

# A Contribution to our Knowledge of the Freshwater Algae of the Transvaal Province

by

M. I. Claassen,

*Department of General Botany, University of Pretoria,*

*with the Cooperation of the Division of Botany,*

*Department of Agriculture*

*(Being an abridged form of the thesis presented in partial fulfilment of the degree of Master of Science at the University of Pretoria)*

## CONTENTS

- I. Introduction.
- II. Enumeration of the Taxa.
- III. Vegetative Reproduction in Desmids.
- IV. Summary.
- V. Literature.

## I. INTRODUCTION

The freshwater algae occurring in the Transvaal districts of Warmbaths, Nylstroom and Naboomspruit have apparently not been investigated before. This study consisted of an enumeration of the taxa found, an investigation of vegetative reproduction in Desmids and a few hydrobiological observations.

The classification adopted here is essentially that of Wettstein (1935), W. and G. S. West (1904) and Hustedt (1930). Soon after the investigation was begun, it became apparent that many of the taxa found did not correspond with any already known and described. The new ones are described and illustrated in this paper.

It was possible to investigate cell division in the Desmids in living material; the rate of cell division proved to be of particular interest.

As it was impracticable to collect samples regularly from the various localities, no systematic hydrobiological observations could be made on variations in pH, periodicity, diurnal and annual fluctuations in temperature, etc., but where possible the pH of the water was measured at the time the material was gathered.

*Collection and Preservation of Samples.*—Samples were taken with a tablespoon from deposits on submerged rocks and mud in shallow pools, springs and small streams. Glass vials of 30 ml. capacity with plastic screw caps were used for keeping the samples. Twenty-seven ml. of the sample and 3 ml. of 40 per cent formalin were added to a vial.

Where living material was to be studied, the samples were placed in one-quart Ball jars together with a large volume of the water in which they had been found. The mouth of each jar was covered with a piece of waxed paper held in place by a rubber band.

*Mounting of the Material.*—It was found best to mount the algae in the liquid in which they were preserved or, to prevent drying out, in glycerine. Living material was mounted in the water in which the sample was collected or in distilled water. Where necessary a drop of distilled water was added to compensate for evaporation during microscopic examination.

*Drawings.*—Accurate scale drawings were made by means of a micrometer-net-ocular on specially printed squared paper.

*Type material.*—Owing to the fact that it is practically impossible to preserve the type material successfully over many years in a liquid medium, the author desires that the drawing plus the description of the new taxa described in the present paper constitute the type.

*Enumeration of the Samples and Localities.*—The samples were collected in the districts of Warmbaths, Nylstroom and Naboomspruit in the Northern Transvaal. The average altitude of the country exceeds 3,500 feet above sea-level, the maximum being about 5,000 feet. The area consists largely of sandstone with scattered groups of red-granite, diabase and quartz; but the lower country, south of Warmbaths and Naboomspruit, consists of basalt.

The following list of samples collected serves as a key; in the systematic portion of this paper, only the numbers of the samples are cited. Most of the samples were collected over a period extending from April, 1954 to July, 1955. The principal localities where collections were made are shown in Figure 1.

#### A.—Doornfontein and Leeupoort

Situated about 13 miles N.-N.W. of Nylstroom. The samples were collected from the Doornfontein Spruit and Leeupoort Dam. The locations are shown in Figure 2.

1. Greyish-brown deposit covering submerged stones in the spruit near drift, about half a mile S.W. of Leeupoort Dam, in slow-running water, 16·4·54; pH 6.2.
2. Greenish-brown ooze from side of road near drift, 16·4·54.
3. Reddish-brown ooze from side of road halfway between drift and Leeupoort Dam, 16·4·54.

The following samples were collected mainly from pools on rocks below the overflow on the S.W. side of Leeupoort Dam, 16·4·54.

4. Greenish-brown, stagnant water.
5. Orange masses floating on surface of small pool.
6. Reddish-brown deposit, stagnant water.
7. Attached to inner side of embankment of Leeupoort Dam, below surface of the water.
8. Decaying plants on moist part of embankment.
9. In pool on rocks, yellowish-brown.
10. Orange ooze on rocks.
11. Dirty orange-brown scum.
12. Greyish-brown deposit on bottom of pool next to spruit; pH 6.15.

Samples 13 to 17 were collected from Doornfontein Spruit about one mile N.E. of Leeupoort Dam (underneath bridge on asphalt road between Nylstroom and Vaal-water), 16·4·54.

13. Orange-brown growth among stones, N.E. side of stream under bridge, pH 6.35.
14. Orange- to greenish-brown scum next to 13.
15. Dirty orange-brown deposit, N.W. side under bridge, slow-running water.
16. Orange deposit from S.W. side under bridge, in placid water.
17. Greyish-brown deposit, from flowing water-furrow.

Samples collected near school about three miles N.E. of Leeupoort Dam, 16·4·54.

18. From pond, dirty orange- to greenish-brown scum, pH 5.75.
19. In furrow near pond, greyish-brown deposit.

Samples from Doornfontein Spruit about three miles N.E. of Leeupoort Dam, near school, 16·4·54.

20. From pool near stream, pH 6.1.
21. Another pool near the stream.
22. Orange-brown ooze from side of same pool as in 21.
23. Greenish-brown deposit on stones at drift, in running water, pH 6.25.

#### B.—*Moddernek*

Situated about nine miles N.-N.W. of Nylstroom. The part of the farm from which collections were made belongs to Mr. P. W. Botes. The samples were collected from springs, small ponds and water-furrows. The locations are shown in Figure 3.

24. Floodwater S.W. of spring A, 22·4·54.
25. Bottom of small pond (S. side), almost black deposit; about 90 yards S. of spring A, 22·4·54; pH 5.8.
26. Same as 25, 19·11·54.
27. Furrow between spring A and small pond, about 85 yards from spring A, 22·4·54.
28. *Spirogyra* species floating on surface of small pond, 22·4·54.
29. On E. side of larger pond, about 145 yards S. of spring A, 22·4·54.
30. On W. side of same pond, 2·4·55.
- 31, 32 and 33. Sides, surfaces and bottoms of furrows S. of the pond, 22·4·54.
- 34 and 35. From a vlei about three-quarters of a mile S.E. of spring A, 19·11·54; pH 6.31.
36. Near 25 and 26, 2·4·55; pH 5.85.
37. W. side of small pond, 2·4·55.
38. N. side of small pond, 2·4·55.
39. Spring B, 2·4·55; pH 5.45.
40. Spring A, orange scum from side, 2·4·55; pH 5. (This sample did not contain any algal flora.)
41. Furrow halfway between spring B and small pond, 2·4·55.

#### C.—*Rietfontein 288*

Situated about 28 miles N.-N.W. of Nylstroom. The farm belongs to Mr. J. E. Theron.

42. From spring, 6·4·55; pH 5.7.
43. Water from spring flowing into pond N.W. of spring, 6·4·55.
44. From N.E. side of vlei, W. of pond, 6·4·55.

#### D.—*Glentig*

A farm belonging to Mr. L. J. Groenewald; situated about seven miles E. of Rietfontein 288.

45. From spring, 21·11·54; pH 5.5.
46. From furrow, about 30 yards N. of spring, 21·11·54.

#### E.—*Warmbaths*

Samples collected between the old and new bridges over the Plat River, about 3-4 miles W. of Warmbaths; leg. Cholnoky.

47. Almost stagnant water in deep part of river, 30·5·54.
48. Slightly lower down, deposits on a flat stone, slow-running water, 30·5·54.
49. In shade of new bridge in slow-running water, brown covering on sand, 30·5·54.
50. Near 49, deep bend in river in slow-running water, 30·5·54.

F.—*Between Warmbaths and Nylstroom*

Samples from a tributary of the Nyl River and other places near the road about halfway between Warmbaths and Nylstroom; leg. Cholnoky.

51. Side of waterfall W. of road, swift-running water over sandstone, 6·6·54.
52. A small tributary, slow-running water, 6·6·54.
53. On rocks, stagnant water, 6·6·54.
54. Shallow water from river above the waterfall, 6·6·54; pH 6.35.  
Samples collected in a vlei E. of the road; pH 6.2.
55. About 200 yards from bridge, beginning of a vlei, stagnant water, 6·6·54.
56. Small pools further down the vlei, 6·6·54.
- 57 and 58. Two places in the vlei on *Gramineae* and *Cyperaceae*, 6·6·54.

G.—*Kranskop*

Situated about seven miles E. of Nylstroom; leg. Cholnoky.

59. Small pond with partly broken bank, about 100 yards in diameter, stagnant water with *Marsilea* and *Nymphaea*, 6·6·54; pH 6.75.
60. Overflow of pond, swift-running water, 6·6·54.  
Samples from a tributary of the Nyl River near Kranskop.
61. Shallow water near the bank, 6·6·54.
62. Deeper, slow-running water from the main part of the stream, 6·6·54.

H.—*Modderpoort*

The farm belonging to Mr. G. Moerdyk between Warmbaths and Nylstroom, not far from the locality where samples 51–58 were collected; leg. Cholnoky.

- 63 and 64. Further from the road to the west, two samples collected on stones in the river, 6·6·54; pH 6.2.

I.—*Mosdene*

Samples collected on the farm of Mr. E. A. Galpin, near Naboomspruit, 12·7·55; pH 6.1–6.4; leg. Cholnoky.

65. From the portion of the farm called Masoga, in a swimming pool among *Myriophyllum*.
66. From the shallow part of a vlei with a sandy bottom on Masoga.
67. Same locality as 66 but in deep water among Green Algae.
68. Wall of Premier Dam, overflow, slow-running water, among *Marsilea*.
69. From Premier Dam; the bottom of the dam was sampled at a place far from the bank, and where the water was one metre deep.
70. A vlei situated between the Premier Dam and the Nyl River; in water about 10 cm. deep.
71. Near 70, in a furrow near the Nyl-road.
72. From the Nyl River, in swift-running water, on marshy sand: clearly oligotrophic.
73. From the Nyl Dam near the Nyl River, large algal masses.
74. Premier Dam, living material; leg. Dr. S. Saubert.

*Geographical Distribution.*—In the taxonomic part of this paper, the general geographical distribution of each taxon of the Desmidiaceae encountered has been added. As the author was unable to study all literature dealing with Desmids, the details regarding their geographical distribution must needs be considered incomplete.

## II.—ENUMERATION OF THE TAXA

## TRIBUS: SCHIZOPHYTA

*Class:* Schizophyceae (Cyanophyceae).

*Order:* Chroococcales.

*Fam.:* Chroococcaceae.

**Merismopedia Meyen**

1. *M. convoluta* Bréb. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 106.) Sample 20.
2. *M. glauca* (Ehrenb.) Näg. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 106, fig. 125.) Samples 47, 48.
3. *M. punctata* Meyen. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 106, fig. 124.) Samples 39, 48.

*Order:* Hormogonales.

*Fam.:* Stigonemataceae.

**Stigonema Ag.**

4. *S. pseudominutum* spec. nova, *S. minuto* (Ag.) Hass. affinis, sed filamentis et hormogoniis tam angustus ut vel 5  $\mu$  aequantibus, vaginis filamentorum vetustiorum luteo-fulvis et heterocystis nonnumquam etiam terminalibus differt.

Except for the considerably narrower threads and hormogonia this agrees with *S. minuto* (Ag.) Hass. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 186, figs. 224, 225); the heterocysts occupy terminal as well as lateral and intercalary positions. The cells are arranged in 1-4 series, but mainly in a single series. The threads are well-branched, the branches being narrower than the main axis. The older sheaths are yellowish-brown in colour whereas the younger sheaths are colourless. Diameter of threads 5-20  $\mu$ . (Tab. 1, figs. 1, 2.) Sample 27.

*Fam.:* Scytonemataceae.

**Scytonema Ag.**

5. *S. myochrous* (Dillw.) Ag. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 275, figs. 324, 325.) Threads narrower than in the typical form and some of the cells are shorter than broad; parts of the sheath lack the diverging layers. Breadth of thread 10-24  $\mu$ ; breadth of cells 5-7  $\mu$ ; length of cells 3-6  $\mu$ ; breadth of heterocysts 8  $\mu$ ; length of heterocysts 9-10  $\mu$ . (Tab. 1, figs. 3-7.) Sample 22.

*Fam.:* Nostocaceae.

**Nostoc Vaucher**

6. *N. commune* Vaucher (Geitler & Pascher: Süswasserflora, 12, 1925, p. 301, fig. 350). Sample 29.
7. *N. nylstromicum* spec. nova, *N. muscorum* Kütz. affinis, sed heterocystis cylindricis (nunquam apice rotundatis) valde distincta. „Dauerzellen” abesse videntur.

This species comes nearest to *N. muscorum* Kütz. (Geitler & Pascher: Süswasserflora, 12, 1925, p. 299, fig. 349), but can be distinguished by the shape of the heterocysts which are cylindrical in outline; no „Dauerzellen” were observed. Trichomes loosely twisted, blue-green in colour; cells cylindrical, 2.8-3.6  $\mu$  broad and 3.5-8.75  $\mu$  long. Heterocysts 3.85-4.4  $\mu$  broad and 5.6-9.5  $\mu$  long. A number of trichomes within a common mucilaginous sheath. (Tab. 2, fig. 2.) Sample 20.

8. *N. pseudogelatinosum* spec. nova, *N. gelatinoso* Schousboe affinis, sed differt magnitudine aliquanto minore et cellulis interdum non longioribus quam latioribus; constrictio saeptorum magis conspicua, heterocystorum nulla nisi terminalia sunt, neque ullae „Dauerzellen” adesse videntur.

This differs from *N. gelatinosum* Schousboe (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 298, fig. 347) in having smaller dimensions, more marked constrictions at the septa, terminal heterocysts, no “Dauerzellen” and cells which can be as long as they are broad. Trichomes irregularly twisted, blue-green in colour; cells quadrate or cylindrical, 2.4–2.8  $\mu$  broad and 2.4–6.3  $\mu$  long; heterocysts always occupy a terminal position, more or less elliptical in outline, 3.1–4  $\mu$  broad and 5.5–7.9  $\mu$  long. Only the common sheath, within which a number of trichomes occur, is distinct and of a dirty yellowish colour. (Tab. 2, fig. 1.) Sample 20.

#### *Anabaena* Bory

9. *A. galpinii* spec. nova, *A. affini* Lemm. affinis, sed trichomatis semper separatis, vaginae mucosae abesse videntur; cellulae breviores quam latiores. „Dauerzellen” iuxta heterocysta sitae sunt.

This species differs from *A. affinis* Lemm. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 320, fig. 374) in having individual trichomes (not containing a number of trichomes within a common sheath), in the absence of a sheath, in the position of the “Dauerzellen” (adjacent to the heterocysts), and in the cells being shorter than broad. Trichomes free-floating, straight, blue-green in colour; cells 8.5–9  $\mu$  broad and 4.3–6.8  $\mu$  long; heterocysts more or less spherical, 8.5–9  $\mu$  broad and 8–9  $\mu$  long. “Dauerzellen” single, oval, bright blue-green in colour and more granular than the vegetative cells, about 11  $\mu$  broad and 16  $\mu$  long. (Tab. 2, fig. 3.) Sample 66.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

10. *A. mesiana* spec. nova, *A. catenulae* (Kütz.) Born. et Flah. affinis, sed differt et trichomatis semper separatis et quod vagina mucosa abest. „Dauerzellen” breviores adsunt.

This species is near *A. catenula* (Kütz.) Born. et Flah. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 318, fig. 370); however the trichomes are single and the “Dauerzellen” are not as long as in Born. and Flah.’s species. Trichomes free-floating, straight, blue-green in colour; no sheaths were discernible. Cells spherical or slightly elliptical, 5–6  $\mu$  broad and 5–7  $\mu$  long. “Dauerzellen” single, adjacent to the heterocysts, oblong, 7.5–8  $\mu$  broad and 11.5–19  $\mu$  long. (Tab. 2, fig. 4.) Sample 66.

This species is named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

11. *A. pseudocatenula* spec. nova, *A. catenulae* (Kütz.) Born. et Flah. affinis, sed eo differt quod separata sunt trichomata, vagina mucosa abesse videtur, cellulae vero minores sunt ac breviores quam latiores neque ullae „Dauerzellen” visae sunt.

This species closely resembles *A. catenula* (Kütz.) Born. and Flah., but the trichomes are single, the cells are smaller and shorter than broad and no sheaths or “Dauerzellen” were observed. Trichomes free-floating, straight, blue-green in colour. Cells 3.16–3.65  $\mu$  broad and 1.58–3.5  $\mu$  long. Heterocysts elliptical, 3.5  $\mu$  broad and 6.63  $\mu$  long. (Tab. 2, fig. 5.) Sample 1.

Fam.: Oscillatoriaceae.

#### *Oscillatoria* Vaucher

12. *O. nylstromica* spec. nova, *O. simplicissimae* Gom. affinis, sed trichomatis angustioribus subcaeruleisque, cellulis brevioribus vel tam longis quam latis bene distinguenda.

This species agrees superficially with *O. simplicissima* Gom. (Geitler & Pascher, Süßwasserflora, 12, 1925, p. 364, fig. 429), but the trichomes are narrower, and light steel-blue in colour, and the cells are shorter than broad, or quadrate. Trichomes solitary, free-floating, more or less straight, not tapering towards the extremities, 4·6–4·75  $\mu$  broad. Cells granular at the septa and not constricted, 1·45–4·8  $\mu$  long. Apical cell broadly rounded, without calyptra. (Tab. 2, fig. 7.) Samples 1, 11.

13. *O. princeps* Vaucher. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 358, fig. 421.) Sample 47.

14. *O. subpristleyi* spec. nova, *O. pristleyi* W. et G. S. West affinis, sed valde differt quod trichomata extrema non curvantur et quod cellulae paulo angustiores porro longiores quam latiores sunt neque ad saepta constrictae.

This specimen closely resembles *O. pristleyi* W. et G. S. West (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 371, fig. 451), but differs from the latter in the absence of a curvature near the apex, the narrower trichomes, the cells being longer than broad and in the absence of constrictions at the septa. Trichomes solitary, free-floating, bright blue-green in colour, more or less straight, tapering towards the extremities, cells 3·16–5·5  $\mu$  broad and 4·7–9·5  $\mu$  long, granular at the septa. Apical cell slightly pointed, without calyptra. (Tab. 2, fig. 6.) Sample 1.

15. *O. tenuis* Ag. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 362, figs. 427, 428a.) (Tab. 2, fig. 8.) Samples 1, 5, 7, 9, 11, 12, 13, 14, 15, 18.

16. *O. waterbergensis* spec. nova, *O. annae* van Goor affinis, sed differt eo quod cellulae ad saepta non nisi levissime constrictae, breviores vel paulo longiores quam latiores et ad saepta granulatae sunt neque trichomata ad apicem sunt curvata.

This species agrees superficially with *O. annae* van Goor (Huber-Pestalozzi: Die Binnengewässer, Band XVI, Teil 1, p. 232, fig. 171); but some of the cells are longer than broad, and the trichomes lack a curvature near the apex, are slightly constricted at the septa and are granular. Trichomes more or less straight, greyish-green in colour, not tapering towards the extremities, 7–7·5  $\mu$  broad. Cells 4·75–8  $\mu$  long; apical cell rounded, without calyptra. (Tab. 2, fig. 9.) Sample 1.

#### Lyngbya Ag.

17. *L. uliginosa* spec. nova. Nulla affinitate obvia. Cellulae vel tam longae quam latae vel etiam longiores, filamentis ad saepta manifeste constrictae sunt; filamenta separata sunt neque vagina mucosa arte ad trichomata adhaeret.

Threads straight, solitary, free-floating, 4·5–5·1  $\mu$  broad; sheath of the filament thin, colourless, encircling the trichome loosely. Trichomes constricted at septa, 2·8–3·3  $\mu$  broad; cells 2·8–6·2  $\mu$  long, dark green in colour; apical cell rounded. (Tab. 2, fig. 10.) Sample 3.

#### TRIBUS: MONADOPHYTA

Class: Flagellatae.

Order: Euglenineae.

Fam.: Euglenaceae.

#### Euglena Ehrenb.

18. *E. spirogyra* Ehrenb. var. *major* var. nova. Haec specimina multo maiora sunt quam typus et varietates speciei adhuc notae, neque ullae formae intermediae visae sunt.

This variety is much larger than the type and its varieties, with the exception of var. *suprema* Skuja (Huber-Pestalozzi: Die Binnengewässer, Band XVI, Teil 4, p. 102, fig. 83), from which it differs in shape and breadth of cells. Cells 152–196  $\mu$  long and 22–26  $\mu$  broad. (Tab. 32, fig. 11.) Samples 25, 39.

As most Flagellates are either completely dissolved or quite unidentifiable in formalin-treated material, examination of living material must be made for their recognition. Several unidentifiable *Euglena* species were found in samples 2, 23, 24, 25, 26, 27, 34, 35, 36 and 47.

#### Phacus Dujardin

19. *Ph. pleuronectes* (O.F.M.) Duj. (Pascher & Lemmermann: Süßwasserflora, 2, 1913, p. 138, fig. 236.) Samples 1, 12, 32, 34, 35.

#### TRIBUS: CONJUGATOPHYTA

Class: Conjugatae.

Fam.: Mesotaeniaceae.

#### Cylindrocystis Menegh.

20. *C. barbarica* spec. nova, affinis *C. crassae* De Bary, sed cellulis 1·2–1·4-plo longioribus quam latioribus, etiam forma chromatophorum differt, quippe quibus processus minus sint radiantes.

This species superficially agrees with *C. crassa* De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 59, Pl. IV, figs. 33–38); but the cells are about 1·2–1·4 times longer than broad and the chloroplasts possess fewer radiating processes. Cells small, unstricted, subcylindrical, with the apices broadly rounded; cell wall smooth and colourless; chloroplasts stellate with a few radiating processes. Length 28–32  $\mu$ ; breadth 23–24  $\mu$ . (Tab. 3, fig. 1.) Sample 19.

21. *C. caffra* spec. nova, affinis *C. brébissonii* Menegh., sed cellulis latioribus, etiam forma chromatophori differt.

This species somewhat resembles *C. brébissonii* Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 58, Pl. IV, figs. 23–32; Pl. V, fig. 10); but the cells are broader than in Meneghini's species and the shape of the chloroplast differs. Cells of medium size, cylindrical, unstricted, about 1·7–2·6 times longer than their diameter, apices rounded, chloroplasts with a few radiating prolongations; cell wall smooth and colourless. Length 36–58  $\mu$ ; breadth 20–24  $\mu$ . (Tab. 3, fig. 2.) Samples 18, 19.

#### Netrium Näg.

22. *N. digitus* (Ehrenb.) Itzigs. & Rothe. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 64, Pl. VI, figs. 14–16.) Several of the specimens measured are considerably smaller than in the typical form namely 92–126  $\mu$  long, 33–44  $\mu$  broad and 15–20  $\mu$  broad near the apices. Samples 2, 19, 22, 25, 35, 39, 41, 66, 68, 69, 70.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Generally distributed in Europe; Faeroes; India; Ceylon; Siam; Java; Central China; Japan; Australia; New Zealand; Azores; United States; British Guiana; Brazil; Portuguese East Africa; South Africa.

23. *N. oblongum* (De Bary) Lütkem. var. *cylindricum* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 67, Pl. V, fig. 7.) Sample 25.

*Geographical Distribution.*—England; Wales; Scotland; Italy; Somaliland; Japan; South Africa.



Order: Desmidiiales.

Fam.: Desmidiaceae.

Subfam.: Saccodermae.

**Gonatozygon De Bary**

24. *G. monotaenium* De Bary. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 30, Pl. I, figs. 1-7; Pl. V, fig. 5.) Sample 20.

*Geographical Distribution*.—England: Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Sweden; Faeroes; N. Russia; Greenland; India; Ceylon; Siam; Sumatra; West, Central and East Africa; W. Indies; United States; Brazil (var.); South Africa.

Subfam.: Placodermae.

**Penium Bréb.**

25. *P. barbaricum* spec. nova, affinis *P. margaritaceo* (Ehrenb.) Bréb., sed granulis membranae diffuse (neque in seriebus longitudinalibus) dispositis, membranaque achroa differt.

This species superficially resembles *P. margaritaceum* (Ehrenb.) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 83, Pl. VIII, figs. 32-35); but the cell wall is colourless and furnished with numerous scattered granules. Cells of medium size, about 3.2-6.3 times longer than their diameter, with a distinct median constriction, apices rounded. Length 70-144  $\mu$ ; breadth 18-23  $\mu$ . (Tab. 3, fig. 6.) Samples 20, 47, 48.

26. *Penium* species ad *P. cruciferum* (De Bary) Wittr. Cellulae cum *P. crucifero* valde congruentes praeterquam quod paulo minores sunt neque ullae costae in chromatophora visae sunt. Zygospora inventa est sed *P. cruciferi* zygospora adhuc ignoratur.

This comes very near *P. cruciferum* (De Bary) Wittr. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 100, Pl. X, figs. 18-19), but the cells are slightly smaller and no ridges were observed in the chloroplasts. A zygospora was found, but the zygospora of *P. cruciferum* has hitherto been unknown. The cells are very small, about 1.7-2.2 times longer than their diameter; ellipsoid-subcylindrical with a slight median constriction, apices rounded; cell wall smooth and colourless; each chloroplast with a central pyrenoid. Zygospora subquadrate, sides concave; cell wall straw-coloured. Length 12-13  $\mu$ ; breadth 6-7  $\mu$ ; diameter of zygospora 12-14  $\mu$ . (Tab. 3, figs. 16-17.) Sample 35.

27. *P. cucurbitinum* Biss. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 94, Pl. IX, figs. 13, 14.) Sample 39.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Japan; South Africa.

28. *P. cucurbitinum* f. *botesii* f. nova, affinis *P. cucurbitino* formae *minori* West, sed cellulis multo minoribus, apice hebetato, punctis in 8 series longitudinales ordinatis differt.

This species somewhat resembles *P. cucurbitinum* f. *minor* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 95, Pl. IX, fig. 16); but the cells are much smaller, with the apices truncate; cell wall punctate, punctae arranged in about eight longitudinal rows. Cells small, about twice as long as broad, with a slight median constriction; chloroplasts with about four longitudinal ridges. Length 24-28  $\mu$ ; breadth 11-14  $\mu$ ; breadth of isthmus 7-10  $\mu$ . (Tab. 3, fig. 15.) Sample 27.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

29. *P. curtum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 97, Pl. X, figs. 21, 22.) Samples 7, 11, 32.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Italy; Norway; Sweden; Greenland; Spitzbergen; Nova Zembla; Franz-Joseph Land; India; Burma; Siam; West Africa; Madagascar; West Indies; United States; South Africa.

30. *P. curtum* var. *waterbergense* var. nova, a typo speciei membrana ad apices cellulae haud incrassata et sculptura membranae differt.

This agrees somewhat with the typical form, but differs in the absence of a cell wall thickening at the apices and in the sculpture of the cell wall. Cell wall punctate, punctae arranged in about eight longitudinal rows. Length 27–33  $\mu$ ; breadth 18–20  $\mu$ ; breadth of isthmus 16–18  $\mu$ . (Tab. 3, fig. 9.) Samples 30, 51, 52, 53, 54, 58, 64.

31. *P. jenneri* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 77, Pl. VII, figs. 20, 21.) Sample 2.

*Geographical Distribution.*—England; Scotland; Ireland; Germany; Austria; Norway; Sweden; Poland; South Africa.

32. *P. libellula* (Focke) Nordst. var. *schweickerdtii* var. nova, affinis *P. libellulae* var. *interrupto* W. et G. S. West, sed cellulis 3·8–5-plo longioribus quam latioribus chromatophoris constrictis neque interruptis differt.

This approaches *P. libellula* var. *interruptum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 74, Pl. VII, figs. 9–10); but the cells are shorter, and 3·8–5 times longer than their diameter; chloroplasts constricted and not transversely divided. Cells of medium size, unconstricted, fusiform, apices slightly truncately rounded; chloroplasts with about 10 longitudinal ridges. Length 68–108  $\mu$ ; breadth 16–25  $\mu$ ; breadth near apices 6–12  $\mu$ . (Tab. 3, fig. 7.) Samples 2, 24, 25, 27, 32, 39, 41.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

33. *P. margaritaceum* (Ehrenb.) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 83, Pl. VIII, figs. 32–35.) Tab. 3, fig. 3 shows a form during cell-division in which the cell wall is furnished with longitudinal rows of granules, but the granules are irregularly scattered at the apices. Samples 13, 18, 19.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Poland; Hungary; Italy; Portugal; Norway; Sweden; Finland; Lapland in Russia; Faeroes; Greenland; Spitzbergen; Java; New Zealand; East Africa; Azores; United States; Ecuador; Switzerland; South Africa.

34. *P. margaritaceum* var. *brevior* var. nova, a typo speciei cellulis valde latioribus fere 3·6–4·8-plo longioribus quam latioribus differt.

Length in proportion to breadth differs from the typical form; cells 3·6–4·8 times longer than their diameter. Length 84–96  $\mu$ ; breadth 20–23  $\mu$ . (Tab. 3, fig. 5.) Samples 13, 19.

35. *P. margaritaceum* var. *incognitum* var. nova, a typo speciei semicellulis ad basim tumidis similiter ac apud genus *Pleurotaenium* Näg. differt.

This variety differs from the typical form in possessing a basal inflation in each semicell similar to that found in the genus *Pleurotaenium* Näg. Cells large, 7·7–8·4 times longer than their diameter, apices rounded; cell wall yellowish-brown and furnished with longitudinal rows of granules; chloroplasts with about 10 longitudinal plates (or ridges) and showing a median interruption. Length of cell 184–185  $\mu$ ; breadth at base of semicell 22  $\mu$ , near basal inflation 18–18·5  $\mu$ , at middle of semicell 22–24  $\mu$ , at apices 16–17  $\mu$ . (Tab. 3, fig. 4.) Sample 13.

36. *P. mesianum* spec. nova, affinis *P. phymatosporo* Nordst., sed membrana cellulae granulata haud striata differt.

This is near *P. phymatosporum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 91, Pl. VI, figs. 9–11); but the cell wall is furnished with minute granules and is not striated. Cells small, more than twice as long as broad, with a slight median constriction; apices truncately rounded; cell wall conspicuously covered with granules; each chloroplast has a single pyrenoid. Length 32–42  $\mu$ ; breadth 13–16  $\mu$ . (Tab. 3, figs. 10–13.) Samples 3, 24, 27.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

37. *P. navicula* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 75, Pl. VII, figs. 12–15, 19.) Specimens were found with length 33–80  $\mu$ ; breadth 12–20  $\mu$ ; breadth of apices 6–8  $\mu$ . Samples 2, 51, 52, 53, 54, 57, 58, 63.

*Geographical Distribution.*—England: Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Norway; Sweden; Italy; Russia; Lapland; Faeroes; Greenland; India; Ceylon; Singapore; United States; Brazil; First record for South Africa.

38. *P. phymatosporum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 91, Pl. VI, figs. 9–11.) Sample 2.

*Geographical Distribution.*—England; Scotland; Ireland; France; Austria; Italy; Argentina; Trinidad (?); Japan; Switzerland; Nantucket, U.S.A.; South Africa.

39. *P. pseudorufescens* spec. nova, affinis *P. rufescenti* Cleve, sed cellula dimidio minore differt; constrictura media haud visa, membrana achroa.

Near *P. rufescens* Cleve (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 99, Pl. VI, figs. 12, 13); but the cells are only about half the size of those of Cleve's species; no trace of a constriction in the middle of the cell was found; cell wall colourless. Cells small, about 2·5–3 times longer than their diameter, slightly attenuated towards the apices, which are rounded; cell wall smooth. Length 28–30  $\mu$ ; breadth 9–12  $\mu$ . (Tab. 3, fig. 14.) Sample 24.

40. *P. subcucurbitinum* spec. nova, affinis *P. cucurbitino* Biss., sed cellulis fere duplo longioribus quam latioribus, apice hebetato nec non sculptura membranae differt.

Near *P. cucurbitinum* Biss. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 94, Pl. IX, figs. 13, 14); however the cells are about two times longer than their diameter, and the apices are truncate; it also differs in the sculpture of the cell wall. Cells small, subcylindrical, with a slight median constriction, gradually attenuated towards the apices; cell wall furnished with granules. Length 39  $\mu$ ; breadth 20  $\mu$ . (Tab. 3, fig. 8.) Sample 39.

#### *Closterium* Nitzsch

41. *C. abruptum* West var. *westiorum* var. nova, affinis *C. abrupto* var. *breviori* W. et G. S. West, sed cellulis minus arcuatis vel rectis et polis hebetatis differt.

Near *C. abruptum* var. *brevius* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 160, Pl. XX, figs. 11, 12); but the cells are less curved or practically straight and the apices are more truncate. Cells about 5·9–6·5 times longer than their diameter. Chloroplasts with about eight ridges and a central series of 2–3 pyrenoids. Length 75–84  $\mu$ ; breadth 12–13  $\mu$ ; breadth of apices 6–7  $\mu$ . (Tab. 6, figs. 9, 10.) Sample 2.

Named after Messrs. W. & G. S. West.

42. *C. acerosum* (Schrank) Ehrenb. var. *waterbergense* var. nova, affinis *C. aceroso* var. *elongato* Bréb., sed cellulis valde minoribus et polis hebetatis differt.

This comes near *C. acerosum* var. *elongatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 148, Pl. XVIII, fig. 1); but differs in having smaller cells with truncate apices. Cells of medium size, about 9·5–10·5 times longer than their diameter, inner margin slightly concave, gradually attenuated towards the apices, which are truncate; cell wall yellowish-brown, striated, about 40 striae visible across the cell; chloroplasts with about eight ridges and a central series of 10–15 pyrenoids; terminal vacuoles with a number of moving granules. Length 398–432  $\mu$ ; breadth 41–42  $\mu$ ; breadth of apices 8  $\mu$ . (Tab. 4, figs. 6, 7.) Sample 54.

43. *C. acutum* (Lyngb.) Bréb. var. *linea* (Perty) W. & G. S. West f. *minor* f. nova, a varietate *linea* (Perty) W. et G. S. West cellulis multo brevioribus (nec angustioribus) differt.

The cells are considerably shorter than those in var. *linea* (Perty) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 178, Pl. XXIII, fig. 15), but have the same breadth. Cells 16–18 times longer than their diameter; chloroplasts with 3–4 pyrenoids; terminal vacuoles with one moving granule. Length 64–88  $\mu$ ; breadth 4–5  $\mu$ . (Tab. 6, fig. 22.) Sample 22.

44. *C. atomicum* spec. nova, affinis *C. striolata* Ehrenb., sed differt cellulis multo minoribus, margine ventrali medio incrassato, membrana cellulae 14 striis quae videre possunt ornata.

This is near *C. striolata* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 122, Pl. XIII, figs. 7–16); but the cells are considerably smaller, inner margin tumid in the median part. Cells of medium size, 7–8 times longer than their diameter, curved, inner margin concave and tumid in the median portion, gradually attenuated towards the apices, which are slightly truncate; cell wall yellowish-brown, about 14 striae visible across the cell. Length 160–196  $\mu$ ; breadth 22·5–26  $\mu$ ; breadth of apices 9–12  $\mu$ . (Tab. 5, fig. 16.) Sample 3.

45. *C. barbaricum* spec. nova, affinis *C. parvulo* Näg., sed cellulis minus arcuatis, polis hebetatis, vacuolis terminalibus granulato singulo se moventi praeditis differt.

This species differs from *C. parvulum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 133, Pl. XV, figs. 9–12) in the cells having a smaller curvature, the apices being acute and in the terminal vacuoles containing only one moving granule. Cells small, 7–9 times longer than their diameter, curved, inner margin concave, not tumid, gradually attenuated towards the apices, which are truncately-rounded; cell wall smooth and colourless; chloroplasts with six ridges and six pyrenoids. Figs. 5 and 6 show cells which have atypical apices, possibly owing to the fixative used. Length 66–92·5  $\mu$ ; breadth 8–11·5  $\mu$ . (Tab. 6, figs. 4–6.) Sample 2.

46. *C. boyanum* spec. nova, affinis *C. stellenboschensi* Hodgetts, sed cellulis maioribus, minusque arcuatis et apice utroque poro praedito differt.

Near *C. stellenboschense* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 74, fig. 8); but the cells are larger and less curved, there is a pore at each apex. Cells of medium size, 7·3–7·4 times longer than their diameter, inner margin concave, slightly tumid in the median portion, gradually attenuated towards the apices, which are slightly acutely-rounded; cell wall smooth, straw-coloured or yellowish, with a pore at each apex; chloroplasts with about six ridges and a central series of five pyrenoids; terminal vacuoles large, with a number of moving granules. Length 167–174  $\mu$ ; breadth 23–24  $\mu$ . (Tab. 5, fig. 13.) Samples 57, 58, 64.

47. *C. caffrorum* spec. nova, affinis *C. cynthiae* De Not, sed cellulis multo minus arcuatis et polis hebetatis differt. Membrana cellulae plus minusve 9 striis quae videri possunt ornata.

This species is near *C. cynthia* De Not (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 113, Pl. XI, figs. 1-3); but the cells are less curved and have truncate apices. Cells small, curved, inner margin concave, apices truncate; chloroplasts with six ridges and a central series of about four pyrenoids; cell wall yellowish-brown and striated, about nine striae being visible across the cell; terminal vacuoles with a single moving granule. Length 100-104  $\mu$ ; breadth 13.5-14  $\mu$ . (Tab. 8, fig. 4.) Sample 64.

48. *C. calosporum* Wittr. var. *minor* var. *nova*, a typo speciei cellulis multo minoribus ad apices hebetato-rotundatis et minus curvatis differt.

These specimens differ from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 138, Pl. XVI, figs. 1-4) in having smaller cells, truncately-rounded apices and a smaller curvature. Cells about 7.7 times longer than their diameter; chloroplasts with a single series of about two pyrenoids. Length 54  $\mu$ ; breadth 7  $\mu$ . (Tab. 6, fig. 20.) Sample 3.

49. *C. ceratium* Perty var. *angustum* var. *nova*, a typo speciei cellulis multo angustioribus (cellula 49.1-56.1-plo longior quam latior) differt. Formae intermediae non visae.

Cells narrower than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 176, Pl. XXIII, figs. 6-8). Cells about 49.1-56.1 times longer than their diameter; straight for almost the whole length of the cell; chloroplasts with 11-12 pyrenoids. Length 123.5-124  $\mu$ ; breadth 2.2-2.5  $\mu$ . (Tab. 6, fig. 14.) Sample 3.

50. *C. cornu* Ehrenb. var. *minor* var. *nova*, a typo cellulis multo minoribus et poli minus acutis differt. Formae intermediae non visae.

Cells considerably smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 157, Pl. XX, figs. 1-5), being about 13-17 times longer than their diameter; chloroplasts with about three pyrenoids. Length 64-74  $\mu$ ; breadth 4-5  $\mu$ ; breadth of apices 2.2-2.6  $\mu$ . (Tab. 6, fig. 23.) Sample 22.

51. *C. cornu* var. *angustum* var. *nova*, a var. *minori* Claassen cellulis paulo angustioribus et polis multo acutioribus differt.

Near var. *minor* Claassen; but the cells are narrower and the apices more acute. Cells 12.5-19 times longer than their diameter. Length 75-77  $\mu$ ; breadth 3.4-4  $\mu$ . (Tab. 6, fig. 24.) Sample 2.

52. *C. cymbellaeformis* spec. *nova*. Nulla affinitate obvia. Cellulae naviculares, margo ventralis tenuiter convexus apices hebetati, et membrana cellulae paulo incrassata.

Cells of medium size, boat-shaped, inner margin slightly convex, apices truncate with a slightly thickened cell wall; cell wall smooth and colourless; chloroplasts with about 10 ridges and a central series of four pyrenoids; subterminal vacuoles large, with a number of moving granules. Length 168-171.5  $\mu$ ; breadth 28-29  $\mu$ ; breadth of apices 8-10  $\mu$ . (Tab. 5, fig. 15.) Sample 2.

53. *C. cynthia* De Not var. *waterbergense* var. *nova*, differt a typo speciei cellulis minus arcuatis pauloque latioribus, polis minus acutis et membrana plus minusve 13 striis quae videri possunt ornata.

The cells are less curved than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 113, Pl. XI, figs. 1-3); they are slightly broader, the apices are less acute and the cell wall has about 13 striae visible across the cell. Inner margin slightly tumid; cell wall yellowish-brown; chloroplasts with about six ridges and a central series of four pyrenoids; terminal vacuoles with one moving granule. Length 115-119  $\mu$ ; breadth 18.5-20  $\mu$ . (Tab. 8, fig. 3.) Sample 64.

54. *C. decorum* Breb. var. *minor* var. *nova*, differt a typo cellulis multo minoribus et membrana striis 23–24 quae videri possunt disposita.

Cells considerably smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 184, Pl. XVII, figs. 7, 8; Pl. XXVIII, figs. 1–3) and the cell wall with more striae. Cells of medium size, 10–14·6 times longer than their diameter, curvature somewhat variable, inner margin concave, slightly but broadly tumid in the median portion, gradually attenuated towards the apices, which are truncate; cell wall straw-coloured or yellowish-brown; each chloroplast with a central series of 6–11 pyrenoids. Length 176–292  $\mu$ ; breadth 17–20  $\mu$ ; breadth of apices 4–5  $\mu$ . (Tab. 5, fig. 12.) Samples 3, 63.

55. *C. ehrenbergii* Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 143, Pl. XVII, figs. 1–4.) Sample 42.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Bosnia in Hungary; Italy; Portugal; Norway; Sweden; Denmark; North, Central and South Russia; Faeroes; Central China; Japan; India; Siam; Samoa; New Zealand; Central Africa (var.); East Africa; United States; West Indies; Brazil; Uruguay; Patagonia; South Africa.

56. *C. ehrenbergii* var. *minutissimum* var. *nova*, affinis *C. ehrenbergii* Menegh., sed cellulis fere 5–7-plo minoribus, polis plus hebetatis, vacuolis terminalibus granulo singulo se moventi praeditis differt.

The cells are about 5–7 times smaller than in the typical form, the apices are more truncate and the terminal vacuoles have a single moving granule. Cells small, 4·1–4·8 times longer than their diameter; cell wall smooth and yellowish; chloroplasts with about six ridges and a central series of five pyrenoids. Length 75·5–77  $\mu$ ; breadth 16  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 6, fig. 21.) Sample 39.

57. *C. gracile* Breb. var. *brevius* var. *nova*, a typo speciei cellulis multo latioribus differt. Formae intermediae non visae.

Cells broader than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 166, Pl. XXI, figs. 8–12). Cells about 11–15·5 times longer than their diameter; chloroplasts with about six ridges and a single series of 4–6 pyrenoids; terminal vacuoles with one moving granule. Length 112–136  $\mu$ ; breadth 8·5–12  $\mu$ ; breadth of apices 2·2–3  $\mu$ . (Tab. 6, fig. 12.) Samples 51, 52, 54, 64.

58. *C. incurvum* Breb. var. *elaboratum* var. *nova*, a typo speciei cellulis minus arcuatis, polis minus acutis, vacuolis terminalibus singulo se moventi granulo praeditis differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 136, Pl. XV, figs. 28–30) in the smaller curvature of the cells, in the terminal vacuoles containing only one moving granule and in the less acute apices. Cells 4·5–6 times longer than their diameter, apices acutely rounded; chloroplasts with six ridges and a central series of two pyrenoids. Length 51–52  $\mu$ ; breadth 8·5–11  $\mu$ ; breadth of apices 1·5–2·5  $\mu$ . (Tab. 6, fig. 19.) Samples 58, 59, 63.

59. *C. insolitum* spec. *nova*. Nulla affinitate obvia. Cellulae solum plus minusve 2·8-plo longiores quam latiores, valide arcuatae ad apices rotundatae, membrana achroa glabraque. Chromatophora binis seriebus 2 vel 3 pyrenoidorum ornata.

This differs from other species of *Closterium* in the cells being rather broad in proportion to their length. Cells of medium size, about 2·8 times longer than their diameter, strongly curved, apices rounded; cell wall smooth and colourless; chloroplasts with about four ridges and two series of 2–3 pyrenoids each. Length 124  $\mu$ ; breadth 44  $\mu$ . (Tab. 8, fig. 5.) Sample 39.

60. *C. intermedium* Ralfs var. *mesianum* var. nova, affinis *C. intermedio* var. *hibernico* West, sed polis non valde arcuatis, membrana cellulae glabra et achroa (quae colore caret) differt.

This superficially resembles *C. intermedium* var. *hibernicum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 126, Pl. XIV, fig. 6); but the poles are less incurved; cell wall smooth and colourless and the cells are considerably longer than in West's variety. Cells of medium size, about 19–22·7 times longer than their diameter, moderately curved, inner margin straight in the median portion, gradually attenuated towards the apices, which are truncate and slightly incurved; chloroplasts with about eight ridges, and 12–13 pyrenoids in one axile series; terminal vacuoles with a number of moving granules. Length 324–364  $\mu$ ; breadth 16–18  $\mu$ ; breadth of apices 4  $\mu$ . (Tab. 4, fig. 3.) Sample 44.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

61. *C. jenneri* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 134, Pl. XV, figs. 23–25.) Sample 27.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Galicia; Hungary; Italy; Spain; Norway; Sweden; Bornholm; North and South Russia; Faeroes; Nova Zembla; Greenland; Siam; Java; Central and East Africa; Azores; United States; Brazil; Switzerland; South Africa.

62. *C. jenneri* var. *dubitabilis* var. nova, affinis *C. jenneri* var. *robusto* G. S. West, sed cellulis minus arcuatis differt.

This is near *C. jenneri* var. *robustum* G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 136, Pl. XV, figs. 26, 27); but the cells are less curved than in West's variety. Cells small, about 6·5–7·4 times longer than their diameter; cell wall smooth and yellowish-brown; chloroplasts with about six ridges and five pyrenoids; terminal vacuoles with 1–2 moving granules. Length 84–86  $\mu$ ; breadth 11·5–13  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 6, fig. 7.) Sample 3.

63. *C. kranskopense* spec. nova. Prima facie forma cellulae plus minusve *C. cornu* Ehrenb. congruens, sed cellulis 7-plo maioribus, membrana luteo-brunea apicem versus incrassata et plus minusve 60 striis disposita differt.

The shape of the cell (low magnification) agrees with that of *C. cornu* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 157, Pl. XX, figs. 1–5); but the cells are about seven times as large as those in Ehrenberg's species; the cell wall is yellowish-brown and striated, with about 60 striae visible across the cell, and the cell walls are thickened at the apices. Cells large, 15–16 times longer than their diameter, moderately curved, inner margin concave, gradually attenuated towards the apices, which are truncately rounded; cell wall with a distinct thickening at each apex; chloroplasts with about six ridges, and a central series of 14–23 pyrenoids; terminal vacuoles with a number of moving granules. Length 765–854  $\mu$ ; breadth 52–54·5  $\mu$ . (Tab. 4, figs. 4, 5.) Sample 61.

64. *C. kützingii* Bréb. var. *transvaalense* var. nova, a typo speciei differt quod cellulae media pars multo longius est incrassata.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 186, Pl. XXV, figs. 6–11) in the cells being tumid in the median part for a greater distance. Cells about 24 times longer than their diameter; about 16 striae visible across the cell. Length 336  $\mu$ ; breadth 14  $\mu$ ; breadth of apices 3  $\mu$ . (Tab. 6, fig. 1.) Sample 3.

65. *C. malinvernianum* De Not. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 145, Pl. XVII, figs. 5, 6.) Up to 68 striae visible across the cell. Figs. 9–11 are cells soon after division. (Tab. 4, figs. 8–11.) Samples 51, 52, 53, 54, 57, 58.

*Geographical Distribution*.—England; Scotland; Ireland; Austria and Galicia; Italy; Spain; Norway; Sweden; South Africa.

66. *C. moniliferum* (Bory) Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 142, Pl. XVI, figs. 15, 16.) Samples 4, 6, 14.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Belgium; Germany; Switzerland; Galicia in Austria; Hungary and Bosnia; Italy; Portugal; Norway; Sweden; Denmark; Bornholm; North and South Russia; Poland; Faeroes; Iceland; China; Japan; Ceylon; New Zealand; Central Africa; United States; Brazil; Argentina; Uruguay; Patagonia; South Africa.

67. *C. moniliferum* var. *epithemioides* var. nova, a typo speciei margine ventrali medio minus tumido, membrana straminea et cellulis plerumque paulo minoribus differt.

Inner margin slightly but broadly tumid; cell wall straw-coloured; cells usually somewhat smaller than in the typical form. Cells 5–7 times longer than their diameter; chloroplasts with about eight ridges and a central series of 5–6 pyrenoids. Length 184–240  $\mu$ ; breadth 34–38  $\mu$ ; breadth of apices 6–8  $\mu$ . (Tab. 5, fig. 14.) Samples 13, 14, 15.

68. *C. parvulum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 133, Pl. XV, figs. 9–12.) Sample 32.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria; Galicia; Hungary; Spain; Norway; Sweden; Denmark; Finland; North, South and Central Russia; Nova Zembla; Greenland; Siberia; Japan; Ceylon; Siam; Sumatra; Java; Samoa; Australia; Central and East Africa; United States; Brazil; Ecuador; Patagonia; South Africa.

69. *C. parvulum* var. *minor* var. nova, a typo speciei cellulis multo minoribus et apicibus aliquanto plus hebetatis differt. Formae intermediae haud visae.

Cells smaller and apices more truncate than in the typical form. Length 76–76.5  $\mu$ ; breadth 7–8  $\mu$ ; breadth of apices 3–4  $\mu$ . (Tab. 6, fig. 8.) Sample 3.

70. *C. peracerosum* Gay var. *elegans* G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 155, Pl. XIX, figs. 12, 13.) Ventral margin in the median portion of the cell slightly more tumid than in the typical form, and the cells are shorter. Length 134–172  $\mu$ ; breadth 9–15  $\mu$ . (Tab. 6, fig. 11.) Samples 13, 14, 15. *Geographical Distribution*.—England; First record for South Africa.

71. *C. praelongum* Bréb. forma *brevior* West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 165, Pl. XXI, figs. 3–5.) Cell wall yellowish and punctate. Sample 6.

*Geographical Distribution*.—England; Scotland; Ireland; Portugal; Sweden; New Zealand; South Africa.

72. *C. pritchardianum* Arch. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 172, Pl. XXII, figs. 6–14.) These specimens are generally larger than the typical form. Length 496–825  $\mu$ ; breadth 48–58  $\mu$ ; breadth of apices 5–7  $\mu$ . Samples 6, 42.

*Geographical Distribution*.—England; Scotland; Ireland; France; Germany; Austria and Galicia; Italy; Norway; Sweden; North Russia; China; Brazil; Argentina; Switzerland; South Africa.

73. *C. pseudoleibleinii* spec. nova, affinis *C. leibleinii* Kütz., sed differt èt cellulis non tantopere curvatis èt polis hebetatis èt quod tumor in medio margine ventrali minor est. Membrana cellulæ iuxta ante apices in marginibus ventrali dorsalique incrassata.



This species comes near *C. leibleinii* Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 141, Pl. XVI, figs. 9–14); but the cells are less curved, with truncate apices and the ventral margin less tumid; the cell wall has an annular thickening at each apex. Cells of medium size, about 10·5 times longer than their diameter; cell wall smooth and yellowish-brown; the chloroplast has about six ridges and a central series of 6–8 pyrenoids; terminal vacuoles with one large moving granule. Length 231·5  $\mu$ ; breadth 21·5  $\mu$ ; breadth of apices 8·5  $\mu$ . (Tab. 5, fig. 8.) Sample 24.

74. *C. pseudolunula* spec. nova, affinis *C. lunulae* (Müll.) Nitzsch, sed apicibus cellulae hebetatis et minus recurvatis, etiam cellululis angustioribus differt.

Near *C. lunula* (Müll.) Nitzsch (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 150, Pl. XVIII, figs. 8, 9), but the apices of the cells are truncate and less recurved and the cells are narrower and shorter. Cells of medium size, about 7–8 times longer than their diameter. straight, inner margin fairly straight or slightly tumid in the median part of the cell, gradually attenuated towards the apices, which are truncately rounded; cell wall smooth and colourless; each chloroplast with about 10 ridges and numerous scattered pyrenoids; terminal vacuoles large, with a number of moving granules. Length 372–412  $\mu$ ; breadth 51·5–58  $\mu$ ; breadth of apices 14–16  $\mu$ . (Tab. 4, fig. 1.) Samples 34, 35.

75. *C. ralfsii* Bréb. var. *subralfsii* var. nova, affinis *C. ralfsii* var. *hybrido* Rabenh., sed differt et cellululis minus arcuatis, et quod margo ventralis in media cellula incrassatus non est; et membrana 25–30 striis, chromatophoraque 11–16 pyrenoidibus minoribus instructa differt.

Near *C. ralfsii* var. *hybridum* Rabenh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 183, Pl. XXIV, figs. 8–13); but the cells are less curved, and are without a median inflation; 25–30 striae visible across the cell; chloroplasts with a median series of 11–16 small pyrenoids. Cells of medium size, 9–13 times longer than their diameter, apices truncately rounded; cell wall yellowish-brown; chloroplasts with about six ridges; terminal vacuoles with a number of moving granules. Length 314–424  $\mu$ ; breadth 34–38  $\mu$ ; breadth of apices 8–10  $\mu$ . (Tab. 5, fig. 1.) Samples 34, 35.

76. *C. ralfsii* var. *glentigianum* var. nova, affinis var. *subralfsii* Claassen, sed membrana cellulae 32–34 striis et chromatophora 5–7 pyrenoidibus magnis instructa differt.

Cell wall with 32–34 striae across the cell; chloroplasts with a series of 5–7 large pyrenoids. Apices slightly obliquely-rounded. Length 322–344  $\mu$ ; breadth 35–36  $\mu$ ; breadth of apices 9–10  $\mu$ . (Tab. 5, fig. 2.) Sample 46.

77. *C. ralfsii* var. *minor* var. nova, a typo speciei cellululis multo minoribus differt. Membrana cellulae 21–23 striis et chromatophora 10–12 pyrenoidibus instructa. Formae intermediae haud visae.

Cells considerably smaller than in the typical form. Cells of medium size, 7–10 times longer than their diameter, moderately curved, inner margin concave. Cell wall yellowish-brown, striated, 21–23 striae visible across the cell; chloroplasts with 10–12 pyrenoids. Length 202–264  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 8–10  $\mu$ . (Tab. 5, figs. 4–5.) Sample 3.

78. *C. ralfsii* var. *nodosum* var. nova, affinis *C. ralfsii* var. *hybrido* Rabenh. sec. Fukushima et Fujisawa, sed differt et polis leviter capitatis et quod plus minusve 18 striis, quae videri possunt, membrana distincta est.

This is near *C. ralfsii* var. *hybridum* Rabenh. sec. Fukushima & Fujisawa (H. Fukushima and the late K. Fujisawa, Desmids Flora of Oze. Reprinted from Scientific Researches of the Ozegahara Moor. Tokyo, 1954, p. 596, Pl. I. figs. L–M.); but the apices are slightly clavate and about 18 striae are visible across the cell. Cells of medium size, 8·6–8·8 times longer than their diameter, curved, inner margin concave and

straight in the median portion, gradually attenuated towards the apices; cell wall yellowish-brown; chloroplasts with about 12 ridges and a central series of 12–13 pyrenoids; terminal vacuoles with a number of moving granules. Length 306–310  $\mu$ ; breadth 35–35.5  $\mu$ ; breadth of apices 12–12.5  $\mu$ . (Tab. 5, fig. 3.) Sample 42.

79. *C. rostratum* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 188, Pl. XXVI, figs. 1–5.) Some specimens are slightly narrower (17  $\mu$ ) than in the typical form. Sample 21.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Portugal; Norway; Sweden; Bornholm; Poland; North, Central and South Russia; Finland; Faeroes; Iceland; Nova Zembla; Greenland; Siberia; Japan; Ceylon (form); East Africa; United States; Brazil; Ecuador; Paraguay; Switzerland; South Africa.

80. *C. schweickerdtii* spec. nova, affinis *C. stellenboschensi* Hodgetts, sed cellulis multo maioribus et magis arcuatis, polisque acutioribus differt. Apex uterque poro vacuolaeque terminales paucis granulis se moventibus praeditae.

Near *C. stellenboschense* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 74, fig. 8); but the cells are considerably larger, the apices are more acute and the cells are strongly curved; each apex furnished with a pore; terminal vacuoles with a number of moving granules. Cells of medium size, about 6.8–8.5 times longer than their diameter, inner margin tumid in the median portion, gradually attenuated towards the apices, which are somewhat acute; cell wall smooth and colourless; chloroplasts with about eight ridges and a series of 5–9 pyrenoids; terminal vacuoles with 4–5 large moving granules. Length 170–186  $\mu$ ; breadth 20–26  $\mu$ . (Tab. 5, fig. 18.) Samples 42, 44.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

81. *C. spetsbergense* Borge var. *subafricanum* var. nova, affinis *C. spetsbergensi* var. *africano* Fritsch et Rich, sed differt et forma polorum et quod membrana cellulae striata est. Cellulae multo minores sunt; striarum dispositio cum *C. pritchardiano* Arch. valde congruit.

This is near *C. spetsbergense* Borge var. *africanum* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S.A., Vol. XVIII, 1930, p. 57, fig. 16C–G); but the shape of the apices is different, the cells are considerably smaller, and the cell wall is striated; striae similar to those found in *C. pritchardianum* Arch. Cells about 7–11 times longer than their diameter; cell wall yellowish or yellowish-brown, 35–40 striae visible across the cell; striae composed of fine punctae; chloroplasts with 6–10 ridges, and a central series of 4–9 pyrenoids; terminal vacuoles with a number of moving granules. Length 238–394  $\mu$ ; breadth 34–52  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 4, fig. 2.) Samples 13, 14, 15.

82. *C. striolatum* Ehrenb. var. *nylstromicum* var. nova, a typo cellulis brevioribus et 7–8-plo longioribus quam latioribus, polis plus hebetatis, membrana ad apices leviter incrassata et 13–18 striis praedita differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 122, Pl. XIII, figs. 7–16) in having shorter cells (about 7–8 times longer than their diameter) with blunter apices; cell wall slightly thickened at the apices, yellowish-brown, with 13–18 striae visible across the cell. Length 192–220  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 12  $\mu$ . (Tab. 5, fig. 9.) Samples 34, 35.

83. *C. striolatum* var. *subnylstromicum* var. nova, affinis var. *nylstromico* Claassen, sed differt striis inter se plus approximatis, plus minusve 19 in membrana dispositis, quae ad apices est incrassata.

Cells of medium size, about 7·5 times longer than their diameter, slightly curved, gradually attenuated towards the apices, which are obtusely-rounded; cell wall yellowish-brown, striated, with 19 striae visible across the cell; each chloroplast with 6–7 pyrenoids; terminal vacuoles with one large moving granule. Length 191  $\mu$ ; breadth 25  $\mu$ ; breadth of apices 12  $\mu$ . (Tab. 5, fig. 10.) Sample 54.

84. *C. subdecorum* spec. nova, affinis *C. decoro* Bréb., sed cellulis multo minoribus, margine ventrali pro parte maiore tumido, membrana striis carenti differt.

This is near *C. decorum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 184, Pl. XVII, figs. 7, 8; Pl. XXVIII, figs. 1–3), but the cells are considerably smaller, the inner margin of the cell is tumid for a longer distance and the cell wall is smooth. Cells of medium size, about 10·4–10·7 times longer than their diameter, curved, gradually attenuated towards the apices, which are obtusely-rounded; cell wall smooth and colourless; chloroplasts with a central series of three pyrenoids; terminal vacuoles with a number of moving granules. Length 203·5–208  $\mu$ ; breadth of apices 3·5–4  $\mu$ . (Tab. 5, fig. 11.) Sample 2.

85. *C. sublagoense* spec. nova, affinis *C. lagoensi* Nordst., sed cellulis angustioribus, forma poli et margine ventrali medio incrassato differt.

This species is near *C. lagoense* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 114, Pl. XI, figs. 5–7); but the cells are narrower, the shape of the apices differs and the inner margin is tumid in the median portion. Cells small, 7·5–8·5 times longer than their diameter, strongly curved, gradually attenuated towards the apices, which are somewhat acutely rounded; cell wall yellowish, striated, with about 11 striae visible across the cell. Length 160–168  $\mu$ ; breadth 20–21  $\mu$ . (Tab. 5, fig. 17.) Sample 12.

86. *C. subsiliqua* spec. nova, affinis *C. siliqua* W. et G. S. West, sed cellulis haud curvatis, margine ventrali recto, vel in media cellula leviter incrassata differt.

This somewhat resembles *C. siliqua* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 154, Pl. XIX, figs. 6–8); but the cells are straight. Cells of medium size, about 8·9·4 times longer than their diameter, more or less straight, inner margin straight or slightly tumid in the median portion, gradually attenuated towards the apices, which are slightly acute, and recurved in some specimens; cell wall smooth and colourless or straw-coloured; chloroplasts with about 10 ridges and a central series of 7–11 pyrenoids; terminal vacuoles with one large moving granule. Length 227–264  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 3–6  $\mu$ . (Tab. 5, fig. 7.) Samples 13, 14, 15.

87. *C. truncatum* spec. nova. Nulla affinitate notata. Cellulae plus minusve 6·2-plo longiores quam latiores. Margo ventralis in media cellula leviter incrassatus; poli hebetati. Membrana glabra, subflava et apicem versus leviter incrassata.

Cells of medium size, about 6·2 times longer than their diameter, slightly curved, inner margin somewhat concave, with the median portion slightly tumid, gradually attenuated towards the apices, which are truncate; cell wall smooth, yellowish and with a thickening at the apices; chloroplasts with about 10 ridges and a central series of four pyrenoids; terminal vacuoles large, with a number of moving granules. Length 224–225·5  $\mu$ ; breadth 36  $\mu$ ; breadth of apices 8–8·5  $\mu$ . (Tab. 5, fig. 6.) Sample 21.

88. *C. tumidum* Johnson. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 156, Pl. XIX, figs. 15–18.) Cells up to 9·9–13 times longer than their diameter. Length 102–114  $\mu$ ; breadth 9–10·5  $\mu$ ; breadth of apices 2·5–3  $\mu$ . (Tab. 6, fig. 15.) Sample 9.

*Geographical Distribution.*—England; Wales; Scotland; Norway; Nova Zembla; Siam; Celebes; Samoa; United States; Brazil; Paraguay; Patagonia; Japan; South Africa.

89. *C. tumidum* var. *angustum* var. nova, a typo speciei cellulis multo angustioribus et minus arcuatis differt. Cellula 15·5–22-plo longior quam lator.

Cells narrower than in the typical form, being about 15·5–22 times longer than their diameter, and less curved. Chloroplasts with about nine pyrenoids. Length 108–132  $\mu$ ; breadth 6–8  $\mu$ ; breadth of apices 1–1·3  $\mu$ . (Tab. 6, fig. 13.) Sample 3.

90. *C. venus* Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 137, Pl. XV, figs. 15–20.) Samples 4, 9, 21.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; North Russia; Faeroes; Nova Zembla; Greenland; Siberia; Central China; Japan; Ceylon; Burma; Siam; New Zealand; Central Africa; Azores; United States; Brazil; Patagonia; Switzerland; South Africa.

91. *C. venus* var. *inflatum* var. nova, a typo speciei differt quod margo ventralis cellulae media in parte leviter inflatus, membranaque achroa est vel subflava.

This differs from the typical form in that the inner margin is slightly tumid. Cells about 6·8–7·1 times longer than their diameter; cell wall smooth and colourless or yellowish; each chloroplast with a central series of two pyrenoids; terminal vacuoles with 1–2 moving granules. Length 68–70  $\mu$ ; breadth 9–10  $\mu$ ; breadth of apices 1·5–2·5  $\mu$ . (Tab. 6, figs. 16–18.) Samples 6, 11.

92. *C. warmbadianum* spec. nova, affinis *C. spinosporo* Hodgetts, sed cellulis brevioribus latoribusque, membrana cellulae ad apices non incrassata sed in medio margine ventrali leviter incrassata differt. Vacuolae terminales granulis paucis globosis seque moventibus praeditae.

Near *C. spinosporum* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 72, fig. 7A–B); but the cells are shorter and broader, the inner margin is slightly tumid in the median portion. The apices are without a cell wall thickening; and the terminal vacuoles are large, with a number of spherical moving granules. Cells small, 6·5–8 times longer than their diameter, curved, gradually attenuated towards the apices, which are slightly acutely rounded; cell wall smooth and colourless; chloroplasts with about eight ridges and 2–5 pyrenoids. Length 104–118  $\mu$ ; breadth 14–18  $\mu$ . (Tab. 6, fig. 2.) Samples 51, 52, 53, 54.

93. *C. warmbadianum* var. *porulosum* var. nova, a typo speciei differt quod apex uterque poro est praeditis et vacuolae terminales granula aliquot maiora, elongata, se moventia habent.

Each apex with a pore in the cell wall; terminal vacuoles with a number of large oblong moving granules. Cell wall colourless or yellowish-brown; chloroplasts with about six ridges and 3–4 pyrenoids. Length 104–120  $\mu$ ; breadth 12–15  $\mu$ . (Tab. 6, fig. 3.) Samples 58, 63, 64.

#### **Pleurotaenium Näg.**

94. *P. caffrorum* spec. nova, affinis *P. basiundato* W. et G. S. West, sed semicellulis iuxta tumorem basalem unica undulatione praeditis differt.

This comes near *P. basiundatum* W. & G. S. West (W. & G. S. West, Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 5, fig. 35); but the semicells have a single small undulation above the basal inflation. Cells of medium size, cylindrical, 25·8–30 times longer than their diameter; semicells gradually attenuated from base to apex, with a distinct basal inflation and a smaller undulation above it; apices obtusely rounded, bordered by a ring of tubercles, eight in number (four visible across the apex); cell wall punctate. Length 400–482  $\mu$ ; breadth at base of semicells 20  $\mu$ , at middle of semicells 15·5–16  $\mu$ , at apices 14·4–15  $\mu$ . (Tab. 7, fig. 6.) Sample 20.

95. *P. ehrenbergii* (Bréb.) De Bary. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 9–11; Pl. XXX, fig. 1.) Sample 20.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Denmark; Bornholm; Poland; North Russia; Nova Zembla; Siberia; Central China; India; Ceylon; Java; Sumatra; Samoa; Australia; New Zealand; Madagascar; East and West Africa; United States; Brazil; Patagonia; Japan; Switzerland; South Africa.

96. *P. ehrenbergii* var. *waterbergense* var. nova, affinis *P. ehrenbergii* var. *undulato* Schaarschm., sed differt et membrana luteo-fulva et quod semicellulis iuxta tumorem basalem undulato aut deest aut vix perspicui potest.

Near *P. ehrenbergii* var. *undulatum* Schaarschm. (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 18, fig. 28); but the semicells are without or with one very slight undulation above the basal inflation, cell wall yellowish-brown. Cells of medium size, 10·7–11·4 times longer than their diameter; semicells gradually attenuated from base to apex; apices bordered by a ring of pear-shaped tubercles, 4–8 in number (three or five visible across the apex); cell wall punctate. Length 416–428  $\mu$ ; breadth at base of semicells 36·4–41  $\mu$ , at middle of semicells 36–36·5  $\mu$ , at apices 26–29  $\mu$ . (Tab. 7, figs. 7, 8.) Sample 22.

97. *P. maximum* (Reinsch) Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 213, Pl. XXXI, figs. 1, 2.) Sample 61.

*Geographical Distribution.*—Wales; Scotland; France; Germany; Italy; Austria and Galicia; Hungary; Sweden; Japan (var.); Ceylon; Siam; Abyssinia; West Africa; Brazil; Ecuador (var.); Paraguay; Uruguay; South Africa.

98. *Pleurotaenium* species ad *P. ovatum* Nordst. Cells of medium size; 3·8–4 times longer than their diameter; semicells tumid, a little broader at the middle than at the base, attenuated from the middle to the apices, without a basal inflation; apices with one or two rings of tubercles, outer ring with 6–10 tubercles (4–6 visible across the apex) and the inner ring with 6–8 (3–4 visible across the cell); cell wall punctate. Length 313–356  $\mu$ ; breadth 83–90  $\mu$ ; breadth of isthmus 44–60  $\mu$ ; breadth of apices 25–28  $\mu$ . (Tab. 8, figs. 1, 2.) Samples 20, 42.

Since only the description of *P. ovatum* Nordst. was available, it is impossible to decide with certainty whether these specimens really belong to Nordstedt's species.

99. *P. pseudoehrenbergii* spec. nova, affinis *P. ehrenbergii* (Bréb.) De Bary, sed membrana glabra, apice utrinque tuberculo uno ornato, cellula iuxta tumorem basalem vix undulata differt.

This species is near *P. ehrenbergii* (Bréb.) De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 9–11; Pl. XXX, fig. 1); but the undulation above the basal inflation is very slight, there is one tubercle on each side of the apex, and the cell wall is smooth. Cells of medium size, subcylindrical, 12·4–12·5 times longer than their diameter; semicells with one distinct basal inflation and a small undulation above it, gradually attenuated towards the apices or slightly tumid and then gradually attenuated towards the apices; apices truncate, furnished with two tubercles. Length 408–448  $\mu$ ; breadth at base of semicells 31–34  $\mu$ , at middle of semicells 32–36  $\mu$ , at apices 24–26·5  $\mu$ . (Tab. 7, fig. 2.) Sample 24.

100. *P. trabecula* (Ehrenb.) Näg. var. *angustum* var. nova, a typo speciei cellulis multo angustioribus differt. Cellulae plus minusve 25·5–28·3-plo longiores quam latiores.

Cells narrower in proportion to their length than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 209, Pl. XXX, figs. 11–13); cells 25·5–28·3 times longer than their diameter. Apices obtusely rounded, without tubercles; cell wall punctate. Length 514–568  $\mu$ ; breadth at base of semicell 24–24·5  $\mu$ , at middle of semicell 20–21  $\mu$ , at the apices 16–19  $\mu$ . (Tab. 7, figs. 3–5.) Samples, 59, 60.

101. *P. trabecula* var. *barbaricum* var. nova, affinis *P. trabeculae* var. *recto* (Delp.) W. et G. S. West, sed differt quod apex cellulæ circulo 6 tuberculorum instructus est, cellulæ 14·9–16-plo longioribus quam latioribus, at quam variationis *rectum* (Delp.) W. et G. S. West paulo latiores sunt.

This closely resembles *P. trabecula* var. *rectum* (Delp.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 212, Pl. XXX, figs. 9, 10); but the cells are a little broader and the apices tuberculate. Cells of medium size, rather narrow and subcylindrical; semicells somewhat variable in shape, attenuated from base to apex or slightly tumid and then gradually attenuated to the apices, with a distinct basal inflation and one small undulation immediately above it; apices truncate, bordered by a ring of conical tubercles, six in number (four visible across the apex); cell wall smooth. Length 402·5–420  $\mu$ ; breadth at base of semicells 27–28  $\mu$ , at middle of semicells 23–27  $\mu$ , at apices 18–20  $\mu$ . (Tab. 7, fig. 1.) Sample 61.

102. *P. trabecula* var. *brevis* var. nova, a typo speciei cellulis valde brevioribus et apicibus tuberculis ornatis differt.

Cells shorter than in the typical form, apices with one tubercle. Length 359  $\mu$ ; breadth at base of semicell 28–28·5  $\mu$ , at middle of semicells 26–27·5  $\mu$ , and at apices 19–20  $\mu$ . (Tab. 7, fig. 10.) Sample 35.

103. *P. trochiscum* W. & G. S. West var. *galpinii* var. nova, a typo cellulis multo brevioribus et 7·2–8-plo longioribus quam latioribus, margine apicali circulo tuberculorum fere 8 ornato differt.

The cells are considerably shorter than in the typical form (W. & G. S. West, North American Desmidiæ, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 13, figs. 4, 5), and are about 7·2–8 times longer than their diameter; apices bordered by a ring of tubercles, about eight in number (five visible across the apex). Length 252–264  $\mu$ ; breadth at base of semicell 33–35  $\mu$ , at middle of semicell 30–32  $\mu$ , at apices 20–23  $\mu$ . (Tab. 8, fig. 7.) Sample 71.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

104. *P. truncatum* (Bréb.) Näg. var. *mattiei* var. nova, affinis *P. truncato* var. *granulato* West, sed cellulis multo brevioribus, semicellulis media in parte minus tumidis, margine apicali tuberculis paucioribus ornato differt.

Near *P. truncatum* var. *granulatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 7, 8); but the cells are much shorter, they are less tumid in the median part of the semicells and the apical margin has fewer tubercles. Cells small, about 7·2 times longer than their diameter; semicells with one basal inflation, slightly tumid in the middle of the semicells; apices bordered by a ring of tubercles, 2–4 in number (2–3 visible across the apex); cell wall punctate. Length 272  $\mu$ ; breadth at base of semicell 36  $\mu$ , at middle of semicell 38–39  $\mu$ , at apices 26–28  $\mu$ . (Tab. 8, fig. 6.) Sample 21.

105. *P. westiorum* spec. nova, affinis *P. monilifero* W. et G. S. West, sed apicibus cellulæ multo latioribus (modo non tam latis quam ad semicellulæ basim) differt.

This is near *P. moniliferum* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 5, fig. 32); but with broader apices (about as broad as at the base of the semicells). Cells large, 16–16·5 times longer than their diameter; semicells slightly tumid in the middle, with a slight basal inflation and two smaller undulations above it; apices truncate, and bordered by a ring of pear-shaped tubercles, 24 in number (13 visible across the apex); cell wall smooth. Length 796–800  $\mu$ ; breadth at base of semicells 48–50  $\mu$ , near base of semicells 44–46  $\mu$ , at middle of semicells 48–50  $\mu$ , near apices 40–44·5  $\mu$ , at apices 44–47  $\mu$ . (Tab. 7, fig. 9.) Sample 1.

Named after Messrs. W. & G. S. West.

**Tetmemorus Ralfs**

106. *T. laevis* (Kütz.) Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 222, Pl. XXXII, figs. 11–16.) Sample 2.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Italy; Norway; Sweden; Denmark; Bornholm; North and South Russia; Nova Zembla; Greenland; Singapore; Australia; New Zealand; Sandwich Islands; Azores; Dominica and Trinidad; West India; Brazil; Japan; Central Africa; Switzerland; United States; South Africa.

**Euastrum Ehrenberg**

107. *E. ansatum* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 27, Pl. XXXVI, figs. 10–13.) Fig. 8 shows a cell with dividing pyrenoids. (Tab. 9, fig. 8.) Samples, 3, 25, 34, 35, 36, 54, 56.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; North and South Russia; Faeroes; Iceland; Greenland; Central China; Japan; India; Ceylon; Burma (var.); Siam; Singapore; Sumatra; Java; Australia (form); New Zealand; Madagascar; East Africa; Azores; Sandwich Islands; United States; West Indies (var.); Brazil; Paraguay; Switzerland; South Africa.

108. *E. brasiliense* Borge var. *theronii* var. nova, affinis *E. brasiliensi* var. *africanum* Fritsch et Rich, sed cellularum a latere visarum forma differt quoniam semicellulae gradatim a basi apicem versus in cuneum deplanantur, neque tuberculi apparent.

This variety closely resembles *E. brasiliense* var. *africanum* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S.A., Vol. XI—Part 4, 1924, p. 330, fig. 9); but the shape of its semicells differs in being gradually attenuated from base to apex when seen in lateral view and the cells are slightly smaller. Cells of medium size, about 3·3–4 times longer than broad, deeply constricted; sinus narrowly linear, open towards the extremity; semicells pyramidate, basal angles rounded, lower part of lateral margins convex, upper part slightly concave; apex truncate with rounded angles, median incision not very deep; semicells tumid above the isthmus. Side view of semicell elongate-pyramidate; cell wall punctate. Length 107–108  $\mu$ ; breadth 32–35  $\mu$ ; breadth of isthmus 16–18  $\mu$ ; breadth of apex 22–23  $\mu$ . (Tab. 9, figs. 6, 7.) Sample 42.

Named after Mr. J. E. Theron of Rietfontein 288, Nylstroom.

109. *E. cuneatum* Jenner var. *minor* var. nova, cum typo speciei valde congruens, sed cellulis multo minoribus et incisura apicali multo angustiore bene distincta. Formae intermediae haud visae.

Cells much smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 25, Pl. XXXVI, fig. 9) and the apical incision is narrower. Cell wall finely punctate. Length 64–68  $\mu$ ; breadth 25–27  $\mu$ ; breadth of isthmus 9–12  $\mu$ ; thickness 20  $\mu$ . (Tab. 9, figs. 13, 14.) Sample 3.

110. *E. denticulatum* (Kirchn.) Gay. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 56, Pl. XXXIX, figs. 1–4.) Sample 24.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Galicia and Austria; Norway; Sweden; Bornholm; Finland; North Russia (var.); Iceland; Greenland; Central China; Ceylon; Siam; Singapore; Java; Australia (var.); New Zealand; Madagascar (var.); East and Central Africa; Azores; United States; West Indies; Brazil (var.); South Africa.

111. *E. divaricatum* Lund. var. *transvaalense* var. nova, cum typo speciei plus minusve congruens, sed paulo major; lobus apicalis dentibus duobus parvis, lobis lateralis infimus dentibus 3 parvis munitus. A latere visus processus supra isthmum glaber singularisque, sed a vertice bipartitus videtur.

The cells are slightly larger than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 42, Pl. XXXVIII, figs. 3, 4). Lower lateral lobules with three teeth and upper lobules with two teeth each; protuberance in each semicell above the isthmus single in lateral view and bilobulate in vertical view. Length  $52\ \mu$ ; breadth  $36\ \mu$  (with teeth  $41\ \mu$ ); breadth of isthmus  $8-9\ \mu$ ; breadth of apex  $20\ \mu$ . (Tab. 24, figs. 1-3.) Sample 39.

112. *E. divergens* Joshua var. *subbifidum* var. nova, affinis *E. divergenti* var. *bifido* Schmidle, sed praecipue forma lobi polaris et cellululis multo minoribus differt.

This variety has a greater resemblance to var. *bifidum* Schmidle (W. Schmidle, Engler Botan. Jahrb., Vol. 26, 1899, p. 44, Taf. II, fig. 34) than to Joshua's species (W. Joshua, Burmese Desmidiaceae, Journ. Linn. Soc. Bot., Vol. XXI, p. 640, Pl. 23, figs. 8, 9). However, it differs from Schmidle's variety in having relatively smaller cells and in the shape of the polar lobes. Cells small, about 1.2 times longer than broad, deeply constricted; sinus narrowly linear; semicells deeply 3-lobed; granules above central inflation in concentric arrangement; lateral lobes semifusiform, ends truncate, upper part of lobes elongated, lobes ornate with granules; polar lobe quadrate in lower part and widening at the apex. Length  $44-50\ \mu$ ; breadth  $36-42\ \mu$ ; breadth of isthmus  $10-12\ \mu$ ; maximum breadth of polar lobe  $20\ \mu$ . (Tab. 9, fig. 3.) Sample 20.

113. *E. divergens* var. *galpinii* var. nova, affinis *E. divergenti* var. *subbifido* Claassen, sed lobis lateralibus multo brevioribus latioribusque (quam prioris varietatis) et forma lobi polaris differt.

Upper part of lateral lobes shorter and broader than in var. *subbifidum* Claassen, and the shape of the polar lobe is different. Length  $55\ \mu$ ; breadth  $48\ \mu$  (with spines  $53\ \mu$ ); breadth of isthmus  $12\ \mu$ ; maximum breadth of polar lobe  $24\ \mu$ . (Tab. 29, fig. 3.) Sample 68.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

114. *E. dubitabilis* spec. nova, affinis *E. inermi* (Ralfs) Lund., sed discrepantia latitudinis ad basin et ad apicem multo minore bene distincta.

This species is near *E. inermis* (Ralfs) Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 24, Pl. XXXVI, figs. 7, 8); but the apices are not very much narrower than the base of the semicells and the cells are smaller. Cells small, about 2.1-2.2 times longer than broad, deeply constricted, sinus narrowly linear; semicells truncate-pyramidal, basal angles rounded; upper part of lateral margins somewhat concave; apex convex with a narrow median incision. Cell wall smooth. Length  $36.5-38\ \mu$ ; breadth  $16.5-18\ \mu$ ; breadth of isthmus  $7.5-8\ \mu$ ; breadth of apex  $12\ \mu$ . (Tab. 9, fig. 9.) Sample 24.

115. *E. elegans* (Bréb.) Kütz. var. *transvaalense* var. nova, affinis *E. eleganti* var. *madagascariensi* W. et G. S. West, sed forma apicis, incisura apicali multo angustiore, et tumore supra isthmum granulis 4 ornato bene distincta.

This is near *E. elegans* var. *madagascariense* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895-1901, Pl. 6, fig. 18); but differs in the shape of the apex, the apical incision is narrower and the protuberance above the isthmus contains four granules; the cells are slightly smaller than in Messis. West's variety. Length  $23-24\ \mu$ ; breadth  $16\ \mu$ ; breadth of isthmus  $3-4\ \mu$ ; breadth of apex  $6.5-8\ \mu$ . (Tab. 9, fig. 18.) Sample 20.



116. *E. galpinii* spec. nova, affinis *E. bidentato* Näg., sed lobo infimo laterali latiore quam lobo laterali supremo et margine apicali recto bene distincta.

Near *E. bidentatum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 39, Pl. XXXVII, figs 16–19); but the semicells are broader at the lower lateral lobule than at the upper lateral lobule; apical margin straight. The protuberance in the centre above the isthmus has four granules, and there are a few granules within the lateral lobules and the apex. Length 38  $\mu$ ; breadth 27  $\mu$ ; breadth of isthmus 8  $\mu$ ; breadth of apex 16  $\mu$ . (Tab. 29, fig. 1.) Sample 72.

117. *E. insulare* (Wittr.) Roy. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 68, Pl. XL, figs. 11–13.) Fig. 11 shows a cell during normal cell division and fig. 12 shows an abnormal one. (Tab. 9, figs. 10–12.) Samples 3, 24, 41.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Galicia in Austria; Norway; Sweden; Siam; United States; Japan; Switzerland; South Africa.

118. *E. obesum* Josh. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 29, Pl. XXXVI, figs. 16, 17.) Sample 52.

*Geographical Distribution*.—England; India; Burma; Singapore; Sumatra; Madagascar; South Africa.

119. *E. pseudovalidum* spec. nova, affinis *E. valido* W. et G. S. West, sed forma cellulae (praecipue ad basin semicellulae) haud multum sed plane differt. Dentes desunt.

Near *E. validum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 75, Pl. XL, figs. 21, 22); but differs in the shape of the basal part of the semicells, and in the absence of teeth. Cells small, about 1.5–1.6 times longer than broad, very deeply constricted, sinus narrowly linear; semicells truncate-pyramidate, lateral margins retuse, inferior angles inflated, superior angles somewhat acutely-rounded; apex broad, truncate-convex, emarginate. Semicells ovate in lateral view, and elliptic in vertical view. Cell wall smooth. Length 36–36.5  $\mu$ ; breadth 22–23  $\mu$ ; breadth of isthmus 8–9.5  $\mu$ ; breadth of apex 14–16  $\mu$ ; thickness 14  $\mu$ . (Tab. 9, figs. 15–17.) Sample 24.

120. *E. rostratum* Ralfs subsp. *umbonatum* W. & G. S. West var. *kranskopense* var. nova, affinis *E. rostrato* subsp. *umbonato* W. et G. S. West, sed sculptura membranae omnino diversa facile distinguenda.

The shape of the cells agrees with that of *E. rostratum* subsp. *umbonatum* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, fig. 16); but the cell wall sculpture differs. Apex of polar lobe convex, slightly undulate, with a deep and slightly open median notch, a short spine at each outer angle, and a thickening of the cell wall at each angle and below the apical notch. Cell wall punctate, punctae in rows. Length 50–54  $\mu$ ; breadth 30.5–32  $\mu$ ; breadth of isthmus 9–10  $\mu$ ; breadth of apex (without spines) 19–20  $\mu$ . (Tab. 9, figs. 4, 5.) Sample 61.

121. *E. spinulosum* Delponte subsp. *africanum* Nordst. (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 19, fig. 21.) Interlobular incisions slightly deeper than in the typical form. The Doornfontein specimens are considerably larger than the Mosdene specimens.

	<i>Doornfontein</i>	<i>Mosdene</i>
Length.....	78–84 $\mu$	60 $\mu$
breadth.....	68–72 $\mu$	56–60 $\mu$
breadth of isthmus.....	16–18 $\mu$	16 $\mu$

(Tab. 9, fig. 1; Tab. 29, fig. 2.) Samples 20, 68, 72.

*Geographical Distribution*.—Ceylon; South Africa.

122. *E. spinulosum* subsp. *africanum* var. *transvaalense* var. nova, affinis var. *duplo-minori* W. et G. S. West, sed forma lobi polaris et incisuris interlobularibus minus profundis distinguenda.

This differs from var. *duplo-minor* W. & G. S. West (W. & G. S. West, The Fresh-water Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 6, fig. 13) in the shape of the polar lobe, and in having shallower interlobular incisions and larger cells. Lobes more or less semicircular. Length 81–82  $\mu$ ; breadth 62.5–64  $\mu$ ; breadth of isthmus 15–15.5  $\mu$ . (Tab. 9, fig. 2.) Sample 6.

123. *E. schweickerdtii* spec. nova, ab omnibus generis speciebus distincta. Cellulae plus minusve tam longae quam latae. Semicellulae latae et obtuse pyramidales, margine apicali haud penitus inciso, supra isthmum dentes magno munitae; a latere visae planae et ovatae, a vertice ellipticae. Incisura apicali non profunda.

Cells small, about as long as broad, deeply constricted, sinus narrowly linear; semicells broad and flat, apical margin with a shallow median incision; with a tooth in the centre of each semicell above the isthmus. Side view of semicell flattened-ovate and oval in vertical view. Length 27  $\mu$ ; breadth 27–28  $\mu$ ; breadth of isthmus 7  $\mu$ ; thickness 12.5–13  $\mu$  (with teeth 18  $\mu$ ). (Tab. 9, figs. 19–21.) Sample 38.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

#### Micrasterias Ag.

124. *M. americana* (Ehrenb.) Ralfs var. *transvaalensis* var. nova, affinis typo speciei, sed lobo polari bifido et minore differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 117, Pl. LIII, figs. 4, 5; Pl. LIV, figs. 1–3) in the shape of the polar lobe. Polar lobe smaller than in the typical form, divided into two equal parts near the base (lateral view of semicell); apical margin with a slight median depression, angles produced into small divergent processes, each with a truncate-denticulate apex. Length 104–108  $\mu$ ; breadth 80–82.5  $\mu$ ; breadth of isthmus 17.5–18  $\mu$ ; maximum breadth of polar lobe 34–35  $\mu$ . (Tab. 16, fig. 4.) Sample 19.

125. *M. apiculata* (Ehrenb.) Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 97, Pl. XLVII, figs. 1, 2.) Polar lobe less exerted than in the typical form, apical angles with one spine and in some specimens without spines (the typical form has a pair of diverging spines). Some specimens slightly smaller than in the type. Length 210–236  $\mu$  (with spines 238–252  $\mu$ ); breadth 173–196  $\mu$  (with spines 186–217  $\mu$ ); breadth of isthmus 30–35  $\mu$ ; maximum breadth of polar lobe 64–80  $\mu$ . (Tab. 10, figs. 1–4.) Samples 25, 26, 38, 39.

*Geographical Distribution.*—England; France; Germany; Galicia in Austria; Italy; Sweden; Denmark; Bornholm; Finland; Poland; Russia; Japan; India; Burma; United States; First record for South Africa.

126. *M. crux-melitensis* (Ehrenb.) Hass. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 116, Pl. LIII, figs. 1–3.) The shape of the polar and lateral lobes differs slightly from those in the type. Cells slightly larger than in the typical form. Length 116–148  $\mu$  (with processes 128–168  $\mu$ ); breadth 118–126  $\mu$  (with spines 128–140  $\mu$ ); breadth of isthmus 20–23  $\mu$ ; maximum breadth of polar lobe 60–80  $\mu$ . (Tab. 18, figs. 1–14; Tab. 19, figs. 1–11; Tab. 20, figs. 1–6; Tab. 21, figs. 1–4; Tab. 22, figs. 1–6; Tab. 23, fig. 1.) Samples 66, 73, 74.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Galicia; Hungary; Italy; Sweden; Denmark; Poland; North and South Russia; Japan; North India; Ceylon; Burma; Celebes; Madagascar (var.); Central Africa; United States; Brazil; Switzerland; South Africa.

127. *M. crux-melitensis* var. *evoluta* W. B. Turner. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895-1901, Pl. 6, fig. 1.) Apical margin of the polar lobe with four small teeth; the lateral lobes with more subdivisions than in the typical form. Length 98-124  $\mu$  (with processes 113-144  $\mu$ ); breadth 101-116  $\mu$  (with teeth 111-128  $\mu$ ); breadth of isthmus 17-22  $\mu$ ; maximum breadth of polar lobe 36.5-45  $\mu$ . (Tab. 16, fig. 3; Tab. 17, fig. 1.) Samples 59, 74.

*Geographical Distribution*.—Madagascar; East India; South Africa.

128. *M. crux-melitensis* var. *transvaalensis* var. nova, typo speciei affinis, sed forma lobi polaris distincta et margine apicali paene recto quippe cui pars media leviter sit depressa.

This differs from the typical form in the shape of the polar lobe and in having an almost straight apical margin. Fig. 2 shows a cell shortly after division. Length 98-104  $\mu$  (with processes 110-113  $\mu$ ); breadth 86-98  $\mu$  (with spines 96-105  $\mu$ ); breadth of isthmus 16-19  $\mu$ ; maximum breadth of polar lobe 40-44  $\mu$ . (Tab. 16, figs. 1, 2.) Samples 24, 39.

129. *M. denticulata* Bréb. var. *africana* var. nova, affinis *M. denticulatae* Bréb. var. *angustosinuatae* Gay, sed lobulo polari latiore et brevior, incisuris minus altis bene distinguenda.

This variety is near *M. denticulata* var. *angustosinuata* Gay (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 108, Pl. L, fig. 5); but differs in having a shorter and broader polar lobe and shallower interlobular incisions. Some specimens with slightly exserted polar lobes (fig. 3). Length 234-248  $\mu$ ; breadth 196-220  $\mu$ ; breadth of isthmus 32-40  $\mu$ ; maximum breadth of polar lobe 74-95  $\mu$ . (Tab. 11, figs. 1-4; Tab. 12, fig. 1.) Samples 24, 25, 36, 39.

130. *M. denticulata* var. *subnotata* West forma *cornuta* forma nova, affinis var. *subnotatae* West, sed differt quod in lobis polaribus ad incisuram media utrimque bini sunt processus, quibus singuli denticuli insunt.

This differs from West's variety (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 108, Pl. L, fig. 7) in the polar lobe possessing a pair of processes on each side of the median notch; each process furnished with a small tooth. Cells slightly larger than var. *subnotata* West, and some lobules with more subdivisions. Length 208-256  $\mu$ ; breadth 180-216  $\mu$  (fig. 3, 156  $\mu$ ); breadth of isthmus 26-34  $\mu$ ; maximum breadth of polar lobe 44-52  $\mu$ . (Tab. 12, fig. 2; Tab. 13, figs. 1-3.) Samples 35, 38.

131. *M. decemdentata* (Näg.) Arch. (Nägeli, Gatt. einzell. Algen, 1849, p. 123, Tab. VI, H, fig. 2; F. E. Fritsch & F. Rich., Trans. Roy. Soc. S. Afr., Vol. XI—Part 4, 1924, p. 337, fig. 13.)

Cell wall smooth or punctate. Length 76.5-80  $\mu$ ; breadth 71.5-75.5  $\mu$  (with teeth 79-87  $\mu$ ); breadth of isthmus 15-17  $\mu$ ; maximum breadth of polar lobe 54-60.5  $\mu$ . (Tab. 16, fig. 5-7.) Samples 24, 39.

132. *M. decemdentata* var. *galpinii* var. nova. A typo speciei cellulis multo moniribus distincta. Formae intermediae haud visae.

Cells smaller than in the typical form; lateral angles of polar lobe acuminate. Length 48.5-52  $\mu$ ; breadth 47-51  $\mu$  (with teeth 56-63  $\mu$ ); breadth of isthmus 14-17  $\mu$ ; maximum breadth of polar lobe 40-44  $\mu$ . (Tab. 17, figs. 4-7.) Samples 65, 66, 68, 70, 71, 74.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

133. *M. groenewaldii* spec. nova, affinis *M. confertae* Lund., sed lobi polaris forma differt et membranae tres processus supra isthmum sunt conspicui.

This species is near *M. conferta* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 88–89, Pl. XLIII, figs. 4–9); but differs in the shape of the polar lobe and each semicell has three processes above the isthmus. Cells fairly large, a little longer than broad, sub-elliptic, deeply constricted, sinus and interlobular incisions open outwards; semicells 5-lobed; polar lobe with convex sides in its lower half, upper half cuneate, apex with a median notch, apical margin with 4–5 spines on each side of the median hollow; superior lateral lobes slightly larger than inferior lateral lobes, each divided into two lobules, lobules again divided, the four ultimate divisions of each lobe being emarginate (or sometimes tridenticulate); the small lobule adjoining the polar lobe usually tridenticulate. Semicells with three projections across the base, the middle one immediately above the isthmus larger than the lateral ones. Cell wall furnished with numerous minute spines, arranged in subradiate rows. Cell in vertical view fusiform, poles acute, with three projections on each side towards the middle. Length 184–190  $\mu$  (with spines 197–203  $\mu$ ); breadth 162–166  $\mu$  (with spines 170–174  $\mu$ ); breadth of isthmus 29–33  $\mu$ ; maximum breadth of polar lobe 61–68  $\mu$ . (Tab. 14, figs. 1–4.) Sample 46.

Named after Mr. L. J. Groenewald of Glentig, near Nylstroom.

134. *M. mahabuleshwarensis* Hobson var. *transvaalensis* var. nova, affinis *M. mahabuleshwarensis* var. *tetracero* W. et G. S. West, sed et forma lobi lateralis summi et dispositione dentium distincta. Margo lobi polaris duobus tantum processibus accessoriis est munitus, qui processibus *M. mahabuleshwarensis* similes sed multo breviores sunt.

Near *M. mahabuleshwarensis* var. *tetracerum* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, figs. 2–4); but differs in the shape of the upper lateral lobule, and in the arrangement of the small spines; polar lobe with only two accessory denticulate processes like those in var. *wallichii* (Grun.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 122, Pl. LIV, figs. 7, 8; Pl. LV, figs. 1–3); but the processes are considerably shorter. Apical margin of polar lobe furnished with four 3-pointed spines; each lobule of the lateral lobes furnished with singular or branched teeth; cell wall with a series of small teeth within the lateral lobes, across the lateral sides of the polar lobe and a few denticulations above the isthmus. Length 128  $\mu$  (with apical processes 148  $\mu$ ); breadth 112  $\mu$ ; breadth of isthmus 28  $\mu$ ; maximum breadth of polar lobe 84  $\mu$ . (Tab. 17, fig. 2.) Samples 65, 71.

135. *M. nylstromica* spec. nova, ex affinitate *M. confertae* Lund., sed et forma lobi polaris et lorum superiorum-lateralium differt et quod dentibus est ornata.

This species somewhat resembles *M. conferta* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 88–89, Pl. XLIII, figs. 4–9); but differs in the shape of the polar and superior lateral lobes; cell wall furnished with small spines. Cells large, broadly elliptic, deeply constricted, sinus narrowly linear; semicells 5-lobed, the interlobular incisions being narrowly linear and not very deep; polar lobe sub-cuneate, lateral angles downwardly curved, apex concave with a median notch, with three spines on each side of the median notch, and a large curved spine on the apical margin close to each angle, and a smaller spine near the extremity; lateral lobes unequal, superior lateral lobes considerably larger than the inferior lateral lobes, each lateral lobe divided into two more or less similar lobules and each lobule furnished with four marginal spines except the lobule adjoining the polar lobe; this lobule consists of a lower part with four marginal spines, and an upper part which consists of a two-spined lower half and a three-spined upper half, the latter with the top spine upwardly curved to overlap the apical angle of the polar lobe. Cell wall strongly punctate and furnished

with numerous minute spines, arranged in subradiate rows within the polar and lateral lobes. Length 264–276  $\mu$  (with spines 278–292  $\mu$ ); breadth 221–226  $\mu$  (with spines 233–241  $\mu$ ); breadth of isthmus 42–43  $\mu$ ; maximum breadth of polar lobe 102.5–108  $\mu$ . (Tab. 12, fig. 3; Tab. 13, fig. 4.) Samples 26, 39.

136. *M. pinnatifida* (Kütz.) Ralfs var. *transvaalensis* var. nova, affinis *M. pinnatifidae* var. *divisae* W. West formae *majori* Schmidle, sed differt et forma lobi polaris et quod tuberculi iuxta supra isthmum semicellulae desunt.

This differs from var. *divisa* W. West forma *major* Schmidle (W. Schmidle, Engler Botan. Jahrb., XXXII Bd., 1903, p. 73, Taf. II, fig. 7) in the shape of the polar lobes and in the absence of tubercles above the isthmus in each semicell. Length 108–116  $\mu$ ; breadth 104–116  $\mu$  (with teeth 114–124  $\mu$ ); breadth of isthmus 16–18  $\mu$ ; maximum breadth of polar lobe 74–92  $\mu$ . (Tab. 23, figs. 2, 3.) Samples 72, 74.

137. *M. sol* (Ehrenb.) Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 95, Pl. XLVI, figs. 1, 2.) These specimens are slightly smaller than in the typical form. Length 146–152  $\mu$ ; breadth 146–152  $\mu$ ; breadth of isthmus 18–20  $\mu$ ; maximum breadth of polar lobe 32–36  $\mu$ . (Tab. 15, fig. 6.) Samples 24, 25, 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Italy; Sweden; Denmark; United States; Jamaica; Brazil; First record for South Africa.

138. *M. tropica* Nordstedt var. *elongatissima* var. nova, affinis *M. tropicae* var. *elongatae* Schmidle, sed forma lobi polaris et dispositione dentium valde distincta. Cellula non duplo longior quam latior.

Near var. *elongata* Schmidle (W. Schmidle, Engler Botan. Jahrb., Vol. 26, 1899, p. 48, Taf. III, fig. 13); but the proportion of length to breadth is not 2:1, and the shape of the polar lobe and the arrangement of the spines differ. Cells longer than in var. *elongata* Schmidle, polar lobes shorter and with a distinct constriction below the apex, apical margin concave, with the angles produced into short processes. Cell wall furnished with seven series of small spines within the lateral lobes, and with a number of spines within the lateral margins of the polar lobe. Length 112–128  $\mu$ ; breadth 76–80  $\mu$ ; breadth of isthmus 16  $\mu$ ; maximum breadth of polar lobe 22–24  $\mu$ . (Tab. 17, fig. 3.) Sample 73.

139. *M. truncata* (Corda) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 82, Pl. XLII, figs. 1–8; Pl. XLV, figs. 5, 6.) These specimens are usually slightly shorter than broad. Length 124–132  $\mu$ ; breadth 124–138  $\mu$ ; breadth of isthmus 22.5–27  $\mu$ ; maximum breadth of polar lobe 82–100  $\mu$  (without spines 76–94  $\mu$ ). (Tab. 15, figs. 1–3.) Samples 24, 25, 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; Poland (form); North and South Russia; Faeroes; North India; Sandwich Islands; United States; Brazil; Switzerland; Japan; South Africa.

140. *M. truncata* var. *africana* Fritsch & Rich. (F. E. Fritsch & F. Rich, Trans. Roy. Soc. S. Afr., Vol. XI—Part 4, 1924, p. 338, fig. 14B and C.) Polar lobe somewhat variable in shape, cuneate or with subparallel sides in the lower portion and dilated in the upper portion. Length 134–152  $\mu$ ; breadth 124–136  $\mu$  (without spines 120–131  $\mu$ ); breadth of isthmus 25.5–26  $\mu$ ; maximum breadth of polar lobe 62–67  $\mu$ . (Tab. 15, figs. 4, 5.) Samples 24, 39.

*Geographical Distribution.*—South Africa.

141. *M. truncata* var. *minor* var. nova. Cellulae varietatis quam typi speciei aliquanto minores sunt. Formae intermediae haud visae.

These specimens are considerably smaller than in the type. Lateral angles of polar lobe acuminate; cell wall punctate. Length 57·5–60  $\mu$ ; breadth 56–60  $\mu$  (with spines 62–66  $\mu$ ); breadth of isthmus 12·5–13  $\mu$ ; maximum breadth of polar lobe 44–50  $\mu$ . (Tab. 17, fig. 8.) Sample 74.

#### Cosmarium Corda

142. *C. barbaricum* spec. nova, affinis *C. entochondro* W. et G. S. West, sed membrana cellulae glabra, sinu undulato et marginibus lateralibus magis undulatis facile distinguenda.

Near *C. entochondrum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 193, Pl. LXXXVII, fig. 17); but the sides have more undulations, the sinus is undulate and the cell wall is smooth. Cells small, about as long as broad, deeply constricted, sinus narrow and slightly crenate; semicells semicircular, apex truncate, basal angles furnished with a spine, sides convex and with 3–5 undulations, apical margin smooth. Chloroplasts axile, each with two pyrenoids. Length 20–28  $\mu$ ; breadth 19–28  $\mu$ ; breadth of isthmus 9–9·5  $\mu$ ; breadth of apex 10–14  $\mu$ . (Tab. 26, fig. 16.) Sample 24.

143. *C. binum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 246, Pl. LXXXVIII, figs. 10–14.) Some specimens with two horizontal series of granules below the conspicuous tumour immediately adjacent to the isthmus. (Tab. 27, figs. 1, 2.) Samples 7, 8, 12, 19, 20, 21, 23, 30, 35, 42, 43, 46, 47, 48, 51, 52, 53, 54, 57, 58, 65, 66, 72.

*Geographical Distribution.*—Scotland; Austria; Poland; Ceylon; Sumatra; Central Africa; Brazil; Australia; United States; South Africa.

144. *C. botesii* spec. nova, affinis *C. praemorso* Bréb., sed et dispositione granulorum omnino dissimili et membrana cellulae leviter undulata differt.

This species differs from *C. praemorsum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 196, Pl. LXXXIV, figs. 1–5) in the cell wall sculpture and in having slightly undulate margins. Cells of medium size, about 1·1–1·3 times as long as broad, deeply constricted, sinus narrowly linear; semicells semicircular, apex truncate, sides with 3–6 distinct and a number of obscure undulations, apical margin smooth or with about 3–4 undulations. Cell wall minutely punctate and with a number of large scattered granules in the upper part of the semicell. Each chloroplast contains two pyrenoids. Length 46–49  $\mu$ ; breadth 39–41  $\mu$ ; breadth of isthmus 11–12·5  $\mu$ . (Tab. 27, figs. 3, 4.) Samples 24, 25.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

145. *C. caffrorum* spec. nova, affinis *C. subundulato* Wille, sed semicellulis paulo applanatis, membranibus lateralibus solum undulatis, ore sinus denticulato, distinguitur.

This comes near *C. subundulatum* Wille (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 151, Pl. LIX, figs. 13–15); but the semicells are slightly flattened, only the lateral margins are undulate and there is a small spine at each basal angle. Cells small, 1·2–1·3 times longer than broad, deeply constricted, sinus narrow, linear or slightly undulate; semicells truncate-pyramidate, basal angles furnished with a spine, sides convex with 3–4 undulations. Cell wall slightly thickened at the apex; chloroplasts axile, with two pyrenoids each. Length 33–42·5  $\mu$ ; breadth 26–33  $\mu$ ; breadth of isthmus 8·5–10·5  $\mu$ . (Tab. 25, figs. 7, 8.) Sample 24.

146. *C. connatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 25, Pl. LXVII, figs. 15–17.) Sample 71.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Galicia; Italy; Norway; Sweden; Denmark; Bornholm; Finland; South Russia; Japan; India; Burma; Singapore; Sumatra (form); Java; Central Africa; Sandwich Isles; United States; Guiana; Brazil; Switzerland; South Africa.

147. *C. connatum* var. *subellipticum* var. nova, affinis *C. connato* var. *truncato* West, sed semicellulis plus deplanatis et sinu aliquanto profundiore differt.

This is closely allied to *C. connatum* var. *truncatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 26, Pl. LXVII, fig. 18); but differs in the character of the sinus and in having more flattened semicells. Cells of medium size, about 1.3–1.4 times as long as broad, deeply constricted, sinus widely open; semicells subelliptic with a flattened apex. Cell wall smooth and colourless and thickened at the apices. Chloroplasts with two pyrenoids each. Length 48–49.5  $\mu$ ; breadth 37–40  $\mu$ ; breadth of isthmus 14–17  $\mu$ ; breadth of apex 14–17  $\mu$ . (Tab. 27, fig. 8.) Sample 24.

148. *C. contractum* Kirchn. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 170, Pl. LXI, figs. 23–25, 34.) Sample 24.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Germany; Galicia in Austria; Poland; Norway; India; Ceylon; Burma; Siam; Australia; Central Africa; Madagascar; United States; Patagonia; First record for South Africa.

149. *C. contractum* forma *jacobsenii* (Roy) W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 171, Pl. LXI, fig. 26.) Sample 71.

*Geographical Distribution.*—England; Scotland; Germany; Galicia in Austria; Norway; Sweden; Denmark; Bornholm; Central Africa; South Africa.

150. *C. contractum* var. *ellipsoideum* (Elv.) West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 172, Pl. LXI, figs. 28, 35.) Sample 38.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Germany; Sweden; Finland; North Russia; Faeroes; Iceland; Australia; Switzerland; South Africa.

151. *C. contractum* var. *pseudogartanense* var. nova. Cellulae plus orbiculatae quam in typo, membrana marginis apicalis incrassata.

The semicells are more rounded than in the typical form; cell wall thickened at the apices and punctate. This is near var. *gartanense* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 173, Pl. LXI, fig. 27) in shape; but the apex is not retuse-emarginate. Length 47–48  $\mu$ ; breadth 30–31  $\mu$ ; breadth of isthmus 14  $\mu$ . (Tab. 24, fig. 6.) Sample 39.

152. *C. debaryi* Arch. var. *minor* var. nova. Differt a typo speciei cellulis dimidio minoribus et in medio margine apicali incisura minime profunda. Formae intermediae haud visae.

These specimens are about half the size of the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 61, Pl. LXX, figs. 14–16; Pl. XCIII, fig. 2); apical margin with a shallow median incision. Length 46.5–48  $\mu$ ; breadth 22.5–23  $\mu$ ; breadth of isthmus 17  $\mu$ ; thickness 18–20  $\mu$ . (Tab. 25, figs. 15, 16.) Sample 39.

153. *C. decoratum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895-1901, Pl. 7, fig. 21.) Cell wall sculpture only distinct in the median parts of the front, vertical and side views of the semicell as the semicell is not flat but ovate in side view and elliptic in vertical view. In this respect I do not agree with Messrs. West's figures. Samples 30, 46.

*Geographical Distribution.*—Madagascar; First record for South Africa.

154. *C. decoratum* var. *galpinii* var. nova, a typo speciei cellulis latioribus et membranae sculptura in media tantum parte conspicua differt.

Cells broader than in the type; cell wall sculpture only distinct in the median part of the semicell; cells about 1.2 times longer than broad. Length 84  $\mu$ ; breadth 70  $\mu$ ; breadth of isthmus 24  $\mu$ . (Tab. 29, fig. 11.) Sample 72.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

155. *C. decoratum* var. *waterbergense* var. nova, a typo speciei hiatibus, quibus sculptura membranae consistit, plus confertis—qui ornatus non per totam superficiem membranae apparet—et magnis granulis in ordinem circum marginem cellulae dispositis bene distincta.

Cell wall sculpture only distinct in the median part of the semicells and with a series of fairly large granules situated on the margins; cells about 1.4 times longer than broad. Length 73-82  $\mu$ ; breadth 52-60.5  $\mu$ ; breadth of isthmus 20-23.5  $\mu$ . (Tab. 24, fig. 11.) Sample 54.

156. *C. galpinii* spec. nova, affinis *C. isthmochondro* Nordst., sed differt quod margo apicalis duorum ordinum—quorum alter tantum a fronte videri potest—granulis quaternis magnis est ornatus; porro membranae sculptura toto caelo differt.

This species is near *C. isthmochondrum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 173, Pl. LXXXI, fig. 7); but differs in that the apical margin contains two series of four large granules each (only one series visible in front view of semicell), and in the cell wall sculpture. Cells small, about 1.2 times as long as broad, fairly deeply constricted, sinus narrowly linear; semicells truncate-semicircular, apical margin straight, with a series of four large granules; cell wall colourless or yellowish-brown, punctate, and with a number of scattered granules. Vertical view more or less elliptic, with two circular series of granules in the centre, two series of four granules each on each side, and three smaller granules arranged in a triangle within the poles. Length 36  $\mu$ ; breadth 29  $\mu$ ; breadth of isthmus 14  $\mu$ ; thickness 24  $\mu$ . (Tab. 29, figs. 5, 6.) Samples 65, 70.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

157. *C. granatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 186, Pl. LXIII, figs. 1-4.) Sample 43.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Poland; Hungary; Italy; Bosnia; Portugal; Norway; Sweden; Denmark; Bornholm; Finland; North and South Russia; Siberia; Faeroes; Iceland; Greenland; Spitzbergen; Nova Zembla; Afghanistan; Kordofan; India; Ceylon; Burma; Central China; New Zealand; Australia; West, Central and East Africa; Madagascar; United States; West Indies; Ecuador (var.); Brazil; Paraguay (var.); Argentina; Patagonia; Switzerland; South Africa.

158. *C. granatum* var. *africanum* Fritsch. (F. E. Fritsch & E. Stephens, Trans. Roy. Soc. of S. Afr., Vol. IX, 1921, p. 32, fig. 11C.) (Tab. 25, figs. 17, 18; Tab. 29, fig. 4.) Samples 39, 74.

*Geographical Distribution.*—South Africa; Switzerland.



159. *C. hammeri* Reinsch. var. *minor* var. nova, a typo speciei cellulis dimidio minoribus differt. Formae intermediae haud visae.

Cells less than half the size of the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 181, Pl. LXXII, figs. 20, 21); and about 1.3–1.6 times longer than broad. Length 16–19  $\mu$ ; breadth 12  $\mu$ ; breadth of isthmus 3–4  $\mu$ . (Tab. 24, fig. 13.) Sample 24.

160. *C. impressulum* Elfv. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 86, Pl. LXXII, figs. 14–18.) Some specimens are considerably smaller than in the typical form, viz.: length 16–21  $\mu$ ; breadth 12–15  $\mu$ ; breadth of isthmus 3–4  $\mu$ . (Tab. 24, figs. 14, 15.) Samples 7, 19, 42.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Bohemia and Galicia in Austria; Denmark; Finland; Faeroes; Greenland; Bosnia; Siberia; Japan; India; New Zealand; Australia; West and East Africa; Azores; United States; Brazil; Argentina; Patagonia; South Africa.

161. *C. laeve* Rabenh. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 99, Pl. LXXIII, figs. 8–19.) Samples 37, 38.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Galicia in Austria; Hungary; Italy; Spain; Portugal; Norway; Poland; North Russia; Faeroes; Nova Zembla; India; Ceylon; Burma; Siam; Australia; Madagascar; Central and East Africa; Azores; United States; West Indies; Ecuador; Uruguay; Argentina; Patagonia; Switzerland; South Africa.

162. *C. laeve* var. *majus* var. nova. Differt a typo speciei cellulis multo maioribus. Formae intermediae haud visae.

This differs from the typical form in having much larger dimensions. Cells 1.5–1.7 times longer than broad. Length 48–50  $\mu$ ; breadth 29–32  $\mu$ ; breadth of isthmus 10–11  $\mu$ . (Tab. 24, fig. 7.) Samples 37, 39.

163. *C. maximum* (Börg.) W. & G. S. West var. *minor* West. (W. & G. S. West, Welwitsch's African Freshwater Algae, Journ. of Bot., Vol. XXXV, 1897, p. 114, Tab. 367, fig. 21.) Cells slightly larger than in the typical form. Length 69.5–70  $\mu$ ; breadth 55.5–58  $\mu$  (with spines 60.5–66  $\mu$ ); breadth of isthmus 12–14.5  $\mu$ . (Tab. 27, fig. 5.) Sample 24.

*Geographical Distribution.*—Central Africa; First record for South Africa.

164. *C. meneghinii* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 90, Pl. LXXII, figs. 29–32.) Sample 38.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria (and Galicia); Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; Poland; Lapland; North, Central and South Russia; Faeroes; Iceland; Nova Zembla; Greenland; Siberia; Mongolia; China; Japan; India; Ceylon; Siam; Chatham Island; New Zealand; Madagascar; Central Africa; Azores; United States; Porto Rico; Jamaica; Brazil; Ecuador; Paraguay; Argentina; Patagonia; Switzerland; South Africa.

165. *C. nanum* spec. nova, affinis *C. pseudarcto* Nordst., sed cellulis ad apicem leviter deplanatis et sinu profunde constricto distincta.

Near *C. pseudarctoum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 32, Pl. LXVIII, figs. 12–14; Pl. LXXII, figs. 40, 41); but the cells are slightly depressed at the apices and are deeply constricted at the sinus. Cells very small, 1.7–1.8 times as long as broad; sinus narrowly linear; semicells semicircular with a slightly

truncately-rounded apex. Cell wall smooth. Each chloroplast contains one central pyrenoid. Length 14–20  $\mu$ ; breadth 8–12  $\mu$ ; breadth of isthmus 3–4.5  $\mu$ . (Tab. 24, fig. 12.) Sample 19.

166. *C. norimbergense* Reinsch. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 52, Pl. LXIX, figs. 25–27.) Sample 38.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Germany; Hungary; Sweden; Bornholm; Finland; India; Ceylon; Siam; New Zealand; Central Africa; Japan; First record for South Africa.

167. *C. nylstromicum* spec. nova., affinis *C. năgeliano* Bréb., sed cellulis multo maioribus, numero undulationum membranae et forma angulorum basialium semicellularum differt.

This somewhat resembles *C. năgelianum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 14, Pl. LXVI, fig. 12); but differs in the number of undulations, the delineation of the basal angles of the semicells, and in having larger dimensions. Cells of medium size, about 1.2–1.3 times longer than broad, deeply constricted, sinus narrowly linear with a slightly dilated extremity; semicells truncate-pyramidate, basal angles rounded, sides with 4–5 undulations, apical margin with four undulations; cell wall smooth and colourless. In each semicell there is one axile chloroplast containing a single central pyrenoid. Length 41–49  $\mu$ ; breadth 33–36  $\mu$ ; breadth of isthmus 18–19.5  $\mu$ ; breadth of apex 18–20  $\mu$ . (Tab. 26, fig. 13.) Sample 19.

168. *C. obliquum* Nordst. forma *minima* West. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 51, Pl. LXIX, figs. 22, 23.) Sample 27.

*Geographical Distribution*.—England; Norway; First record for South Africa.

169. *C. obsoletum* (Hantzsch) Reinsch var. *transvaalense* var. nova. Hae cellulae praeter membranae crassationem ad semicellularem basium angulos, etiam alteram membranae crassationem ad apicem ostendunt, polis plus quam in typo applanatis.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 133, Pl. LVI, figs. 1–3) in the cell wall being thickened at the apices; semicells more depressed. Length 40–46  $\mu$ ; breadth 46–50  $\mu$ ; breadth of isthmus 12–13  $\mu$ . (Tab. 28, figs. 1–3.) Samples 24, 25, 27, 38, 39, 41.

170. *C. orthostichum* Lund. var. *compactum* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 169, Pl. LXXX, fig. 22.) Samples 7, 43.

*Geographical Distribution*.—Scotland; First record for South Africa.

171. *C. orthostichum* var. *pseudopumilum* var. nova, affinis var. *pumilo* Lund., sed semicellulis minus applanatis et sculptura membranae toto caelo differt.

This differs from var. *pumilum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 169, Pl. LXXX, figs. 20, 21) in having less flattened semicells and in the sculpture of the cell wall. Cells small, a little longer than broad, deeply constricted, sinus open outwards; semicells subelliptic, with a somewhat flattened apex. Cell wall granulate, granules without any definite arrangement; chloroplasts with one pyrenoid each. Length 23–29  $\mu$ ; breadth 19.5–24  $\mu$ ; breadth of isthmus 8.5–12  $\mu$ . (Tab. 25, fig. 3.) Sample 3.

172. *C. orthostichum* var. *transvaalense* var. nova, a typo speciei numero et dispositione granulorum in membrana et sinu angustiore differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 167, Pl. LXXX, figs. 12–19) in the number and disposition of the granules, and in having a narrower sinus. Cell wall granulate, granules arranged in 9–10 vertical

series, with 4–6 granules in each series; granules more or less of the same size. Length 19–22  $\mu$ ; breadth 16–18  $\mu$ ; breadth of isthmus 5.5–6  $\mu$ . (Tab. 26, fig. 8.) Samples 20, 22.

173. *C. pachydermum* Lund. var. *waterbergense* var. nova, affinis *C. pachydermo* var. *aethiopico* W. et G. S. West, sed cellulis aliquanto minoribus et ad apicem deplanatis differt.

This is near *C. pachydermum* var. *aethiopicum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 140, Pl. LVII, figs. 8, 9); but differs in having smaller dimensions and flattened apices and in the cell wall sculpture. Cell wall more or less regularly granulate, granules small. Length 43–54  $\mu$ ; breadth 36–46  $\mu$ ; breadth of isthmus 21–25  $\mu$ . (Tab. 28, fig. 4.) Samples 18, 51, 52, 53, 54, 57, 58, 72.

174. *C. pseudamoenum* Wille. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 31, Pl. CII, figs. 7–9.) (Tab. 29, figs. 9, 10.) Samples 66, 70, 71.

*Geographical Distribution.*—England; Ireland; Germany; Galicia in Austria; Sweden; Bornholm; Finland; North Russia; Central China; New Zealand; East Africa; United States; Brazil; First record for South Africa.

175. *C. pseudoprotractum* spec. nova, affinis *C. protracto* (Näg.) De Bary, sed lobo polari amplius rotundato, forma cellulae a latere visae et dispositione granulorum differt.

Near *C. protractum* (Näg.) De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 181, Pl. LXXXII, fig. 8; Pl. XCLV, figs. 4, 5); but the shape of the apical lobe, the shape of the semicells in lateral view and the arrangement of the granules differ. Cells of medium size, longer than broad, deeply constricted, sinus narrowly linear with a slightly dilated extremity; semicells 3-lobed, with a subrectangular incision between the apical lobe and each lateral lobe, lateral and apical lobes broadly rounded and fairly short; lobes granulate, granules large and arranged in 3–4 more or less distinct horizontal rows and in somewhat irregular vertical rows. Side view of semicell subovate; vertical view rather narrowly elliptic, with a smooth protuberance at the middle on each side. Chloroplasts axile, with one pyrenoid each. Length 48  $\mu$ ; breadth 32–34  $\mu$ ; breadth of isthmus 12.5–14  $\mu$ ; thickness 20–21  $\mu$ ; breadth of apical lobe 16–19  $\mu$ . (Tab. 25, figs. 4–6.) Samples 9, 11.

176. *C. pseudopyramidatum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 201, Pl. LXIV, figs. 9–12.) Samples 19, 25.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Poland; Hungary; Italy; Norway; Sweden; Finland; North and South Russia; Siberia; Spitzbergen; Nova Zembla; Faeroes; Ceylon; Siam; New Zealand (var.); Australia; West, Central and East Africa; Madagascar; United States; West Indies; Brazil; Paraguay; Uruguay; Switzerland; Mozambique; South Africa.

177. *C. pseudotaxichondrum* Nordst. var. *atomicum* var. nova, affinis *C. pseudotaxichondro* var. *siamensi* W. et G. S. West, sed membrana haud undulata, cellula a vertice visa ad polum utrimque denticulo ornata distincta est.

This variety is near var. *siamense* W. & G. S. West (W. & G. S. West, Siamese Desmids, Botanisk Tidsskrift, Bind 24, 1902, p. 173, Tavle 3, fig. 26); but there are no undulations; each pole has a small tooth in vertical view. Length 31–32  $\mu$ ; breadth 28–28.5  $\mu$ ; breadth of isthmus 11–12  $\mu$ ; thickness 16–18  $\mu$ . (Tab. 25, figs. 1, 2.) Sample 3.

178. *C. pyramidatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 199, Pl. LXIV, figs. 5–7.) Samples 24, 25, 27, 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; South Russia; India; Ceylon; Burma (form); West Africa; Azores; United States; Brazil; Paraguay; Uruguay (form); Argentina; Patagonia (form); Switzerland; Japan; Mozambique; South Africa.

179. *C. pyramidatum* var. *elongatum* var. nova. Differt a typo speciei cellulis dimidio longioribus, nulla latitudinis discrepantia.

The cells are about one and a half times longer than the typical form; but the difference in breadth is slight. Cells very large, slightly more than twice as long as broad; sides of semicells almost straight, apex slightly concave, cell wall with a thickening at the apices and densely punctate. Length 149–150  $\mu$ ; breadth 69·5–70  $\mu$ ; breadth of isthmus 26–28  $\mu$ . (Tab. 27, fig. 10.) Sample 22.

180. *C. pyramidatum* var. *majus* var. nova, a typo speciei et cellulis aliquantulo maioribus et quod membranae cellularum in apicibus crassiores fiunt, et semicellularis non ita constanter truncatis et pyramidalibus differt.

The shape of the cells in front view is somewhat variable, the cells are larger than in the typical form, and the cell wall is densely punctate and thickened at the apices. This may also be compared with *C. pseudopyramidatum* Lund. subsp. *maximum* Börgesen forma *minor* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XI—Part 4, 1924, p. 347, fig. 17–E–G) to which it has a great resemblance as far as the shape of its semicells in front view is concerned, but from which it differs in having larger dimensions, in having no thickening of the membrane in the region above the isthmus, as seen in lateral and vertical views in the majority of the specimens investigated, and in the individuals always containing two pyrenoids per semicell. Length 118–130  $\mu$ ; breadth 70–76  $\mu$ ; breadth of isthmus 26–30  $\mu$ . (Tab. 24, figs. 4, 5.) Samples 38, 39, 41.

181. *C. quadratum* Ralfs var. *africanum* Fritsch. (F. E. Fritsch & E. Stephens, Trans. Roy. Soc. of S. Afr., Vol. IX, 1921, p. 33, fig. 12.)

Cells about 1·6–1·8 times as long as broad; basal angles of semicells less prominent than in the type; cell wall distinctly punctate. Length 41–64  $\mu$ ; breadth 24–36  $\mu$ ; breadth of isthmus 8–10  $\mu$ . (Tab. 24, fig. 10.) Sample 24.

*Geographical Distribution.*—South Africa.

182. *C. reniforme* (Ralfs) Arch. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 157, Pl. LXXIX, figs. 1, 2; Pl. LXXXII, fig. 15.) Specimens usually slightly smaller than in the typical form. Length 40–46  $\mu$ ; breadth 38–48  $\mu$ ; breadth of isthmus 13–17  $\mu$ . (Tab. 28, figs. 5, 6.) Samples 4, 7, 19, 30, 32, 42, 47, 48, 51, 57.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria and Galicia; Italy; Norway; Sweden; Faeroes; Greenland; Spitzbergen; United States; Brazil; Argentina; South Africa.

183. *C. schweickerdtii* spec. nova, affinis *C. cucumi* (Corda) Ralfs. Margo apicalis membranae crenis—binis vel ternis—ornatus est; iuxta marginem apicalem bina vel terna granula adsunt conspicua ac sub granulis 3 vel 4 depressiones ellipticae.

Near *C. cucumis* (Corda) Ralfs (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 152, Pl. LIX, figs. 18–20); but the apical margin has 2–3 crenations, there are 2–3 large granules within the median part of the apex and 3–4 elliptical depressions just below the granules. Cells small, about 1·4 times longer than broad, deeply con-

stricted, sinus narrowly linear; semicells more or less semicircular. Cell wall punctate. Length 38–40  $\mu$ ; breadth 28  $\mu$ ; breadth of isthmus 10–11  $\mu$ . (Tab. 29, figs. 7, 8.) Sample 71.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

184. *C. sexangulare* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 81, Pl. LXXII, fig. 3.) (Tab. 25, fig. 9.) Samples 24, 25.

*Geographical Distribution*.—Scotland; Germany; Galicia in Austria; Hungary; Sweden; Poland; North and South Russia; Japan; Australia; East Africa; Azores; United States; South Africa.

185. *C. sexnotatum* Gutw. var. *simplex* var. nova, affinis *C. sexnotato* var. *tristriato* (Lütkem.) Schmidle, sed membrana cellulae omnino glabra differt.

Near var. *tristriatum* (Lütkem.) Schmidle (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 228, Pl. LXXXVI, figs. 8, 9); but the cell wall is smooth and without granules. Sides of semicells convex and 5-crenate, apex truncate and straight. Length 28  $\mu$ ; breadth 22  $\mu$ ; breadth of isthmus 10  $\mu$ ; breadth of apex 11–12  $\mu$ . (Tab. 24, figs. 8, 9.) Sample 19.

186. *C. speciosum* Lund. var. *simplex* Nordst. forma *africanum* forma nova, a varietate *simplici* Nordst. forma genuinum numero granulorum et cellula apicem versus minus deplanata differt.

These specimens form a group within the limits of Nordstedt's variety (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 250, Pl. LXXXIX, fig. 6): but which nevertheless can be distinguished by the number of granules and less attenuated apices. Margins of semicells crenate, crenations 14–16 (four apical and 5–6 lateral); granulate within the margins, granules in regular radial series, seven granules in each series, basal vertical series of granules absent. Chloroplasts axile, with one pyrenoid each. Length 44–48  $\mu$ ; breadth 26–28  $\mu$ ; breadth of isthmus 16–18  $\mu$ . (Tab. 26, figs. 9, 10.) Sample 19.

187. *C. subauriculatum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, fig. 31.) Sample 71.

*Geographical Distribution*.—Madagascar; South Africa.

188. *C. subconnatum* spec. nova, a latere visa affinis *C. connato* Bréb. var. *truncato* West, sed a fronte visa cellulis plus deplanatis et pyramidalibus distincta.

In lateral view, this species resembles the front view of *C. connatum* Bréb. var. *truncatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1908, p. 26, Pl. LXVII, fig. 18); but it has rounded apices; the semicells in front view are somewhat truncate-pyramidate. Cells of medium size, about 1.1–1.3 times longer than broad, moderately constricted, sinus very widely open with an obtuse apex; semicells transversely subelliptic with a broad base, apex flattened. Cell wall punctate with two series of minute punctae on each side of the isthmus. Side view of semicell subovate. Chloroplasts containing two pyrenoids each. Length 42–66  $\mu$ ; breadth 34–56  $\mu$ ; breadth of isthmus 24–38  $\mu$ . (Tab. 26, figs. 14, 15.) Sample 20.

189. *C. subcostatum* Nordst. var. *warmbadianum* var. nova, differt a typo speciei dispositione et numero granulorum in membrana.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 236, Pl. LXXXVII, figs. 3–5) in the number and arrangement of the granules. Sides of semicells convex and crenulate, with about two small entire crenulations near the basal angles and 3–5 emarginate (or bigranulate) crenulations on the rest of the

lateral margin; apex truncate and with a few small undulations; within the margin minutely granulate, granules radially and concentrically disposed; opposite each of the three crenulations at the base of the semicell is a series of three granules, the two series next to the margin opposite the next crenulation binate and the series nearest the centre single, the first series next to the margin opposite the following two crenulations binate and the second and third series single; next to the apex two series of two granules each; in the centre, above the isthmus with a granulated tumour, granules in three vertical series of three each. Length 32–36  $\mu$ ; breadth 27–30  $\mu$ ; breadth of isthmus 10–12  $\mu$ ; breadth of apex 12–13  $\mu$ . (Tab. 25, figs. 12–14.) Sample 48.

190. *C. subtumidum* Nordst. var. *klebsii* (Gutw.) W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 193, Pl. LXIII, figs. 21–23.) Sample 7.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Germany; Galicia in Austria; South Africa.

191. *C. subtumidum* var. *theronii* var. nova, affinis *C. subtumido* var. *klebsii* (Gutw.) W. et G. S. West, sed cellulis triplo maioribus, membrana cellulae densis punctis distincta, sinu foras aperto differt.

Near var. *klebsii* (Gutw.) W. & G. S. West; but differs in the cells being about thrice the size of var. *klebsii*, and in having an open sinus and a densely punctated cell wall. Cells very large, about 1·2–1·4 times as long as broad, deeply constricted, sinus open; semicells broadly pyramidate with truncate apices, basal angles rounded. Cell wall very densely punctate, with a thickening at the apex of each semicell. Each chloroplast with two pyrenoids. Length 141·5–148  $\mu$ ; breadth 104–124  $\mu$ ; breadth of isthmus 42–44  $\mu$ ; breadth of apices 40–43·5  $\mu$ . (Tab. 27, fig. 9.) Samples 42, 72.

Named after Mr. J. E. Theron of Rietfontein 288, near Nylstroom.

192. *C. tetragonum* (Näg.) Arch. var. *transvaalense* var. nova, affinis *C. tetragono* var. *eleganti* (Roy et Biss.) W. et G. S. West, sed numero undulationum membranae, sculptura eiusdem, et cellula apicem versus minus vel omnino non deplanata differt.

Near var. *elegans* (Roy et Biss.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 20, Pl. LXVI, fig 27); but differs in the number of undulations, in the cell wall sculpture and in the semicells, which are less attenuated towards the apices. Cells about 1·6–1·7 times as long as broad; sides of semicells (including the angles) 7–8-undulate, apex with 8–10 undulations; with a series of three granules within each lateral undulation and a series of five granules within each apical undulation. In each semicell there is one axile chloroplast containing two pyrenoids. Length 44–51  $\mu$ ; breadth 29–34  $\mu$ ; breadth of isthmus 17–20·5  $\mu$ ; breadth of apices 21–32  $\mu$ . (Tab. 26, figs. 11, 12.) Sample 19.

193. *C. trachypleurum* Lund. var. *pseudonatalensis* var. nova, affinis *C. trachypleuro* var. *natalensi* Fritsch et Rich, sed hic spinarum vel maxima pars in margine sita, quum in Fritschii et Richii varietate aliquantulum introrsum ab margine absit.

This differs from var. *natalensis* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XI—Part 4, 1924, p. 349, fig. 18–I–J) in having pronounced spines on the margins and about three series of spines within the margins. Length 60–64  $\mu$  (with spines 67–69  $\mu$ ); breadth 48–51·5  $\mu$  (with spines 56–57  $\mu$ ); breadth of isthmus 18–19  $\mu$ . (Tab. 27, fig. 7.) Sample 24.

194. *C. trachypleurum* var. *pseudonatalensis* forma *irregularis* forma nova. Dentes temere dispositi. Semicellula dentibus ternis sub margine apicali glabro munita est.

In these specimens the spines are irregularly disposed, and there are three spines just within the apical margin, which is smooth. Length 58–59  $\mu$ ; breadth 44–47  $\mu$ ; breadth of isthmus 16–17  $\mu$ . (Tab. 27, fig. 6.) Sample 25.

195. *C. trachypleurum* var. *subspinosum* var. nova, affinis *C. trachypleuro* var. *spinoso* West, sed differt quod singularum semicellularum media in parte iuxta supra isthmum quattuor tantum spinulae adsunt.

The specimens closely resemble var. *spinoso* West (G. Nygaard, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 142, fig. 43; W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2—Bot., Vol. V, 1895–1901, Pl. 7, fig. 17) except that the median tumour contains only four granules. The shape of the semicells in front view has a greater resemblance to the figure by Nygaard than to the type illustrated by Messrs. West. Length 42–42.5  $\mu$ ; breadth 32.5–34  $\mu$ ; breadth of isthmus 12–13  $\mu$ ; breadth of apices 16–18  $\mu$ . (Tab. 25, fig. 10.) Sample 47.

196. *C. transvaalense* spec. nova, affinis *C. trachypleuro* Lund., sed semicellulis minus applanatis, margine apicali spinis munito, ore sinus spinoso, et omni spinarum dispositione valde distincta.

This species is near *C. trachypleurum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 172, Pl. LXXXI, figs. 2, 3); but the semicells are less flattened, there are spines on the apical margin, there is a spine at each basal angle, and the cell wall sculpture is different. Cells of medium size, about 1.1–1.3 times longer than broad, deeply constricted, sinus narrowly linear; semicells semicircular, apex somewhat flattened. Cell wall punctate and furnished with a number of irregularly disposed spines. Length 48–50.5  $\mu$ ; breadth 36–37.5  $\mu$ ; breadth of isthmus 15–16  $\mu$ . (Tab. 25, fig. 11.) Sample 25.

197. *C. trilobulatum* Reinsch. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 185, Pl. LXII, figs. 28–30.) Samples 19, 72.

*Geographical Distribution.*—England; Scotland; Ireland; France; Germany; Hungary; North Russia; Poland; Norway; Sweden; New Zealand; Madagascar; Central and East Africa; Brazil; Japan; South Africa.

198. *C. tumidum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 160, Pl. LX, fig. 18.) Sample 71.

*Geographical Distribution.*—Wales; Scotland; Ireland; France; Germany (form); Norway; Sweden; Denmark; Poland; North Russia; Finland; Greenland; United States; First record for South Africa.

199. *C. waterbergense* spec. nova, affinis *C. holmiensi* Lund., sed membrana haud undulata differt.

Near *C. holmiense* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 1, Pl. LXV, figs. 1, 2); but differs in having crenulations. Cells rather small, about 1.5–1.8 times longer than broad, deeply constricted, sinus narrowly linear; semicells broadly pyramidate with a flattened apex, basal angles rounded. Cell wall punctate. Length 35–39  $\mu$ ; breadth 20–26.5  $\mu$ ; breadth of isthmus 8–9.5  $\mu$ ; breadth of apex 12–14  $\mu$ . (Tab. 26, figs. 1–7.) Sample 19.

*Xanthidium Ehrenberg.*

200. *X. cristatum* Bréb. var. *delpontei* Roy & Biss. forma *laevis* forma nova, differt a varietate *delpontei* et membrana cellulae omnino glabra et quod spinulae supra isthmum desunt.

A form in which the semicells are entirely destitute of a thickened or scrobiculated central area; the shape of the semicells differ slightly from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 74, Pl. CXI, fig. 5). Length  $72\ \mu$  (with spines  $90\text{--}94\ \mu$ ); breadth  $68\ \mu$  (with spines  $80\text{--}88\ \mu$ ); breadth of isthmus  $15.5\ \mu$ . (Tab. 29, fig. 12.) Sample 74.

201. *X. cristatum* var. *transvaalense* var. nova, affinis var. *delpontei* Roy et Biss., sed cellulis multo angustioribus differt. Formae intermediae non visae.

This differs from var. *delpontei* in the narrower semicells. Cells about  $1.25\text{--}1.5$  times longer than broad; each tumour above the isthmus with a circle of  $7\text{--}10$  small spines; in some specimens there may be a spine in the centre of the circle. Length  $48\text{--}56\ \mu$ ; breadth  $38\text{--}44\ \mu$ ; breadth of isthmus  $16\text{--}18\ \mu$ ; length of spines  $8\text{--}12\ \mu$ . (Tab. 28, figs. 7–10.) Samples 24, 25.

*Straurastrum Meyen.*

202. *St. barbaricum* spec. nova, affinis *St. caffrorum* Claassen sed differt quod depressio in margine apicali deest, porro supra isthmum tantum una series spinularum adest sculpturaque membranae etiam differt.

This is near *St. caffrorum* Claassen; but differs in having no cavity in the apical margin, and in the cell wall sculpture. Cells small, about  $1.3\text{--}1.4$  times as long as broad, deeply constricted, sinus open; semicells more or less quadrangular in vertical view, with a single series of spines near the base, apical margin and angles furnished with spines. Length  $28\ \mu$ ; breadth  $20\text{--}21.5\ \mu$ ; breadth of isthmus  $7\ \mu$ . (Tab. 30, figs. 10, 11.) Sample 3.

203. *St. brevispinum* Bréb. var. *masoganum* var. nova, affinis *St. brevispino* var. *obversum* W. et G. S. West, sed sinu latiore et cellularum e vertice visarum lateribus undulatis neque concavis differt.

This variety is near var. *obversum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 148, Pl. CXXIII, fig. 7); but the sinus is broader, and the sides in vertical view are undulate and not concave. Cells small, slightly shorter than broad, deeply constricted, sinus open; semicells more or less fusiform, each apical angle furnished with a short spine. Vertical view of cell triangular, sides 3-undulate. Cell wall smooth. One pyrenoid per chloroplast. Length  $26\ \mu$ ; breadth  $28\ \mu$ ; breadth of isthmus  $8\ \mu$ . (Tab. 29, figs. 19, 20.) Sample 66.

204. *St. caffrorum* spec. nova. Inter species descriptas nulla affinitas obvia. Semicellulae e vertice visae plus minusve quadratae, margo apicalis depressione praeditus, quae spinis brevibus circumdata est. Supra isthmum duae series spinularum adsunt et anguli apicales semicellularum etiam spinulis muniti.

Cells small, about  $1.2$  times as long as broad, deeply constricted, sinus open outwards; semicells subelliptic, more or less quadrangular in vertical view, apical margin with a cavity in the median part, margin of cavity furnished with short spines; above the isthmus in each semicell are two series of small spines, apical angles furnished with spines. Length  $24\ \mu$ ; breadth  $20\ \mu$  (greatest—fig. 7) and  $16\ \mu$  (smallest—fig. 9); breadth of isthmus  $8\ \mu$ . (Tab. 30, figs. 7–9.) Sample 3.



205. *St. connatum* Roy & Biss. var. *warmbadianum* var. nova, affinis *St. connato* var. *americano* W. et G. S. West, sed differt et semicellulis latioribus brevioribusque et quod a vertice visa latera concaviora sunt.

This closely resembles var. *americanum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 7); but the semicells are shorter and broader, and the sides in vertical view are more concave. Length 20–22  $\mu$ ; breadth 22–23  $\mu$ ; breadth of isthmus 6–7.5  $\mu$ . (Tab. 31, figs. 23, 24.) Sample 47.

206. *St. crenatum* spec. nova, affinis *St. elliptico* West, sed membrana cellulae crenata differt.

Near *St. ellipticum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 138, Pl. CXIX, fig. 7); but the cell wall is crenated. Cells small, about 1.2 times as long as broad, deeply constricted, sinus widely open; semicells triangular in vertical view. Length 24–25  $\mu$ ; breadth 20–20.5  $\mu$ ; breadth of isthmus 9–10  $\mu$ . (Tab. 31, figs. 21, 22.) Samples 54, 58, 63.

207. *St. dickiei* Ralfs. (E. Messikommer, Beiträge zur geobotanischen Landesaufnahme der Schweiz, Heft 24, 1942, Taf. XII, figs. 3, 4.) Spine on apical angle straight or slightly incurved. (Tab. 31, figs. 7, 8.) Samples 59, 72.

*Geographical Distribution*.—Davos in Switzerland; Madagascar; United States; First record for South Africa.

208. *St. dilatatum* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 172, Pl. CXXVI, figs. 10–15.) Sinus less widely open than in the type and all the specimens observed were triangular in vertical view. The Rietfontein and Mosdene specimens are slightly larger than the other specimens. Length 24–40  $\mu$ ; breadth 20–36  $\mu$ ; breadth of isthmus 5–12  $\mu$ . (Tab. 30, figs. 1–6; Tab. 31, figs. 14–16.) Samples 2, 3, 12, 19, 20, 24, 27, 32, 35, 38, 41, 42, 51, 65, 66, 67, 71, 72.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Roumania; Servia; Macedonia; Italy; Portugal; Norway; Sweden; Denmark; Central and South Russia; Greenland; Japan; India; Ceylon; Australia; New Zealand; Madagascar; Central Africa; Azores; United States; Brazil; Bolivia; Paraguay; Argentina; South Africa.

209. *St. excavatum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 42.) Length 12  $\mu$ ; breadth 10  $\mu$ ; length of arms 12–20  $\mu$ ; breadth of isthmus 6  $\mu$ . (Tab. 32, fig. 7.) Samples 65, 72.

*Geographical Distribution*.—Madagascar; First record for South Africa.

210. *St. furcatum* (Ehrenb.) Bréb. (F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 175, fig. 11 A–C.) (Tab. 32, figs. 3–6.) Samples 65, 66, 74.

*Geographical Distribution*.—Davos in Switzerland; South Africa.

211. *St. galpinii* spec. nova, affinis *St. rotulae* Nordst., sed differt quod semicellula 7 tantum brachiis et margo apicalis 7 papillis est praeditus.

Near *St. rotula* Nordst. (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 18, fig. 11); but each semicell has only seven arms, and the apical margin is furnished with seven papillae. Cells of medium size, about 1.75–2.2 times longer than broad, sinus widely open; semicells with seven slightly incurved arms, each arm containing four small spines at the apex, sides crenate with a circle of spines around each crenation (not clear in some specimens); apical margin furnished with seven emarginate projections. Chloroplasts with one

central pyrenoid each. Length 38–44  $\mu$  (with papillae 46–50  $\mu$ ); breadth 18–25  $\mu$  (with arms 56–64  $\mu$ ); breadth of isthmus 10–13  $\mu$ . (Tab. 29, figs. 15–17  $\mu$ .) Samples 66, 71.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

212. *St. gemelliparum* Nordst. var. *africanum* var. nova, a typo speciei differt quod circulus intimus 6 brachiorum propius mediam cellulae partem dispositus est.

This closely approaches the typical form (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 21, fig. 25); but in vertical view, the inner circle of six arms is nearer to the axis of the cell. Cells small, about 1.4 times as long as broad, deeply constricted, sinus open; semicells more or less elliptical, furnished with six short arms near the base and another six near the apical margin, apices of arms emarginate. Vertical view of semicell triangular, with two arms on each angle and a circular series of six arms within the margin, angles truncate. Each chloroplast containing one central pyrenoid. Length 24  $\mu$  (with arms 30  $\mu$ ); breadth 17  $\mu$  (with arms 24  $\mu$ ); breadth of isthmus 9  $\mu$ . (Tab. 32, figs. 1, 2.) Sample 66.

213. *St. leptocladum* Nordst. var. *cornutum* Wille. These specimens are larger than in the typical form (W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 9, figs. 12, 13; F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 175, fig. 13 F). Length 38–41  $\mu$ ; breadth 11–14  $\mu$  (with processes 72–108  $\mu$ ); breadth of isthmus 8–9  $\mu$ . (Tab. 32, fig. 8.) Sample 74.

*Geographical Distribution.*—Madagascar; South Africa.

214. *St. mattiei* spec. nova. Nulla affinitate notata. Cellulae parva, aliquanto latiores quam longiores, sinu foras aperto, membrana spinulis praecipue in angulis apicalibus praedita, semicellula e vertice visa lateribus concavis triangulata.

Cells small, slightly shorter than broad, deeply constricted, sinus open. Vertical view of semicell triangular, sides concave. Cell wall furnished with short spines, mainly on the apical angles. Length 17.5–26  $\mu$ ; breadth 19.5–28  $\mu$ ; breadth of isthmus 6–14  $\mu$ ; length of spines 3–4  $\mu$ . (Tab. 31, figs. 25–27.) Sample 24.

215. *St. mesianum* spec. nova. Cum sp. *St. subgemma* W. et G. S. West congruit quod semicellulis sena brachia sunt, quae tamen glabra sunt, spinula utrimque ad basim tantum praedita.

Near *St. subgemma* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 34) in that each semicell contains six arms, but the arms are smooth and furnished with a small spine on each side at the base. Cells moderately constricted, sinus open; semicells with six gradually attenuated arms, with four small spines at the apex of each arm. Cell wall smooth. Each chloroplast with one pyrenoid. Length 28–29  $\mu$ ; breadth 20–21  $\mu$  (with arms 43–44  $\mu$ ); breadth of isthmus 10–12  $\mu$ . (Tab. 31, figs. 3, 4.) Sample 59.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

216. *St. orbiculare* Ralfs var. *ralfsii* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 156, Pl. CXXIV, figs. 12–16.) Cells slightly smaller than in the typical form. Length 26  $\mu$ ; breadth 21  $\mu$ ; breadth of isthmus 7.5–8  $\mu$ . (Tab. 30, figs. 14, 15.) Sample 60.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria and Galicia; Hungary; Servia; Italy; Portugal; Norway; Sweden; Denmark; Bornholm; Finland; Poland; North, Central and

South Russia; Faeroes; Iceland; Nova Zembla; Spitzbergen; Greenland; East and North India; Australia; United States; Bolivia; Paraguay; Argentina; Patagonia; Brazil; First record for South Africa.

217. *St. orbiculare* var. *waterbergense* var. nova, affinis *St. orbiculari* var. *hibernico* W. et G. S. West, sed lateralibus, a vertice visis, concavis differt.

Near var. *hibernicum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 156, Pl. CXXIV, figs. 5-9); but differs in that the sides are concave in vertical view. Length 31-33  $\mu$ ; breadth 28-30  $\mu$ ; breadth of isthmus 7.5-9  $\mu$ . (Tab. 31, figs. 5, 6.) Samples 52, 54, 58.

218. *St. pseudogemmulum* spec. nova, affinis *St. subgemma* W. et G. S. West, sed differt et brachiis leviter incurvatis et quod semicellulis a vertice visis binae sunt granulorum series, quae circuli modo dispositae ternis consistunt granulis. Circulo interiori sex eiusmodi sunt series, exteriori tamen duodecim.

This differs from *St. subgemma* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 8, fig. 34) in having slightly incurved arms and in the cell wall sculpture. Cells small, about 1.6-1.7 times longer than broad, sinus open; semicells with six arms, apex of each arm emarginate. Cell wall, in vertical view of semicell, with two circular series of granules arranged in groups of three granules each. inner circle consists of six groups and outer circle contains 12 groups; and with three circles of granules around each arm. Each chloroplast contains a central pyrenoid. Length 29-32  $\mu$ ; breadth 17-19  $\mu$  (with arms 33-34  $\mu$ ); breadth of isthmus 10-11  $\mu$ . (Tab. 31, figs. 9, 10.) Sample 19.

219. *St. pseudogemmulum* var. *warmbadianum* var. nova, affinis *St. pseudogemmulum* Claassen, sed brachiis quam prioris varietatis longioribus tenuioribusque differt, quae a vertice visa 4 granula singulis in seriebus ad interiorem circumulum habent.

Arms longer and narrower than in *St. pseudogemmulum* Claassen; cell wall with the inner series of granules consisting of four granules per group. Length 28.5-32  $\mu$ ; breadth 16-17  $\mu$  (with arms 34-37  $\mu$ ); breadth of isthmus 7.5-9  $\mu$ . (Tab. 31, figs. 11-13.) Sample 48.

220. *St. pygmaeum* Bréb. var. *botesii* var. nova, affinis var. *apiculato* W. et G. S. West, sed angulis apicalibus spinulis munitis, ceteroquin omnino glabra differt.

This differs from var. *apiculatum* W. & G. S. West (W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 8, fig. 26) in the cell wall being smooth except for the apical angles, which contains a few spines. Cells small, about as long as broad, deeply constricted, sinus open; semicells with three spines on the apical angles and a circle of spines near the angles. Vertical view triangular. Length 26-28  $\mu$ ; breadth 25.5-26  $\mu$ ; breadth of isthmus 8.5-10  $\mu$ . (Tab. 31, figs. 28, 29.) Sample 24.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

221. *St. quadrangulare* Bréb. var. *subarmatum* var. nova, affinis *St. quadrangulare* var. *armato* W. et G. S. West, sed sinu latiore, spinulis longioribus, et cellulis multo maioribus differt; semicellulae e vertice visae triangulatae.

This differs from var. *armatum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 16, fig. 18) in having a broader sinus, longer spines and considerably larger cells; semicells triangular in vertical view. Fig. 18 shows the cell in front view; it was impossible to keep the cell in vertical position in order to illustrate it. Length 32  $\mu$ ; breadth 41-43  $\mu$  (with spines 48-50  $\mu$ ); breadth of isthmus 14-14.5  $\mu$ . (Tab. 29, fig. 18.) Samples 68, 71.

222. *St. setigerum* Cleve var. *pectinatum* W. et G. S. West forma *australe* forma nova. A var. *pectinato* W. et G. S. West isthmo multo latiore differt.

This form differs from var. *pectinatum* (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 28) in that the isthmus is about 2·2 times broader. Length 33  $\mu$  (with spines 46  $\mu$ ); breadth 32  $\mu$  (with spines 48  $\mu$ ); breadth of isthmus 14  $\mu$ . (Tab. 29, figs. 13, 14.) Sample 65.

223. *St. subgemmulatum* W. & G. S. West var. *mattiei* var. nova, affinis var. *gracili* W. et G. S. West, sed cellulae brachiis longioribus tenuioribusque praeditae eam distinguunt.

These specimens are near var. *gracilius* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 35); but differ in possessing longer and narrower arms. Length 32–32·5  $\mu$ ; breadth 15–17  $\mu$  (with arms 43·5–46  $\mu$ ); breadth of isthmus 10–11  $\mu$ . (Tab. 31, figs. 1, 2.) Sample 59.

224. *St. subtrifurcatum* West forma *major* W. & G. S. West. These specimens are larger than in the typical form (W. Schmidle, Engler Bot. Jahrb., XXXII Bd., 1903, p. 73, Taf. II, fig. 8). Length 72–76  $\mu$ ; breadth 58–62  $\mu$ ; breadth of isthmus 24–26·5  $\mu$ ; length of spines 20–36  $\mu$ . (Tab. 30, figs. 16–18.) Samples 24, 25, 39. *Geographical Distribution.*—Central Africa; First record for South Africa.

225. *St. teliferum* Ralfs var. *transvaalense* var. nova. A typo speciei spinulis hebetatis differt.

This is near *St. teliferum* Ralfs (E. Messikommer, Beiträge zur geobotanischen Landesaufnahme der Schweiz, Heft 24, 1942, Taf. XIV, fig. 8); but differs in the spines being blunt. Length 30·5–31  $\mu$ ; breadth 28  $\mu$ ; breadth of isthmus 11–13  $\mu$ ; length of spines 2·5–4  $\mu$ . (Tab. 31, figs. 19, 20.) Sample 19.

This may also be compared with *St. breviaculeatum* G. M. Smith (Wm. R. Taylor, Alpine Algae from the Santa Marta Mountains, Colombia., Am. Journ. of Bot., Vol. 22, 1935, p. 772, Pl. 2, fig. 5).

226. *St. trihedrale* Wolle var. *australe* var. nova. A typo speciei isthmo multo latiore differt.

This differs from the typical form (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 29) in that the isthmus is 1·5 times broader. Length 44  $\mu$ ; breadth 30  $\mu$ ; breadth of isthmus 14–15·5  $\mu$ . (Tab. 31, figs. 17, 18.) Sample 27.

227. *St. tumidum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 142, Pl. CXXII, figs. 1–5.) Sample 71.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Galicia in Austria; Norway; Denmark; Sweden; Bornholm; United States; First record for South Africa.

228. *St. xiphidiophorum* Wolle var. *westiorum* var. nova. E vertice visae cellulae cum var. *brachyacantho* W. et G. S. West valde congruunt, sed differt spinis in angulis apicalibus multo brevioribus.

This closely resembles var. *brachyacanthum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 18, fig. 7) in vertical view; but the spines on the apical angles are much shorter and the cells are smaller. Cells small, about 1·3 times as long as broad, fairly deeply constricted, sinus open; basal and apical angles of semicells truncate and furnished

with a few spines. Semicells more or less triangular in vertical view; each angle with three spines (it seems to be 9-angular). Length  $24\ \mu$ ; breadth  $18.5\text{--}19\ \mu$ ; breadth of isthmus  $10\text{--}10.5\ \mu$ . (Tab. 30, figs. 12, 13.) Sample 3.

Named after Messrs. W. & G. S. West.

### *Sphaerosma* Corda

229. *Sph. aubertianum* W. West. Cells somewhat smaller than in the type (W. West, Journ. of Bot., Vol. XXVII, 1889, Tab. 291, fig. 17). Length  $10\text{--}12\ \mu$ ; breadth  $13\text{--}16\ \mu$ ; breadth of isthmus  $5\text{--}6\ \mu$ . (Tab. 32, fig. 9.) Sample 74.

*Geographical Distribution*.—Maine; First record for South Africa.

### *Onychonema* G. C. Wallich

230. *Onychonema* species ad *O. laeve* Nordst. var. *micracanthum* Nordst. The cells correspond with those in Nordstedt's variety except for the somewhat undulated apical margin in some specimens; this may be due to the fixative as other specimens from the fresh material have smooth apical margins. Unfortunately the measurements of Nordstedt's variety are not available. Length  $16\text{--}18\ \mu$ ; breadth  $20\text{--}24\ \mu$  (with spines  $24\text{--}30\ \mu$ ); breadth of isthmus  $4\text{--}4.5\ \mu$ . (Tab. 32, fig. 10.) Sample 74.

## TRIBUS: BACILLARIOPHYTA

The different Diatom taxa have been determined by Dr. B. J. Cholnoky and the descriptions and figures have been published by him. (Beiträge zur Kenntnis der Südafrikanischen Diatomeenflora II. Einige Gewässer im Waterberg-Gebiet, Transvaal. Portugaliae Acta Biologica (Série B) Vol. 6, No. 2, 1958, pp. 99–160, Taf. I–VII. The diatoms of the following samples have not been determined as yet:

30, 36, 37, 38, 39, 41, 42, 43, 44, 66, 67, 68, 69, 70, 71, 72, 73, 74.

*Class*: Diatomeae.

*Order*: Centrales.

*Suborder*: Discineae.

*Fam.*: Coscinodisceae.

*Subfam.*: Melosiroideae.

### *Melosira* Agardh.

231. *M. granulata* (E.) Ralfs. Samples 47, 48, 49, 50, 57.

232. *M. nyassensis* O.M. Sample 12.

233. *M. roeseana* Rabh. Sample 51.

*Subfam.*: Coscinodiscoideae.

### *Cyclotella* Kutê.

234. *C. kützingiana* Thw. Sample 50.

Order: Pennales.

Suborder: Araphidineae.

Fam.: Fragilariaceae.

Subfam.: Fragilarioideae.

**Fragilaria Lyngbye**

235. *F. capucina* Desm. var. *acuta* Grun. Sample 63.  
 236. *F. fonticola* Hust. Sample 1.  
 237. *F. ungeriana* Grun. Sample 63.

**Asterionella Hassall**

238. *A. africana* Chy. Sample 49.

**Synedra Ehrenberg**

239. *S. acus* Kg. var. *radians* (Kg.) Hust. Samples 7, 59, 60.  
 240. *S. rumpens* Kg. Samples 1, 4, 5, 7, 8, 10, 11, 12, 60, 63, 64.  
 241. *S. rumpens* var. *fragilarioides* Grun. Samples 9, 11, 18.  
 242. *S. rumpens* var. *meneghiniana* Grun. Samples 5, 7, 8, 10, 11, 12, 23, 47, 63, 64.  
 243. *S. rumpens* var. *scotica* Grun. Sample 50.  
 244. *S. ulna* (Nitzsch) E. Samples 1, 4, 5, 6, 8, 9, 11, 15, 18, 19, 20, 23, 32, 46, 47, 48, 49, 50, 51, 52, 53, 55, 57, 58, 60, 63, 64.  
 245. *S. ulna* var. *biceps* (Kg.) Hust. Samples 1, 5, 6, 7, 8, 12, 13, 47, 48, 50, 60, 63.  
 246. *S. ulna* var. *danica* (Kg.) Grun. Samples 7, 63, 64.  
 247. *S. vaucheriae* Kg. Sample 6.

Suborder: Raphidioidineae.

Fam.: Eunotiaceae.

Subfam.: Eunotioideae.

**Eunotia Ehrenberg**

248. *E. alpina* (Näg.) Hust. Sample 24.  
 249. *E. exigua* (Bréb.) Grun. Samples 2, 3, 24, 25, 26, 27, 28, 29, 33, 35, 45, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 250. *E. garusica* Chy. Samples 47, 60.  
 251. *E. lunaris* (E.) Grun. Sample 60.  
 252. *E. lunaris* var. *subarcuata* (Näg.) Grun. Sample 51.  
 253. *E. mogolensis* Chy. Samples 25, 26, 27, 28, 45, 52.  
 254. *E. montana* Hust. Sample 45.  
 255. *E. pectinalis* (Kg.) Rabh. Samples 26, 28, 46, 52, 58, 64.  
 256. *E. pectinalis* var. *minor* (Kg.) Rabh. Samples 46, 52, 54, 55, 56, 57, 58.  
 257. *E. porcellus* Chy. Sample 25.  
 258. *E. praeupta* E. var. *inflata* Grun. Sample 54.  
 259. *E. pseudoflexuosa* Hust. Samples 45, 54, 57.  
 260. *E. subaequalis* Hust. Samples 23, 25, 26, 27, 28, 29, 35, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64.  
 261. *E. tenella* (Grun.) Hust. Samples 3, 24, 25, 26, 27, 28, 29, 34, 35, 45, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63.  
 262. *E. tschirchiana* O.M. Sample 7.  
 263. *E. zygodon* E. Samples 25, 26, 27, 28, 45.  
 264. *E. zygodon* var. *elongata* Hust. Samples 26, 27, 28, 29.

Suborder: Monoraphidineae.

Fam.: Achnantheae.

Subfam.: Achnantheoideae.

**Achnanthes Bory**

265. *A. exigua* Grun. Samples 6, 63.  
 266. *A. lanceolata* (Bréb.) Grun. var. *rostrata* Hust. Sample 51.  
 267. *A. linearis* W. Sm. Samples 13, 14, 15, 32.  
 268. *A. microcephala* Kg. Samples 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 22, 23, 29, 32, 33, 45, 47, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 269. *A. minutissima* Kg. Samples 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 23, 29, 32, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.

Suborder: Biraphidineae.

Fam.: Naviculaceae.

Subfam.: Naviculoideae.

**Frustulia Agardh.**

270. *F. rhomboides* (E.) de Toni. Samples 23, 45, 46, 51, 52, 53, 54, 55, 57, 58.  
 271. *F. rhomboides* var. *saxonica* (Rabh.) de Toni. Samples 12, 14, 20, 29, 32, 45, 47, 50, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 272. *F. vulgaris* (Thw.) de Toni var. *angusta* Chy. Samples 1, 7, 9, 11, 12, 13, 14, 15, 47, 50, 53, 54, 55, 57, 60, 63, 64.

**Gyrosigma Hassall**

273. *G. kützingii* (Grun.) Cl. Samples 1, 7, 10, 12, 13, 15, 18, 20, 23, 47, 48, 49, 50, 62.  
 274. *G. spenceri* (W. Sm.) Cl. var. *nodifera* Grun. Sample 6.

**Caloneis Cleve**

275. *C. aequatorialis* Hust. var. *tugelae* Chy. Samples 14, 15, 62.  
 276. *C. bacillum* (Grun.) Cl. Samples 13, 15, 20, 63.  
 277. *C. chasei* Chy. Sample 22.  
 278. *C. incognita* Hust. Samples 14, 15, 16, 47.  
 279. *C. silicula* (E.) Cl. Samples 12, 14, 64.  
 280. *C. silicula* var. *peisonis* Hust. Samples 47, 50.  
 281. *C. silicula* var. *truncatula* Grun. Samples 14, 47, 48, 49, 50, 53, 56.

**Neidium Pfitzer**

282. *N. affine* (E.) Cl. Samples 6, 7, 19, 25, 26, 33, 46, 54, 60.  
 283. *N. affine* var. *amphirhynchus* (E.) Cl. Samples 28, 46, 48, 52, 53, 54, 55, 56, 59.  
 284. *N. affine* var. *longiceps* (Greg.) Cl. Samples 12, 52, 53, 56, 57.  
 285. *N. gracile* Hust. Samples 46, 52.  
 286. *N. gracile* forma *aequale* Hust. Samples 29, 45, 46.  
 287. *N. iridis* (E.) Cl. Samples 26, 33, 47, 48, 49, 53, 54, 55, 57, 59, 63, 64.  
 288. *N. iridis* var. *amphigomphus* (E.) van Heurck. Samples 25, 26, 28.  
 289. *N. iridis* var. *ampliata* (E.) Cl. Sample 56.  
 290. *N. javanicum* Hust. Sample 58.  
 291. *N. productum* (W. Sm.) Cl. Samples 14, 15, 26, 46, 54, 56, 58, 63, 64.

**Diploneis Ehrenberg**

292. *D. ovalis* (Hilse) Cl. Sample 59.  
 293. *D. subovalis* Cl. Sample 52.

**Stauroneis Ehrenberg**

294. *S. anceps* E. Samples 6, 19, 20, 23, 47, 50, 51, 53, 54, 56, 63.  
 295. *S. anceps* forma *gracilis* (E.) Cl. Samples 46, 52, 53, 54, 55, 56, 58, 64.  
 296. *S. borrichi* (Petersen) Lund. Samples 53, 56.  
 297. *S. claasseniae* Chy. Sample 59.  
 298. *S. crucicula* Grun. Sample 1.  
 299. *S. phoenicenteron* E. Samples 24, 25, 26, 28, 29, 33, 46, 48, 51, 52, 54, 55, 56, 57, 59, 60.  
 300. *S. phoenicenteron* forma *gracilis* (Dippel) Hust. Samples 45, 56.

**Anomoeoneis Pfitzer**

301. *A. exilis* (Kg.) Cl. Samples 1, 5, 7, 8, 9, 10, 11, 12, 14, 20, 23, 63.  
 302. *A. sphaerophora* (Kg.) Pfitzer. Samples 59, 60.

**Navicula Bory**

303. *N. acidophila* Chy. Sample 24.  
 304. *N. anglica* Ralfs. Samples 12, 13, 14, 16, 20, 22, 47, 48, 49, 50.  
 305. *N. bryophila* Petersen. Samples 5, 6, 9, 10, 11, 25, 26, 27, 45.  
 306. *N. cari* E. Samples 13, 17, 46, 59, 61, 62.  
 307. *N. cari* var. *angusta* Grun. Samples 20, 21, 22, 26, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 308. *N. cincta* (E.) Kg. Samples 14, 15, 20, 46, 49, 61, 62.  
 309. *N. cinctaeformis* Hust. Sample 61.  
 310. *N. confervacea* Kg. Samples 47, 48.  
 311. *N. cryptocephala* Kg. Samples 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 24, 25, 26, 28, 29, 32, 33, 34, 35, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64.  
 312. *N. cryptocephala* var. *intermedia* Grun. Samples 6, 63.  
 313. *N. cryptocephala* var. *veneta* (Kg.) Grun. Sample 57.  
 314. *N. cuspidata* Kg. Samples 48, 49, 53, 54, 58, 59, 63.  
 315. *N. cuspidata* var. *ambigua* (E.) Cl. Samples 15, 20, 21, 22, 46, 49, 51, 55, 56, 57, 59, 60, 63, 64.  
 316. *N. dicephala* (E.) W. Sm. Samples 15, 48.  
 317. *N. dicephala* var. *neglecta* (Krasske) Hust. Sample 50.  
 318. *N. elaborata* Hust. Sample 35.  
 319. *N. exigua* (Greg.) O.M. Samples 1, 13, 20, 47, 48, 50.  
 320. *N. exiguiformis* Hust. Samples 51, 63.  
 321. *N. gastrum* E. Samples 51, 52, 53, 54, 55, 57, 58.  
 322. *N. graciloides* A. Mayer. Sample 7.  
 323. *N. gregaria* Donk. Samples 2, 32, 47, 50, 51, 59.  
 324. *N. gregarioides* Chy. Samples 21, 23, 26, 46, 51, 52, 53, 54, 55, 56, 57, 58, 60, 63.  
 325. *N. grimmei* Krasske. Samples 1, 4, 13, 35, 47, 48, 59, 63, 64.  
 326. *N. hungarica* Grun. var. *capitata* (E.) Cl. Samples 1, 20, 48.  
 327. *N. krasskei* Hust. Samples 25, 29.  
 328. *N. lanceolata* (Ag.) Kg. Samples 15, 47, 48, 49, 50, 59, 60.  
 329. *N. longicephala* Hust. Samples 55, 56.  
 330. *N. mengeae* Chy. Sample 57.



331. *N. menisculus* Schum. Samples 6, 11, 13.  
 332. *N. microcephala* Grun. Sample 50.  
 333. *N. minima* Grun. var. *atomoides* (Grun.) Cl. Sample 46.  
 334. *N. minuscula* Grun. Sample 47.  
 335. *N. minusculoides* Hust. Samples 60, 61.  
 336. *N. muralis* Grun. Samples 2, 24, 49.  
 337. *N. mutica* Kg. Samples 7, 8, 25, 26, 27, 29, 31, 35, 51, 56, 57, 63.  
 338. *N. mutica* forma *cohnii* (Hilse) Hust. Samples 3, 4, 8, 19, 20, 27, 29, 34.  
 339. *N. mutica* var. *nivalis* (E.) Hust. Samples 1, 7, 10, 19, 20, 21, 33, 35, 51, 53, 55, 56.  
 340. *N. mutica* var. *pseudolagerheimii* Chy. Samples 11, 28, 45, 48, 55, 58, 63.  
 341. *N. nyassensis* O.M. Samples 12, 13, 54, 56, 57, 58, 63.  
 342. *N. nyassensis* var. *capitata* O.M. Sample 63.  
 343. *N. nyassensis* var. *minor* Chy. Samples 13, 14, 15, 16, 20, 23, 52, 59, 61, 62.  
 344. *N. perpusilla* Grun. Samples 25, 27, 28.  
 345. *N. pupula* Kg. Samples 46, 54, 56, 60, 61, 62, 63, 64.  
 346. *N. pupula* var. *capitata* Hust. Samples 47, 48, 49, 50, 55, 64.  
 347. *N. pupula* var. *rectangularis* (Greg.) Grun. Sample 63.  
 348. *N. pygmaea* Kg. Samples 59, 60.  
 349. *N. radiosa* Kg. Samples 7, 8, 11, 12, 46, 47, 48, 52, 53, 54, 55, 57, 58, 63, 64.  
 350. *N. radiosa* var. *tenella* (Bréb.) Grun. Samples 9, 11, 25, 32, 33, 35, 45, 47, 48, 49, 50, 52, 54, 55, 57, 58, 59, 60, 63, 64.  
 351. *N. rhyngocephala* Kg. Samples 7, 13, 14, 15, 48, 60.  
 352. *N. ruttneri* Hust. Sample 33.  
 353. *N. schroeteri* Meister. Samples 1, 7, 9, 10, 12, 14, 47, 48, 50.  
 354. *N. seminuloides* Hust. Sample 7.  
 355. *N. seminuloides* var. *sumatrana* Hust. Samples 29, 45.  
 356. *N. seminulum* Grun. Samples 29, 32, 33, 49, 59, 60.  
 357. *N. simplex* Krasske var. *minor* Chy. Samples 20, 22, 23, 52, 53, 54, 55, 56, 58.  
 358. *N. subtilissima* Cl. Samples 3, 52, 56.  
 359. *N. suecorum* Carlson. Samples 19, 64.  
 360. *N. tenelloides* Hust. Samples 19, 21, 29, 31, 32, 33, 35, 45, 46, 62.  
 361. *N. terrestris* Petersen. Samples 63, 64.  
 362. *N. tridentula* Krasske. Sample 60.  
 363. *N. viridula* Kg. Samples 1, 60.  
 364. *N. viridula* var. *linearis* Hust. Sample 1.  
 365. *N. viridula* var. *rostellata* (Kg.) Cl. Samples 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 23, 28, 47, 48, 49, 50, 51, 60, 62, 63, 64.  
 366. *N. vulpina* Kg. Sample 59.  
 367. *N. zanoni* Hust. Samples 1, 5, 7, 8, 9, 10, 11, 12, 13, 47, 50.

#### *Pinnularia Ehrenberg*

368. *P. acoricola* Hust. Samples 25, 29, 45.  
 369. *P. acrosphaeria* Bréb. Samples 5, 14, 15, 59.  
 370. *P. acrosphaeria* var. *controversa* Chy. Sample 59.  
 371. *P. amaniensis* Hust. Samples 25, 26, 28.  
 372. *P. borealis* E. Sample 23.  
 373. *P. braunii* (Grun.) Cl. Samples 54, 58.  
 374. *P. braunii* var. *amphicephala* (A. Mayer) Hust. Sample 45.  
 375. *P. claasseniae* Chy. Sample 35.  
 376. *P. dactylus* E. Sample 45.  
 377. *P. divergens* W. Sm. Samples 14, 15, 20, 47, 50, 54.  
 378. *P. divergens* var. *undulata* Héríb. & Perag. Sample 13.  
 379. *P. dubitabilis* Hust. Samples 2, 3, 12, 20, 24, 25, 27, 28, 29, 33, 35, 45, 47, 48, 53, 55, 57, 60, 63, 64.

380. *P. gibba* E. Samples 6, 7, 11, 14, 15, 20, 25, 26, 27, 28, 29, 33, 45, 46, 47, 48, 49, 50, 51, 52, 54, 56, 57, 58, 59, 61, 63, 64.  
 381. *P. gibba* forma *subundulata* Mayer. Samples 16, 31, 33, 47, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64.  
 382. *P. gibba* var. *parva* (E.) Grun. Samples 4, 7, 9, 11, 13, 14, 15, 19, 25, 26, 27, 28, 29, 31, 33, 35, 45, 51, 63, 64.  
 383. *P. gibba* var. *sancta* Grun. Samples 25, 28, 33, 50, 51, 54, 55, 56, 59, 63.  
 384. *P. graciloides* Hust. Samples 4, 23.  
 385. *P. interrupta* W. Sm. Samples 23, 25, 26, 27, 28, 29, 32, 33, 63.  
 386. *P. interrupta* var. *minutissima* Hust. Samples 7, 24.  
 387. *P. maior* (Kg.) Cl. Samples 13, 14, 15, 58.  
 388. *P. mesolepta* (E.) W. Sm. Sample 19.  
 389. *P. microstauron* (E.) Cl. Sample 64.  
 390. *P. microstauron* forma *biundulata* O.M. Sample 48.  
 391. *P. microstauron* var. *brébissonii* (Kg.) Hust. Sample 19.  
 392. *P. ruttneri* Hust. Samples 25, 28.  
 393. *P. subcapitata* Greg. Samples 2, 3, 9, 12, 19, 20, 22, 23, 25, 27, 28, 29, 31, 32, 33, 34, 35, 45, 50, 51, 52, 53, 54, 55, 60, 64.  
 394. *P. subcapitata* var. *hilsiana* (Janisch) O.M. Samples 2, 4, 7, 10, 11, 12, 25, 28, 31, 32, 33, 34, 35, 45, 46, 48, 50, 51, 52, 53, 54, 55, 56, 57.  
 395. *P. viridis* (Nitzsch) E. Samples 4, 12, 13, 14, 15, 16, 20, 27, 28, 33, 47, 48, 49, 50, 52, 53, 54, 56, 57, 58, 59, 63, 64.  
 396. *P. viridis* var. *sudetica* (Hilse) Hust. Sample 33.

*Subfam.*: Amphiprotozoidea.

#### *Amphora Ehrenberg*

397. *A. ovalis* Kg. Samples 12, 14, 59.  
 398. *A. ovalis* var. *libyca* (E.) Cl. Samples 47, 48, 49, 50.  
 399. *A. submontana* Hust. Samples 11, 13, 14, 15, 16, 23, 46, 47, 48, 49, 50, 62.

#### *Cymbella Agardh.*

400. *C. amphicephala* Näg. Sample 29.  
 401. *C. amphicephala* var. *hercynica* (N.S.) Cl. Sample 26.  
 402. *C. bengalensis* Grun. Sample 63.  
 403. *C. cistula* (Hempr.) Grun. Samples 5, 6, 7, 8, 9, 14.  
 404. *C. cistula* var. *africana* Chy. Samples 11, 12.  
 405. *C. claasseniae* Chy. Samples 25, 26, 28, 51, 54, 56, 58.  
 406. *C. gracilis* (Rabh.) Cl. Samples 7, 14, 15, 52.  
 407. *C. javanica* Hust. Sample 32.  
 408. *C. kappii* Chy. Samples 1, 5, 7, 8, 9, 10, 11, 12.  
 409. *C. kolbei* Hust. Samples 1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 20, 47, 50, 63, 64.  
 410. *C. microcephala* Grun. Samples 1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 20, 23, 45, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 411. *C. mülleri* (O.M.) Hust. Sample 7.  
 412. *C. naviculiformis* Auersw. Samples 13, 14, 18, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 413. *C. nylstromensis* Chy. Sample 63.  
 414. *C. pretoriensis* Chy. Samples 21, 24, 25, 26, 27, 28, 29.  
 415. *C. pseudoincerta* Chy. Sample 29.  
 416. *C. raytonensis* Chy. Samples 22, 25, 26, 27, 28, 29, 52.  
 417. *C. raytonensis* var. *debegeonica* Chy. Sample 21.  
 418. *C. spicula* Hust. Sample 64.  
 419. *C. spuria* Cl. Samples 8, 46.

420. *C. turgida* (Greg.) Cl. Samples 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 23, 34, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 421. *C. turgida* forma *minor* Chy. Samples 7, 22, 23, 50, 52, 53, 55, 57, 58, 59, 60, 63.  
 422. *C. turgida* var. *pseudogracilis* Chy. Sample 63.  
 423. *C. ventricosa* Kg. Samples 1, 5, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 22, 23, 29, 32, 33, 34, 35, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64.

#### **Gomphonema** Agardh.

424. *G. acuminatum* E. var. *turris* (E.) Cl. Sample 7.  
 425. *G. augur* E. Sample 52.  
 426. *G. clevei* Fricke. Samples 9, 50, 63, 64.  
 427. *G. constrictum* E. Samples 57, 60, 63, 64.  
 428. *G. gracile* E. Samples 1, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 18, 23, 24, 25, 26, 28, 29, 32, 46, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 429. *G. gracile* var. *lanceolatum* (Kg.) Cl. Samples 7, 9, 12, 51, 59, 60, 63, 64.  
 430. *G. lanceolatum* E. Samples 4, 5, 6, 9, 10, 11.  
 431. *G. parvulum* (Kg.) Grun. Samples 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 20, 23, 26, 29, 32, 33, 35, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 432. *G. parvulum* var. *lagenula* (Grun.) Hust. Samples 1, 2, 4, 5, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 28, 29, 31, 32, 33, 34, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64.  
 433. *G. subtile* E. Samples 7, 26, 28, 33.

Fam.: Epithemiaceae.

Subfam.: Epithemioideae.

#### **Epithemia** Brébisson

434. *E. zebra* (E.) Kg. Sample 7.

Subfam.: Rhopalodioideae.

#### **Rhopalodia** O. Müller

435. *R. gibba* (E.) O.M. Samples 4, 6, 9, 11, 12, 13, 14, 23, 47, 48, 49, 50, 62.

Fam.: Nitzschiaceae.

Subfam.: Nitzschioideae.

#### **Hantzschia** Grunow

436. *H. amphioxys* (E.) Grun. Samples 11, 12, 17, 20, 23, 33, 56, 59, 60, 62, 64.  
 437. *H. amphioxys* var. *africana* Hust. forma *minuta* Chy. Samples 1, 3, 4, 21, 25, 26, 27, 28, 29, 31, 34, 35, 48, 49, 51, 52, 55, 57, 58, 63.  
 438. *H. amphioxys* var. *intermedia* Grun. Samples 20, 57, 58, 59, 63.  
 439. *H. amphioxys* var. *vivax* (Hantzsch) Grun. Samples 20, 26, 27, 29, 47, 48, 49, 53, 55, 56, 57, 59.

#### **Nitzschia** Hassal

440. *N. accommodata* Hust. Samples 1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 20, 22, 23, 25, 26, 27, 28, 32, 33, 34, 46, 47, 48, 49, 51, 53, 54, 58, 59, 60, 61, 62, 63.  
 441. *N. amphibia* Grun. Samples 48, 50.  
 442. *N. capitellata* Hust. Samples 1, 33, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 62, 64.

443. *N. claasseniae* Chy. Samples 1, 5, 7, 12, 20, 23, 57, 58, 59, 60.  
 444. *N. clausii* Hantzsch. Samples 1, 13, 14, 15, 18, 47, 50, 63.  
 445. *N. confinis* Hust. Samples 7, 13, 48.  
 446. *N. debilis* (Arnott) Grun. Sample 63.  
 447. *N. denticula* Grun. Sample 22.  
 448. *N. diserta* Hust. Sample 5.  
 449. *N. dissipata* (Kg.) Grun. Samples 1, 16.  
 450. *N. fonticola* Grun. Samples 9, 13, 17, 19, 21, 23, 28, 29, 31, 32, 33, 34, 35, 45, 46, 49.  
 451. *N. frustulum* (Kg.) Grun. var. *perpusilla* (Rabh.) Grun. Samples 5, 12, 18, 19, 20, 22, 60.  
 452. *N. goetzeana* O.M. Samples 13, 14, 59.  
 453. *N. kützingiana* Hilse. Samples 46, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62.  
 454. *N. linearis* (Ag.) W. Sm. Samples 1, 5, 7, 9, 11, 13, 14, 15, 16, 47, 48, 49, 50, 51, 59, 60, 62, 64.  
 455. *N. palea* (Kg.) W. Sm. Samples 2, 5, 11, 12, 24.  
 456. *N. palea* var. *tropica* Host. Sample 49.  
 457. *N. purvuloides* Chy. Samples 21, 26, 32, 45, 53.  
 458. *N. perminuta* Grun. Samples 46, 53, 55, 56, 58, 59, 60, 61, 62.  
 459. *N. pseudobacata* Chy. Sample 47.  
 460. *N. recta* Hantzsch. Sample 1.  
 461. *N. romana* Grun. Sample 59.  
 462. *N. sigma* (Kg.) W. Sm. Samples 1, 20, 23, 47, 48, 50.  
 463. *N. subadapta* Chy. Sample 12.  
 464. *N. subcommunis* Hust. Sample 50.  
 465. *N. subvitrea* Hust. Samples 14, 47, 49.  
 466. *N. tarda* Hust. Samples 8, 20, 23, 47, 49, 55, 56, 59, 60.  
 467. *N. transvaalensis* Chy. Sample 59.  
 468. *N. tropica* Hust. Samples 1, 4, 19, 20, 22, 23.  
 469. *N. tryblionella* Hantzsch var. *levidensis* (W. Sm.) Grun. Samples 1, 7, 59.  
 470. *N. von-hauseniae* Chy. Samples 20, 25, 26, 32, 33, 63, 64.

Fam.: Surirellaceae.

Subfam.: Surirelloideae.

**Cymatopleura** *W. Smith*

471. *C. solea* (Bréb.) W. Sm. Samples 12, 14.

**Stenopterobia** *Brébisson*

472. *S. intermedia* (Lewis) Hust. Samples 25, 26, 27, 28, 46.  
 473. *S. rautenbachiae* Chy. Sample 64.

**Surirella** *Turpin*

474. *S. angusta* Kg. Samples 1, 7, 13, 14, 15, 20, 47, 48, 50, 59, 60, 61, 62, 63, 64.  
 475. *S. delicatissima* Lewis. Samples 22, 24, 26, 27, 28, 32, 34, 35, 45, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 476. *S. linearis* W. Sm. Samples 1, 46, 56, 58, 64.  
 477. *S. robusta* E. var. *splendida* (E.) van Heurck. Sample 48.  
 478. *S. tenera* Greg. Samples 1, 7, 13, 14, 20, 23, 29, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58.  
 479. *S. tenera* forma *minor* Chy. Sample 64.

## TRIBUS: EUTHALLOPHYTA

*Class:* Chlorophyceae.

*Order:* Protococcales.

*Fam.:* Hydrodictyaceae.

**Pediastrum Meyen.**

480. *P. boryanum* (Turpin) Menegh. var. *granulatum* (Kütz.) Al Braun. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61e.) This agrees in shape and size with var. *granulatum* Al Braun, but no granules were perceptible. (Tab. 33, fig. 4.) Sample 20.
481. *P. boryanum* var. *longicorne* Reinsch. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61d.) Sample 20.
482. *P. boryanum* var. *minor* var. nova. *P. boryano* var. *forcipato* Racib. affinis, sed membrana cellulae neque granulata neque punctata facile distinguenda.  
Near var. *forcipatum* Racib. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61f); but the membrane is not granular or punctate. Colonies with 16–31 cells, margin-cells 6–8  $\mu$  in diameter; cells 8–11  $\mu$  long and 5–6  $\mu$  broad. (Tab. 33, fig. 5.) Samples 18, 20.
483. *P. duplex* Meyen var. *reticulatum* Lagerheim. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 95, fig. 57h.) Sample 47.
484. *P. duplex* var. *reticulatum* forma *cohaerens* Bohlin. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 95, fig. 57f.) (Tab. 33, figs. 1–3.) Sample 74.
485. *P. tetras* (Ehrenb.) Ralfs forma *evoluta* West. Samples 47, 48.
486. *P. tetras* var. *excisum* Rabenh. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 104, fig. 64b.) (Tab. 33, fig. 6.)

*Fam.:* Coelastraceae.

**Scenedesmus Meyen**

487. *Sc. bijugatus* (Turpin) Kütz. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 167.) Samples 19, 23, 48.
488. *Sc. quadricauda* (Turpin) Bréb. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 165, fig. 223.) Samples 12, 20, 23, 35, 47, 48.

*Order:* Ulotrichales.

*Fam:* Oedogoniaceae.

**Oedogonium Link.**

489. *Oe. boyanum* spec. nova, *Oe. crasso* Wittr. sec. Hirn affinis, sed plantae bisexuales, antheridia 3–16-cellulata, oogonia et oosporae latiores sunt.

This species is near *Oe. crassum* Wittr. sec. Hirn. (Pascher Süßwasserflora, Heft 6, 1914, p. 200, fig. 286); but the plants are monoecious, the antheridia have 3–16 cells and the oogonia and oospores are broader. Oogonia solitary, elliptical, with a pore in the upper part, 79–82  $\mu$  broad and 112–130  $\mu$  long. Oospores elliptical, not filling the oogonium, membrane smooth and thick, 74  $\mu$  broad and 91  $\mu$  long. Vegetative cells 52–54  $\mu$  broad and 96–192  $\mu$  long. Antheridium cells 44–48  $\mu$  broad and 6–12  $\mu$  long. (Tab. 34, figs. 9, 10.) Sample 73.

490. *Oe. mattiei* spec. nova, *Oe. zig-zag* Cleve sec. Hirn affinis, sed antheridiis 1-3-cellulatis, cellulis sterilibus latioribus, oogoniis brevioribus, zygotis globosis et oogonium haud complentibus, cellulis antheridii latioribus brevioribusque valde differt.

Near *Oe. zig-zag* Cleve sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 209, fig. 304); but differs in that the oospore does not fill the oogonium, and in having broader vegetative cells, shorter oogonia, spherical oospores, and shorter, broader, 1-celled to 3-celled antheridia. Monoecious; oogonium solitary, more or less spherical, with a pore in the upper part, 44-50  $\mu$  broad and 43-52  $\mu$  long. Oospore membrane smooth and thick, 42  $\mu$  in diameter. Vegetative cells 28-30  $\mu$  broad and 40-72  $\mu$  long. Antheridium cells 26-28  $\mu$  broad and 6-8  $\mu$  long. (Tab. 34, fig. 8.) Sample 73.

491. *Oe. mesianum* spec. nova, *Oe. varians* Wittr. et Lund. sec. Hirn affinis, sed ternis vel quaternis antheridorum cellulis, sterilibus cellulis paulo latioribus et zygotis multo minoribus facile distinguenda.

This species closely resembles *Oe. varians* Wittr. & Lund. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 206, fig. 298); but the antheridia consist of 3-4 cells, the vegetative cells are slightly broader and the oospores are considerably smaller. Monoecious; oogonia solitary, subovate, with a pore in the upper part, oogonia 36  $\mu$  broad and 38  $\mu$  long. Oospores spherical, not filling the oogonia, membrane smooth and fairly thick, 27  $\mu$  in diameter. Vegetative cells 16-20  $\mu$  broad and 44-80  $\mu$  long. Antheridium cells 15  $\mu$  broad and 3-8  $\mu$  long. (Tab. 34, fig. 5.) Sample 20.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

492. *Oe. pseudofragile* spec. nova, ex affinitate *Oe. fragile* Wittr. sec. Hirn. Differt tamen eo quod antheridiis ternae, quaternae vel quinae sunt cellulae, oogonia et oosporae minora sunt et antheridii cellulae breviores.

Near *Oe. fragile* Wittr. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 302); but the antheridia consist of 3-5 cells, the oogonia and oospores are smaller and the antheridium cells are shorter. Monoecious; oogonia solitary, more or less spherical, with a pore in the upper part, 36-38  $\mu$  broad and 32-36  $\mu$ . Oospores not filling the oogonia, more or less spherical, membrane smooth and fairly thick, 32  $\mu$  broad and 30-32  $\mu$  long. Vegetative cells 12-20  $\mu$  broad and 44-80  $\mu$  long. Antheridium cells 12-16  $\mu$  broad and 4-6  $\mu$  long. (Tab. 34, figs. 1-4.) Sample 20.

493. *Oe. subintermedium* spec. nova, affinis *Oe. intermedio* Wittr. sec. Hirn, sed differt quod oogonium in parte superiore angustatum, cellulae steriles paulo latiores, cellulae antheridii paulo et latiores et longiores sunt quam in *Oe. intermedio*.

This is near *Oe. intermedium* Wittr. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 301); but the upper part of the oogonium is attenuated, the vegetative and antheridium cells are slightly broader and the antheridium cells are slightly longer. Monoecious; oogonia solitary, more or less spherical, with a pore in the upper part, 34  $\mu$  broad and 33  $\mu$  long. Oospore more or less spherical, not filling the oogonium, membrane smooth, 30  $\mu$  broad and 28  $\mu$  long. Vegetative cells 20  $\mu$  broad and 60-80  $\mu$  long. Antheridia 2-celled, 19  $\mu$  broad and 10-12  $\mu$  long. (Tab. 34, fig. 6.) Sample 73.

494. *Oe. subvaucherii* spec. nova, *Oe. vaucherio* A. Braun sec. Hirn affinis, sed oogoniis globosis differt.

This differs from *Oe. vaucherii* A. Braun sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 303) in the oogonia being spherical. Monoecious; oogonium solitary, spherical, with a pore in the upper part, 46  $\mu$  in diameter. Oospore spherical, not filling the oogonium, membrane smooth and thick, 40  $\mu$  in diameter. Vegetative cells 22  $\mu$  broad and 60-80  $\mu$  long. Antheridia 2-4-celled, 19  $\mu$  broad and 6-8  $\mu$  long. (Tab. 34, fig. 7.) Sample 73.

## III.—VEGETATIVE REPRODUCTION IN DESMIDS

In Desmids vegetative reproduction takes place by cell division. In the genera possessing a median constriction the two semicells move apart during the elongation of the isthmus which is accompanied or followed by nuclear division. Normally the next step is the formation of a cylindrical girdle band within the wall in the median region of the elongated isthmus. In exceptional cases the girdle band is not formed during every cell division; in some species the girdle band is consistently absent. From this girdle band a plate-like projection grows inwards and eventually becomes the cross-partition. Simultaneously the elongated isthmus-halves begin to swell and develop into new semicells. During this process of swelling the chloroplasts of the parent semicells elongate, divide and take up their position in the newly formed semicells. Finally, the cross-partition splits and the newly formed individuals move apart.

Cell division does not always take place in the normal manner in vitro: it was observed that an individual in which one of the semicells had not reached full maturity was capable of dividing again, so that the daughter individuals differed markedly in shape and size from the normal type. (See Tab. 13, fig. 3; Tab. 21, figs. 1, 4; Tab. 22, figs. 5, 6; Tab. 23, fig. 1.)

During August, 1955, cell division was studied in two species of *Micrasterias*. It was observed that the chloroplasts of individuals about to divide were a deeper green colour than those of resting individuals.

The rate and manner of cell division in *Micrasterias crux-melitensis* (Ehrenb.) Hass. are illustrated in Tab. 35, figs. A–P. Similar observations on *Micrasterias denticulata* Bréb. are presented in Tab. 36, figs. A–G and Tab. 37, figs. H–K.

Cell division usually begins during the afternoon. The first divisional stages are reached fairly rapidly; but it may take up to several days before the new semicells reach their mature size, normal shape and effiguration.

Not infrequently however, patterns deviating from the normal are met with. For instance, the cross septum may not be completed, and the swelling isthmus develops curiously shaped monstrosities between the two adjacent parent semicells.

Rosenberg (1940) studied the effect of various sets of conditions on zygospore formation in desmids. He worked mainly with *Micrasterias americana* (Ehrenb.) Ralfs. He found that a low rate of division was obtained by growing this species in Benecke's nutrient solution (250 p.p.m.) in the dark at a low temperature of 8°C. After 10 days, he examined the cultures and found that about 10 per cent of the cells were abnormally large and contained an additional section between the two halves which normally join at the isthmus. When these giant cells were isolated and placed under conditions favouring rapid division, each cell divided at both isthmuses simultaneously, giving rise to one giant cell and two normal cells. The results of several series of experiments showed that giant cell formation takes place when conditions are unfavourable for cell division, for instance during the winter.

In the material collected in the districts of Warmbaths, Nylstroom and Naboomspruit giant cells were observed in: *Euastrum insulare* (Wittr.) Roy (Tab. 9, fig. 12); *Micrasterias crux-melitensis* (Ehrenb.) Hass. (Tab. 21, fig. 4; Tab. 22, figs. 1–3); *Cosmarium sexnotatum* Gutw. var. *simplex* Claassen (Tab. 24, fig. 9); *C. waterbergense* Claassen (Tab. 26, figs. 4–7) and *Staurastrum dilatatum* Ehrenb. (Tab. 30, fig. 6). The material of *M. crux-melitensis* was collected during August, 1955 and that of the other four species during April, 1954.

As only mature giant cells were observed, and not their actual formation, it was not possible to determine whether those in *M. crux-melitensis* were the result of a very low division rate or not. It should be mentioned that numerous other variations in this species were observed to arise during very rapid division. The material containing giant cells of the other four species was fixed at the time of collecting.

Numerous variations were observed among the specimens of *M. crux-melitensis* (Ehrenb.) Hass. The normal type is illustrated in Tab. 18, figs. 1, 2 and the following figures depict the majority of the variations: Tab. 18, figs. 3-14; Tab. 19, figs. 1-11; Tab. 20, figs. 1-6; Tab. 21, figs. 1-4; Tab. 22, figs. 1-6; Tab. 23, fig. 1.

G. S. West (1899) in discussing variation in the Desmidiaceae, states:

“The ordinary method of increase in this family (Desmidiaceae) of unicellular plants is by division of the mother-cell into two exactly similar daughter-cells, each constituted of one of the half-cells of the mother and a newly developed half. The latter is sometimes markedly different from the parent half, but in cases where this difference is extreme the new halves of the next division generally conform to the original type, though more rarely this may not occur for several generations.

The great diversity of form and wonderfully varied character of these plants are to be associated with their confinement to small ponds or the quiet margins of lakes, &c., localities suitable for their existence in large numbers. In these restricted areas the unceasing effect of the struggle for existence will result in a gradually increasing diversity of form, and this is to be correlated with the immense numbers of individuals that are sometimes found in these situations.

As regards the conditions favourable to variation among the members of this group of plants, it may be said that the occurrence in large quantity of a particular species is most conducive to the production of deviations from the normal form. It may happen that in some localised spot an immense quantity of some particular species is occasionally produced by very rapid division, and in such a case some variation is always met with”.

The foregoing facts were found to be applicable to fresh material of *Micrasterias crux-melitensis* (Ehrenb.) Hass. kept in glass containers and studied from 12/7/55 onwards. It was observed in numerous individuals that where there were differences between the new semicells and the parent semicells, the semicells formed during the next division reverted to the original type (Tab. 18, fig. 7; Tab. 19, fig. 7; Tab. 21, figs. 1, 3).

West (1899) also states:

“The most numerous variations are to be found amongst the commoner and more widely distributed species. The majority of these variations appear to affect only the superficial characters—the warts, spines, striolations, granules, scrobiculations, &c., on the external or internal surfaces of the cell-wall. Some of them, however, are more important modifications, being changes in the external form of symmetry of the plant; and yet others are variations in the structure and arrangement of the cell-contents.

That variation in a species has a tendency to be reproduced there can be no doubt, especially when the reproduction takes place, as in these plants, by simple cell-division; yet extreme modifications, which are obvious abnormalities, are never (or very rarely) repeated in succeeding generations and may be regarded merely as accidental occurrences in the history of species.

The five statements which follow represent the result of the direct observations on variation in this group of plants, and may, owing to our insufficient knowledge of the question, be subject to further alterations.

1. The structure of the cell-contents is one of the most constant features exhibited by a species; but this fact can be of little classificatory value owing to the very large number of species which possess the same structure and arrangement of the chromatophores.



2. The outward form of the cell, as seen in front view, varies within certain limits, which are usually very small, but which may in exceptional cases be considerable. The form of the vertical view is, as a rule, a more constant feature than the form of the front view.
3. The ornamentation (scrobiculations, granulations, spinulations, &c.) of the cell-wall is relatively constant, being always arranged according to a definite law, which is only transgressed by variations in one or more of the individual component groups which constitute the pattern of arrangement.
4. The prolific growth and rapid division of immense numbers of Desmids have a tendency to produce variations from the typical forms.
5. Changes in the conditions of environment cannot affect the characters of a species unless they act for long periods of time".

Abnormal cell division was also observed in two species of *Cosmarium* viz. Tab. 28, fig. 3 and Tab. 29, fig. 4.

#### IV.—SUMMARY

The freshwater algal flora of the districts of Warmbaths, Nylstroom and Naboomspruit in South Africa has been investigated. A total of 494 species, varieties and forms have been identified. These include 17 Cyanophyceae with seven genera, two Flagellatae with two genera, four Mesotaeniaceae with two genera, 207 Desmidiaceae with 12 genera, 249 Diatomeae with 26 genera and 15 Chlorophyceae with three genera. Thus in the material studied, the Desmidiaceae and Diatomeae are best represented.

Several of the taxa in the present communication are new records for South Africa.

The diatom taxa have been studied in detail by Dr. B. J. Cholnoky and are only mentioned in the taxonomic part for the sake of completeness as regards the survey of the freshwater algal flora of the region under consideration. Of the 245 other taxa, 157 are described as new species, varieties or forms, as indicated in Table I.

TABLE I.—*The Numbers of Species, Subspecies, Varieties and Forms belonging to the Different Groups*

	Total Spp.	New Spp.	Total Subspp.	Total Varieties	New Varieties	Total Forms	New Forms
Cyanophyceae.....	17	10	—	—	—	—	—
Flagellatae.....	1	—	—	1	1	—	—
Mesotaeniaceae.....	3	2	—	1	—	—	—
Desmidiaceae.....	100	46	1	95	84	11	7
Chlorophyceae.....	8	6	—	5	1	2	—
TOTALS.....	129	64	1	102	86	13	7

From the investigation of this relatively small area in South Africa, it is clear that—

- (1) new taxa are abundant in this area;
- (2) additional taxa from this area await description since several of these were in a condition that did not permit identification;
- (3) further investigation is of the utmost importance if a relatively complete survey of the freshwater microflora of this area is aimed at. In this respect a closer study of the Cyanophyceae, Flagellatae, Chlorophyceae, Zygnemales and the smaller forms of the Desmidiaceae should be undertaken.

## ACKNOWLEDGEMENTS

It is my pleasant duty to offer my cordial thanks to the following persons and institutions to whom I am indebted for help and advice during my studies:—

The Council for Scientific and Industrial Research, Pretoria, for liberal financial assistance during the course of these studies;

The Librarian, Division of Botany and Plant Pathology, Department of Agriculture, Pretoria, for the generous loan of literature;

Prof. Dr. H. G. Schweickerdt, Department of General Botany, University of Pretoria, for his encouragement and guidance throughout this investigation;

Dr. B. J. Cholnoky, C.S.I.R., Pretoria, for collecting samples 47-74 and determining the Diatom taxa;

Dr. W. B. Turrill, Royal Botanic Gardens, Kew, for supplying certain literature on Desmids not available in South Africa;

Prof. Dr. H. G. Schweickerdt, Department of General Botany, and Prof. Dr. H. L. Gonin, Department of Latin, University of Pretoria, for their assistance with the Latin diagnoses of new taxa.

A word of special thanks is due in memory of my parents for their encouragement and financial assistance throughout this study.

The author is most grateful to these persons and institutions for their generous help, without which this study would not have been possible.

## V.—LITERATURE CITED

- BORGE, O AND ERDTMAN, G. (1954).. On the Occurrence of *Pediastrum* in Tertiary Strata in the Isle of Wight. Särtryck ur Botaniska Notiser 1954. Häfte 2. Lund. pp. 112-113.
- BØRGESEN, F. (1890)..... Et lille Bidrag til Bornholm Desmidié-Flora. Botanisk Tidsskrift. Bind 17, pp. 141-152.
- CARTER, NELLIE (1935)..... Alpine Desmids from British Columbia. Journ. Linn. Soc. London, Vol. L, No. 333, pp. 151-174.
- CHOLNOKY, B. J. (1952)..... Beiträge zur Kenntnis der Algenflora von Portugiesisch-Ost-Afrika. (Moçambique.) I. Separata do „Boletim da Sociedade Portuguesa de Ciências Naturais”, Vol. IV, 2.ª Série (Vol. XIX), Fasc. 1, Págs. 89a 135. Lisboa/1952.
- (1954)..... Ein Beitrag zur Kenntnis der Algenflora des Mogollflusses in Nordost-Transvaal.\* Sonderabdruck aus Band 101, Heft 1/2, 1954, der Österreichischen Botanischen Zeitschrift, pp. 118.
- (1954)..... Diatomeen und einige andere Algen aus dem „de Hoek”-Reservat in Nord-Transvaal. Särtryck ur Botaniska Notiser 1954, Häfte 3. Lund. pp. 269.
- (1955)..... Hydrobiologische Untersuchungen in Transvaal I. Vergleichung der herbstlichen Algengemeinschaften in Raytonvlei und Leeufontein. Hydrobiologia, Vol. VII, No. 3, pp. 137-209.
- CUSHMAN, J. A..... Various papers on North American Desmids in the Bulletin of the Torrey Botanical Club.
- (1903)..... Vol. XXX, pp. 513-514.
- (1904)..... Vol. XXXI, pp. 161-164, Pl. 7; pp. 393-397; pp. 581-584 Pl. 26.
- (1905)..... Vol. XXXII, pp. 223-229, Pl. 7-8; pp. 549-553.
- (1906)..... Vol. XXXIII, pp. 343-351.
- (1907)..... Vol. XXXIV, pp. 599-601.
- (1908)..... Vol. XXXV, pp. 109-134, Pl. 3-5.

\* This area is situated in N.W. Transvaal.

- CZURDA, V. (1932)..... Pascher, Süßwasserflora. Heft 9. Zygnemales, 2. Aufl.
- ENGLER, A..... A. Engler, Beiträge zur Flora von Afrika XX. Berichte über die botanischen Ergebnisse der Nyassa-See- und Kinga-Gebirgs-Expedition der Hermann- und Elise-geb. Heckmann-Wentzel-Stiftung.
- (1901)..... III.—Die von W. Goetze und Dr. Stuhlmann im Ulugurugebirge, sowie die von W. Goetze in der Kisaki- und Khutu-Steppe und in Uhehe gesammelten Pflanzen. Bot. Jahrb. Vol. 28, pp. 332-334.
- (1902)..... IV.—Die von W. Goetze am Rukwa-See und Nyassa-See sowie in den zwischen beiden Seen gelegenen Gebirgs-ländern, insbesondere dem Kinga-Gebirge gesammelten Pflanzen, nebst einigen Nachträgen zu Bericht III. Bot. Jahrb. Vol. 30, pp. 239-253.
- FRITSCH, F. E. (1930)..... Über Entwicklungstendenzen bei Desmidiaceen. Zeitschrift für Botanik, Band 23, pp. 402-418.
- (1935-1945)..... The Structure and Reproduction of the Algae. Vol. I-II.
- FRITSCH, F. E. AND RICH, F. (1924).. Contributions to our knowledge of the freshwater Algae of Africa. 4. Freshwater and subaerial Algae from Natal. Trans. Roy. Soc. of S. Afr., Vol. XI—Part 4, pp. 297-398.
- (1930)..... Contributions to our knowledge of the freshwater Algae of Africa. 7. Freshwater Algae (exclusive of Diatoms) from Griqualand West. Trans. Roy. Soc. of S. Afr., Vol. XVIII, pp. 1-123.
- FRITSCH, F. E. AND STEPHENS E. (1921) Contributions to our knowledge of the freshwater Algae of Africa. 3. Freshwater Algae (exclusive of Diatoms), mainly from the Transkei Territories, Cape Colony. Trans. Roy. Soc. of S. Afr., Vol. IX, pp. 1-72.
- FUKUSHIMA, H. (1954)..... Further Notes on the Cyanophyceae of Oze. Reprinted from Scientific Researches of the Ozegahara Moor. Tokyo, 1954.
- FUKUSHIMA, H. AND THE LATE FUJISAWA, K. (1954) Desmids Flora of Oze. Reprinted from Scientific Researches of the Ozegahara Moor. Tokyo, 1954, pp. 590-601.
- GEITLER, L. AND PASCHER, A. (1925).. Pascher, Süßwasserflora. Heft 12. Cyanophyceae, Cyanochloridinae, Chlorobacteriaceae.
- GOJDJCS, M. (1953)..... The Genus Euglena.
- GRÖNBLAD, R. AND KALLIO, P. (1954) A new Genus and a new Species among the Desmids. Särtryck ur Botaniska Notiser 1954, Häfte 2. Lund. pp. 167-178.
- HALLAS, E. (1905)..... Nye Arter af Oedogonium fra Danmark. Botanisk Tidsskrift, Bind 26, pp. 397-410.
- HEERING, W. (1914)..... Pascher, Süßwasserflora. Heft 6. Chlorophyceae III.
- HIRANO, M. (1954)..... The Desmid-flora of the Nasu Volcanic Range. Jap. Journ. Bot., Vol. 14, No. 2, pp. 215-234.
- HODGETTS, W. J. (1926)..... Contributions to our knowledge of the freshwater Algae of Africa. 6. Some freshwater Algae from Stellenbosch, Cape of Good Hope. Trans. Roy. Soc. of S. Afr., Vol. XIII, p. 49.
- HUBER-PESTALOZZI, G. (1930)..... Algen aus dem Knysnawalde in Südafrika. Zeitschrift für Botanik, Vol. 23, pp. 443-480.
- (1938)..... Das Phytoplankton des Süßwassers. Binnengewässer, von Prof. Dr. August Thienemann. Band XVI. Teil I.
- HUSTEDT, F. (1930)..... Pascher, Süßwasserflora. Heft 10. Bacillariophyta (Diatomeae).
- JACOBSEN, M. J. P. (1873-74)..... Aperçu Systématique et Critique sur les Desmidiacées du Danemark. Botanisk Tidsskrift, Bind 7-9, pp. 143-215.
- JOHNSON, L. N. (1894)..... On some species of Micrasterias. Bot. Gazette, Vol. XIX, pp. 56-60, Pl. VI.
- (1894)..... Some New and Rare Desmids of the United States, I. Bull. Torrey Botan. Club, Vol. XXI, pp. 285-291, Pl. 211.

- (1895)..... Some New and Rare Desmids of the United States, II. Bull Torrey Botan. Club, Vol. XXII, pp. 289–298, Pl. 232–233.
- JØRGENSEN, E. G. (1947)..... Algevegetation i Madum Sø. Botanisk Tidsskrift, Bind 48, Hefte 2, pp. 141–155.
- JOSHUA, W. (1882)..... Notes on British Desmidiaceae. Journ. of Bot., Vol. XX pp. 300–302.
- (1883)..... Notes on British Desmidiaceae—No. 2. Journ. of Bot. Vol. XXI, pp. 290–292, 349.
- (1885)..... On some new and rare Desmidiaceae—No. 3. Journ. of Bot., Vol. XXIII, p. 33, Tab. 254.
- (1885)..... Burmese Desmidiaceae, with descriptions of new species occurring in the neighbourhood of Rangoon. Journ. Linn Soc. Bot., Vol. XXI, 1884–1886, pp. 634–655, Pl. 22–25.
- KOPETZKY-RECHTERPERG, O. (1952)..... Artenliste von Desmidiales aus den österreichischen Alpen. Snn 161–24. Aus den Sitzungsberichten der Österr. Akademie der Wissenschaften, Mathem.-Naturw. Kl., Abt. I, 161 Bd., 4. und 5. Heft. Wien. pp. 239–261.
- KUFFERATH, H. (1932)..... Quelques Desmidiées du Congo Belge. Annales de Cryptogamie exotique. Decembre 1932. Tome V, Fasc. 3–4, pp. 276–281.
- LOUB, W. (1953)..... Zur Algenflora der Lungauer Moore. Snn 162–36. Aus den Sitzungsberichten der Österr. Akademie der Wissenschaften, Mathem.-Naturw. Kl., Abt. I, 162 Bd., 7. und 8. Heft. Wien 1953, pp. 545–569.
- MASSEE, G. (1887)..... On causes influencing the direction of growth, and the origin of multicellular plants. Journ. of Bot., Vol. XXV, pp. 257–267, Pl. 277 (Types of sheath in Algae).
- MESSIKOMMER, E. (1942)..... Beitrag zur Kenntnis der Algenflora und Algenvegetation des Hochgebirges um Davos. Pflanzen geographische Kommission der Schweizerischen Naturforschenden Gesellschaft. Beiträge zur geobotanischen Landesaufnahme der Schweiz, Heft 24.
- MIGULA, W. (1924)..... Die Desmidiaceen. 2. Auflage. Handbücher für die praktische naturwissenschaftliche Arbeit V. Kryptogamen-Flora von Deutschland, Deutsch-Osterreich und der Schweiz im Anschluss an Thomé's Flora von Deutschland. Band II. Algen.
- NÄGELI, C. (1849)..... Gattungen einzelliger Algen. [Micrasterias decemdentata (Näg.) Arch., p. 123, Tab. VI, H, Fig. 2.]
- NORDSTEDT, O. (1887)..... The Figures in Cooke's "British Desmids". Journ. of Bot., Vol. XXV.
- NYGAARD, G. (1932)..... Contributions to our knowledge of the freshwater Algae of Africa. 9. Freshwater Algae and Phytoplankton from the Transvaal. (Communicated by Miss E. L. Stephens.) Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, pp. 101–148.
- OLTMANN, F. (1922)..... Morphologie und Biologie der Algen. I Bd.
- PASCHER, A. AND LEMMERMANN, E. (1913)..... Pascher, Süßwasserflora. Heft 2. Flagellatae II.
- PASCHER, A., LEMMERMANN, E. AND BRUNTHALER, J. (1915)..... Pascher, Süßwasserflora. Heft 5. Chlorophyceae 2.
- PASCHER, A. (1927)..... Pascher, Süßwasserflora. Heft 4. Volvocales.
- PETERSEN, J. B. (1936)..... On some Algae from Grimsey. Botanisk Tidsskrift, Bind 43, pp. 269–277.
- (1934)..... The Algal Vegetation of Hammer Bakker. Botanisk Tidsskrift, Bind 42, pp. 1–48.
- PRESCOTT, G. W. (1948)..... Desmids. Botan. Review, Vol. XIV, pp. 644–676.
- PRINTZ, H. (1927)..... Chlorophyceae (nebst Conjugatae, Heterokontae und Charophyta). Die Natürlichen Pflanzenfamilien. Herausgegeben von A. Engler. Band 3.

- REINSCH, P. (1878)..... Contributions ad floram Algarum aquae dulcis Promotorii Bonae Spei. Journ. Linn. Soc. Bot., Vol. XVI, pp. 232-248. Pl. VI.
- RICH, F. (1932)..... Contributions to our knowledge of the freshwater Algae of Africa. 10. Phytoplankton from South African pans and vleis. (Communicated by Miss E. L. Stephens.) Trans Roy. Soc. of S. Afr., Vol. XX—Part 2, pp. 149-188.
- ROSENBERG, M. (1940)..... Formation and division of binucleate giant cells in *Micrasterias americana* (Ehrenb.) Ralfs. New Phytologist, Vol. 39, No. 1, pp. 80-85.
- ROY, J. (1890)..... Freshwater Algae of Enbridge Lake and Vicinity, Hampshire. Journ. of Bot., Vol. XXVIII, pp. 334-338.
- ROY, J. AND BISSETT, J. P. (1886).... Notes on Japanese Desmids. Journ. of Bot., Vol. XXIV, pp. 193-196, 237-242, Tab. 268.
- SCHAARSCHMIDT, J. (1884)..... Notes on Afghanistan Algae. Journ. Linn. Soc. Bot., Vol. XXI, 1884-1886, pp. 241-250, Pl. 5.
- SCHMIDLE, W. (1899)..... Die von Prof. Dr. Volkens und Dr. Stuhlmann in Ost-Afrika gesammelten Desmidiaceen, bearbeitet unter Benützung der Vorarbeiten von Prof. G. Hieronymus. A. Engler, Beiträge zur Flora von Afrika. XVI. Botanische Jahrb., Band 26, pp. 1-59.
- (1900)..... Berichte über die botanischen Ergebnisse der Nyassa-see- und Kinga- Gebirgs-Expedition der Hermann- und Eliseggeb. Heckmann-Wentzel-Stiftung. A. Engler, Beiträge zur Flora von Afrika XVIII.
- (1900)..... II. W. Schmidle, Über Planktonalgen und Flagellaten aus dem Nyassasee. Botan. Jahrb., Band 27, pp. 226-237.
- (1903)..... V. Algen, insbesondere solche des Plankton, aus dem Nyassa-See und seiner Umgebung, gesammelt von Dr. Fülleborn. Botan. Jahrb., Band 32, pp. 56-88.
- (1904)..... VI. W. Schmidle, Das Chloro- und Cyanophyceenplankton des Nyassa- und einiger anderer innerafrikanischer Seen. A. Engler, Beiträge zur Flora von Afrika XXIV. Botan. Jahrb., Band 33, pp. 1-33.
- (1902)..... Beiträge zur Algenflora Afrikas. A. Engler, Beiträge zur Flora von Afrika XXI. I. Algen aus Ost-Afrika. Botan. Jahrb., Band 30, pp. 58-68.
- SCHMIDT, J. (1898-1899)..... Danmarks blaagrønne Alger (Cyanophyceae Daniae). Botanisk Tidsskrift, Bind 22, pp. 283-418.
- SCHULZE, G. M. (1954)..... Internationaler Code der Botanischen Nomenklatur. Angenommen vom Siebenten Internationalen Botanischen Kongress Stockholm, Juli 1950.
- TAYLOR, WM. R. (1935)..... Alpine Algae from the Santa Marta Mountains, Colombia. Amer. Journ. of Bot., Vol. 22, pp. 763-781, Pl. 1-3, Taylor: Algae.
- TAYLOR, WM. R. AND COLTON, H. S. (1928) The Phytoplankton of some Arizona pools and lakes. Amer. Journ. of Bot., Vol. 15, pp. 596-614, Pl. XLVI-XLVII.
- VAN OYE, P. (1949)..... Nouvelles Données sur les Desmidiées des Environs de Matadi (Congo Belge). Hydrobiologia. Acta Hydrobiologica, Limnologica et Protistologica. Separatum. Vol. 1, No. 3, pp. 282-308.
- (1953)..... Etude sur les Desmidiées du Grand-Duché de Luxembourg. Un Problème Biogéographique. Bulletin de la Société Royale de Botanique de Belgique, Tome 85, pp. 157-194 (juin 1953)—Communication présentée à la séance du 19 octobre 1952.
- VIRET, L. (1909)..... Desmidiacées de la Vallée du Trient (Valais, Suisse). Bull. de la Soc. bot. Genève, Vol. 1, pp. 251-268, Pl. III.
- WEST, G. S. (1899)..... On variation in the Desmidiaceae, and its Bearings on their classification. Journ. Linn. Soc. Bot., Vol. XXXIV, pp. 366-416, Pl. 8-11.
- (1904)..... A Treatise on the British Freshwater Algae.

- (1904)..... West Indian Freshwater Algae. Journ. of Bot., Vol. XLII, pp. 281–294, Tab. 464.
- (1905)..... Desmids from Victoria. Journ. of Bot., Vol. XLIII, pp. 252–254.
- (1907)..... Freshwater Algae of the Third Tanganyika Expedition. Journ. Linn. Soc. Bot., Vol. XXXVIII, pp. 81–197, t. 2–10.
- (1909)..... The Algae of the Birket Qarun, Egypt. Journ. of Bot., Vol. 47, pp. 237–244, t. 498.
- (1909)..... The Algae of the Yan Yean Reservoir: a Biological and Oecological Study. Journ. Linn. Soc. Bot., Vol. XXXIX, pp. 1–88, Pl. 1–6.
- (1911)..... Algological Notes, I–IV. Journ. of Bot., Vol. XLIX, pp. 82–89.
- (1912)..... Freshwater Algae. Ann. S. Afr. Mus. 9, pp. 61–90, t. 1–2.
- WEST, W. (1888)..... The Desmids of Maine. Journ. of Bot., Vol. XXVI, pp. 339–340.
- (1889)..... The Freshwater Algae of Maine. Journ. of Bot., Vol. XXVII, pp. 289–298, Tab. 291.
- (1889)..... The Freshwater Algae of North Yorkshire. Journ. of Bot., Vol. XXVII.
- (1891)..... The Freshwater Algae of Maine II. Journ. of Bot., Vol. XXIX, pp. 353–357, Tab. 315.
- (1893)..... A Contribution to the Freshwater Algae of West Ireland. Journ. Linn. Soc. Bot., Vol. XXIX, pp. 103–216, Pl. 18–24.
- WEST, W. AND WEST, G. S. (1895).... A contribution to our knowledge of the freshwater Algae of Madagascar. Trans. Linn. Soc. London, Ser. 2, Vol. V, Botany, 1895–1901. Part II—October, 1895, pp. 41, Pl. V–IX.
- (1895)..... Some recently published Desmidiaceae. Journ. of Bot., Vol. XXXIII, pp. 65–70.
- (1896)..... On some North American Desmidiaceae. Trans. Linn. Soc. London, Ser. 2—Vol. V, Botany, 1895–1901. Part V—December, 1896, p. 229, Pl. XII–XVIII.
- (1896)..... Algae from Central Africa. Journ. of Bot., Vol. 34, pp. 377–384, t. 361.
- (1897)..... Welwitsch's African Freshwater Algae. Journ. of Bot., Vol. XXXV, pp. 2–7; 33–42; 77–89; 113–122; 172–183; 235–243; 264–272; 297–304, t. 365–370.
- (1897)..... Desmids from Singapore. Journ. Linn. Soc. Bot., Vol. XXXIII, 1897–1898, pp. 156–167, Pl. 8–9.
- (1898)..... On some Desmids of the United States. Journ. Linn. Soc. Bot., Vol. XXXIII, 1897–1898, pp. 279–322, Pl. 16–18.
- (1899)..... A further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot., Vol. XXXIV, pp. 279–295.
- (1900)..... Notes on Freshwater Algae—II. Journ. of Bot., Vol. XXXVIII.
- (1902)..... A contribution to the freshwater Algae of Ceylon. Trans. Linn. Soc. London, Ser. 2—Vol. VI, Botany, 1901–1902. Part III—March, 1902, pp. 123, Pl. 17–22.
- (1902)..... Fresh Water Chlorophyceae Flora of Koh Chang. Contributions to the knowledge of the vegetation in the Gulf of Siam, by Johs. Schmidt. Part IV. Botanisk Tidsskrift, Bind 24, pp. 157–186.
- (1903)..... Scottish Freshwater Plankton—No. I. Journ. Linn. Soc. Bot., Vol. XXXV, pp. 519–556, Pl. 14–18.
- (1904–1912)..... A monograph of the British Desmidiaceae. The Ray Society London. Vol. I–IV.
- WETTSTEIN, R. (1935)..... Handbuch der Systematischen Botanik.

## EXPLANATION OF THE ILLUSTRATIONS.

## FIGURE 1.

Topographical Map of the districts of Warmbaths, Nylstroom and Naboomspruit showing the principal localities where collections were made.

## FIGURE 2.

Localities of collections in the Doornfontein and Leeupoort area.

## FIGURE 3.

Localities of collections in the Moddernek area.

## TABULA 1

FIGS.

- 1, 2. *Stigonema pseudominutum* sp. nov.
- 3-7. *Scytonema myochrous* (Dillw.) Ag.

## TABULA 2

FIGS.

1. *Nostoc pseudogelatinosum* sp. nov.
2. *N. nylstromicum* sp. nov.
3. *Anabaena galpinii* sp. nov.
4. *A. mesiana* sp. nov.
5. *A. pseudocatenula* sp. nov.
6. *Oscillatoria subpristleyi* sp. nov.
7. *O. nylstromica* sp. nov.
8. *O. tenuis* Ag.
9. *O. waterbergensis* sp. nov.
10. *Lyngbya uliginosa* sp. nov.

Figs. 3, 4  $\times$  a; 5, 6, 7, 9  $\times$  b; 1, 2, 8, 10  $\times$  c.

## TABULA 3

FIGS.

1. *Cylindrocystis barbarica* sp. nov.
2. *C. caffra* sp. nov.
3. *Penium margaritaceum* (Ehrenb.) Bréb.
4. *P. margaritaceum* var. *incognitum* var. nov.
5. *P. margaritaceum* var. *brevior* var. nov.
6. *P. barbaricum* sp. nov.
7. *P. libellula* (Focke) Nordst. var. *schweickerdtii* var. nov.
8. *P. subcucurbitinum* sp. nov.
9. *P. curtum* Bréb. var. *waterbergense* var. nov.
- 10-13. *P. mesianum* sp. nov.
14. *P. pseudorufescens* sp. nov.
15. *P. curcubitinum* Biss. forma *botesii* forma nov.
- 16, 17. *Penium* species ad *P. cruciferum* (De Bary) Wittr. Fig. 17 = zygospore.

Figs. 4, 5, 6, 7, 10, 11, 13  $\times$  a; 1, 2, 3, 8, 9, 12, 14, 15, 16, 17  $\times$  b.  
a = 40  $\mu$ ; b = 40  $\mu$ .

## TABULA 4

FIGS.

1. *Closterium pseudolunula* sp. nov.
  2. *C. spetsbergense* Borge var. *subafricanum* var. nov.
  3. *C. intermedium* Ralfs var. *mesianum* var. nov.
  - 4-5. *C. kranskopense* sp. nov.
  - 6-7. *C. acerosum* (Schrank) Ehrenb. var. *waterbergense* var. nov.
  - 8-11. *C. malinvernianum* De Not.
- Figs. 1, 3, 4, 8, 9, 10, 11  $\times$  a; 6  $\times$  b; 5, 7  $\times$  c; 2  $\times$  d.

## TABULA 5

FIGS.

1. *Closterium ralfsii* Bréb. var. *subralfsii* var. nov.
2. *C. ralfsii* var. *glentigianum* var. nov.
3. *C. ralfsii* var. *nodosum* var. nov.
- 4-5. *C. ralfsii* var. *minor* var. nov.
6. *C. truncatum* sp. nov.
7. *C. subsiliqua* sp. nov.
8. *C. pseudoleibleinii* sp. nov.
9. *C. striolatum* Ehrenb. var. *nylstromaticum* var. nov.
10. *C. striolatum* var. *subnylstromaticum* var. nov.
11. *C. subdecorum* sp. nov.
12. *C. decorum* Bréb. var. *minor* var. nov.
13. *C. boyanum* sp. nov.
14. *C. moniliferum* (Bory) Ehrenb. var. *epithemioides* var. nov.
15. *C. cymbellaeformis* sp. nov.
16. *C. atomicum* sp. nov.
17. *C. sublagoense* sp. nov.
18. *C. schweickerdtii* sp. nov.

Figs. 1, 2, 3  $\times$  a; 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 18  $\times$  b; 11, 12, 16, 17  $\times$  c.

## TABULA 6

FIGS.

1. *Closterium kützingii* Bréb. var. *transvaalense* var. nov.
2. *C. warmbadianum* sp. nov.
3. *C. warmbadianum* var. *porulosum* var. nov.
- 4-6. *C. barbaricum* sp. nov.
7. *C. jenneri* Ralfs var. *dubitabilis* var. nov.
8. *C. parvulum* Näg. var. *minor* var. nov.
- 9-10. *C. abruptum* West var. *westiorum* var. nov.
11. *C. peracerosum* Gay var. *elegans* G. S. West.
12. *C. gracile* Bréb. var. *brevius* var. nov.
13. *C. tumidum* Johnson var. *angustum* var. nov.
14. *C. ceratium* Perty var. *angustum* var. nov.
15. *C. tumidum* Johnson.
- 16-18. *C. venus* Kütz. var. *inflatum* var. nov.
19. *C. incurvum* Bréb. var. *elaboratum* var. nov.
20. *C. calosporum* Wittr. var. *minor* var. nov.
21. *C. ehrenbergii* Menegh. var. *minutissimum* var. nov.
22. *C. acutum* (Lyngb.) Bréb. var. *linea* (Perty) W. & G. S. West forma *minor* f. nov.
23. *C. cornu* Ehrenb. var. *minor* var. nov.
24. *C. cornu* var. *angustum* var. nov.

Figs. 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 17, 18, 20, 24  $\times$  a; 2, 3, 12, 15, 16, 19, 21, 22, 23  $\times$  b; 1  $\times$  c.

a = 40  $\mu$ ; b = 40  $\mu$ .



## TABULA 7

FIGS.

1. *Pleurotaenium trabecula* (Ehrenb.) Näg. var. *barbaricum* var. nov.
2. *Pl. pseudoehrenbergii* var. nov.
- 3-5. *Pl. trabecula* (Ehrenb.) Näg. var. *angustum* var. nov.
6. *Pl. caffrorum* sp. nov.
- 7-8. *Pl. ehrenbergii* (Bréb.) De Bary var. *waterbergense* var. nov.
9. *Pl. westiorum* sp. nov.
10. *Pl. trabecula* var. *brevis* var. nov.

Figs. 7, 8  $\times$  a; 1, 2, 3, 4, 5, 10  $\times$  b; 9  $\times$  c; 6  $\times$  d.

## TABULA 8

FIGS.

- 1, 2. *Pleurotaenium* species ad *Pl. ovatum* Nordst.
3. *Closterium cynthia* De Not var. *waterbergense* var. nov.
4. *C. caffrorum* sp. nov.
5. *C. insolitum* sp. nov.
6. *Pleurotaenium truncatum* (Bréb.) Näg. var. *mattei* var. nov.
7. *Pl. trochiscum* W. & G. S. West var. *galpinii* var. nov.

Figs. 1, 2  $\times$  a; 3, 4, 5  $\times$  b; 6, 7  $\times$  c.

## TABULA 9

FIGS.

1. *Euastrum spinulosum* Delp. subsp. *africanum* Nordst.
2. *E. spinulosum* subsp. *africanum* var. *transvaalense* var. nov.
3. *E. divergens* Josh. var. *subbifidum* var. nov.
- 4-5. *E. rostratum* Ralfs subsp. *umbonatum* W. & G. S. West var. *kranskopense* var. nov.
- 6-7. *E. brasiliense* Borge var. *theronii* var. nov.
8. *E. ansatum* Ralfs.
9. *E. dubitabilis* sp. nov.
- 10-12. *E. insulare* (Wittr.) Roy.
- 13-14. *E. cuneatum* Jenner var. *minor* var. nov.
- 15-17. *E. pseudovalidum* sp. nov.
18. *E. elegans* (Bréb.) Kütz. var. *transvaalense* var. nov.
- 19-21. *E. schweickerdtii* sp. nov.

Figs. 1, 2, 3, 10, 11, 12, 13, 14  $\times$  a; 4, 5, 6, 7, 8, 9, 15, 16, 17, 18, 19, 20, 21  $\times$  b.

a = 40  $\mu$ ; b = 40  $\mu$ .

Figs. 5, 7, 14, 16, 20 = lateral view of cell and figs. 17, 21 = vertical view of semicell.

## TABULA 10

FIGS.

- 1-4. *Micrasterias apiculata* (Ehrenb.) Menegh.

Figs. 1, 2  $\times$  a; 3, 4  $\times$  b.

## TABULA 11

FIGS.

- 1-4. *Micrasterias denticulata* Bréb. var. *africana* var. nov.

Figs. 1, 2  $\times$  a; 3, 4  $\times$  b.

## TABULA 12

FIGS.

1. *Micrasterias denticulata* Bréb. var. *africana* var. nov.
2. *M. denticulata* var. *subnotata* West forma *cornuta* forma nov.
3. *M. nylstromica* sp. nov.

## TABULA 13

FIGS.

- 1-3. *Micrasterias denticulata* Bréb. var. *subnotata* West forma *cornuta* forma nov.
4. *M. nylstromica* sp. nov.

## TABULA 14

FIGS.

- 1-4. *Micrasterias groenewaldii* sp. nov.
- Fig. 2 = vertical view of semicell.

## TABULA 15

FIGS.

- 1-3. *Micrasterias truncata* (Corda) Bréb.
- 4, 5. *M. truncata* var. *africana* Fritsch & Rich.
6. *M. sol* (Ehrenb.) Kütz.

Figs. 1, 2, 3  $\times$  a; 4, 5, 6  $\times$  b.

## TABULA 16

FIGS.

- 1, 2. *Micrasterias crux-melitensis* (Ehrenb.) Hass. var. *transvaalensis* var. nov.
3. *M. crux-melitensis* var. *evoluta* Turn.
4. *M. americana* (Ehrenb.) Ralfs var. *transvaalensis* var. nov.
- 5-7. *M. decemdentata* (Näg.) Arch.

## TABULA 17

FIGS.

1. *Micrasterias crux-melitensis* (Ehrenb.) Hass. var. *evoluta* Turn.
2. *M. mahabuleshwarensis* Hobson var. *transvaalensis* var. nov.
3. *M. tropica* Nordst. var. *elongatissima* var. nov.
- 4-7. *M. decemdentata* (Näg.) Arch. var. *galpinii* var. nov.
8. *M. truncata* (Corda) Bréb. var. *minor* var. nov.

## TABULA 18

FIGS.

- 1-14. *Micrasterias crux-melitensis* (Ehrenb.) Hass.
- Fig. 2 = vertical view of semicell.

## TABULA 19

FIGS.

- 1-11. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 20

FIGS.

- 1-6. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 21

FIGS.

- 1-4. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 22

FIGS.

- 1-6. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 23

FIGS.

1. *Micrasterias crux-melitensis* (Ehrenb.) Hass.  
2, 3. *M. pinnatifida* (Kütz.) Ralfs var. *transvaalensis* var. nov.

## TABULA 24

FIGS.

- 1-3. *Euastrum divaricatum* Lund. var. *transvaalense* var. nov.  
4-5. *Cosmarium pyramidatum* Bréb. var. *majus* var. nov.  
6. *C. contractum* Kirchn. var. *pseudogartanense* var. nov.  
7. *C. laeve* Rabenh. var. *majus* var. nov.  
8, 9. *C. sexnotatum* Gutw. var. *simplex* var. nov.  
10. *C. quadratum* Ralfs var. *africanum* Fritsch.  
11. *C. decoratum* W. & G. S. West var. *waterbergense* var. nov.  
12. *C. nanum* sp. nov.  
13. *C. hammeri* Reinsch var. *minor* var. nov.  
14, 15. *C. impressulum* Eلفv.

Figs. 14 × a; 1-13, 15 × b.

Fig. 2 = lateral view and fig. 3 = vertical view of cell.

a = 40 μ; b = 40 μ.

## TABULA 25

FIGS.

- 1, 2. *Cosmarium pseudotaxichondrum* Nordst. var. *atomicum* var. nov.  
3. *C. orthostichum* Lund. var. *pseudopumilum* var. nov.  
4-6. *C. pseudoprotractum* sp. nov.  
7, 8. *C. caffrorum* sp. nov.  
9. *C. sexangulare* Lund.  
10. *C. trachypleurum* Lund. var. *subspinosum* sp. nov.  
11. *C. transvaalense* sp. nov.  
12-14. *C. subcostatum* Nordst. var. *warmbadianum* var. nov.  
15, 16. *C. debaryi* Arch. var. *minor* var. nov.  
17, 18. *C. granatum* Bréb. var. *africanum* Fritsch.

Figs. 1, 2, 3, 9, 11, 18 × a; 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17 × b.

a = 40 μ; b = 40 μ.

Figs. 2, 6, 14, 16 = vertical view and fig. 5 = lateral view of cells.

## TABULA 26

FIGS.

- 1-7. *Cosmarium waterbergense* sp. nov.  
8. *C. orthostichum* Lund. var. *transvaalense* var. nov.  
9, 10. *C. speciosum* Lund. var. *simplex* Nordst. forma *africanum* forma nov.  
11, 12. *C. tetragonum* (Näg.) Arch. var. *transvaalense* var. nov.  
13. *C. nylstromicum* sp. nov.  
14, 15. *C. subconnatum* sp. nov.  
16. *Cosmarium barbaricum* sp. nov.

Figs. 8, 14, 15 × a; 1-7, 9-13, 16 × b.

Fig. 15 = lateral view of cell.

## TABULA 27

FIGS.

- 1, 2. *Cosmarium binum* Nordst.
  - 3, 4. *C. botesii* sp. nov.
  5. *C. maximum* (Börg.) W. & G. S. West var. *minor* West.
  6. *C. trachypleurum* Lund. var. *pseudonatalensis* var. nov. forma *irregulare* f. nov.
  7. *C. trachypleurum* var. *pseudonatalensis* var. nov.
  8. *C. connatum* Bréb. var. *subellipticum* var. nov.
  9. *C. subtumidum* Nordst. var. *theronii* var. nov.
  10. *C. pyramidatum* Bréb. var. *elongatum* var. nov.
- Figs. 1, 2, 4, 6  $\times$  a; 3, 5, 7-10  $\times$  b.  
Fig. 2 = vertical view of semicell.

## TABULA 28

FIGS.

- 1-3. *Cosmarium obsoletum* (Hantzsch) Reinsch var. *transvaalense* var. nov.
  4. *C. pachydermum* Lund. var. *waterbergense* var. nov.
  - 5, 6. *C. reniforme* (Ralfs) Arch.
  - 7-10. *Xanthidium cristatum* Bréb. var. *transvaalense* var. nov.
- Figs. 1, 5, 6, 9, 10  $\times$  a; 2, 3, 4, 7, 8  $\times$  b.  
Fig. 10 = vertical view of semicell.

## TABULA 29

FIGS.

1. *Euastrum galpinii* sp. nov.
  2. *E. spinulosum* Delp. subsp. *africanum* Nordst.
  3. *E. divergens* Josh. var. *galpinii* var. nov.
  4. *Cosmarium granatum* Bréb. var. *africanum* Fritsch.
  - 5, 6. *C. galpinii* sp. nov.
  - 7, 8. *C. schweickerdtii* sp. nov.
  - 9, 10. *C. pseudamoenum* Wille.
  11. *C. decoratum* W. & G. S. West var. *galpinii* var. nov.
  12. *Xanthidium cristatum* Bréb. var. *delpontei* Roy & Biss. forma *laevis* forma nov.
  - 13, 14. *Staurastrum setigerum* Cleve var. *pectinatum* W. & G. S. West forma *australe* forma nov.
  - 15-17. *St. galpinii* sp. nov.
  18. *St. quadrangulare* Bréb. var. *subarmatum* var. nov.
  - 19, 20. *St. brevispinum* Bréb. var. *masoganum* var. nov.
- Figs. 6, 14, 15, 20 = vertical view of semicells.

## TABULA 30

FIGS.

- 1-6. *Staurastrum dilatatum* Ehrenb.
  - 7-9. *St. caffrorum* sp. nov.
  - 10, 11. *St. barbaricum* sp. nov.
  - 12, 13. *St. xiphidiophorum* Wolle var. *westiorum* var. nov.
  - 14, 15. *St. orbiculare* Ralfs var. *ralfsii* W. & G. S. West.
  - 16-18. *St. subtrifurcatum* West forma *major* W. & G. S. West.
- Figs. 16  $\times$  a; 14, 15, 17, 18  $\times$  b; 1-13  $\times$  c.  
Figs. 3, 4, 8, 11, 12, 14, 18 = vertical view of semicells.

## TABULA 31

## FIGS.

- 1, 2. *Staurastrum subgemmastrum* W. & G. S. West var. *mattiei* var. nov.  
 3, 4. *St. mesianum* sp. nov.  
 5, 6. *St. orbiculare* Ralfs var. *waterbergense* var. nov.  
 7, 8. *St. dickiei* Ralfs.  
 9, 10. *St. pseudogemmastrum* sp. nov.  
 11–13. *St. pseudogemmastrum* var. *warmbadianum* var. nov.  
 14–16. *St. dilatatum* Ehrenb.  
 17, 18. *St. trihedrale* Wolle var. *australe* var. nov.  
 19, 20. *St. teliferum* Ralfs var. *transvaalense* var. nov.  
 21, 22. *St. crenatum* var. nov.  
 23, 24. *St. connatum* Roy & Biss. var. *warmbadianum* var. nov.  
 25–27. *St. mattiei* sp. nov.  
 28, 29. *St. pygmaeum* Bréb. var. *botesii* var. nov.  
 Figs. 2, 4, 5, 7, 10, 11, 13, 15, 16, 17, 20, 22, 24, 26, 29 = vertical view of semicells.

## TABULA 32

## FIGS.

- 1, 2. *Staurastrum gemelliparum* Nordst. var. *africanum* var. nov.  
 3–6. *St. furcatum* (Ehrenb.) Bréb.  
 7. *St. excavatum* W. & G. S. West.  
 8. *St. leptocladum* Nordst. var. *cornutum* Wille.  
 9. *Sphaerosoma aubertianum* W. West.  
 10. *Onychonema* species ad. *On. laeve* Nordst. var. *micracanthum* Nordst.  
 11. *Euglena spirogyra* Ehrenb. var. *major* var. nov.  
 Figs. 2, 4, 5 = vertical view of cells.

## TABULA 33

## FIGS.

- 1–3. *Pediastrum duplex* Meyen var. *reticulatum* Lagerh. forma *cohaerens* Bohlin.  
 4. *P. boryanum* (Turpin) Menegh. var. *granulatum* (Kütz.) A. Br.  
 5. *P. boryanum* var. *minor* var. nov.  
 6. *P. tetras* (Ehrenb.) Ralfs var. *excisum* Rabenh.  
 Figs. 1, 4, 5, 6 × a; 2, 3 × b.

## TABULA 34

## FIGS.

- 1–4. *Oedogonium pseudofragile* sp. nov.  
 5. *Oe. mesianum* sp. nov.  
 6. *Oe. subintermedium* sp. nov.  
 7. *Oe. subvaucherii* sp. nov.  
 8. *Oe. mattiei* sp. nov.  
 9, 10. *Oe. boyanum* sp. nov.

## TABULA 35

## FIGS.

- a-p. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 36

## FIGS.

- A–G. *Micrasterias denticulata* Bréb.

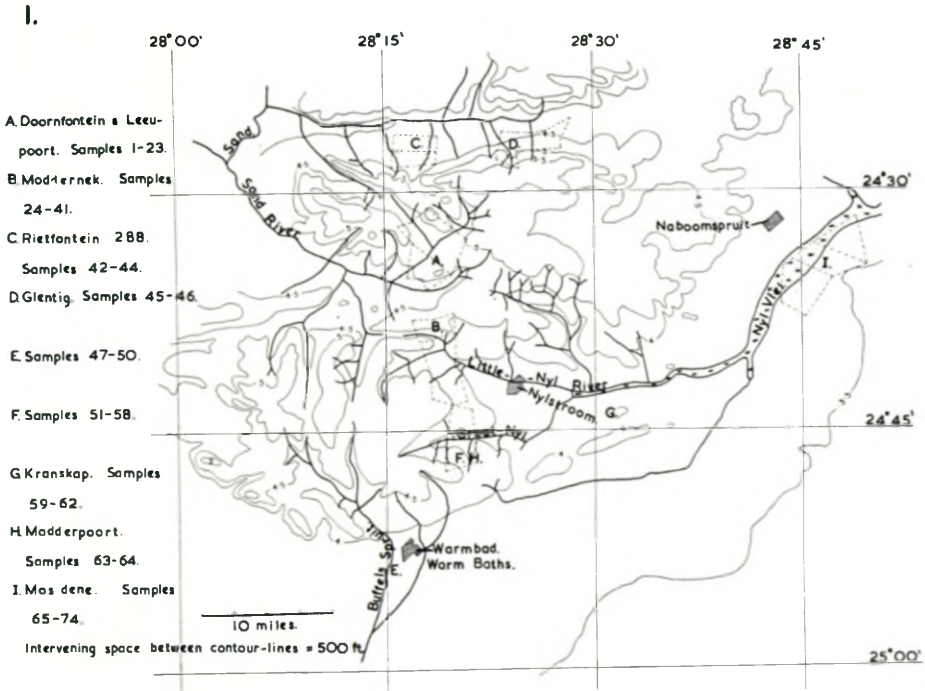
## TABULA 37

## FIGS.

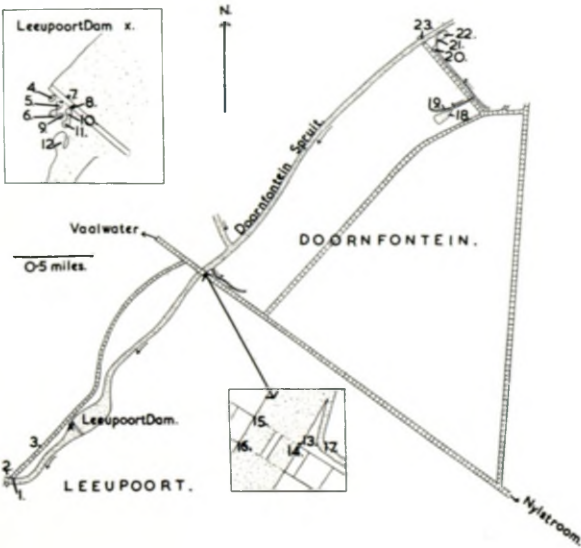
- H–K. *Micrasterias denticulata* Bréb.



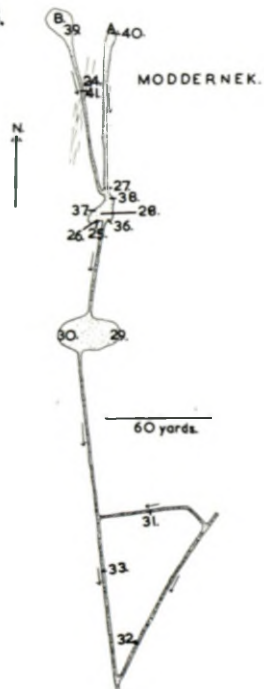
TOPOGRAPHICAL MAP.

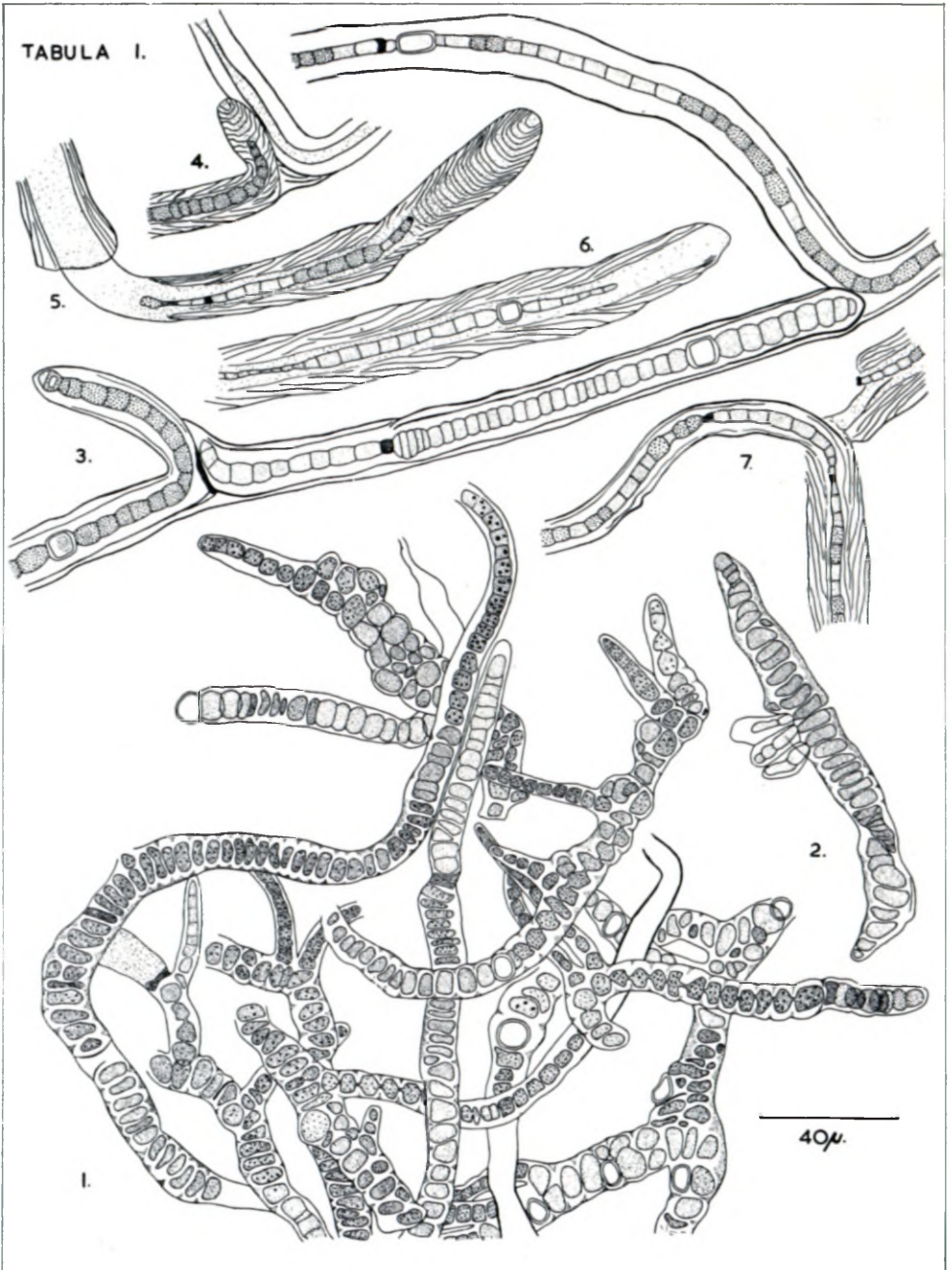


2.



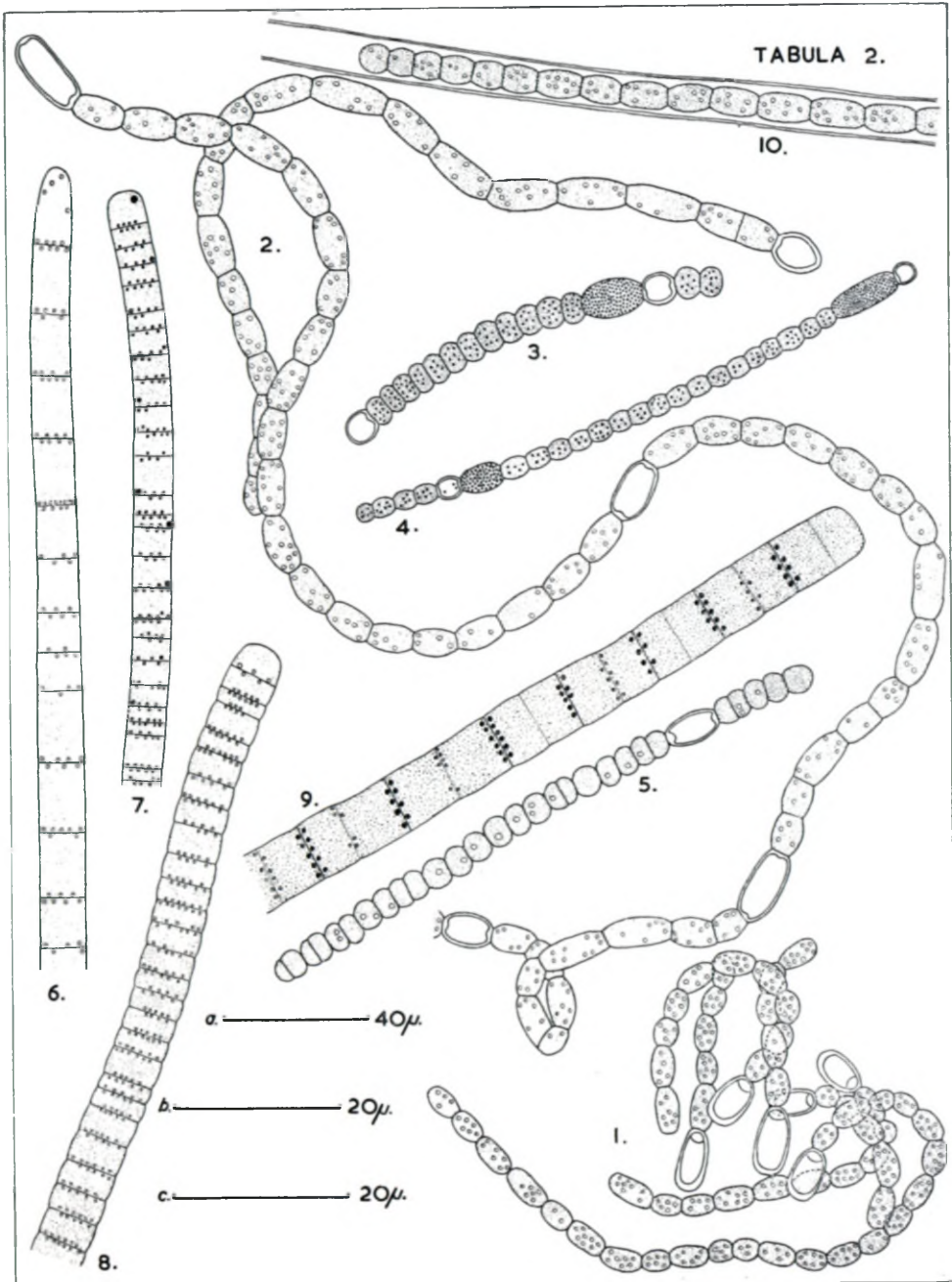
3.



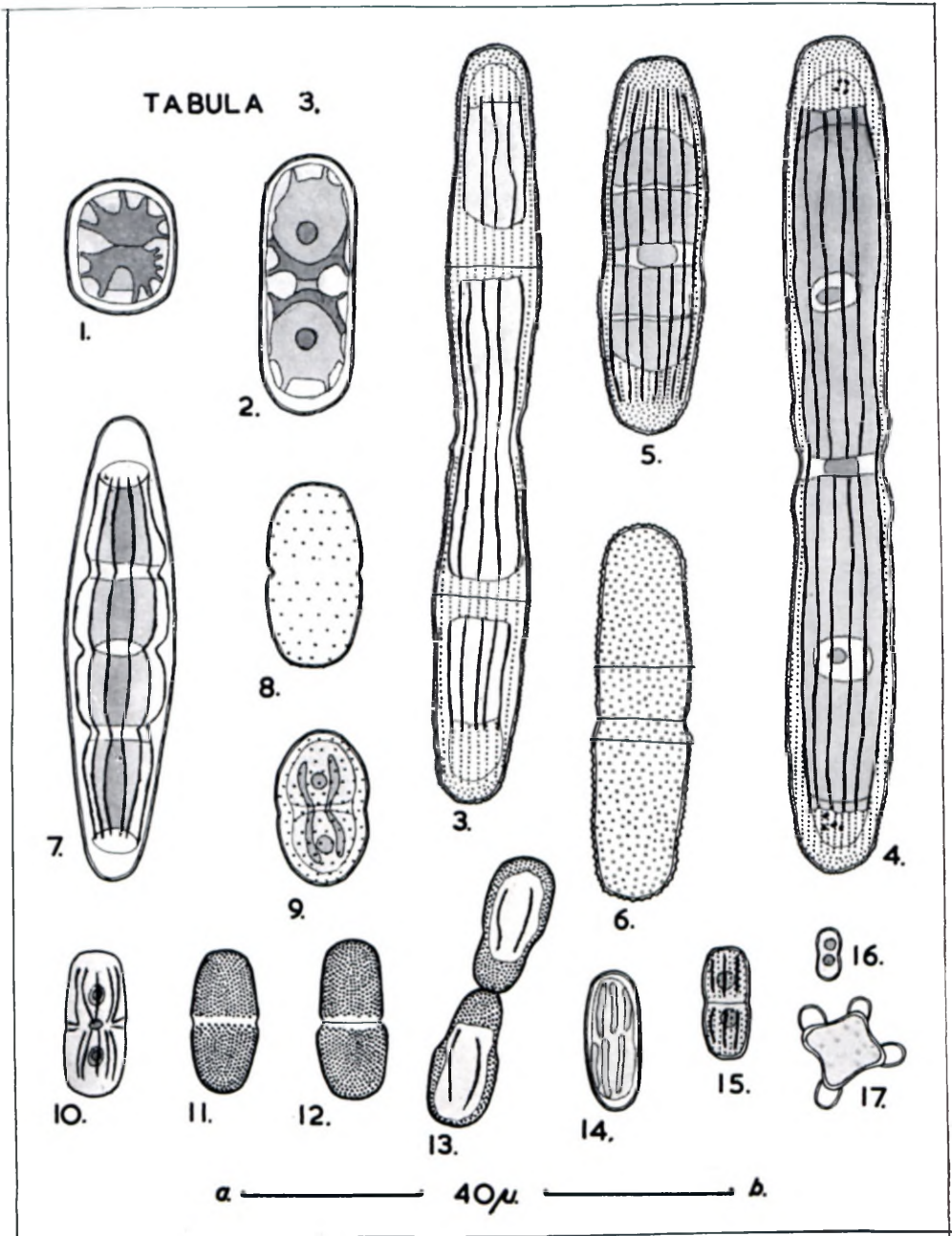




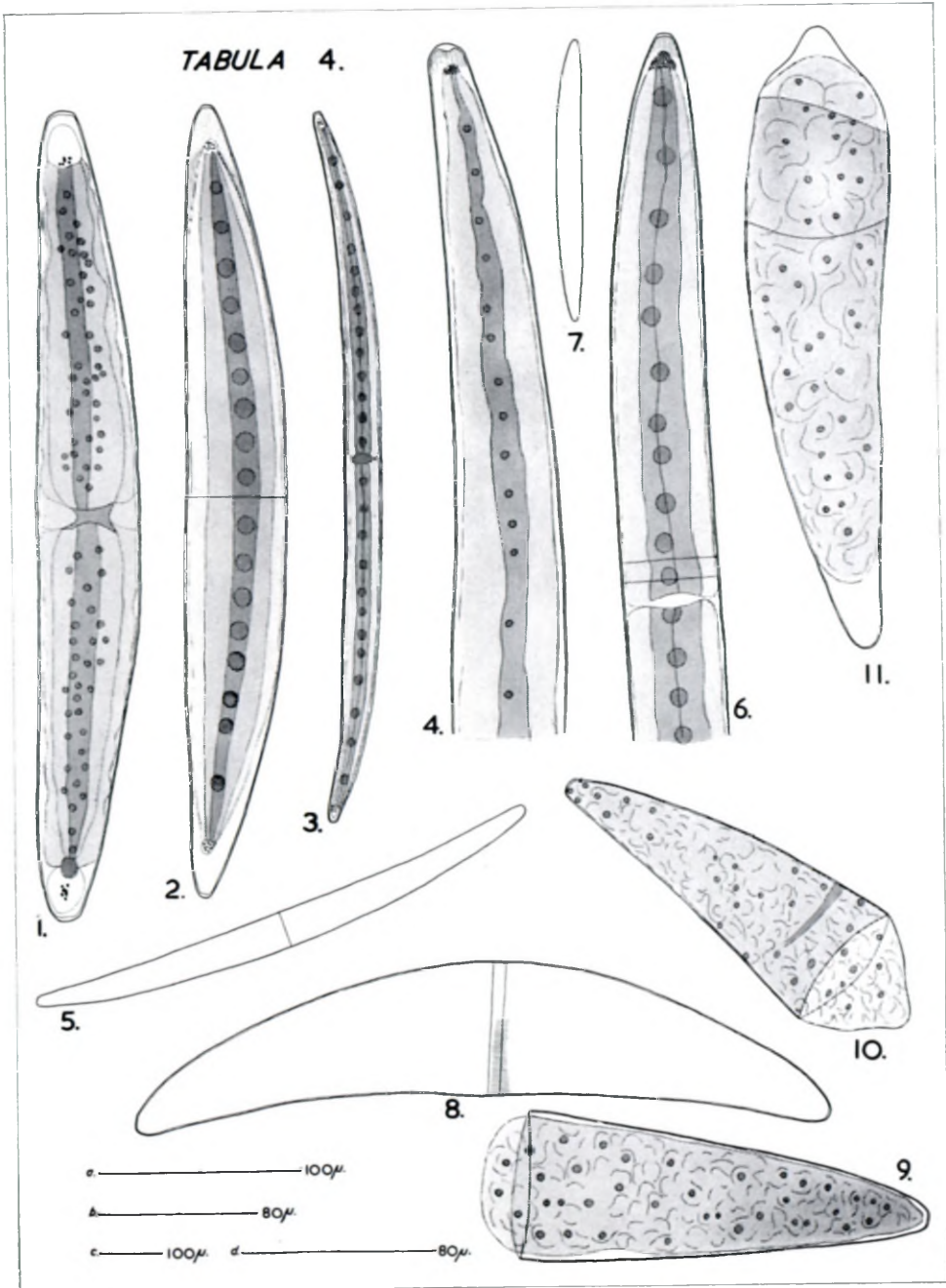
TABULA 2.

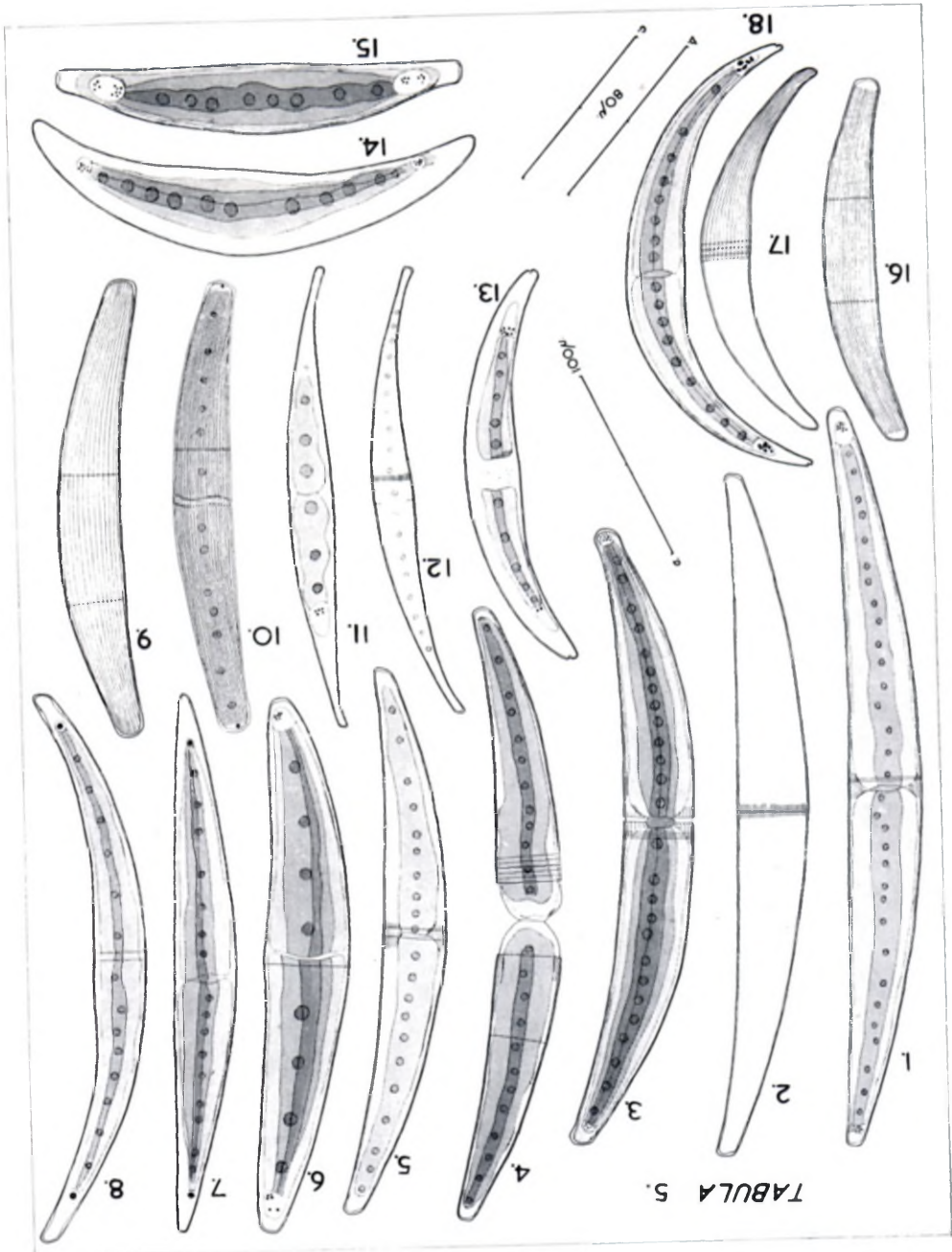


TABULA 3.



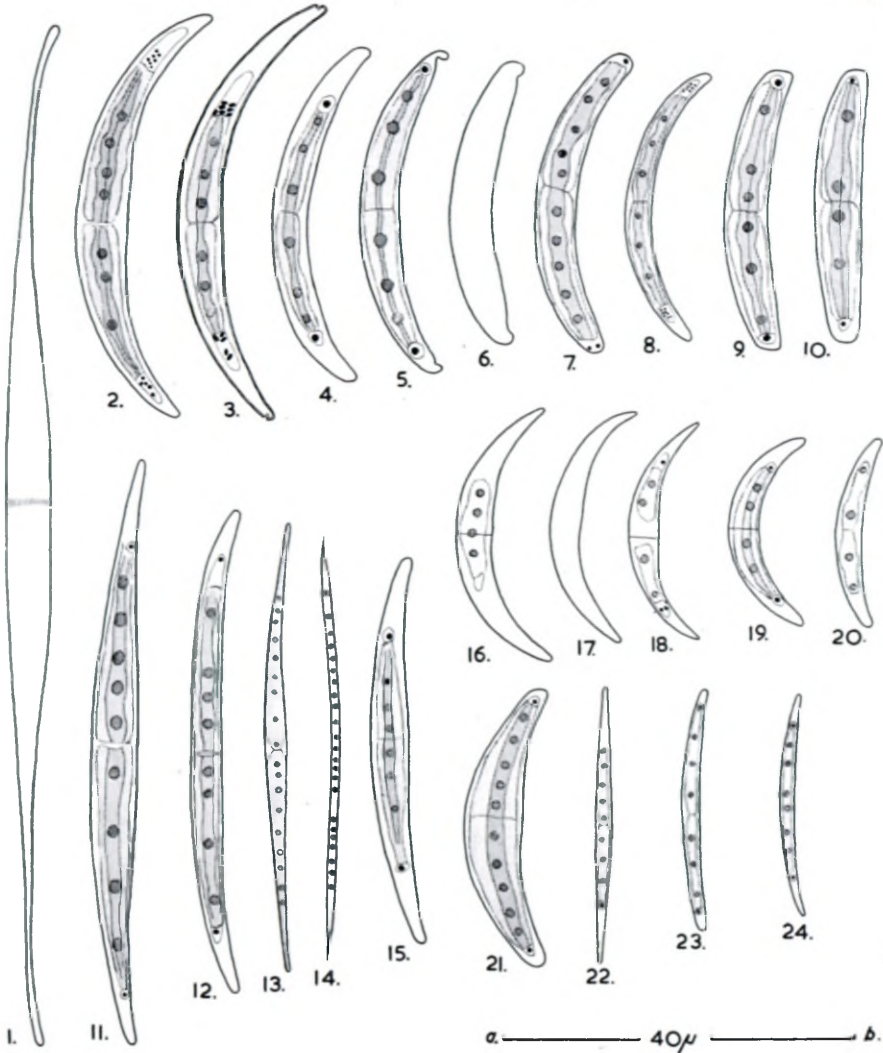
TABULA 4.



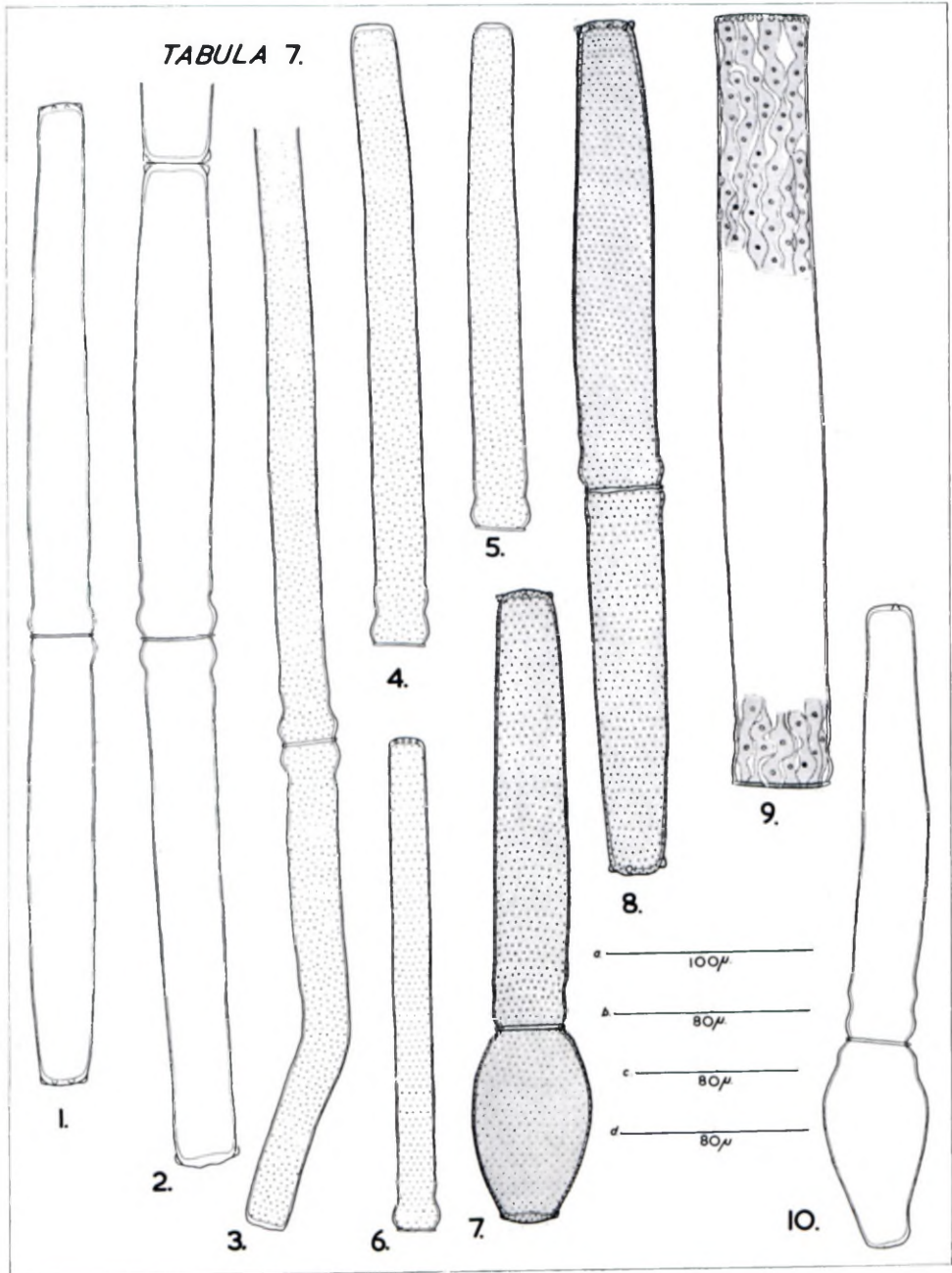


TABULA 6.

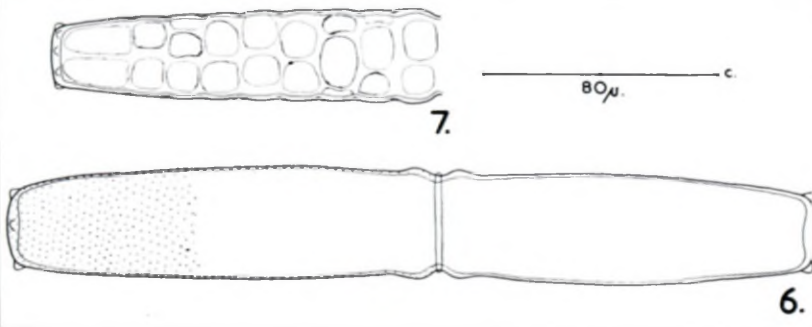
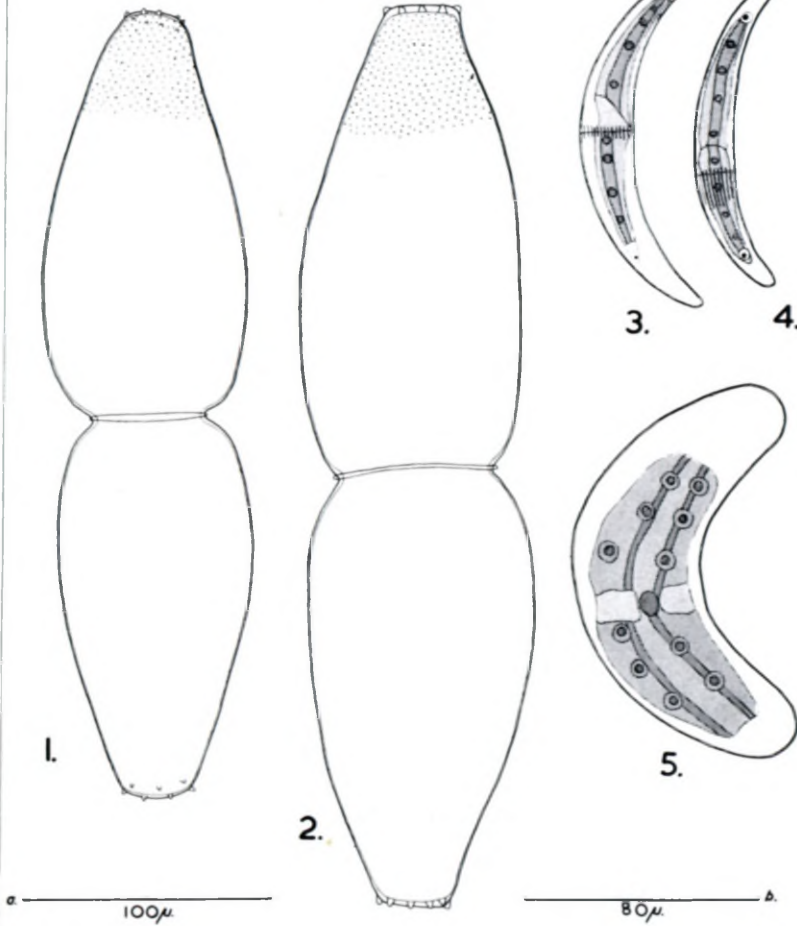
c. ————— 80μ.



TABULA 7.

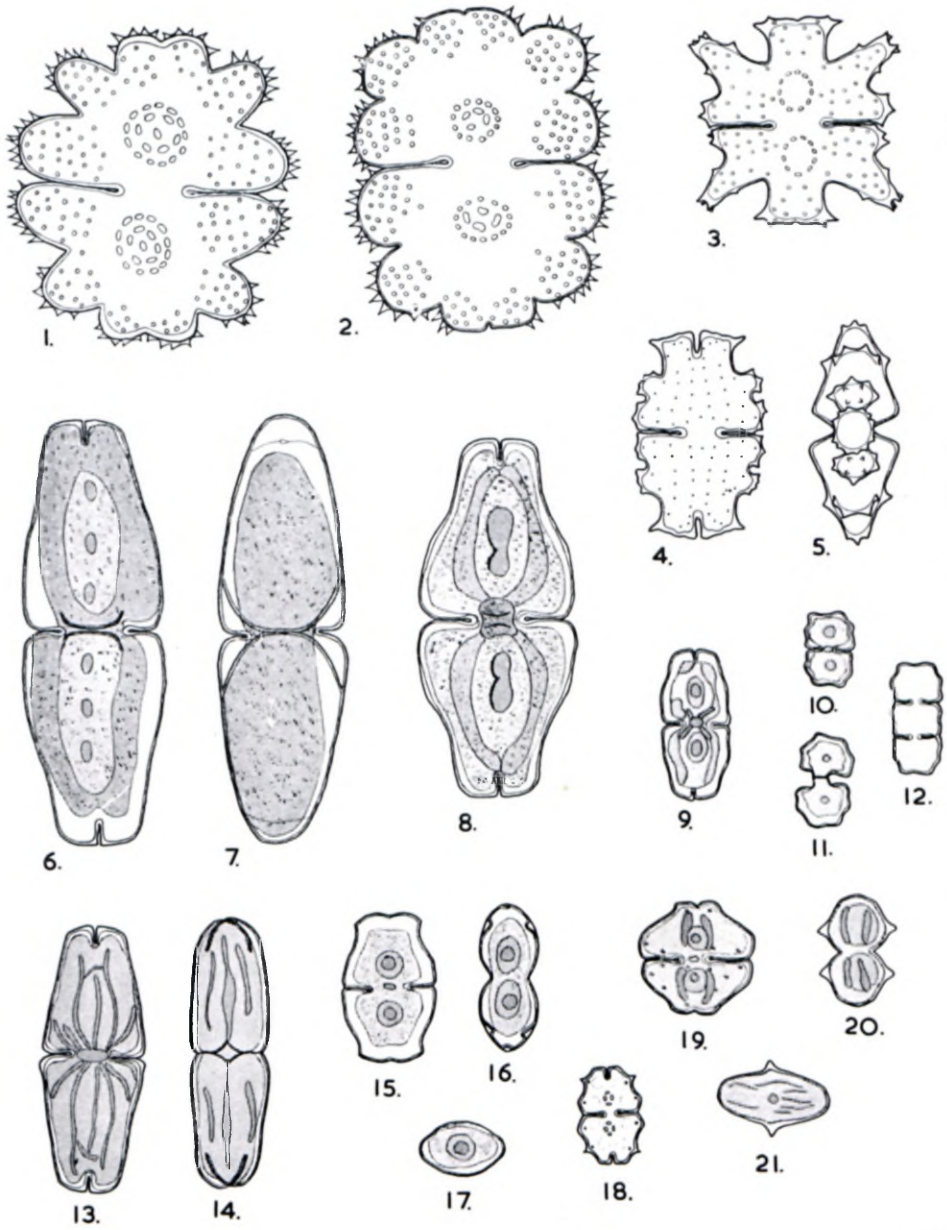


## TABULA 8.



TABULA 9.

a. ————— 40μ. ————— b.



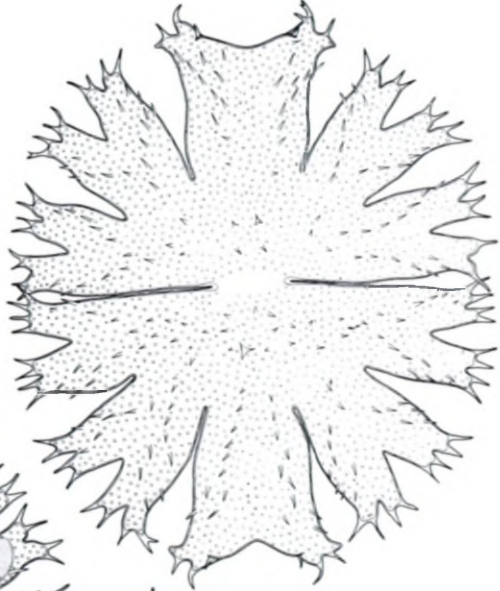


TABULA IO.

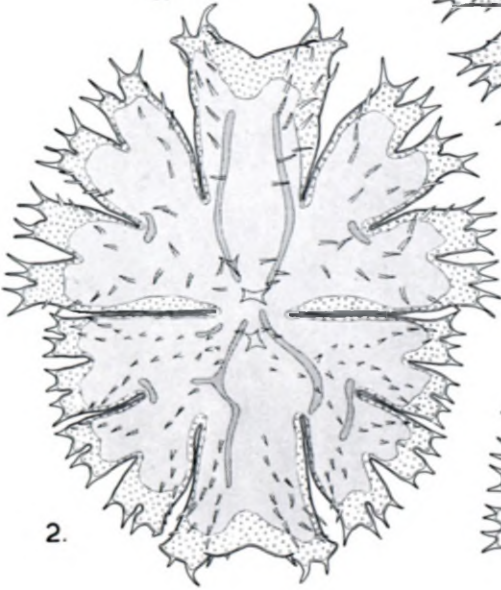
a ————  
b ———— 40μ.



3.



1.



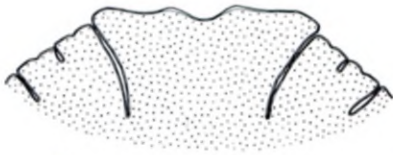
2.



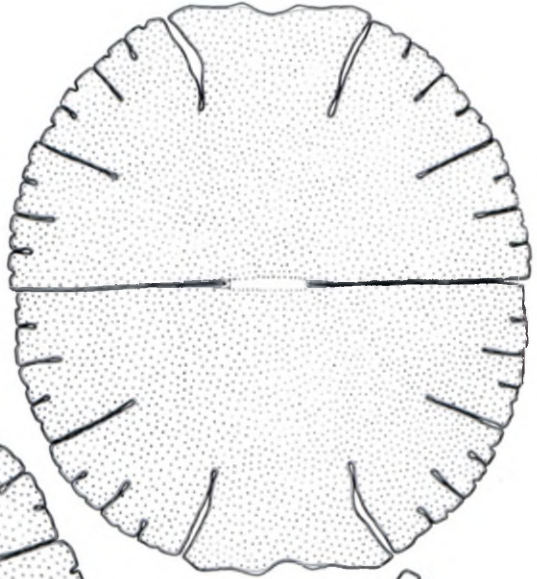
4.

TABULA II.

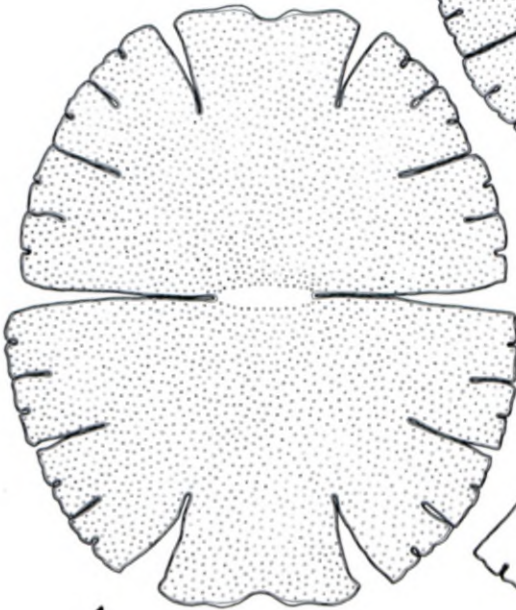
° ——— 40μ  
Δ ———



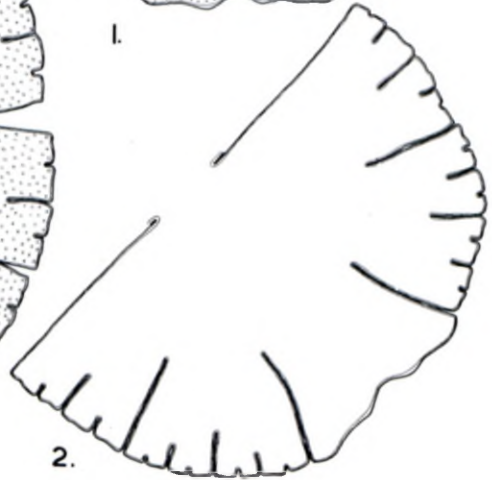
3.



1.

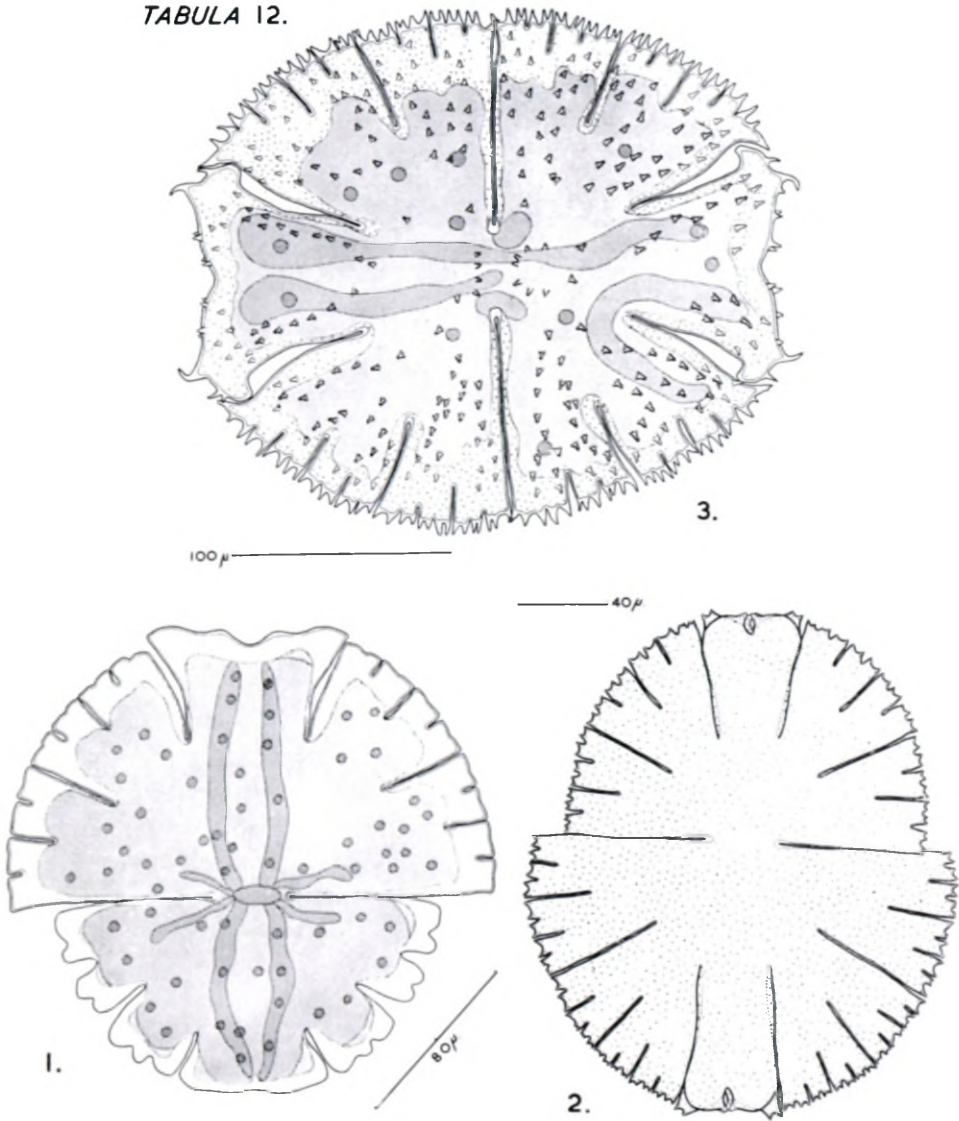


4.

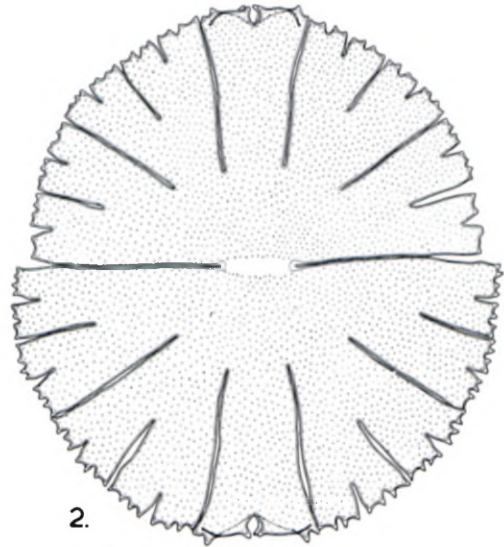
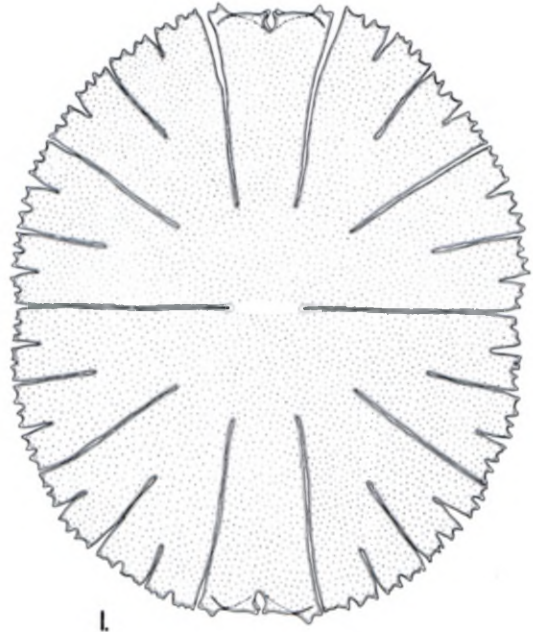
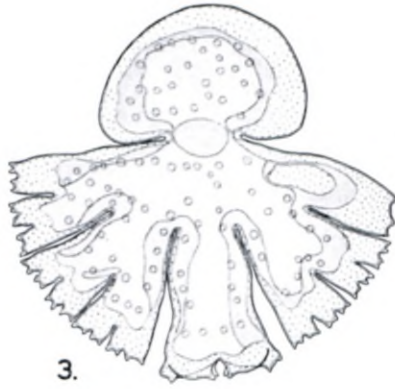


2.

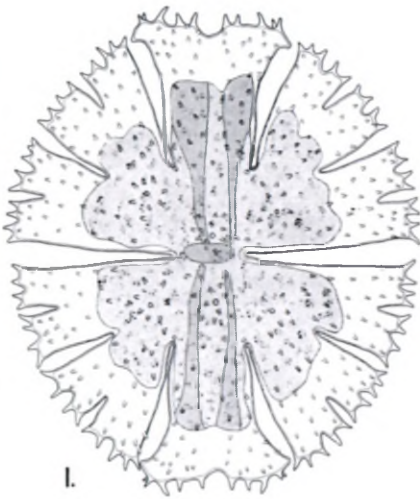
TABULA 12.



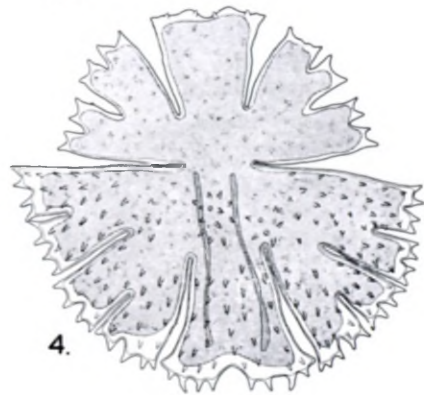
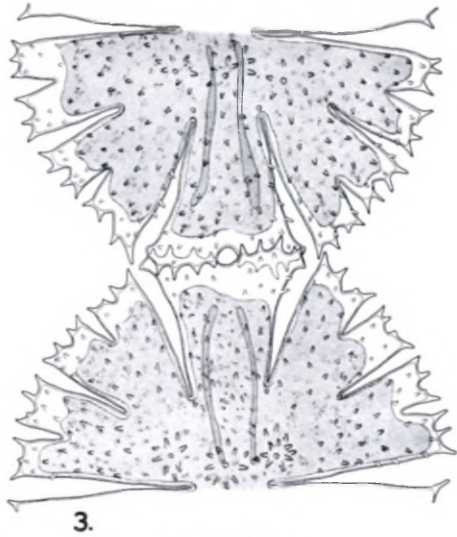
TABULA 13.

— 40 $\mu$ .

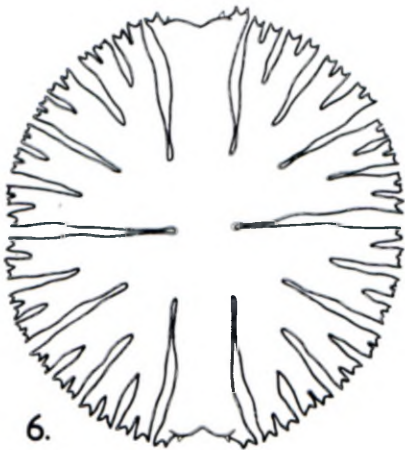
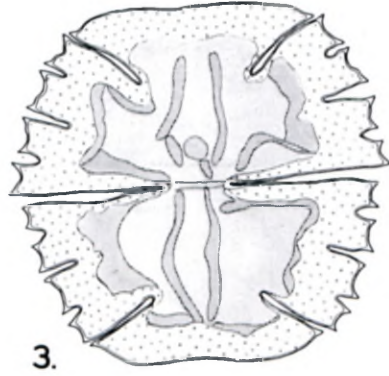
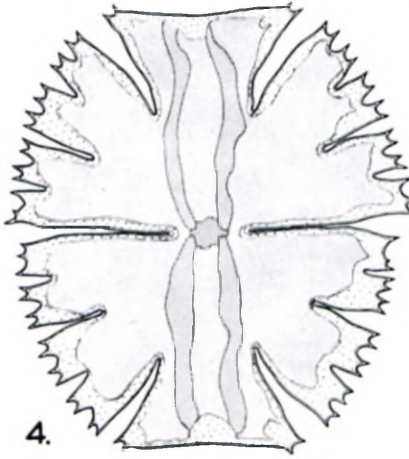
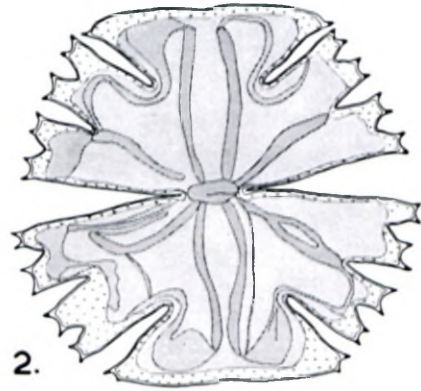
TABULA 14.



— 40μ.

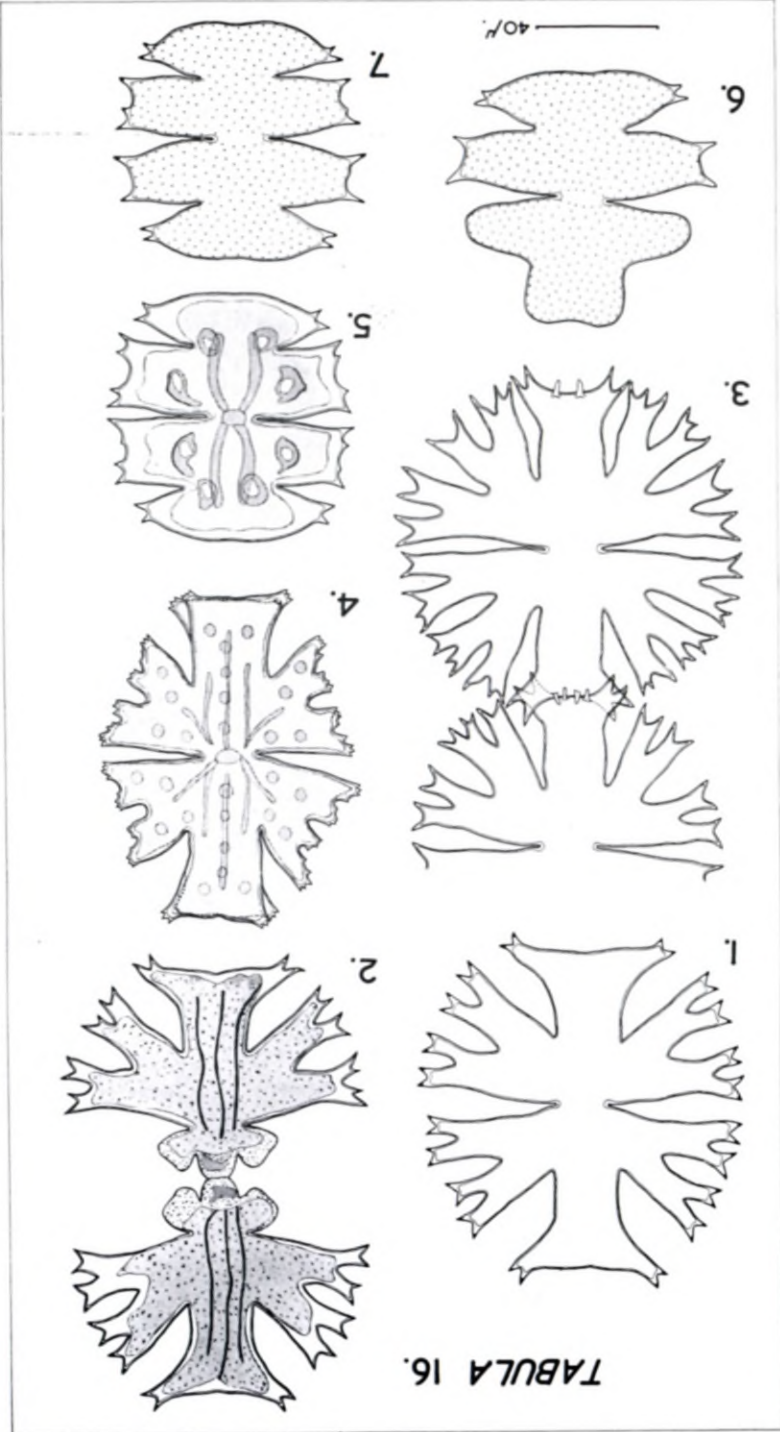


TABULA 15.

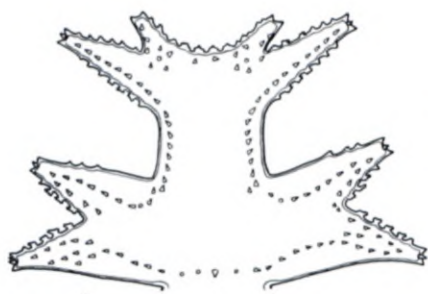


a ——— 40 $\mu$

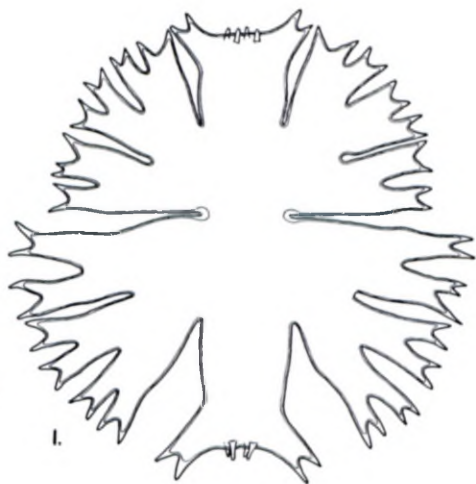
b ——— 40 $\mu$



TABULA 17.



2.



1.



3.



4.



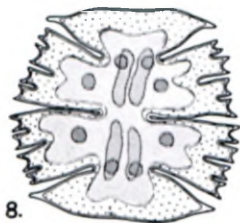
5.



6.



7.



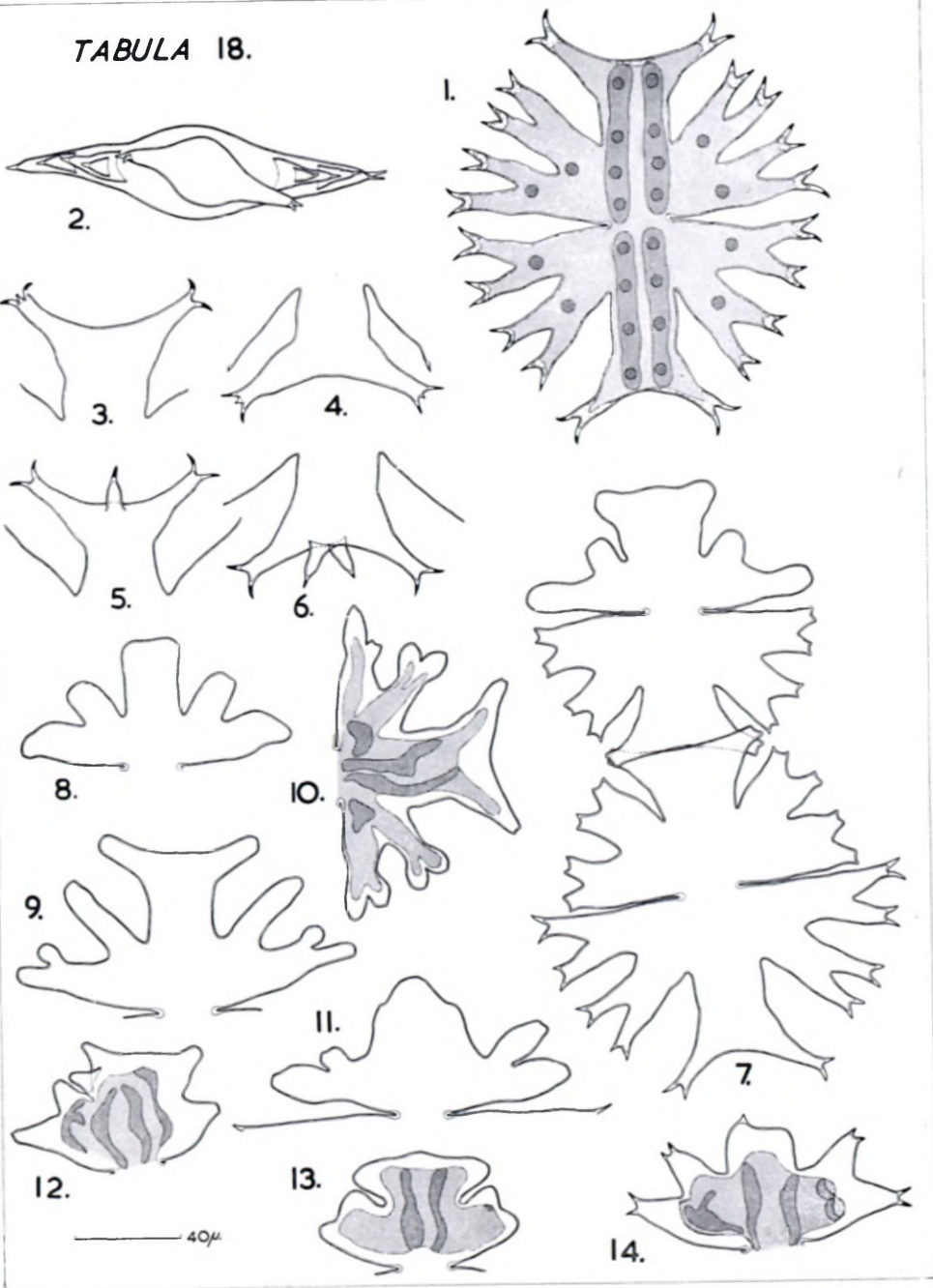
8.

---

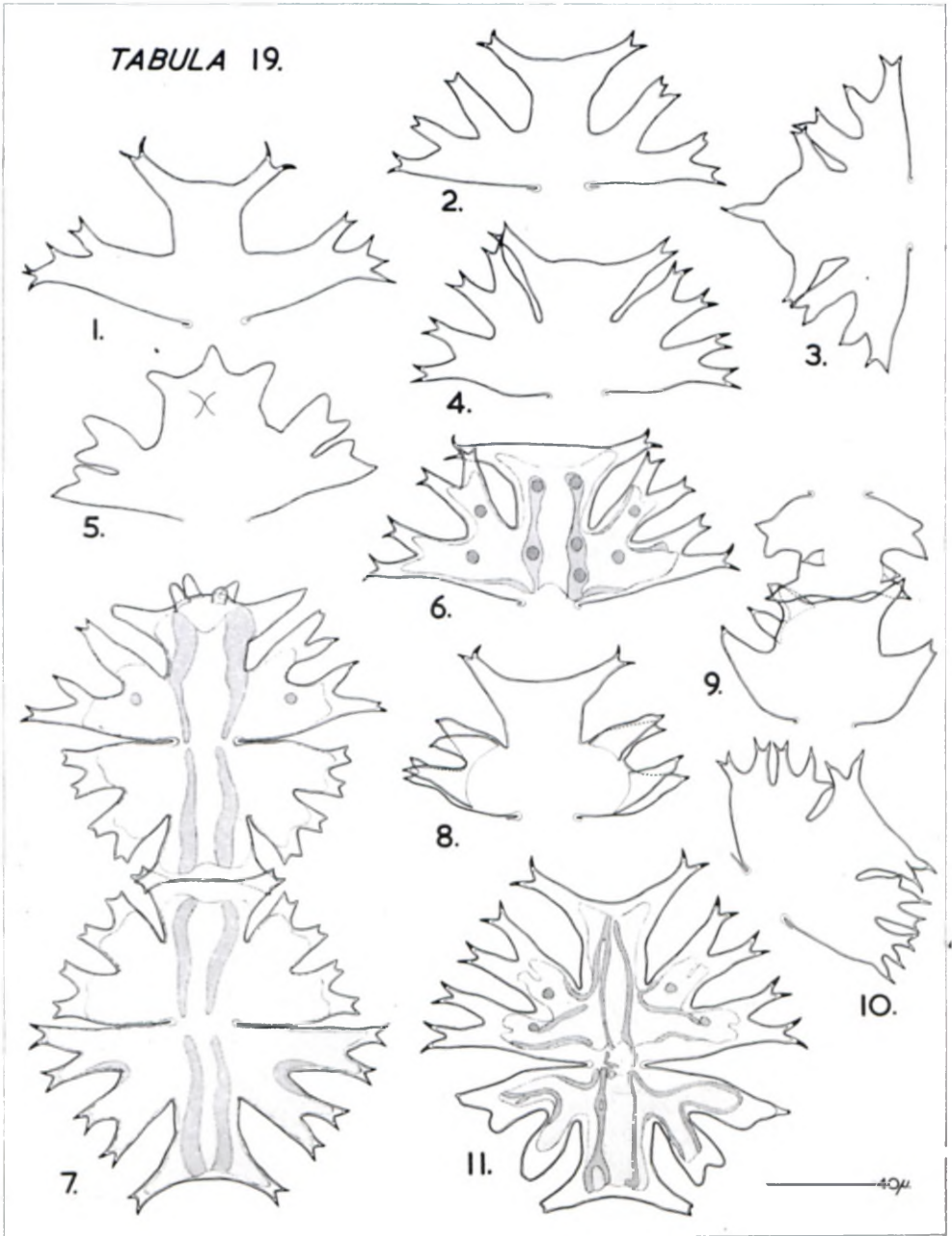
80 $\mu$ .



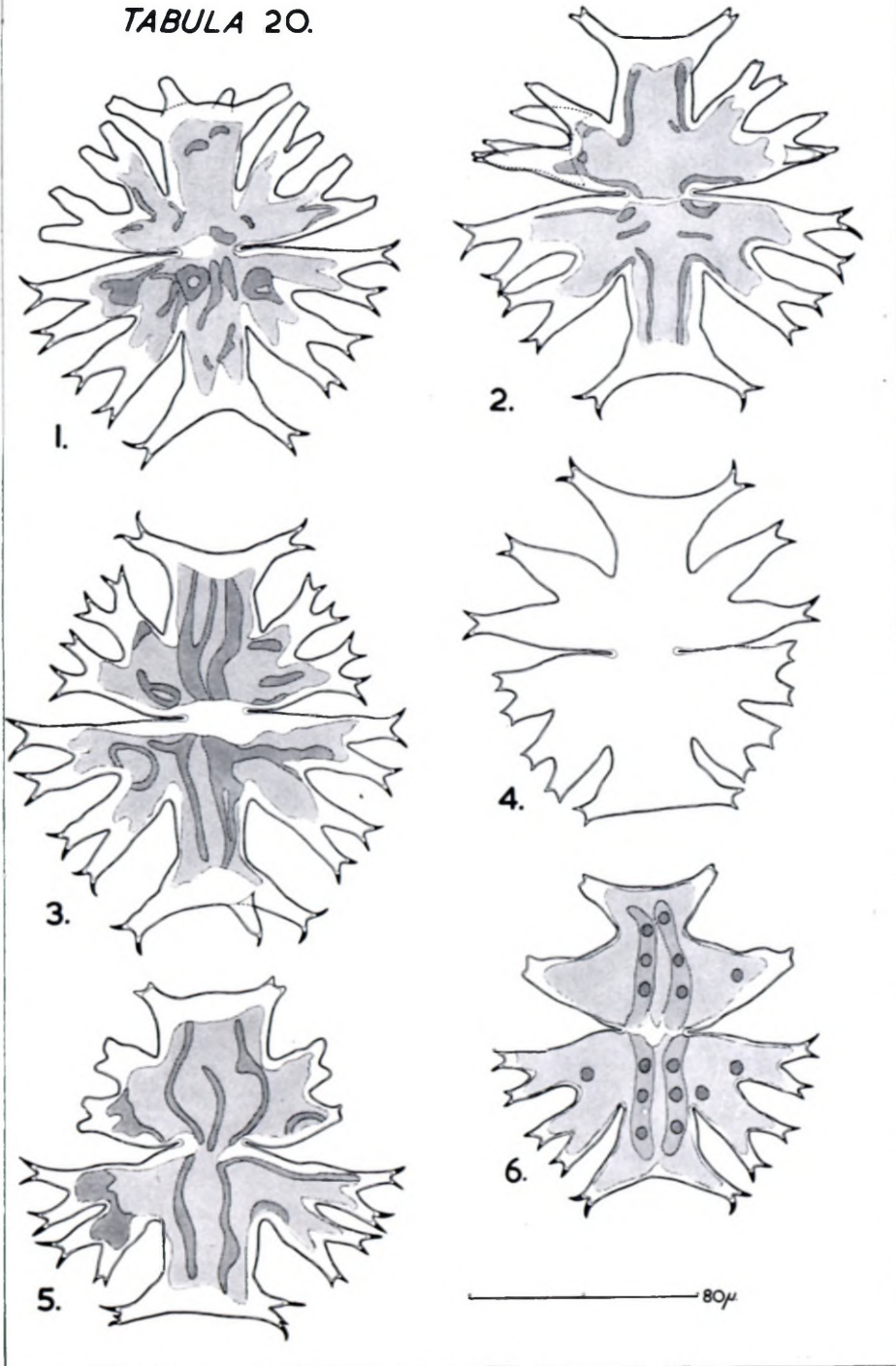
TABULA 18.



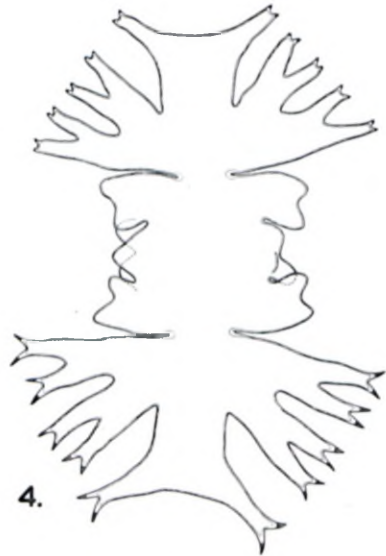
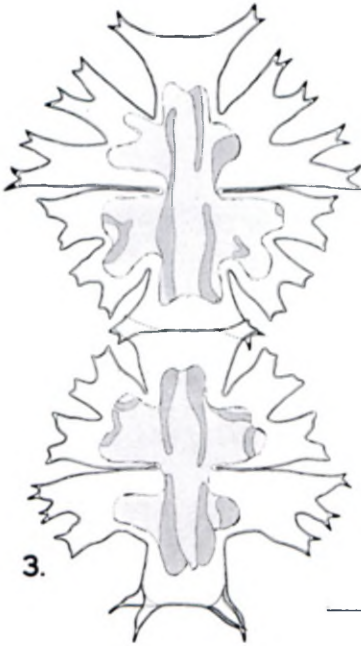
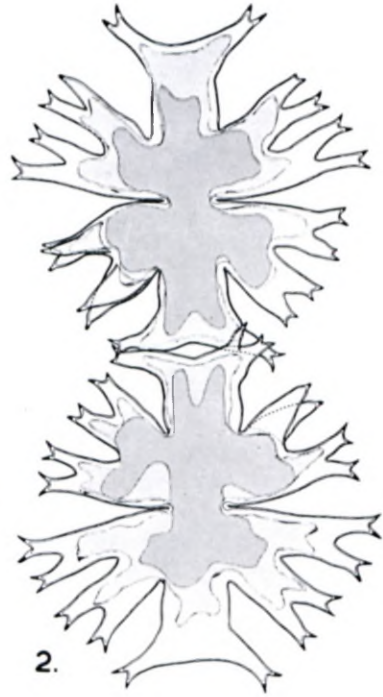
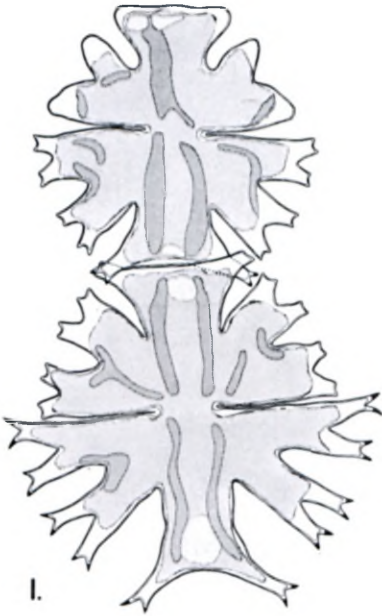
TABULA 19.



TABULA 20.

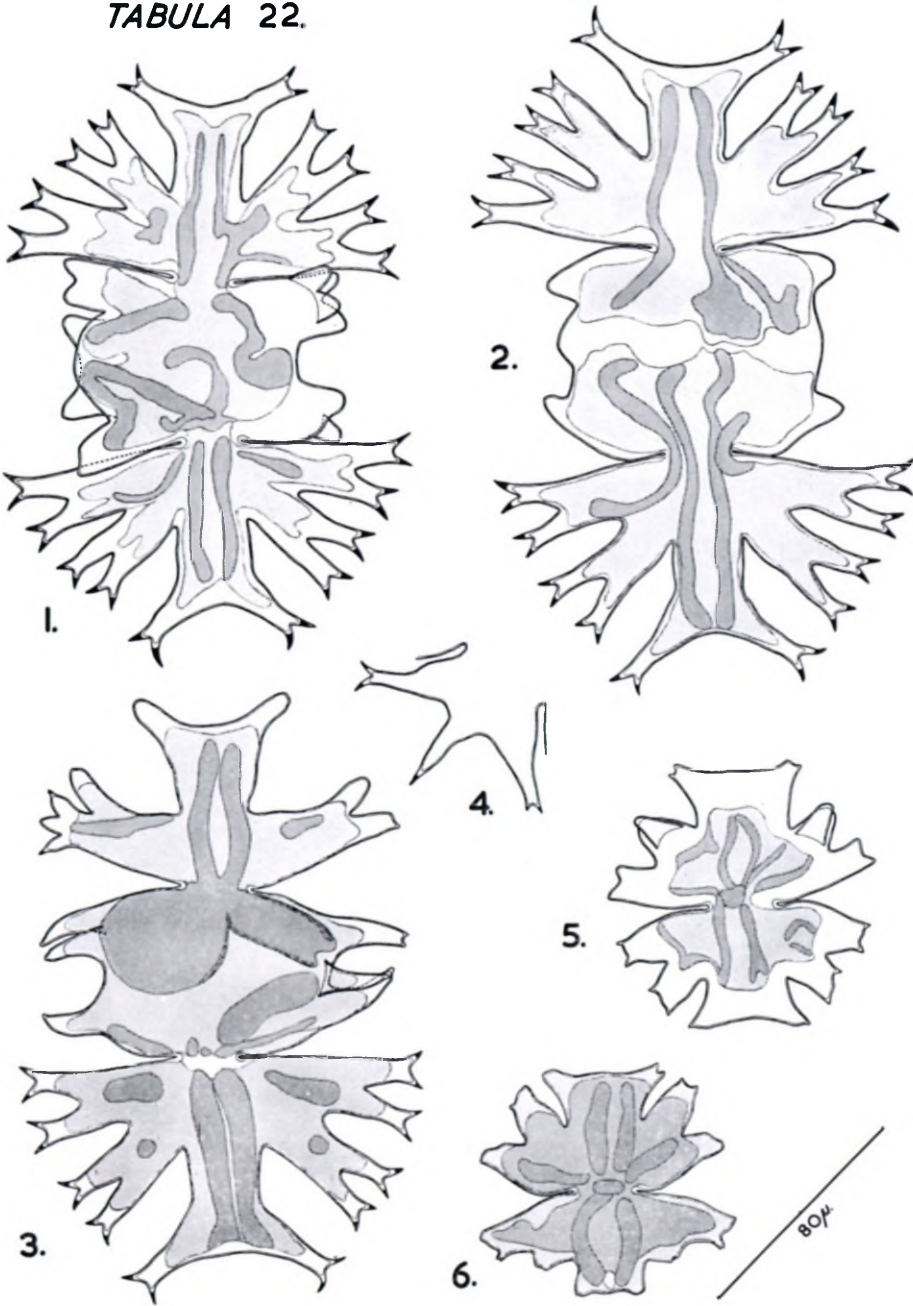


TABULA 21.

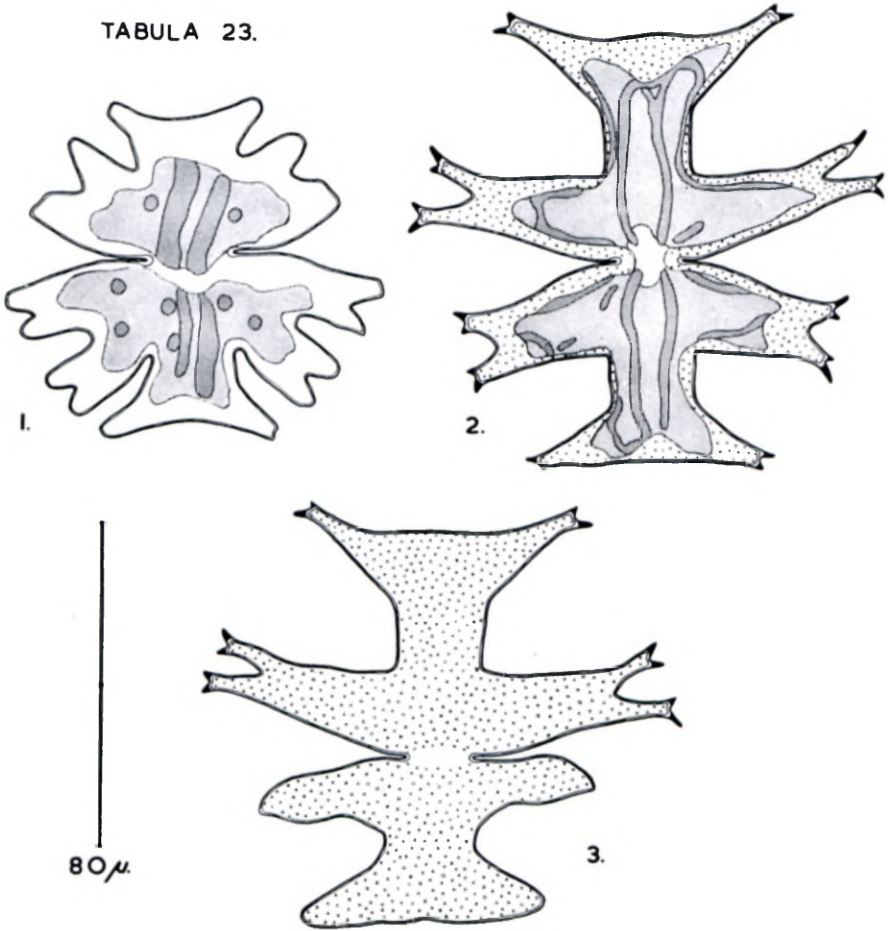


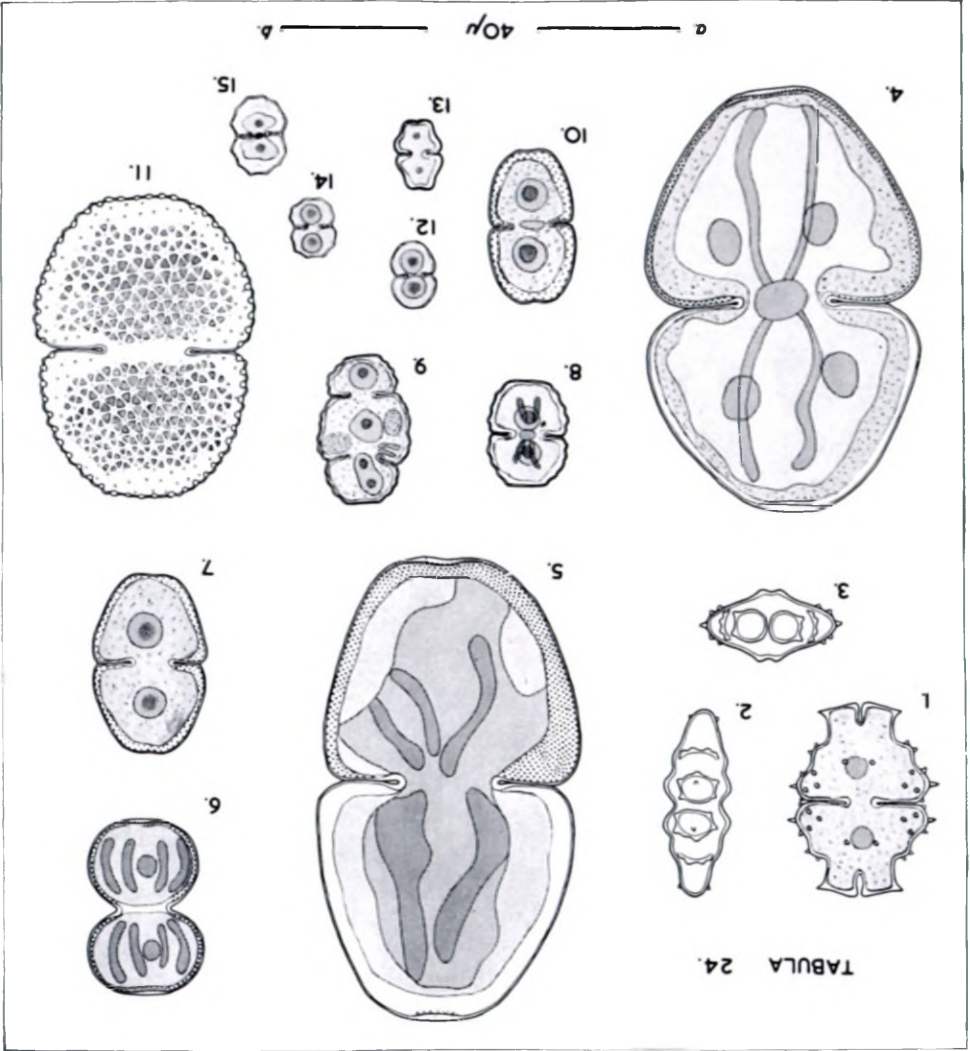
80μ

TABULA 22.

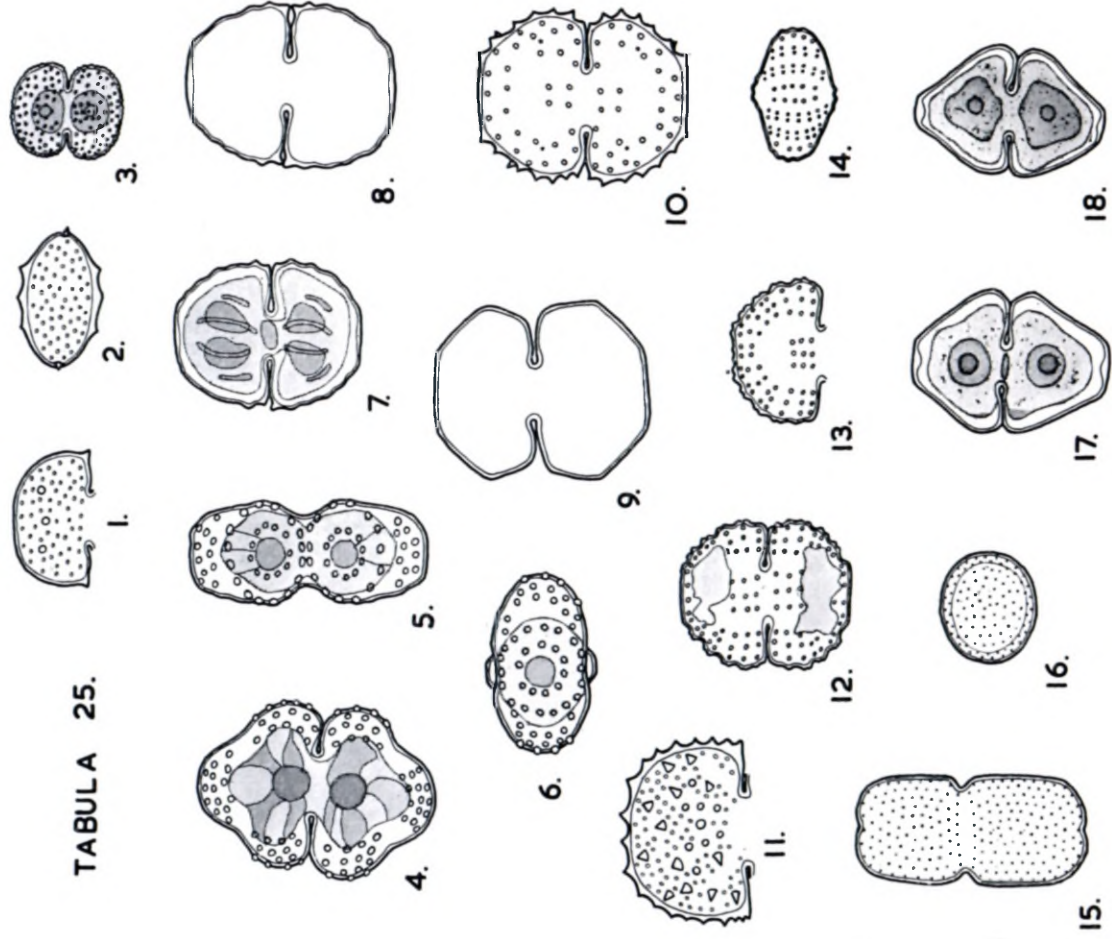


TABULA 23.





TABULA 25.

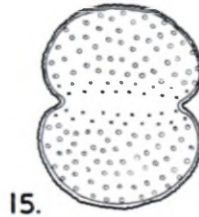
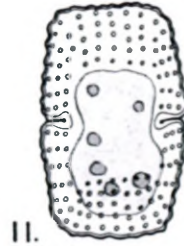
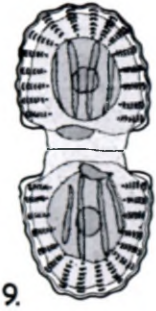


a. ——— 40 $\mu$  ——— b.

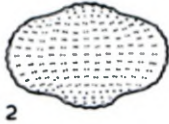


TABULA 26.

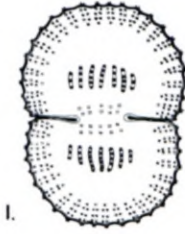
40  $\mu$ . a.  
b.



TABULA 27.



2



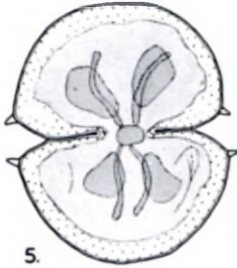
1.



3.



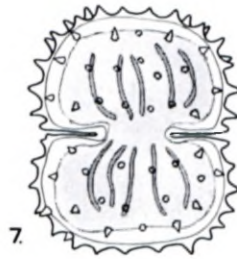
4.



5.



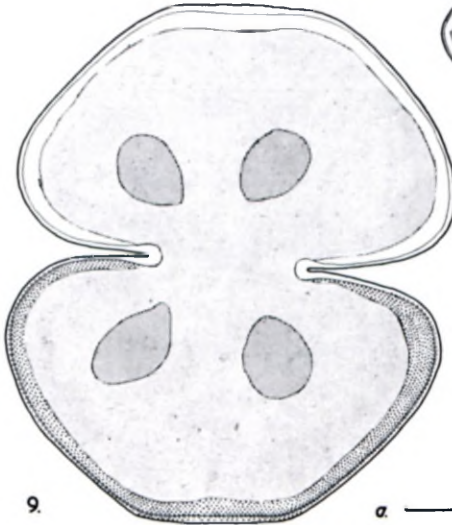
6.



7.

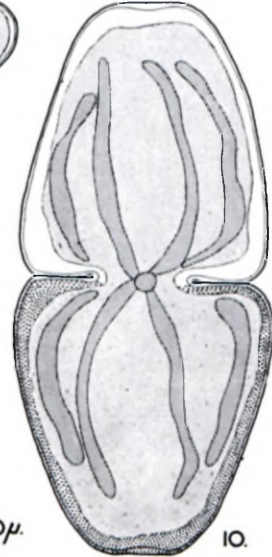


8.



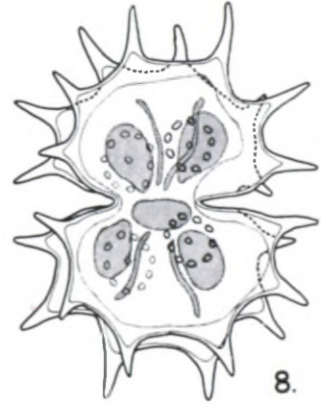
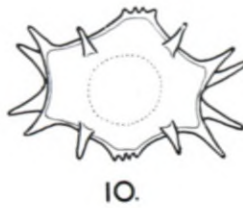
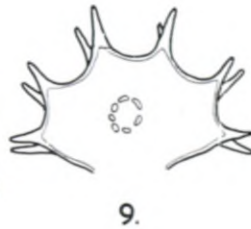
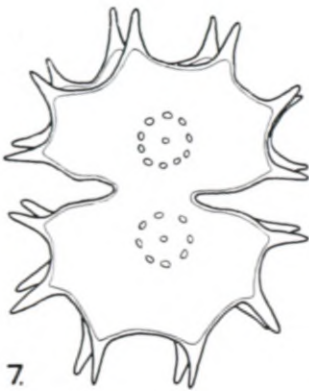
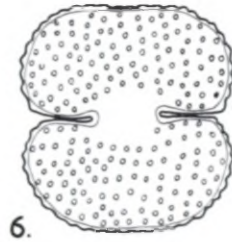
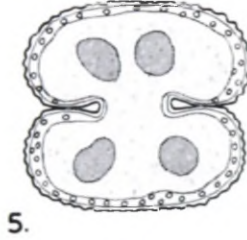
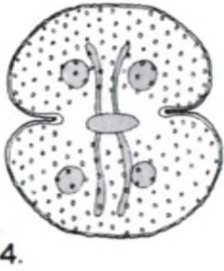
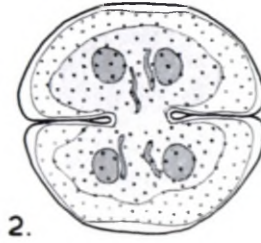
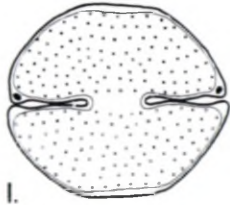
9.

a. \_\_\_\_\_  
 b. \_\_\_\_\_ 40 $\mu$ .



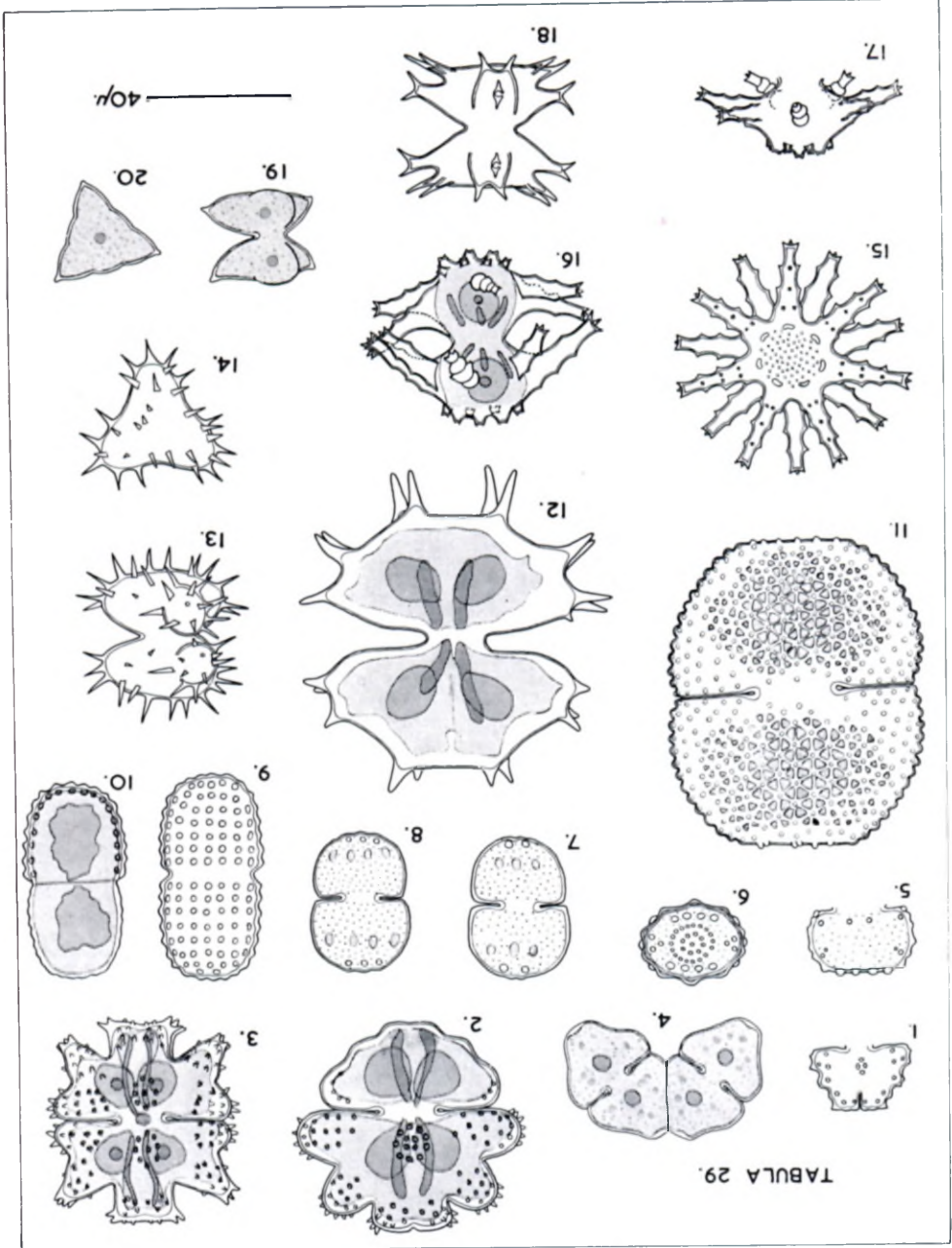
10.

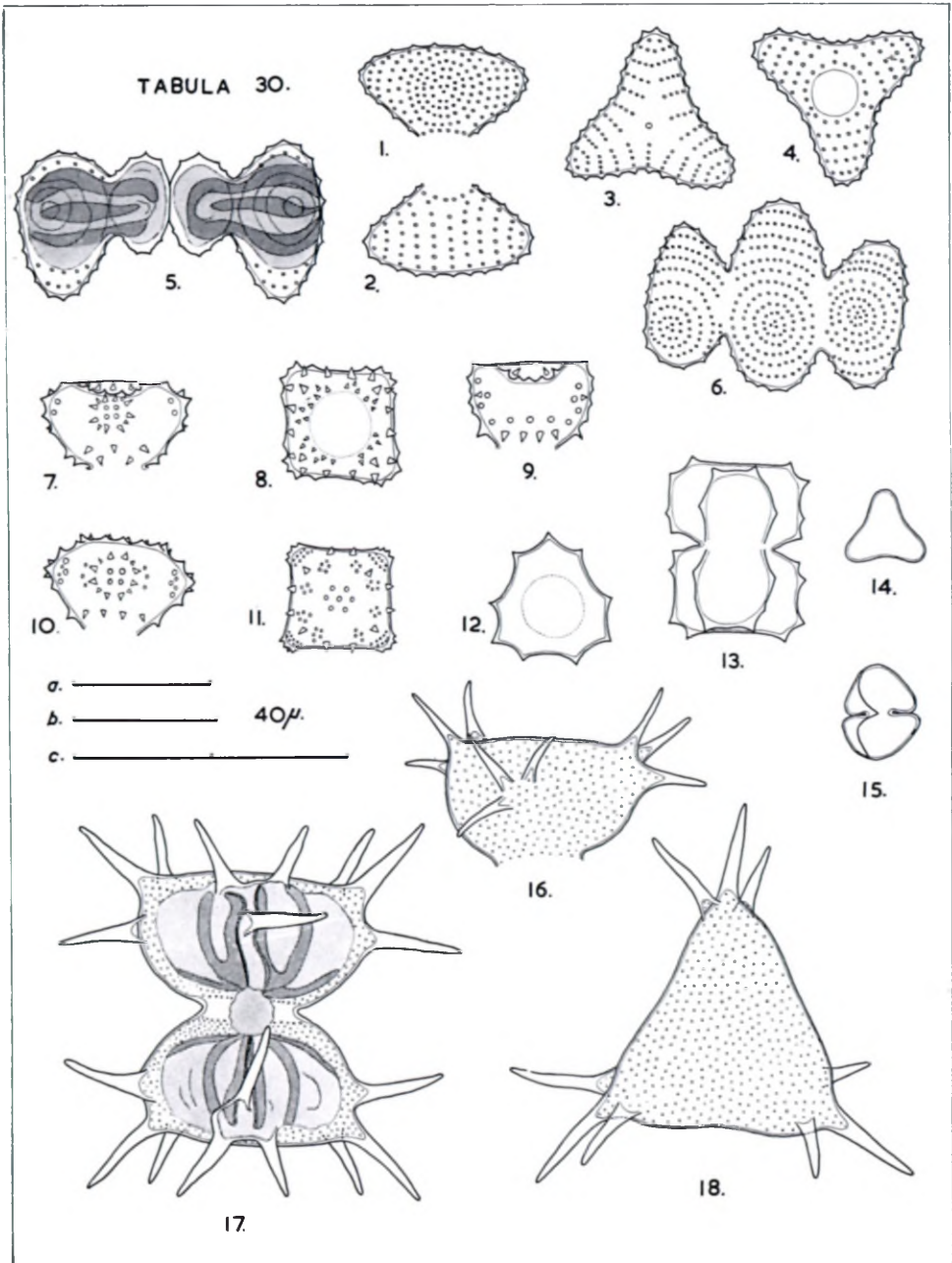
TABULA 28.



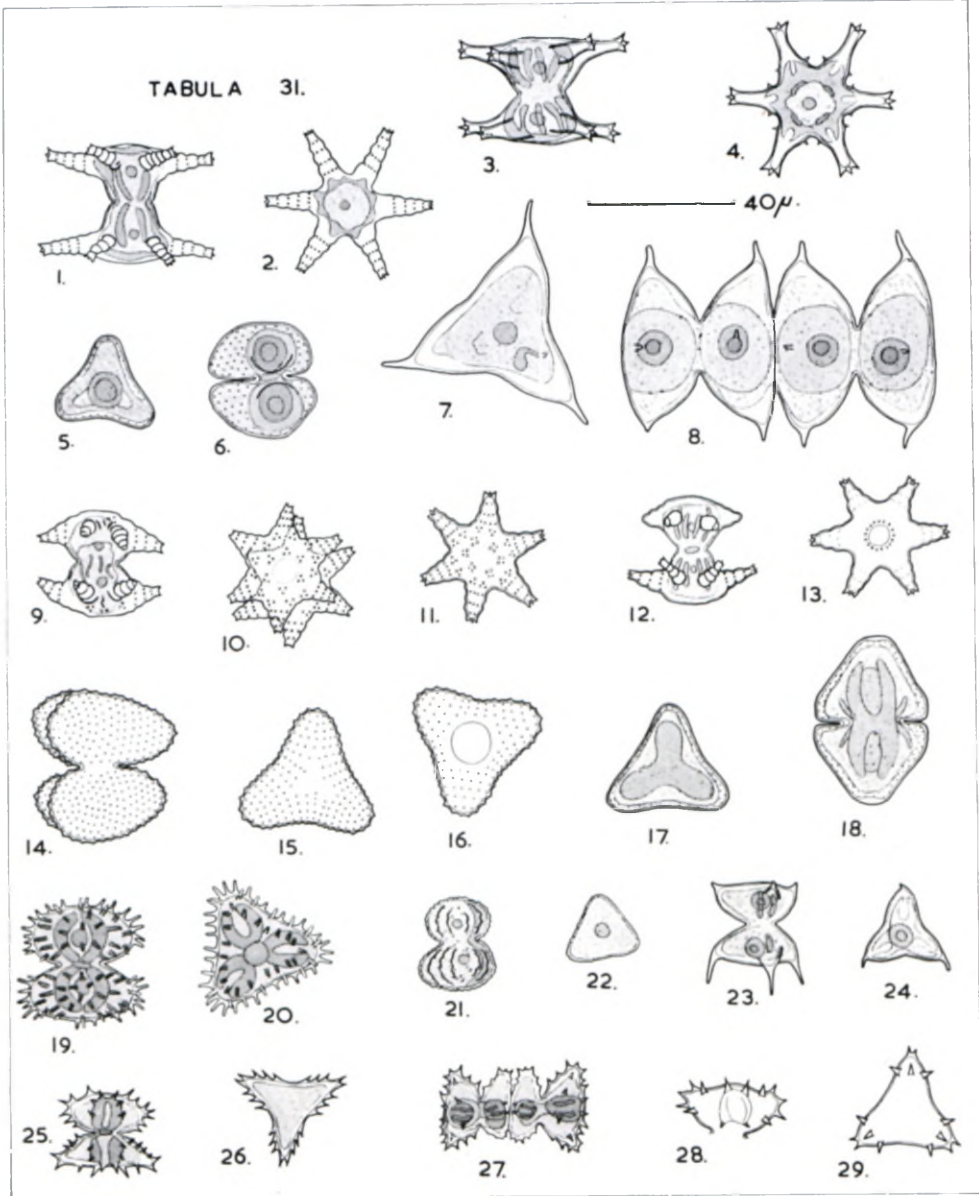
a. —————  
40μ.

————— b.  
40μ.

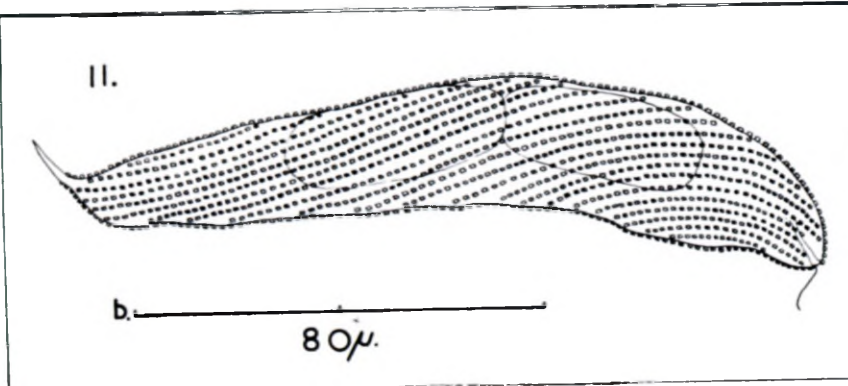
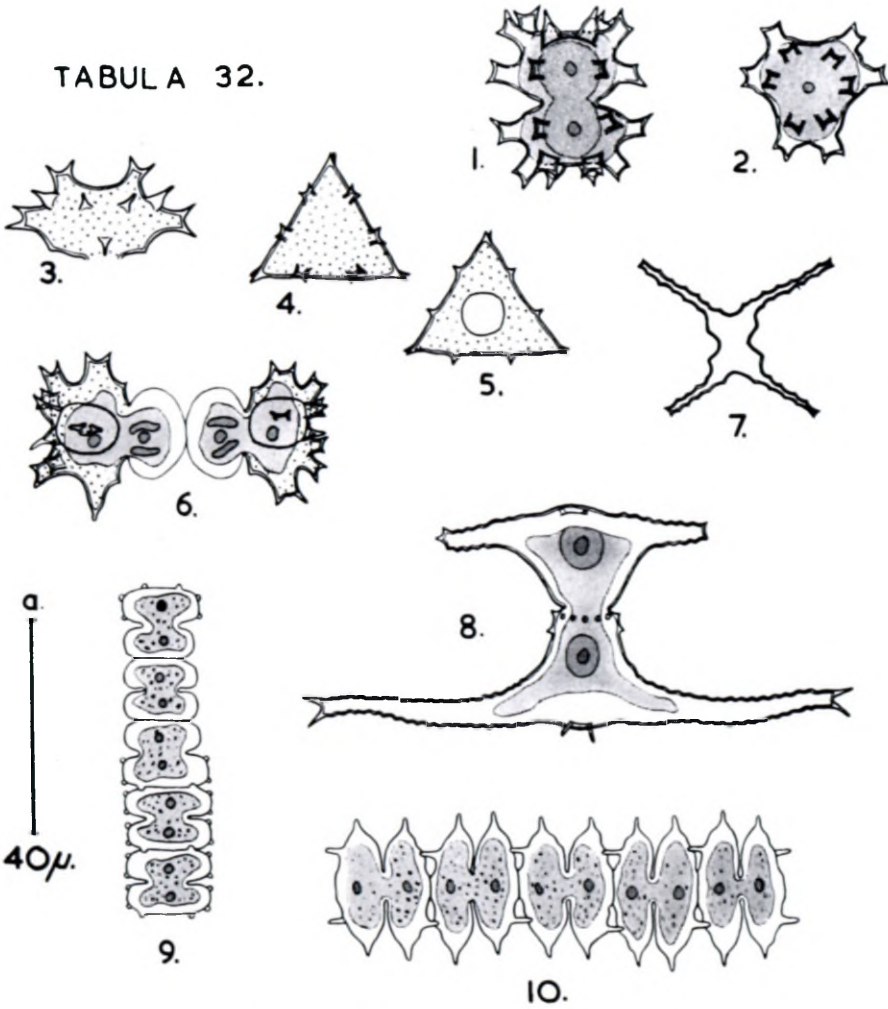




TABULA 31.



TABULA A 32.



TABULA 33.

