[*Extracted from the* Linnean Society's Journal—Botany,
vol. xxxviii. *October* 1907.

# Report on the Freshwater Algæ, including Phytoplankton, of the Third Tanganyika Expedition conducted by Dr. W. A. Cunnington, 1904–1905.

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(Plates 2–10.)

[Read 20th December, 1906.]



## I. INTRODUCTION.

The Algæ collected by Dr. Cunnington during his expedition to the large African lakes, in 1904–5, were submitted to me for examination by Dr. Rendle, Keeper of the Botanical Department of the British Museum. Dr. Cunnington's collections were of an extensive nature, and consisted largely of plankton obtained from the three great lakes, Nyasa, Victoria Nyanza, and Tanganyika. A portion of the material was collected in swamps and swampy pools, and a few of the most interesting Algæ were obtained from among the finely divided leaves of certain species of *Utricularia*.

The plankton from Tanganyika is for several reasons of the greatest interest. In the first place, no plankton has previously been reported on from this lake, although accounts have appeared on plankton from both Lake Nyasa and Victoria Nyanza. The species of the phytoplankton are likewise of a very noteworthy character, and the phytoplankton as a whole presents several peculiarities which may be of some slight assistance in the elucidation of the Tanganyika problem.

During recent years a considerable amount of work has been done on the freshwater Algæ of Tropical Africa, but our knowledge of their distribution throughout this vast area still remains very fragmentary and incomplete. No collections have as yet been sufficiently representative, and the published records are both few in number and from districts widely remote from one another. Until much more collecting and systematic examination has been accomplished, it is quite impossible to draw any definite conclusions concerning the geographical distribution of the Algæ in the fresh waters of Tropical Africa.

It would appear that the study of the family Desmidiaceæ is likely to give more valuable evidence regarding a definite region characterized by African types than the investigation of any other family of Algæ, and therefore future collections would have most value if made largely from the permanent and long-standing swamps. Notwithstanding the cosmopolitan nature of no

small number of Desmids, these plants show more decided geographical peculiarities than are to be found among the members of any other large group of Algæ. Even with the present state of our knowledge there is evidence which indicates a very definite Indo-Malayan region, extending to North Queensland, and characterized by certain well-marked types; a second one comprising much of North America and N.W. Europe; and also a third, South-American region, which possibly extends into the South Australian area. The African region may probably embrace Madagascar, and there is also much similarity between some of the Madagascar Desmids and those of Ceylon. More collections of Algæ from Tropical Africa are urgently required consisting of material obtained by carefully squeezing and stripping the aquatic phanerogams and submerged mosses of the swamps.

Only a small proportion of Dr. Cunningtop's material was from swamps, and much of that which had been collected from such situations consisted merely of floating Algæ. This at once explains the fact that the Desmidiaceæ recorded in this paper are in no way striking, or, with few exceptions, particularly representative of the African region. Those which may be regarded as of a distinctly African type are the following :—

*Euastrum hypochondroides*, W. & G. S. W.
*E. personatum*, W. & G. S. W.
*E. pseudopectinatum*, Schmidle.
*Cosmarium glyptodermum*, W. & G. S. W.
*C. planum*, W. & G. S. W.
*C. subauriculatum*, W. & G. S. W.
*C. multiordinatum*, W. & G. S. W.
*C. subconstrictum*, Schmidle.
*Staurastrum limneticum*, Schmidle.
*S. gracile*, Ralfs, var. *subornatum*, Schmidle.

Five Desmids and two filamentous Conjugates I have described as new species.

Of the Chlorophyceæ other than the Conjugatæ, *Œdogonium Kurzii*, Zeller, and *Chodatella subsalsa*, Lemm., are both very interesting species, and seven others I have described as new; one—*Sphinctosiphon polymorphus*, from the plankton of Victoria Nyanza—having had to be regarded as the type of a new genus. Of the other new forms of green Algæ, *Cœlastrum compositum* differs from all other described species of the genus in the composite grouping of its cells.

The Diatoms were both numerous and peculiar, ten species not agreeing with any previously described. The Diatoms of the plankton are particularly noteworthy, especially those of the family Surirellaceæ.

Numerous Myxophyceæ (or blue-green Algæ) were present both in the plankton and the other collections. The genera *Anabæna*, *Calothrix*, *Lyngbya*, *Phormidium*, and *Oscillatoria* were very well represented, and eleven species of various genera have been regarded as new.



The collections were preserved in formalin, and taken as a whole the material was in very good condition for examination.

Considering the somewhat special character of the plankton, and the fact that it constituted one half of the material collected, I have dealt with it separately in the next chapter.

The principal publications on Freshwater Algæ from Tropical Africa, which are particularly important in conjunction with the present paper, are the following :—

F. Cohn : Desmidiaceæ Bongoenses. Festschr. d. naturf. Ges. in Halle, 1879.
C. F. O. Nordstedt : De Algis et Characeis, I. Act. Univ. Lund. xvi., 1880.
—— Conjugatæ. Forschungsr. S.M.S. 'Gazelle,' IV., Berlin, 1888.
E. de Wildeman : Quelques mots sur la flore algologique du Congo. Bull. Soc. roy. bot. Belg. xxviii. 2, 1889.
J. B. De Toni : Algæ Abyssinicæ a cl. Prof. O. Penzig collectæ. Malpighia, Ann. v., fasc. vii.–ix., 1892.
G. v. Lagerheim : Chlorophyceen aus Abessinien und Kordofan. La Nuova Notarisia, ser. 4, 1893.
W. West & G. S. West : A Contribution to our Knowledge of the Freshwater Algæ of Madagascar. Trans. Linn. Soc. ser. 2 (Bot.) v. part 2, 1895.
—— —— Algæ from Central Africa. Journ. Bot. xxxiv. 1896.
—— —— Welwitsch's African Freshwater Algæ. Journ. Bot. xxxv. 1897.
W. Schmidle : Die von Professor Volkens und Dr. Stuhlmann in Ost-Africa gesammelten Desmidiaceen. Engl. Bot. Jahrb. xxvi., 1898.
—— Beiträge zur Algenflora Afrikas. Engl. Bot. Jahrb. xxx., 1901.
—— Schizophyceæ, Conjugatæ, Chlorophyceæ in A. Engler, Die von W. Goetze am Rukwa- und Nyasa-See etc. ges. Pflanzen. Engl. Bot. Jahrb. xxx., 1902.
—— Algen, insbesondere solche des Plankton, aus dem Nyassa-See und seiner Umgebung, gesammelt von Dr. Fülleborn. Engl. Bot. Jahrb. xxxii., 1903.
—— Das Chloro- und Cyanophyceenplankton des Nyassa und einiger anderer innerafrikanischer Seen. Engl. Bot. Jahrb. xxxiii., 1904.
O. Müller : Berichte über die botanischen Ergebnisse der Nyassa-See und Kinga-Gebirgs-Expedition, VII. Bacillariaceen aus dem Nyassalande und einigen benachbarten Gebieten. Engl. Bot. Jahrb. xxxiv., 1905; xxxvi., 1905.

## II. THE PHYTOPLANKTON.

*General remarks.*—The observations on the phytoplankton of Lake Nyasa, Victoria Nyanza, and Lake Tanganyika are largely concerning the occurrence of certain species, and it has been a matter of no small difficulty to identify with certainty some of these plankton-forms. With regard to the species which were present in the collections, the examination of the material has been fairly exhaustive, but owing to the restricted explorations little can be said about the periodicity, or concerning any maximum development which these species may attain. In Lake Nyasa the material was collected in

June 1904, and is chiefly interesting in comparison with material collected by Dr. Fülleborn (1898–1900) and reported upon by Schmidle *. In Victoria Nyanza the material was collected in April 1905, and again the chief interest lies in a comparison with Schmidle's report † upon material collected by Dr. Stuhlmann in Oct. 1892. From Tanganyika, however, the collections were much more extensive, ranging from July 1904 to Feb. 1905, and this is the more gratifying as there are no previous records of phytoplankton from this lake.

The phytoplankton of these large African lakes is at once peculiar in the absence of many genera which are a dominant feature of the European lake-plankton. Most noticeable in this respect are the genera *Dinobryon*, *Asterionella*, *Tabellaria*, *Rhizosolenia*, and *Cœlosphærium*. Schmidle has already commented ‡ upon the absence of *Dinobryon* from Lake Nyasa, and it is similarly absent from both Victoria Nyanza and Tanganyika. In temperate Europe and N. America this genus is one of the most conspicuous of plankton-organisms, having a well-marked maximum period, and it also occurs in abundance in the lakes of more northern latitudes. Its absence from the plankton of the tropics is perhaps due to unsuitable conditions of temperature, as this genus appears to attain its maximum in the European plankton at a temperature below 15° C., whereas the mean temperature of Tanganyika is about 24·7° C. The absence of *Asterionella* and *Rhizosolenia* may be due to the same cause, viz., too high a temperature, the latter genus attaining its maximum in certain European lakes at a temperature below 10° C. The genus *Tabellaria* is absent from the plankton, but *Tabellaria flocculosa* has been observed from other situations in Angola, W. Africa.

*Sphærocystis Schroeteri* is also absent from the collections of phytoplankton which have so far been made in these great African lakes, and as Schmidle has also commented upon its absence from the plankton of Lake Nyasa §, even from collections extending over a period of ten or eleven months, it would appear that the Alga in question is entirely absent from this lake. It is likewise absent from the Tanganyika collections, which are fairly representative of eight months of the year: but, strange to say, it occurred in great abundance in two samples of plankton from the Lofu River which runs into Tanganyika.

The Desmidiaceæ are poorly represented in the plankton of Tanganyika and Lake Nyasa, but in the plankton of Victoria Nyanza Desmids play a conspicuous part. This was not only the case in Dr. Cunnington's material collected in April 1905, but also in Dr. Stuhlmann's material collected in October 1902 ‖. The plankton of Victoria Nyanza thus compares favourably

* W. Schmidle, in Engler, Bot. Jahrb. xxxii. (1903).
† W. Schmidle, *l. c.* xxvi. (1898).
‡ W. Schmidle, *l. c.* xxxii. (1903) p. 8.
§ W. Schmidle, *l. c.* xxxii. (1903) p. 8.
‖ W. Schmidle, *l. c.* xxvi. (1896) p. 6.



with that of the British lakes with regard to its Desmid-flora. Moreover, the most abundant Desmid is *Staurastrum limneticum*, Schmidle, a species of a similar type to *S. Ophiura*, Lund., which latter is generally distributed in many lakes of the western areas of the British Islands.

The Surirellaceæ are well represented, and certain handsome species of *Surirella* seem to have firmly established themselves in the plankton. This is again strictly comparable to the establishment as plankton-species of several large *Surirellas* in the Scottish and Irish lake-plankton *. *Cymatopleura Solea* seems also in many cases to have become a plankton Diatom, and in the plankton of Victoria Nyanza there is a large species which I have named *Cymatopleura Nyansæ*.

Species of *Cœlosphærium*, which constitute no small amount of the European lake-plankton at certain seasons of the year, appear to be quite absent from these African lakes.

As in the European plankton, there is a tendency among certain of the Algæ to a spiral growth, which results in the production of close-coiled filaments. In the Scottish and Irish plankton this feature was principally confined to the filaments of *Anabæna Flos-aquæ* and *A. circinalis*, to certain of the small species of *Mougeotia*, and to the disposition of the frustules in the colonies of *Asterionella* and *Tabellaria*. In the African plankton a spiral twisting is a conspicuous feature of the *Anabæna*-filaments, but the spirals are of a more regular type and the filaments relatively much shorter. In *Lyngbya circumcretum* the same tendency to spiral growth has resulted in the formation of short spiral filaments which have the appearance of little coils of wire. The same spiral character is exhibited by *Lyngbya contorta*, Lemm. Ostenfeld † has described and figured from a lake in Iceland, and Volk ‡ has mentioned as occurring in the Elbe, a similar coiled condition of the filaments of *Melosira granulata*.

It has already been suggested § that the development of this coiled condition is a limnetic character, and it is certainly of great interest to find this character in so many different species and genera of the phytoplankton. Lemmermann ‖ attributes the curvature of the *Melosira*-filaments to the movements of the water. This may be so, but how is it that the majority of *Melosira*-filaments met with in the plankton are quite straight? The filaments

* W. & G. S. West, in Trans. Roy. Soc. Edinburgh, xli. part 3 (1905), p. 515, t. 1. figs. 2–4, t. 2. figs. 4 & 6. W. & G. S. West, in Trans. Roy. Irish Acad. xxxiii. sect. B (1906), p. 89, t. 6. figs. 1 & 3, t. 8. figs. 2 & 3, t. 9. fig. 6.
† C. H. Ostenfeld, in Botanisk Tidsskrift, xxvi. (1904) p. 233, fig. 5 (p. 232).
‡ R. Volk, Hamburgische Elb-Untersuchung I., Hamburg, 1903, p. 113.
§ W. & G. S. West, in Journ. Linn. Soc., Bot. xxxv. (1903) p. 524 (*Mougeotia* sp.) Ostenfeld, 1904, *l. c.* p. 233 (*Melosira granulata* f. *curvata*, Grun.); W. & G. S. West, in Trans. Roy. Soc. Edinburgh, xli. (1905) p. 497 (*Mougeotia* sp.).
‖ E. Lemmermann, in Ber. Deutsch. Bot. Ges. xxii. (1904) p. 17.

of *Melosira granulata* and of *M. nyassensis* in the African plankton were either quite straight or almost straight, and the same remarks apply to the species of *Melosira* in the Scottish and Irish plankton. Ostenfeld points out that the *Melosira*-filaments are straight in the Danish plankton *, but commonly coiled in plankton he examined from a lake in Iceland.

I am not aware of a definite spiral character, such as the one just mentioned, having been developed by any Algæ other than limnetic species †, and another equally well-marked limnetic feature is exhibited by certain of the smaller species of *Synedra*, in which there is a tendency to assume a colonial character owing to the grouping of the frustules in radiating clusters ‡.

Special characters of this nature, which appear only to be fully acquired in the plankton, are most probably directly concerned in increasing the floating-capacity of the species; and the rearrangement of the mucus enveloping all these plants to a greater or less degree, which must be caused by the acquirement of such peculiarities, may also assist their capabilities of suspension.

A strict comparison between the phytoplankton of the three lakes is not possible from the present material, owing to the fact that the collections from each lake were not made at the same seasons of the year. Nevertheless, considerable differences exist which are in no way due to seasonal variations of the plankton-organisms, and these differences are of a highly interesting character. A more complete comparison can be made between Tanganyika and Lake Nyasa than between either of these lakes and Victoria Nyanza, as collections from the two former lakes extend over a corresponding period of about eight months.

The table immediately following has been constructed to show all the species which have been observed in Dr. Cunnington's plankton-collections; after which are paragraphs relating to the peculiarities of the plankton of each lake, Tanganyika receiving rather fuller treatment than the others.

* *Cf.* also C. Wesenberg-Lund, 'Studier over de danske Söers Plankton,' Kjöbenhavn, 1904.

† In the genera *Spirulina* and *Arthrospira* the filaments are usually very much longer and the spirals of much less diameter than in the limnetic spirally-twisted forms. *Spirulina laxissima*, a new species from the plankton of Tanganyika, is particularly interesting, as in correlation with its limnetic existence the filaments are short and the spiral twists of much greater diameter than usual.

‡ Lemmermann has created a subgenus "*Belonastrum*" for the plankton-species which form these stellate or radiating clusters. *Cf.* Ber. Deutsch. Bot. Ges. xviii. (1900) p. 30. In this subgenus of *Synedra* Lemmermann places four species (*S. actinastroides*, *S. berolinensis*, *S. revaliensis*, and *S. limnetica*) and several varieties, of which he gives a summary in the same Journal, xxiv. (1906) pp. 537, 538.



GENERAL TABLE OF PHYTOPLANKTON.

| Species. | Nyasa. | Victoria Nyanza. | Tanganyika. |
|---|---|---|---|
| **Chlorophyceæ.** | | | |
| *Closterium Leibleinii*, Kütz. | .... | .... | × |
| *Cosmarium depressum*, (Näg.) Lund. | .... | × | |
| " *contractum*, Kirchn., var. *ellipsoideum*, (Elfv.) W. & G. S. West. | .... | × | |
| " *moniliforme*, (Turp.) Ralfs | .... | × | |
| *Arthrodesmus Incus*, (Bréb.) Hass., forma | .... | × | |
| *Staurastrum cuspidatum*, Bréb. | .... | × | |
| " *brevispinum*, Bréb., var. *inerme*, Wille | .... | × | |
| " *alternans*, Bréb. | .... | .... | × |
| " *setigerum*, Cleve, var. *Nyansæ*, Schmidle | .... | × | |
| " *tohopekaligense*, Wolle | .... | × | |
| " *leptocladum*, Nordst., forma *africanum* | × | × | |
| " *gracile*, Ralfs, var. *subornatum*, Schmidle | .... | × | |
| " " var. *protractum*, var. n. | × | | |
| " " var. *Nyansæ*, var. n. | .... | × | |
| " *anatinum*, Cooke & Wills, var. *subglabrum*, var. n. | .... | × | |
| " *limneticum*, Schmidle | .... | × | |
| " " var. *aculeatum*, Lemm. | .... | × | |
| *Sphærozosma excavatum*, Ralfs | × | | |
| *Hyalotheca mucosa*, (Dillw.) Ehrenb. | .... | .... | × |
| *Pediastrum simplex*, Meyen | × | × | × |
| " " forma *Sturmii*, (Reinsch) nob. | × | | |
| " " var. *clathratum*, (Schröt.) nob. | × | × | |
| " " " forma *radians* | × | | |
| " " " forma *microporum* | .... | × | |
| " " " forma *ovatum* | × | × | |
| " *duplex*, Meyen | .... | × | × |
| " " var. *clathratum*, A. Br. | .... | × | |
| " " var. *reticulatum*, Lagerh. | .... | × | |
| " *Boryanum*, (Turp.) Menegh. | × | .... | × |
| " " var. *rugulosum*, var. n. | .... | × | |
| " *Tetras*, (Ehrenb.) Ralfs | .... | .... | × |
| " " var. *longicorne*, Racib. | × | | |
| " *integrum*, Näg. | .... | .... | × |
| *Cœlastrum sphæricum*, Näg. | × | × | |
| " *microporum*, Näg. | × | × | |
| " *cambricum*, Arch. | × | | |
| " " var. *intermedium*, (Bohlin) nob. | × | | |
| " " var. *nasutum*, (Schmidle) nob. | .... | × | |
| " *reticulatum*, (Dang.) Senn. | × | × | |
| " *compositum*, sp. n. | .... | × | |
| *Sorastrum Hathoris*, (Cohn) Schmidle | .... | × | |
| *Crucigenia tetracantha*, sp. n. | .... | .... | × |
| *Scenedesmus bijugatus*, (Turp.) Kütz. | .... | .... | × |
| " " forma *arcuatus*, (Lemm.) W. & G. S. West. | .... | .... | × |
| " *acutiformis*, Schröder, var. *brasiliensis*, (Bohlin) W. & G. S. West. | .... | .... | × |
| " *quadricauda*, (Turp.) Bréb. | × | .... | × |
| " " var. *maximus*, W. & G. S. West | .... | × | × |
| *Dimorphococcus lunatus*, A. Br. | .... | × | |

| Species. | Nyasa. | Victoria Nyanza. | Tanganyika. |
|---|---|---|---|
| **Chlorophyceæ** (*continued*). | | | |
| *Ankistrodesmus falcatus*, (Corda) Ralfs, var. *spirilliformis*, G. S. West. | .... | .... | × |
| „ *nitzschioides*, sp. n. | .... | .... | × |
| *Closteriopsis longissima*, Lemm. | × | × | |
| *Selenastrum gracile*, Reinsch | .... | × | |
| *Kirchneriella obesa*, (West) Schmidle | .... | × | |
| *Oocystis lacustris*, Chodat | × | × | × |
| „ *parva*, W. & G. S. West | × | | |
| *Tetraëdron minimum*, (A. Br.) Hansg. | .... | .... | × |
| *Cerasterias rhaphidioides*, Reinsch | .... | .... | × |
| *Richteriella botryoides*, (Schmidle) Lemm., forma *quadriseta*, (Lemm.) Chodat. | .... | .... | × |
| *Chodatella subsalsa*, Lemm. | .... | .... | × |
| *Dictyosphærium pulchellum*, Wood | × | × | × |
| *Botryococcus Braunii*, Kütz. | × | × | × |
| *Ineffigiata neglecta*, W. & G. S. West | .... | × | |
| *Tetracoccus botryoides*, West | .... | .... | × |
| *Sphinctosiphon polymorphus*, gen. et sp. n. | .... | × | |
| *Glœocystis gigas*, (Kütz.) Lagerh. | .... | × | × |
| **Bacillarieæ.** | | | |
| *Melosira granulata*, Ralfs, var. *angustissima*, O. Müll. | × | × | |
| „ *nyassensis*, O. Müll. | × | × | |
| *Cyclotella Kützingiana*, Chauvin | × | × | |
| „ *operculata*, Kütz. | × | .... | × |
| „ *compta*, (Ehrenb.) Kütz. | .... | × | |
| *Stephanodiscus Astræa*, (Ehrenb.) Grun. | × | | |
| „ „ var. *spinulosus*, Grun. | × | × | |
| „ „ var. *minutulus*, (Kütz.) Grun. | × | | |
| *Synedra Acus*, Kütz. | .... | × | × |
| „ „ var. *delicatissima*, (W. Sm.) Grun. | × | × | × |
| „ „ var.? (=*S. revaliensis*, Lemm.) | .... | .... | × |
| „ *actinastroides*, Lemm. | .... | .... | × |
| *Cocconeis Pediculus*, Ehrenb. | .... | .... | × |
| „ *Placentula*, Erhenb. | .... | .... | × |
| *Navicula Tanganyikæ*, sp. n. | .... | .... | × |
| „ *elliptica*, Kütz. | × | .... | × |
| „ *Pupula*, Kütz. | .... | .... | × |
| „ *mutica*, Kütz. | × | | |
| „ *Crucicula*, (W. Sm.) Donkin | × | | |
| „ *bahusiensis*, Grun. | × | .... | × |
| „ *radiosa*, Kütz. | .... | × | × |
| „ *rhynchocephala*, Kütz. | × | .... | × |
| „ *distincta*, sp. n. | .... | .... | × |
| „ *Gastrum*, Ehrenb. | × | .... | × |
| *Schizostauron Crucicula*, Grun. | .... | .... | × |
| *Gyrosigma attenuatum*, (Kütz.) Cleve | .... | .... | × |
| „ *nodiferum*, (Grun.) nob. | .... | .... | × |
| *Cocconema grossestriatum*, (O. Müll.) nob., var. *Tanganyikæ*, var. n. | .... | .... | × |
| „ *cymbiforme*, Ehrenb. | × | .... | × |
| „ *Cistula*, (Ehrenb.) W. Sm., var. *maculata*, (Kütz.) Cleve. | .... | × | |



| Species. | Nyasa. | Victoria Nyanza. | Tanganyika. |
|---|---|---|---|
| *Amphora ovalis*, Kütz. | .... | .... | × |
| „ *coffæiformis*, (Ag.) Kütz. | .... | .... | × |
| *Epithemia turgida*, (Ehrenb.) Kütz. | × | × | × |
| *Rhopalodia gibba*, (Kütz.) O. Müll., var. *ventricosa*, (Grun.) O. Müll. | .... | × | × |
| „ *hirudiniformis*, O. Müll. | × | × | × |
| „ *gracilis*, O. Müll. | .... | .... | × |
| „ „ var. *undulata*, O. Müll. | × | | |
| „ *vermicularis*, O. Müll. | × | × | |
| *Nitzschia Tryblionella*, Hantzsch, var. *littoralis*, (Grun.) Van Heurck. | .... | .... | × |
| „ *Lancettula*, O. Müll. | × | | |
| „ *dissipata*, (Kütz.) Grun., var. *media*, Hantzsch. | .... | .... | × |
| „ *tubicola*, Grun. | .... | .... | × |
| „ *Palea*, (Kütz.) W. Sm. | .... | × | × |
| „ *nyassensis*, O. Müll. | × | .... | × |
| *Surirella Fülleborni*, O. Müll. | .... | × | |
| „ „ var. *elliptica*, O. Müll. | .... | × | |
| „ *bifrons*, (Ehrenb.) Kütz., var. *tumida*, O. Müll. | × | × | |
| „ „ var. *intermedia*, O. Müll. | × | | |
| „ *Malombæ*, O. Müll. | .... | × | |
| „ *Nyassæ*, O. Müll. | × | | |
| „ *plana*, sp. n. | .... | .... | × |
| „ *constricta*, Ehrenb., var. *africana*, O. Müll. | .... | .... | × |
| „ *obtusiuscula*, sp. n. | .... | .... | × |
| „ *Tanganyikæ*, sp. n. | .... | .... | × |
| „ *striatula*, Turp. | .... | .... | × |
| *Cymatopleura Solea*, (Kütz.) W. Sm. | × | × | × |
| „ „ var. *laticeps*, O. Müll. | × | | |
| „ *Nyansæ*, sp. n. | .... | × | |
| **Myxophyceæ.** | | | |
| *Nostoc piscinale*, Kütz. | .... | .... | × |
| „ *carneum*, Ag. | .... | .... | × |
| *Anabæna Flos-aquæ*, (Lyngb.) Bréb., forma | × | .... | × |
| „ „ var. *circularis*, var. n. | .... | .... | × |
| „ sp.? (fil. rigidissim.) | .... | .... | × |
| „ *Tanganyikæ*, sp. n. | .... | .... | × |
| „ sp.? (fil. contort.) | × | | |
| *Plectonema Wollei*, Farlow | .... | .... | × |
| *Lyngbya bipunctata*, Lemm. | × | | |
| „ *circumcreta*, sp. n. | .... | × | |
| „ *limnetica*, Lemm. | .... | .... | × |
| „ *perelegans*, Lemm. | .... | .... | × |
| *Phormidium tenue*, (Ag.) Gom. | .... | .... | × |
| „ *angustissimum*, W. & G. S. West | .... | .... | × |
| *Oscillatoria princeps*, Vauch. | .... | .... | × |
| „ *Cortiana*, Menegh. | .... | .... | × |
| „ *Tanganyikæ*, sp. n. | .... | .... | × |
| „ *tenuis*, Ag. | .... | .... | × |
| *Spirulina laxissima*, sp. n. | .... | .... | × |
| *Glœotrichia longiarticulata*, sp. n. | × | | |
| „ *natans*, (Hedwig) Rabenh. | .... | .... | × |
| *Dactylococcopsis africana*, sp. n. | .... | × | |

| Species. | Nyasa. | Victoria Nyanza. | Tanganyika. |
|---|---|---|---|
| **Myxophyceæ (*continued*).** | | | |
| *Merismopedia elegans*, A. Br. | .... | .... | × |
| „ „ var. *remota*, var. n. | .... | .... | × |
| „ *æruginea*, Bréb. | .... | .... | × |
| „ *glauca*, (Ehrenb.) Näg. | .... | .... | × |
| „ *punctata*, Meyen | .... | .... | × |
| *Gomphosphæria aponina*, Kütz. | .... | .... | × |
| „ *lacustris*, Chodat | × | × | |
| *Microcystis viridis*, (A. Br.) Lemm. | × | × | |
| „ *æruginosa*, Kütz. | × | × | |
| „ *elabens*, (Bréb.) Kütz. | .... | .... | × |
| „ *incerta*, Lemm. | .... | × | |
| *Chroococcus minimus*, (Keissler) Lemm. | × | | |
| „ *turgidus*, (Kütz.) Näg. | .... | .... | × |
| „ *pallidus*, Näg. | .... | × | |
| **Peridinieæ.** | | | |
| *Glenodinium Pulvisculus*, (Ehrenb.) Stein. | .... | .... | × |
| *Peridinium africanum*, Lemm., sp. n. | × | .... | × |
| „ *berolinense*, Lemm., var. *apiculatum*, Lemm., var. n. | .... | .... | × |
| *Peridiniopsis Cunningtonii*, Lemm., sp. n. | .... | .... | × |
| *Ceratium Hirundinella*, O. F. Müll., forma | .... | × | |

*Phytoplankton of Nyasa.*—This lake lies between 9° 30′ and 14° 25′ S. lat., its long axis running almost north and south. It is about 400 miles long, with an average width of 25 miles, and is 1570 ft. above sea-level. Its area is about equal to that of Tanganyika. The phytoplankton has been fairly well investigated by Schmidle from material collected at intervals from April 1898 to Dec. 1900 by Dr. Fülleborn. Schmidle reported upon the species he found in the plankton, the periodicity of the genera so far as he was able to work it out, and the vertical depth to which the various genera extended in the lake. Nyasa is shallow at the north end and very deep towards the south end, no bottom having been found in several places at 1200 feet. Schmidle states that the phytoplankton extends in no trifling quantity to fully 300 ft. from the surface, and at this depth consists principally of Diatoms, with a few Chlorophyceæ and Myxophyceæ.

In Dr. Cunnington's material, collected in June 1904, Chlorophyceæ were not very abundant, and those which did occur were mostly representatives of the Protococcoideæ. Only three Desmids were observed, one of which—*Staurastrum leptocladum* forma *africanum*—was in moderate abundance. Forms of *Pediastrum simplex* and species of *Cœlastrum* were very abundant, and in some of the collections *Closteriopsis longissima* was fairly common. The Diatoms comprised relatively few genera, of which *Melosira*, *Cyclotella*, *Stephanodiscus*, and *Surirella* were conspicuous. A few species of *Navicula* were not uncommon and *Nitzschia nyassensis* was frequent. *Surirella Nyassæ* and *S. bifrons* were very characteristic, the former being a large and handsome species which is apparently peculiar to this lake.



Some of the collections, more especially nos. 15 and 16, were remarkable for the prodigious abundance of a form of *Anabæna Flos-aquæ*. The other Myxophyceæ of importance were *Lyngbya bipunctata* and *Glœotrichia longiarticulata*, sp. n.

A species of *Peridinium*, which Lemmermann has described as *P. africanum*, occurred abundantly in some of the material.

*Phytoplankton of Victoria Nyanza.*—This large sheet of water extends from 0° 25′ N. to 3° S. and from 31° 45′ to 34° 45′ E., occupying an area of 32,167 square miles. Its greatest length is 180 miles and its greatest width 208 miles, its height above the sea being about 3800 ft. The depth is very variable, from about 6 ft. (at 2 miles from the shore) in Speke Gulf in the south to 300 ft. towards the middle, and 620 ft. near the eastern shore.

The material was collected in April 1905, and was decidedly rich in Chlorophyceæ, especially Protococcoideæ and Desmidiaceæ. Of the latter, *Staurastrum limneticum* and *S. tohopekaligense* occurred in great abundance, and *S. leptocladum* forma *africanum*, *S. brevispinum* var. *inerme*, forms of *S. gracile*, and *Cosmarium moniliforme* were fairly common. The Protococcoideæ were both abundant and of diverse character. Conspicuous were numerous forms of *Pediastrum simplex* and large cœnobia of *Cœlastrum reticulatum* and *C. cambricum* var. *nasutum*. *Cœlastrum compositum* is a previously undescribed species in which the grouping of the cells is very peculiar. Fine colonies of *Dimorphococcus lunatus* were not uncommon, and the colonies of *Selenastrum gracile* were the largest and best-developed I have ever seen. *Closteriopsis longissima*, which was present in the material from Lake Nyasa, and which is known from the plankton of several parts of Europe, was frequent, and *Sphinctosiphon polymorphus* is a new genus of the Palmellaceæ in which the mature colonies assume a vermiform character.

The Diatoms were relatively few in number, but included a few fine species of *Surirella*, such as *S. Fülleborni* and *S. Malombæ*, a large new species of *Cymatopleura* (*C. Nyansæ*, sp. n.), and several species of *Cyclotella* and *Melosira*.

The Myxophyceæ were poorly represented except for a few of the Chroococcaceæ. Two species I have considered to be new, *Lyngbya circumcreta* and *Dactylococcopsis africana*. Only a few fragments of a species of *Anabæna* were observed, but this may be due to the season of the year, as this genus was abundant in Tanganyika and Lake Nyasa later in the year.

Of the Peridinieæ, a curious reduced form of *Ceratium Hirundinella* was

rather scarce. The apical horn was very short and only two ant-apical horns were present.

From the examination of Dr. Cunnington's material collected in April, I agree with Schmidle's remarks upon Dr. Stuhlmann's collections which were made in October. The phytoplankton is essentially a Chlorophyceous plankton, and from the abundance of certain species of *Staurastrum*, it has all the features of a Desmid-plankton.

*Phytoplankton of Tanganyika.*—This lake is an elongated sheet of water lying between 3° and 9° S. lat. It has a length of 400 miles and a width varying between 10 and 45 miles. Its area is estimated at 14,000 square miles, and it is situated at 2700 ft. above sea-level. It is a deep lake, the southern end reaching a depth of 980 ft., and the northern end exceeding 1300 ft. in several places. The mean temperature of the water is stated to be 24·7° C. (76·6° F.).

Dr. Cunnington's collections of plankton extended from July 1904 to February 1905, and can be considered as fairly representative of eight consecutive months from July to February inclusive.

The phytoplankton is considerably richer as regards species than that of Lake Nyasa or Victoria Nyanza. The Chlorophyceæ are not particularly abundant, and, as in Lake Nyasa, Desmids are practically absent. In direct contrast to the phytoplankton both of Nyasa and Victoria Nyanza, *Pediastrum simplex* was very scarce and the genus *Coelastrum* was quite absent. *Oocystis lacustris* was the most abundant of the Protococcoideæ, although *Scenedesmus quadricauda* was fairly general, and *Scenedesmus bijugatus* forma *arcuatus* was a feature of the October and November plankton. Other interesting species of the Protococcoideæ were *Crucigenia tetracantha*, sp. n., *Ankistrodesmus nitzschioides*, sp. n., *Cerasterias rhaphidioides*, Reinsch, and *Chodatella subsalsa*, Lemm. The latter is a brackish-water species which occurred in abundance in one of the November collections.

The Diatoms formed a large part of the phytoplankton throughout the whole eight months, and 25 of the species were not observed either in Nyasa or Victoria Nyanza. Eight species of *Navicula* were noted, two of which, *N. Tanganyikæ* and *N. distincta*, are new. The genus *Surirella* was represented by five species, of which three (*S. plana*, *S. obtusiuscula*, and *S. Tanganyikæ*) are new, and one of the others, *S. striatula*, is usually brackish or marine. A Diatom which I have considered to be identical with *Nitzschia nyassensis*, O. Müll., occurred in prodigious abundance from July to September, and in considerable quantity in the other months. The remaining Diatoms of importance were *Synedra actinastroides*, *S. Acus* var.? *vevaliensis*, *Gyrosigma nodosum*, and *Cymbella grossestriata* var. *Tanganyikæ*.

The almost entire absence of Centric Diatoms is a noteworthy feature of the Tanganyika collections, offering a marked contrast to the plankton of Nyasa and Victoria Nyanza, in which *Stephanodiscus*, *Cyclotella*, and *Melosira* abound. Only one species of *Cyclotella* was observed in the Tanganyika plankton and that very sparingly in the November collections.



Of the Myxophyceæ, two pelagic species of *Nostoc* (*N. piscinale* and *N. carneum*) were present in the August collections, and *Anabæna Flos-aquæ* var. *circularis* occurred in large quantity from October to February. So abundant was this *Anabæna* from October to December that the material taken from the tow-nets was of a dull blue-green colour although no spores had been developed. *A. Tanganyikæ*, a new, spirally-twisted species, only occurred in January and February. Four species of *Oscillatoria* were observed, one of which, *O. Tanganyikæ*, is a remarkable new species nearest to the marine *O. subuliformis*. Another new species of interest is *Spirulina laxissima*. The cells in the genus *Spirulina* are normally twisted into a rather close and narrow spiral, and the laxness of the twists in *S. laxissima* may be due to its adaptation to a pelagic existence.

The occurrence of *Plectonema Wollei*, Farlow, in the plankton is also worthy of note. This alga is not uncommon in the more aërated of the fresh waters of the tropics, but usually occurs attached to stones or large aquatic plants, especially in running water. Except for the very rare presence of false branches ("pseudo-rami"), this species appears to me to differ in no essential point from *Lyngbya majuscula*, Harvey, which is the largest of the marine species of *Lyngbya*. May not the presence or absence of false ramification be due to a difference of environment?

Eight species of the Chroococcaceæ were observed in the plankton of Tanganyika which were not observed from the other lakes.

Four species of the Peridinieæ occurred, all of which were most abundant from September to November, about the time of the maximum period of *Anabæna Flos-aquæ* var. *circularis*. *Peridinium africanum* and *Peridiniopsis Cunningtonii* have been described by Lemmermann as new species. *Glenodinium Pulvisculus* was particularly abundant in one of the November collections.

From a careful comparison of the collections there are slight indications that the plankton of this lake may not be uniform throughout. The constituents are probably not in the same proportions in different parts of the lake at the same time, and further observations will probably show that this is especially the case with regard to the relative dominance of *Anabæna Flos-aquæ* and *Synedra Acus* (together with *Nitzschia nyassensis*).

The following table contrasts the relative frequency of the various species observed in the collections from July 1904 to February 1905. "ccc" = very abundant, "cc" = common, "c" = fairly common, "r" = infrequent, "rr" = rare, and "rrr" = very rare.

| Species. | 1904. | | | | | | 1905. | |
|---|---|---|---|---|---|---|---|---|
| | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. |
| **Chlorophyceæ.** | | | | | | | | |
| *Closterium Leibleinii*, Kütz. | .. | .. | .. | .. | .. | .. | .. | rr |
| *Staurastrum alternans*, Bréb. | .. | .. | .. | .. | rrr | | | |
| *Hyalotheca mucosa*, (Dillw.) Ehrenb. | .. | .. | rr | | | | | |
| *Pediastrum simplex*, Meyen | .. | .. | .. | .. | rr | .. | .. | rr |
| „ *duplex*, Meyen | .. | .. | .. | .. | .. | .. | .. | r |
| „ *Boryanum*, (Turp.) Menegh. | .. | .. | .. | rr | rr | | | |
| „ *Tetras*, (Ehrenb.) Ralfs | .. | .. | .. | .. | .. | .. | .. | rr |
| „ *integrum*, Näg. | .. | .. | rrr | .. | rrr | | | |
| *Crucigenia tetracantha*, sp. n. | .. | .. | .. | .. | .. | .. | .. | rrr |
| *Scenedesmus bijugatus*, (Turp.) Kütz. | c | .. | .. | r | | | | |
| „ „ forma *arcuatus*, (Lemm.) W. & G. S. West. | .. | .. | .. | c | cc | | | |
| „ *acutiformis*, Schröder, var. *brasiliensis*, (Bohlin) W. & G. S. West. | .. | .. | .. | r | | | | |
| „ *quadricauda*, (Turp.) Bréb. | .. | r | .. | .. | r | r | r | rr |
| „ „ var. *maximus*, W. & G. S. West. | .. | .. | .. | r | rr | r | .. | rr |
| *Ankistrodesmus falcatus*, (Corda) Ralfs, var. *spirilliformis*, G. S. West. | .. | .. | .. | .. | rr | | | |
| „ *nitzschioides*, sp. n. | .. | .. | .. | .. | rrr | | | |
| *Tetraëdron minimum*, (A. Br.) Hansg. | rrr | | | | | | | |
| *Cerasterias rhaphidioides*, Reinsch. | .. | .. | .. | .. | rrr | | | |
| *Richteriella botryoides*, (Schmidle) Lemm., forma *quadriseta*, (Lemm.) Chodat. | .. | .. | .. | .. | rrr | | | |
| *Chodatella subsalsa*, Lemm. | .. | .. | .. | .. | r | | | |
| *Dictyosphærium pulchellum*, Wood | .. | .. | .. | .. | r | | | |
| *Tetracoccus botryoides*, West | rr | .. | .. | rr | rr | | | |
| *Botryococcus Braunii*, Kütz. | .. | .. | .. | .. | .. | c | | |
| *Glœocystis gigas*, (Kütz.) Lagerh. | .. | .. | .. | r | | | | |
| **Bacillarieæ.** | | | | | | | | |
| *Cyclotella operculata*, Kütz. | .. | .. | .. | .. | r | | | |
| *Synedra Acus*, Kütz. | .. | .. | cc | c | c | c | | |
| „ „ var. *delicatissima*, (W. Sm.) Grun. | cc | c | c | ccc | ccc | c | c | |
| „ „ ? var. *revaliensis*, (Lemm.) | .. | .. | .. | rrr | rr | r | c | c |
| „ *actinastroides*, Lemm. | cc | c | c | r | r | rr | rrr | |
| *Cocconeis Pediculus*, Ehrenb. | rr | r | | | | | | |
| „ *Placentula*, Ehrenb. | .. | .. | r | r | c | | | |
| *Navicula Tanganyikæ*, sp. n. | .. | rr | rr | .. | r | .. | .. | rr |
| „ *elliptica*, Kütz. | .. | .. | .. | r | r | | | |
| „ *Pupula*, Kütz. | .. | rr | .. | .. | r | r | .. | r |
| „ *bahusiensis*, Grun. | .. | .. | .. | .. | .. | rrr | | |
| „ *radiosa*, Kütz. | .. | c | c | .. | .. | r | | |
| „ *rhynchocephala*, Kütz. | .. | r | r | .. | r | | | |
| „ *distincta*, sp. n. | .. | .. | .. | .. | rr | | | |
| „ *Gastrum*, Ehrenb. | .. | r | c | c | c | r | | |
| *Schizostauron Crucicula*, Grun. | .. | rr | .. | rr | rr | | | |
| *Gyrosigma attenuatum*, (Kütz.) Cleve | .. | .. | .. | .. | r | .. | rr | r |
| „ *nodiferum*, (Grun.) nob. | .. | .. | .. | .. | rrr | | | |
| *Cocconema grossestriatum*, (O. Müll.) nob., var. *Tanganyikæ*, var. n. | .. | .. | .. | .. | rr | rrr | | |
| „ *cymbiforme*, Ehrenb. | .. | .. | r | rr | | | | |
| *Amphora ovalis*, Kütz. | .. | .. | r | c | r | r | .. | c |



| Species. | 1904. | | | | | | 1905. | |
|---|---|---|---|---|---|---|---|---|
| | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. |
| *Amphora coffæiformis*, (Ag.) Kütz. | .. | .. | .. | rrr | | | | |
| *Epithemia turgida*, (Ehrenb.) Kütz. | .. | .. | rrr | .. | rr | | | |
| *Rhopalodia gibba*, (Kütz.) O. Müll., var. *ventricosa*, (Grun.) O. Müll. | .. | rrr | .. | c | | | | |
| „ *hirudiniformis*, O. Müll. | c | .. | .. | r | r | | | |
| „ *gracilis*, O. Müll. | rr | .. | .. | .. | rr | | | |
| *Nitzschia Tryblionella*, Hantzsch, var. *littoralis*, (Grun.) Van Heurck. | .. | .. | rr | | | | | |
| „ *dissipata*, (Kütz.) Grun., var. *media*, Hantzsch. | .. | .. | .. | rr | | | | |
| „ *tubicola*, Grun. | rrr | .. | .. | .. | rr | | | |
| „ *Palea*, (Kütz.) W. Sm. | .. | .. | r | | | | | |
| „ *nyassensis*, O. Müll. | cc | ccc | ccc | c | c | | | |
| *Surirella plana*, sp. n. | .. | .. | .. | .. | .. | .. | .. | rr |
| „ *constricta*, Ehrenb., var. *africana*, O. Müll. | .. | .. | rr | rrr | rr | | | |
| „ *obtusiuscula*, sp. n. | .. | .. | .. | rr | rr | | | |
| „ *Tanganyikæ*, sp. n. | .. | r | r | .. | r | | | |
| „ *striatula*, Turp. | .. | .. | .. | .. | .. | .. | rr | r |
| *Cymatopleura Solea*, (Kütz.) W. Sm. | .. | r | .. | rr | r | r | .. | rr |
| **Myxophyceæ.** | | | | | | | | |
| *Nostoc piscinale*, Kütz. | .. | r | | | | | | |
| „ *carneum*, Ag. | .. | rr | | | | | | |
| *Anabæna Flos-aquæ*, (Lyngb.) Bréb., forma | .. | .. | .. | .. | r | c | | |
| „ „ var. *circularis*, var. n. | .. | .. | .. | ccc | ccc | ccc | c | r |
| „ sp.? (fila rigidissima) | .. | .. | .. | .. | rr | | | |
| „ *Tanganyikæ*, sp. n. | .. | .. | .. | .. | .. | .. | r | cc |
| *Plectonema Wollei*, Farlow | rr | .. | .. | c | | | | |
| *Lyngbya perelegans*, Lemm. | .. | c | .. | .. | rr | | | |
| „ *limnetica*, Lemm. | c | | | | | | | |
| *Phormidium tenue*, (Ag.) Gomont | .. | .. | .. | .. | rr | .. | .. | r |
| „ *angustissimum*, W. & G. S. West | .. | .. | .. | .. | cc | rr | r | |
| *Oscillatoria Princeps*, Vauch. | .. | rrr | | | | | | |
| „ *Cortiana*, Menegh. | .. | .. | .. | .. | .. | .. | rrr | |
| „ *Tanganyikæ*, sp. n. | .. | .. | .. | .. | .. | rr | .. | r |
| „ *tenuis*, Ag. | .. | .. | rr | | | | | |
| *Spirulina laxissima*, sp. n. | .. | .. | .. | .. | c | | | |
| *Glœotrichia natans*, (Hedwig) Rabenh. | .. | cc | | | | | | |
| *Merismopedia elegans*, A. Br. | .. | .. | .. | rrr | | | | |
| „ „ var. *remota*, var. n. | .. | .. | .. | .. | .. | .. | .. | rr |
| „ *æruginosa*, Bréb. | .. | .. | .. | rr | | | | |
| „ *glauca*, (Ehrenb.) Näg. | .. | .. | .. | .. | .. | .. | .. | c |
| „ *punctata*, Meyen | .. | .. | .. | .. | rr | | | |
| *Gomphosphæria aponina*, Kütz. | cc | .. | .. | rr | | | | |
| *Microcystis elabens*, (Bréb.) Kütz. | rr | .. | rr | | | | | |
| *Chroococcus turgidus*, (Kütz.) Näg. | .. | .. | .. | .. | .. | .. | .. | rrr |
| **Peridinieæ.** | | | | | | | | |
| *Glenodinium Pulvisculus*, (Ehrenb.) Stein | .. | .. | r | r | cc | | | |
| *Peridinium africanum*, Lemm., sp. n. | .. | .. | .. | .. | r | | | |
| „ *berolinense*, Lemm., var. *apiculatum*, Lemm., var. n. | .. | .. | .. | c | r | | | |
| *Peridiniopsis Cunningtonii*, Lemm., sp. n. | .. | .. | .. | c | r | | | |

It will be seen from the above table that the phytoplankton is richest in species in October and November, especially the latter month. In these months occur the maxima of *Scenedesmus bijugatus* f. *arcuatus*, *Synedra Acus* (and var. *delicatissima*), *Navicula Gastrum*, *Anabæna Flos-aquæ* (and var. *circularis*), *Phormidium angustissimum*, *Spirulina laxissima*, and *Glenodinium Pulvisculus*. In December there is a marked general decrease in the number of species. In January (the following month) the decrease in the Chlorophyceæ and Myxophyceæ is very noticeable, and concurrently a great quantity of *Nauplius*-larvæ appear in the plankton.

*Plankton from the Lofu River.*—This river runs into Tanganyika, and two tubes of plankton-material were collected from it by Dr. Cunnington in October 1904. The phytoplankton differs very much from that of Tanganyika, and the species bear much resemblance to those of the surrounding pools and swamps, from which they are doubtless recruited. Of the thirty species observed in this river-plankton only one occurred in the plankton of the lake itself.

The occurrence of *Sphærocystis Schroeteri*, Chodat, is very remarkable. This Alga is one of the most conspicuous features of the European freshwater phytoplankton, and is rarely found except in the plankton of lakes. No specimens were observed in the collections from Tanganyika itself, nor any from Lake Nyasa or Victoria Nyanza, but it was present in great abundance in the Lofu River and the specimens were exceedingly well developed.

The following species were observed :—

**Chlorophyceæ.**

*Œdogonium*, sp.
*Myxonema subuligerum*, (Kütz.) Hazen.
*Ulothrix tenerrima*, Kütz.
*Mougeotia*, sp.
*Zygnema*, sp.
*Spirogyra*, spp.
*Gonatozygon monotœnium*, De Bary.
*Closterium Venus*, Kütz.
*Pleurotœnium subcoronulatum*, (W. B. Turn.) W. & G. S. West.
„ *elatum*, (W. B. Turn.) Borge, var. *conjunctum*, (W. B. Turn.) W. & G. S. West.
*Euastrum denticulatum*, (Kirchn.) Gay.
*Micrasterias americana*, (Ehrenb.) Ralfs.
*Cosmarium Pseudobroomei*, Wolle.
„ *Blyttii*, Wille.
„ *binum*, Nordst.
„ *margaritatum*, (Lund.) Roy. & Biss.
„ *nitidulum*, De Not.



*Hyalotheca mucosa*, (Dillw.) Ehrenb.
*Scenedesmus denticulatus*, Lagerh., var. *linearis*, Hansg.
„ *obliquus*, (Turp.) Kütz.
*Ankistrodesmus falcatus*, (Corda) Ralfs.
*Sphærocystis Schroeteri*, Chodat.

**Bacillarieæ.**

*Synedra Ulna*, (Nitzsch) Ehrenb.
„ „ var. *splendens*, (Kütz.) Van Heurck.
*Achnanthes linearis*, (W. Sm.) Grun.
*Vanheurckia vulgaris*, (Thw.) Van Heurck.
*Gomphonema parvulum*, (Kütz.) Grun.
*Cocconema gracile*, (Rabenh.) G. S. West.
„ *lævе*, (Näg.) nob.
*Surirella robusta*, Ehrenb., var. *splendida*, (Ehrenb.) Van Heurck.

**Myxophyceæ.**

*Lyngbya bipunctata*, Lemm.

## III SYSTEMATIC ACCOUNT OF THE ALGÆ OF THE COLLECTIONS.

This portion of the paper is devoted to a complete systematic account of all the Algæ observed in Dr. Cunnington's collections, those from pools and swamps, from scrapings of wet rocks, &c., being included along with the plankton. The collections from Tanganyika and the vicinity were the most numerous, and this fact accounts largely for the greater number of species recorded from that area. The few collections from the vicinity of Victoria Nyanza contained a relatively greater variety of Algæ, and had more collections been made in the area, a very rich Alga-flora would undoubtedly have been revealed.

The absence of plants belonging to the Stigonemaceæ is somewhat remarkable, the genus *Nostochopsis* being the only representative of the family observed. Species of *Hapalosiphon* are of general occurrence in the swamps and marshes of the tropics, not to mention certain of the bog-loving and rupestral *Stigonema*, and four species of the first-mentioned genus have already been recorded from Tropical Africa.

Several of the Algæ observed have been excluded from this account owing to the impossibility of identifying them with any degree of certainty. Such species were mostly in a fragmentary condition, and amongst them were two species of *Nostoc* from the Tanganyika area, a species of *Calothrix* from Deep Bay, Nyasa, and a *Batrachospermum* from the Lofu River, Tanganyika.

One genus, thirty-six species, and eighteen varieties and forms are here described for the first time.

The Peridinieæ have been examined, and the new forms described, by Mr. E. Lemmermann of Bremen, to whom I offer my best thanks for his kindly assistance on this as on other occasions, with this group of flagellate organisms.

## Class CHLOROPHYCEÆ.

### Order ŒDOGONIALES.

### Family ŒDOGONIACEÆ.

#### Genus ŒDOGONIUM, *Link*.

1. ŒDOGONIUM CRYPTOPORUM, *Wittr. Dispos. Œdog. Suec.* (1870) p. 19; *Prodr. Monog. Œdog.* (1874) p. 7.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

2. ŒDOGONIUM HIRNII, *Gutw. in Rospraw. matem.-przy. Akad. Umiej. Krakow.* xxxii. (1897) p. 2, t. 5. fig. 1; *Hirn, in Act. Soc. Sci. Fennicæ*, xxvii. (1900) p. 93, t. 5. fig. 29.

| | | | |
|---|---|---|---|
| Crass. cell. veget. | 11–13 $\mu$; | altit. | 4–5-plo major; |
| „ oogon. | 34–37 $\mu$; | „ | 37–40 $\mu$; |
| „ oospor. | 30–31 $\mu$; | „ | 30–31 $\mu$; |
| „ cell. antherid. | 11 $\mu$; | „ | 7– 8·5 $\mu$. |

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

This species has previously been observed only in Galicia and Ireland.

Var. AFRICANUM, var. n.

Var. cellulis vegetativis leviter crassioribus et brevioribus, levissime capitellatis; oogoniis paullo majoribus; antheridiis 3-cellularibus.

| | | | |
|---|---|---|---|
| Crass. cell. veget. | 13–15 $\mu$; | altit. | 2½–3-plo major; |
| „ oogon. | 39–40 $\mu$; | „ | 38 $\mu$; |
| „ oospor. | 33–34 $\mu$; | „ | 33–34 $\mu$; |
| „ cell. antherid. | 13–13·5 $\mu$; | „ | 5– 6 $\mu$. |

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

3. ŒDOGONIUM DICTYOSPORUM, *Wittr. Prodr. Monogr. Œdog.* (1874) p. 13; *Hirn, l. c.* p. 103, t. 7. fig. 43.

Forma oogoniis et oosporis ovato-ellipsoideis, paullo majoribus.

| | | | |
|---|---|---|---|
| Crass. cell. veget. | 14–16 $\mu$; | altit. | 3–5-plo major; |
| „ oogon. | 42 $\mu$; | „ | 52 $\mu$; |
| „ oospor. | 40 $\mu$; | „ | 50 $\mu$; |
| „ cell. antherid. | 13 $\mu$; | „ | 8–9 $\mu$. |

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).



4. ŒDOGONIUM KURZII, *Zeller, in Hedwigia*, xii. (1873) p. 189; *Hirn, in Act. Soc. Sci. Fennicæ*, xxvii. (1900) p. 135, t. 16. fig. 93.

| | | | |
|---|---|---|---|
| Crass. cell. veget. | 47–51 $\mu$; | altit. | 2–5-plo major; |
| „ oogon. | 78–90 $\mu$; | „ | 111–121 $\mu$; |
| „ oospor. | 75–86 $\mu$; | „ | 80– 90 $\mu$; |
| „ cell. antherid. | 44–50 $\mu$; | „ | 6– 16 $\mu$. |

**Nyasa.**—In swamp, Karonga (29 June, 1904; no. 32).

This interesting species was in fine fruiting condition. It has only previously been found in the Pegu province of E. India. Hirn states that the number of cells composing the antheridia may be as many as six. In the African specimens four or five was the usual number, but some of the antheridia were composed of as many as 15 cells. The hypogynous position of the antheridia was very characteristic.

5. ŒDOGONIUM KITUTÆ, sp. n.

*Œ.* dioicum, nannandrium; oogoniis singulis vel binis, subglobosis vel obovato-globosis, poro superiore apertis; oosporis globosis, oogonia non complentibus, membrana glabra; cellulis suffultioriis tumidis; androsporangiis . . . . . ? cellula terminali obtusa; nannandribus elongatis, leviter curvatis, oblongis, inferne angustioribus, in cellulis suffultioriis et oogoniis sedentibus, antheridio interiori (?).

| | | | |
|---|---|---|---|
| Crass. cell. veget. | 26 $\mu$; | altit. | 5–7-plo major; |
| „ oogon. | 76–78 $\mu$; | „ | 75–80 $\mu$; |
| „ oospor. | 72 $\mu$; | „ | 72 $\mu$; |
| „ cell. suffult. | 44 $\mu$; | „ | 3-plo major; |
| „ nannandr. | 12–13 $\mu$; | „ | 58–66 $\mu$. |

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

No examples of this species were observed in which the antheridia were fully formed, but from the structure of the dwarf-males (nannandria) there can be little doubt that they are internal in development. The only diœcious nannandrous species in which the antheridia are developed internally within the dwarf-males, and which can be compared with *Œ. Kitutæ* in respect of size of vegetative cells and form of oogonia and oospores, are *Œ. alternans*, Wittr. & Lund., *Œ. cataractum*, Wolle, and *Œ. cyathigerum*, Wittr.

*Œ. Kitutæ* differs from *Œ. alternans* in the smaller size of its vegetative cells, which are more elongated, and in the oospores not filling the oogonia. The oogonia are also much less numerous than in *Œ. alternans*, and they are only found singly or in pairs near the ends of the filaments.

From *Œ. cyathigerum* it is distinguished by its relatively larger and differently-shaped oogonia and oospores, the latter being destitute of the longitudinal costæ.

It should also be compared with *Œ. Borisianum*, (Le Clerc) Wittr., from

which it differs in its slightly thicker vegetative cells, its larger oogonia and oospores, and in its internal antheridia. The oogonia are developed in a very similar manner and in the same part of the filament as those of *Œ. Borisianum*.

Note.—Sterile species of *Œdogonium* were observed from the following localities:—**Nyasa.** In swamp, Kota Kota (20 June, 1904; no. 18); in swamp, Karonga (2 July, 1904; no 34); small sp. with capitellate cells in the plankton of Monkey Bay (17 June, 1904; no. 15), and off Vahambwera Point (24 June, 1904; no. 24).—**Tanganyika.** In swamp, Kituta (23 Aug. 1904; no. 72); on surface of swampy pond, Mrumbi (27 Dec. 1904; no. 195); in the plankton of Lofu River (5 Oct. 1904; no. 124).

Genus BULBOCHÆTE, *Ag.*

6. Bulbochæte elatior, *Pringsh. Jahrb.* i. p. 73 (1858); *Hirn, in Act. Soc. Scient. Fennicæ*, xxvii. (1900) p. 321, t. 51. fig. 327.

| | | | |
|---|---|---|---|
| Crass. cell. veget. ..... | 14–17 $\mu$; | altit. | 2–3-plo major; |
| „ oogon. ..... | 41–43 $\mu$; | „ | 36–38 $\mu$; |
| „ cell. androsp. ... | 12 $\mu$; | „ | 9 $\mu$; |
| „ stip. nannandr.. | 8 $\mu$; | „ | 23 $\mu$; |
| „ cell. antherid.... | 7 $\mu$; | „ | 11 $\mu$. |

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

Note.—Sterile species of *Bulbochæte* were observed from the two following localities:—**Nyasa.** In swamp, Kota Kota (20 June, 1904; no. 18).—**Tanganyika.** Surface of swamp, Toa (10 Jan. 1905; no. 208).

Order CHÆTOPHORALES.

Family **ULOTRICHACEÆ.**

Genus ULOTHRIX, *Kütz.*

7. Ulothrix tenerrima, *Kütz. Phyc. Germ.* (1845) p. 253, t. 9. fig. 1; *Sp. Alg.* (1849) p. 346; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 366; *Hazen, in Mem. Torr. Bot. Club*, xi. no. 2 (1902) p. 151, t. 21. figs. 3, 4.

Crass. fil. 7·5–8·5 $\mu$; cellulis diametro 1–1¾-plo longioribus.

**Tanganyika.**—In plankton, surface of Lofu River (5 Oct. 1904; no. 124).

Genus URONEMA, *Lagerh.*

8. Uronema confervicolum, *Lagerh. in Malpighia* (1887), p. 518, t. 12. figs. 1–10.

Crass. fil. 4·5–6·5 $\mu$.



**Victoria Nyanza.**—Among *Utricularia* in swampy pool near Bukoba (20 Aug. 1905; no. 618).

**Tanganyika.**—Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905; no. 611).

Family **CHÆTOPHORACEÆ.**

Genus CHÆTOPHORA, *Schrank.*

9. ? Chætophora elegans, (*Roth*) *Ag. Dispos. Alg. Suec.* 42 (1812); *Cooke, Brit. Freshw. Alg.* (1883) p. 194, t. 78. fig. 2.

Crass. cell. 3·5–5·5 $\mu$.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 123); in small gelatinous masses among *Myxonema subuligerum*. The specimens were insufficient for accurate identification.

Genus MYXONEMA, *Fries*, 1825.

10. Myxonema subuligerum, (*Kütz.*) *Hazen, in Mem. Torr. Bot. Club*, xi. (1902) p. 200, t. 30.—Stigeoclonium subuligerum, *Kütz. Sp. Alg.* (1849) p. 354; *Tab. Phyc.* iii. (1853) t. 5. fig. 1.

Crass. fil. prim. 14·5–16 $\mu$; crass. ram. circ. 6–10 $\mu$.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124)

Order CLADOPHORALES.

Family **CLADOPHORACEÆ.**

Genus CHÆTOMORPHA, *Kütz.*

11. Chætomorpha Linum, *Kütz. Phyc. Germ.* (1845) p. 204; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 327.—Conferva Linum, *O. F. Müll.* Chætomorpha sutoria, *Berk.*

Crass. fil. 108–161 $\mu$; crass. membr. cell. 6–8 $\mu$.

**Tanganyika.**—Dredged from a few fathoms, Niamkolo Bay (3 Aug. 1904; no. 40). Floating on the surface, Kituta Bay (26 Aug. 1904; no. 79).

Genus CLADOPHORA, *Kütz.*

12. Cladophora fracta, (*Dillw.*) *Hass. Brit. Freshw. Alg.* (1845) p. 216. t. 55; *Kütz. Sp. Alg.* (1849) p. 410.—C. fracta *a.* fracta normalis, *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 334.

Forma FLOTOWIANA, (*Kütz.*) *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 335.

Crass. fil. prim. 80–102 $\mu$; crass. ram. 65–70 $\mu$; crass. ramul. 25–32 $\mu$.

**Tanganyika.**—Scraped from the bottom of Dr. Cunnington's "dau" (24 Jan. 1905; no. 216).

The branches of the first order were somewhat patent and subdichotomously branched; those of the second order (ramuli) were short, often papilliform and unicellular, or even merely curved (subuncinate) outgrowths from the upper extremities of the cells of branches of the first order.

13. CLADOPHORA CRISPATA, (*Roth*) *Kütz. Phyc. Gen.* (1843) p. 264; *Rabenh. l. c.* p. 336; *Cooke, Brit. Freshw. Alg.* p. 143, t. 55. fig. 3.

**Tanganyika.**—Growing on grass-stems close to the shore, Kituta Bay (23 Aug. 1904; no. 73).

Forma parva, parce ramosa, articulis diametro 5–12-plo longioribus; cytiodermate crasso, distincte plicato-striato.

Crass. fil. prim. 48–58 $\mu$; crass. ram. 23–27 $\mu$.

**Nyasa.**—Dredged in three fathoms, growing on bivalve shells, Anchorage Bay (no. 11).

Forma parva, rigida, parce ramosa, filis usque ad 2·5 cm. longis.

Cross. fil. prim. 95–104 $\mu$; crass. ram. 30–64 $\mu$.

**Victoria Nyanza.**—Growing on rocks just below the water-level, Bukoba (17 Apr. 1905; no. 247).

14. CLADOPHORA CANALICULARIS, (*Roth*) *Kütz. Sp. Alg.* (1849) p. 109 *Rabenh. l. c.* p. 342.

Forma CAPITELLATA.

Forma parva, usque ad 2 cm. alta, ramosissima, ramis basi connatis; articulis diametro 4–8-plo longioribus, distincte capitellatis, ad genicula plus minusve constrictis.

Crass. fil. prim. 26–34 $\mu$; crass. ram. 18–24 $\mu$.

**Nyasa.**—On rocks at water-level, Deep Bay (25 June, 1904; no. 26).

**Tanganyika.**—Scraped from the bottom of Dr. Cunnington's "dau" (24 Jan. 1905; no. 217).

15. CLADOPHORA BRACHYSTELECHA, *Rabenh. Alg. Sachs.* no. 654 (1862); *Fl. Europ. Alg.* iii. (1868) p. 343.

Fila usque ad 4 mm. alta, densissime radiata circa culmos vetustos pelagios, ramosissima; ramis divaricatis et intricatis; articulis diametro 5–11-plo longioribus.

Crass. fil. prim. 50–64 $\mu$; crass. ram. et ramul. 27–35 $\mu$.

**Tanganyika.**—Thickly covering floating fragments of stems collected in the tow-nets off Niamkolo Island (29 July, 1904; no. 36).



16. CLADOPHORA INCONSPICUA, sp. n.

*C.* pallide viridis, minuta, calce partim incrustata, in lapidibus litoris erosis; cæspitibus 1–3 mm. alta, valde et dichotome ramosa, ramis sursum subdichotome ramulosis, ramis et ramulis plerumque crassitudine æqualibus, insertione ramorum laterali vel apicali; cellulis (fil. prim., ramorum, et ramulorum) diametro $3\frac{1}{2}$–$8\frac{1}{2}$-plo longioribus; cellula apicali ramorum mucronata; membrana firma et subcrassa.

Crass. fil. prim. 50–56 $\mu$; crass. ram. et ramul. 18–40 $\mu$; crass. ramul. ult. 12–15 $\mu$.

**Tanganyika.**—On stones, dredged in a few fathoms, Niamkolo.

The pebbles on which this *Cladophora* was growing were coated with a deposit of lime about 4–5 mm. in thickness, the surface of which was much eroded, and the minute tufts of the Alga occupied the numerous irregular depressions and holes covering the exposed surface of the incrustation. The pebbles were of a flinty nature, consisting of dark-coloured impure silica, and the outer incrustation of lime containing the hollows was of a brownish-yellow colour and much pitted. The actual thallus of the *Cladophora* is not incrusted with lime except at the extreme basal portions. The pebbles presented much the same appearance as those described by Chodat from the lakes of the Jura.

*Cladophora inconspicua* is probably the smallest described species of the genus. The thallus is much branched, the branching being mostly dichotomous. The tufts are very dense, and the basal part of the thallus is firmly attached to the stone by colourless rhizoids, which frequently branch and become somewhat irregular in outline. Some of the branches of the first order terminate in cylindrical apical cells with a mucronate apex, whereas the apical cells of the smaller branches are generally narrower and considerably attenuated to a blunt extremity.

Among the basal portions of the *Cladophora*, in the eroded cavities of the stones, were numerous thalli of *Palmophyllum foliaceum*, sp. n., and attached to the branches of the *Cladophora*, especially the younger ones, were quantities of *Calothrix brevissima* forma.

17. CLADOPHORA sp.

*C.* filis di(vel 3–4)-chotoma, ramosissima, ad 6 mm. altis, ramulis brevibus et fasciculatis, articulis diametro 3–7-plo longioribus.

Crass. fil. prim. usque ad 130 $\mu$; crass. ram. 24–34 $\mu$.

**Tanganyika.**—Growing on stones, shells, submerged roots and grasses, Niamkolo (1 Aug. 1904; no. 44). Probably the same plant but less branched, with quantities of sand among the branches, attached to shells dredged in about 10 fathoms, Mtondwe Bay (2 Sept. 1904; no. 83).

## Order CONJUGATÆ.

### Family **ZYGNEMACEÆ.**

#### Subfam. MESOCARPEÆ.

#### Genus MOUGEOTIA, *Ag.*

A number of sterile species of this genus were observed, principally from the Tanganyika region. No trace of spore-formation was observed in any of them.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72). In plankton, Lofu River (5 Oct. 1904 ; nos. 123 and 124).

#### Subfam. ZYGNEMEÆ.

#### Genus DEBARYA, *Wittr.*

18. DEBARYA AFRICANA, sp. n. (Pl. **5**. figs. 3–4.)

*D.* cæspitibus laxe intricatis, cellulis vegetativis diametro 4–8-plo longioribus, pyrenoidibus 5–8 in chromatophora unoquoque ; zygosporis ubi conjugatione scalariformi productis, globoso-ellipsoideis, magnis, tubo conjugatione complentibus et in gametangiis immersis, axe longiore transverse disposito ; membrana zygosporæ glabra ; membrana gametangiorum subcrassa ; gametangiis sæpe tortis.

Crass. cell. veget. 23–26 $\mu$ ; lat. zygosp. 56 $\mu$ ; long. zygosp. 50 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18).

As in other species of *Debarya* the gametangia undergo a change subsequent to conjugation. In this case the cell-walls increase considerably in thickness, and during this process a narrow pit arises in the middle of each transverse wall (*vide* Pl. **5**. fig. 4). The zygospore is large and occupies the whole of a greatly swollen conjugating-tube, extending on each side to the outer walls of the gametangia.

*D. africana* is nearest to *D. immersa*, W. West (*Mougeotia immersa*, W. West, in Journ. Bot. xl. (1902) p. 144), a species only known from India, but is distinguished by its much longer vegetative cells, its larger, smooth, and more completely immersed zygospores, and by the thickened walls of the gametangia.

#### Genus ZYGNEMA, *Ag.*

Sterile species were observed from :—

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80). In plankton, Lofu River (5 Oct. 1904 ; nos. 123 and 124).



#### Genus SPIROGYRA, *Link.*

19. SPIROGYRA sp. ad *S. longatam*, (Vauch.) Wittr. accedens.

The zygospores were not mature and the specimens were scarcely in a condition for accurate description.

Crass. cell. veget. 34–38 $\mu$ ; long. zygosp. immatur. 72 $\mu$, lat. 53 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 33).

20. SPIROGYRA PORTICALIS, (*Vauch.*) *Cleve, in Nov. Act. R. Soc. Sci. Upsal.* ser. 3. vi. no. 11 (1868), p. 22 ; *Petit, Spirog. Environs Paris* (1880), p. 21, t. 5. figs. 8–12.

Var. AFRICANA, var. n.

Var. cellulis fructiferis leviter tumidis ; cellulis vegetativis et chromatophoris singulis ut in forma typica ; zygosporis paullo majoribus, oblongo-ellipticis, mesosporio plicato-ruguloso.

Crass. cell. veget. 40–41 $\mu$ ; long. zygosp. 93 $\mu$, lat. 58 $\mu$.

**Nyasa.**—Among weeds and various Algæ, in swamp, Karonga (2 July, 1904 ; no. 34).

21. SPIROGYRA ÆQUINOCTIALIS, sp. n. (Pl. **5**. figs. 1–2.)

*S.* cellulis vegetativis diametro circiter 4–6-plo longioribus, extremitatibus non replicatis ; chromatophoris 3 (interdum 2), subcrassis, marginibus irregulariter undulatis, anfractibus 1–1½, cum pyrenoidibus magnis ; conjugatione scalariformi, cellulis fructiferis inflatis et suboblongo-rectangularibus ; zygosporis oblongo-ellipticis, ovoideis, vel oblongo-ovoideis, diametro circiter 1¼–1¾-plo longioribus ; membrana zygosporæ crassa, lamina mediana dense scrobiculata.

Crass. cell. veget. 23–25 $\mu$ ; crass. cell. fructif. (♀) 41·5–43 $\mu$ ; long. zygosp. 52–71 $\mu$, lat. 41–43 $\mu$ ; crass. membr. zygosp. 4 $\mu$.

**Nyasa.**—Growing on stones, &c., on the shore, Domira Bay (19 June, 1904 ; no. 17).

The zygospores are mostly oblong-elliptic in form, with brown walls of considerable thickness, the middle coat of which is densely and markedly scrobiculate. They fill up the fructiferous cells transversely, being closely applied to the swollen walls of the female gametangia. The chloroplasts are most commonly three (sometimes only two) in each cell, with nodulose or undulate margins and large pyrenoids.

It stands nearest to another tropical species, *S. Schmidtii*, W. & G. S. West (Freshw. Alg. Koh Chang, in Bot. Tidsskr. xxiv. (1901) p. 161, t. 4. figs. 43–45), but is distinguished by its thinner vegetative filaments with shorter cells, by the shorter and more oblong zygospores, and by the oblong form of the inflated fructiferous cells.

22. Spirogyra decimina, (*Müll.*) *Kütz. Phyc. Germ.* (1845) p. 223; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 242; *Petit, Spirog. Env. Paris*, 1880, p. 25. t. 8. figs. 1–3.

Crass. cell. veget. 32–36 $\mu$; long. zygosp. 65–68 $\mu$; lat. zygosp. 37–39 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; nos. 32 and 33).

Forma cellulis crassioribus et zygosporis sæpe diametro duplo longioribus. Crass. cell. veget. 42–54 $\mu$; long. zygosp. 68–124 $\mu$; lat. zygosp. 47–50 $\mu$.

**Nyasa.**—In swamp, Karonga (29 June, 1904; no. 32).

Forma tropica [*S. decimina*, forma, W. & G. S. West, in Bot. Tidsskr. xxiv. (1901) p. 161].

Forma major, cellulis vegetativis diametro $2\frac{1}{2}$–5(usque 6)-plo longioribus; cellulis fructiferis non inflatis; chromatophoris 3, cum marginibus asperis, anfractibus $2\frac{1}{2}$–$4\frac{1}{2}$.

Crass. cell. veget. 46–52 $\mu$; long. zygosp. 72–92 $\mu$; lat. zygosp. 46–50 $\mu$.

**Nyasa.**—In pools on the shore, Nkata Bay (23 June, 1904; no. 22).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

Precisely the same form has been observed from Koh Chang in the Gulf of Siam.

Very near to these tropical forms of *S. decimina*, and most probably identical with them, is a species described by Schmidle as *S. Fällebornei* (*vide* Engl. Bot. Jahrb. xxxii. (1903) p. 76, t. 3. fig. 2). The thickness of the vegetative cells is the same, there are three spirals in each case, and the size and form of the zygospores are the same. Schmidle's plant was described from the vicinity of Nyasa.

23. Spirogyra neglecta, (*Hass.*) *Kütz. Sp. Alg.* (1849) p. 441; *Rabenh. l. c.* p. 248; *Petit, l. c.* p. 26, t. 9. figs. 1–5.—Zygnema neglecta, *Hass.*

Var. ternata, (*Ripart*) *W. & G. S. West, in Journ. Bot.* xxxv. (1897) p. 41.—S. ternata, *Ripart, in Bull. Soc. Bot. Fr.* xxiii. (1876) p. 162; *Petit, l. c.* p. 26, t. 8. figs. 4–7.

Crass. cell. veget. 52–59 $\mu$; long. zygosp. 74–78 $\mu$; lat. zygosp. 52–53 $\mu$.

**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904; no. 196).

24. Spirogyra nitida, (*Dillw.*) *Link, Handb.* iii. (1833) p. 262; *Kütz. l. c.* p. 442; *Petit, l. c.* p. 28, t. 10. figs. 6–10.

Crass. cell. veget. 80–85 $\mu$; long. zygosp. 105–148 $\mu$; lat. zygosp. 55–84 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 33).

25. Spirogyra bellis, (*Hass.*) *Cleve, in Nov. Act. R. Soc. Sci. Upsal.* ser. 3, vi. no. 11 (1868), p. 18; *Petit, l. c.* p. 31, t. 10. figs. 1–3.

Var. minor, var. n.

Var. cellulis angustioribus et zygosporis minoribus. Crass. cell. veget. 56–58 $\mu$; diam. zygosp. 44–56 $\mu$.

**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904; no. 196).



Note.—Sterile species of *Spirogyra* were observed from the following localities:—**Nyasa.** In swamp, Kota Kota (20 June, 1904; no. 18). In pools, on shore, Nkata Bay (23 June, 1904; no. 22). Among weeds, in swamp, Karonga (2 July, 1904; no. 34).—**Tanganyika.** In swamp, Mbete (28 Sept. 1904; no. 108). In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124); this was a large species, similar to *S. crassa*, Kütz.; crass. veg. cell. 114–132 $\mu$; diam. zygosp. immatur. 100–104 $\mu$.

A fact of some interest is the complete absence from the collections of any species of *Spirogyra* with replicate extremities to the vegetative cells.

## Family **DESMIDIACEÆ**.

### Subfam. Saccodermæ.

### Genus GONATOZYGON, *De Bary*.

26. Gonatozygon monotænium, *De Bary, in Rabenh. Alg.* (1856) no. 539; *W. & G. S. West, Brit. Desm.* i. (1904) p. 30, t. 1. figs. 1–7.—G. Ralfsii, *De Bary, Conj.* (1858) p. 76, t. 4. figs. 23–25.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124).

27. Gonatozygon Kinahani, (*Arch.*) *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 156; *W. & G. S. West, l. c.* p. 35, t. 2. figs. 1–3.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

**Victoria Nyanza.**—In swampy pool, near Bukoba (20 Apr. 1905; no. 618).

### Genus CYLINDROCYSTIS, *Menegh.*

28. Cylindrocystis subpyramidata, *W. & G. S. West, in Bot. Tidsskr.* xxiv. (1901) p. 162, t. 2. figs. 8–11.

Long. 26–29 $\mu$; lat. 16–18 $\mu$; lat. constrict. 15–16 $\mu$.

**Victoria Nyanza.**—In swampy pool, Bukoba (20 Apr. 1905; no. 618).

**Tanganyika.**—Among weeds, mouth of Malagarasi River (16 Jan. 1905 no. 611).

### Genus NETRIUM, *Lütkem.*

29. Netrium Digitus, (*Ehrenb.*) *Itzigs. & Rothe, in Rabenh. Alg.* no. 508 (1856); *W. & G. S. West, Brit. Desm.* i. (1904) p. 64, t. 6. figs. 14–16.—Penium Digitus, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 150, t. 25. fig. 3.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

Forma parva et angustior: long. 112–140 $\mu$; lat. 27–32 $\mu$.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1906; no. 251).

**Tanganyika.**—In swamps, Kituta (26 Aug. 1904; no. 80).

22. Spirogyra decimina, (*Mall.*) *Kütz. Phyc. Germ.* (1845) p. 223; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 242; *Petit, Spirog. Env. Paris*, 1880, p. 25, t. 8. figs. 1–3.

Crass. cell. veget. 32–36 $\mu$; long. zygosp. 65–68 $\mu$; lat. zygosp. 37–39 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; nos. 32 and 33).

Forma cellulis crassioribus et zygosporis sæpe diametro duplo longioribus.

Crass. cell. veget. 42–54 $\mu$; long. zygosp. 68–124 $\mu$; lat. zygosp. 47–50 $\mu$.

**Nyasa.**—In swamp, Karonga (29 June, 1904; no. 32).

Forma tropica [*S. decimina*, forma, W. & G. S. West, in Bot. Tidsskr. xxiv. (1901) p. 161].

Forma major, cellulis vegetativis diametro 2½–5(usque 6)-plo longioribus; cellulis fructiferis non inflatis; chromatophoris 3, cum marginibus asperis, anfractibus 2½–4½.

Crass. cell. veget. 46–52 $\mu$; long. zygosp. 72–92 $\mu$; lat. zygosp. 46–50 $\mu$.

**Nyasa.**—In pools on the shore, Nkata Bay (23 June, 1904; no. 22).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

Precisely the same form has been observed from Koh Chang in the Gulf of Siam.

Very near to these tropical forms of *S. decimina*, and most probably identical with them, is a species described by Schmidle as *S. Fällebornei* (*vide* Engl. Bot. Jahrb. xxxii. (1903) p. 76, t. 3. fig. 2). The thickness of the vegetative cells is the same, there are three spirals in each case, and the size and form of the zygospores are the same. Schmidle's plant was described from the vicinity of Nyasa.

23. Spirogyra neglecta, (*Hass.*) *Kütz. Sp. Alg.* (1849) p. 441; *Rabenh. l. c.* p. 248; *Petit, l. c.* p. 26, t. 9. figs. 1–5.—Zygnema neglecta, *Hass.*

Var. ternata, (*Ripart*) *W. & G. S. West, in Journ. Bot.* xxxv. (1897) p. 41.—S. ternata, *Ripart, in Bull. Soc. Bot. Fr.* xxiii. (1876) p. 162; *Petit, l. c.* p. 26, t. 8. figs. 4–7.

Crass. cell. veget. 52–59 $\mu$; long. zygosp. 74–78 $\mu$; lat. zygosp. 52–53 $\mu$.

**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904; no. 196).

24. Spirogyra nitida, (*Dillw.*) *Link, Handb.* iii. (1833) p. 262; *Kütz. l. c.* p. 442; *Petit, l. c.* p. 28, t. 10. figs. 6–10.

Crass. cell. veget. 80–85 $\mu$; long. zygosp. 105–148 $\mu$; lat. zygosp. 55–84 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 33).

25. Spirogyra bellis, (*Hass.*) *Cleve, in Nov. Act. R. Soc. Sci. Upsal.* ser. 3, vi. no. 11 (1868), p. 18; *Petit, l. c.* p. 31, t. 10. figs. 1–3.

Var. minor, var. n.

Var. cellulis angustioribus et zygosporis minoribus. Crass. cell. veget. 56–58 $\mu$; diam. zygosp. 44–56 $\mu$.

**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904; no. 196).



Note.—Sterile species of *Spirogyra* were observed from the following localities:—**Nyasa.** In swamp, Kota Kota (20 June, 1904; no. 18). In pools, on shore, Nkata Bay (23 June, 1904; no. 22). Among weeds, in swamp, Karonga (2 July, 1904; no. 34).—**Tanganyika.** In swamp, Mbete (28 Sept. 1904; no. 108). In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124); this was a large species, similar to *S. crassa*, Kütz.; crass. veg. cell. 114–132 $\mu$; diam. zygosp. immatur. 100–104 $\mu$.

A fact of some interest is the complete absence from the collections of any species of *Spirogyra* with replicate extremities to the vegetative cells.

## Family **DESMIDIACEÆ**.

### Subfam. Saccodermæ.

### Genus GONATOZYGON, *De Bary*.

26. Gonatozygon monotænium, *De Bary, in Rabenh. Alg.* (1856) no. 539; *W. & G. S. West, Brit. Desm.* i. (1904) p. 30, t. 1. figs. 1–7.—*G. Ralfsii, De Bary, Conj.* (1858) p. 76, t. 4. figs. 23–25.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124).

27. Gonatozygon Kinahani, (*Arch.*) *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 156; *W. & G. S. West, l. c.* p. 35, t. 2. figs. 1–3.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

**Victoria Nyanza.**—In swampy pool, near Bukoba (20 Apr. 1905; no. 618).

### Genus CYLINDROCYSTIS, *Menegh.*

28. Cylindrocystis subpyramidata, *W. & G. S. West, in Bot. Tidsskr.* xxiv. (1901) p. 162, t. 2. figs. 8–11.

Long. 26–29 $\mu$; lat. 16–18 $\mu$; lat. constrict. 15–16 $\mu$.

**Victoria Nyanza.**—In swampy pool, Bukoba (20 Apr. 1905; no. 618).

**Tanganyika.**—Among weeds, mouth of Malagarasi River (16 Jan. 1905 no. 611).

### Genus NETRIUM, *Lütkem.*

29. Netrium Digitus, (*Ehrenb.*) *Itzigs. & Rothe, in Rabenh. Alg.* no. 508 (1856); *W. & G. S. West, Brit. Desm.* i. (1904) p. 64, t. 6. figs. 14–16.—Penium Digitus, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 150, t. 25. fig. 3.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

Forma parva et angustior: long. 112–140 $\mu$; lat. 27–32 $\mu$.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1906; no. 251).

**Tanganyika.**—In swamps, Kituta (26 Aug. 1904; no. 80).

Subfam. PLACODERMÆ.

Genus PENIUM, *Bréb.*

30. PENIUM NAVICULA, *Bréb. in Mém. Soc. Sci. Nat. Cherb.* iv. (1856) p. 146, t. 2. fig. 37; *W. & G. S. West, Brit. Desm.* i. (1904) p. 75, t. 7. figs. 12–15.

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 618).

31. PENIUM AUSTRALE, *Racib. in Rospraw. matem.-przy. Akad. Umiej. Krakow.* ser. 2, xxii. (1892) p. 367, t. 6. fig. 27; *W. & G. S. West, in Journ. Linn. Soc., Bot.* xxxiii. (1897) p. 157, t. 8. fig. 16; *in Bot. Tidsskr.* xxiv. (1901) p. 163.

*a.* Forma brevior: long. 55–57 $\mu$; lat. 36–38 $\mu$; lat. isthm. 35–36 $\mu$. (Pl. 6. fig. 3.)

**Victoria Nyanza.**—Near the shore, Bukoba (20 Apr. 1905; no. 251).

*b.* Forma crassior: long. 72 $\mu$; lat. 51 $\mu$; lat. isthm. 48 $\mu$. (Pl. 6. fig. 4.)

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 618)

Genus CLOSTERIUM, *Nitzsch.*

32. CLOSTERIUM LAGOENSE, *Nordst. in Vidensk. Medd. f. d. Naturh. Foren. Kjöb.* (1870) p. 203, t. 2. fig. 2.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

33. CLOSTERIUM NEMATODES, *Josh. in Journ. Linn. Soc., Bot.* xxi. (1886) p. 652, t. 22. figs. 7–9.

Var. TUMIDUM, var. n. (Pl. 6. fig. 2.)

Var. cellulis paullo tumidis ad medium marginis ventralis, poris obtusioribus, striis validioribus.

Long. 190 $\mu$; lat. 27 $\mu$; lat. apic. 10 $\mu$.

**Victoria Nyanza.**—Near the shore of the lake, Bukoba (20 Apr. 1905; no. 251).

The apices of this variety are more obtuse than in the typical form, and the ventral margin of the cell is distinctly tumid, giving it a stouter appearance.

34. CLOSTERIUM PARVULUM, *Näg. Gatt. einz. Alg.* (1849) p. 106, t. 6 c. fig. 2 (ex parte); *W. & G. S. West, Brit. Desm.* i. (1904) p. 133, t. 15. figs. 9–12.

Small forms: lat. 11 $\mu$; apicibus 105 $\mu$ inter se distantibus.

**Nyasa.**—In swamp, Karonga (2 July, 1904: nos. 33 and 34).

**Victoria Nyanza.**—In swamp pool near Bukoba (20 Apr. 1905; no. 618).

35. CLOSTERIUM JENNERI, *Ralfs, Brit. Desm.* (1848) p. 167, t. 28. fig. 6; *W. & G. S. West, l. c.* p. 134, t. 15. figs. 23–25.

Lat. 11–13 $\mu$; apicibus 82–91 $\mu$ inter se distantibus.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1905; no. 251).



36. CLOSTERIUM VENUS, *Kütz. Phyc. Germ.* (1845) p. 130; *W. & G. S. West, Brit. Desm.* i. (1904) p. 137, t. 15. figs. 15–20.

Lat. 8·5 $\mu$; apicibus 72 $\mu$ inter se distantibus.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 123).

37. CLOSTERIUM LEIBLEINII, *Kütz. in Linnæa*, viii. (1833) p. 536; *W. & G. S. West, l. c.* p. 141, t. 16. figs. 9–14.

**Nyasa.**—Among Algæ growing on stones, Domira Bay (19 June, 1904; no. 17). Among *Utricularia*, Domira Bay (19 June, 1904; no. 579).

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1905; no. 251).

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108). In plankton, Baraka (24 Feb. 1905; no. 240).

38. CLOSTERIUM MONILIFERUM, (*Borg*) *Ehrenb. Infus.* p. 91 (1838); *Ralfs, Brit. Desm.* (1848) p. 166, t. 28. fig. 3; *W. & G. S. West, l. c.* p. 142, t. 16. figs. 15, 16.

Var. GALICIENSE, (*Gutw.*) nob. Closterium galiciense, *Gutw. in Rospraw. matem.-przy. Akad. Umiej. Krakow.* (1896), p. 39, t. 6. fig. 18.

Long. 248–294 $\mu$; lat. 44–47 $\mu$; lat. apic. 11–12 $\mu$.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1905; no. 251).

The African plants possessed a smooth and colourless cell-wall, and agreed perfectly in size and general proportions with Gutwinski's Galician examples. The distinctive features from typical *C. moniliferum* are the thickened apices of the cells and the reduced ventral inflation.

39. CLOSTERIUM ACEROSUM, (*Schrank*) *Ehrenb. Infus.* p. 92 (1838); *Ralfs, Brit. Desm.* (1848) p. 164, t. 27. fig. 2; *W. & G. S. West, l. c.* p. 146, t. 18. figs. 2–5.

**Nyasa.**—Among other Algæ on the shore, Domira Bay (19 June, 1904; no. 17). Among *Utricularia*, Domira Bay (19 June, 1904; no. 579.)

**Tanganyika.**—In swamp, Toa (10 Jan. 1905; no. 208.)

40. CLOSTERIUM TUMIDUM, *Johnson, in Bull. Torr. Bot. Club*, xxii. (1895) p. 291, t. 239. fig. 4; *W. & G. S. West, l. c.* p. 156, t. 19. figs. 15–18.

Rather stout forms: long. 116–142 $\mu$; lat. 19–20 $\mu$; lat. apic. circ. 5 $\mu$.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1905; no. 251).

41. CLOSTERIUM GRACILE, *Bréb. List Desmid.* p. 155 (1856); *W. & G. S. West, l. c.* p. 166, t. 21. figs. 8–12.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

Var. TENUE, (*Lemm.*) *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1902) p. 138, t. 18. figs. 22, 23.—C. limneticum, *Lemm.*, var. tenue, *Lemm.*

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

42. CLOSTERIUM ACUTUM, (*Lyngb.*) *Brèb. in Ralfs, Brit. Desm.* (1848) p. 177, t. 30. fig. 5, t. 34. fig. 5 *a*, *b*, *d–f*; *W. & G. S. West, Brit. Desm.* i. (1904) p. 177, t. 23. figs. 9–14.

Lat. cell. 4–4·5 $\mu$; long. zygosp. 32 $\mu$; lat. max. zygosp. 18 $\mu$.

**Nyasa.**—Among *Utricularia*, swampy margin of lake, Domira Bay (19 June, 1904; no. 579).

**Tanganyika.**—In swamp, Kituta, with zygospores (26 Aug. 1904; no. 80).

43. CLOSTERIUM RALFSII, *Brèb. in Ralfs, Brit. Desm.* (1848) p. 17; *Ralfs, l. c.* p. 174, t. 30. fig. 2; *W. & G. S. West, l. c.* p. 182, t. 24. figs. 6, 7.

Var. HYBRIDUM, *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 135; *W. & G. S. West, l. c.* p. 183, t. 24. figs. 8–13.

Forma paullo crassior: long. 302–332 $\mu$; lat. 42–45 $\mu$; lat. apic. 9–10 $\mu$.

**Victoria Nyanza.**—In pools near the shore, Bukoba (20 Apr. 1905; no. 251).

The specimens were rather broader than is usual for this frequent tropical *Closterium*, and in this respect they resembled a plant described by Gutwinski as *C. Wagæ* (*vide* Rospraw. matem.-przyr. Akad. Umiej. Krakow. 1896, p. 40, t. 2. fig. 20). The apices were also somewhat angular. It seems probable that *C. Wagæ* is only an extreme shortened form of *C. Ralfsii* var. *hybridum*.

## Genus PLEUROTÆNIUM, *Näg.*

44. PLEUROTÆNIUM CORONATUM, (*Brèb.*) *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 143; *W. & G. S. West, l. c.* p. 199, t. 27. figs. 16–18, t. 28. fig. 4.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; nos. 72 and 80).

45. PLEUROTÆNIUM SUBCORONULATUM, (*W. B. Turn.*) *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 44, t. 5. f. 33.

Var. DETUM, *W. & G. S. West, l. c.* (1896) p. 235, t. 13. figs. 2, 3.

Long. 460 $\mu$; lat. ad bas. semicell. 40 $\mu$, ad apic. 35 $\mu$.

**Victoria Nyanza.**—Among *Utricularia* in swampy pool near Bukoba (20 Apr. 1905; no. 618).

Borge has observed specimens from Brazil in which only one semicell possessed the infra-apical constriction (*vide* Arkiv för Botanik, K. Sv. Vet.-Akad., Bd. i. (1903), p. 82). The curious ligature-like constriction of this variety was well marked in the examples from Victoria Nyanza, but it is possible that it is only a variation due to inequality of growth.



46. PLEUROTÆNIUM ELATUM, (*W. B. Turn.*) *Borge, in Bih. K. Sv. Vet.-Akad. Handl.* xxiv. (1899) Afd. 3, no. 12, p. 16.—Docidium elatum, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 27, t. 2. fig. 16. Docidium robustum, *W. B. Turn. l. c.* p. 27, t. 2. fig. 8.

Var. CONJUNCTUM, (*W. B. Turn.*) *W. & G. S. West, in Trans. Linn. Soc.*, ser. 2, *Bot.* vi. (1902) p. 144.—Docidium conjunctum, *W. B. Turn. l. c.* p. 32, t. 4. fig. 6.

Long. 530–561 $\mu$; lat. ad bas. semicell. 45–48 $\mu$; lat. apic. 40–42 $\mu$.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124).

The individuals observed were slightly larger than Turner's measurements of *P. elatum* var. *conjunctum*, but not so large as the forms *duplo-major* described from Ceylon. The lateral margins of the semicells were slightly undulate from base to apex, and each apex possessed 26–27 tuberculi. The individuals remained attached by their apices, and filaments of 15 cells were observed.

47. PLEUROTÆNIUM CALDENSE, *Nordst., in Öfvers. K. Vet.-Akad. Förh.* (1877) no. 3, p. 17, t. 2. fig. 2.

Forma AFRICANA. (Pl. **6**. fig. 1.)

Forma cellulis longioribus, leviter attenuatis apices versus, tuberculis apicalibus 18 (9–10 visis).

Long. 670 $\mu$; lat. ad bas. semicell. 34 $\mu$; lat. apic. 25 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

The African form differs principally from the Brazilian one in the distinct attenuation of the apical part of the semicells.

48. PLEUROTÆNIUM EHRENBERGII, (*Brèb.*) *De Bary, Conj.* (1858) p. 75; *W. & G. S. West, Brit. Desm.* i. (1904) p. 205, t. 29. figs. 9–11.—Docidium Ehrenbergii, *Brèb.*

**Nyasa.**—In swamp, Karonga (2 July, 1904; nos. 33 and 34).

**Victoria Nyanza.**—In swampy pools near Bukoba (20 Apr. 1905; nos. 251 and 618).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72. Also 26 Aug. 1904; no. 80).

49. PLEUROTÆNIUM TRABECULA, (*Ehrenb.*) *Näg. Gatt. einz. Alg.* (1849) p. 104, t. 6. fig. A; *W. & G. S. West, l. c.* p. 209, t. 30. figs. 11–13.

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 251).

50. PLEUROTÆNIUM MAXIMUM, (*Reinsch*) *Lund. in Nov. Act. Reg. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 89; *W. & G. S. West, l. c.* p. 213, t. 31. figs. 1, 2.—Docidium maximum, *Reinsch.*

Long. 720 $\mu$; lat. ad bas. semicell. 40 $\mu$, ad apic. 28 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

Genus EUASTRUM, *Ehrenb.*

51. EUASTRUM SINUOSUM, *Lenorm. ex Ralfs, Brit. Desm.* (1848) p. 85; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 20, t. 36. fig. 1.

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 618).

52. EUASTRUM ANSATUM, *Ralfs, l. c.* t. 14. fig. 2.

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 251).

53. EUASTRUM ROSTRATUM, *Ralfs, in Ann. Nat. Hist.* xiv. (1844) p. 192; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 35, t. 37. figs. 11–13.

Long. 46 $\mu$; lat. 27 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

54. EUASTRUM PERSONATUM, *W. & G. S. West, in Trans. Linn. Soc.*, ser. 2, *Bot.* v. (1895) p. 52, t. 6. fig. 19.

Forma incisuris apicalibus leviter apertioribus, angulis basalibus semicellularum delicatissime bidenticulatis.

Long. 48 $\mu$; lat. 32 $\mu$; lat. isthm. 9 $\mu$; crass. 17 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

55. EUASTRUM ELEGANS, (*Bréb.*) *Kütz. Phyc. Germ.* (1845) p. 135; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 48, t. 38. figs. 16–21.

Forma angulis basalibus semicellularum sursum divergentibus.

Long. 31 $\mu$; lat. 20 $\mu$; lat. isthm. 6·5 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

56. EUASTRUM BINALE, (*Turp.*) *Ehrenb. in Berlin Monatsber.* (1840) p. 208; *W. & G. S. West, l. c.* p. 51, t. 38. figs. 28, 29.

Forma HIANS, *West, in Journ. Linn. Soc., Bot.* xxix. (1892) p. 140, t. 20. fig. 14.

**Nyasa.**—Among Algæ growing on stones, Domira Bay (19 June, 1904; no. 17).

Var. SUBELOBATUM, *West, l. c.* p. 140, t. 20. fig. 15.

Long. 21 $\mu$; lat. 16·5 $\mu$; lat. isthm. 5 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

57. EUASTRUM DENTICULATUM, (*Kirchn.*) *F. Gay, in Bull. Soc. Bot. Fr.* xxxi. (1884) p. 335.—E. binale, *var.* denticulatum, *Kirchn. Alg. Schles.* (1878) p. 159.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124).

58. EUASTRUM HYPOCHONDROIDES, *W. & G. S. West, in Trans. Linn. Soc.*, ser. 2, *Bot.* v. (1895) p. 49, t. 6. fig. 8.

**Victoria Nyanza.**—Among *Utricularia* in sheltered bay near Entebbe (1 May, 1905; no. 620).



59. EUASTRUM SPINULOSUM, *Delp. in Mem. Accad. Sci. Torino*, ser. 2, xxx. (1878) p. 97, t. 6. figs. 17, 18.

Subsp. AFRICANUM, *Nordst. in Act. Univ. Lund.* xvi. (1880) p. 9, t. 1. fig. 16.

Small form: long. 56 $\mu$; lat. 48 $\mu$; lat. isthm. 12 $\mu$.

**Tanganyika.**—Among Algæ in swamp, Mrumbi (27 Dec. 1904; no. 196).

—— forma DUPLO-MINOR, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 51, t. 6. fig. 13.

Long. 44 $\mu$; lat. 39 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; nos. 33 and 34).

60. EUASTRUM PSEUDOPECTINATUM, *Schmidle, in Engl. Bot. Jahrb.* xxvi. (1898) p. 46, t. 2. fig. 39.

Forma mucronibus lobi polaris reductis. (Pl. **7.** figs. 4–5.)

Long. 44–46 $\mu$; lat. 34–35·5 $\mu$; lat. lob. polar. 20–21·5 $\mu$; lat. isthm. 8 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

61. EUASTRUM TRUNCATIFORME, sp. n. (Pl. **7.** fig. 3.)

*E.* submediocre, circiter 1½-plo longius quam latius, profundissime constrictum, sinu angusto-lineari extremo subampliato; semicellulæ trilobæ, incisuris lateralibus subprofundis et angustis; lobis lateralibus sinuato-bilobulatis, lobulis subquadratis rotundo-emarginatis; lobo polari transverse rectangulari-fusiformi, lateribus sursum convergentibus et retusis, apice convexo; tumore magno glabro in lobo laterali unoquoque, tumore magno in centro lobi polaris, tumore parvo intra lobulum lateralem unumquemque; a vertice visæ oblongo-ellipticæ, polis rotundatis, tumoribus magnis binis subdistantibus utrobique et tumore parvo polum unumquemque versus utrobique, lobo polari subrhomboideo; a latere visæ subovatæ, tumore magno prope basin et tumore minore apicem rotundatum versus utrobique.

Long. 47 $\mu$; lat. 33 $\mu$; lat. lob. polar. 21 $\mu$; lat. isthm. 8 $\mu$; crass. 19 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

This species bears considerable resemblance to *E. sympagium*, W. & G. S. West (in Trans. Linn. Soc. ser. 2, Bot. v. (1895) p. 50, t. 6. fig. 11), a species known only from Madagascar, but is distinguished by the relatively smaller polar lobe, by the strongly retuse lateral lobes with broader angles (lobules), and by the different disposition of the surface tumours, the latter feature causing considerable differences in the vertical and lateral views.

It should also be compared with *E. truncatum*, Joshua (*vide* W. & G. S. West, *l. c.* vi. (1902) p. 152, t. 20. figs. 9, 10), from which it differs in the deeply retuse lateral lobes, the convex apex of the polar lobe, and the form of the polar lobe in vertical view. The three large tumours of *E. truncatiforme* also occur in the same relative positions on *E. truncatum*, but the latter possesses two others within the angles of the polar lobe, and

lacks the small tumours which occur within the lateral lobules of *Euastrum truncatiforme*. The large scrobiculation in the centre of the semicells of *E. truncatum* is likewise absent from *E. truncatiforme*.

Compare also with *E. pseudopectinatum*, Schmidle, var. *evolutum*, Schmidle (in Engl. Bot. Jahrb. xxxii. (1903) p. 72, t. 2. fig. 6).

### Genus MICRASTERIAS, *Ag.*

62. MICRASTERIAS INCISA, *Breb., ex Ralfs, Brit. Desm.* (1848) p. 211; *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 89 (*α. typica*). —Euastrum incisum, *Breb. in Menegh. Synops. Desm.* (1840) p. 216. Holocystis incisa, *G. C. Wall. in Ann. Mag. Nat. Hist.* ser. 3, v. (1860) p. 276, t. 13. figs. 4, 5.

Forma lobis lateralibus oblique truncatis; spinis totis minoribus.

Long. 56 $\mu$; lat. cum spin. 60 $\mu$; lat. isthm. 11 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

63. MICRASTERIAS CUNNINGTONII, sp. n. (Pl. **7.** figs. 1–2.)

*M.* mediocris, circiter 1½-plo longior quam latior, elliptica, profundissime constricta, sinu angusto sed leviter aperto; semicellulæ quinquelobæ, incisuris inter lobos non profundis et apertis; lobo polari late et breviter cuneato (late campanulato e basi subangusto), apice convexo sed late emarginato ad medium, cum dentibus irregularibus circ. 10 ad marginem superiorem et angulis lateralibus unidentatis; lobis lateralibus subæqualibus (superioribus majoribus), cum incisura primaria mediana et incisuris parvis secundis duobus, lobulis emarginato-bispinatis (raro trispinatis) quattuor; membrana irregulariter et subsparse denticulato-spinata. Semicellulæ a latere visæ ovato-lanceolatæ, ad basin subrotundatæ, lateribus subretusis, apice rotundato et tridentato, marginibus lateralibus dense denticulato-spinatis.

Long. 192 $\mu$; lat. 138 $\mu$; lat. max. lob. polar. 74–78 $\mu$; lat. isthm. 28 $\mu$; crass. sine spin. 54–56 $\mu$.

**Victoria Nyanza.**—In swampy pools near the shore, Bukoba (20 Apr. 1905; no. 251).

This species can best be compared with *M. apiculata*, (Ehrenb.) Menegh., from which it is at once distinguished by the shallow incisions and the much wider and shorter polar lobe. The spines are also shorter, and they are much more irregular in size and disposition than those of *M. apiculata*, especially towards the centre of the semicells. It is, however, the polar lobe which is the distinctive feature of *M. Cunningtonii*. It is very widely campanulate from a rather narrow base, and the disposition of the spines on its convex-emarginate apex is also peculiar.



64. MICRASTERIAS AMERICANA, (*Ehrenb.*) *Ralfs, Brit. Desm.* (1848) p. 19 *W. & G. S. West, Brit. Desm.* ii. (1905) p. 117, t. 53. figs. 4, 5, t. 54. figs. 1–3

**Victoria Nyanza.**—Among *Utricularia* in swampy pool, Bukoba (20 Apr 1905; no. 618).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 124).

### Genus COSMARIUM, *Corda.*

65. COSMARIUM OBSOLETUM, (*Hantzsch*) *Reinsch, Sp. Gen. Alg.* (1867) p. 142, t. 22. D.I. figs. 1–4; *W. & G. S. West, l. c.* p. 133, t. 56. figs. 1–3.

**Nyasa.**—In pools on the shore, Nkata Bay (23 June, 1904; no. 22).

**Victoria Nyanza.**—In swampy pools near the shore, Bukoba (20 Apr. 1905; no. 251).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72. Also 26 Aug. 1904; no. 80).

66. COSMARIUM LUNDELLII, *Delp. in Mem. Accad. Sci. Torino*, ser. 2, xxx. (1878) p. 13, t. 7. figs. 62–64.—*C. subcirculare*, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 52, t. 8. fig. 3, and t. 9. figs. 27, 37.

Var. MADAGASCARIENSE, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 55, t. 8. fig. 2.

Long. 74 $\mu$; lat. 67 $\mu$; lat. isthm. 29 $\mu$.

**Nyasa.**—In pools on the shore, Nkata Bay (23 June, 1904; no. 22).

67. COSMARIUM SUBAURICULATUM, *W. & G. S. West, l. c.* p. 55, t. 6. fig. 31.

Forma sinu non aperto.

Long. 48–56 $\mu$; lat. sine spin. 46–54 $\mu$; lat. cum spin. 49–58 $\mu$; lat. isthm. 27–30 $\mu$.

**Nyasa.**—In pools on the shore, Nkata Bay (23 June, 1904; no. 22).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

This species has been recorded by Schmidle from the vicinity of Lake Nyasa (*vide* Engl. Bot. Jahrb. xxxii. (1903) p. 68, t. 1. fig. 24). It is now known to occur in Madagascar, Central Africa, Siam, and Central China.

The Desmid described by Gutwinski from Java as *C. suberosum* (Gutw. in Bull. de l'Acad. Sci. Cracov., Nov. 1902, p. 592, t. 38. fig. 36) is identical with *C. subauriculatum* var. *truncatum*, W. & G. S. West, in Bot. Tidsskr. xxiv. (1901) p. 172, t. 2. fig. 20, described from the island of Koh Chang in the Gulf of Siam.

68. COSMARIUM FONTIGENUM, *Nordst. in Wittr. & Nordst. Alg. Exsic.* 1878, no. 171; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 147, t. 59. figs. 16, 17.

Long. 24·5 $\mu$; lat. 24·5 $\mu$; lat. isthm. 7 $\mu$.

**Nyasa.**—Among *Utricularia*, Domira Bay (19 June, 1904; no. 579).

69. Cosmarium Phaseolus, *Bréb. in Menegh. Synops. Desm.* (1840) p. 220; *Ralfs, Brit. Desm.* (1848) p. 106, t. 32. fig. 5.

A form approaching var. *elevatum*, Nordst.

**Nyasa.**—Among Algæ on the shore, Domira Bay (19 June, 1904; no. 17).

70. Cosmarium bioculatum, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 95, t. 15. fig. 5; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 165, t. 61. figs. 3–7.

Forms with a punctate cell-wall, some individuals approaching var. *hians*, W. & G. S. West: long. 19–21 $\mu$; lat. 16–18 $\mu$; lat. isthm. 4·5–6 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Bukoba (20 Apr. 1905; no. 618.

71. ? Cosmarium minutissimum, *Arch. in Quart. Journ. Micr. Sci.* xvii. (1877) pp. 194 and 301.

Long. 11 $\mu$; lat. 9 $\mu$; lat. isthm. 3 $\mu$; crass. 5·5 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

It is with much doubt that I refer this minute *Cosmarium* to *C. minutissimum*, Arch., a species concerning which very little is definitely known. Another African form, from Huilla, Angola, W. Africa, has also been with uncertainty regarded as *C. minutissimum* (*vide* W. & G. S. West, in Journ. Bot. xxxv. (1897) p. 38). The sinus of the Nyanza specimens was not "a narrow incision" as described by Archer, and the outline of the cell was exactly similar to that exhibited by some forms of *C. contractum*, var. *ellipsoideum*.

72. Cosmarium contractum, *Kirchn. Alg. Schles.* (1878) p. 47; *Wolle, Desm. U.S.* (1884) p. 63, t. 50. fig. 24; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 170, t. 61. figs. 23–25, 34.

Var. ellipsoideum, (*Elfv.*) *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxii. part i. (1902) p. 40.—C. ellipsoideum, *Elfv.*

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905; no. 249). In sheltered bay near Entebbe (1 May, 1905; no. 620).

73. Cosmarium depressum, (*Näg.*) *Lund. in Nov. Act. Reg. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 38; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 176, t. 62. figs. 2–5. –C. Scenedesmus, *Delp.*

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905; no. 249).

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

74. Cosmarium retusiforme, (*Wille*) *Gutw. in Bot. Centralbl.* xliii. (1890) p. 69.—C. Hammeri, *Reinsch, var.* retusiforme, *Wille.*

Forma abscissum (*Schmidle*), *Borge, in Arkiv för Bot. K. Sv. Vet.-Akad.* i. (1903) p. 96, t. 3. fig. 19.—C. Hammeri, *Reinsch, f.* abscissa, *Schmidle, in Hedwigia*, xxxiv. (1895) p. 302, t. 4. fig. 8.

Long. 22–31 $\mu$; lat. 17–23 $\mu$; lat. apic. 9·5–13·5 $\mu$; lat. isthm. 5–6·5 $\mu$.

**Victoria Nyanza.**—Near Bukoba (20 Apr. 1905; no. 618). In sheltered bay near Entebbe (1 May, 1905; no. 620).



This form was not uncommon from the above localities, and to a certain extent it combines the characters of *C. retusum*, (Perty) Rabenh., and *C. retusiforme*, (Wille) Gutw. It has the deep linear constriction of the former, but the proportions of the latter. The subrectangular basal angles are distinctive. It appears to be a tropical form with a wide geographical distribution, and was first described from Sumatra.

75. Cosmarium Hammeri, *Reinsch, Sp. Gen. Alg.* (1867) p. 115, t. 22 B.I. figs. 1–10; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 181, t. 62. figs. 20, 21.

Long. 30 $\mu$; lat. 22 $\mu$; lat. isthm. 6 $\mu$; crass. 11 $\mu$.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905; no. 251).

76. Cosmarium granatum, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 96, t. 32. fig. 6; *W. & G. S. West, l. c.* p. 186, t. 63. figs. 1–3.

**Nyasa.**—In pools, Nkata Bay (23 June, 1904; no. 22). In swamp, Karonga (2 July, 1904; no. 34).

77. Cosmarium galeritum, *Nordst. in Vidensk. Medd. Naturh. Foren. Kjöb.* (1870) p. 209, t. 3. fig. 26.

Var. retusum, var. n. (Pl. **7.** fig. 6.)

Semicellulæ lateribus paullo retusis apicem versus et apice leviter retuso.

Long. 38 $\mu$; lat. 34 $\mu$; lat. isthm. 10 $\mu$.

**Nyasa.**—In the swampy lake margin, Domira Bay (19 June, 1904; no. 579).

**Victoria Nyanza.**—In sheltered bay near Entebbe (1 May, 1905; no. 620).

The Desmid described and figured by Schmidle from Nyasa (*cf.* Engl. Bot. Jahrb. xxxii. (1903) p. 69, t. 1. fig. 26) as "*C. komalodermum* var. *minor*" is most probably identical with this variety.

78. Cosmarium nitidulum, *De Not. Desm. Ital.* (1867) p. 42, t. 3. fig. 26; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 197, t. 64. figs. 1–3.

Small form: long. 25 $\mu$; lat. 21 $\mu$; lat. isthm. 5 $\mu$.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 124).

79. Cosmarium pseudopyramidatum, *Lund. in Act. R. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 41, t. 2. fig. 18.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905; no. 251).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72. Also 26 Aug. 1904; no. 80).

80. Cosmarium moniliforme, (*Turp.*) *Ralfs, Brit. Desm.* (1848) p. 107, t. 17. fig. 6.

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905; no. 249).

81. Cosmarium globosum, *Bulnh. in Hedwigia*, ii. (1861) p. 52, t. 9. fig. 8.

Var. Wollei, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1896) p. 252, t. 15. fig. 17.—C. globosum, *Wolle, Desm. U.S.* (1884) p. 60, t. 49. figs. 15–17.

Forma major: long. 44–49 $\mu$; lat. 37–39 $\mu$; lat. isthm. 35–37 $\mu$. (Pl. 7. fig. 10.)

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905; nos. 251 and 618).

**Tanganyika.**—In swamp close to shore, Kituta (23 Aug. 1904; nos. 72 and 73. Also 26 Aug. 1904; no. 80).

This *Cosmarium* occurred in some abundance, and is characterized by the slightness of its constriction. In outline the African specimens agreed exactly with the figures given by Wolle, but they were of decidedly larger dimensions.

There is one pyrenoid in each semicell, from which radiate a number of vertically-disposed divisions of the chloroplast.

The specimens very closely resemble a Desmid described by Schmidle from Zanzibar as *Dysphinctium subellipticum* (*vide* Engl. Bot. Jahrb. xxvi. (1898) p. 21, t. 1. fig. 15), but there was no large series of punctulations on each side of the isthmus.

82. Cosmarium subconstrictum, *Schmidle, in Engl. Bot. Jahrb.* xxx. (1901) p. 66, t. 2. fig. 4.

Long. 27–30 $\mu$; lat. 26–28 $\mu$; lat. isthm. 17–20 $\mu$; crass. 17–19 $\mu$.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905; nos. 251 and 618).

This species was fairly abundant, and seems well characterized by its shallow constriction and by the two pyrenoids in each semicell.

83. Cosmarium Regnesi, *Reinsch, in Abh. Naturh. Ges. Nürnb.* iii. (1866) p. 112, t. 7. fig. 8; *G. S. West, in Journ. Linn. Soc., Bot.* xxvii. (1899) p. 387, t. 10. figs. 10–21.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

84. Cosmarium planum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 59, t. 8. fig. 9.

Long. 29 $\mu$; lat. 18 $\mu$; lat. isthm. 6 $\mu$.

**Nyasa.**—In shore pools, Nkata Bay (23 June, 1904; no. 22).

85. Cosmarium minimum, *W. & G. S. West, l. c.* p. 58, t. 8. fig. 10.

Several slightly different forms.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).



86. Cosmarium sexangulare, *Lund. in Act. R. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 35, t. 2. fig. 23.

Forma minimum, *Nordst. in Bot. Notiser* (1887), p. 162; *in K. Sv. Vet.-Akad. Handl.* xxii. (1888) no. 8, p. 60, t. 7. fig. 26.

Long. 13·5 $\mu$; lat. 11·5 $\mu$; lat. isthm. 3 $\mu$; lat. apic. 6 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34). Among *Utricularia*, Domira Bay (19 June, 1904; no. 579).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

87. Cosmarium abruptum, *Lund. tom. cit.* p. 43, t. 2. fig. 22.

Var. granulatum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 65, t. 7. fig. 32.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

88. Cosmarium Meneghinii, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 96, t. 15. fig. 6.

Forma octangulare, *Wille, in Öfvers. K. Vet.-Akad. Förh.* (1879) no. 5, p. 43, t. 12. fig. 35.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 33).

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905; no. 251).

89. Cosmarium angulosum, *Bréb. in Mém. Soc. Sci. Nat. Cherb.* iv. (1856) p. 127, t. 1. fig. 17.

**Nyasa.**—Among Algæ on shore, Domira Bay (19 June, 1904; no. 17). In swamp, Kota Kota (20 June, 1904; no. 18).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

Var. concinnum, (*Rabenh.*) *W. & G. S. West, in Bot. Tidsskr.* xxiv. (1901) p. 91.—Cosmarium concinnum, *Reinsch.*

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 618). Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

90. Cosmarium læve, *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 161; *G. S. West, in Journ. Linn. Soc., Bot.* xxvii. (1899) p. 386, t. 10. figs. 1–6.

**Nyasa.**—Among Algæ on shore, Domira Bay (19 June, 1904; no. 17).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

Var. minimum, *W. & G. S. West, in Journ. Bot.* xxxv. (1897) p. 119, t. 368. fig. 6.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

91. Cosmarium Cunningtonii, sp. n. (Pl. 7. fig. 7.)

*C.* parvum, circiter 1½-plo longius quam latius, profundissime constrictum, sinu angustissimo-lineari extremo paullo ampliato; semicellulæ pyramidatæ (vel pyramidato-subtrapeziformes), angulis basalibus truncato-rectangularibus

(interdum levissime retusis), lateribus subrectis vel levissime convexis, angulis superioribus subrotundatis, apice subtruncato-convexo, infra et juxta apicem granulis magnis binis ornatæ, granulo singulo ad angulis basalibus juxta sinum, et scrobiculis conspicuis quinquncialiter ordinatis in centro semicellulæ ; a vertice visæ ellipticæ, polis levissime truncatis, intra marginem unumquemque granulis magnis binis instructæ ; a latere visæ oblongo-ellipticæ (vel elliptico-circulares), ad apicem utrinque granulo magno ornatæ ; pyrenoidibus binis.

Long. 42–44 $\mu$ ; lat. 34·5–32·5 $\mu$ ; lat. isthm. 9 $\mu$ ; crass. 19 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

This species stands nearest to *C. bigemma*, Racib. (in Pamietnik matem.-przy. Akad. Umiej. Krakow. xvii. (1889) p. 85, t. 5. fig. 10), from which it is distinguished by the truncate basal angles of the semicells, the smooth sides and slightly convex apex, as well as by the two pyrenoids in each chloroplast.

It should also be compared with *C. supergranatum*, W. B. Turn., forma *pulchrum*, W. B. Turn. (in K. Sv. Vet.-Akad. Handl. xxv. (1893) no. 5, p. 57, t. 9. fig. 24), and *C. ceylanicum*, W. & G. S. West (in Trans. Linn. Soc. ser. 2, Bot. vi. (1902) p. 174, t. 21. figs. 14, 15).

92. Cosmarium scabratulum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 64, t. 6. fig. 27.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905 ; no. 251).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80).

93. Cosmarium præmorsum, *Bréb. in Mém. Soc. Sci. Nat. Cherb.* iv. (1856) p. 128, t. 1. fig. 8; *Nordst. in Act. Univ. Lund*, ix. (1873) p. 12, t. 1. fig. 1.

**Victoria Nyanza.**—In sheltered bay, near Entebbe (1 May, 1905; no. 620).

94. Cosmarium decachondrum, *Roy & Biss. in Journ. Bot.* xxiv. (1886) p. 196, t. 268. fig. 15.

Var. ornatum, var. n. (Pl. 7. fig. 8.)

Var. semicellulis depressis, granulis infra sed juxta apicem majoribus et conspicuis, cum granulum supra isthmum et granulis duobus apicem versus.

Long. 26 $\mu$ ; lat. 26–29 $\mu$ ; lat. isthm. 9 $\mu$ ; crass. 17 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

This variety differs from the type in the somewhat flattened apices, the more conspicuous apical granules, the single granule above the isthmus, and the two granules below the apex of the semicells. Schmidle has described a var. *striatum* of this species from Zanzibar and Mozambique.

It is closely allied to varieties of *C. taxichondrum*, Lund., especially to var. *subundulatum*, Boldt, and its form *subdenticulatum*, W. & G. S. West.



95. Cosmarium Blyttii, *Wille, in Vid.-Selsk. Forhandl. Christiania* (1880), no. 11, p. 25, t. 1. fig. 7.

**Nyasa.**—On the shore, Domira Bay (19 June, 1904; no. 17).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 123).

96. Cosmarium subcostatum, *Nordst. in Öfvers. K. Vet.-Akad. Förh.* (1876) no. 6, p. 37, t. 12. fig. 13.

Long. 33 $\mu$; lat. 29 $\mu$; lat. isthm. 9 $\mu$.

**Tanganyika.**—In swamp, Toa (10 Jan. 1905; no. 208).

Forma minus, *W. & G. S. West, in Journ. Bot.* xxxiv. (1896) p. 379, t. 361. fig. 15.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

97. Cosmarium subprotumidum, *Nordst. in Öfvers. K. Vet.-Akad. Förh.* (1876) p. 38, t. 12. fig. 14.

Long. 24–25 $\mu$; lat. 22–23 $\mu$; lat. isthm. 6–7 $\mu$.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905; no. 251).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

Schmidle has described a species from Nyasa as *C. occultum* which stands very near to *C. subprotumidum*.

98. Cosmarium glyptodermum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 69, t. 7. fig. 23.

Long. 70–80 $\mu$ ; lat. 45–55 $\mu$ ; lat. isthm. 34 $\mu$.

**Tanganyika.**—Abundant in swamp, Kituta (23 Aug. 1904 ; no. 72. Also 26 Aug. 1904 ; no. 80).

99. Cosmarium binum, *Nordst. in Wittr. & Nordst. Alg. Exsic.* (1880) no. 383, fasc. 21 (1889), p. 39 ; *De Toni, Syll. Alg.* i. p. 993.

**Nyasa.**—In shore pools, Nkata Bay (23 June, 1904 ; no. 22).

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905 ; no. 251).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 123).

100. Cosmarium subspeciosum, *Nordst. in Öfvers. K. Vet.-Akad. Förh.* (1875) no. 6, p. 22, t. 6. fig. 13.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904 ; no. 108).

101. Cosmarium multiordinatum, *W. & G. S. West, in Journ. Bot.* xxxv. (1897) p. 121, t. 367. fig. 8.

Long. 66 $\mu$ ; lat. 48 $\mu$ ; lat. isthm. 15 $\mu$.

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905 ; no. 251).

The original examples of this species were described from Pungo Andongo

in Angola, W. Africa. The Nyanza specimens were relatively a little longer, but otherwise precisely similar.

One of the chief features of this species is the presence between the granules of small rounded scrobiculations similar to those of *C. margaritatum* (Lund.), Roy & Biss. ; and I should like once more to emphasize the fact that it is the only species of its section in which the hexagons of scrobiculations are disposed so that two opposite sides are horizontal.

Schmidle (in Engl. Bot. Jahrb. xxvi. (1898) p. 27, t. 1. fig. 20) has described and figured a *Cosmarium* from Zanzibar, which he names "*C. multiordinatum*, forma," but which is most probably a form of *C. decoratum*, W. & G. S. West.

102. Cosmarium quadrum, *Lund. in Act. R. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 25, t. 2. fig. 11.

Forma granulis paullo minoribus.

Long. 66 $\mu$ ; lat. 65 $\mu$ ; lat. isthm. 22 $\mu$.

**Nyasa.**—Among Algæ on rocks, Nkata Bay (23 June, 1904 ; no. 23).

This form was very slightly smaller than the original Swedish plants, and the granules were rather more numerous and of somewhat smaller size.

103. Cosmarium margaritatum, *(Lund.) Roy & Biss. in Journ. Bot.* xxiv. (1886) p. 194.—C. latum, *Bréb., var.* margaritatum, *Lund.*

Long. 66 $\mu$ ; lat. 60 $\mu$ ; lat. isthm. 19 $\mu$.

**Nyasa.**—Among Algæ on stones, Domira Bay (19 June, 1904 ; no. 17).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 124).

104. Cosmarium lacunatum, sp. n.

*C.* mediocre, circiter tam longum quam latum, profundissime constrictum, sinu angusto *introrsum valdissime ampliato* (*lacunato*), isthmo breviter cylindrico ; semicellulæ trapeziformes, angulis superioribus et inferioribus rotundatis, apice lato recto vel levissime concavo, lateribus leviter convexis et sursum divergentibus : membrana granulata, granulis in seriebus obliquis (circ. 14) ordinatis, in ambitu toto semicellularum cum granulis circiter 35, punctulis minutis 5–6 circa granulum unumquemque ; a vertice visæ anguste ellipticæ vel oblongo-ellipticæ, polis rotundatis.

Long. 77 $\mu$ ; lat. bas. semicell. 60–62 $\mu$ ; lat. apic. semicell. 80–86 $\mu$ ; lat. isthm. 22 $\mu$ ; crass. 37 $\mu$.

**Nyasa.**—In swamp, Karonga (29 June, 1904 ; no. 32).

This remarkable *Cosmarium* is at once distinguished by the form of the semicells and the extraordinarily dilated sinus. The granulation is very similar to that of *C. margaritatum*, and, as in that species, small punctulations are present between the granules. Excluding the sinus, the outline of the semicells very much resembles that of *C. biretum*, Bréb.



One other curious feature of *C. lacunatum* is the narrowness of the vertical view, which is $2\frac{1}{5}$ times longer than broad.

Compare also with *C. sublatum*, Nordst.

105. Cosmarium Pseudobroomei, *Wolle, Desm. U.S.* (1884) p. 86, t. 51. figs. 36, 37 (fig. not good) ; *W. B. Turner, in K. Sv. Vet.-Akad. Handl.* xxv. (1893) n. 5, p. 66, t. 9. fig. 41 ; *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1902) p. 170, t. 21. fig. 4.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18). In swamp, Karonga (2 July, 1904 ; no. 34).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 123).

Var. compressum, var. n. (Pl. 7. fig. 11.)

Var. cellulis paullo latioribus quam longioribus, angulis superioribus magis rotundatis.

Long. 30 $\mu$ ; lat. 35 $\mu$ ; lat. isthm. 8 $\mu$ ; crass. 18 $\mu$.

**Tanganyika.**—Abundant in swamp, Kituta (23 Aug. 1904 ; no. 72).

Since Wolle's somewhat crude account of *C. Pseudobroomei* in 1884, the species has been found in many parts of the world and is now very well known.

A number of varieties have also been discovered, some of which appear to be well-marked and of constant character. The African variety most nearly approaches var. *convexum*, W. & G. S. West (in Trans. Bot. Soc. Edinb., Nov. 1904, p. 21, t. 1. fig. 22), in the roundness of the upper angles of its semicells, but the general proportions and the basal angles are quite different.

106. Cosmarium creperum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 63, t. 7. fig. 11.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

This plant differs from typical *C. Pseudobroomei* in its open sinus and in its fewer and relatively smaller granules. In view, however, of the recently discovered varieties of *C. Pseudobroomei*, it would perhaps be better regarded as a variety of that species.

107. Cosmarium pseudamœnum, *Wille, in Bih. K. Sv. Vet.-Akad. Handl.* viii. (1884) no. 18, p. 18, t. 1. fig. 37.—C. inornatum, *Joshua, in Journ. Linn. Soc., Bot.* xxi. (1886) p. 648, t. 24. figs. 26, 27.

*a.* Forma paullo major : long. 59 $\mu$ ; lat. 28 $\mu$ ; lat. isthm. 23 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

*b.* Forma major et paullo longioribus : long. 71 $\mu$ ; lat. 29 $\mu$ ; lat. isthm. 24 $\mu$.

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80).

Many of the specimens of the latter form were considerably larger than any I have previously examined, and in some the granules were more evidently arranged in transverse than in longitudinal series.

Genus XANTHIDIUM, *Ehrenb.*

108. XANTHIDIUM CRISTATUM, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 115, t. 19. fig. 3.

Forma semicellulis subsemicirculari-trapeziformibus, sinu aperto, spinis basalibus paullo reductis (interdum duplicatis ut in *X. fasciculato*).

Long. sine spin. 60 $\mu$, cum spin. 74 $\mu$ : lat. sine spin. 46 $\mu$, cum spin. 58 $\mu$ ; lat. isthm. 15 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18).

Genus ARTHRODESMUS, *Ehrenb.*

109. ARTHRODESMUS INCUS, (*Bréb.*) *Hass. Brit. Freshw. Algæ*, p. 357 (1845) ; *Ralfs, Brit. Desm.* (1848) p. 118, t. 20. fig. 4 *a–d*.

Var. RALFSII, *W. & G. S. West, Alga-fl. Yorks.* (1901) p. 109.—A. Ralfsii, *West, in Journ. Linn. Soc., Bot.* xxix. (1892) p. 168. A. Incus, *Ralfs, l. c.* t. 20. fig. 4 *e–h*.

*a*. Forma semicellulis triangularibus, apice recto, spinis validis variabiliter curvatis subhorizontaliter dispositis.

Long. 20 $\mu$ ; lat. sine spin. 16 $\mu$, cum spin. 52 $\mu$. (Pl. **6**. fig. 13.)

**Victoria Nyanza.**—In plankton, Bukoba (21 Apr. 1905 ; no. 252).

*b*. Forma spinis multe brevioribus.

Long 14·5 $\mu$ ; lat. sine spin. 13 $\mu$ ; long. spin. 3·5 $\mu$.

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905 ; no. 618).

This form is almost identical with one observed in the Scottish plankton (*vide* W. & G. S. West, in Trans. Roy. Soc. Edinb. xli. pt. iii. (1905) p. 501 t. 7. fig. 10).

Genus STAURASTRUM, *Meyen.*

110. STAURASTRUM DICKIEI, *Ralfs, Brit. Desm.* (1848) p. 123, t. 14. fig. 23.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

111. STAURASTRUM CUSPIDATUM, *Bréb. in Menegh. Synops. Desm.* (1840) p. 226 ; *Ralfs, l. c.* p. 122, t. 21. fig. 1.

**Victoria Nyanza.**—In plankton, Bukoba (21 Apr. 1905 ; no. 252).

112. STAURASTRUM BREVISPINUM, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 124, t. 34. fig. 7.

Var. INERME, *Wille, in Öfvers. K. Vet.-Akad. Förh.* 1879, no. 5, p. 52, t. 13. fig. 62.

Forma tetragona : long. 40–43 $\mu$ ; lat. 32–38 $\mu$ : lat. isthm. 14–17 $\mu$.

**Victoria Nyanza.**—In plankton with preceding species (no. 252).



113. STAURASTRUM ORBICULARE, (*Ehrenb.*) *Menegh. in Linnæa*, xiv. (1840) p. 225 ; *Nordst. in Wittr., Nordst. & Lagerh. Alg. Exsic.* fasc. 35 (1903) pp. 9–10 (c. fig.).

Var. DEPRESSUM, *Roy & Biss. in Journ. Bot.* xxiv. (1886) p. 237, t. 268. fig. 14.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

114. STAURASTRUM TURGESCENS, *De Not. Desm. Ital.* (1867) p. 51, t. 4. fig. 43 ; *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxii. sect. B (1902), p. 50, t. 2. fig. 32.

Forma minor : long. 28 $\mu$ ; lat. 25 $\mu$ ; lat. isthm. 10 $\mu$.

**Nyasa.**—In shore pools, Nkata Bay (23 June, 1904 ; no. 22).

115. STAURASTRUM PUNCTULATUM, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 113, t. 22. fig. 1.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905 ; no. 251).

116. STAURASTRUM ALTERNANS, *Bréb. in Ralfs, l. c.* p. 132, t. 21. fig. 7.

**Tanganyika.**—In plankton, Kalambo (5 Nov. 1904 ; no. 154).

117. STAURASTRUM SINENSE, *Lütkem. in Ann. des k.-k. Naturhist. Hofmus. Wien*, xv. (1900) p. 124, t. 6. figs. 39, 40.

Long. 18–18·5 $\mu$ ; lat. 18–23 $\mu$ ; lat. isthm. 7 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

118. STAURASTRUM PILOSUM, (*Näg.*) *Arch. in Pritch. Infus.* (1861) p. 739.—Phycastrum pilosum, *Näg. Gatt. einz. Alg.* 1849, p. 126, t. 8 A. fig. 4.

Var. MINIMUM, var. n. (Pl. **6**. fig. 5.)

Var. perparva, spinis ut in forma typica sed minoribus.

Long. sine spin. 22 $\mu$, cum spin. 25 $\mu$ ; lat. sine spin. 20–22 $\mu$, cum spin. 25 $\mu$ ; lat. isthm. 6 $\mu$.

**Victoria Nyanza.**—Swampy pool, Bukoba (20 Apr. 1905 ; no. 618).

119. STAURASTRUM ECHINATUM, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 215, t. 35. fig. 24 (figure poor) ; *W. & G. S. West, in Bot. Tidsskr.* xxiv. (1901) p. 177, t. 3. fig. 31.

Small form : long. sine spin. 26 $\mu$, cum spin. 31 $\mu$ ; lat. sine spin. 23 $\mu$, cum spin. 32 $\mu$ ; lat. isthm. 8 $\mu$.

**Victoria Nyanza.**—With the preceding species (no. 618).

Except for being slightly smaller, the specimens agreed very well with those observed from Siam. The cells were of the same form, and the spines were of the same size and length.

120. Staurastrum setigerum, *Cleve, Bidr.* p. 490 (1863); *Roy & Biss. in Ann. Scott. Nat. Hist.* (1893) p. 243; *ib.* (1894) t. 3. fig. 9.

Var. Nyansæ, *Schmidle, in Engl. Bot. Jahrb.* xxvi. (1898) p. 53, t. 4. fig. 8.

Long. sine acul. 60 $\mu$, cum acul. 77 $\mu$; lat. sine acul. 48–52 $\mu$, cum acul. 84–90 $\mu$; lat. isthm. 11 $\mu$.

**Victoria Nyanza.**—In the plankton, Bukoba (21 Apr. 1905; no. 252).

This Desmid was not uncommon in the plankton of Victoria Nyanza, but the specimens observed were decidedly larger than those collected by Stuhlmann in 1872 and subsequently described by Schmidle (1898). The var. *Nyansæ* appears to differ from the type in the deeper constriction and in the fewer number of the more delicate aculei. Even in European specimens, however, the number of these delicate aculei is very variable.

121. Staurastrum quadrangulare, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 128, t. 34. fig. 11, t. 22. fig. 7.

Var. attenuatum, *Nordst. in Vidensk. Medd. Naturh. Foren. Kjöb.* (1870) p. 229, t. 4. fig. 44.

Forma angulis semicellularum compressis, cum spinis duobus supra et spinis singulis vel binis infra; a vertice visis pentagonis, lateribus retusis, angulis bi- vel trispinatis. (Pl. **6.** fig. 6.)

Long. 25 $\mu$; lat. sine spin. 21–24 $\mu$, cum spin. 24–27 $\mu$; lat. isthm. 9 $\mu$.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

Lagerheim has recorded a pentagonal form of this variety from Abyssinia (*vide* Nuova Notarisia, 1893, p. 164). The form observed from Tanganyika might equally well be regarded as a small pentagonal form of *S. angulare*, W. B. Turn. (in K. Sv. Vet.-Akad. Handl. xxv. (1893) no. 5, p. 130, t. 14. fig. 17), a species which appears scarcely to be distinct from *S. quadrangulare*.

122. Staurastrum monticulosum, *Bréb. in Menegh. Synops. Desm.* (1840) p. 226; *Ralfs, Brit. Desm.* (1848) p. 130, t. 34. fig. 9.

Var. bidens, var. n. (Pl. **6.** fig. 9.)

Semicellulæ a fronte visæ subrectangulares, verrucis bidenticulatis (vel bispinatis) binis supra angulum unumquemque; a vertice visæ quadratæ, lateribus levissime retusis, angulis bidenticulatis.

Long. sine dentic. 27 $\mu$, cum dentic. 32 $\mu$; lat. sine dentic. 22–26 $\mu$, cum dentic. 26–32 $\mu$; lat. isthm. 10 $\mu$.

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905; no. 251).

This variety differs from *S. monticulosum* var. *bifarium*, Nordst., in the absence of the six inferior accessory spinate warts. It closely approaches a Desmid described by Raciborski as *S. Libellii* (in Pamietnik matem.-przy. Akad. Umiej. Krakow, xvii. (1889) p. 100, t. 7. fig. 12).



123. Staurastrum denticulatum, (*Nág.*) *Arch. in Pritch. Infus.* (1861) p. 738; *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxiii. sect. B (1906), p. 103, t. 11. fig. 11.—Phycastrum denticulatum, *Nág.*

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905; no. 618).

124. Staurastrum Cunningtonii, sp. n. (Pl. **6.** fig. 7.)

*S.* parvum, circiter tam longum quam latum (cum processibus), modice constrictum; semicellulæ campanulatæ, parte inferiore glabra, angulis superioribus in processus breves denticulatos horizontaliter dispositos productis, apicibus processuum tridenticulatis, apice convexo et verrucoso; a vertice visæ triangulares, lateribus rectis (vel levissime convexis), angulis in processus breves denticulatos productis, cum dente conico ad basin processuum utrobique et verrucis bidenticulatis intra marginem lateralem unumquemque, in centro punctatæ.

Long. 30 $\mu$; lat. cum proc. 24–30 $\mu$; lat. isthm. 8 $\mu$.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

This species should be compared with *S. margaritaceum*, (Ehrenb.) Menegh., from which it is distinguished by the more delicate processes, the verrucose apex of the semicell, and the form of the vertical view. The triangular vertical view possesses a conical tooth at each side of the base of each process and a pair of bidenticulate warts within each lateral margin.

125. Staurastrum subgemmulatum, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 76, t. 8. fig. 34.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

126. Staurastrum mutabile, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 129, t. 16. fig. 42.

Long. 35 $\mu$; lat. 36 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

127. Staurastrum polymorphum, *Bréb., in Ralfs, Brit. Desm.* (1848) p. 135, t. 22. fig. 9, t. 34. fig. 6.

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905; no. 618).

128. Staurastrum pseudotetracerum, (*Nordst.*) *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 79.—*S. contortum, Delp.*, var. pseudotetracerum, *Nordst. in K. Sv. Vet.-Akad. Handl.* xxii. (1888) no. 8, p. 37, t. 4. fig. 9.

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905; no. 251.)

129. Staurastrum tetracerum, *Ralfs, in Ann. Nat. Hist.* iv. (1845) p. 150; *Brit. Desm.* (1848) p. 137, t. 23. fig. 7 (figures not good).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72). In swamp, Mbete (28 Sept. 1904; no. 108).

Forma processibus minus divergentibus.

Long. sine proc. 8 $\mu$, cum proc. 16 $\mu$; lat. sine proc. 6 $\mu$, cum proc. 29 $\mu$; lat. isthm. 2·5 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

130. STAURASTRUM GRACILLIMUM, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 75, t. 8. fig. 1.

Forma 3-radiata.

**Victoria Nyanza.**—Among *Utricularia*, in sheltered bay near Entebbe (1 May, 1905; no. 620).

131. STAURASTRUM GRACILE, *Ralfs, in Ann. Nat. Hist.* xv. (1845) p. 155; *Brit. Desm.* (1848) p. 136, t. 22. fig. 12.

Var. SUBORNATUM, *Schmidle, in Engl. Bot. Jahrb.* xxvi. (1898) p. 51, t. 4. fig. 1.

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905; no. 249).

Var. PROTRACTUM, var. n. (Pl. **6.** fig. 11.)

Var. apice semicellulæ protracto leviter retuso et glabro.

Long. 29 $\mu$; lat. sine proc. circ. 16 $\mu$, cum proc. 58–62 $\mu$; lat. isthm. 7 $\mu$.

**Nyasa.**—In plankton, Anchorage Bay (13 June, 1904; no. 9).

Var. NYANSÆ, var. n. (Pl. **6.** fig. 10.)

Var. corpore semicellularum angustiore, ad basin inflato-bulboso, processibus incurvatis delicate noduloso-denticulatis.

Long. 26 $\mu$; lat. sine proc. circ. 12 $\mu$, cum proc. 48 $\mu$; lat. isthm. 4·5 $\mu$.

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905; no. 249).

This variety is very near to *S. gracile* var. *elegantulum*, W. & G. S. West (in Trans. Linn. Soc. ser. 2, Bot. vi. (1902) p. 191, t. 22. fig. 20), but differs in the narrow and bulbous base of the semicells, and in the more incurved and more coarsely denticulate processes.

132. STAURASTRUM LONGIRADIATUM, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1896) p. 267, t. 17. fig. 23.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; n. 620).

133. STAURASTRUM SUBMANFELDTII, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1906) p. 188, t. 22. fig. 16.

**Victoria Nyanza.**—With the preceding species (no. 620).

Forma semicellulæ a vertice visæ lateribus undulatis et denticulatis (verrucis emarginatis perreductis ornatis).

Long. 38 $\mu$; lat. cum proc. 52–60 $\mu$; lat. bas. semicell. 13·5 $\mu$; lat. isthm. 8·5 $\mu$.

**Nyasa.**—In swamp, Karonga (2 Aug. 1904; no. 34).



134. STAURASTRUM ANATINUM, *Cooke & Wills, in Journ. Quek. Micr. Club* (1881), t. 15. figs. 12, 13; *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxii. sect. B (1902), p. 54, t. 1. figs. 24, 25.

Var. SUBGLABRUM, var. n. (Pl. **6.** fig. 8.)

Var. corpore semicellularum verrucis emarginatis pæne destituto; processibus ut in forma typica.

Long. sine proc. 42 $\mu$; lat. sine proc. 24–27 $\mu$; cum proc. 84–96 $\mu$; lat. isthm. 11·5 $\mu$.

**Victoria Nyanza.**—In plankton, Bukoba (21 Apr. 1905; no. 252).

Only a few of the emarginate warts are present on the semicells of this variety, but the processes are quite characteristic of the species.

135. STAURASTRUM LEPTOCLADUM, *Nordst. in Vidensk. Meddl. Naturh. Foren. Kjöb.* 1869, p. 228, t. 4. fig. 57.

Forma AFRICANUM, nob. (Pl. **6.** fig. 12.)

Forma paullo major, processibus subrectis et horizontaliter dispositis (parallelis), ad basin semicellulæ cum denticulis singulis vel binis; apicibus semicellularum convexis et glabris; semicellulis a vertice visis corpore lato elliptico-rotundato.

Long. 42–43 $\mu$; lat. sine proc. circ. 11–21 $\mu$, cum proc. 146–152 $\mu$; lat. isthm. 6–7 $\mu$; crass. 14 $\mu$.

**Nyasa.**—In the plankton, near Mtangula (22 June, 1904; no. 20). Plankton, off Vahambwera Point (24 June, 1904; no. 24). Plankton, Deep Bay (24 June, 1904; no. 25). Plankton, off Karonga (1 July, 1904; no. 30).

**Victoria Nyanza.**—In plankton, Bukoba (21 Apr. 1905; no. 252).

This large form with horizontally-directed processes was frequent in the plankton of Nyasa and Victoria Nyanza. Schmidle mentions a form which is possibly identical with it as occurring in Stuhlmann's collections from Victoria Nyanza.

A few smaller specimens of *S. leptocladum* were observed from Victoria Nyanza in which the processes were shorter, and the two spines at the extremity of each process disposed in a horizontal plane, the bifurcation only being apparent in the vertical view.

136. STAURASTRUM LIMNETICUM, *Schmidle, in Engl. Bot. Jahrb.* xxvi. (1898) p. 52, t. 4. fig. 5.

Long. sine proc. 46–51 $\mu$; lat. sine proc. circ. 28–36 $\mu$, cum proc. 100–130 $\mu$; lat. isthm. 14 $\mu$. (Pl. **3.** figs. 8–10, 20.)

**Victoria Nyanza.**—Abundant in the plankton, Bukoba (18 Apr. 1905; no. 249, and 21 Apr. 1905; no. 252).

This species was in great abundance in the plankton of Victoria Nyanza, the locality from which Schmidle originally described it. The semicells possessed either five or six processes, which exhibited considerable variation in the denticulation. The denticulation of the under surfaces of the processes was commonly much more pronounced than that of the upper surfaces, but in some few cases the denticulation was almost equal all round the processes. Each process was terminated by three or four short spines.

Var. ACULEATUM, *Lemm. in Abh. Nat. Ver. Brem.* xvi. (1899) p. 344, t. 1. figs. 10, 11.

Long. sine proc. 36–38 $\mu$; lat. sine proc. circ. 23–25 $\mu$, cum proc. 103–128 $\mu$; lat. isthm. 9 $\mu$.

**Victoria Nyanza.**—Abundant with the type (nos. 249 and 252).

This variety was quite as abundant as the more typical form, and the semicells similarly possessed either five or six processes. It appears to differ from *S. limneticum* in two principal features:—the body of the semicell is relatively much smaller, and the processes are aculeate.

Lemmermann's specimens were from the plankton of Lake Wakatipu, New Zealand, and the African examples differed from his in the fewer and more irregularly disposed aculei, which were strongly reminiscent of those on the processes of *S. aspinosum*, Wolle, and *S. acanthastrum*, W. & G. S. West. Some individuals were noticed which possessed a few sharp aculei on the apex of the semicells near the bases of the processes.

137. STAURASTRUM TOHOPEKALIGENSE, *Wolle, Freshw. Alg. U.S.* (1887) p. 45, t. 59. figs. 4, 5.—S. nonanum, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 119, t. 15. fig. 14.

*a.* Forma triangularis: long. sine proc. 51 $\mu$, cum proc. 86–91 $\mu$; lat. sine proc. 35–36 $\mu$, cum proc. 90–96 $\mu$; lat. isthm. 16·5 $\mu$.

*b.* Forma quadrangularis: long. sine proc. 49 $\mu$, cum proc. 84 $\mu$; lat. sine proc. 33–34 $\mu$, cum proc. 76–78 $\mu$; lat. isthm. 16 $\mu$.

**Victoria Nyanza.**—Plankton, Bukoba (18 Apr. 1905; no. 249, and 21 Apr. 1905; no. 252).

Triangular and quadrangular forms of this species were equally abundant in the plankton of Victoria Nyanza. They were typical as regards proportions and length of processes, and the latter possessed two or three divergent spines at their apices. These are the first specimens of the type form which have been recorded with more than two spines on the processes, although three spines are generally found on the described varieties of this species.

Schmidle has recorded the var. *quadrangulare*, W. & G. S. West, from Victoria Nyanza, but no specimen I examined possessed the proportions of that variety.



Genus SPHÆROZOSMA, *Corda*.

138. SPHÆROZOSMA EXCAVATUM, *Ralfs, in Ann. Nat. Hist.* xvi. (1845) p. 15; *Brit. Desm.* (1848) p. 67, t. 6. fig. 2.

**Nyasa.**—Plankton, Anchorage Bay (11 June, 1904; no. 5).

Genus HYALOTHECA, *Ehrenb.*

139. HYALOTHECA MUCOSA, (*Dillw.*) *Ehrenb. in Bericht Berlin* (1840), p. 212; *Ralfs, Brit. Desm.* (1848) p. 53, t. 1. fig. 2.—Conferva mucosa, *Dillw.* (1819).

**Tanganyika.**—Plankton, Mbete (28 Sept. 1904; no. 105). Plankton, Lofu River (5 Oct. 1904; nos. 123 and 124), very abundant.

Order PROTOCOCCOIDEÆ.

Family **VOLVOCACEÆ**.

Genus PANDORINA, *Bory*.

140. PANDORINA MORUM, (*O. F. Müll.*) *Bory*; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 99; *Cooke, Brit. Freshw. Alg.* t. 27. fig. 2.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905; no. 251).

Family **CHARACIEÆ**.

Genus CHARACIUM, *A. Br.*

141. CHARACIUM LONGIPES, *Rabenh. Alg. Sachs.* no. 171 (1852); *Fl. Europ. Alg.* iii. (1868) p. 85.

Long. cell. 28·5–31 $\mu$; lat. cell. 6–7 $\mu$; long. stip. 12·5–18 $\mu$.

**Victoria Nyanza.**—Swampy pools, Bukoba (20 Apr. 1905; no. 251).

142. CHARACIUM PRINGSHEIMII, *A. Br. Alg. Unicell.* p. 106 (1855); *Rabenh. l. c.* p. 86.

Long. cell. cum stip. brev. 34 $\mu$; lat. cell. 11 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

Family **PLEUROCOCCACEÆ**.

Genus TROCHISCIA, *Kütz.*

143. TROCHISCIA ACICULIFERA, (*Lagerh.*) *Hansg. in Hedwigia*, xxvii. (1888), p. 129.—Acanthococcus aciculiferus, *Lagerh.*

Diam. cell. sine spin. 14 $\mu$; long. spin. 2·5 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

Family **HYDRODICTYACEÆ**.

Subfam. PEDIASTREÆ.

Genus PEDIASTRUM, *Meyen*.

144. PEDIASTRUM TETRAS, (*Ehrenb.*) *Ralfs, in Ann. Nat. Hist.* xiv. (1844) p. 469, t. 12. fig. 4.—Micrasterias Tetras, *Ehrenb.*

Dispositio cellularum 4, 4 + 7, et 5 + 11.

**Nyasa.**—On shore, Domira Bay (19 June, 1904 ; no. 17). In swamp, Kota Kota (20 June, 1904 : no. 18). Swampy lake margin, Domira Bay (no. 579).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In swamp, Kituta (23 and 26 Aug. 1904 ; nos. 72 and 80). Floating on surface, Kituta Bay (26 Aug. 1904 ; no. 79). In swamp, Mbete (29 Sept. 1904 ; no. 108). Plankton, Lofu River (5 Oct. 1904 ; no. 123). Plankton, Baraka (24 Feb. 1905 : no. 240).

From Nyasa (no. 17) a cœnobium was observed consisting of only three cells (Pl. **5.** fig. 6). This is a very interesting condition directly intermediate in character between the two-celled cœnobia of *Euastropsis* and the simple four-celled cœnobia of *Pediastrum*.

Var. LONGICORNE, *Racib.*

Diam. cœnob. 4 cell. (cum cornibus) 18–20 $\mu$. (Pl. **5.** fig. 5.)

**Nyasa.**—Plankton, Anchorage Bay (13 June, 1904 : no. 9).

145. PEDIASTRUM BORYANUM, (*Turp.*) *Menegh. Synops. Desm. in Linnœa*, xiv. (1840) p. 210 ; *Ralfs, Brit. Desm.* (1848) p. 187, t. 31. fig. 9 *a*.

**Nyasa.**—Plankton, Deep Bay (24 June, 1904 ; no. 25). In swamp, Kota Kota (20 June, 1894 ; no. 18).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904 ; no. 108). Plankton, near Sumbu (13 Oct. 1904 ; no. 138). Plankton, near Kala (19 Nov. 1904 ; no. 170).

Var. RUGULOSUM, var. n. (Pl. **5.** fig. 22.)

Var. cellulis irregulariter cristatis, cristis valde irregularibus sinuatis et anastomosis.

Diam. cœnob. 150–192 $\mu$ ; diam. cell. 22–29 $\mu$.

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252).

146. PEDIASTRUM INTEGRUM, *Näg. Gatt. einz. Alg.* (1849) p. 96, t. 5 B. fig. 4.

Diam. cœnob. 28–67 $\mu$.

**Tanganyika.**—Plankton, near Mbete (28 Sept. 1904 ; no. 109). Plankton, near Kala (19 Nov. 1904 ; no. 170).



147. PEDIASTRUM DUPLEX, *Meyen, Beob. Algenf.* (1829) p. 772 ; *Lagerh. in Öfvers. K. Vet.-Akad. Förh.* (1882) no. 2, p. 56.—P. pertusum, *Kütz. Phyc. Germ.* (1845) p. 143 (ex parte). P. Napoleonis, *Ralfs, Brit. Desm.* (1848) p. 186, t. 31. fig. 7 *c, e*.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

**Tanganyika.**—Plankton, near Baraka (24 Feb. 1905 ; no. 240).

Forma cellulis centralibus ut in forma *rectangulari*, cellulis peripheriis cum processibus divaricatis valde attenuatis ; membrana cellularum granulata.

Diam. cœnob. 160–235 $\mu$ ; diam. cell. 29–33 $\mu$.

**Victoria Nyanza.**—Plankton, near Bukoba (20 Apr. 1905 ; no. 252).

This form resembles forma *cohærens*, Bohlin, and forma *rectangulare*, Bohlin (in Bih. K. Sv. Vet.-Akad. Handl. xxiii. no. 7 (1897), p. 31, t. 2. figs. 1–3), in the form of the central cells, but differs in its peripheral cells.

Var. CLATHRATUM, *A. Br. Alg. Unicell.* (1855) p. 93.

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252). Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In swamp, Mbete (28 Oct. 1904 ; no. 108).

Var. RETICULATUM, *Lagerh. in Öfvers. K. Vet.-Akad. Förh.* (1882) no. 2, p. 56, t. 2. fig. 1.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In swamp, Mbete (no. 108).

148. PEDIASTRUM SIMPLEX, *Meyen, l. c.* ; *Menegh. in Linnœa*, xiv. (1840) p. 212 ; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 71 ; *Wildeman, in Bull. de l'Herb. Boissier*, i. (1893) p. 412, t. 9 ; *Chodat, Algues Vertes de la Suisse* (1902), p. 225 c. fig.—P. simplex, *cf. Reinsch, Algenfl. Frank.* (1867) p. 88, t. 7. fig. 4 *a, b*. P. simplex *α*. compactum, *Chodat, l. c.*

Peripheral cells produced outwardly into a long attenuated process, *outer margins of cells concave* ; central cells polygonal, either without intercellular spaces, or with minute spaces between some or all of the cells. Processes radiating, generally rather delicate but sometimes stout, apices minutely truncate or nearly emarginate ; cell-walls commonly punctate and sometimes granulate.

Diam. cœnob. 44–92 $\mu$ ; diam. cell. 9–16 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (13 and 14 June, 1904 ; nos. 9 and 10).

**Tanganyika.**—In plankton, near Chamkaluki (15 Nov. 1904 ; no. 160) and near Baraka (24 Feb. 1905 ; no. 240).

Forma STURMII.—P. Sturmii, *Reinsch, l. c.* p. 90, t. 7. fig. 1. P. Sturmii, *var.* radiatus, *Lemm. Forschungsb. Biol. Stat. Plön*, vii. (1899) p. 20.

Outer margins of peripheral cells *convex* ; central cells generally without intercellular spaces, but sometimes with small ones.

Diam. cœnob. 20–82 $\mu$ ; diam. cell. 8–17 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (13 Apr. 1904 ; no. 9).

**Victoria Nyanza.**—Near Bukoba (17 Apr. 1905 ; no. 248). In sheltered bay, near Entebbe (1 May, 1905 ; no. 620).

Var. CLATHRATUM.—P. clathratum, (*Schröt.*) *Lemm. Forschungsb. Biol. Stat. Plön*, vii. (1899) p. 20 ; *Schmidle, in Engl. Bot. Jahrb.* xxxii. (1903) t. 3. fig. 19. P. enoplon, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 81, t. 5. figs. 1, 2.

With large intercellular spaces between the central cells ; outer margins of peripheral cells typically concave. Processes long and moderately robust.

Diam. cœnob. 100–180 $\mu$ ; diam. (max.) cell. 18–26 $\mu$. (Pl. **2.** figs. **17, 18** ; Pl. **3.** fig. 16.)

**Nyasa.**—Plankton, off Vahambwera Point (24 June, 1904 ; no. 24) and off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252).

—— forma RADIANS.—P. simplex, *var.* radians, *Lemm.* 1897; *Forschungsber. Biol. Stat. Plön*, vii. (1899) p. 19, t. 2. figs. 24, 25. P. simplex, *β.* annulatum, *Chodat*, 1902.

Cœnobium consisting of a ring of peripheral cells, the outer margins of which are concave ; no central cells.

Diam. cœnob. 46–75 $\mu$. An abnormal cœnobium is figured on Pl. **5.** fig. 21.

**Nyasa.**—Plankton, Anchorage Bay (11 and 13 June, 1904 ; nos. 5 and 9). Plankton, off Vahambwera Point (24 June, 1904 ; no. 24) and off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—In sheltered bay, near Entebbe (1 May, 1905 ; no 620).

—— forma MICROPORUM.—P. clathratum, *var.* microporum, *Lemm. l. c.* p. 20, t. 2. figs. 29–31. P. clathratum, *var.* Baileyanum, *Lemm. l. c.* t. 2. figs. 26–28.

Peripheral cells of cœnobium as in typical var. *clathratum*, but central cells stouter with smaller intercellular spaces.

Diam. cœnob. usque ad 182 $\mu$.

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252).

—— forma OVATUM, (*Ehrenb.*).—P. Schröteri, *Lemm. l. c.* p. 20, t. 2. fig. 33, *et var.* microporum, *Lemm.* t. 2. figs. 34, 35. P. clathratum, *forma* ovatum, (*Ehrenb.*) *Schmidle, in Engl. Bot. Jahrb.* xxxii. (1903) p. 84, t. 3. fig. 18.

Central and peripheral cells ovoid and stout, margins generally convex (rarely slightly concave).

Diam. cœnob. usque ad 240 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (13 and 14 June, 1904 ; nos. 9 and 10). Plankton, off Vahambwera Point (24 June, 1904 ; no. 24) and off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252).

*P. simplex* occurred in great abundance in some of the plankton-material



and many diverse forms were observed. Extreme forms scarcely appear to belong to the same species, but a careful comparison of all the forms gives almost a complete gradation from one extreme to the other. Most of these forms have at different times been described under various specific names ; but after examining the African plankton-forms it is impossible to recognize more than one species, and for the specific name I have retained Meyen's old name *Pediastrum simplex*. This name is a very appropriate one, as there is no other species of the genus with a simple radiating process from each peripheral cell.

In any of the forms the cell-wall may be smooth, punctate, or granulate, and the processes may be obtuse, truncate, or minutely emarginate.

In one most interesting form the cœnobium was not plane, the cells being disposed in the manner of a somewhat simplified *Cœlastrum*. Some of these cells possessed only one process and others two, and one of them appeared to be a resting akinete (Pl. **5.** fig. 20). This form was from Victoria Nyanza (no. 620) : diam. cœnob. 40–46 $\mu$ ; diam. cell. 10–17 $\mu$. It should be compared with *Cœlastrum cornutum*, Lemaire (in Journ. de Bot. févr. (1894) pp. 82, 83 cum fig.), and also with *Pediastrum Kaweraiskyi*, Schmidle (Algen Hochseen Kaukasus, 1897, p. 5 ; Lemm. in Ber. Deutsch. Bot. Ges. xix. (1901) t. 4. fig. 5).

## Family **PROTOCOCCACEÆ** (or **AUTOSPORACEÆ**).

### Subfam. CŒLASTREÆ.

### Genus CŒLASTRUM, *Näg.*

149. CŒLASTRUM MICROPORUM, *Näg. ex A. Br. Alg. Unicell.* (1855) p. 70 ; *Rabenh. Fl. Europ. Alg.* iii. 1868, p. 89.

Diam. cœnob. 38–90 $\mu$ ; diam. cell. 11·5–27 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (13 June, 1904 ; no. 9).

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905 ; no. 252).

150. CŒLASTRUM SPHÆRICUM, *Näg. Gatt. einz. Alg.* (1849) p. 97, t. 5 *c*. fig. 1 *a–d*.

**Nyasa.**—Plankton, Anchorage Bay (13 June, 1904 ; no. 9). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579). In swamp, Kota Kota (20 June, 1904 ; no. 18).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

151. CŒLASTRUM CAMBRICUM, *Arch. in Micr. Journ.* (1868) p. 65 ; *Cooke, Brit. Freshw. Alg.* (1882) p. 46 ; *Lemaire, in Journ. de Bot.* no. 4, févr. (1894) pp. 79, 80 (cum fig.).—C. cambricum, *var.* quinqueradiatum, *Lemaire*, 1894. C. pulchrum, *Schmidle, in Ber. Deutsch. Bot. Ges.* x. (1892) p. 206, t. 11. fig. 1 ; *in Ber. d. Nat. Ges. Freiburg*, vii. (1893) p. 12, t. 2. fig. 10 ; *Bohlin, in Bih. K. Sv. Vet.-Akad. Handl.* xxii. (1897) no. 7, p. 35.

**Nyasa.**—Plankton, Anchorage Bay (14 June, 1904; no. 10).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80). In swamp, Mbete (28 Sept. 1904; no. 108).

**Victoria Nyanza.**—Near Entebbe (1 May, 1905; no. 620).

This species was abundant in some of the collections, and the cells showed great variation in the form of the external margin. It is a very characteristic plant and should not be confused with any other species of the genus. Lemaire's "var. *quinqueradiatum*" is one of its commonest forms.

Var. INTERMEDIUM, *(Bohlin) nob.*—C. pulchrum, *Schmidle, var.* intermedium, *Bohlin, in Bih. K. Sv. Vet.-Akad. Handl.* xxii. (1897) no. 7, p. 35, t. 2. figs. 16, 17. C. cruciatum, *Schmidle, in Bot. Centralbl.* lxxxi. (1900) no. 13.

Diam. cœnob. usque ad 108 $\mu$; diam. cell. 13–16 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (14 June, 1904; no. 10).

The cells of this variety, as in the case of the type, possess from four to six short radiating processes. The variety only differs in the bluntness of the outstanding projections, which are rounded and not truncate.

Var. NASUTUM, *(Schmidle) nob.*—C. pulchrum, *var.* nasutum, *Schmidle, in Engl. Bot. Jahrb.* xxvi. (1898) p. 6; xxxii. (1903) p. 85, t. 3. fig. 7.

Diam. cœnob. 40–114 $\mu$; diam. cell. 8–27 $\mu$; long. process. margin. 4·5–6·5 $\mu$.

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905; no. 249).

This well-marked variety occurred abundantly, and a large number of auto-colonies were observed in process of formation in the mother-cells. The principal feature of the variety could be recognized when the auto-colonies were only 18 $\mu$ in diameter. The marginal processes were sometimes truncate and sometimes broadly rounded. It was originally described from the plankton of Victoria Nyanza by Schmidle in 1898.

152. CŒLASTRUM COMPOSITUM, sp. n. (Pl. **5**. figs. 8–9.)

*C.* cœnobiis cubicis e subfamiliis 8 formatis vel sphæricis e subfamiliis pluribus formatis: subfamilia unaquaque tetraëdrica cum angulis abrupte truncatis vel depresso-pyramidatis, e cellulis parvis 4 tetraëdrica dispositis compositis, et cum lacuna minuta inter cellulas; lacunis magnis inter subfamilias, iis cœnobiorum cubicorum irregulariter rotundo-rectangularibus, iis cœnobiorum sphæricorum subtriangularibus. Membrana cellularum firma glabra et non incrassata.

Diam. cœnob. 36–82 $\mu$; diam. cell. 6–10 $\mu$.

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905; no. 252). Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

This interesting *Coelastrum* differs from all other species of the genus in having a tetrahedral group of four cells in place of what would normally be a single cell. The interstices between the groups are very large, and there is also a small intercellular space between the four cells of each group. The abruptly truncate external angles of the cells are also peculiar.

I have not seen any stage in the formation of auto-colonies in this species; such a condition should be of great interest.



153. CŒLASTRUM RETICULATUM, *(Dang.) Senn.* — Hariotina reticulata, *Dang. in Le Botaniste*, i. (1889) p. 162; *Chodat, Alg. Vert. Suisse*, i. (1902) p. 233. C. subpulchrum, *Lagerh. in La Nuova Notarisia* (1893), p. 158; *Bohlin, in Bih. K. Sv. Vet.-Akad. Handl.* xxiii. (1897) no. 7, p. 37, t. 2. figs. 28–32. C. distans, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* xxv. (1893) no. 5, p. 161, t. 21. fig. 18.

Diam. cœnob. usque ad 132 $\mu$.

**Nyasa.**—In shore pools, Nkata Bay (23 June, 1904; no. 22). Plankton, off Vahambwera Point (24 June, 1904; no. 24) and in Deep Bay (24 June, 1904; no. 25). In swamp, Karonga (2 July, 1904; no. 33).

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905; no. 252). Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

Some of the specimens reached a large size, and the reticulate colonies were a conspicuous feature of the plankton.

### Genus SORASTRUM, *Kütz.*

154. SORASTRUM HATHORIS, *(Cohn) Schmidle, in Engl. Bot. Jahrb.* xxvii. (1899) p. 230; xxxii. (1903) p. 85.—Selenosphærium Hathoris, *Cohn, 'Desm. Bongoenses,' Festschr. zur Feier des hundertjähr. Bestehens der Naturf. Ges. in Halle-a-S.* (1879) p. 13, t. 11. figs. 16, 17.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905; no. 249).

### Subfam. CRUCIGENIEÆ.

### Genus CRUCIGENIA, *Morren.*

155. CRUCIGENIA TETRACANTHA, sp. n. (Pl. **5**. fig. 7.)

Cœnobium quadratum, e cellulis 4 formatum consociatum; cellulæ subquadratæ, lateribus subrectis, ad angulum exteriorum spina longa valida attenuata leviter curvata ornatæ, apicibus spinorum acutissimis; pyrenoide singulo in cellula unaquaque.

Diam. cœnob. sine acul. 17–19 $\mu$; diam. cell. 9 $\mu$; long. acul. 17–18 $\mu$.

**Tanganyika.**—Plankton, near Baraka (24 Feb. 1905; no. 240).

This species is, perhaps, nearest to *C. heteracantha*, Nordst., but is at once distinguished by the large solitary spine at the external angle of each of the four cells. It bears considerable resemblance to a four-celled colony of some forms of *Pediastrum simplex*. There is a minute space in the centre of the cœnobium between the four cells, and there appeared to be a complete absence of a mucous envelope. The spines are hollow, greatly attenuated, and their apices drawn out into very sharp points. The single pyrenoids in each cell were conspicuous.

Subfam. SELENASTREÆ.

Genus SCENEDESMUS, *Meyen*.

156. SCENEDESMUS BIJUGATUS, (*Turp.*) *Kütz. Synops. Diat.* (1834).—Achnanthes bijuga, *Turp.*, 1828. Scenedesmus obtusus, *Meyen*, 1829.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

**Tanganyika.**—Plankton, off Niamkolo Island (29 July, 1904 ; no. 36). On the stones of the shore, Niamkolo (3 Aug. 1904 ; no. 44). Plankton, Komba Bay (11 Oct. 1904 ; no. 135) and near Sumbu (13 Oct. 1904 ; no. 138). In swamp, Toa (10 Jan. 1905 ; no. 208).

Forma ARCUATA, (*Lemm.*) *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxiii. sect. B (1906), p. 105, t. 10. figs. 12–14.—Scenedesmus arcuatus, *Lemm. in Forschungsb. Biol. Stat. Plön*, vii. (1899) p. 17, t. 1. figs. 2–4.

**Tanganyika.**—Plankton, Komba Bay (11 Oct. 1904 ; no. 135) and near Chamkaluki (15 Nov. 1904 ; no. 160).

This form appears to be frequent in the plankton. Several colonies were observed (from no. 160) attached together to form a curved plate of oblong cells, which greatly resembled a colony of *Crucigenia rectangularis*, (Näg.) F. Gay, var. *irregularis*, (Wille) nob.

157. SCENEDESMUS DENTICULATUS, *Lagerh. in Öfvers. K. Sc. Vet.-Akad. Förh.* (1882) no. 2, p. 61, t. 2. figs. 13–16.

Var. LINEARIS, *Hansg. in Archiv Naturwiss. Landesdurchf. Böhm.* vi. (1888) no. 6, p. 268.—S. denticulatus, *var.* lineatus, *West, in Journ. Linn. Soc., Bot.* xxix. (1892) p. 193, t. 18. fig. 7.

**Nyasa.**—On stones on shore, Domira Bay (19 June, 1904 ; no. 17). In swamp, Kota Kota (20 June, 1004 ; no. 18). In swamp, Karonga (2 July, 1904 ; no. 34).

**Tanganyika.**—Plankton, Lofu River (5 Oct. 1904 ; no. 123).

158. SCENEDESMUS ACUTIFORMIS, *Schröder, in Forschungsb. Biol. Stat. Plön*, v. (1897) p. 17, t. 2. f. 4.

**Nyasa.**—In pools, Nkata Bay (23 June, 1904 ; no. 22). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

Var. BRASILIENSIS, (*Bohlin*) *W. & G. S. West, in Trans. Bot. Soc. Edinb.* xxiii. (1905) p. 30, t. 1. figs. 8, 9.—S. brasiliensis, *Bohlin, in Bih. K. Sv. Vet.-Akad. Handl.* xxiii. (1897) no. 7, p. 22, t. 1. figs. 26–27. S. acutiformis, *Schröd. var.* spinulifer, *W. & G. S. West, in Bot. Tidsskr.* xxiv. (1901) p. 182, t. 4. figs. 46–49.

**Nyasa.**—On rocks and in shore-pools, Nkata Bay (23 June, 1904 ; nos. 22 and 23). Among other Algæ in scrapings off the bottom of s.s. 'Guendolen,' at anchor at S. end of the lake (15 June, 1904 ; no. 577).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72). Plankton, near Sumbu (13 Oct. 1904 ; no. 138) and near Kala (19 Nov. 1904 ; no. 170).

159. SCENEDESMUS OBLIQUUS, (*Turp.*) *Kütz. Synops. Diat.* (1834) p. 609.—Achnanthes obliqua, *Turp.*, 1828. Scenedesmus acutus, *Meyen*, 1829 ; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 64.

**Nyasa.**—On stones on shore, Domira Bay (19 June, 1904 ; no. 17). Shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

**Tanganyika.**—Plankton, Lofu River (5 Oct. 1904 ; no. 123).

160. SCENEDESMUS QUADRICAUDA, (*Turp.*) *Breb. Alg. Falais.* p. 66 (1835).—Achnanthes quadricauda, *Turp.*, 1828. Scenedesmus caudatus, *Corda*, 1838 ; *Ralfs. Brit. Desm.* (1848) p. 190, t. 31. fig. 12 *a–g*.

**Nyasa.**—Plankton, Anchorage Bay (13 June, 1904 ; nos. 5 and 9). On shore, Domira Bay (19 June, 1904 ; no. 17). Shore-pools, Nkata Bay (23 June, 1904 ; no. 22). In swamp, Kota Kota (20 June, 1904 ; no. 18). In swamp, Karonga (2 July, 1904 ; no. 33). S. end of lake (no. 577). Swampy lake margin, Domira Bay (no. 579).

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904 ; no. 108). Plankton, Kituta Bay (26 Aug. 1904 ; no. 81), near Kala (19 Sept. 1904 ; no. 170), near Kirando (1 Dec. 1904 ; no. 175), near Maswa (14 Jan. 1905 ; no. 211), and near Baraka (24 Feb. 1905 ; no. 240).

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905 ; no. 618). Sheltered bay near Entebbe (1 May, 1905 ; no. 620).

Var. MAXIMUS, *W. & G. S. West, in Trans. Linn. Soc. ser. 2, Bot.* v. (1895) p. 83, t. 5. figs. 9, 10.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; nos. 33 and 34).

**Tanganyika.**—In plankton, near Sumbu (13 Oct. 1904 ; no. 138), near Chamkaluki (15 Nov. 1904 ; no. 160), near Kala (19 Nov. 1904 ; no. 170), off Kirando (1 Dec. 1904 ; no. 175), and near Baraka (24 Feb. 1905 ; no. 240).

**Victoria Nyanza.**—In plankton, near Bukoba (18 Apr. 1905 ; no. 249). Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

Some of the cœnobia were very large, up to 54 $\mu$ in length (cœnob. of 4 cells) ; length of cells 42 $\mu$. The variety was originally described from Madagascar.

Var. OPOLIENSIS, (*Richt.*) *W. & G. S. West, in Trans. Linn. Soc. ser. 2, Bot.* vi. (1902) p. 197, t. 17. figs. 16, 17.—S. opoliensis, *Richter*, 1895.

**Tanganyika.**—Abundant in swamp, Mbete (28 Sept. 1904 ; no. 108).

### Genus DIMORPHOCOCCUS, *A. Br.*

161. DIMORPHOCOCCUS LUNATUS, *A. Br. Alg. Unicell.* (1855) p. 44; *Rabenh. Fl. Europ. Alg.* iii. (1868) pp. 6 (cum fig.) et 35; *West, in Journ. Roy. Micr. Soc.* (1892) p. 735, t. 9. fig. 39.—Scenedesmus radiatus, *Reinsch.*

Diam. colon. usque ad 104 $\mu$; long. cell. 14–16 $\mu$.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904; no. 108).

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905; no. 249).

### Genus ANKISTRODESMUS, *Corda.*

162. ANKISTRODESMUS FALCATUS, (*Corda*) *Ralfs, Brit. Desm.* (1848) p. 180, t. 34. fig. 3.—Micrasterias falcata, *Corda*, 1835. Ankistrodesmus fusiformis, *Corda*, 1838 (ex parte). Rhaphidium fasciculatum, *Kütz.*, 1845. R. polymorphum, *Fresen., var.* falcatum, *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 45.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

**Tanganyika.**—Plankton, Lofu River (5 Oct. 1904; no. 123).

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905; no. 618). Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

*a.* Forma cellulis robustis lunatis, chromatophora cum pyrenoide singulo. Lat. cell. 5 $\mu$.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904; no. 18).

*b.* Forma cellulis robustis rectis solitariis, leviter tumidis, sine pyrenoidibus. Lat. cell. 7 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 24).

Var. ACICULARIS, (*A. Br.*) *G. S. West, Treat. Brit. Freshw. Alg.* (1904) p. 223.—Rhaphidium aciculare, *A. Br. in Rabenh. Alg.* 1849, no. 442. Ankistrodesmus acutissimus, *Arch. in Journ. Micr. Sci.* 1862, p. 255, t. 12. figs. 44–57.

**Nyasa.**—On stones on shore, Domira Bay (19 June, 1904; no. 17). Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

Var. SPIRILLIFORMIS, *G. S. West, l. c.* (1904) p. 224.—Rhaphidium polymorphum, *var.* spirale, *W. & G. S. West, in Journ. Bot.* xxxvi. (1898) p. 335.

**Tanganyika.**—Plankton, near Kala (19 Nov. 1904; no. 170).

163. ANKISTRODESMUS NITZSCHIOIDES, sp. n. (Pl. 5. fig. 18.)

*A.* cellulis solitariis, elongatis, fusiformibus, ad polum unumquemque in spinam longissimam tenuissimam valde attenuatis, extremitatibus spinarum curvatis (extremitati spinæ alterius poli cum ea alterius curvato in directione opposita); chromatophora pallide viridi, pyrenoidibus nullis.

Long. cell. cum spin. 116–126 $\mu$; lat. cell. in med. 3·6–4 $\mu$.

**Tanganyika.**—Plankton, near Chamaluki (15 Nov. 1904; no. 160).

This species stands nearest to *A. setigerus*, (Schröd.) G. S. West (*Reinschella*? *setigera*, Schröd. in Ber. Deutsch. Bot. Ges. xv. (1897) p. 492, t. 25.



fig. 4), but is distinguished by its narrower cells, its stouter and curved spines, and by the absence of pyrenoids from the chloroplast.

It bears considerable resemblance to certain small and attenuated species of the genus *Nitzschia.*

### Genus CLOSTERIOPSIS, *Lemm.*

164. CLOSTERIOPSIS LONGISSIMA, *Lemm. in Forschungsb. Biol. Stat. Plön*, vii. (1899) p. 29, t. 2. figs. 36–38; *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxiii. sect. B (1906), p. 106, t. 10. figs. 17–19.

**Nyasa.**—Plankton, Deep Bay (24 June, 1904; no. 25) and off Karonga (1 July, 1904; no. 30).

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905; no. 249).

### Genus SELENASTRUM, *Reinsch.*

165. SELENASTRUM GRACILE, *Reinsch, in Abh. Natur. Ges. Nürnb.* iii. Heft 2 (1867), p. 65, t. 4. fig. 3.

Diam. colon. usque ad 154 $\mu$; crass. cell. 4–5 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

**Victoria Nyanza.**—Plankton, near Bukoba (21 Apr. 1905; no. 252). Some of the colonies were of very large size.

### Genus KIRCHNERIELLA, *Schmidle.*

166. KIRCHNERIELLA OBESA, (*West*) *Schmidle, in Flora*, lxxvii. (1894) p. 44.—Selenastrum obesum, *West, in Journ. Roy. Micr. Soc.* (1892) p. 734, t. 10. figs. 50–52.

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904; no. 80).

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905; no. 252).

### Subfam. OOCYSTIDEÆ.

### Genus OOCYSTIS, *Nag.*

167. OOCYSTIS SOLITARIA, *Wittr. in Wittr. & Nordst. Alg. Exsic.* fasc. v. (1879) no. 244; *Bot. Notiser* (1879), p. 24.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).

168. OOCYSTIS PARVA, *W. & G. S. West, in Journ. Bot.* xxxvi. (1898); *G. S. West, l. c.* xxxvii. (1899) t. 394. figs. 14–17.

**Nyasa.**—Plankton, Monkey Bay (17 June, 1904; no. 15).

169. OOCYSTIS LACUSTRIS, *Chodat, in Bull. Herb. Boiss.* v. (1897) p. 296; *Algues Vertes de la Suisse* (1902), p. 190.

**Long. colon.** 39–54 $\mu$; long. cell. 12–20 $\mu$; lat. cell. 7–13 $\mu$.

**Nyasa.**—Plankton, Anchorage Bay (13 June, 1904; no. 9).

**Tanganyika.**—Plankton, off Niamkolo (July and Aug. 1904 ; nos. 36 and 39), near Mbete (28 Sept. 1904 ; no. 109), Vua Harbour (29 Oct. 1904 ; no. 150), near Kalambo (5 Nov. 1904 ; no. 154), near Chamkaluki (15 Nov. 1904 ; no. 160), near Kala (19 Nov. 1904 ; no. 170), near Kirando (1 Dec. 1904 ; no. 175), in middle of lake crossing from Rumonge to Uvira (30 Jan. 1905 ; no. 218), near Ndauvie (7 Feb. 1905 ; no. 227), and near Baraka (24 Feb. 1905 ; no. 240).

**Victoria Nyanza.**—Plankton, near Bukoba (18 Apr. 1905 ; no. 249).

This Alga was very frequent in the plankton, especially of Tanganyika. The envelope surrounding the colonies is always very hyaline, and no colonies were observed of more than eight cells. The faint apiculus at each pole is very characteristic, although exceedingly slight. Two chloroplasts were generally present in each cell. The plants observed were identical in every respect with those which occurred in the plankton of certain Irish lakes (*cide* Trans. Roy. Irish Acad. xxxiii. sect. B, 1906, p. 107).

### Genus NEPHROCYTIUM, *Näg.*

170. Nephrocytium Agardhianum, *Näg. Gatt. einz. Alg.* (1849) p. 79, t. 3 c. figs. *a–p*.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 34).

**Tanganyika.**—In swamp, Kituta (23 & 26 Aug. 1904 ; nos. 72 and 80).

171. Nephrocytium lunatum, *West, in Journ. Roy. Micr. Soc.* (1892) p. 736, t. 10. fig. 49.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904 ; no. 108).

### Subfam. Tetraëdreæ.

### Genus TETRAËDRON, *Kütz.*

172. Tetraëdron trigonum, (*Näg.*) *Hansg. in Hedwigia*, xxvii. (1888) p. 130.—Polyedrium trigonum, *Näg. Gatt. einz. Alg.* (1849) p. 84, t. 4 b. fig. 1.

Diam. cell. sine spin. 14–16 $\mu$ ; long. spin. 5–6·5 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

173. Tetraëdron minimum, (*A. Br.*) *Hansg. l. c.* p. 131.—Polyedrium minimum, *A. Br. in Rabenh. Fl. Europ. Alg.* iii. (1868) p. 62.

Trigonal forms : **Nyasa.**—In scrapings from bottom of s.s 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577). In swamp, Karonga (2 July, 1904 ; no. 34).

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36). In swamp, Toa (10 Jan. 1905 ; no. 168).



174. Tetraëdron regulare, *Kütz. Phyc. Germ.* (1845) p. 129.—Polyedrium tetraëdricum, *Näg. Gatt. einz. Alg.* (1849) p. 84, t. 4 b. fig. 3.

Diam. cell. sine spin. 18–26 $\mu$.

**Nyasa.**—In swamp, Karonga (29 June, 1904 ; no. 32, and 2 July, 1904 ; no. 34).

175. Tetraëdron lobulatum, (*Näg.*) *Hansg. in Hedwigia*, xxvii. (1888) p. 132.—Polyedrium lobulatum, *Näg. Gatt. einz. Alg.* (1849) p. 84, t. 4 b. fig. 4.

**Victoria Nyanza.**—Among *Utricularia* near Entebbe (1 May, 1905 ; no. 620).

176. Tetraëdron bifurcum, (*Wille*) *Lagerh. in Nuova Notarisia* (1893), p. 160.—Polyedrium trigonum *β.* bifurcum, *Wille, in Bih. K. Sv. Vet.-Akad. Handl.* viii. (1884) no. 18, p. 12, t. 1. fig. 24.

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905 ; no. 618).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

### Genus CERASTERIAS, *Reinsch.*

177. Cerasterias rhaphidioides, *Reinsch, in Abh. Naturh. Ges. Nürnb.* iii. (1867) p. 68, t. 5. fig. 1.

Diam. cell. (cum radiis) 48–60 $\mu$.

**Tanganyika.**—Plankton, near Chamkaluki (15 Nov. 1904 ; no. 160) and near Kala (19 Nov. 1904 ; no. 170).

### Subfam. Phythelieæ.

### Genus RICHTERIELLA, *Lemm.*

178. Richteriella botryoides, (*Schmidle*) *Lemm. in Hedwigia*, xxxvii. (1898) p. 306, t. 10. figs. 1–6.—Golenkinia botryoides, *Schmidle*. Richteriella globosa, *Lemm.*

Forma quadriseta, (*Lemm.*) *Chodat*, 1902.—R. quadriseta, *Lemm. l. c.* p. 307, t. 10. fig. 7.

**Tanganyika.**—Plankton, near Kala (19 Nov. 1904 ; no. 170).

### Genus CHODATELLA, *Lemm.*

179. Chodatella subsalsa, *Lemm. in Hedwigia*, xxxvii. (1898) p. 310.—Lagerheimia subsalsa, *Lemm. in Forschungsb. Biol. Stat. Plön*, vi. (1898) t. 5. figs. 2–6.

Long. cell. (sine acul.) 5–13 $\mu$ ; lat. cell. 2·5–8·5 $\mu$ ; long. acul. 7·5–26 $\mu$.

**Tanganyika.**—In plankton, near Kala (19 Nov. 1904 ; no. 170).

This Alga was fairly frequent in one of the plankton collections from Tanganyika (no. 170), but was not observed from any of the others. The

cells attained slightly larger dimensions than those described by Lemmermann from Germany. The three spine-like bristles at each pole were frequently bent and usually widely spreading.

Subfam. DICTYOSPHÆRIEÆ.

Genus DICTYOSPHÆRIUM, *Näg.*

180. DICTYOSPHÆRIUM PULCHELLUM, *Wood, Freshw. Alg. U. S.* (1874) p. 84, t. 10. fig. 4.

**Nyasa.**—In plankton, Anchorage Bay (11 June, 1904 ; no. 5).

**Tanganyika.**—In plankton, near Chumkaluki (15 Nov. 1904 ; no. 160) and near Kala (19 Nov. 1904 ; no. 170).

**Victoria Nyanza.**—In plankton, near Bukoba (18 Apr. 1905 ; no. 249). In swampy pool near Bukoba (20 Apr. 1905 ; no. 618).

Genus TETRACOCCUS, *West.*

181. TETRACOCCUS BOTRYOIDES, *West, in Journ. Roy. Micr. Soc.* (1892) p. 735, t. 10. figs. 43–48.

Diam. colon. 56–84 $\mu$ ; diam. cell. 4–8 $\mu$.

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36), Komba Bay (11 Oct. 1904 ; no. 135), and near Kala (19 Nov. 1904 ; no. 170).

Genus BOTRYOCOCCUS, *Kütz.*

182. BOTRYOCOCCUS BRAUNII, *Kütz. Sp. Alg.* (1849) p. 892 ; *Rabenh. Fl. Europ. Alg.* iii. (1868) p. 42, fig. 14 ; *Chodat, in Morot, Journ. de Bot.* x. (1896) p. 303, t. 3.

**Nyasa.**—In plankton, Monkey Bay (17 and 18 June, 1904 ; nos. 15 and 16); also off Vahambwera Point (24 June, 1904 ; no. 24) and off Karonga (1 July, 1904 ; no. 30).

**Tanganyika.**—In plankton, Utinta (5 Dec. 1904 ; no. 181).

**Victoria Nyanza.**—In plankton, near Bukoba (20 and 21 Apr. 1905 ; nos. 250 and 252).

The large colonies of this Alga formed in some instances a yellow scum on the surface of the water. This was due to the appearance of the brick-red pigment which at certain seasons gives the colonies a decided yellow or yellowish-red colour and causes a corresponding coloration of the water.

Genus INEFFIGIATA, *W. & G. S. West.*

183. INEFFIGIATA NEGLECTA, *W. & G. S. West, in Journ. Roy. Micr. Soc.* (1897) p. 503 ; *W. & G. S. West, in Journ. Bot.* xli. (1903) p. 80, t. 447. figs. 1–6.

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).



This Alga requires further investigation. The tough membrane which encloses the families of cells, and irregular lobes and strands of which hold the colonies together, seems to distinguish it from *Botryococcus Braunii*. It may, however, be only a state of that Alga. All the specimens from Victoria Nyanza had the prickly appearance which is often one of the peculiarities of *Ineffigiata* (*vide* W. & G. S. West, in Journ. Bot. xli. (1903) t. 447. fig. 3), the tough outer membrane being densely covered with irregular spines and spinous processes.

Family **PALMELLACEÆ**.

Genus PALMOPHYLLUM, *Kütz.*

184. PALMOPHYLLUM FOLIACEUM, sp. n. (Pl. **5**. fig. 10.)

Thallus minutus, cartilagineus, suberassus, foliacco-lobatus, basin angustiorem fixus, sine lineis concentricis, lobis sinuatis ; cellulis minutissimis, confertissimis, in lineis longitudinaliter dispositis, oblongis vel oblongo-ellipticis, viridibus. Cellularum divisio in unam directionem.

Long. thall. 250–330 $\mu$ ; lat. max. thall. 140–320 $\mu$ ; long. cell. 2·2–3·4 $\mu$ ; lat. cell. 1·3–1·6 $\mu$.

**Tanganyika.**—On stones, dredged in a few fathoms, Niamkolo ; among *Cladophora inconspicua* in the hollows of a calcareous incrustation.

This species is distinguished from *P. crassum*, (Nacc.) Rabenh. (= *P. flabellatum*, Kütz.) by the smaller size of the thallus, which is destitute of the zones of concentric lines, and by the minute cells. The thallus is expanded from a narrow base and is of uneven thickness. It is of a dark green colour, lobed and sinuate at the margin, and sometimes deeply cleft. The nature of the chloroplast could not be determined from the preserved (dried) material.

SPHINCTOSIPHON, gen. n.

Cellulæ in tegumentis tubulosis conferte et irregulariter aggregatæ ; tegumentis gelatinosis, achrois, tubulosis, firmis et lamellosis, lamellis externis sæpe diffluentibus ; cellulæ globosæ, cum chromatophora singula parietali læte viridi et valde granulosa ; membrana cellularum tenuissima ; tegumentis junioribus subrotundatis vel irregulariter lobatis, iis vetustis elongatis, siphoniformibus, curvatis, hinc inde ligatis. Propagatio divisione tegumentorum lobatorum juniorum in omnes directiones.

185. SPHINCTOSIPHON POLYMORPHUS, sp. unica. (Pl. **3**. fig. 12 ; Pl. **5**. figs. 11–13.)

Character idem ac generis. Tegumentis adultis irregulariter cylindricis, vermiformibus, nunquam ramosis, sæpe in articulis elongatis constrictis vel subconstrictis.

Diam. teg. jun. 80–180 $\mu$ : diam. teg. adult. (vermiform.) 39–60 $\mu$ ; diam. cell. 5·5–7·5 $\mu$ ; crass. teg. 5–8 $\mu$.

**Victoria Nyanza.**—In plankton, near Bukoba (18 and 21 Apr. 1905 ; nos. 249 and 252).

This peculiar genus stands nearest to *Palmodactylon*, Näg., but is at once distinguished by the hollow integuments with a firm outer gelatinous wall. If the Alga be subjected to slight pressure, the cells can be squeezed from one part of the hollow vermiform integument to another. The wall of the integument often shows a lamellose structure, and in the younger individuals the outer coats often become mucilaginous. In the young stages the thallus is rounded or irregularly lobed, and while in this condition it frequently divides, forming several more or less rounded segments, each of which then grows to form an adult plant. The adult thallus is very long, reaching a length of 2 mm., and it is more or less cylindrical and vermiform in appearance. It possesses slight irregular swellings and constrictions of variable depths at intervals, and is not infrequently segmented into several elongated joints. *Sphinctosiphon* does not appear to branch.

The exact nature of the chromatophore could not be determined from the preserved material. It is undoubtedly massive and occupies most of the cell, being for the greater part parietal in disposition.

### Genus SPHÆROCYSTIS, *Chodat.*

186. Sphærocystis Schroeteri, *Chodat, in Bull. Herb. Boiss.* v. (1897) p. 292, t. 9.

**Tanganyika.**—In the plankton, Lofu River (5 Oct. 1904 ; nos. 123 and 124).

This Alga occurred in great abundance in the two collections of river-plankton and, curiously enough, it was not observed in the plankton of the lakes themselves. The colonies were the largest I have yet seen and reached a diameter of 240 $\mu$. It is generally distributed in all the freshwater plankton of Europe.

### Genus GLŒOCYSTIS, *Näg.*

187. Glœocystis gigas, (*Kütz.*) *Lagerh. in Öfvers. K. Sv. Vet.-Akad. Förh.* (1883) no. 2, p. 63.—Protococcus gigas, *Kütz. Phyc. Germ.* (1845) p. 145. Chlorococcum gigas, (*Kütz.*) *Grun.*

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18). In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80).

A form with rather large cells and very tough, brownish or yellowish integuments occurred in the plantation from near Sumba (13 Oct. 1904 ; no. 138).

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).



## Class **HETEROKONTÆ.**

### Order CONFERVALES.

### Family **TRIBONEMACEÆ.**

### Genus OPHIOCYTIUM, *Näg.*

188. Ophiocytium parvulum, (*Perty*) *A. Br. Alg. Unicell.* (1855) p. 55.—Brochidium parvulum, *Perty.*

Crass. cell. 4–5 $\mu$.

**Nyasa.**—Among weeds and various Algæ, in swamp, Karonga (2 July, 1904 ; no. 34).

## Class **BACILLARIEÆ.**

### Order CENTRICÆ.

### Family **MELOSIRACEÆ.**

### Genus MELOSIRA, *Ag.*

189. Melosira nyassensis, *O. Müll. in Engl. Bot. Jahrb.* xxxiv. (1905) p. 285, t. 3, fig. 3.

Crass. fil. 22–33 $\mu$. (Pl. **2**. figs. 6, 7 ; Pl. **3**. figs. 5, 26.)

**Nyasa.**—In plankton, Anchorage Bay (9–14 June, 1904 ; nos. 2, 5, 7, 9, and 10), and also off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—In plankton, off Bukoba (20 and 21 Apr. 1905 ; nos. 250 and 252).

This Diatom was the dominant feature of some of the plankton collections. It was described by O. Müller in 1895 from the plankton of Lake Nyasa and the waters of some of the surrounding areas. It may be regarded as one of the numerous forms of *Melosira granulata.*

190. Melosira granulata, *Ralfs, in Pritch. Infus.* ed. 4 (1861), p. 820.

**Nyasa.**—In plankton, Anchorage Bay (13 and 14 June, 1904 ; nos. 9 and 10).

**Victoria Nyanza.**—In plankton, near Bukoba (20 Apr. 1905 ; no. 250).

Var. angustissima, *O. Müll. l. c.* p. 285, t. 4, fig. 12.

Crass. fil. 3–4·5 $\mu$.

**Nyasa.**—In plankton, Anchorage Bay (9–14 June, 1904 ; nos. 2, 7, 9, and 10), and also off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

This delicate variety was very abundant in some of the plankton collections, and unless cleaned and prepared specially for examination, was difficult to recognize as a *Melosira*. As compared with their diameter, the cells are relatively longer than in other forms of *M. granulata.*

Family **COSCINODISCACEÆ**.

Genus CYCLOTELLA, *Kütz.*

191. CYCLOTELLA COMPTA, *(Ehrenb.) Kütz. Sp. Alg.* p. 20 (1849).
**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905 ; no. 249).

192. CYCLOTELLA MENEGHINIANA, *Kütz. Bacill.* p. 50 (1865).

Var. RECTANGULATA, *Grun.* ; *Van Heurck, Syn. Diat. Belg.* t. 94. figs. 17–19.
Diam. valv. 15 *μ*.
**Nyasa.**—In scrapings from bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577).

193. CYCLOTELLA OPERCULATA, *Kütz. l. c.*
**Nyasa.**—In plankton, Anchorage Bay (11–14 June, 1905 ; nos. 5, 9, and 10) and Monkey Bay (18 June, 1904 ; no. 16).
**Tanganyika.**—In plankton, near Kala (19 Nov. 1904 ; no. 170).

194. CYCLOTELLA KÜTZINGIANA, *Chauvin* ; *Thw. in Ann. Mag. Nat. Hist.* ser. 2, i. (1848) p. 169 ; *Van Heurck, l. c.* t. 94. figs. 1, 46.
**Nyasa.**—In plankton, Anchorage Bay (14 June, 1905 ; nos. 9 and 10).
**Tanganyika.**—On surface of swamp, Toa (10 Jan. 1905 ; no. 208).
**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

Genus STEPHANODISCUS, *Ehrenb.*

195. STEPHANODISCUS ASTRÆA, *(Ehrenb.) Grun. in Cleve & Grun. Arct. Diat.* 114 (1880); *Van Heurck, Syn. Diat. Belg.* (1885) t. 95. fig. 5.
**Nyasa.**—In plankton, Anchorage Bay (11–14 June, 1904 ; nos. 5, 9, and 10). On shore, Domira Bay (19 June, 1904 ; no. 17). On rocks, Nkata Bay (23 June, 1904 ; no. 23). In plankton, off Vahambwera Point (24 June, 1904 ; no. 24).
Some finely developed specimens of this Diatom were observed, the valves attaining a diameter of 81 *μ*.

Var. SPINULOSUS, *Grun.* ; *Van Heurck, l. c.* t. 95. fig. 6.
**Nyasa.**—In plankton, Anchorage Bay (14 June, 1904 ; no. 10); also Deep Bay (24 June, 1904 ; no. 25).

Var. MINUTULUS, *(Kütz.) Grun.* ; *Van Heurck, l. c.* t. 95. figs. 7, 8.—Cyclotella minutula, *Kütz.*
**Nyasa.**—In plankton, Anchorage Bay (11–14 June, 1904 ; nos. 5, 9, and 10).



Order PENNATÆ.

Family **FRAGILARIACEÆ**.

Genus FRAGILARIA, *Lyngb.*

196. FRAGILARIA VIRESCENS, *Ralfs, in Ann. Nat. Hist.* ser. 1, xii. (1843) p. 110, t. 2. fig. 6 ; *Rabenh. Fl. Europ. Alg.* i. (1864) p. 119.
**Nyasa.**—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

197. FRAGILARIA ÆTHIOPICA, sp. n. (Pl. **8**. fig. 1.)
Cellulæ ut visa aspectu valvulari subanguste elliptica, polis rotundatis, pseudorhaphide distincta sublata in centro stauriformi, costis lateralibus crassis glabris 11 utrobique, costa mediana brevi et rotundata ; ut visa aspectu cingulato quadrato-rectangularis, apicibus truncatis, lateribus levissime retusis in medio et cum costis crassis 11. Cellulæ ut visæ solitariæ.
Long. valv. 17–19·5 *μ* ; lat. valv. 7·5–8 *μ*.
**Tanganyika.**—On stones, submerged roots, grasses, etc., Niamkolo (1 Aug. 1904 ; no. 44).
This species is readily distinguished by its few, broad costæ. The valve-view is somewhat narrowly elliptic, and there are eleven broad smooth costæ on each side, extending towards the central line, but leaving a fairly broad pseudoraphe. In the centre the pseudoraphe widens out forming a stauros, the median costa on each side being correspondingly short. The costæ are not transverse, but exhibit a decided radiation near the median part of the valve. In the girdle-view the cell is quadrate-rectangular and the costæ show very plainly along each lateral margin.
*F. æthiopica* belongs to the section '*Staurosira*, Ehrenb.'

Genus SYNEDRA, *Ehrenb.*

198. SYNEDRA NYANSÆ, sp. n. (Pl. **8**. fig. 3.)
Cellula ut visa aspectu valvulari robusta, linearis, diametro 6½–13½-plo longior, marginibus lateralibus parallelis, subiter attenuata apices versus, apicibus productis et subcapitato-rostratis, pseudorhaphide recta magna et conspicua (usque 4 *μ* lata), striis 14–15 in 10 *μ* ; ut visa aspectu cingulato linearis, apicibus rectangularibus.
Long. valv. 91–150 *μ* ; lat. valv. 10–13 *μ* ; lat. apic. 3·2–3·8 *μ*.
**Victoria Nyanza.**—Among Algæ on rocks below the water-level, Bukoba (17 Apr. 1905 ; no. 248).
This species resembles in outline *S. Ulna*, (Nitzsch) Ehrenb., and *S. oxyrhynchus*, Kütz., but differs in its much finer striations, its broader and more conspicuous pseudoraphe, as well as in the absence of the clear space in the median part of the valves.
In its general proportions it was somewhat variable, and some very short, robust individuals were observed.

199. Synedra Ulna, (*Nitzsch*) *Ehrenb. Infus.* (1838) p. 211, t. 17. fig. 1; *Rabenh. Fl. Europ. Alg.* i. (1864) p. 133.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; no. 123). In swamp, Toa (10 Jan. 1905; no. 208).

**Victoria Nyanza.**—In swampy pool, near Bukoba (20 Apr. 1905; no. 618).

Var. splendens, (*Kütz.*) *Van Heurck.*—S. splendens, *Kütz. Bacill.* (1844) p. 66, t. 14. fig. 16. S. radians, *W. Sm. Brit. Diat.* i. p. 71.

**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904; nos. 123 and 124).

200. Synedra pulchella, *Kütz. Bacill.* (1844) p. 68, t. 29. fig. 37; *W. Sm. Brit. Diat.* i. p. 70, t. 11. fig. 84.

**Tanganyika.**—Floating on surface of water, Kituta Bay (26 Aug. 1904; no. 79). In swamp, Mbete (28 Sept. 1904; no. 108).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

201. Synedra Acus, *Kütz. Bacill.* (1844) p. 68, t. 15. fig. 7; *Rabenh. Fl. Europ. Alg.* i. (1864) p. 136.

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904; no. 579).

**Tanganyika.**—In plankton, near Kirando (1 Dec. 1904; no. 175).

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905; no. 252). Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

Var. delicatissima, (*W. Sm.*) *Grun.*—S. delicatissima, *W. Sm.*

**Nyasa.**—In plankton, Anchorage Bay (9 June, 1904; no. 2, and 13 June, 1904; no. 9), and Monkey Bay (18 June, 1904; no. 16). S. end of lake (15 June, 1904; no. 577).

**Tanganyika.**—In plankton, off Niamkolo (29 July, 1904; no. 36, and 9 Aug. 1904; no. 53). In swamp, Kituta (26 Aug. 1904; no. 80). In plankton, Mbete (28 Sept. 1904; no. 109), Komba Bay (11 Oct. 1904; no. 135), Vua Harbour (29 Oct. 1904; no. 150), near Kassanga (14 Nov. 1904; no. 159), and near Chamkaluki (15 Nov. 1904; no. 160). This variety was particularly abundant from no. 109.

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905; no. 252).

Var. ? (=Synedra revaliensis, *Lemm. ex W. & G. S. West, in Trans. Roy. Irish Acad.* xxxiii. (1906) sect B, p. 110.)

Long. 85–94 $\mu$; lat. 2–2·5 $\mu$.

**Tanganyika.**—In plankton, near Kasawa, near Kirando (1 Dec. 1904; no. 175), near Utinta (5 Dec. 1904; no. 181), near Maswa (14 Jan. 1905; no. 211), in middle of lake between Rumonge and Uvira (30 Jan. 1905; no. 218), and near Ndauvie (7 Feb. 1905; no. 227).

I am not quite certain of this determination, as I have not seen a published description or figure of Lemmermann's species. [Since this was written Lemmermann's description of *S. revaliensis* has appeared in Ber. Deutsch. Bot. Ges. xxiv. (1906) p. 536.] It agrees, however, with



specimens of a *Synedra* from the Irish Lakes which were referred by Lemmermann to *S. revaliensis*. It seems to be identical with the *Synedra* mentioned by Ostenfeld and Wesenberg-Lund as occurring in two Icelandic lakes (*vide* Proc. Roy. Soc. Edinb. xxv. part xii. (1906) p. 1114, t. 2. figs. 16, 17); and I am inclined to agree with those authors that it is merely a form of *S. Acus* var. *delicatissima*, the stellate colonies resulting from an adaptation to a limnetic life. Some of the radiating colonies contained upwards of 50 individuals. It may also be identical with the Diatom recorded by Schmidle from Lake Nyasa as "*Synedra ? asterionelloides*, O. Müller, n. sp." (*cf.* Engl. Bot. Jahrb. xxxiii. (1902) p. 8).

In both this Diatom and the succeeding species (*S. actinastroides*) the individuals are arranged in radiating colonies after the manner of the genus *Actinastrum*, and Lemmermann places them along with the two species *S. limnetica*, Lemm., and *S. berolinensis*, Lemm., in a subgenus "*Belonastrum*" of *Synedra*.

202. Synedra actinastroides, *Lemm. in Ber. Deutsch. Bot. Ges.* xviii. (1900) p. 30; *Forschungsber. Biol. Stat. Plön*, xi. (1904) p. 311.

Long. 44–49 $\mu$; lat. 2·5 $\mu$.

**Tanganyika.**—In plankton, off Niamkolo (2 and 9 Aug. 1904; nos. 36 and 52), in Kituta Bay (25 Aug. 1904; no. 77), near Mbete (28 Sept. 1904; no. 109), near Kasawa (no. 132), near Kassanga (14 Nov. 1904; no. 159), near Maswa (14 Jan. 1905; no. 211), and in middle of lake between Rumonge and Uvira (30 Jan. 1905; no. 218).

203. Synedra Cunningtonii, sp. n. (Pl. 8. fig. 4.)

Cellula ut visa aspectu valvulari angustissima linearis, in parte mediana tertia cum inflationibus insignis latis binis, partibus apicalibus angustissimis cum marginibus parallelis, apicibus minute capitatis, striis 12–13 in 10 $\mu$, in partibus apicalibus elongatis vix conspicuis, pseudorhaphide lata in parte mediana inflata cellulæ; ut visa aspectu cingulato anguste linearis, parte mediana subanguste inflata, polis truncatis.

Long. 200–210 $\mu$; lat. in med. 4·5 $\mu$; lat. max. 6·5 $\mu$; lat. part. apical. 1·4 $\mu$; lat. apic. 1·8 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, in sheltered bay near Entebbe (1 May, 1905; no. 620).

This *Synedra* is remarkable for the double inflation of the median part of the valves, the extremities being very long and narrow, with parallel margins. The inflation is not merely visible in the valve-view, but is likewise very large in the girdle-view. In the girdle-view, however, the median inflation has subparallel margins in the central part and does not show any signs of the constriction which is such a peculiar feature of the valve-view. Each of the narrow extremities of the valve is very faintly (almost imperceptibly) swollen.

I know of no species to which it is very closely related except forms of *S. Acus*, and from these it is at once distinguished by its peculiar form.

Family **EUNOTIACEÆ**.

Genus EUNOTIA, *Ehrenb.*

204. EUNOTIA PECTINALIS, *Rabenh. Fl. Europ. Alg.* i. (1864) p. 73.—Himantidium pectinale, *Kütz. Bacill.* 1844, t. 16. fig. 11.

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80).

**Victoria Nyanza.**—In swampy pool near Bukoba (20 Apr. 1905 ; no. 618)

205. EUNOTIA LUNARIS, *Grun. in Van Heurck, Synops. Diat. Belg.* p. 144, t. 35. figs. 3, 4, 6.—Synedra lunaris, *Ehrenb.* ; *W. Sm. Brit. Diat.* i. p. 69, t. 11. fig. 82.

**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905 ; no. 251), and among *Utricularia*, near Bukoba (20 Apr. 1905 ; no. 618).

206. EUNOTIA BICEPS, *Ehrenb.*, 1854.—Synedra biceps, *W. Sm.* Eunotia flexuosa, *Kütz., var.* bicapitata, *Grun. in Van Heurck, Synops. Diat. Belg.* p. 145, t. 35. fig. 11.

**Victoria Nyanza.**—Among *Utricularia*, near Bukoba (20 Apr. 1905 ; no. 618), and in sheltered bay near Entebbe (1 May, 1905 ; no. 620).

Family **ACHNANTHACEÆ**.

Genus ACHNANTHES, *Bory.*

207. ACHNANTHES COARCTATA, *Grun. in Cleve & Grun. Arct. Diat.* p. 20 (1880).

**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

208. ACHNANTHES LINEARIS, (*W. Sm.*) *Grun. l. c.* p. 23.—Achnanthidium lineare, *W. Sm. Brit. Diat.* ii. p. 31, t. 61. fig. 381.

**Tanganyika.**—In the plankton, Lofu River (5 Oct. 1904 ; no. 123).

Family **COCCONEIDACEÆ**.

Genus COCCONEIS, *Ehrenb.*

209. COCCONEIS PLACENTULA, *Ehrenb. Infus.* p. 194 ; *W. Sm. Brit. Diat.* i. p. 21, t. 3. fig. 32.

**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905 ; no. 618). In sheltered bay near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—On stones, shells, submerged grasses, etc., Niamkolo Bay (Aug. 1904 ; nos. 40 and 44). Among various Algæ, Kituta Bay (26 Aug. 1904 ; no. 79). In plankton, near Mbete (28 Sept. 1904 ; no. 105), Komba Bay (11 Oct. 1904 ; no. 135), off Chamkaluki (15 Nov. 1904 ; no. 160), and near Kala (19 Nov. 1904 ; no. 170). Also among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).



210. COCCONEIS PEDICULUS, *Ehrenb. Infus.* p. 11 ; *W. Sm. Brit. Diat.* i. p. 21, t. 3. fig. 31.

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36), and Kituta Bay (26 Aug. 1904 ; no. 81). In shallow water, Mbete (29 Sept. 1904 ; no. 114).

Family **NAVICULACEÆ**.

Genus NAVICULA, *Bory.*

211. NAVICULA (§ NEIDIUM) PRODUCTA, *W. Sm. Brit. Diat.* i. p. 51, t. 17. fig. 144.—N. Iridis *var.* producta, *Van Heurck, Synops. Diat. Belg.* p. 104, t. 13. fig. 3.

**Nyasa.**—In swamp, Karonga (29 June, 1904 ; no. 32).

212. NAVICULA (§ NEIDIUM) TANGANYIKÆ, sp. n. (Pl. **8**. fig. 11.)

Cellula ut in visa aspectu valvulari oblonga cum lateribus levissime concavis, utroque polis cuneatis et apicibus obtusis ; platea axiali angusta, lineis approximatis binis utrobique inter marginem lateralem valvæ unumquemque et axem centrali, platea centrali transverse dilatata (elliptica) ; punctis valvæ densissimis et irregulariter ordinatis ; striis margines versus visis 10–11 in 10 $\mu$.

Long. valv. 76–98 $\mu$ ; lat. 34–40 $\mu$.

**Tanganyika.**—In plankton, Kituta Bay (25 Aug. 1904 ; no. 77), near Mbete (28 Sept. 1904 ; no. 105), near Kalambo (5 Nov. 1904 ; no. 154), and near Baraka (24 Feb. 1905 ; no. 240).

Pfitzer founded the genus *Neidium* in 1871 on the general arrangement of the cell-contents, and Cleve (1894) has pointed out that the structure of the valve is also sufficient to separate the species included in *Neidium* from the rest of the naviculoid Diatoms. *N. Tanganyikæ* is on the whole nearest to *N. Amphigomphus*, Ehrenb., but in none of the specimens I examined were the punctæ of the valves arranged in lines. There were a pair of accessory longitudinal lines, closely approximate, and running from pole to pole between the central line and each margin of the valve. These lines were situated rather nearer the outer margin than the median line, and they were regularly bent inwards in the cuneate poles. The central area was transversely elliptical and the punctæ were rather more distinct in its immediate vicinity. The striations could only be observed between the margins of the valve and the accessory longitudinal lines. The area between the latter and the sagittal axis (or raphe) was entirely occupied by irregularly scattered punctæ.

213. NAVICULA (§ DIPLONEIS) ELLIPTICA, *Kütz. Bacill.* (1844) p. 98, t. 30. fig. 55.—N. ovalis, *W. Sm. Brit. Diat.* i. p. 48, t. 18. fig. 153 *d*?

**Nyasa.**—In plankton, Anchorage Bay (13 June, 1904 ; no. 9).

**Tanganyika**.—In plankton, near Sumbu (13 Oct. 1904 ; no. 138) and near Kalambo (5 Nov. 1904 ; no. 154). Among various Algæ scraped from the inside of canoe (6 Jan. 1905 ; no. 205).

214. Navicula Pupula, *Kütz. Bacill.* (1844) p. 93 ; *Van Heurck, Synops. Diat. Belg.* p. 106, t. 13. figs. 15, 16 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 131.

**Tanganyika**.—In plankton, Kituta Bay (26 Aug. 1904 ; no. 81), near Kalambo (5 Nov. 1904 ; no. 154), near Kala (19 Nov. 1904 ; no. 170), off Kirando (1 Dec. 1904 ; no. 175), and near Baraka (24 Feb. 1905 ; no. 240).

215. Navicula mutica, *Kütz. l. c.* t. 3. fig. 32 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 129.

Forma valvis leviter tumidis ad medium utrobique.

Long. valv. 30–34 $\mu$ ; lat. ad med. 13–14 $\mu$.

**Nyasa**.—In plankton, Anchorage Bay (13 June, 1904 ; nos. 9 and 10).

216. Navicula Crucicula, (*W. Sm.*) *Donkin, Brit. Diatomaceæ*, p. 44, t. 6. fig. 14 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 139.—Stauroneis Crucicula, *W. Sm.*

**Nyasa**.—In plankton, Anchorage Bay (11 June, 1904 ; no. 5).

217. Navicula bahusiensis, *Grun. Diat. Franz-Jos.-land*, p. 51 (1880) ; *Cleve, Synops. Navic. Diat.* ii. (1895) p. 4.

**Nyasa**.—In plankton, Anchorage Bay (13 June, 1904 ; no. 9).

**Tanganyika**.—In plankton, off Kirando (1 Dec. 1904 ; no. 175).

This Diatom has previously been recorded only as a marine species, but is regarded by Van Heurck as a variety of *N. minuscula*, Grun., which is of freshwater habit.

218. Navicula (§ Anomœoneis) sphærophora, *Kütz. Bacill.* 1844, p. 95, t. 4. fig. 17.

**Nyasa**.—On shores of lake, Domira Bay (19 June, 1904 ; no. 17).

219. Navicula (§ Anomœoneis) exilis, *Kütz. l. c.* ; *Van Heurck, Synops. Diat. Belg.* p. 101, t. 12. figs. 11, 12.

**Nyasa**.—In swamp, Karonga (2 July, 1904 ; no. 34).

220. Navicula cryptocephala, *Kütz. l. c.* t. 3. fig. 26 ; *W. Sm. Brit. Diat.* p. 53, t. 17. fig. 155.

**Tanganyika**.—In swamp, Toa (10 Jan. 1905 ; no. 208).

221. Navicula radiosa, *Kütz. t. c.* p. 91, t. 4. fig. 23.

**Victoria Nyanza**.—In plankton, near Bukoba (18 Apr. 1905 ; no. 249).



**Tanganyika**.—In plankton, Kituta Bay (26 Aug. 1904 ; no. 81), and off Kirando (1 Dec. 1904 ; no. 175).

222. Navicula rhynchocephala, *Kütz. Bacill.* (1844) t. 30. fig. 35 ; *Donkin, Brit. Diat.* p. 38, t. 6. fig. 4.

**Nyasa**.—In plankton, Anchorage Bay (June 1904 ; nos. 9 and 10).

**Tanganyika**.—In plankton, Kituta Bay (26 Aug. 1904 ; no. 81), near Mbete (28 Sept. 1904 ; no. 105), and near Chamkaluki (15 Nov. 1904 ; no. 160). In swamp, Toa (10 Jan. 1905 ; no. 208).

223. Navicula distincta, sp. n.

Minuta ; cellula ut in visa aspectu valvulari late elliptica, polis rotundatis vel subacute rotundatis ; striis validis, distinctis et glabris, 8 in 10 $\mu$, radiatis, in parte mediana striis brevibus 2 vel 3 cum striis multe longioribus alternantibus.

Long. 20–24 $\mu$ ; lat. 16–17 $\mu$.

**Tanganyika**.—In plankton, near Kala (19 Nov. 1904 ; no. 170.)

This small species is distinct by reason of its broadly elliptical valves and the conspicuous striations. There are in all 17 or 18 striations along each side of the valve, markedly radiating in disposition, and reaching close up to the sagittal line or raphe. Two or three of the median striations are relatively short, extending only about halfway from the margin of the valve to the sagittal line. These short striations do not occur next each other, but alternate with those of maximum length. The striations appear to be perfectly smooth.

224. Navicula Gastrum, *Kütz. Bacill.* (1844) p. 94 ; *Donkin, Brit. Diat.* p. 22, t. 3. fig. 10 ; *Van Heurck, Synops. Diat. Belg.* p. 87, t. 8. figs. 25, 27.

**Nyasa**.—In plankton, Anchorage Bay (June 1904 ; nos. 9 and 10). On rocks, Deep Bay (25 June, 1904 ; no. 26).

**Tanganyika**.—In plankton, Kitutu Bay (26 Aug. 1904 ; no. 81), near Niamkolo (7 Sept. 1904 ; no. 88), near Mbete (28 Sept. 1904 ; no. 105), Lofu (6 Oct. 1904 ; no. 130), near Kala (19 Nov. 1904 ; no. 170), and near Kirando (1 Dec. 1904 ; no. 175).

From no. 175 some very large forms were observed : length 64 $\mu$ ; lat. 28 $\mu$.

225. Navicula dicephala, *W. Sm. Brit. Diat.* i. p. 87, t. 17. fig. 157.

**Nyasa**.—In swamp, Karonga (2 July, 1904 ; no. 33).

**Tanganyika**.—In rain-water pool on large rock near the shore, Utinta (6 Dec. 1904 ; no. 186).

226. Navicula (§ Pinnularia) interrupta, *W. Sm. l. c.* ii. p. 96 ; *Cleve, Synops. Navic. Diat.* ii. (1895) p. 76.—N. bicapitata, *Lagerst.* Pinnularia biceps, *Greg.*

The specimens observed had a rhomboidal central area (=forma *biceps*) : long. 60 $\mu$; lat. ad med. 13 $\mu$; lat. apic. 8·5 $\mu$.

**Nyasa**.—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

227. Navicula (§ Pinnularia) mesolepta, *Ehrenb.* ; *Kütz. Bacill.* p. 101 (1844) ; *W. Sm. Brit. Diat.* t. 19. fig. 182 ; *Van Heurck, Synops. Diat. Belg.* p. 79, t. 6. figs. 10, 11.

**Tanganyika**.—In swamp, Toa (10 Jan. 1905 ; no. 208).

228. Navicula (§ Pinnularia) gibba, (*Ehrenb.*) *W. Sm. Brit. Diat.* i. t. 19. fig. 180.

**Nyasa**.—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22). In swamp, Kambwelagoon near Karonga (27 June, 1904 ; no. 20).

**Tanganyika**.—In swamp, Mrumbi (27 Dec. 1904 ; nos. 195 and 196). In swamp, Toa (10 Jan. 1905 ; no. 208).

229. Navicula (§ Pinnularia) acrosphæria, (*Bréb.*) *Kütz. Bacill.* (1844) p. 97, t. 5. fig. 2 ; *W. Sm. Brit. Diat.* t. 19. fig. 183.

**Nyasa**.—In swamp, Karonga (29 June, 1904 ; no. 32, and 2 July, 1904 ; no. 33).

230. Navicula (§ Pinnularia) Dactylus, *Ehrenb., ex Van Heurck, Synops. Diat. Belg.* t. 5. fig. 1.

**Tanganyika**.—In swamp, Kituta (26 Aug. 1904 ; no. 80).

231. Navicula (§ Pinnularia) viridis, *Kütz. l. c.* t. 30. fig. 12 ; *Van Heurck, l. c.* t. 5. fig. 5.

**Victoria Nyanza**.—In swampy pools, near Bukoba (20 Apr. 1905 ; no. 251).

232. Navicula (§ Pinnularia) cardinalis, *Ehrenb. in Abh.* p. 19 (1840) ; *W. Sm. Brit. Diat.* i. t. 19. fig. 166.

**Victoria Nyanza**.—With the preceding species, but not so abundant (no. 251).

Genus STAURONEIS, *Ehrenb.*

233. Stauroneis anceps, *Ehrenb. in Phys. Abh. Akad. Wiss. Berl.* 1841 (1843), p. 422 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 147.

**Nyasa**.—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

**Victoria Nyanza**.—In swampy pools, near Bukoba (20 Apr. 1905 ; no. 251).

Genus SCHIZOSTAURON, *Grun.*

234. Schizostauron Crucicula, *Grun. in Cleve, New or little-known Diat.* p. 16 (1881).—Stauroneis Crucicula, *Cleve, Synops. Navic. Diat.* i. (1894) p. 151.



Large forms : long. 42–65 $\mu$ ; lat. 9·5–15·5 $\mu$ ; lat. apic. 3·2–3·8 $\mu$. Valves oblong or oblong-lanceolate, with rostrate apices. (Pl. **8**. fig. 12.)

**Tanganyika**.—Plankton, Kituta Bay (26 Aug. 1904 ; no. 81), Komba Bay (11 Oct. 1904 ; no. 135), and near Kirando (1 Dec. 1904 ; no. 175).

The bifid stauros and the longitudinal septa (or diaphragms) in the apical parts of the valves are the distinguishing features between this genus and *Stauroneis*. The specimens observed were all obtained from the fine surface plankton, and they reached almost twice the size of any previously recorded examples. The striæ were very fine, about 23 or 25 in 10 $\mu$.

Genus VANHEURCKIA, *Bréb.*

235. Vanheurckia rhomboides, (*Ehrenb.*) *Bréb. Monogr.* p. 4 (1869) ; *Van Heurck, Synops. Diat. Belg.* p. 112, t. 17. figs. 1, 2.—Navicula rhomboides, *Ehrenb.* ; *W. Sm. Brit. Diat.* i. p. 46, t. 16. fig. 129. Frustulia rhomboides, *De Toni*.

**Victoria Nyanza**.—In swampy pools, near Bukoba (20 Apr. 1905 ; no. 251).

Var. saxonica, (*Rabenh.*) *G. S. West*.—Frustulia saxonica, *Rabenh.* Navicula crassinervia, *Bréb. in W. Sm. Brit. Diat.* i. p. 47, t. 31. fig. 271.

**Tanganyika**.—In swamp, Mbete (28 Sept. 1904 ; no. 108).

**Victoria Nyanza**.—In swampy pool, near Bukoba (20 Apr. 1905 ; no. 618).

236. Vanheurckia vulgaris, (*Thw.*) *Van Heurck, Synops. Diat. Belg.* p. 112, t. 17. fig. 6.—Colletonema vulgaris, *Thw.*

**Tanganyika**.—In plankton, Lofu River (5 Oct. 1904 ; no. 123).

Genus GYROSIGMA, *Hass.*

237. Gyrosigma attenuatum, (*Kütz.*) *Cleve, Synops. Navic. Diat.* i. (1894) p. 114.—Pleurosigma attenuatum, *W. Sm. Brit. Diat.* i. p. 68, t. 22. fig. 216.

**Tanganyika**.—In plankton, near Kassanga (14 Nov. 1904 ; no. 159), near Kala (19 Nov. 1904 ; no. 170), near Maswa (14 Jan. 1905 ; no. 211), and near Baraka (24 Feb. 1905 ; no. 240).

The specimens observed were all considerably shorter than is usual in this species. The apices of the valves were not quite so attenuated as in European examples.

238. Gyrosigma nodiferum, (*Grun.*).—Pleurosigma nodiferum, *Grun. Arct. Diat.* p. 59. P. Spenceri, *W. Sm., var.* nodifera, *Van Heurck, Synops. Diat. Belg.* (1885) p. 118, t. 21. fig. 13 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 117.

Long. 152 $\mu$ ; lat. 17 $\mu$.

**Tanganyika**.—In plankton, near Kala (19 Nov. 1904 ; no. 170).

The general form of this species and the curious elongated, *oblique* central nodule appear to me to be quite distinctive.

## Family GOMPHONEMACEÆ.

### Genus GOMPHONEMA, *Ag.*

239. GOMPHONEMA PARVULUM, *Kütz. Bacill.* p. 83 (1844) : *Van Heurck, Synops. Descr. Belg.* p. 125, t. 25. fig. 9.

**Nyasa.**—On bivalve shells, Anchorage Bay (no. 11). On rocks, Deep Bay (25 June, 1904 ; no. 26).

**Tanganyika.**—On rocks in shallow water, Mbete (29 Sept. 1904 ; no. 114). In plankton, Lofu River (5 Oct. 1904 ; no. 123). Among Algæ scraped from the bottom of Dr. Cunnington's dau (24 Jan. 1905 : nos. 216 and 217).

Var. MICROPUS, (*Kütz.*) *Cleve, Synops. Navic. Diat.* i. (1894) p. 180.—G. micropus, *Kütz. Bacill.* (1844) p. 84.

**Victoria Nyanza.**—On rocks, near Bukoba (17 Apr. 1905 ; no. 247).

240. GOMPHONEMA ANGUSTATUM, *Kütz. l. c.* p. 83 ; *Cleve, l. c.* p. 181.

**Nyasa.**—On stones, shores of Domira Bay (19 June, 1904 ; no. 17).

241. GOMPHONEMA INTRICATUM, *Kütz. l. c.* p. 87, t. 9. fig. 4.

**Nyasa.**—On *Cladophora*, Anchorage Bay (no. 11). On rocks and in shore-pools, Nkata Bay (23 June, 1904 ; nos. 22 and 23).

Var. VIBRIO, (*Ehrenb.*) *Van Heurck* ; *Cleve, l. c.* p. 182.—G. Vibrio, *Ehrenb.*

**Nyasa.**—On stones, shores of Domira Bay (19 June, 1904 ; no. 17). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

242. GOMPHONEMA GRACILE, *Ehrenb. Infus.* p. 217 (1838) ; *Cleve, l. c.* p. 185.

**Nyasa.**—In swamp, Karonga (29 June, 1904 ; no. 32).

**Victoria Nyanza.**—On rocks, near Bukoba (17 Apr. 1905 ; no. 247).

Var. DICHOTOMUM, (*W. Sm.*) *Van Heurck.*—G. dichotomum, *W. Sm. Brit. Diat.* i. p. 79, t. 28. fig. 240.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

243. GOMPHONEMA EXIGUUM, *Kütz. l. c.* p. 84, t. 30. fig. 58 ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 188.

**Victoria Nyanza.**—On Algæ attached to rocks, near Bukoba (17 Apr. 1905 ; no. 247).

**Tanganyika.**—In large numbers attached to decaying fragments of *Cladophora* sp., in plankton off Niamkolo Island (29 June, 1904 ; no. 36). On Algæ floating in Kituta Bay (26 Aug. 1904 ; no. 79). Attached to Algæ scraped from bottom of Dr. Cunnington's dau (24 Jan. 1905 ; no. 217).

This species appears to have been previously recorded only as marine in habit.



244. GOMPHONEMA AFRICANUM, sp. n. (Pl. 8. fig. 13.)

*G.* magna : cellula ut in visa aspectu valvulari ovato-lanceolata, lateribus inferioribus leviter concavis, lateribus superioribus convexis, apice subacuto, ad basin angulari-rotundata, cum stigmati singulo unilaterali prope nodulum centralem, platea axiali angusta in medio non dilatata, striis 10–11 in 10 $\mu$, transversis sed radiatis prope apicem ; in visa aspectu cingulato cuneata, basi et apice rotundato-truncato, lateribus levissime biundulato.

Long. 102–128 $\mu$ ; lat. max. 23–28 $\mu$ ; lat. apic. aspect. cingul. usque ad 34 $\mu$.

**Tanganyika.**—Among *Chætomorpha Linum*, Kütz., floating on surface of Kituta Bay (26 Aug. 1904 ; no. 79). On rocks, in shallow water, near Mbete (29 Sept. 1904 ; no. 114).

This species should be compared with *G. oxycephalum*, Cleve, Synops. Navic. Diat. i. (1894) p. 187, t. 5. fig. 10.

## Family COCCONEMACEÆ.

### Genus COCCONEMA, *Ehrenb.*

245. COCCONEMA LÆVE, (*Näg.*) *nob.*—Cymbella lævis, *Näg. in Kütz. Sp. Alg.* (1849) p. 59 ; *Van Heurck, Synops. Diat. Belg.* p. 62, t. 3. fig. 7.

**Tanganyika.**—In plankton, Lofu River (5 Nov. 1904 ; no. 124).

246. COCCONEMA LEPTOCEROS, *Ehrenb. in Phys. Abh. Akad. Wiss. Berl.* 1841 (1843), p. 412.—Cymbella leptoceros, *Rabenh. Süssw. Diat.* t. 7. fig. 14 (1843) ; *Van Heurck, l. c.* p. 62, t. 2. fig. 18.

**Victoria Nyanza.**—Near Bukoba (17 Apr. 1905 ; no. 248).

247. COCCONEMA GROSSESTRIATUM, (*O. Müll.*) *nob.*—Cymbella grossestriata, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 154, t. 1. fig. 13.

Var. TANGANYIKÆ, var. n. (Pl. 8. fig. 9.)

Var. margine ventrali convexiore, polis obtusioribus sed levissime productis ; striis validis et latis, 3·5 in 10 $\mu$ (ad pol. 4 in 10 $\mu$).

Long. 74 $\mu$ ; lat. 29 $\mu$.

**Tanganyika.**—In plankton, near Kassanga (14 Nov. 1904; no. 159) and near Kirando (1 Dec. 1904 ; no. 175).

This is a handsome Diatom with exceedingly coarse striæ composed of large granules. The specimens observed from Tanganyika were stouter and more swollen on the ventral margin than Müller's Nyasa specimens, the striæ being even coarser.

248. COCCONEMA TURGIDUM, (*Greg.*) *nob.*—Cymbella turgida, *Greg.* (1856) ; *Cleve, Synops. Navic. Diat.* i. (1894) p. 168.

**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18).

**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904 ; no. 196).

249. Cocconema ventricosum, (*Kütz.*) *nob.*—Frustulia ventricosa, *Kütz.* (1834). Encyonema ventricosum, *Van Heurck*. E. cæspitosum, *Kütz.* (1849).
**Tanganyika.**—On the shore, near Niamkolo (1 Aug. 1904 ; no. 44) and in Niamkolo Harbour (7 Sept. 1904 ; no. 87).

250. Cocconema gracile, (*Rabenh.*) *G. S. West, Treat. Brit. Freshw. Alg.* (1904) p. 299.—Encyonema gracile, *Rabenh.*
**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18).
**Victoria Nyanza.**—In swampy pool, near Bukoba (20 Apr. 1904 ; no. 618).
**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 123).

251. Cocconema cymbiforme, *Ehrenb. Infus.* p. 225 (1838) ; *W. Sm. Brit. Diat.* i. p. 76, t. 23. fig. 220.
**Nyasa.**—In plankton, Deep Bay (24 June, 1904 ; no. 25). Among Algæ on rocks, Deep Bay (25 June, 1904 ; no. 26). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).
**Victoria Nyanza.**—Swampy pool, near Bukoba (20 Apr. 1905 ; no. 618). In sheltered bay, near Entebbe (1 May, 1905 ; no. 620) ; very numerous and with sporangial valves.
**Tanganyika.**—In plankton, near Mbete (21 Sept. 1904 ; no. 105) and in Vua Harbour (29 Oct. 1904 ; no. 150). In swampy pond, Mrumbi (27 Dec. 1905 ; no. 195). Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).

252. Cocconema Cistula, (*Ehrenb.*) *W. Sm. Brit. Diat.* i. p. 76, t. 23. fig. 221.
**Tanganyika.**—Kombe Bay (10 Oct. 1904 ; no. 134). Among Algæ scraped from bottom of Dr. Cunnington's dau (24 Jan. 1905 ; no. 217).

Var. maculatum, (*Kütz.*) *Cleve, Synops. Navic. Diat.* i. (1894) p. 173.—Cymbella maculata, *A. Schm. Atlas*, t. 71. fig. 21.
**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

## Genus AMPHORA, *Ehrenb.*

253. Amphora ovalis, *Kütz. Synops. Diat.* (1833) ; *Bacill.* (1844) p. 107, t. 5. figs. 35, 39 ; *Rabenh. Fl. Europ. Alg.* i. (1864) p. 91.
**Nyasa.**—On shore, Domira Bay (19 June, 1904 ; no. 17). In swamp, Karonga (July, 1904 ; nos. 33 and 34).
**Tanganyika.**—In plankton, Mbete (28 Sept. 1904 ; no. 105), Kombe Bay (11 Oct. 1904 ; no. 135), near Kala (19 Nov. 1904 ; no. 170), off Kirando (1 Dec. 1904 ; no. 175), and near Baraka (24 Feb. 1905 ; no. 240).

254. Amphora coffeæformis, (*Ag.*) *Kütz. Bacill.* (1844) p. 108 ; *Cleve, Synops. Navic. Diat.* ii. (1895) p. 120.
**Tanganyika.**—In plankton, Kombe Bay (11 Oct. 1904 ; no. 135).



## Genus EPITHEMIA, *Bréb.*

255. Epithemia turgida, (*Ehrenb.*) *Kütz. Bacill.* (1844) p. 34, t. 5. fig. 14 ; *Rabenh. Fl. Europ. Alg.* i. (1864) p. 62.
**Nyasa.**—In plankton, Anchorage Bay (June 1904 ; nos. 9 and 10). In swamp, Karonga (29 June, 1904 ; no. 32). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).
**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).
**Tanganyika.**—In plankton, near Mbete (28 Sept. 1904 ; no. 105) and near Kala (19 Nov. 1904 ; no. 170). Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).

## Genus RHOPALODIA, *O. Müll.*

256. Rhopalodia gibba, (*Kütz.*) *O. Müll. in Engl. Bot. Jahrb.* xxii. (1895) p. 65.—Epithemia gibba, *Kütz. Bacill.* (1844) p. 35, t. 4. fig. 22 ; *W. Sm. Brit. Diat.* p. 15, t. 1. fig. 13.
**Tanganyika.**—In swampy pond, Mrumbi (27 Dec. 1904 ; no. 181).

Var. ventricosa, (*Kütz.*) *O. Müll.*—Epithemia ventricosa, *Kütz.*
**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).
**Victoria Nyanza.**—In plankton, near Bukoba (21 June, 1905 ; no. 252). In sheltered bay, near Entebbe (1 May, 1905 ; no. 620).
**Tanganyika.**—In plankton, Kituta Bay (27 Aug. 1904 ; no. 82) and near Sumbu (13 Oct. 1904 ; no. 138).

257. Rhopalodia gibberula, (*Ehrenb.*) *O. Müll. l. c.* xxxvi. (1905) p. 165. —Epithemia gibberula, *Kütz. Bacill.* (1844) t. 30. fig. 3.
**Nyasa.**—Among Algæ in shallow water, Anchorage Bay (15 June, 1904 ; no. 12). On rocks, Nkata Bay (23 June, 1904 ; no. 23). In swamp, Karonga (2 July, 1904 ; no. 33).
**Tanganyika.**—Among floating Algæ, Kituta Bay (26 Aug. 1904 ; no. 79).

258. Rhopalodia hirudiniformis, *O. Müll. l. c.* p. 167.
**Nyasa.**—In the plankton, Anchorage Bay (14 June, 1904 ; no. 10). In swamp, Kota Kota (20 June, 1904 ; no. 18). On rocks, Deep Bay (25 June, 1904 ; no. 26). In swamp, Karonga (29 June, 1904 ; no. 32). In scrapings from off bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577).
**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252). In swampy pool, near Bukoba (20 Apr. 1905 ; no. 618). Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).
**Tanganyika.**—In plankton off Niamkolo Island (29 July, 1904 ; no. 36). Floating in Kituta Bay (26 Aug. 1904 ; no. 79). On rocks, Mbete (29 Sept. 1904 ; no. 114). In plankton, near Kala (19 Nov. 1904 ; no. 170).

259. RHOPALODIA GRACILIS, *O. Müll. in Engl. Bot. Jahrb.* xxii. (1895) p. 63 ; *A. Schm. Atlas Diat.* t. 255. figs. 22–27.
**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36) and off Kalambo (5 Nov. 1904 ; no. 154).

Var. UNDULATA, *O. Müll. in Hedwigia*, xxxvi. (1905) p. 163, t. 1. fig. 17.
**Nyasa.**—In plankton, Anchorage Bay (no. 1) and off Vahambwera Point (24 June, 1904 ; no. 24).

Var. IMPRESSA, *O. Müll.* ; *A. Schm. Atlas Diat.* t. 255. figs. 28–32.
**Nyasa.**—Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

260. RHOPALODIA VERMICULARIS, *O. Müll. l. c.* p. 67, t. 1. figs. 34–39, t. 2. figs. 10, 11, 14 ; *A. Schm. Atlas Diat.* t. 256. figs. 17–19.
**Nyasa.**—In plankton, Monkey Bay (17 June, 1904 ; no. 14). On rocks, Deep Bay (25 June, 1904 ; no. 26).
**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).
This species is commonly attached by thick gelatinous stalks and occurs in dense clusters. It was observed forming thick, yellow-brown, matted masses on the back of a beetle (*Limnogeton*) on the lake shore, Karonga, Nyasa.

## Family NITZSCHIACEÆ.

### Genus NITZSCHIA, *Hass.* ; *em. Grunow.*

261. NITZSCHIA TRYBLIONELLA, *Hantzsch, in Rabenh. Alg.* no. 980 (1860).
Var. LITTORALIS, (*Grun.*) *Van Heurck.*—N. littoralis, *Grun.*
**Tanganyika.**—In plankton, near Niamkolo (7 Sept. 1904 ; no. 88).

262. NITZSCHIA LANCETTULA, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 175, t. 2. fig. 15.
Long. 46–48 $\mu$ ; lat. 10–11 $\mu$ ; punct. carin. 6 in 10 $\mu$ ; striis 13 in 10 $\mu$.
**Nyasa.**—In plankton, Anchorage Bay (June 1904 ; nos. 9 and 10).

263. NITZSCHIA DISSIPATA, (*Kütz.*) *Grun. in Cleve & Grun. Arct. Diat.* p. 90 (1880).—Synedra dissipata, *Kütz.*
Var. MEDIA, *Hantzsch.*
**Tanganyika.**—In plankton, near Sumba (13 Oct. 1904 ; no. 138).

264. NITZSCHIA TUBICOLA, *Grun. l. c.* p. 97 ; *Van Heurck, Synops. Diat. Belg.* (1885) t. 69. fig. 14.
Long. 69 $\mu$ ; lat. 7 $\mu$ ; punct. carin. 7 in 10 $\mu$.
**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36) and near Kala (19 Nov. 1904 ; no. 170).



265. NITZSCHIA AMPHIBIA, *Grun. in Wien. Verhandl.* (1882) p. 574 ; *Van Heurck, Synops. Diat. Belg.* (1885) p. 184, t. 68. figs. 15–17.
Cellulæ lanceolatæ cum punct. carin. 7 in 10 $\mu$ ; long. 35 $\mu$ ; lat. 10 $\mu$.
**Nyasa.**—Abundant in scrapings off bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577).

266. NITZSCHIA LINEARIS, *W. Sm. Brit. Diat.* i. p. 39, t. 13. fig. 110.

Var. TENUIS, *Grun.*—N. tenuis, *W. Sm.*
**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18).
**Tanganyika.**—In swamp, Mrumbi (27 Dec. 1904 ; no. 196).

267. NITZSCHIA PALEA, (*Kütz.*) *W. Sm. l. c.* ii. p. 89.—Synedra Palea, *Kütz. Bacill.* (1844) t. 3. fig. 27, t. 4. fig. 2.
**Nyasa.**—In swamp, Kota Kota (20 June, 1904 ; no. 18). On rocks, Nkata Bay (24 June, 1904 ; no. 23). In swamp, Karonga (2 July, 1904 ; no. 34).
**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).
**Tanganyika.**—On rocks, Niamkolo Harbour (7 Sept. 1904 ; no. 87). In plankton, near Mbete (28 Sept. 1904 ; no. 108). In swamp, Toa (10 Jan. 1905 ; no. 208).

Var. DEBILIS, *Van Heurck.*
**Victoria Nyanza.**—On rocks, Bukoba (17 Apr. 1905 ; no. 248).

Var. TENUIROSTRIS, *Van Heurck.*
**Tanganyika.**—In swamp, Toa (10 Jan. 1905 ; no. 208).

268. NITZSCHIA NYASSENSIS, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 177, t. 2. figs. 5–9.
Long. 380–430 $\mu$ ; lat. ad med. (aspect. valv.) 3·2 $\mu$. (Pl. 4. figs. 7–9.)
**Nyasa.**—In plankton, off Vahambwera Point (24 June, 1904 ; no. 24) and off Karonga (1 July, 1904 ; no. 30). Also in swamp, Kambwelagoon near Karonga (27 June, 1904 ; no. 29).
**Tanganyika.**—In plankton, Niamkolo (July and Aug. 1904 ; nos. 36, 39, and 52), Kituta Bay (Aug. 1904 ; nos. 77 and 81), near Mbete (28 Sept. 1904 ; nos. 105 and 109), Komba Bay (11 Oct. 1904 ; no. 135), Vua Harbour (29 Oct. 1904 ; no. 150), near Kalambo (5 Nov. 1904 ; no. 154), near Kirando (1 Dec. 1904 ; no. 175), Utinta (5 Dec. 1904 ; no. 181), and near Maswa (14 Jan. 1905 ; no. 211). Also in Mtondwe Bay, among Algæ scraped from shells (2 Sept. 1904 ; no. 83).
This Diatom occurred in prodigious quantity in the plankton of Tanganyika, more especially from July to September. I am somewhat doubtful regarding its exact identification, as it seems to me to resemble so closely the slender and elongated species of *Synedra*. It undoubtedly agrees with Müller's

species, which he described from the plankton of Nyasa and the pools in the vicinity of that lake, but I am not convinced of its correct inclusion in the genus *Nitzschia*. On first examining it I took it to be a form of *Synedra Lemmermannii*, W. & G. S. West ("Plankton of Some Irish Lakes," Trans. Roy. Irish Acad. xxxiii. (1906) p. 109, t. 11. figs. 1, 2), but the frustules are not so straight as in that species, the markings not so distinct, and the poles much less capitate. The African forms were commonly a little curved, which is not surprising in such a long narrow Diatom, and in some of the collections they were often curiously bent (especially in nos. 52 and 150). In this species, and very probably in several other shorter ones, the genera *Nitzschia* and *Synedra* merge into each other.

## Family **SURIRELLACEÆ**.

### Genus SURIRELLA, *Turp.*

269. SURIRELLA ROBUSTA, *Ehrenb. in Ber. Akad. Berl.* (1840) p. 215.—*S. nobilis*, *W. Sm. Brit. Diat.* i. p. 32, t. 7. fig. 63.

Var. SPLENDIDA, (*Ehrenb.*) *Van Heurck, Synops. Diat. Belg.* 1885, p. 187, t. 72. fig. 4.—*S. splendida*, *Kütz. Bacill.* (1844) p. 62, t. 7. fig. 9.
**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 124).

270. SURIRELLA FÜLLEBORNII, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 30, t. 1. fig. 11.
**Victoria Nyanza.**—In plankton, near Bukoba (18 Apr. 1905 ; no. 249).

Var. ELLIPTICA, *O. Müll. l. c.* p. 31, t. 1. fig. 13.
Long. 216–250 $\mu$ ; lat. 80–97 $\mu$. (Pl. **3**. figs. 3, 4.)
**Victoria Nyanza.**—With the typical form, but much more abundant (nos. 249 and 252).

271. SURIRELLA BIFRONS, (*Ehrenb.*) *Kütz. Bacill.* (1844) p. 61.

Var. TUMIDA, *O. Müll. l. c.* p. 27, t. 1. fig. 2.
Long. 98–160 $\mu$ ; lat. 46–53 $\mu$.
**Nyasa.**—In plankton, Anchorage Bay (June, 1904 ; nos. 9 and 10).
**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905 ; no. 249).

Var. INTERMEDIA, *O. Müll. l. c.* p. 27, t. 1. fig. 1.
**Nyasa.**—In plankton, Anchorage Bay (June, 1904 ; nos. 9 and 10).

272. SURIRELLA MALOMBÆ, *O. Müll. l. c.* p. 34, t. 2. fig. 5 [*inclus. forma acuta*, *O. Müll. l. c.* t. 2. fig. 7].
Long. 125–161 $\mu$ ; lat. 70–74 $\mu$. (Pl. **3**. figs. 2, 13, 14, 22, 23.)
**Victoria Nyanza.**—Very abundant in the plankton, near Bukoba (Apr. 1905; nos. 249 and 252).



This species was in great abundance and every intermediate stage was noticed between it and *S. bifrons* var. *tumida*. Many of the forms of *S. bifrons* var. *tumida* from Lake Nyasa might have been equally well named *S. Malombæ*. Much variation was also shown in the apiculation of the extremities.

273. SURIRELLA NYASSÆ, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 33, t. 2. fig. 3 [*inclus. var.* Sagitta, *O. Müll. l. c.* t. 2. fig. 4].
Long. 359–382 $\mu$ ; lat. max. 69–75 $\mu$ ; lat. ad med. 54–57 $\mu$.
**Nyasa.**—In plankton, off Vahambwera Point (24 June, 1904 ; no. 24), Deep Bay (24 June, 1904 ; no. 25), and off Karonga (1 July, 1904 ; no. 30).
This handsome species was very abundant and many intermediate states occurred between the typical form as described by Müller and his var. *Sagitta*. It is a large species, which, so far as present observations go, appears to be confined to the plankton of Lake Nyasa.
Many of the frustules were thickly coated with attached *Vorticellæ* (*vide* Pl. **2**. figs. 11, 12).

274. SURIRELLA PLANA, sp. n. (Pl. **8**. fig. 5.)
*S.* subparva ; cellula ut in visa aspectu valvulari ovato-elliptica ; pseudorhaphide recta et distincta ; costis validis subconfertis, circiter 3 in 10 $\mu$ (29–30 in margine laterali unoquoque), transversis sed polos versus leviter radiatis, pseudorhaphidem extensis ; alis curtis juxta margines laterales.
Long. 103 $\mu$ ; lat. max. 39 $\mu$.
**Tanganyika.**—In plankton, near Ndauvie (7 Feb. 1905 ; no. 227).
This Diatom was only noticed from one of the plankton collections. It should be compared with *S. diaphana*, Bleisch, and *S. tenera*, Greg.

275. SURIRELLA LINEARIS, *W. Sm. Brit. Diat.* i. p. 31, fig. 58 *a*.
**Victoria Nyanza.**—Among *Utricularia*, near Bukoba (20 Apr. 1905 ; no. 618).

276. SURIRELLA CONSTRICTA, *Ehrenb. Mikr.* t. 14. fig. 37 (1854).—Navicula ? constricta, *Ehrenb. Infus.* 1838, p. 188, t. 21. fig. 17.

Var. AFRICANA, *O. Müll. in Engl. Bot. Jahrb.* xxxvi. (1905) p. 32, t. 2. fig. 1.
Long. 250–295 $\mu$ ; lat. max. 42–45 $\mu$ ; lat. min. 33–34 $\mu$.
**Tanganyika.**—In plankton, Niamkolo (7 Sept. 1904 ; no. 88), near Sumba (13 Oct. 1904 ; no. 138), and near Kassanga (14 Nov. 1904 ; no. 159).

277. SURIRELLA OBTUSIUSCULA, sp. n. (Pl. **8**. fig. 7.)
*S.* parva ; cellula ut in visa aspectu valvulari oblongo-elliptica, marginibus lateralibus leviter concavis (cellula levissime et gradatim constricta), polis obtusis ; pseudorhaphide recta vix distincta ; costis brevibus, transversis sed polos versus radiatis, 4 in 10 $\mu$ (20–21 in margine laterali unoquoque) ; alis ad margines laterales ; cellula ut in visa aspectu cingulato oblonga, marginibus lateralibus in medio retusis, polis truncatis sed angulis rotundatis.

Long. 60–62 $\mu$ ; lat. max. 18 $\mu$ ; lat. min. 16 $\mu$.

**Tanganyika.**—In plankton, Komba Bay (11 Oct. 1904 ; no. 135) and near Kala (19 Nov. 1904 ; no. 170).

Compare with *S. linearis*, W. Sm., and *S. constricta*, Ehrenb.

278. SURIRELLA TANGANYIKÆ, sp. n. (Pl. **8**. fig. 6.)

*S.* parva ; cellula ut in visa aspectu valvulari elliptico-oblonga, marginibus lateralibus in parte mediana subparallelis, polis subconicis ad extremo leviter rotundatis ; pseudorhaphide recta et distincta ; costis validis paucis 2–2½ in 10 $\mu$ (12–13 in margine laterali unoquoque), subbrevibus, iis in medio transversis, iis ad polos radiatis ; alis intra et juxta margines laterales ; valvis inter costos dense et valde punctata ; cellula ut in visa aspectu cingulato oblongo-rectangularis, angulis rotundatis.

Long. 84–88 $\mu$ ; lat. 30–32 $\mu$.

**Tanganyika.**—In plankton, Kituta Bay (25 Aug. 1904 ; no. 77), near Mbete (28 Sept. 1904 ; no. 105), and near Kala (19 Nov. 1904 ; no. 170).

This species was not uncommon in the above plankton collections. The costæ are relatively few, although occasionally slightly irregular in their arrangement ; and they are also short, only extending about half the distance from the margin of the valve to the sagittal axis (pseudoraphe). The alæ as seen in the valve-view are marginal or just within the margin. The entire valve between the costæ and right up to the pseudoraphe is strongly punctate. There is no hyaline area on each side of the pseudoraphe.

The outward form of the valve, the few and remote costæ, and the strong punctulations are features which separate *S. Tanganyikæ* from any other species.

279. SURIRELLA STRIATULA, *Turp. in Diet. Sc. Nat.* li. p. 508 (Suriraya) ; *Kütz. Bacill.* (1844) p. 62, t. 7. fig. 6 ; *Schmidt, Atlas Diat.* t. 24. figs. 17 & 20.

Long. 120 $\mu$ ; lat. 82 $\mu$.

**Tanganyika.**—In plankton, near Maswa (14 Jan. 1905 ; no. 211) and near Baraka (24 Feb. 1905 ; no. 240).

This interesting species is mostly marine and submarine in habit.

### Genus CYMATOPLEURA, *W. Sm.*

280. CYMATOPLEURA SOLEA, *W. Sm. in Ann. Mag. Nat. Hist.* ser. 2, vii. (1851) p. 12 ; *Brèb. Diat.* i. p. 36, t. 10. fig. 78.—Surirella Solea, *Kütz. Bacill.* (1844) p. 60, t. 3. fig. 61.

**Nyasa.**—In plankton, Anchorage Bay (13 June, 1904 ; no. 9) and off Karongo (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In plankton, Kituta Bay (26 Aug. 1904 ; no. 81), Komba Bay (11 Oct. 1904 ; no. 135), near Kirando (1 Dec. 1904 ; no. 175), and near Ndawie (7 Feb. 1905 ; no. 227).



Forma cellulis curtis, polis mucronatis, ad formam *apiculatam* (= *C. apiculata*, W. Sm.) accedens.

**Tanganyika.**—In plankton, near Kala (19 Nov. 1904 ; no. 170).

Var. LATICEPS, *O. Müll. in Engl. Bot. Jahrb.* xxxiv. (1905) p. 22 cum fig. 2.

**Nyasa.**—In plankton, Anchorage Bay (14 June, 1904 ; no. 10).

281. CYMATOPLEURA NYANSÆ, sp. n. (Pl. **8**. fig. 8.)

*C.* magna et insignis ; cellula ut in visa aspectu valvulari in parte mediana angusta et subcylindrica, in partibus apicalibus valde inflatis subcircularibus, polis submamillatis ; costis ad margines laterales 7 in 10 $\mu$ ; cellula ut in visa aspectu cingulato ut in *C. Solea*.

Long. 189–195 $\mu$ ; lat. in med. 20 $\mu$ ; lat. max. (part. polar.) 56–58 $\mu$.

**Victoria Nyanza.**—Not uncommon in the plankton, near Bukoba (April 1905 ; nos. 249 and 252).

This species is distinct from *C. Solea* by reason of its curious dumbbell-shaped valves. The median part of the valve is relatively narrow, and the polar portions are almost circular in outline.

## Class **MYXOPHYCEÆ**.

### Order HORMOGONEÆ.

### Family **STIGONEMACEÆ**.

### Genus NOSTOCHOPSIS, *Wood*.

282. NOSTOCHOPSIS GOETZEI, *Schmidle, in Bot. Centralbl.* lxxxi. (1900) p. 417.—Myxoderma Goetzei, *Schmidle, in Engl. Bot. Jahrb.* xxx. (1902) p. 246, t. 4. figs. 2, 3.

Crass. fil. prim. (cell. torulos.) 4–5 $\mu$ ; crass. ram. (cell. cylindr.) 2–3 $\mu$ ; crass. heterocyst. 5·5–6·5 $\mu$.

**Nyasa.**—Taken in a shrimp-net in about 4 feet of water (15 June, 1904 ; no. 12).

The plants occurred in free-floating gelatinous masses of irregular outline, reaching a diameter of several cms. The main portions of the primary filaments were more or less torulose, and the cells were of very variable shape. The lateral branches consisted of cylindrical cells, 2½–4 times longer than the diameter, with slight constrictions between them. The apical cells were bluntly rounded. The heterocysts were invariably lateral, either sessile or stalked, the stalk consisting of one to three rounded cells. Each branch is attached to the side of one of the primary cells, from which it originally arose as a small lateral outgrowth.

The specimens collected by Dr. Cunnington agreed very well with Schmidle's description and figures, the plants he examined being collected in the vicinity of Nyasa in 1899.

I think Schmidle's genus *Myxoderma* must be regarded as synonymous with *Nostochopsis*, Wood. The only difference is in the form of the thallus, which is expanded in the one case (*N. Goetzei*) and more or less rounded in the other (*N. lobatus*), and to my mind this is not sufficient as a generic distinction. One of the most distinctive features of *Nostochopsis* is the lateral and often stalked condition of the heterocysts, and this is the same in each case. *N. lobatus*, Wood, is known to occur in Central Africa (*vide* W. & G. S. West, in Journ. Bot. xxxiv. (1896) p. 381, t. 361. figs. 1, 2; *op. cit.* xxxv. (1897) p. 264); and *N. Goetzei* differs from it in the more expanded thallus and consequent laxer disposition of the filaments, which in their inferior part are not arranged in parallel bundles.

### Family **SCYTONEMACEÆ**.

#### Genus SCYTONEMA, *Ag.*

283. Scytonema mirabile, (*Dillw.*) *Born. in Bull. Soc. Bot. Fr.* xxxvi. (1889) p. 155 in obs.—Conferva mirabilis, *Dillw.* Scytonema figuratum, *Ag. Syst. Algar.* 1824, p. 38; *Born. & Flah. in Ann. Sci. Nat.* 7e sér., *Bot.* v. (1887) pp. 101–3.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

284. Scytonema crispum, (*Ag.*) *Born. l. c.* p. 156 in obs.—Lyngbya crispa, *Ag.* (pro parte). Scytonema cincinnatum, (*Kütz.*) *Thur. in Ann. Sci. Nat.* 6e sér., *Bot.* i. (1875) p. 380; *Born. & Flah. l. c.* (1887) p. 89.

**Nyasa.**—On rocks at water-level, Deep Bay (25 June, 1904; no. 26).

**Tanganyika.**—Among other Algæ scraped from bottom of Dr. Cunnington's dau (24 Jan. 1905; no. 217).

#### Genus TOLYPOTHRIX, *Kütz.*

285. Tolypothrix tenuis, *Kütz. Phyc. Gen.* p. 228 (1843); *em. J. Schmidt, in Bot. Tidsskr.* xxii. (1899) pp. 383 et 413.—*Inclus.* T. lanata, *Wartmann*, 1858.

Crass. fil. 11–14 $\mu$; crass. trich. 9–10 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

I thoroughly agree with Schmidt (*l. c.* 1899) regarding the identity of *Tolypothrix tenuis*, Kütz., and *T. lanata*, Wartm.

### Family **NOSTOCACEÆ**.

#### Genus NOSTOC, *Vaucher.*

286. Nostoc paludosum, *Kütz. Tab. Phyc.* ii. (1850) p. 1, t. 1. fig. 2; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 164; *Born. & Flah. l. c.* (1888) p. 191.

**Nyasa.**—In swamp, Karonga (2 July, 1904; no. 34).



287. Nostoc piscinale, *Kütz. Phyc. general.* (1843) p. 208; *Tab. Phyc.* ii. p. 4, t. 11. fig. 3 (1846); *Born. & Flah. in Ann. Sci. Nat.* 7e ser., *Bot.* vii. (1888) p. 194.

Crass. trich. 4 $\mu$; crass. heterocyst. 5–6 $\mu$; diam. spor. 5·5–7·5 $\mu$.

**Tanganyika.**—In plankton, Kituta Bay (24 Aug. 1904; no. 74). On surface of swamp, Toa (10 Jan. 1905; no. 209).

288. Nostoc carneum, *Ag. Syst. Algar.* 1824, p. 22; *Born. & Flah. l. c.* (1888) p. 186.

Crass. trich. 2·8–3·5 $\mu$; long. heterocyst. 10 $\mu$; lat. heterocyst. 5·5 $\mu$; long. spor. 9–11·5 $\mu$; lat. spor. 5·7–6·5 $\mu$.

**Tanganyika.**—In plankton, Kituta Bay (27 Aug. 1904; no. 82).

#### Genus ANABÆNA, *Bory.*

289. Anabæna Flos-aquæ, (*Lyngb.*) *Bréb. Alg. Eur. Falais.* p. 36 (1835); *Born. & Flah. l. c.* (1888) p. 228; *J. Schmidt, in Bot. Tidsskr.* xxii. (1899) p. 367.

Forma trichomatibus curtis, spiraliter dispositis, anfractibus arctis plerumque 2–4; cellulis globosis cum granulis conspicuis paucis; heterocystis intercalaribus (non terminalibus); sporis non vidis.

Crass. trich. 6–7 $\mu$; crass. heterocyst. 7·5–8 $\mu$. (Pl. **4**. figs. 10, 11, 14, 15; Pl. **10**. fig. 1.)

**Nyasa.**—In the plankton, Anchorage Bay (13 June, 1904; no. 9) and Monkey Bay (17 and 18 June, 1904; nos. 15 and 16); very abundant.

**Tanganyika.**—In the plankton, near Kalambo (5 Nov. 1904; no. 154), near Kirando (1 Dec. 1904; no. 175), and near Utinta (5 Dec. 1904; no. 181).

The trichomes are spirally twisted after the manner of a corkscrew, mostly making from 2 to 4 turns, rarely as many as 8. The cells are almost exactly globose, and the heterocysts were never observed to be terminal. It was the dominant feature of two of the Nyasa plankton collections.

This form may be the same as the *Anabæna* mentioned by Schmidle as occurring in Lake Nyasa, and for which he suggested the name "*A. Flos-aquæ*, forma *discoidea*" (*cf.* Schmidle, in Engl. Bot. Jahrb. xxxii. (1903) p. 61). It is, however, rather larger than the measurements he gives for the specimens collected by Dr. Fülleborn. It may also be identical with *A. spiroides*, Klebahn.

Dr. Cunnington states that on one occasion in Lake Nyasa, and on a few occasions in Lake Tanganyika, a yellow scum was present on the surface, which he attributed to immense quantities of an *Anabæna*. He thinks that this appearance was the same as that noted by Livingstone and more recently by Mr. J. E. S. Moore ('The Tanganyika Problem,' p. 323), who describes the surface as "appearing as if tinged with a fine golden dust." Mr. Moore,

however, says that the "yellow clouds" consisted of a large infusorian resembling a *Peridinium* or a *Colpodium*. The organism in question may have been a *Peridinium* or possibly *Botryococcus Braunii*, a Protococcaceous alga, which is the cause of similar coloration and "yellow clouds" in many European lakes.

Var. CIRCULARIS, var. n. (Pl. **4**. figs. 10, 11, 14, 15; Pl. **10**. fig. 2.)

Var. filis brevissimis, spiraliter dispositis anfractibus 1–1½, utroque fine heterocysta terminatis; cellulis sphæricis, oblongo-ellipticis vel oblongis, cum granulo magno (*gas-vac.*) in cellula unaquaque.

Crass. trich. 4·5–6 μ; crass. heterocyst. 5–8 μ.

**Tanganyika**.—In plankton, Komba Bay (11 Oct. 1904; no. 135), near Sumbu (13 Oct. 1904; no. 138), Vua Harbour (29 Oct. 1904; no. 150), near Kalambo (5 Nov. 1904; no. 154), near Kassanga (14 Nov. 1904; no. 159), near Chamaluki (15 Nov. 1904; no. 160); near Kala (19 Nov. 1904; no. 170), near Kirando (1 Dec. 1904; no. 175), near Maswa (14 Jan. 1905; no. 211), and near Baraka (24 Feb. 1905; no. 240).

This variety was the dominant feature of some of the plankton collections from Tanganyika, giving the collected sediment a decided blue-green colour. The trichomes are remarkable for their shortness, being mostly coiled in the form of a circle, sometimes overlapping at the extremities to form a spiral with about one and a half turns. Each end of this short trichome is terminated by a globular or ellipsoidal heterocyst, and both cells and heterocysts contain a single large granule, most probably of the nature of a gas-vacuole. The total length of the trichomes from heterocyst to heterocyst varies from 80 to 140 μ. Very rarely a straight (or almost straight) trichome is observed among the coiled ones. The cells are somewhat variable in form, showing all gradations from globose to oblong.

290. ANABÆNA sp. (Pl. **9**. fig. 8.)

*A.* trichomatibus rectis rigidissimis, evaginatis, solitariis; cellulis sphæricocompressis, cytoplasmate atro-viridi et minute granulato; heterocystis sphæricis, diametro trichomatis subæqualibus; sporis non visis. Forsan sit propria species: *A. rigidissima*.

Crass. trich. 11–12 μ.

**Victoria Nyanza**.—Among *Utricularia*, near Bukoba (20 Apr. 1905; no. 618).

**Tanganyika**.—In plankton, near Kala (19 Nov. 1904; no. 170).

The trichomes of this *Anabæna* were remarkable for their exactly lineal character.

291. ? ANABÆNA INÆQUALIS, (*Kütz.*) *Born. & Flah. in Ann. Sci. Nat.* 7e sér., *Bot.* vii. (1888) p. 231.—Sphærozyga inæqualis, *Kütz.* (1843).

Crass. trich. 3·5–4 μ; crass. heterocyst. 6 μ; sporis non vidis.

**Nyasa**.—In swamp, Kambwelagoon near Karonga (27 June, 1904; no. 29).



292. ANABÆNA TANGANYIKÆ, sp. n. (Pl. **10**. fig. 3.)

*A.* pelagica, trichomatibus brevissimis, spiraliter contortis anfractibus 1–2 (plerumque circ. 1½), evaginatis, inter cellulas non constrictis, utroque fine heterocysta terminatis; cellulis cylindricis, diametro 2–3-plo longioribus (3·5–8·5 μ longis), utroque polo truncatis; cytoplasmate minute granulato, pallide æruginoso; heterocystis oblongo-ellipticis terminalibus; sporis ellipticis, solitariis?, ab heterocystis plerumque remotis, episporio lævi et hyalino.

Crass. trich. 2·4–2·6 μ; long. heterocyst. 5·5 μ; lat. heterocyst. 3 μ; long. spor. 13 μ, lat. 7 μ.

**Tanganyika**.—In plankton, near Baraka (24 Feb. 1905; no. 240).

This species presents a similar modification of the trichomes to that shown by *A. Flos-aquæ* var. *circularis*. Each trichome is short and twisted into a spiral of rather more than one complete revolution, and each extremity is terminated by a heterocyst. Beyond this point, however, the resemblance ceases. *A. Tanganyikæ* is a very much narrower species, with exactly cylindrical cells and scarcely any trace of constrictions between them.

In the thickness of its trichomes it most nearly approaches *A. hyalina*, Schmidle, but is very different in other characters and in its habit.

293. ANABÆNA SPHÆRICA, *Born. & Flah. in Ann. Sci. Nat.* 7e sér., *Bot.* vii. (1888) p. 228.

Forma tenuis: crass. trich. 4–5 μ; crass. heterocyst. 5·5 μ; long. spor. 11–14 μ; lat. spor. 10 μ.

**Nyasa**.—Among *Utricularia*, Domira Bay (19 June, 1904; no. 579).

The filaments are rigid and straight, and except for being a trifle thinner agree in every particular with the description of *A. sphærica*. It is similar in size to *A. baltica*, J. Schmidt, but the trichomes of the latter are strongly flexuose and circinate, and the spores are relatively larger.

294. ANABÆNA sp. ad *A. balticam*, J. Schmidt, accedens; trichomatibus valde flexuoso-circinatis; cellulis globosis, diam. 3–3·5 μ; sporis non vidis.

**Nyasa**.—In plankton, Anchorage Bay (13 June, 1904; no. 9).

## Genus NODULARIA, *Mertens*.

295. NODULARIA SPHÆROCARPA, *Born. & Flah. l. c.* (1888) p. 245.

Crass. trich. 6 μ.

**Tanganyika**.—On surface of swamp, Toa (10 Jan. 1905; no. 208).

296. NODULARIA TENUIS, sp. n.

*N.* filis tenuibus, brevibus et rigidis, utroque fine paullo attenuatis et cellula acute conica terminatis; vagina tenerrima, hyalina et diffluente, vix conspicua; cellulis ante divisionem diametro æquilobis, rotundo-quadratis; heterocystis late ellipsoideis; sporis . . . . ?

Crass. trich. 3–3·8 μ; crass. heterocyst. 5·5–6 μ; long. heterocyst. 7 μ.

**Tanganyika.**—Among various Algæ, floating, Komba Bay (10 Nov. 1904 ; no. 134).

The spores of this species were not observed, but it differs so much from previously described plants of this genus that I feel justified in naming it *Nodularia tenuis*.

The trichomes are thinner than those of *N. Harveyana*, (Thw.) Thur., the cells are rounded quadrate, and the apical cells are acutely conical. The heterocysts are very numerous, broadly elliptical in form, and situated about 110–120 $\mu$ apart.

297. Nodularia sp.

Crass. cell. veget. (trich.) 6–7 $\mu$ ; crass. heterocyst. 10–11 $\mu$ ; sporis non vidis.

**Nyasa.**—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

298. Nodularia sp.

Crass. trich. 4–4·5 $\mu$ ; cellulis depresso-quadratis ; heterocystis late ellipticis, long. 7·5–9 $\mu$, lat. 6–7 $\mu$ ; cellula apicali hemisphærica ; sporis non vidis.

**Tanganyika.**—Among *Cladophora* sp., on stones, shells, roots of grasses, etc., Niamkolo (1 Aug. 1904 ; no. 44).

### Genus CYLINDROSPERMUM, *Kütz.*

299. Cylindrospermum Goetzei, *Schmidle, in Engl. Bot. Jahrb.* xxx. (1902) p. 245, t. 4. fig. 5.

Crass. trich. 2·2–3 $\mu$ ; cellulis diametro $1\frac{1}{2}$–2-plo longioribus ; long. heterocyst. 8–9 $\mu$ ; lat. heterocyst. 3–3·8 $\mu$ ; long. spor. 19–28 $\mu$ ; lat. spor. 6·2–9·2 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

This characteristic species was abundant in stagnant water. It is chiefly remarkable for its narrow trichomes and the length of the heterocysts.

## Family **OSCILLATORIACEÆ.**

### Subfam. Vaginarieæ.

### Genus SCHIZOTHRIX, *Kütz.*

300. Schizothrix lacustris, *A. Br. in Kütz. Sp. Alg.* (1849) p. 320 ; *Gomont, in Ann. Sci. Nat.* 7e *sér., Bot.* xv. (1892) p. 301, t. 6. figs. 9–12.

Crass. trich. 1·2–1·4 $\mu$.

**Tanganyika.**—On rocks, in a few fathoms, Niamkolo Harbour (9 Aug. 1904 ; no. 54).



### Genus MICROCOLEUS, *Desmaz.*

301. Microcoleus vaginatus, (*Vauch.*) *Gomont, in Morot, Journ. de Bot.* iv. (1890) p. 353 ; *Ann. Sci. Nat.* 7e *sér., Bot.* xv. (1892) p. 355.

Var. monticola, (*Kütz.*) *Gomont.*—Chthonoblastus monticola, *Kütz.*

Crass. trich. 3·6–4 $\mu$.

**Nyasa.**—On rocks, Nkata Bay (23 June, 1904 ; no. 23).

### Subfam. Lyngbyeæ.

### Genus PLECTONEMA, *Thur.*

302. Plectonema Wollei, *Farlow, in Bull. Bussey Inst.* (1875) p. 77 ; *Gomont, l. c.* xvi. (1893) p. 98, t. 1. fig. 1.—Lyngbya Wollei, *Farlow* (1876).

Crass. fil. 32–52 $\mu$ ; crass. trich. 27–42 $\mu$.

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36), Komba Bay (11 Oct. 1904 ; no. 135), and near Sumbu (13 Oct. 1904 ; no. 138).

Forma robusta : crass. fil. 60–80 $\mu$ ; crass. trich. 42–59 $\mu$.

**Tanganyika.**—Floating and dredged, Komba Bay (10 Oct. 1904 ; no. 134). This stout form was loaded with epiphytes.

303. Plectonema Tomasinianum, (*Kütz.*) *Born. in Bull. Soc. Bot. France,* xxxvi. (1889) p. 155 in obs. ; *Gomont, l. c.* p. 99.

Crass. fil. 18–23 $\mu$ ; crass. trich. 15–17 $\mu$.

**Tanganyika.**—With the preceding species (no. 134).

### Genus LYNGBYA, *C. Ag.*

304. Lyngbya putealis, *Montagne, in Ann. Sci. Nat. sér. 2, Bot.* xiii. (1840) p. 200 ; *Gomont, l. c.* p. 143, t. 3. fig. 14.

Crass. fil. 9·5–10·2 $\mu$ ; crass. trich. 7–7·8 $\mu$.

**Tanganyika.**—On shells, dredged in about 10 fathoms, Pemba (25 Nov. 1904 ; no. 174).

305. Lyngbya Martensiana, *Meneghini, Consp. Alg. Eugan.* (1837) p. 12 ; *Gomont, l. c.* p. 145, t. 3. fig. 17.—Oscillatoria turfosa, *Carm.* (1841).

Crass. fil. 8 $\mu$ ; crass. trich. 6 $\mu$.

**Tanganyika.**—On rocks in shallow water, Mbete (29 Sept. 1904 ; no. 114).

306. Lyngbya versicolor, (*Wartm.*) *Gomont, l. c.* p. 147, t. 4. figs. 4, 5.

Crass. fil. 3·8–4·5 $\mu$ ; crass. trich. 2·8–3·3 $\mu$.

**Nyasa.**—On rocks, Nkata Bay (23 June, 1904 ; no. 23). Amongst various Algæ scraped from bottom of s.s. 'Guenkolen' at anchor 8. end of lake (15 June, 1904 ; no. 577).

**Victoria Nyanza.**—On rocks, Bukoba (17 Apr. 1905 ; no. 248).
**Tanganyika.**—On rocks in shallow water, Mbete (29 Sept. 1904 ; no. 114).

307. Lyngbya ærugineo-cærulea, (*Kütz.*) *Gomont, Ann. Sci. Nat.* 7e sér., *Bot.* xvi. (1892) p. 146, t. 4. figs. 1–3.
**Tanganyika.**—On rocks, Niamkolo Harbour (7 Sept. 1904 ; no. 87).

308. Lyngbya Kützingii, *Schmidle, in Allgem. Bot. Zeitschr.* iii. (1897) p. 58.—Leibleinia Martensiana, *Kütz. Tab. Phyc.* i. p. 45, t. 82. fig. 1. Lyngbya Martensiana, *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 143.

Var. distincta, (*Nordst.*) *Lemm. in Engl. Bot. Jahrb.* xxxiv. (1905) p. 620.—L. Martensiana, β. distincta, *Nordst. Alg. Sandvic.* p. 4. L. subtilis, *West, in Journ. Roy. Micr. Soc.* (1892) p. 741, t. 10. fig. 58. L. distincta, *Schmidle, l. c.*
**Victoria Nyanza.**—Among *Utricularia*, swampy pool near Bukoba (20 Apr. 1905 ; no. 618) and in sheltered bay near Entebbe (1 May, 1905 ; no. 620).

309. Lyngbya circumcreta, sp. n. (Pl. 9. fig. 7.)

*L.* filis solitariis pelagiis et brevibus, spiraliter contortis ; spiris latis et arctissimis, anfractibus adnatis 2–9 (plerumque 2–2½) ; vaginis tenuibus, firmis, arctissimis et achrois ; celiulis subquadratis vel diametro brevioribus, cytoplasmate pallide ærugineo et homogeneo ; cellula apicali rotundo-truncata.

Crass. cell. 1·8–2·1 μ ; long. cell. 1–2 μ ; diam. anfract. 28–44 μ.
**Victoria Nyanza.**—In plankton, near Bukoba (April 1935 ; nos. 249 and 252). Also in sheltered bay near Entebbe (1 June, 1905 ; no. 620).

This species occurred floating in the plankton as closely coiled threads which have the appearance of small hoops. The filament grows in the manner of a flat spiral, the twists of the spiral being wide but very close together.

It is nearest to *L. contorta*, Lemm., but differs in the hoop-like coiling of its filaments, which are also of greater thickness, and in the much shorter cells. The coils of *L. circumcreta* are much wider than those of *L. contorta* and more exactly circular.

310. Lyngbya purpurea, *Gomont, l. c.* (1892) p. 149.—Oscillatoria purpurea, *Hook. f. & Harv.*
Crass. trich. 1·7 μ.
**Tanganyika.**—Among *Calothrix cartilaginea*, sp. n., on inside of canoe (6 Jan. 1905 ; no. 205).

311. Lyngbya bipunctata, *Lemm. in Forschungsb. Biol. Stat. Plön*, vi. (1900) p. 138, t. 2. fig. 48 ; *l. c.* x. (1903) p. 152.
a. Crass. trich. 1·4–1·5 μ ; long. cell. 3·5–5·5 μ.
**Nyasa.**—In plankton, near Mtangula (22 June, 1904 ; no. 20), and off Vahambwera Point (24 June, 1904 ; no. 24). In swamp, Kambwelagoon near Karonga (27 June, 1904 ; no. 29).



*b.* Crass. trich. 1 μ ; long. cell. 5–6 μ.
**Tanganyika.**—In plankton, Lofu River (5 Oct. 1904 ; no. 124).

This minute *Lyngbya* exhibited considerable variation. The range of diameter was from 1 μ to 1·5 μ, and the length of the cells from 3·5 to 6 μ. In all cases a strong puncta or large granule was visible on each side of the dissepiments. In some instances the filaments were regularly twisted into a lax spiral, in others they were only curved, and very rarely they were almost straight. The spiral specimens only differed from *L. Lagerheimii*, (Möb.) Gomont, in the slightly longer cells, and in some of them the apical cells were very slightly narrowed and faintly capitate as in *L. Nyassæ*, Schmidle.

I place the plants observed under *L. bipunctata*, Lemm., mainly owing to the length of the cells. They appear to me to combine the characters of *L. Lagerheimii*, *L. bipunctata*, and *L. Nyassæ*, three Lyngbyas which would perhaps be better regarded as constituting one species with well-marked punctæ and with filaments which frequently become twisted into a lax spiral. Particularly interesting was the finding of narrowed and faintly capitate apical cells in the spirally twisted forms. Precisely the same plant was observed from stones in a swamp as occurred in the plankton.

312. Lyngbya perelegans, *Lemm. in Abh. Nat. Ver. Bremen*, xvi. (1899) p. 355 ; xviii. (1904) p. 153, t. 11. figs. 13, 14.
Crass. cell. 1·5–1·8 μ.
**Tanganyika.**—In plankton, Niamkolo (Aug. 1904 ; nos. 39 and 52) and near Kala (19 Nov. 1904 ; no. 170).

313. Lyngbya limnetica, *Lemm. in Bot. Centralb.* lxxvi. (1898) p. 154 ; *Forschungsb. Biol. Stat. Plön*, x. (1903) p. 151.
**Tanganyika.**—In plankton off Niamkolo Island (29 July, 1904 ; no. 36).

## Genus PHORMIDIUM, *Kütz.*

314. Phormidium foveolarum, (*Mont.*) *Gomont, in Ann. Sci. Nat.* 7e sér., *Bot.* xvi. (1892) p. 164, t. 4. fig. 16.
Crass. trich. 1·4–1·8 μ.
**Tanganyika.**—Epiphytic on *Plectonema Wollei*, Komba Bay (10 Oct. 1904; no. 134). On rocks, among *Lyngbya Martensiana* and *L. versicolor*, Mbete (29 Sept. 1904 ; no. 114). On rocks dredged in 2 or 3 fathoms, Niamkolo Harbour (7 Sept. 1904 ; no. 87).

The varied habit of this species is worthy of comment.

315. Phormidium tenue, (*Menegh.*) *Gomont, l. c.* p. 169, t. 4. figs. 23–25.
**Tanganyika.**—On stones, shores of lake Niamkolo (1 Aug. 1904 ; no. 44). In swamp, Kituta (23 Aug. 1904; no. 72). Near Kala, both in the plankton

and dredged from the bottom (19 Nov. 1904; nos. 170 and 171). In swampy pond, Mrumbi (27 Dec. 1904 ; no. 195). In swamp, Toa (10 Jan. 1905 ; no. 208). In plankton near Baraka (24 Feb. 1905 ; no. 240).

316. Phormidium angustissimum, *W. & G. S. West, in Journ. Bot.* xxxv. (1897) p. 72.
Crass. trich. 0·8 μ.
**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).
**Tanganyika.**—In plankton, near Kala (19 Nov. 1904; no. 170). In swamp, Toa (10 Jan. 1905 ; no. 208). In plankton, middle of lake between Rumonge and Uvira (30 Jan. 1905 ; no. 218). Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).

317. Phormidium Corium, (*Ag.*) *Gomont, in Morot, Journ. de Bot.* iv. (1890) p. 355; *Ann. Sci. Nat.* 7e ser., *Bot.* xv. (1892) p. 172, t. 5. figs. 1, 2.
Crass. trich. 3·8 μ.
**Tanganyika.**—On rocks below the water-level, Kassanga (10 Nov. 1904 ; no. 156).

318. Phormidium papyraceum, (*Ag.*) *Gomont, ll. cc.* p. 355 ; p. 193, t. 5. figs. 3, 4.
Crass. trich. 3·6 μ.
**Tanganyika.**—Epiphytic on *Plectonema Wollei*, Komba Bay (10 Oct. 1904; no. 134).

319. Phormidium inundatum, *Kütz. Sp. Alg.* (1849) p. 251 ; *Tab. Phyc.* i. p. 32, t. 45. fig. 3 ; *Gomont, l. c.* (1892) p. 172, t. 4. figs. 31, 32.
Crass. trich. 3–4·3 μ.
**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 33).

320. Phormidium ambiguum, *Gomont, l. c.* (1892) p. 198, t. 5. fig. 10.
Crass. trich. 5·5–6 μ.
**Tanganyika.**—On rocks dredged in 2 or 3 fathoms, Niamkolo Harbour (7 Sept. 1904 ; no. 87), and on rocks just below water-level, Kassanga (10 Nov. 1904 ; no. 156).

321. Phormidium autumnale, (*Ag.*) *Gomont, l. c.* (1892) p. 187, t. 5. figs. 23, 24 ; *J. Schmidt, in Bot. Tidsskr.* xxii. (1899) pp. 348, 410.—Phormidium uncinatum, (*Ag.*) *Gomont*, 1890 ; *l. c.* (1892) p. 184, t. 5. figs. 21, 22.
Crass. trich. 5·8–6·2 μ.
**Tanganyika.**—On rocks, shallow water, Mbete (29 Sept. 1904 ; no. 114).



Genus OSCILLATORIA, *Vauch.*

322. Oscillatoria Princeps, *Vauch. Hist. Conf.* (1803) p. 190 ; *Gomont, in Ann. Sci. Nat.* 7e sér., *Bot.* xv. (1892) p. 206, t. 6. fig. 9.
**Tanganyika.**—In plankton, Kituta Bay (27 Aug. 1904 ; no. 82).

323. Oscillatoria tenuis, *Ag. Alg. Del.* ii. (1813) p. 25 ; *Gomont, l. c.* p. 220, t. 7. figs. 2, 3.
**Victoria Nyanza.**—In swampy pools, Bukoba (20 Apr. 1905 ; no. 251).
**Tanganyika.**—In plankton, near Mbete (28 Sept. 1904; no. 105). Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).

324. Oscillatoria amphibia, *Ag. in Flora*, x. (1827) p. 632 ; *Gomont, l. c.* p. 221, t. 7. figs. 4, 5.—Oscillaria tenerrima, *Kütz.* (1843).
Crass. trich. 3 μ.
**Victoria Nyanza.**—Swampy pool near Bukoba (20 Apr. 1905 ; no. 618).

325. Oscillatoria geminata, *Menegh. Consp. Alg. Eugan.* (1837) p. 9 ; *Gomont, l. c.* p. 222, t. 7. fig. 6.
Crass. trich. 3 μ.
**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 34).

326. Oscillatoria splendida, *Grev. Fl. Edinb.* p. 305 (1824) ; *Gomont, l. c.* p. 224, t. 7. figs. 7, 8.—Oscillaria leptotricha, *Kütz. Phyc. Germ.* (1845) p. 157.
Var. attenuata, *W. & G. S. West, in Journ. Roy. Micr. Soc.* ser. 2, xvi. (1896) p. 165, t. 4. fig. 58.
Crass. trich. 2·3 μ.
**Tanganyika.**—Among *Utricularia*, mouth of Malagarasi River (16 Jan. 1905 ; no. 611).

327. Oscillatoria Tanganyikæ, sp. n. (Pl. 9. fig. 9.)
*O.* trichomatibus solitariis natantibus et pelagiis, elongatis, olivaceo-viridibus, rectis vel subrectis, apicem versus longe attenuatis, apicibus curvatis vel interdum recurvatis, rotundatis vel rotundo-truncatis, inter cellulas constrictis ; cellulis subquadratis vel plerumque leviter brevioribus, apicem versus ad duplo longioribus ; cytoplasmate minute granuloso et interdum granulis magnis subrefringentibus (*gas-vac.*?) paucis farcti ; cellula apicali plerumque valde curvata, nunquam capitata, extremitati rotundata vel subtruncata ; calyptra nulla.
Crass. trich. 10–12 μ ; crass. apic. trich. 6 μ ; long. cell. 6–10 μ ; long. cell. apical. 11–15 μ.
**Tanganyika.**—In plankton, near Kirando (1 Dec. 1904 ; no. 175) and near Baraka (24 Feb. 1905 ; no. 240).
This interesting *Oscillatoria* most nearly approaches *O. subuliformis*, Kütz.,

a species which occurs on maritime rocks about the tide-limits. It is, however, distinguished by its thicker and much straighter trichomes, by the conspicuous constrictions between the cells, and by its free-floating habit. *O. Tanganyikæ* is a remarkable species and has undoubtedly a closer affinity with *O. subuliformis* than with any other known species of the genus. So striking is this resemblance, and so different is *O. Tanganyikæ* from other species of the genus, that one feels justified in suggesting that these two species have had a common origin, *O. Tanganyikæ* having acquired certain distinctive characters as a result of its adaptation to a pelagic existence.

328. Oscillatoria subbrevis, *Schmidle, in Engl. Bot. Jahrb.* xxx. (1902) p. 243, t. 4. fig. 7.

Forma major ; crass. trich. 10–10·5 μ.

**Tanganyika.**—In swamp, Mbete (28 Sept. 1904 ; no. 108).

The specimens from Tanganyika are in perfect agreement with Schmidle's species except for the thickness. The trichomes are straight, with unattenuated and bluntly rounded extremities, and the cells are exceedingly short. The transverse cell-walls are bent as in specimens of *O. subbrevis* which I have recorded from Barbados in the West Indies (*vide* Journ. Bot. xlii. (1904) p. 292), some of them being concave and some convex to the apex of the trichome. The dark disc-shaped masses of intercellular (?) substance occur at irregular intervals along the length of the trichome.

329. Oscillatoria formosa, *Bory, Dict. Cl. Hist. Nat.* xii. (1827) p. 474; *Gomont, in Ann. Sci. Nat.* 7 sér., *Bot.* xv. (1892) p. 230, t. 7. fig. 16.

Crass. trich. 4–4·2 μ.

**Tanganyika.**—Dredged from a few fathoms, near Kala (19 Nov. 1904 ; no. 171).

330. Oscillatoria Corti*ana, *Meneghini, l. c.* p. 8 ; *Gomont, l. c.* p. 231, t. 7. fig. 17.

Crass. trich. 7–7·5 μ.

**Tanganyika.**—In plankton, near Maswa (14 Jan. 1905 ; no. 11).

Previously recorded only from thermal waters in Italy and Hungary.

## Genus SPIRULINA, *Turp.*

331. Spirulina tenuissima, *Kütz. Alg. Decad.* xiv. (1836) no. 131 ; *Tab. Phyc.* i. p. 26, t. 37. fig. 4.—S. subsalsa, *Œrsted* (1842) ; *Gomont, l. c.* p. 253, t. 7. fig. 32.

**Nyasa.**—On stones on shore, Domira Bay (19 June, 1904 ; no. 17).

332. Spirulina laxissima, sp. n. (Pl. 9. fig. 6.)

Trichomata angustissima, solitaria, inter algas pelagias sparsas, in spiram laxissimam regularem diametro 4·5–5·3 μ æqualiter contorta, anfractibus 17–22 μ inter se distantibus ; apicibus trichomatis rotundo-obtusis ; cytoplasmate pallide æruginoso et homogeneo, sine granulis.



Crass. trich. 0·7–0·8 μ ; long. tot. trich. 21–275 μ.

**Tanganyika.**—In plankton, near Chamkaluki (15 Nov. 1904 ; no. 160) and near Kala (19 Nov. 1904 ; no. 170).

This species occurred in abundance in the two above-mentioned collections. The trichomes are exceedingly narrow and are chiefly remarkable for the laxness of the spirals. Some of them were very short, scarcely exceeding a single turn of the spiral, whereas others possessed as many as fourteen turns and reached a length of 275 μ.

333. Spirulina Princeps, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1902) p. 205.—S. Gomontii, *Gutw. in Bull. Acad. Sci. Cracov.* (1902) p. 613, t. 40. fig. 69. S. gigantea, *Schmidle, in Engl. Bot. Jahrb.* xxxii. (1903) p. 59, t. 1. fig. 5.

Crass. trich. 3·5–4·8 μ. (Pl. 9. fig. 5.)

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 34).

This species has a wide distribution in the tropics, having been described from Java, Ceylon, and Central Africa. Unfortunately, it was described as a "sp. nova" in each case, the name *Spirulina princeps* being the first one given to it.

The cell-contents are of a bright blue-green colour, and homogeneous in character except for a few scattered refractive granules, which are rarely absent. The trichomes are slightly variable in thickness, and in the width of the spiral and relative distance apart of the turns, but to my mind these differences are not of a specific nature. The width of the spiral varies within the extremes even in a single trichome, and the distance between the turns of the spiral varies at different parts of the same trichome.

The following table shows the differences of measurement between the described forms :—

| Locality. | Thickness of trichome. | Diameter of spiral. | Distance apart of turns. |
|---|---|---|---|
| Java (*Sp. Gomontii* of Gutwinski). | 3·8 μ | 8·8 μ | 11 μ |
| Ceylon. | 4·5–5 μ | 11–12 μ | 9·5 μ |
| Africa (Nyasa) (*Sp. gigantea* of Schmidle). | 3–4 μ | 11–16 μ | |
| Africa (Nyasa) (coll. by Dr. Cunnington). | 3·5–4·8 μ | 9–12 μ | 10–12 μ |

The following diagnosis takes into consideration the limits of variation for the species:—

Trichomata robusta et solitaria, inter algas varias sparsas, curta, in spiram laxam vel laxiusculam plus minusve subregulariter diametro 8·8–16 μ contorta; anfractibus 9·5–11 μ inter se distantibus; apicibus trichomatis obtusis vel rotundato-obtusis; cytoplasmate ærugineo-cœruleo et homogeneo, cum granulis minutis sparsis. Crass. trich. 3–5 μ.

*Geogr. distribution.*—Central Africa; Ceylon; Java.

## Family **RIVULARIACEÆ.**

### Genus CALOTHRIX, *Ag.*

334. CALOTHRIX JULIANA, (*Menegh.*) *Born. & Flah. in Ann. Sci. Nat.* 7ᵉ sér., *Bot.* iii. (1886) p. 348.

Crass. fil. 10–12 μ (ad 16 μ); crass. trich. ad bas. 7–9·3 μ.

**Nyasa.**—In scrapings from bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904; no. 577).

335. CALOTHRIX EPIPHYTICA, *W. & G. S. West, in Journ. Bot.* XXXV. (1897) p. 240.

Crass. fil. ad bas. 4·5–9 μ; crass. trich. ad bas. 2·8–5·8 μ.

**Nyasa.**—On *Cladophora*, Anchorage Bay (no. 11).

**Tanganyika.**—On *Cladophora* scraped from the bottom of Dr. Cunnington's dau (24 Jan. 1905; no. 216).

336. CALOTHRIX BREVISSIMA, sp. n. (Pl. **10**. fig. 8.)

*C.* filis minutis et epiphyticis, culmis vetustis pelagiis affixis, gregariis et brevissimis, longitudine toto 53–94 μ, *non vel levissime attenuatis*; vagina firma, arcta, pæne cylindrica, tenui, hyalina et achroa; trichomatibus pallide olivaceo-viridibus, brevissimis, longitudine toto 30–62 μ, vix attenuatis, apice rotundato; cellulis inferioribus diametro subæquilongis vel brevioribus, superioribus diametro duplo brevioribus, minute granulatis; heterocystis basilaribus singulis (rare binis) rotundato-hemisphæricis vel subglobosis.

Crass. fil. 5–7 μ; crass. trich. 3·8–5 μ.

**Victoria Nyanza.**—In the plankton, attached to decaying shreds of vegetable matter (probably old leaves and plant-stems), near Bukoba (21 Apr. 1906; no. 252).

This minute species occurred clustered round fragments of decaying stems and leaves which had collected in the tow-net. It is characterized by its extreme shortness, and is distinguished from all other species of the genus by the absence of any appreciable attenuation. The sheaths are firm and colourless, almost cylindrical, with open extremities, and they fit the trichomes very closely. The trichomes are rounded at both extremities, with the faintest indication of attenuation towards the apex, and the cells are much shorter than their length. There is a well-defined basal heterocyst of a



rounded-hemispherical shape, and sometimes a second heterocyst is developed after the trichome has shifted a short distance from the base of the sheath.

Forma angustior et longior.

Crass. fil. ad bas. 4–5·5 μ; crass. trich. 3·4–3·7 μ; long. toto fil. usque 130 μ.

**Tanganyika.**—Epiphytic on *Cladophora inconspicua*, clothing some of the young branches very thickly, in a few fathoms of water, Niamkolo.

337. CALOTHRIX PARIETINA, (*Kütz.*) *Thur. in Ann. Sci. Nat.* 6ᵉ sér. *Bot.* i. (1875) p. 381; *Born. & Flah. l. c.* 7ᵉ sér. *Bot.* iii. (1886) p. 366.

Crass. fil. ad bas. 13·5–19 μ; crass. trich. 7·5–9·5 μ.

**Victoria Nyanza.**—On rocks just below the water-level, Bukoba (17 Apr. 1905; no. 248). This form approaches a species of *Tolypothrix*.

338. CALOTHRIX BRAUNII, *Born. & Flah. l. c.* (1886) p. 368.

Crass. fil. ad bas. 7–10 μ; crass. trich. 5·5–8 μ.

**Tanganyika.**—Among *Utricularia* and other water-weeds in shallow water, mouth of Malagarasi River (16 Jan. 1905; no. 611).

Forma filis ad basin subrectis.

Crass. fil. ad bas. 6–9 μ; crass. trich. 4·5–6·4 μ.

**Nyasa.**—On rocks below level of water, Nkata Bay (23 June, 1904; no. 23).

339. CALOTHRIX CARTILAGINEA, sp. n. (Pl. **10**. fig. 7.)

*C.* strato compacto late expanso, cartilagineo, atro-viridi vel sordide æruginoso, lignis vetustis affixo, 1 mm. crasso; filis densissime confertis, curvato-flexuosis, imbricatis, plerumque curtis, ad basin leviter bulboso-inflatis; vagina arcta et firma, hyalina, sæpe vix conspicua; trichomatibus brevibus, in pilum brevem attenuatis, inter cellulas constrictis; cellulis inferioribus diametro paullo brevioribus (rare triplo brevioribus disciformibus), plerumque torulosis, superioribus tam longis quam latis vel diametro usque duplo longioribus, cellula basali parva, cellula apicali subconica; *heterocystis nullis*.

Crass. fil. ad bas. 5–10 μ; crass. trich. ad bas. 4·5–9 μ; hormogoneis torulosis usque 50 μ longis.

**Tanganyika.**—Scraped from the inside of a canoe (6 Jan. 1905; no. 205).

The trichomes of this species are rather short and somewhat variable in character. There are no heterocysts and the basal cell is generally considerably smaller than the cells just above it, a slight bulbous swelling being a general feature of the base of the trichome. The basal cells are shorter than their length, but in the upper parts of the trichome the cells are mostly longer than broad. In some of the trichomes each cell contains one or more prominent granules of large size, and occasionally in some of the thinner trichomes the basal region does not appear to be septate.

*Calothrix cartilaginea* should be compared with *C. balearica*, Born. & Flah., and *C. juliana*, Born. & Flah. From the former it is distinguished by the swollen bases of its trichomes, which are never decumbent, and by the much thinner sheath with no trace of lamellation. The cells are also considerably longer. From *C. juliana* it differs in its thinner stratum of darker colour, its narrower, much shorter, and more flexuose trichomes, and its longer cells.

### Genus RIVULARIA, *(Roth) Ag.; em. Thur.*

340. RIVULARIA DURA, *Roth, Neu. Beitr.* p. 273 (1802); *Born. & Flah. in Ann. Sci. Nat.* 7 sér., *Bot.* iv. (1886) p. 347.

Forma: crass. trich. 5·5–7 μ; crass. heterocyst. 5·5–6 μ.

**Tanganyika.**—Attached to floating decayed stems, Lofu River (5 Oct. 1904; no. 124).

341. RIVULARIA GLOBICEPS, sp. n. (Pl. **10**. fig. 6.)

*R.* thallo parvo, submolle, 1·5–3 mm. lato, calce non indurato, hemisphærico-globoso, caulibus vetustis affixo; filis confertis pressione facile secedentibus; vaginis hyalinis et amplis, vix conspicuis; trichomatibus inter cellulas constrictis, apice in pilum sublongum attenuatis; cellulis cylindricis inferioribus diametro 1½–4-plo longioribus, superioribus similibus vel duplo brevioribus, cum granulis paucis magnis; heterocystis magnis globosis, singulis vel rare binis, cum nodulo incrassato conspicuo juxta cellulam basalem.

Crass. trich. ad bas. 4·8–6 μ; crass. heterocyst. 10–12 μ.

**Tanganyika.**—Attached to old stems and leaves, floating in Kituta Bay (24 Aug. 1904; no. 74).

The large size of the heterocysts, which are globular and twice the diameter of the trichomes, is one of the most characteristic features of this species. The cells are cylindrical and in the basal parts of the trichomes are very long. They contain scattered conspicuous granules, which are chiefly located near the exterior, sometimes even projecting from the wall of the cell.

In the size of its trichomes *R. globiceps* most nearly approaches *R. hæmatites*, Ag., but it is at once distinguished by its smaller and much softer colonies, which are not incrusted with lime, by the large size of the heterocysts, and by the somewhat longer basal cells.

### Genus GLŒOTRICHIA, *J. Ag.*

342. GLŒOTRICHIA NATANS, *(Hedwig) Rabenh. Deutschl. Kryptogamenfl.* p. 90 (1847); *Born. & Flah. l. c.* (1886) p. 369.

Forma thallo bulloso usque ad 15 mm. lato; vaginis plerumque diffluentibus; heterocystis basilaribus, singulis, binis vel ternis, globosis, late ellipticis vel oblongis.



Crass. trich. ad bas. 7–9·5 μ; diam. heterocyst. 8·2–12·4 μ.

**Tanganyika.**—Floating in Mtondwe Bay, Niamkolo (13 Aug. 1904; no. 66).

Forma juvenalis?

*G.* thallo minuto subgloboso 170–230 μ lato molle et solido; trichomatibus olivaceis viridibus, curtis, in pilum brevem attenuatis; cellulis basin versus subrectangularibus (diametro 1¼–1¾-plo longioribus) levissime tumidis, superioribus diametro usque 5-plo longioribus, valde granulosis; heterocystis basilaribus globosis; sporis ignotis.

Crass. trich. ad bas. 3–3·4 μ; crass. heterocyst. 5·5–6 μ.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905; no. 620).

343. GLŒOTRICHIA LONGIARTICULATA, sp. n. (Pl. **10**. fig. 5.)

*G.* thallo parvo subgloboso molle 750–900 μ lato; filis subconfertis, pressione facile secedentibus; trichomatibus læte æruginosis, in pilum sublongum attenuatis, inter cellulas distincte constrictis; cellulis cylindricis, ad basin plerumque elongatis, diametro 3–7-plo longioribus (rare 1½-plo longioribus), superioribus sæpe brevioribus (diametro 3–5-plo longioribus), nonnunquam granulo magno conspicuo ad polum unumquemque et cum granulis minutis numerosis; heterocystis basilaribus, magnis, globosis vel late ellipticis (rare oblongis); sporis breviter cylindricis, diametro 3-plo longioribus, polis rotundatis, episporio duplicato glabro et lutescente.

Crass. trich. ad bas. 4·5–5·5 μ; crass. heterocyst. 8–9·5 μ; long. spor. 36–44 μ; lat. spor. 12·5–15 μ.

**Nyasa.**—Floating in Anchorage Bay (10 June, 1904; no. 1).

This species is nearest to *Glœotrichia indica*, Schmidle (in Hedwigia, xxxix. (1900) p. 174, t. 9. figs. 18, 19), from which it differs in the shorter filaments, in the absence of swollen cells next the heterocyst at the base of the trichome, and in the smooth outer coat of the spore. The spores are also shorter and the heterocysts more rounded.

There are well-marked constrictions between the cells, and the large granule (gas-vacuole?) at each pole is particularly conspicuous in the more elongated cells. The heterocysts are mostly of a broadly-elliptic shape and are markedly wider than the trichomes.

*G. longiarticulata* differs from *G. echinulata* (*Conferva echinulata*, Sm., Engl. Bot. t. 1378; *Rivularia echinulata*, Turn. ex Sm. l. c. in obs.), P. Richter (*vide* J. Schmidt, in Bot. Tidsskr. xxii. (1899) p. 401), in the narrower trichomes, with much longer cells, and in the shorter spores.

## Order COCCOGONEÆ.

### Family **CHAMÆSIPHONIACEÆ.**

#### Genus CHAMÆSIPHON, *A. Br. & Grun.*

344. CHAMÆSIPHON CONFERVICOLA, *A. Br. in Rabenh. Alg.* **no. 1726** ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 148.

Long. 30–37 $\mu$ ; lat. 3·5–3·5 $\mu$.

**Tanganyika.**—On *Cladophora* sp., shores of lake, Niamkolo (1 Aug. 1904 ; no. 44). On *Chætomorpha Linum* floating in Kituta Bay (26 Aug. 1904 ; no. 79).

345. CHAMÆSIPHON INCRUSTANS, *Grun. in Rabenh. Fl. Europ. Alg.* ii. (1865) p. 149.—Sphærogonium incrustans, *Rostaf. in Rospraw. Sprawozd. Posiedz. Akad. Umiej.* x. (1883) pp. 304–5, t. 5. figs. 1–7.

**Nyasa.**—On *Cladophora crispata*, Anchorage Bay (no. 11).

**Victoria Nyanza.**—On *Cladophora crispata*, Bukoba (17 Apr. 1905; no. 247).

**Tanganyika.**—On *Chætomorpha Linum*, Niamkolo Bay (3 Aug. 1904; no. 40).

### Family **CHROOCOCCACEÆ.**

#### Subfam. CHROOCYSTEÆ.

#### Genus GLŒOCHÆTE, *Lagerh.*

346. GLŒOCHÆTE WITTROCKIANA, *Lagerh. in Öfvers. K. Sv. Vet.-Akad. Förh.* (1883) no. 2, p. 39, t. 1. figs. 3, 4.—G. bicornis, *Kirchn. Nachtr. zu Algenfl. v. Württ.* 1888, p. 165. Schrammia barbata, *Dangeard, in Le Botaniste* (1889), p. 158, t. 7. figs. 12 *a–j*.

Diam. cell. 8·5–15 $\mu$ ; long. set. 54–196 $\mu$.

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; no. 72).

#### Subfam. CHROOCOCCEÆ.

#### Genus APHANOTHECE, *Näg.*

347. APHANOTHECE MICROSCOPICA, *Näg. Gatt. einz. Alg.* (1849) p. 59, t. 1 H.

**Nyasa.**—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

#### Genus DACTYLOCOCCOPSIS, *Hansg.*

348. DACTYLOCOCCOPSIS AFRICANA, sp. n.

*D.* cellulis circ. 8–9 in familiis fasciculatim aggregatis, in medio decussatim conjunctis ; cellulis elongatis et cylindricis, diametro 37–42-plo longioribus, cum polis attenuatis et acutis ; cytoplasmate homogeneo et pallide æruginoso.

Long. cell. 75–88 $\mu$ ; lat. cell. 1·8–2·5 $\mu$.

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

*D. africana* is distinguished from all other species of the genus by its stellate colonies of elongated cells, which are suddenly bent round each other in the middle after the manner of some forms of *Ankistrodesmus falcatus*, (Corda) Ralfs. In the length of its cells this species agrees with *D. acicularis*, Lemm. (in Ber. Deutsch. Bot. Ges. xviii. (1900) p. 309), but differs in the bent cells, forming star-shaped colonies, and in the absence of the bright refractive granules from the cytoplasm.



#### Genus MERISMOPEDIA, *Meyen.*

349. MERISMOPEDIA GLAUCA, (*Ehrenb.*) *Näg. Gatt. einz. Alg.* (1849) p. 55, t. 1 D. fig. 1.

**Nyasa.**—On shores and among *Utricularia*, Domira Bay (19 June, 1904 ; nos. 17 and 579).

**Victoria Nyanza.**—Among *Utricularia*, near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In plankton, near Baraka (24 Feb. 1905; no. 240).

350. MERISMOPEDIA PUNCTATA, *Meyen*, 1839 ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 57.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 34).

**Victoria Nyanza.**—Near Entebbe (1 May, 1905 ; no. 620).

**Tanganyika.**—In plankton, near Chamkaluki (15 Nov. 1904 ; no. 160).

351. MERISMOPEDIA ÆRUGINEA, *Bréb. in Kütz. Spec. Alg.* (1849) p. 472.

**Tanganyika.**—In plankton, Lofu (6 Oct. 1904 ; no. 130), and near Sumbu (13 Oct. 1904 ; no. 138).

352. MERISMOPEDIA ELEGANS, *A. Br. in Kütz. l. c.* ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 57.

**Tanganyika.**—In plankton, Vua Harbour (29 Oct. 1904 ; no. 150).

Var. REMOTA, var. n.

Var. cellulis ut in forma typica sed remotis, coloniis plus minusve subirregularibus.

Diam. colon. (cell. 32–128) 52–146 $\mu$ ; diam. cell. 7–9 $\mu$.

**Tanganyika.**—In plankton, near Baraka (24 Feb. 1905 ; no. 240).

The cells were similar in size and colour to those of *M. elegans*, but were more or less remote from each other in the enveloping jelly. The colonies were also more irregular than any I have previously observed of *M. elegans*. A few of the cells in each colony possessed a single dark granule, very probably of the nature of a gas-vacuole.

Genus TETRAPEDIA, *Reinsch.*

353. TETRAPEDIA REINSCHIANA, *Arch. in Grevillea*, i. (1872) p. 46, t. 3. figs. 11–13.

**Nyasa.**—On shore, Domira Bay (19 June, 1904; no. 17). In swamp, Karonga (2 July, 1904 ; no. 34).

354. TETRAPEDIA GLAUCESCENS, (*Wittr.*) *Boldt.*—Arthrodesmus? glaucescens, *Wittr. in Bih. K. Sv. Vet.-Ak. Handl.* (1872) no. 1, p. 55, t. 4. fig. 11.

**Nyasa.**—In scrapings from bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577). Swampy lake margin, Domira Bay (19 June, 1904 ; no. 579).

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904 ; n. 72).

Genus GOMPHOSPHÆRIA, *Kütz.*

355. GOMPHOSPHÆRIA APONINA, *Kütz. Tab. Phyc.* i. t. 31. fig. 3 ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 56.

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36). Among *Cladophora* on shores, Niamkolo (1 Aug. 1904 ; no. 44). In plankton, Vua Harbour (29 Oct. 1904 ; no. 150).

356. GOMPHOSPHÆRIA LACUSTRIS, *Chodat, in Bull. Herb. Boiss.* vi. (1898) pp. 180–182, cum fig. 1.

**Nyasa.**—In plankton, off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—In plankton, near Bukoba (21 April, 1905 ; no. 252).

Genus MICROCYSTIS, *Kütz.*

357. MICROCYSTIS ÆRUGINOSA, *Kütz. Tab. Phyc.* i. t. 8.—Polycystis æruginosa, *Kütz.* Clathrocystis æruginosa, *Henfrey, in Journ. Micr. Sci.* (1856) p. 53, t. 4. figs. 28–36.

**Nyasa.**—In plankton, near Mtangula (22 June, 1904 ; no. 20), off Vahambwera Point (24 June, 1904 ; no. 24), and off Karonga (1 July, 1904 ; no. 30).

**Victoria Nyanza.**—In plankton, near Bukoba (April 1905 ; nos. 249, 250, and 252).

358. MICROCYSTIS VIRIDIS, (*A. Br.*) *Lemm. in Abh. Naturh. Ver. Bremen*, xvii. (1903) p. 342.—Polycystis viridis, *A. Br. in Rabenh. Alg.* l.o. 1415 ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 53.

**Nyasa.**—In plankton, Anchorage Bay (13 June, 1904 ; no. 9).

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

359. MICROCYSTIS PRASINA, (*Wittr.*) *Lemm. in Arch. Botanik K. Sv. Vet.-Akad.* Bd. ii. (1904) no. 2, p. 146.—Polycystis prasina, *Wittr. in Wittr. & Nordst. Alg. Exsic.* 1879, no. 297.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 33).



360. MICROCYSTIS ELABENS, (*Bréb.*) *Kütz. Tab. Phyc.* i. t. 8 ; *Sp. Alg.* (1849) p. 210.

**Nyasa.**—In shore-pools, Nkata Bay (23 June, 1904 ; no. 22).

**Tanganyika.**—In plankton, off Niamkolo Island (29 July, 1904 ; no. 36) and near Niamkolo (7 Sept. 1904 ; no. 88).

361. MICROCYSTIS INCERTA, *Lemm. in Abh. Naturh. Ver. Bremen*, xvii. (1903) p. 342.

**Tanganyika.**—In swamp, Kituta (26 Aug. 1904 ; no. 80).

**Victoria Nyanza.**—In plankton, Bukoba (18 Apr. 1905 ; no. 249). In sheltered bay, near Entebbe (1 May, 1905 ; no. 620).

Genus APHANOCAPSA, *Näg.*

362. APHANOCAPSA PULCHRA, (*Kütz.*) *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 49.

**Tanganyika.**—Dredged from a few fathoms, Kala (19 Nov. 1904 ; no. 171).

Genus CHROOCOCCUS, *Näg.*

363. CHROOCOCCUS MINIMUS, (*Keissler*) *Lemm. in Arch. Bot. K. Sv. Vet.-Akad.* ii. (1904) no. 2, p. 102.—Ch. minutus *var.* minimus, *Keissler, in Verh. zool.-bot. Ges. Wien* (1901), p. 394, figs. 1, 2.

**Nyasa.**—In plankton, Anchorage Bay (13 June, 1904 ; no. 9) and Monkey Bay (17 June, 1904 ; no. 15).

364. CHROOCOCCUS PARALLELOPIPEDON, *Schmidle, in Engl. Bot. Jahrb.* xxx. (1902) p. 242, t. 5. fig. 7.

**Nyasa.**—Scrapings from bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577).

365. CHROOCOCCUS HELVETICUS, *Näg. Gatt. einz. Alg.* (1849) p. 46, t. 1 A. fig. 3.

**Tanganyika.**—In swamp, Toa (10 Jan. 1905 ; no. 208).

366. CHROOCOCCUS PALLIDUS, *Näg. l. c.* t. 1 A. fig. 2.

**Victoria Nyanza.**—In plankton, Bukoba (21 Apr. 1905 ; no. 252).

367. CHROOCOCCUS TURGIDUS, (*Kütz.*) *Näg. l. c.* p. 46 ; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 32.

**Nyasa.**—In swamp, Karonga (2 July, 1904 ; no. 33). In scrapings from bottom of s.s. 'Guendolen' at anchor S. end of lake (15 June, 1904 ; no. 577).

**Tanganyika.**—In plankton, Baraka (24 Feb. 1905 ; no. 240).

## Class **PERIDINIEÆ.**

### Order PERIDINIALES.

### Family **GLENODINIACEÆ.**

#### Genus GLENODINIUM, *Ehrenb.*

368. Glenodinium Pulvisculus, (*Ehrenb.*) *Stein, Organ. Infus.* iii. Hälfte 2, t. 2. figs. 23–26.

**Tanganyika.**—In plankton, near Mbete (28 Sept. 1904 ; no. 105), Komba Bay (11 Oct. 1904 ; no. 135), and near Kala (19 Nov. 1904 ; no. 170).

### Family **PERIDINIACEÆ.**

#### Genus PERIDINIUM, *Ehrenb.*

369. Peridinium africanum, *Lemm.*, sp. n. (Pl. **9**. fig. 1.)

*P.* pæna tam longum quam latum, 24–30 $\mu$ longum et 23–27 $\mu$ latum ; corpore in partibus inæqualibus duabus a fossa transversa diviso, parte apicali majore; fossa transversa pæne circulari; fossa longitudinali margine posteriore extensa, parte posteriore multe dilatata; membrana glabra, striis intercalaribus delicatissimis.

*Epivalva* (Pl. **9**. fig. 1, *d*) conica; tabula rhomboidea juxta apicem extensa; tabulis æquatoriis 7; tabulis apicalibus ventralibus hexagonis, tabulis apicalibus dorsalibus pentagonis, tabula dorsali quadrata pro tabulis apicalibus dorsalibus disposita. *Hypovalva* (fig. 1, *c*) rotundo-conica, margine posteriore concavo ; tabulis æquatoriis 5; tabulis antapicalibus 2, una minore et altera multe majore; margine ventrali tabulæ antapicalis spina robusta hyalino ornato.

Cystis cordiformis, 20·5 $\mu$ longis et 22 $\mu$ latis; membrana crassa, glabra et hyalina (fig. 1, *e*).

**Nyasa.**—In plankton, Anchorage Bay (June, 1904 ; nos. 5, 9, and 10) and Monkey Bay (June, 1904 ; nos. 15 and 16).

**Tanganyika.**—In plankton, near Kala (19 Nov. 1904 ; no. 170).

370. Peridinium berolinense, *Lemm. in Ber. Deutsch. Bot. Ges.* xviii. (1900) p. 308.

Var. apiculatum, *Lemm.*, var. n. (Pl. **9**. fig. 3.)

*P.* rhomboideum, 41–42 $\mu$ longum et 40–41 $\mu$ latum; corpore ut in viso aspectu cingulato subcirculari, margine posteriore concavo et spinis brevibus inæqualibus duobus ornato, in partibus æqualibus duabus a fossa transversa diviso. Fossa transversa (Pl. **9**. fig. 3, *b*) spiraliter disposita. Fossa longitudinali margine posteriore extensa sed a parte apicali exclusa; margine sinistro fossæ longitudinalis in alam compressam extenso, margine alæ cum papillis minutissimis numerosis (fig. 3, *c*).



**Tanganyika.**—In plankton, Komba Bay (11 Oct. 1904 ; no. 135) and near Kala (19 Nov. 1904 ; no. 170).

This variety differs from the typical form in the presence of the spines at the posterior margin, in the conical apical part of the cell, and in the absence of the small papillæ which cover the sutures between the plates in the typical form.

#### Genus PERIDINIOPSIS, *Lemm.*

371. Peridiniopsis Cunningtonii, *Lemm.*, sp. n. (Pl. **9**. fig. 2.)

*P.* paullo longius quam latius, 31·5–38 $\mu$ longum et 27–31·5 $\mu$ latum, margine posteriore truncato; corpore in partibus inæqualibus duabus a fossa transversa diviso, parte apicali majori; fossa transversa (Pl. **9**. fig. 2, *a*) conspicue spiraliter disposita; fossa longitudinali in partem apicalem extensa et margine posteriore versus valde dilatato. Membrana delicatissime reticulata; striis intercalaribus delicatis.

*Epivalva* (Pl. **9**. fig. 2, *d*) conica, cum tabulis æquatoriis 6; tabula rhomboidea apicem extensa; tabulis apicalibus 4, ventralibus 2 et dorsalibus 2. *Hypovalva* (Pl. **9**. fig. 2, *e*) truncato-conica, cum tabulis æquatoriis 5, ventralibus 2 et lateralibus 2 cum spina robusta brevi singula ; tabulis antapicalibus 2, cum spina singula in tabula unaquaque.

**Tanganyika.**—In plankton, Komba Bay (11 Oct. 1904 ; no. 135), and near Kala (19 Nov. 1904 ; no. 170).

The body of this species resembles that of *Peridinium quadridens*, Stein, but differs in the number and arrangement of the plates and in the number of the spines.

This is the second described species of the genus *Peridiniopsis*. *P. Borgei*, Lemm. (in Arch. Bot. K. Sv. Vet.-Akad., Bd. ii. (1904) no. 2, p. 134, t. 1. figs. 1–5), has three antapical plates and no spines, whereas *P. Cunningtonii* has two antapical plates and six conspicuous spines. In both species the epivalve possesses six equatorial plates.

#### Genus CERATIUM, *Schrank.*

372. Ceratium Hirundinella, *O. F. Müll.*

Small forms with only two antapical horns : length 136–148 $\mu$ ; breadth 50–54 $\mu$ ; length of apical horn about 50–60 $\mu$ ; length of 1st antapical horn about 30–44 $\mu$ ; length of 2nd antapical horn about 10–12 $\mu$. (Pl. **9**. fig. 4.)

**Victoria Nyanza.**—In plankton, near Bukoba (21 Apr. 1905 ; no. 252).

The species was very scarce, and the few specimens observed differed very much from any others which have come under my notice. They were small, with short horns, and the wall was strongly reticulated. The apical horn was short with a broad base and slightly curved, and only two antapical horns were present. The first antapical horn was attenuated from a broad base, apiculate at the extremity and turned inwards. The second antapical

horn was very short, acute, and slightly variable in its position relative to the first one, but in every specimen seen it was situated much nearer to the first antapical horn than has been described or figured for any European specimen. (*Vide* Lemmermann, in Arch. Bot. K. Sv. Vet.-Akad. ii. (1904) no. 2, t. 2. figs. 1–49; W. & G. S. West, in Trans. Roy. Soc. Edinb. xli. part III. (1905) p. 494, fig. 1 A–D; in Trans. Roy. Irish Acad. xxxiii. sect. B, part II. (1906) p. 94, figs. 1–9.)

## IV. GENERAL SUMMARY OF THE INVESTIGATION.

1. The Algæ observed in Dr. Cunnington's collections can be summarized as follows :—

| | Genera. | Species. | Varieties and Forms. |
|---|---|---|---|
| CHLOROPHYCEÆ. | | | |
| Œdogoniales | 2 | 6 | 1 |
| Chætophorales | 4 | 4 | |
| Cladophorales | 2 | 7 | |
| Conjugatæ | 17 | 122 | 12 |
| Protococcoideæ | 27 | 48 | 17 |
| HETEROKONTÆ. | | | |
| Confervales | 1 | 1 | |
| BACILLARIEÆ. | | | |
| Centricæ | 3 | 7 | 3 |
| Pennatæ | 18 | 86 | 15 |
| MYXOPHYCEÆ. | | | |
| Hormogoneæ | 17 | 62 | 2 |
| Coccogoneæ | 10 | 24 | 1 |
| PERIDINIEÆ. | | | |
| Peridiniales | 4 | 5 | |
| Total | 105 | 372 | 51 |

These results have added greatly to our knowledge of the geographical distribution of freshwater Algæ in tropical Africa.

2. Of the above, 1 genus, 36 species, and 18 varieties and forms are described as new.

3. The plankton collected in Nyasa in June 1904 contained 48 species of Algæ, which are chiefly interesting in comparison with Dr. Fülleborn's more extensive collections from 1898 to 1900.

4. The plankton from Victoria Nyanza was collected in April 1905 and contained 58 species. Again, the chief interest of these collections lies in a



comparison with the material collected by Dr. Stuhlmann in October 1892. The Bacillarieæ and Myxophyceæ are relatively few in number, and the phytoplankton is essentially Chlorophyceous, with all the features of a Desmid-plankton.

5. The phytoplankton of Tanganyika is much richer in number of species than that of Nyasa or Victoria Nyanza. It contained 85 species, of which 61 (72 per cent.) *occurred in this lake alone*. The Chlorophyceæ were relatively few both as regards species and individuals, but the Bacillarieæ and Myxophyceæ were both represented by more than the usual proportion of species, and occurred at certain times in prodigious quantities. The Protococcoideæ and Bacillarieæ were especially evident during November, after which month there was a general diminution of the Algæ accompanied by a great development of *Nauplius* larvæ. Ten species and one variety of this phytoplankton were new.

Several of the species observed in the phytoplankton of this lake are usually marine or brackish in habit, and others more nearly approach marine species than freshwater ones. *Nitzschia Tryblionella*, Hantzsch, var. *littoralis*, (Grun.) Van Heurck, *Surirella striatula*, Turp., and *Chodatella subsalsa*, Lemm., are marine or brackish-water species. *Navicula distincta*, sp. n., and *Surirella Tanganyikæ*, sp. n., more nearly approach marine forms than freshwater ones, and *Oscillatoria Tanganyikæ*, sp. n., is much nearer the marine *Oscillatoria subuliformis*, Kütz., than any other described species. *Plectonema Wollei*, Farlow, is another curious Alga in the plankton: certainly a freshwater species, but one which only differs from the marine *Lyngbya majuscula*, Harvey, in the scarce development of false branches—a character which may be due to change of environment. The occurrence of no less than three species of *Nodularia*, a genus which is typically of brackish habit, in the immediate vicinity of Tanganyika is also a noteworthy fact.

*The Alga-flora of Tanganyika differs very much from that of Nyasa or Victoria Nyanza, but its peculiarities are all of them such as could be accounted for by the prolonged isolation of the lake.* The definite outlet by the River Lukuga into the Congo system is relatively recent, having been established since the formation of the volcanic cones to the north of Lake Kivu. The damming up of the northern end of the Lake Kivu region added a large drainage-area to the Tanganyika lake-basin, and marks the close of the period of isolation. There is every reason to consider the presence of certain brackish-water Algæ, and others with marine affinities, as evidence that during the period of prolonged isolation the water became increasingly saline. Our knowledge of the modifications which some Algæ undergo owing to change of environment is in support of the view that *those Algæ of Tanganyika exhibiting marine affinities may have been produced by a gradual increase in the salinity of the water over an extended period of time. The relatively small proportion of Chlorophyceæ in the plankton, and the large proportion of Bacil-*

*lariæ and Myxophyceæ, is also an indication that the water of the lake was at one time much more saline than it is at present.*

Collections made within a few days of one another from different parts of Tanganyika differ so much, even in their dominant constituents, that it is not at all improbable that some of these plankton-organisms may occur in large shoals of more or less limited extent. From available evidence it is not possible, however, to make a definite statement on this point, as collections were not actually made in different parts of the lake at the same time; but the dominance of *Anabæna Flos-aquæ* var. *circularis* in some collections, and of *Nitzschia nyassensis* and *Synedra Acus* in others obtained very shortly afterwards from other parts, indicates that the plankton of the lake is by no means of a uniform character. The Nyasa plankton collections also furnish evidence of a similar absence of uniformity, but, owing to their less comprehensive nature, to a much less marked degree.

*In large bodies of fresh water, such as these Central African lakes, it would appear that a single sample of plankton obtained in a stated locality must not be regarded as representative of the plankton of the entire lake.*

## EXPLANATION OF THE PLATES.

### Plate 2.

Photomicrographs of plankton from Lake Nyasa.

Figs. 1–16 × 100; figs. 17–20 × 150.

Figs. 1 & 2. Varieties of *Pediastrum simplex*; 3. *Stephanodiscus Astræa*; 4. *Melosira granulata*, var. *angustissima*; 5. *Synedra Acus*; 6 & 7. *Melosira nyassensis*; 8. *Anabæna Flos-aquæ*, forma; 9. *Surirella bifrons*, var. *tumida*.

10. *Closteriopsis longissima*; 11 & 12. *Surirella Nyassæ*, with numerous attached *Vorticellæ* or similar Infusoria.

13 & 14. *Melosira granulata*, var. *angustissima*; 15 & 16. *Anabæna Flos-aquæ*, forma.

17 & 18. *Pediastrum simplex*, var. *clathratum*; 19. *Melosira granulata*, var. *angustissima*; 20. *Anabæna Flos-aquæ*, forma.

### Plate 3.

Photomicrographs of plankton from Victoria Nyanza.

All × 100.

Figs. 1. *Staurastrum cuspidatum*; 2. *Surirella Malombæ*; 3 & 4. *Surirella Fülleborni*, var. *elliptica*; 5. *Melosira nyassensis*; 6 & 7. Masses of partially decomposed organic matter which form a feature of the plankton examined from this lake; 7 is probably the excreta of some animal.

8–10. *Staurastrum limneticum*; 11. *S. leptocladum*, forma *africana*; 12. *Sphinctosiphon polymorphus*, young colony; 13 & 14. *Surirella Malombæ*; 15. *Staurastrum tohopekaligense*.

16. *Pediastrum simplex*, var. *clathratum*; 17. *Surirella*, sp.?; 18. *Lyngbya circumcretum*; 19. Floating and partly decomposed organic matter.



Figs. 20. *Staurastrum limneticum*; 21. *S. tohopekaligense*; 22 & 23. *Surirella Malombæ*; 24 & 25. *Surirella Fülleborni*, var.; 26. *Melosira nyassensis*; 27. Mass of decomposing organic matter, probably excreta; 28. Mass of decaying organic matter, largely derived from Blue-green Algæ.

*Note.*—The quantity of decaying organic matter in the plankton of Victoria Nyanza is rendered very obvious by the numerous dark, ill-defined patches in the photographs.

### Plate 4.

Photomicrographs of plankton from Tanganyika.

Figs. 1–13 × 100; figs. 14–17 × 200.

Figs. 1–3. *Sphærocystis Schroeteri*; 4 & 5. *Hyalotheca mucosa*. Figs. 1–5 represent plankton from the River Lofu near its entrance to Tanganyika.

6. *Oocystis lacustris*; 7 & 8. *Nitzschia nyassensis*. (This Diatom occurred in countless myriads in plankton collections from certain parts of Tanganyika. It is of great length and very slender, much resembling the elongated varieties of *Synedra Acus*, to which plant it should possibly be referred.)

The delicate curved lines in the photograph represent one of the minute plankton-species of the genus *Lyngbya*.

9. *Nitzschia nyassensis*; 10 & 11. *Anabæna Flos-aquæ*, var. *circularis*; 12 & 13. *Glenodinium Pulvisculus*.

The dominating feature of this plankton is the short and much coiled variety of *Anabæna Flos-aquæ*. In this respect the plankton is remarkably similar to certain collections from Nyasa (*vide* Pl. 2. figs. 15 & 16).

14 & 15. *Anabæna Flos-aquæ*, var. *circularis*; 15 shows very clearly the terminal heterocysts. 16 & 17. *Glenodinium Pulvisculus*.

### Plate 5.

Figs. 1–2. *Spirogyra æquinoctialis*, sp. n. × 500. 1, single vegetative cell showing chloroplasts; 2, male and female gametangia, with zygospore in greatly swollen female gametangium.

3–4. *Debarya africana*, sp. n. × 500. 3, zygospore enclosed within the gametangia and conjugating-tube; 4, junction of vegetative cell (*c.v.*) and gametangium (*g.*), showing thickened walls of latter with curious pit-like structure in the end-wall.

Fig. 5. *Pediastrum Tetras*, (Ehrenb.) Ralfs, var. *longicorne*, Racib. × 520.

6. *P. Tetras*, (Ehrenb.) Ralfs. × 520. Curious cœnobium of three cells.

7. *Crucigenia tetracantha*, sp. n. × 500.

Figs. 8–9. *Cœlastrum compositum*, sp. n. × 520. 8, small cœnobium of eight groups of three cells each; 9, much larger cœnobium.

Fig. 10. *Palmophyllum foliaceum*, sp. n. *th.*, thallus, × 100; *c.*, a few of the minute green cells, × 500.

Figs. 11–13. *Sphinctosiphon polymorphus*, gen. et sp. n. 11, young colonies, × 100; 12, older and more elongated colony showing a few slight constrictions, × 100; 13, small portion of colony, × 520. 11 & 12 are only drawn in outline to show the hollow thallus.

14–17. *Chodatella subsalsa*, Lemm. × 500. 15, cell containing two daughter-cells; 16 with four, and 17 with eight undeveloped gonidia (autospores).

Fig. 18. *Ankistrodesmus nitzschioides*, sp. n. × 500.

19. *Pediastrum simplex*, Meyen. × 500. Small 4-celled cœnobium in which one cell has been aborted.

Fig. 20. *Pediastrum simplex*, Meyen. × 500. Curious abnormal form in which the cœnobium is not strictly plate-like. Some of the cells, such as *a*, are like those of typical *P. simplex*; *b* is similar to the peripheral cells of *P. Boryanum*, and *c* like those of *P. Kawraiskyi*, Schmidle; *g.*, resting gonidium (aplanospore).

21. *P. simplex*, Meyen, var *clathratum*, forma *radians*. × 500. Abnormal condition with one cell (*a*) of the ring deformed.

22. *P. Boryanum*, (Turp.) Menegh., var. *rugulosum*, var. n. × 500. Five cells (2 peripheral and 3 central) from a large cœnobium.

### Plate 6.

Fig. 1. *Pleurotænium caldense*, Nordst., forma *africanum*. × 520.
2. *Closterium nematodes*, Josh., var. *tumidum*, var. n. × 520.
3. *Penium australe*, Racib., forma *brevius*. × 520.
4. „ „ forma *crassius*. × 520.
5. *Staurastrum pilosum*, (Näg.) Arch., var. *minimum*, var. n. × 520.
6. „ *quadrangulare*, Bréb., var. *attenuatum*, Nordst., forma. × 520.
7. „ *Cunningtonii*, sp. n. × 520.
8. „ *anatinum*, Cooke & Wills, var. *subglabrum*, var. n. × 520.
9. „ *monticulosum*, Bréb., var. *bidens*, var. n. × 520.
10. „ *gracile*, Ralfs, var. *Nyansæ*, var. n. × 520.
11. „ „ var. *protractum*, var. n. × 500.
12. „ *leptocladum*, Nordst., forma *africanum*. × 500.
13. *Arthrodesmus Incus*, (Bréb.) Hass., var. *Ralfsii*, W. & G. S. West, forma. × 520.

### Plate 7.

Figs. 1-2. *Micrasterias Cunningtonii*, sp. n. × 520.
Fig. 3. *Euastrum truncatiforme*, sp. n. × 520.
Figs. 4-5. „ *pseudopectinatum*, Schmidle, forma. × 520.
Fig. 6. *Cosmarium galeritum*, Nordst., var. *retusum*, var. n. × 520.
7. „ *Cunningtonii*, sp. n. × 520.
8. „ *decachondrum*, Roy & Biss., var. *ornatum*, var. n. × 520.
9. „ *lacunatum*, sp. n. × 520. The minute punctulations which surround the granules are not shown in the figure.
10. „ *globosum*, Buln., var. *Wollei*, W. & G. S. West, forma *major*. × 520.
11. „ *Pseudobroomei*, Wolle, var. *compressum*, var. n. × 520.

### Plate 8.

Fig. 1. *Fragilaria æthiopica*, sp. n. × 1000.
2. *Navicula distincta*, sp. n. × 500.
3. *Synedra Nyansæ*, sp. n. × 520.
4. „ *Cunningtonii*, sp. n. × 250.
5. *Surirella plana*, sp. n. × 500.
6. „ *Tanganyikæ*, sp. n. × 500.
7. „ *obtusiuscula*, sp. n. × 500.
8. *Cymatopleura Nyansæ*, sp. n. × 520.
9. *Cocconema grossestriata*, (O. Müll.) nob., var. *Tanganyikæ*, var. n. × 500.
10. *Gyrosigma nodiferum*, (Grun.) nob. × 500.
11. *Navicula Tanganyikæ*, sp. n. × 500.
12. *Schizostauron Crucicula*, Grun. × 520.
13. *Gomphonema africanum*, sp. n. × 520.



### Plate 9.

Fig. 1. *Peridinium africanum*, Lemm., sp. n. × 750. *a*, ventral view; *b*, dorsal view; *c*, hypovalve; *d*, epivalve; *e*, cyst. (After drawings by Lemmermann.)
2. *Peridiniopsis Cunningtonii*, Lemm., sp. n. × 750. *a*, ventral view; *b*, dorsal view; *c*, lateral view; *d*, epivalve; *e*, hypovalve. (After drawings by Lemmermann.)
3. *Peridinium berolinense*, Lemm., var. *apiculatum*, Lemm., var. n. × 750. *a*, dorsal view; *b*, ventral view; *c*, lateral view. (After drawings by Lemmermann.)
4. *Ceratium Hirundinella*, O. F. Müll. × 500. Small reduced form from Victoria Nyanza. The markings are only shown on a small portion of the cell.
5. *Spirulina Princeps*, W. & G. S. West. × 520.
6. „ *laxissima*, sp. n. × 1000.
7. *Lyngbya circumcretum*, sp. n. × 520. *a*, *b*, and *c*, three specimens to show the coiling of the filaments.
8. *Anabæna* sp. × 520. Consult page 170, no. 290.
9. *Oscillatoria Tanganyikæ*, sp. n. × 500. *a*, *b*, and *c*, apices of three filaments; *d*, middle part of filament. The large granules are probably gas-vacuoles.

### Plate 10.

Fig. 1. *Anabæna Flos-aquæ*, Bréb. forma. × 520.
2. „ „ var. *circularis*, var. n. × 520. *a-d* show normal coiling, the short filaments being terminated at each end by a heterocyst; *e*, a straight filament.
3. *Anabæna Tanganyikæ*, sp. n. × 520. *d*, filament with spore (*sp.*).
4. *Anabæna* sp. × 520. Consult page 171, no. 294.
5. *Glœotrichia longiarticulata*, sp. n. *a*, floating colony, × 10; *b-d*, bases of trichomes; *e* and *f*, spores. *b-f*, × 520.
6. *Rivularia globiceps*, sp. n. *a*, colonies attached to floating fragment of leaf, natural size; *b-d*, bases of trichomes. × 520.
7. *Calothrix cartilaginea*, sp. n. × 500. *a-d*, trichomes in different stages; *e*, middle portion of old trichome with well-marked sheath; *f*, hormogone.
8. *Calothrix brevissima*, sp. n. *a-e*, group of complete filaments, × 500; *d* and *e* each possess two basal heterocysts.

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## ADDENDA.

### DESMIDIACEÆ.

373. Penium lagenarioides, *Roy, in J. P. Bissett, 'Desm. Windermere,' Journ. Roy. Micr. Soc.* (1884) p. 197, t. 5. fig. 6.

Var. sydneyense, *Racib. in Rospraw. Wydz. matem.-przyr. Akad. Umiej. Krakow*, xxii. (1892) p. 368, t. 6. fig. 3.

Long. 74 μ; lat. 29 μ; lat. constrict. 26 μ; lat. apic. 14 μ.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

374. Cosmarium zonarium, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 71, t. 8. fig. 13.

Long. 74 $\mu$; lat. 49 $\mu$; lat. isthm. 45 $\mu$.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

This species has only previously been recorded from Madagascar.

375. Cosmarium Subcucumis, *Schmidle, in Ber. Naturf. Ges. Freiberg i. B.* vii. Heft 1 (1893), p. 98, t. 4. figs. 20–22.

Long. 80 $\mu$; lat. 47 $\mu$; lat. isthm. 21 $\mu$.

**Victoria Nyanza.**—In swamp, Bukoba (20 Apr. 1905; no. 251).

## PROTOCOCCACEÆ (AUTOSPORACEÆ).

376. Sorastrum spinulosum, *Näg. Gatt. einzell. Alg.* (1849) p. 99, t. 5 D.

**Tanganyika.**—In swamp, Kituta (23 Aug. 1904; no. 72).

## SCYTONEMACEÆ.

377. Scytonema coactile, *Montagne, in Kütz. Sp. Alg.* (1849) p. 305; *Rabenh. Fl. Europ. Alg.* ii. (1865) p. 280; *Born. & Flah. in Ann. Sci. Nat.*, sér. 7, *Bot.* v. (1887) p. 90.

Crass. fil. 16·5–20 $\mu$; crass. trich. 11–12 $\mu$; long. heterocyst. 14·5–20 $\mu$, lat. 10–11·5 $\mu$.

Sporæ quadratæ, angulis levissime rotundatis; episporio glabro; long. et lat. 14 $\mu$.

**Nyasa.**—In swamp, Karonga (2 July, 1904; nos. 33 and 34).

The filaments and pseudo-rami were elongated and flexuose. The strong hyaline sheaths, which were turning yellow or yellow-brown in the older portions, were firm and slightly lamellose. The cells were subquadrate, sometimes a little longer than the diameter, of a bright blue-green colour, and often contained a few large granules of much deeper colour.

*Some filaments were noticed with mature spores.* They were seriate, as many as 40 occurring in a chain, and in form were quadrate with slightly rounded angles. Each spore had arisen from a single vegetative cell and possessed a smooth straw-coloured epispore. Borzì (in N. Giornale Bot. Ital. xi. 1879, p. 368) has described the occurrence of globose or ellipsoid spores in this genus, but those observed in *S. coactile* were all quadrate and reminded one very forcibly of the seriate spores of species of *Hapalosiphon*.

## CHROOCOCCACEÆ.

378. Asterocystis africana, sp. n.

Plantæ minutæ et epiphyticæ; filis brevibus, vaginatis, subdichotome ramosis, ramis late patentibus, e serie singula cellularum formatis; vaginis latis et hyalinis; cellulis oblongo-quadratis vel oblongis, diametro usque ad



duplo longioribus, polis subrotundatis; cytoplasmate læte æruginoso et granuloso (fere ut in *Chroococco turgido*).

Long. cell. 5·5–10 $\mu$; lat. cell. 4·5–5·5 $\mu$; crass. vag. 11–15 $\mu$ (usque ad 27 $\mu$).

**Tanganyika.**—Epiphytic on *Chætomorpha Linum*, floating in Kituta Bay (26 Aug. 1904; no. 79).

This plant belongs unquestionably to the Chroococcaceæ, the cells having very much the same structure as those of *Chroococcus*. It would fall naturally into Hansgirg's genus *Chroodactylon* (Ber. Deutsch. Bot. Ges. i. (1885) t. 3), but for the fact that Hansgirg has since placed both *Asterocystis*, Gobi (1879), and his own genus *Chroodactylon* (1885) as sections of "*Allogonium*, Kütz." (*vide* Hedwigia (1887), Heft 1). Although Hansgirg was in error in reviving "*Allogonium*," a name given by Kützing to a number of Algæ of widely different affinities and all of which are now placed in other genera, yet he was evidently of the opinion that *Asterocystis* and *Chroodactylon* were scarcely distinct. It is for this reason that I have placed the African plant as a species of the former genus. Schmitz (in Engl. Natür. Pflanzenfam. 1 Teil, Abt. 2, p. 314) places *Asterocystis* in the Bangiaceæ, but the species observed from Tanganyika is a typical Blue-green Alga.

The colonies of *Asterocystis africana* reach a diameter across the spreading branches of about 360 $\mu$. The gelatinous sheath at the base of the primary filament is somewhat expanded and is firmly attached to the wall of the *Chætomorpha*, in which it makes a pit-like depression often 14 $\mu$ in depth.

## NAVICULACEÆ.

379. Navicula serians, *Bréb. in Kütz. Bacill.* (1844) p. 92, t. 30. fig. 23; *W. Sm. Brit. Diat.* t. 16. fig. 130.

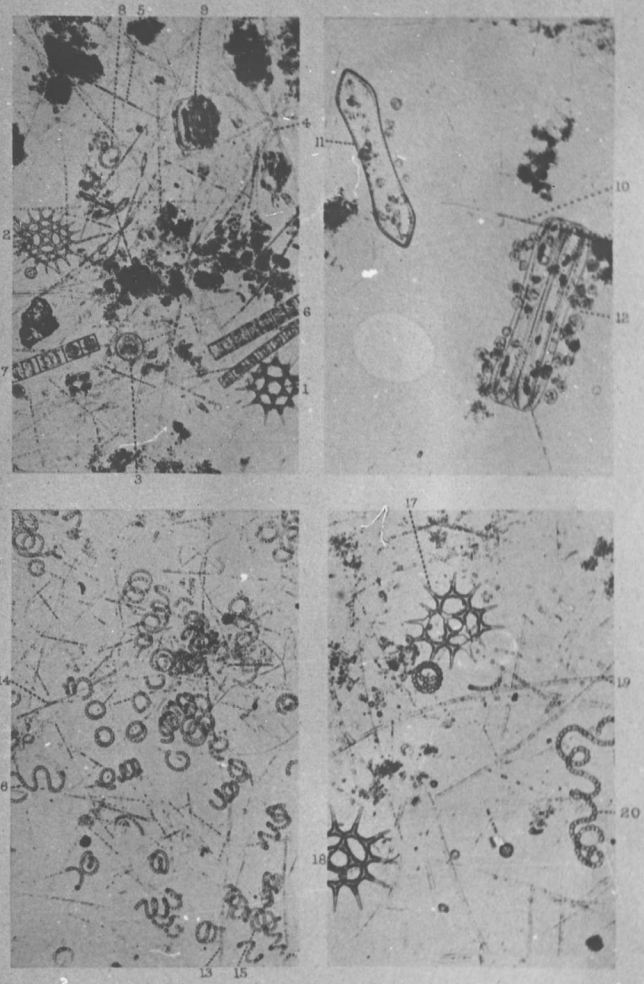
**Nyasa.**—In scrapings from bottom of s.s. 'Guendolen' at S. end of lake (15 June, 1904; no. 577).

## GOMPHONEMACEÆ.

380. Rhoicosphenia curvata, (*Kütz.*) *Gran. in Abh. zool.-bot. Ges. Wien*, x. (1860) p. 511; *Van Heurck, Synops. Diat. Belg.* t. 26. figs. 1, 2, 3.

**Tanganyika.**—On the bottom of Dr. Cunnington's dau (24 Jan. 1905; no. 217).

The University, Birmingham,
19th March, 1907.

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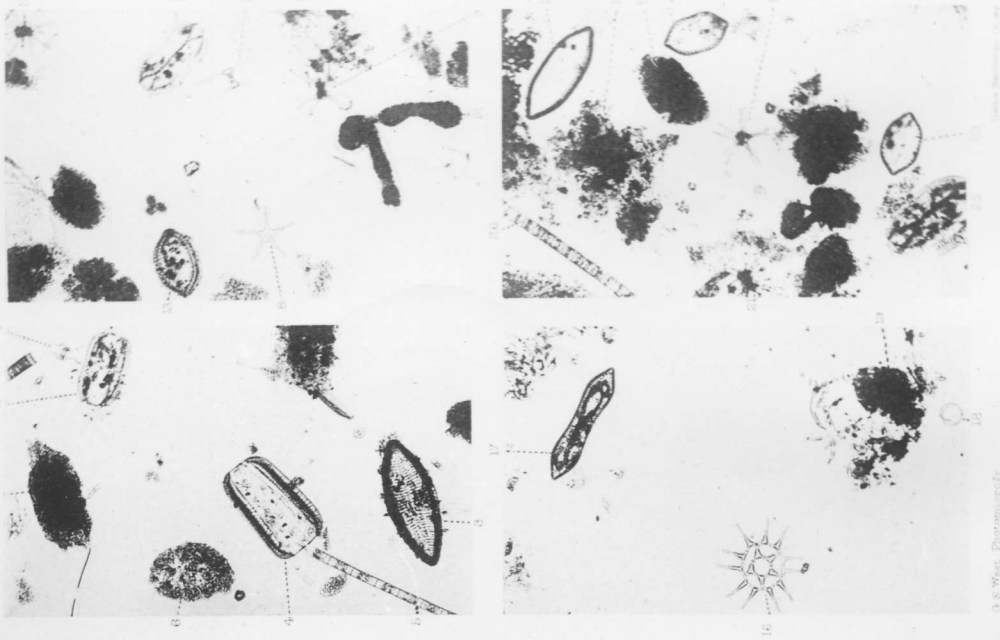
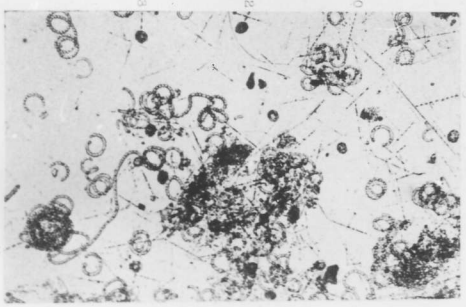
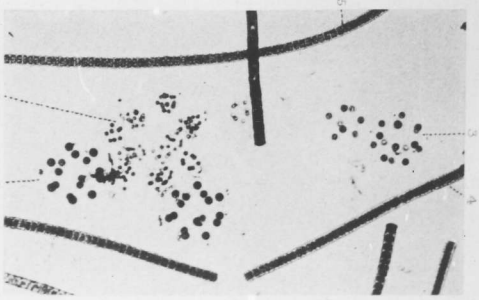
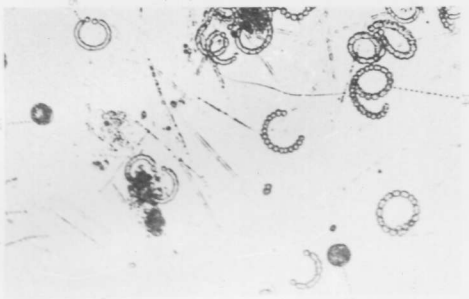
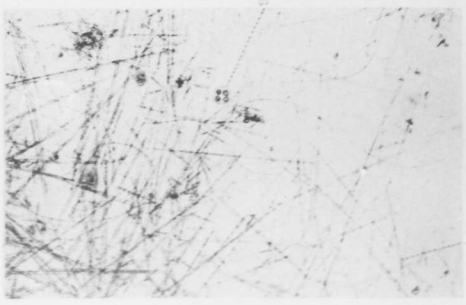
PLANKTON from NYASA.

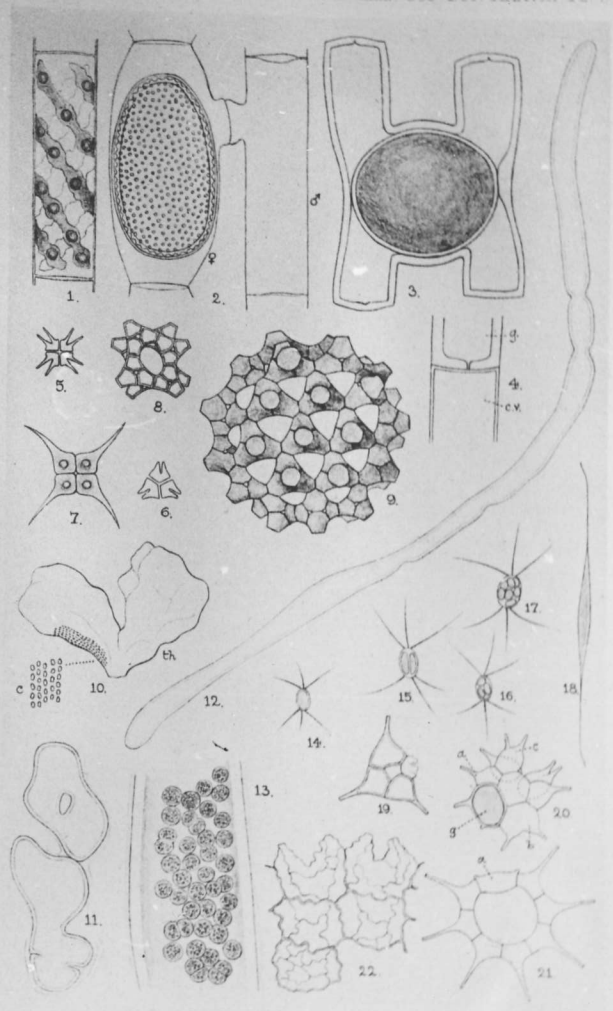










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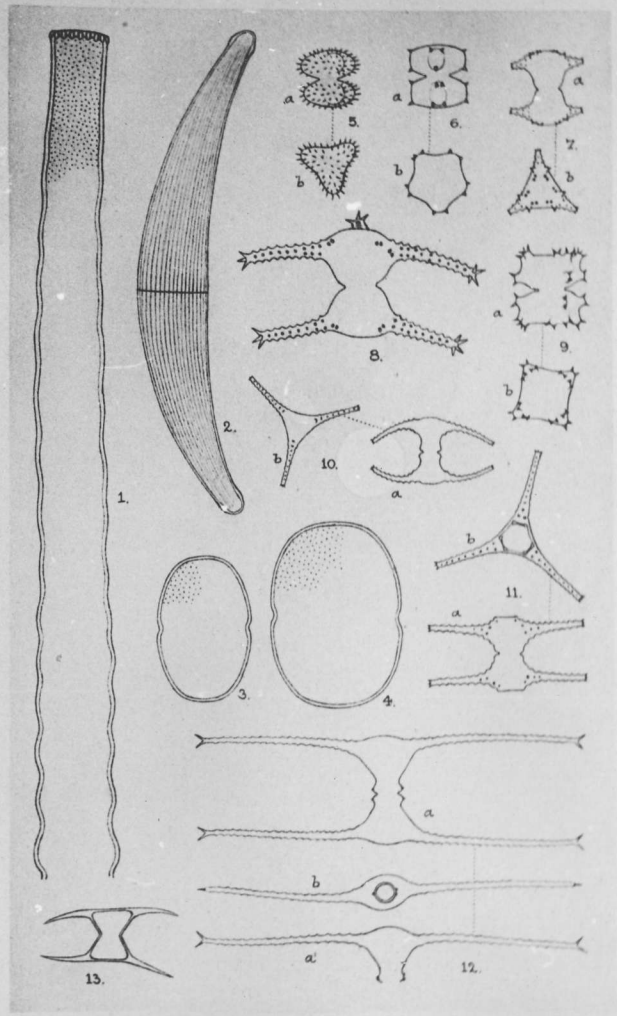


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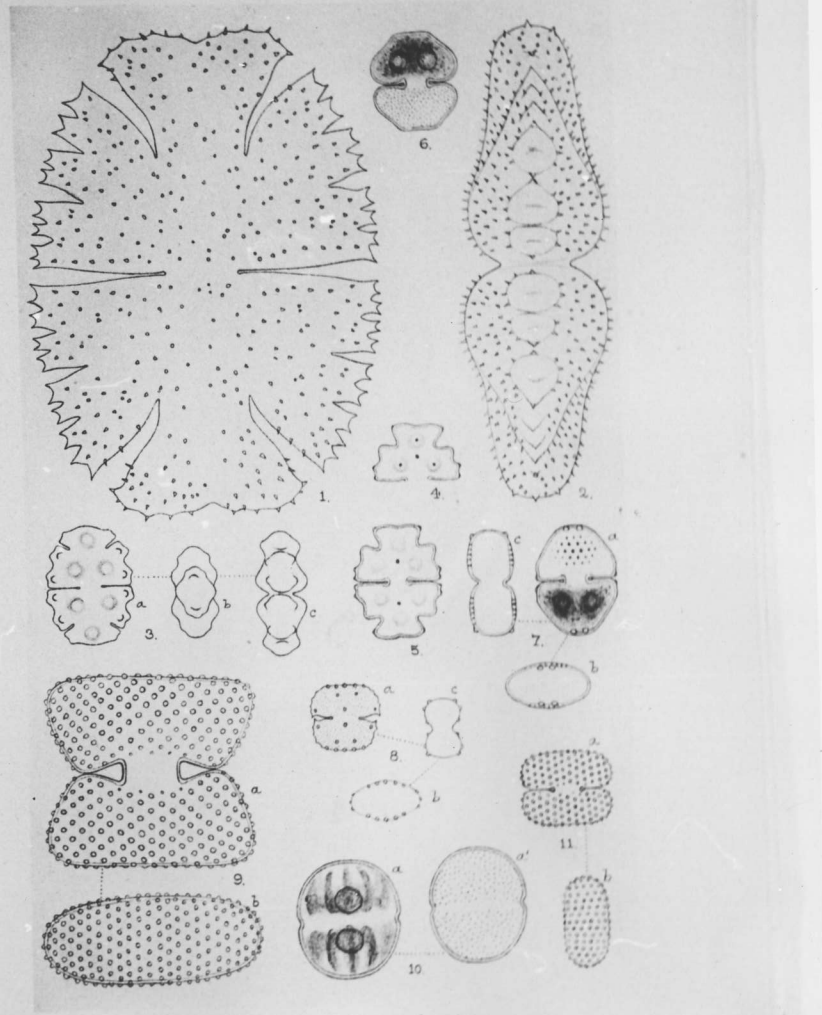


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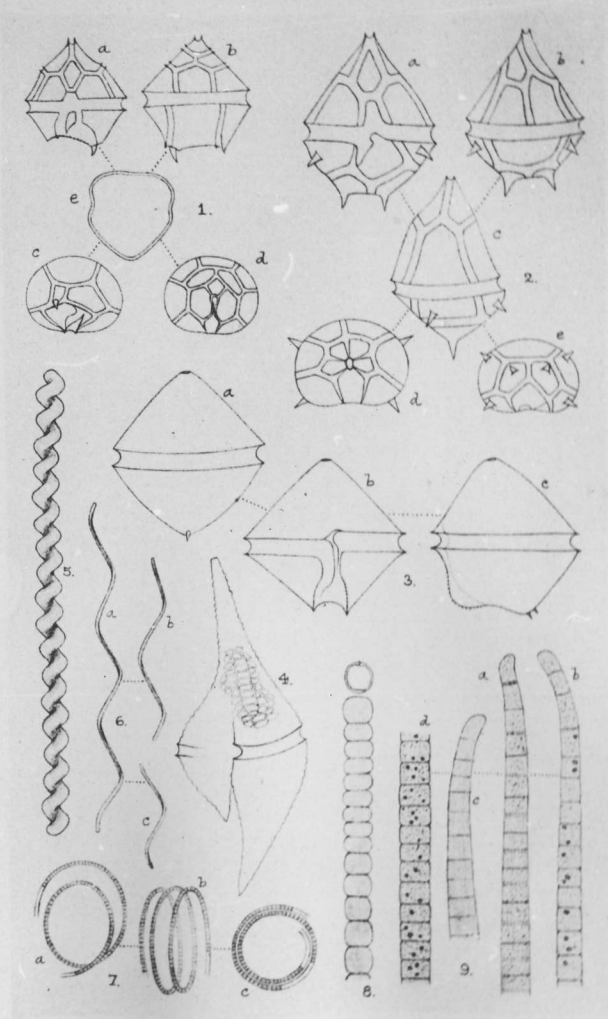


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