Genus ACHNANTHES Bory.

ACHNANTHES WOODLAWNENSIS, n.sp. (Pl. xlv., f.24.)

Frustula oblonga genuflexa, zona connectente per longitudinem striata, striis tenuibus 8-9. Valvæ lineari-lanceolatæ, in medio evissime inflatæ, apicibus conicis, transverse striatis. Valva inferior lineâ centrali et fascia transversali instructa. Valva superior striata tantum, linea centrali nulla nec fascia.

Long. 84, lat. valv. 18, frust. crass. 24 μ. Striæ 8 in 10 μ.

Woodlawn (225).

I can find no description answering to this form, in Cleve's Synopsis. The stauros is 3 μ broad.

ACHNANTHES EXIGUA Grun. (Pl. xlv., f.25, 26.)

Long. 13-16, lat. 6-7, ap. 3; frust. crass. 4 μ.

Lismore (176, 178, 190).

Cf Schumann, Preuss. Diat., Nachtrag ii, Pl. ii., f.59. This species was found, in some quantity, along with *Nav. minima* and its three companions (*supra*), and there was reason to believe that its frustules had been originally, like the others, in long filaments. Cleve, Syn., ii., p.190, gives dimensions, long. 13-17, lat. 5-6 μ. He places the species in a class of *Achnanthes* which, he says, has affinities with the groups of *Navicula*, including the four mentioned above. The chromatophores of all are of the same shape, so that it is highly probable that this form is really a *Navicula*, and that the *Achnanthes*-features are merely temporary. I could see no genuflexion in the sideview of the frustules.

ACHNANTHES LINEARIS W. Sm.

Long. 13-16, lat. 4; crass. frust circ. 3 μ.

Lismore (178).

Found in company with *Ach. exigua*, above, and the four small *Diadesmis*-forms of *Navicula*. I had a suspicion that the latter were occasionally to be found *curved* in girdle-view.

Genus STENOPTEROBIA Bréb.

STEN. ANCEPS var. HERIBAUDII Playf.

Long. 105, lat. 6 μ.

Lismore (240).

These Proceedings, 1913, p.535, Pl.56, f.21. Syn., *Sten. anceps* Heribaud (not Lewis), Diat. Auvergne, Pl. v., f.4. Forms of *Sten. anceps* Lewis, (= *Nitz. franconica* Rein.) are widespread in this country.

MYXOPHYCEÆ.

Genus ANABÆNA Bory.

ANABÆNA OSCILLARIOIDES Bory. (Pl. xlvi., f.1.)

Cf. Biol. Richm. R., p.127, for dimensions. Three shapes of gonidia were noted in this one sample, viz.: (1) oblong, with arched sides, and broadly rounded ends; (2) broadly cylindrical, with flat sides, and broadly rounded subtruncate ends; (3) long narrow cylinders, with straight sides, and truncate ends.

Lismore (185).

Genus CYLINDROSPERMUM Kütz.

CYLINDROSPERMUM RECTANGULARE, n.sp.

Stratum obscure-viride. Trichomata pallidissime æruginosa, ad genicula constricta, apicibus conicis. Vagina tenuissima, distincte observata Cellulæ quadratæ vel cylindraceæ, disjunctæ, protoplasmate homogeneo vel minute granulato. Heterocystides rotundato-conicæ vel oblongæ subcylindraceæ; apicibus rotundatis. Gonidia stricte cylindracea, lateribus planis, apicibus truncatis; vel doliformia, lateribus levissime arcuatis, apicibus truncatis; vel rarius elliptico-lanceolata, apicibus rotundatis; protoplasmate granulato, dilutissime æruginoso pæne hyalino.

Trich. diam. 4-5; cell. alt. 6-10, sæpe 8 μ. Heterocyst. conic. long. 6-10, lat. 5-6, cylindr. long. 11-12, lat. 6 μ. Gonid. cylindr. long. 12-15, lat. 5-6, doliform. long. 16-20, lat. 7-8, lanceol. 22 x 10 μ.

Lismore (256).

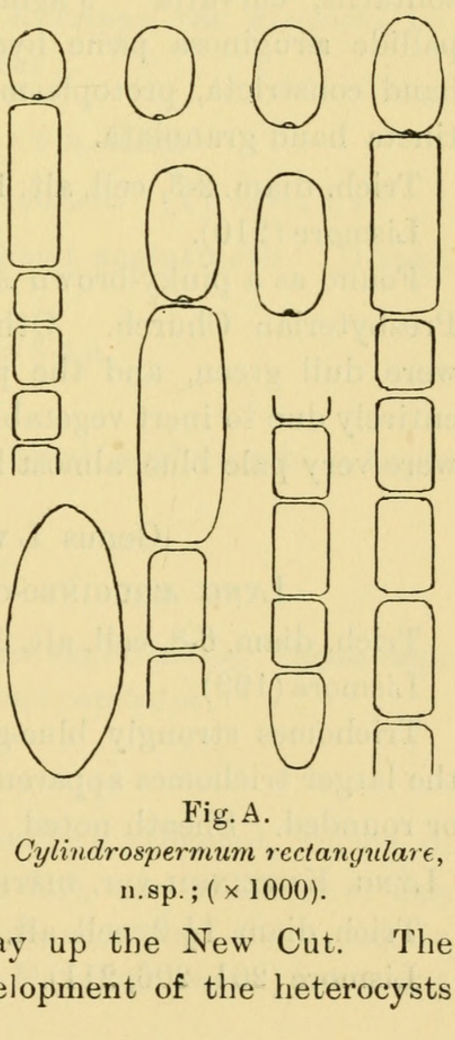

Fig. A.
Cylindrospermum rectangulare, n.sp.; (x 1000).

Found on dripping rocks halfway up the New Cut. The specimen showed very well the development of the heterocysts and of the gonidia. The trichomes and gonidia were very pale blue, almost hyaline. A delicate sheath was distinctly observed.

Genus PLECTONEMA Thuret.

PLECTONEMA NOSTOCORUM Bornet.

Plentiful, much branched, almost hyaline, in a mucilaginous stratum with other *Lyngbyeæ*. I have never found this species pale yellow-green, as noted by Gomont, Monog. d. Oscill., p.103; but almost all the blue-green *Lyngbyeæ* have a yellow-green form.

Lismore (213).

PLECTONEMA CRISPATUM, n.sp. (Pl. xlvi., f.2.)

Stratum sordide olivaceum. Fila primum sessilia cæspitosa, deinde arcte intricata, abundanter pseudo-ramosa, pseudo-ramis solitariis, curvatis. Vaginæ distinctæ hyalinæ. Trichomata pallide æruginosa pæne hyalina, apicibus conicis, ad genicula haud constricta, protoplasmate homogeneo. Dissepimenta distincta haud granulata.

Trich. diam. 2-3, cell. alt. 1-2 μ.

Lismore (210).

Found as a pinky-brown stratum on a zinc-footwasher at the Presbyterian Church. Other parts of the stratum, however, were dull green, and the purple colouration was found to be entirely due to inert vegetable débris. The trichomes themselves were very pale blue, almost hyaline.

Genus LYNGBYA C. Ag.

LYNG. ÆRUGINEO-CÆRULEA (Kütz.) Gomont.

Trich. diam. 6-8, cell. alt. 2-4, plerumque $2\frac{1}{2}$ μ.

Lismore (199).

Trichomes strongly blue-green; dissepiments very distinct, in the larger trichomes apparently minutely granulate; ends conical or rounded. Sheath noted.

LYNG. KUTZINGII var. DISTINCTA (Nord.) Lemm. (Pl. xlvi., f.3)

Trich. diam. $1\frac{1}{2}$-2, cell. alt. circa $1\frac{1}{2}$ μ.

Lismore (201, 206, 211).

Cf. Lemmermann, Engl. Bot. Jahrb., 34, 1905, p.620. Syn., *Lyngbya subtilis* West, Alg. Lake Dist., p.29, Pl, x., f.58 ; *L. Martensiana β distincta* Nord., Alg. Sandvich., p.4; *L. circumcreta* G. S. West, Third Tanganyika Exp., p.174, Pl.9, f.7. Trichomes pale blue, with homogeneous but generally opalescent protoplasm, so that the dissepiments are barely visible; occasionally, however, with translucent protoplasm, when the septa are distinct. The same occurs in *O. splendida*. The cells are square or a little shorter than the diameter, the sheath very delicate, filaments often spirally twisted, apices truncately-rounded. *Lyngbya circumcreta* G. S. West, *l.c.*, is a plankton-form of the species, the coiling of the filaments being a plankton-phenomenon of not infrequent occurrence (cf. *Melosira granulata* var. *circinalis* Playf., Syd. Water-Supply, p.536), and not of any specific value. It should be noted as confirmatory that this form was obtained from the same two localities as *L. Kützingii* var. *distincta*, l.c., pars.308. 309, at the same time of year.

Genus Phormidium Kütz.

Phormidium uncinatum (Ag.) Gomont. (Pl. xlvi., f.4.)

1. Fila distincta, libera, vaginis haud agglutinatis. Dissepimenta plerumque haud granulata.

Trich. diam. 7-8, cell. alt. 2-4, vulgo 3-4 μ.

Lismore (212).

2. Fila distincta, libera, vaginis haud agglutinatis. Septa granulata.

Trich. diam. 8, cell. alt. 4-5 μ.

Lismore (230).

3. Fila distincta, libera, vaginis haud agglutinatis. Septa sæpe granulata. Trichomata omnia apicibus capitatis.

Trich. diam. 8, cell. alt. 4-6 μ,

Lismore (252).

Oscill. uncinata Ag., *Ph. uncinatum* (Ag.) Gomont, Monog. d. Oscill., p.184, Pl. v., f.21, 22. Three, fine, mucous strata of this plant were obtained, not one of which, as stated above, was in the *Phormidium*-condition. The filaments were free, and wandered about the field of view. The trichomes pale blue-green, transparent, attenuate, and curved at the tips; dissepiments distinct, sometimes smooth, sometimes granulate. A great variety of apices were noted, the prevailing types, however, being rounded, capitate, or with depressed conical calyptra.

PHORMIDIUM LUCIDUM (Ag.) Hansg. (Pl. xlvi., f.5.)

Fila distincta, libera; vaginis haud agglutinatis. Trichomata dilutissime æruginosa, ad genicula constricta, cellulis altioribus plerumque dissepimentis incipientibus instructis.

Trich. diam. 8-10; cell. alt. 2-3 μ.

Lismore (213) Cum sequenti intermixtum.

Var. AMŒNUM (Kütz.) mihi. (Pl. xlvi., f.6.)

1. Fila distincta, libera; vaginis haud agglutinatis. Trichomata dilutissime æruginosa semper pæne hyalina, ad genicula non constricta, apicibus conicis vel late-rotundatis, cellulis angustis, dissepimentis conspicuis haud granulatis.

Trich. diam. 5-6; cell. alt. $1\frac{1}{2}$-3 μ, interdum ad 1 μ approx.

Lismore (213).

2. Fila libera. Trichomata saturate æruginosa, apicibus rotundatis subtruncatis, dissepimentis interdum minute granulatis, sæpe septis inconspicuis alternantibus. Cetera ut in f. precedente.

Trich. diam 8-10 (rarius 11); cell. diam. 3-4 μ.

Lismore (213).

3. Fila glabra libera. Trichomata dilute æruginosa, ad genicula quam levissime constricta, apicibus rotundatis conicis, dissepimentis validis non autem granulatis.

Trich. diam. 6; cell. diam. 2-4, vulgo 2 μ.

Lismore (232).

Amphitrix amœna Kützing, (pro parte) Tab. phyc i., p 45, T.79, f.1 (*sec.* Gomont). *Phorm. ambiguum* Gomont, Monog. d Oscill., p.178, Pl. v., f.10. This is a form of *Ph. lucidum* without constricted joints. Not only are the two forms otherwise exactly alike in general characteristics, but, in sample No.213, I find them intermixed; and, in No.232, an intermediate form in which the constriction is very faint, represented only by a minute puncta-spot. In neither of these samples were the filaments in the *Phormidium*-condition.

PHORMIDIUM CORIUM (Ag) Gomont. (Pl. xlvi., f.7.)

Trich. diam. 3-3½; cell. alt. 3-8, vulgo 4 μ.

Lismore (205, 209).

Cf. Gomont, *l.c.*, p.172, Pl. v., f.1, 2. Pale blue, generally transparent, with distinct dissepiments, protoplasm minutely granulate, sometimes a central body in the middle of each cell. Stratum membranous or coriaceous.

Var. ACUMINATUM, n.var. (Pl. xlvi., f.8.)

Formæ typicæ consimile sed latius. Trichomata dilute viridia apicibus acute conicis.

Trich. diam. 5-8; cell. alt. 3-8, apical. 8-10 μ.

Lismore (207, 211, 228).

First obtained from a roadside ditch near the Cathedral. Gomont gives diam. 3-4½ μ for the type, cell. alt. 3-8 μ. Our specimens agree exactly with his details. In this form, the trichomes are green rather than blue, and the natural tips are acutely conical, in broken filaments (with projecting sheath) they may vary from simply rounded to bluntly conical *Phorm. Crouani* Gomont, *l.c.*, p.175, is a still broader form of this species, diam. 7½-10½, cell. alt. 4-8 μ; the description agrees perfectly with that of *Ph. corium*, and var. *acuminatum* just connects the two sizes. I do not see how *Ph. papyraceum* (Ag.) Gomont, *l.c.*, p.173, Pl. v., f.3, 4, can be distinguished from *Ph corium*.

Var. CONSTRICTUM, n.var. (Pl xlvi., f.9.)

Trichomata dilutissime æruginosa, ad genicula constricta, apicibus naturalibus acutissime conicis; cellulis cylindraceis, diametro ad duplum longioribus, protoplasmate minute granulato.

Trich. diam. 4-5; cell. alt. 8 μ.

Lismore (228). Cum priori.

Trichomes about the size of the type, but distinctly constricted at the joints, and very sharply pointed; the cells cylindrical, not quadrate as usual in this species. All the forms of *Ph. corium* were true *Phormidia*, the stratum membranous, sheaths agglutinated.

Genus OSCILLATORIA Vaucher.

OSCILLATORIA PRINCEPS Vaucher (Pl. xlvi., f.10.)

Trich. diam. 28-44, ap. 18; cell. alt. 4-8 μ.

Lismore (187).

Gomont, *l.c.*, p.207, Pl. vi., f.9. Colour pale grey-green, protoplasm very finely granular, dissepiments not granulate. Specimens are often found with a very thick sheath, and there are indications of permanent septa across the sheath between the cells (Pl. xlvi., f.10*c*). Found only in the river here.

OSCILLATORIA CORAKIANA, n.sp. (Pl. xlvi., f.11.)

Fila lata, vaginis observatis. Trichomata subrubicunda vel atrochalybea, viridi tincta, interdum ad genicula constricta; apicibus leviter attenuatis rotundatis, aut arcuatis subtruncatis; cellulis angustis; dissepimentis conspicuis, granulatis; protoplasmate minute granulato.

Trich. diam. 11-12; cell. alt. 2-4 μ.

Coraki (202).

The colour of the trichomes, a pale pinky-brown, or dark grey, flashed with pale green, seems to distinguish this species from all others. The trichomes are sometimes constricted, sometimes not; it is a character that I find to be of very doubtful value.

OSCILLATORIA FORMOSA Bory. (Pl. xlvi., f.12, 13.)

Trichomata dilute cyanea vel dilute viridia, vulgo ad genicula constricta sed non semper, dissepimentis rarissime granulatis.

Trich. diam. 4-7; cell. alt 2-4 μ Vagina repetitim observata

Lismore (201, 206, 207, 208, 221, 226, 229).

Gomont, *l.c.*, p.230, Pl. vii., f.16. Very frequent in the district; the smooth, rounded, uncinate tip cannot be mistaken The breadth is usually 5-6 μ, with cell. alt. 3-4 μ. The dissepiments are almost invariably smooth; in No.229, however, (a pure mucous stratum) the dissepiments have the appearance of thin lines, with 3-4 very distinct granules strung on them.

Var AUSTRALICA, n.var. (Pl. xlvi., f.14.)

Trichomata dimensionibus et ceteris ut in forma typica, cellulis autem protoplasmate spisso, globo centrali colore pallido, ubique zonâ angustâ coloris saturatioris circumcincto.

Trich. diam. 4-8, vulgo 5-6; cell. alt. 2-4, plerumque 3-4 μ.

Lismore (202, 213).

The contents of the cells are peculiarly arranged in this form, giving it a distinct appearance. The protoplasm is opalescent, the central portion very pale and surrounded by a narrow zone slightly darker in colour.

Appendix on the Algal Fungi and Schizomycetes.

ALGAL FUNGI.

CHYTRIDIACEÆ.

Genus CHYTRIDIUM A.Br.

CHYTRIDIUM GREGARIUM Nowakowski.

Filling the carapaces of dead rotifers, as usual. The identification is certain, and I have followed Nowakowski in the nomenclature; but it seems to me that this form is doubtfully placed under *Chytridium.*

Lismore (237, 244).

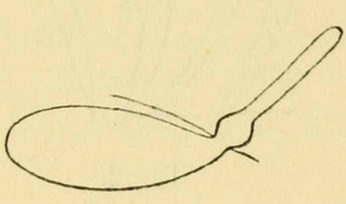

Fig. 1.

Chytridium gregarium; mature cell about to dehisce; (× 665).

CHYTRIDIUM AMPHORIDIUM Playf.

Olpidium amphoridium, e lapsu, Biol. Richm. R., p.137; *Chytridium amphoridium*, ibid., Pl. vii., f.5.

Lismore (220). On *Macrothrix spinosa* (Entomostraca).

CHYTRIDIUM GRACILLIMUM, n.sp.

Cellulæ gracillimæ, ensiformes vel fusiformes; apicibus acutis acuminatis; inferne lateribus ad basin acutam sensim sensimque convergentibus; stipite nullo nec pede. Cytoplasma hyalinum, granulatum, chloroplastidibus nullis. Membrana hyalina tenuissima.

Cell. long. ad 240; lat. 6-8 μ.

Lismore (236) on *Lemna*; (249) on *Moina propinqua* (Entomostraca); (254).

Var. FALCIFORME, n.var.

Cellulæ superne pulcherrime crispatæ.

Long. vertical. 90, lat. 54; cell. diam. 6 μ.

Lismore (236)

This species is very like *Characium ensiforme* Herm., (cf. G. S. West, Br. Frw. Alg., p.200, fig.80D), but it has no stipes or expanded base, and no chlorophyllaceous contents. It is still more like *Chamæsiphon curvatus* Nord., Alg. Sandvich., p.4, T.i., f.2, but the forms of *Chamæsiphon* have a definite sheath of considerable thickness, enclosing a chlorophyllaceous core. The membrane in *Chytridium gracillimum* is very thin, is not of the nature of a sheath, and also there is no chlorophyll in the cell-contents. The species is not uncommon, and small forms may sometimes be met with in numbers.

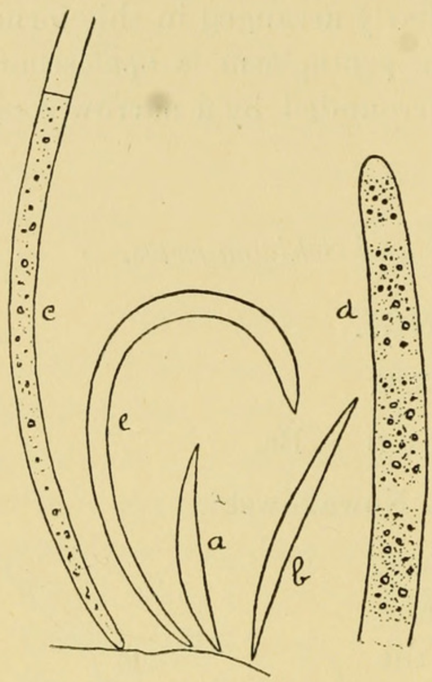

Fig. 2.

Chytridium gracillimum, n.sp.; *a*, *b*, young forms (× 330); *c*, mature cell dehiscing (× 400); *d*, tip of another ripe specimen (× 500); *c*, var. *falciforme*, n.var. (× 330).

CHYTRIDIUM CLAVUM, n.sp.

Cellulæ claviformes, apice inflatæ, capitatæ; inferne lateribus ad basin acutam sensim sensimque convergentibus, stipite nullo nec pede. Cytoplasma hyalinum homogeneum.

Cell. long. 20; lat. 2, ap. 3 μ.

Lismore (254). In quantity on *Hyal. dissiliens*.

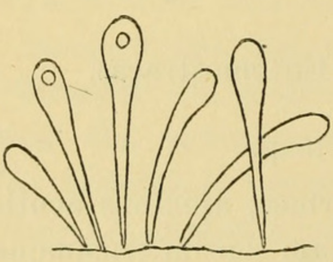

Fig. 3.

Chytridium clavum, n.sp.; (× 665).

Genus TROCHISIA Kütz.

Syn., *Acanthococcus* Lagerheim. In every form mentioned below, the contents of the cell were hyaline, without a trace of chlorophyll.

TROCHISIA HIRTA (Reinsch).

Cell. diam. s.sp. 27-34; sp.long. 4-6 μ. Lismore (225, 236).

Syn., *Acanthococcus aciculiferus* Lag. ; *A. hirtus* Reinsch, Genus *Acanthococcus*, p.240, T. xi., f.1, 5, 15. Reinsch gives diam. 15-32 μ, cf. Biol. Richm. R., Pl. vii., f.2, and the dimensions on p.136.

Var. ELLIPTICA Playf.

Cell. long. s.sp. 74-80, lat. s.sp. 38-62; sp.long. 5-12 μ. Lismore (236, 244). Biol. Richm. R., p.136, Pl, vii., f.1.

TROCHISIA HYSTRIX (Reinsch).

Cell. diam. s.sp. 133; sp. long. 16 μ. Lismore (236).

Reinsch, *l.c.*, p.241, T. xii., f.25. It ought, by rights, I think, to be set down as a variation of *Tr. hirta*. Noted in the same sample with that species and var *elliptica*. Diam. cell. 43-46 μ. Long. spin. 4-7 μ. Reinsch.

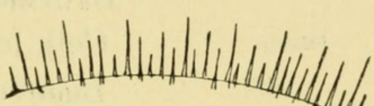

Fig.4. *Trochisia hystrix*; segment of margin; (×665).

TROCHISIA PACHYDERMA (Reinsch)

Cell. diam. s. membr. 18, rugis membr. 2 μ alt. Lismore

Reinsch, *l.c.*, p.240, T. xi., f.8, 9, gives diam. 12-19 μ. A good number of his other species would seem to be only forms of *T. pachyderma*. Eight cells found together, apparently, in a rotifer-skin.

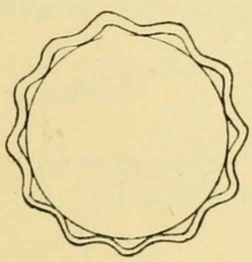

Fig.5. *Trochisia pachyderma*; (×1000).

TROCHISIA LISMORENSIS, n,sp.

Cellulæ sphæricæ setis brevibus bifidis dense vestitæ. Cytoplasma hyalinum.

Cell. diam. s. setis 26; set. long. 4 μ.

Lismore (225).

Two species somewhat like this are *Tr. brachiolata* (Möb.) Lemm., Nord. Plankt., Flagell., &c., p.16, fig.58, and *Tr.* (*Acanth.*) *spinosa* (Reinsch), *l.c.*, p.241, T. xi., f.6. The former is a marine species, and, in both, the spines, though bifid,

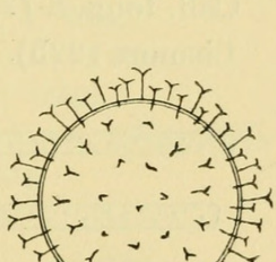

Fig.6. *Trochisia Lismorensis*, n.sp.; (×665).

are of a different character, much stouter and more like elongated verrucæ. In *Tr. Lismorensis*, they are mere bifid setæ, very fine and thickly strewn.

SCHIZOMYCETES.

MICROCOCCUS PRODIGIOSUS (Ehr.) Cohn.

The two zooglœa-forms attributed to *Bacterium termo*, Biol. Richm. R., p.140, Pl. vii., f.14, belong, probably, to this schizophyte. *B. termo* has, indeed, a similar zooglœa-state, but coarser in the grain, on account of its larger cells.

Lismore (206).

BACTERIUM TERMO (Ehr.) Duj.

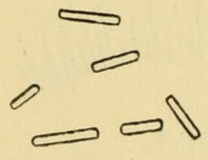

Fig. 7. *Bacterium termo*; (× 1000).

Cell. long. 2-4, lat. 1 μ; plerumque 3 × 1 μ.

Lismore (185, 225).

I have never been able to see the flagella, but, by the way in which the cells tend to adhere to the glass-slip by one end for some moments after the other end is free, I consider they have a flagellum at each end. This getting temporarily stuck to the glass-slip by a flagellum is quite a common occurrence among the smaller flagellates, both animal and vegetable.

BACTERIUM GIGAS, n.sp.

Cellulæ bacilliformes ex inflationibus globosis 4-6 contingentibus compositæ; in extremis flagello singulo præditæ.

Cell. long. 8-12, lat. 2 μ.

Lismore (225).

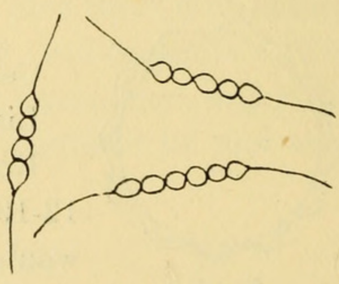

Fig. 8. *Bacterium gigas*, n.sp.; (× 1000).

BACILLUS ULNA Cohn.

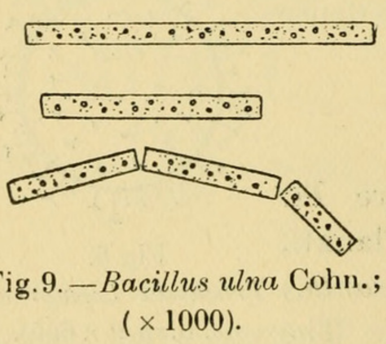

Fig. 9.—*Bacillus ulna* Cohn.; (× 1000).

Cell. alt. 5-20, diam. 2 μ.

Lismore (259).

In quantity with *B. subtilis*, broken filaments in pieces up to 60 μ long. The cells generally 20 μ long, dividing into 10 μ and 5 μ. The contents homogeneous, with scattered granules, large and small. The faint blue colouration, which was apparent, is probably caused by an opalescent refraction from the granules, and not by any colouring matter. *B. ulna* is very rare; I remember to have noted it only once before.

SPIRILLUM VOLUTANS Ehr.

Anfract. diam. 7, alt. 12; fil. diam. $1\frac{1}{2}$ μ.

Lismore (178, 186, 187, 233).

This is exactly the size of Cohn's broadest figures.

Var. MAXIMUM Playf.

Anfract. diam. 14, alt. 24; fil. diam. $1\frac{1}{2}$ μ.

Lismore (233).

The spirals are twice as broad as in the type, cf. Biol. Richm. R., p.139, Pl. vii., f.8.

SPIRILLUM LAXISSIMUM Playf.

Long. 10; fil. diam. 1 μ. Anfractibus singulis.

Lismore (236, 259).

Cf. Biol. Richm. R., p.139, Pl.vii., f.10. *Spirochœte plicatilis* (f.10), and *Vibrio serpens* were also observed.

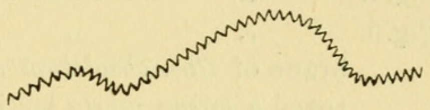

Fig.10.
Spirochœte plicatilis Ehr.; (× 1000).

EXPLANATION OF PLATES XLI.-XLVI.

(All figures magnified 665 diameters, unless stated otherwise.)

Plate xli.

Fig.1.—*Gonatozygon monotœnium* var. *tenue*, n.var.
Fig.2. ,, *Brébissonii* var. *minutum* W. & G. S. West.
Fig.3.—*Penium margaritaceum* var. *pulverulentum*, n.var.; (× 500).
Figs.4, 5. ,, ,, var. *indivisum*, n.var.; (× 500).
Fig.6. ,, *cucurbitinum* var. *subpolymorphum* f. *crassior*, n f.;(× 350).
Fig.7.—*Closterium Spetsbergense* var. *palustre*, n.var.; tip.
Fig.8. ,, *gracile* var. *substrigosum* (Rac.) mihi.
Fig.9. ,, *pronum* Bréb.; (× 335).
Fig.10. ,, *prœlongum* Bréb.; tip of Australian form.
Fig.11.—Mixed form, (*a*) *Cosmarium rectangulare* var. *nodulatum* f. *minor* Playf., (*b*) *Cos. rect.* var. *Boldtii* f. *minor*, n.f.
Fig.12.—*Cosmarium rectangulare* var. *biretum*, n.var.
Fig.13. ,, ,, ,, ,, f. *rectilinearis*, n.f.
Fig.14. ,, ,, ,, ,, f. *angustior*, n.f.

Fig. 15.—*Cosmarium rectangulare* var. *quadrigeminatum* f. *latior*, n.f.; (*a*) side-view.

Fig. 16. ,, ,, var. *angustius* f. *minor*, n.f.; (*a*) end; (× 1000).

Fig. 17. ,, *pseudoprotuberans* v. *australe*, n.var.; (*a*) end; (× 500).

Fig. 18. ,, *moniliforme* var. *subquadratum*, n.var.

Fig. 19. ,, *venustum* var. *Borgei*, nom.nov.

Fig. 20.—*Onychonema filiforme* (Ehr.) Roy & Bissett.

Fig. 21. ,, *læve* var. *micracanthum* Nord.

Plate xlii.

Fig. 1.—*Zygnema pectinatum* (Vauch.) Ag., forma; (× 220).

Fig. 2.—*Spirogyra Grevilleana* var. *australis*, n.var. (*a*, *b*) infertile; (× 335), (*c*) with spores; (× 220).

Fig. 3.—*Cosmarium obsoletum* var. *Sitvense* f. *dentata*, nom.nov.; (× 500).

Fig. 4. ,, *auriculatum* Reinsch, (× 500); (*a*) dentations; (× 1000).

Fig. 5. ,, ,, forma (× 1000) with the protruding membrane of *Cos. obsoletum* at the basal angles. The semicell constituted a *forma mixta* conjointly with a semicell of *Cos. obsoletum* var. *Sitvense* f. *dentata*.

Fig. 6.—*Cosmarium Askenasyi* var. *crateriforme*, n.var.; (× 220).

Fig. 7. ,, *Blyttii* var. *Lismorense*, n.var.; (× 1000).

Fig. 8. ,, *Woodlawnense*, n.sp.; (*a*) end.

Fig. 9.—(*a*) *Xanthidium inchoatum* Nord., f. *spinis nullis*; (× 500).

Fig. 10. ,, ,, var. *Cracoviense* (Rac.) mihi, (also 9*b*); (× 500).

Fig. 11. ,, ,, var. *alpinum* (Rac.) mihi (*a*), with var. *mammillatum* Playf. (*b*); (× 500).

Fig. 12.—*Chlamydomonas globulosa* Perty.

Fig. 13. ,, *monadina* (Ehr.) Stein.

Fig. 14.—*Pteromonas alata* var. *australis*, n.var.; (× 1000).

Fig. 15.—*Phacotus rectangularis*, n.sp., (*a*) side; (× 1000).

Fig. 16. ,, *reticulatus*, n.sp., (*a*) side; (× 1000).

Plate xliii.

Fig. 1. *Chlamydomonas pisiformis* var. *ovalis*, n.var., (*a*) front, (*b*) side; (× 1000).

Fig. 2.—*Phacotus rectangularis*, n.sp., with autospores; (X 1000).

Figs. 3, 4.—*Volvulina Steinii*, gen. et sp.nov.

Figs. 5, 6. ,, ,, var. *subreniformis*, n.var.; (X 500).

Figs. 7-9. ,, ,, var. *parvicellula*, n.var.; (fig. 7 X 500).

Fig. 10. ,, ,, var. *lenticularis*, n.var.

Fig. 11. ,, ,, forma; (X 335).

Plate xliv.

Fig. 1.—*Volvox tertius* var. *guttulosa*, n.var.
Figs. 2, 3. ,, ., var. *tessellata*, n.var.; (× 1000).
Fig. 4. ,, ,, var. *ovalis*, n.var., ripe oospore; (× 500).
Figs. 5, 6. ,, *globator* (L.) Ehr.; (5)surface-view (× 1000), (6)ripe oospore; (× 500).
Figs. 7, 8. ,, *Lismorensis*, n.sp.; (7)front view, (8) optical section.
Fig. 9. ,, ,, var. *globulifera*, n.var., surface-view of daughter-cœnobium.
Fig. 10.—*Chlamydomonas glœocystiformis* var. *australis*, n.var.; (× 1000).
Fig. 11. ,, *pisiformis* Dill.; (× 1000).
Fig. 12. ,, ,, var. *cylindracea*, n.var.; (× 1000).
Fig. 13. ,, ,, var. *ovalis*, n.var.; (× 1000).
Figs. 14, 15. ,, ,, var. *obesa*, n.var.; (× 1000).
Fig. 16. ,, *DeBaryana* Gorosch. f.; (× 1000).
Fig. 17.—*Carteria ovata*, n.sp.; (× 1000).
Fig. 18.—*Pandorina morum* var. *tropica*, n.var.; (× 600).

Plate xlv.

Figs. 1, 2.—*Synura uvella* Ehr.; (× 1000).
Fig. 3. ,, *granulosa*, n sp.; (× 1000).
Figs. 4, 5. ,, *australiensis*, n.sp.; (× 1000).
Figs. 6, 7.—*Tessella volvocina*, gen. et sp.nov.; (6)cœnobium (× 335), (7)cells enlarged (× 665).
Fig. 8.—*Amphora Lagerheimii* var. *minuta*, n.var.; (*a*) frustule, (*b*) with chromatophores, (*c*, *d*) valve-view; (× 1000).
Fig. 9.—*Stauroneis fulmen* Brightwell; (× 335).
Fig. 10.—*Pinnularia streptoraphe* var. *gibbosa* A. Cleve; (× 500).
Fig. 11. ,, *divergens* var. *elliptica* Grun.
Fig. 12.—*Navicula subtilissima* Cleve; (× 1000).
Fig. 13. ,, *minima* Grun.; (× 1330).
Figs. 14, 15 ,, *atomus* Näg., two forms, (15)showing chromatophores; (× 1330).
Fig. 16. ,, *exilissima* Grun.; (*a*) with chromatophores; (× 1330).
Fig. 17. ,, *Flotowii* Grun.; (× 1330).
Fig. 18.—*Vanheurckia rhomboides* (Ehr.) Bréb.
Figs. 19-21. ,, *vulgaris* (Thw.) Van Heurck.
Fig. 22. ,, ,, var. *Richmondiæ*, n.var.
Fig. 23.—*Gomphonema lanceolatum* var. *insigne* Gregory.
Fig. 24.—*Achnanthes Woodlawnensis*, n.sp., (*a*) girdle-view; (× 500).
Figs. 25, 26. ,, *exigua* Grun.,(25) × 1330; (26)showing chromatophores × 1000.

Plate xlvi.

Fig. 1.—*Anabæna oscillarioides* Bory, types of gonidia.
Fig. 2.—*Plectonema crispatum*, n.sp.
Fig. 3.—*Lyngbya Kützingii* var. *distincta* (Nord.) Lemm.; (X 1000).
Fig. 4.—*Phormidium uncinatum* (Ag.) Gomont.
Fig 5. ,, *lucidum* (Ag.) Hansg.
Fig. 6. ,, ,, var. *amœnum* (Kütz.) mihi.
Fig. 7. ,, *corium* (Ag.) Gomont; the cells showing a central body.
Fig. 8. ,, ,, var. *acuminatum*, n. var.
Fig. 9. ,, ,, var. *constrictum*, n. var.
Fig. 10.—*Oscillatoria princeps* Vauch.; (*a*, *b*) tips of trichomes, (*c*) broken filament showing the thick sheath and one of the permanent dissepiments; (X 335).
Fig. 11.—*Oscillatoria Corakiana*, n.sp.
Fig. 12. ,, *formosa* Bory.
Fig. 13. ,, ,, granulate form; (*a*) stouter, (*b*) more slender.
Fig. 14. ,, ,, var. *australica*, n, var.