

## Some Freshwater Algae from Cambodia

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During the winter period of 1969–1970, the scientific investigation to the Mekong Water system of Cambodia<sup>1)</sup> was made by Kochi University, and many algal materials were collected by Dr. Masao OHNO, a member of the investigation party. The materials were sent to specialists of algal research in Japan.

One of the authors, HIRANO, has previously reported on the Desmidiaceae<sup>2)</sup> represented in the collection. In the further study, many algal members have been found among it and the results are presented in this paper.

The authors are grateful to Dr. M. OHNO and the members of the investigation party for giving us an opportunity to study the interesting and valuable materials.

The collection was made chiefly in three regions: Lake Tonle Sap, River Mekong, and ponds of Angkor Wat. The localities and habitats which have yielded the algal samples are listed as follows:

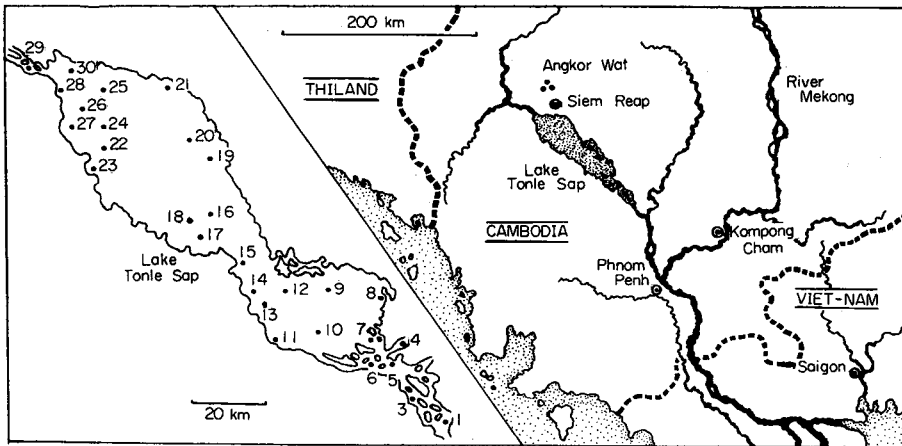
| Sample nos. | Date.        | Localities and habitats.                                              |
|-------------|--------------|-----------------------------------------------------------------------|
| C.P. 1.     | xii-27, '69. | Lake Tonle Sap, near Peam Chhok. Plankton.                            |
| 3.          | xii-28, '69. | Lake Tonle Sap, near Koh Tasok. Plankton.                             |
| 4.          | xii-29, '69. | Lake Tonle Sap, near Vea Phok (Prek Taphauk).<br>Plankton.            |
| 5.          | xii-29, '69. | Lake Tonle Sap, near Phat Sanday (Peam). Plankton.                    |
| 6,7.        | xii-29, '69. | Lake Tonle Sap, near Preak Tasom. Plankton.                           |
| 8.          | xii-30, '69. | Lake Tonle Sap, near Psaurt. Plankton.                                |
| 9,10.       | xii-30, '69. | Lake Tonle Sap, near Balat. Plankton.                                 |
| 11.         | xii-31, '69. | Lake Tonle Sap, near Kongphon Luong. Plankton.                        |
| 12.         | xii-31, '69. | Lake Tonle Sap, near Peam Bang. Plankton.                             |
| 13.         | xii-31, '69. | Lake Tonle Sap, near Reserve Tuol Veng. Plankton.                     |
| 14.         | xii-31, '69. | Lake Tonle Sap, near Peam Stung. Plankton.                            |
| 15.         | xii-31, '69. | Lake Tonle Sap, near Reserve Koh Kaek. Plankton.                      |
| 16.         | xii-31, '69. | Lake Tonle Sap, between Reserve Raing Til and Moat<br>Khla. Plankton. |
| 17.         | xii-31, '69. | Lake Tonle Sap, near Reserve Raing Til (South Center).<br>Plankton.   |
| 18.         | I-1, '70.    | Lake Tonle Sap, near Reserve Raing Til (North Center).<br>Plankton.   |

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1) MITSUSHIO, OHNO & MEAS, Res. Rep. Kochi Univ. 19, pp. 59–68, 1970.

2) HIRANO, Contr. Biol. Lab., Kyoto Univ. 23, pp. 123–157, 1972.

| Sample nos.         | Date.        | Localities and habitats.                                                        |
|---------------------|--------------|---------------------------------------------------------------------------------|
| 19.                 | I-1, '70.    | Lake Tonle Sap, 7 Km. east of Reserve Kg. Khlaing. Plankton.                    |
| 20.                 | I-1, '70.    | Lake Tonle Sap, center of Reserve Kg. Khlaing. Plankton.                        |
| 21.                 | I-1, '70.    | Lake Tonle Sap, near Kg. Phok. Plankton.                                        |
| 22,23.              | I-2, '70.    | Lake Tonle Sap, near Reserve Koh Thom. Plankton.                                |
| 24.                 | I-2, '70.    | Lake Tonle Sap, between Phnom Krom and Kbal Tol. Plankton.                      |
| 25.                 | I-2, '70.    | Lake Tonle Sap, near Phnom Krom. Plankton.                                      |
| 26.                 | I-5, '70.    | Lake Tonle Sap, between Phnom Krom and Peak Kantel. Plankton.                   |
| 27.                 | I-5, '70.    | Lake Tonle Sap, near Peak Kantel. Plankton.                                     |
| 28.                 | I-5, '70.    | Lake Tonle Sap, near Prak Toal. Plankton.                                       |
| 29.                 | I-5, '70.    | Lake Tonle Sap, near Kg. Prahoe (River). Plankton.                              |
| B.A. 1.             | I-6, '70.    | Mekong River, near Beng Amsorg. Plankton.                                       |
| B.A. 2.             | I-6, '70.    | Mekong River, near Beng Amsorg, Chhoung Kon Treg. Plankton.                     |
| B.A. 3.             | I-6, '70.    | Mekong River, near Beng Amsorg, Chhoung Toal. Plankton.                         |
| P.C.                | I-7, '70.    | Mekong River, near Peam Chikung. Plankton.                                      |
| M.R. 1.             | I-7, '70.    | Mekong River (Middle), near Kon Chrouk. Plankton.                               |
| M.R. 2.             | I-7, '70.    | Mekong River (Middle), near Chruog Khmar. Plankton.                             |
| M.R. 3-5 and C.T.M. | I-5, '70.    | Mekong River, near Chak Towonk. Plankton.                                       |
| T.S.M.              | I-15, '70.   | Tonle Sap River, near Phnom Penh. Plankton.                                     |
| Ton. R. 1-3.        | xii-28, '69. | Tonle Sap River, near Anluuong Tonlea. Attached to the aquatic plant.           |
| Kg. Lu. 1-4.        | xii-31, '69. | Lake Tonle Sap, near Kongphon Luong. Attached to the wooden board in the water. |
| Kg. Lu. 5.          | xii-31, '69. | Lake Tonle Sap, near Kongphon Luong. Attached to the aquatic plant.             |
| Kg. Lu. 6.          | xii-31, '69. | Lake Tonle Sap, near Kongphon Luong. Floating.                                  |
| Ton. L. 1-2.        | I-2, '70.    | Lake Tonle Sap, near Siem Reap. Attached to the wooden board in the water.      |
| Ton. L. 3.          | I-2, '70.    | Lake Tonle Sap, near Siem Reap. Floating.                                       |
| Ton. L. 4.          | I-4, '70.    | Lake Tonle Sap, near Siem Reap. Attached to the aquatic plant.                  |
| Anc. 1-2.           | I-4, '70.    | Angkol Wat. Pond. Plankton.                                                     |
| Anc. 3-6.           | I-4, '70.    | Angkol Wat. Pond. Attached to the aquatic plant.                                |
| Anc. 7.             | I-4, '70.    | Angkol Wat. Pond. On the mud of the bottom.                                     |
| Anc. 8-9.           | I-4, '70.    | Angkol Wat. Pond. Attached to the aquatic plant.                                |
| Anc. 10.            | I-4, '70.    | Angkol Wat. Pond. Plankton.                                                     |



- |            |           |                         |                                |
|------------|-----------|-------------------------|--------------------------------|
| Anc. 11.   | I-4, '70. | Angkor Wat. Pond.       | On the mud of the bottom.      |
| Anc. 12-13 | I-4, '70. | Angkor Wat. Pond.       | Floating.                      |
| Anc. 14.   | I-4, '70. | Pond, near Angkor Wat.  | Plankton.                      |
| Anc. 15.   | I-4, '70. | River, near Angkor Wat. | Plankton.                      |
| Anc. 16.   | I-4, '70. | River, near Angkor Wat. | Attached to the aquatic plant. |
| K.C. 1-2.  | I-8, '70. | Kompong Cham. Pond.     | Attached to the aquatic plant. |

### CHLOROPHYTA

1. *Actinastrum hantzschii* LAGERHEIM; SKUJA, Nova Acta Reg. Soc. Sci. Upsal. Ser. 4, 16: 3, p. 181, pl. 29, f. 5-8, 1956; BOURRELLY, Bull. Micro. Appl. 2, p. 176, pl. 17, f. 7, 1963; PHILIPSE, Chlorococcales, p. 217. f. 125a-c, 1967.  
Cell about  $4.5 \mu$  broad and  $26.5 \mu$  long.  
Hab. M.R.5. Distr. Europe and N. America.
2. *Ankistrodesmus braunii* (NAEGELI) BRUNNTHALER; PASCHER's, Suessw.-fl. 5, p. 190, f. 290, 1915; PRESCOTT, Alg. W. Great Lakes Area, p. 253, pl. 46, f. 8, 1951.  
Cell solitary, straight or slightly curved, narrowly fusiform and with acute apices,  $4-8 \mu$  broad and  $35-56 \mu$  long.  
Hab. Anc. 4. Distr. Cosmopolitan.
3. *Ankistrodesmus falcatus* (CORDA) RALFS; BRUNNTHALER, l.c. p. 188, f. 283, 1915; SMITH, Bull. Wiscon. Geol. & Nat. Hist. Surv. 57, p. 134, f. 1, 1920; PRESCOTT, l.c., p. 253, pl. 56, f. 5-6, 1951; PHILIPSE, l.c., p. 211, f. 121a,e, 1967.  
Cell needle-like and loosely clustered in a fasciculate colony;  $2-3 \mu$  broad and  $30-50 \mu$  long.  
Hab. Anc. 4 and Anc. 12. Distr. Europe, N. America, India, Ceylon and Japan.
4. *Ankistrodesmus falcatus* (CORDA) RALFS var. *duplex* (KUETZING) G.S. WEST;

BRUNNTHALER, l.c., p. 188, f. 287, 1915.

Cell narrowly fusiform, straight or slightly curved, clustered in a semilinear colony; the poles of adjacent cells interlocking; cell  $2.5-4\ \mu$  broad and  $20-35\ \mu$  long.

Hab. Anc. 12. Distr. Cosmopolitan.

5. *Ankistrodesmus falcatus* (CORDA) RALFS var. *mirabilis* (W. & G. S. WEST) G. S. WEST; PRESCOTT, l.c., p. 253, pl. 56, f. 10, 1951.

Cell solitary, sigmoid or lunate, apices tapering into fine points;  $2-3\ \mu$  broad and  $85-150\ \mu$  long.

Hab. Ton. R. 1 and Ton. L. 4. Distr. Cosmopolitan.

6. *Ankistrodesmus fusiformis* CORDA; KOMARKOVA-LEGNEROVA in FOTT, Stud. Phycol. p. 90, pl. 6, f. 1-5, 1966.

Cell cylindric-fusiform, clustered in a stellate colony; cell  $2-3\ \mu$  broad and  $45-75\ \mu$  long.

Hab. Anc. 8. Distr. Europe. (Pl. 1, f. 10)

7. *Ankistrodesmus spiralis* (TURNER) LEMMERMAN; BRUNNTHALER, l.c., p. 190, f. 293, 1915; SMITH, l.c., p. 135, pl. 32, f. 6-7, 1920.

Cell needle-like and spirally twisted, clustered in a colony; cell  $1.5-2\ \mu$  broad and  $35-48\ \mu$  long.

Hab. Anc. 4, Anc. 9 and Ton. R. 1. Distr. Cosmopolitan.

8. *Aphanochaete polychaete* (HANSRIG) FRITSCH; PRESCOTT, l.c., p. 125, pl. 17, f. 1, 1951.

Filament short, sparsely branched and creeping on the other filamentous algae or aquatic plants; cell rounded or oblong-rectangular, with 2-6 setae arising from the dorsal wall of each cell; cell  $9-15\ \mu$  broad.

Hab. Anc. 8. Distr. U.S.A. and Japan. (Pl. 1, f. 1)

9. *Aphanochaete repens* BRAUN; PRESCOTT, l.c., p. 125, pl. 17, f. 4, 1951.

Filament sparsely branched, creeping on the other filamentous algae; cell cylindric or irregularly inflated,  $8-10\ \mu$  broad; seta long and very slender, about  $3\ \mu$  broad at the base.

Hab. Ton. R. 1 and K. C. 2. Distr. Cosmopolitan. (Pl. 1, f. 2)

10. *Asterococcus superbis* (CIENK) SCHARFFEL; LEMMERMAN, l.c., p. 33, f. 30, 1915; SKUJA, Nova Acta Reg. Soc. Sci. Upsal. Ser. 4, 18, p. 102, pl. 14, f. 17, 1964.

Cell globose, solitary or in colony of 2-4 cells, with a hyaline, lamellose, gelatinous matrix; cell  $20-25\ \mu$  in diameter.

Hab. Anc. 4. Distr. Europe, U.S.A., Alaska and Japan.

11. *Coelastrum microporum* NAEGELI; BRUNNTHALER, l.c., p. 195, f. 307, 1915; SMITH, l.c., p. 160, pl. 41, f. 12-13, 1920; PHILIPSE, l.c., p. 228, f. 135, 1967.

Cell globose and connected to one another by gelatinous processes; cell  $8-20\ \mu$  in diameter.

Hab. Anc. 4. Distr. Europe, U.S.A., India and Japan.

12. *Coelastrum proboscideum* BOHLIN, Bih. Till. K. Sv. Vet.-Akad. Handl. 23, p. 33, f. 19-22, 1897; BRUNNTHALER, l.c., p. 196, f. 130, 1915; SKUJA, l.c., p. 140, pl. 23, f. 2-5, 1964.

Cell conical and adjoined along the lower lateral walls; cell 8-15  $\mu$  in diameter.

Hab. Anc. 4, Anc. 10 and K.C.1. Distr. Cosmopolitan.

13. *Crucigenia quadrata* MORREN; BRUNNTHALER, l.c., p. 172, f. 248, 1915; SMITH, l.c., p. 147, pl. 36, f. 10-14, 1920.

Cell triangular, 3-6  $\mu$  broad and 5-8  $\mu$  long.

Hab. K.C.1. Distr. Cosmopolitan.

14. *Dicranochaete reniformis* HIERONYMUS; BRUNNTHALER, l.c., p. 68, f. 6A, 1915; COLLINS, Tufts Coll. Stud. 4, p. 27, pl. 1, f. 6a-b, 1918; PRESCOTT, l.c., p. 132, pl. 19, f. 1-2, 1951.

Cell solitary, epiphytic, hemispherical in side view and reniform in vertical view, with a branched gelatinous seta arising from the base of the cell; cell about 20  $\mu$  broad, seta 150-170  $\mu$  long.

Hab. Ton. R. 3. Distr. Europe, U.S.A., Alaska and Japan. (Pl. 1, f. 10)

15. *Dictyosphaerium pulchellum* WOOD; SMITH, l.c., p. 105, pl. 20, f. 13, 1920; PRESCOTT, l.c., p. 238, pl. 51, f. 5-7, 1951; PHILIPPOSE, l.c. p. 199, f. 110, 1967.

Hab. 12-16 and Anc. 4. Distr. Cosmopolitan. (Pl. 7, f. 10)

16. *Dimorphococcus lunatus* BRAUN; BRUNNTHALER, l.c., p. 185, f. 280, 1915; WEST, G. S. & FRITSCH, Brit. Freshw. Alg. p. 136, 1927; PRESCOTT, l.c., p. 252, pl. 55, f. 8, 1951.

Cell arranged in composite colony consisting of definite groups of four cells; cells in group attached on the ends of fine, branched threads; cell subcylindric or reniform; 4-15  $\mu$  broad and 10-25  $\mu$  long.

Hab. Ton. L. 1. Distr. Europe, U.S.A. and Japan.

17. *Elakatothrix viridis* (SNOW) PRINTZ, Skr. Vidensk. Krist. Mat.-Nat. Kl. 6, p. 31, 1914; PRESCOTT, l.c., p. 92, pl. 4, f. 1-2, 1951.

Colony enveloped with a fusiform, gelatinous matrix; cell fusiform, 5-6  $\mu$  broad and 20-35  $\mu$  long.

Hab. Ton. R. 1. Distr. Europe and U.S.A. (Pl. 1, f. 13)

18. *Eudorina elegans* EHRENBERG; SMITH, l.c. p. 96, pl. 19, f. 1, 1920; PASCHER, Suessw.-fl. 4, p. 440, f. 394-401, 1927; HUBER-PESTALOZZI, Binnengew. 16, pt. 5, p. 640, pl. 131, f. 889, 1961.

Hab. 26, 29, and M.R.2-4. Distr. Cosmopolitan.

19. *Lagerheimia splendens* WEST, G. S., Journ. Linn. Soc. Bot. 39, p. 74, pl. 6, f. 4-8, 1909.

Cell cylindrical, pole conical and with 4 strong, robust spines; cell about  $10\ \mu$  broad and  $28\ \mu$  long. The present specimens have somewhat larger cell dimensions than those of the Australian forms described by WEST.

Hab. 29. Distr. Australia. (Pl. 1, f. 14)

20. *Oocystis elliptica* WEST, W.; SMITH, l.c., p. 111, pl. 22, f. 5, 1920; PRESCOTT, l.c. p. 244, pl. 51, f. 11, 1951; PHILIPPOSE, l.c., p. 186, f. 100, 1967.

Hab. Anc. 4. Distr. Europe, N. America and India.

21. *Oocystis pusilla* HANSRIG; BRUNNTHALER, l.c., p. 124, 1915; PRESCOTT, l.c., p. 246, pl. 51, f. 15, 1951.

Hab. Anc. 4. Distr. Europe and U.S.A.

22. *Pediastrum duplex* MEYEN; BRUNNTHALER, l.c., p. 95, f. 57, 1915; SMITH, l.c., p. 171, pl. 46, f. 14-16, 1920; PRESCOTT, l.c., p. 223, pl. 48, f. 4, 1951; PHILIPPOSE, l.c., p. 121, f. 43a-b, 1967.

Hab. 23, 26, M.R.1, Anc. 4, Anc. 13 and K.C.1. Distr. Cosmopolitan.

23. *Pediastrum duplex* MEYEN var. *genuinum* (BRAUN) HANSRIG; BRUNNTHALER, l.c., p. 59, f. 57a, 1915; PHILIPPOSE, l.c. p. 123, f. 43d, 1967.

Hab. 5-6, 14, 16, 19-20 and B.A.1. Distr. Europe, Africa, India, Burma, Java and Japan.

24. *Pediastrum duplex* MEYEN var. *gracillimum* WEST, W. & G. S.; SMITH, l.c., p. 172, pl. 47, f. 8-11, 1920; PRESCOTT, l.c., p. 224, pl. 48, f. 12, 1951; PHILIPPOSE, l.c., p. 124, f. 43h-i, 1967.

Hab. 3, 6, 9, 12, 18, 21 and Anc. 6. Distr. Cosmopolitan. (Pl. 7, f. 8)

25. *Pediastrum duplex* MEYEN var. *reticulatum* LAGERHEIM; BRUNNTHALER, l.c., p. 95, f. 57h, 1915; SMITH, l.c., p. 172, pl. 47, f. 4-7, 1920; PRESCOTT, l.c., p. 224, pl. 49, f. 1, 1951.

Hab. 3, 10, 15, 24, 25, M.R.1 and M.R.3. Distr. U.S.A. and Japan.

26. *Pediastrum duplex* MEYEN var. *subgranulatum* RACIBORSKI; BRUNNTHALER, l.c., p. 95, f. 57i, 1915; PHILIPPOSE, l.c., p. 125, f. 43c-j, 1967.

Hab. 4-5, 13, 18, M.R.3 and B.A.3. Distr. Cosmopolitan. (Pl. 7, f. 1)

27. *Pediastrum simplex* MEYEN; SULEK in FOTT, Stud. Phycol. p. 210, pl. 5, f. 1, 1969.

Hab. 3-20, 22-24, 26-27, M.R.1-4, B.A.2-3, C.T.M. and T.S.M. Distr. Europe, U.S.A., Africa, Burma, and Japan. (Pl. 6, f. 1-6)

28. *Pediastrum sturmii* REINSCH; BRUNNTHALER, l.c., p. 93, f. 53a, 1915; WEST, W., Journ. Bot. 31, p. 99, pl. 333, f. 3, 1893.

Hab. M.R.3. Distr. Europe.

29. *Pediastrum tetras* (EHRENBERG) RALFS; BRUNNTHALER, l.c., p. 103, f. 64a,

1915; SMITH, l.c., p. 173, pl. 48, f. 9–12, 1920; PRESCOTT, l.c., p. 227, pl. 50, f. 3, 6, 1951; PHILIPSE, l.c., p. 128, f. 45a–c, 1967.

Hab. Ton.R.1, Anc. 4, Anc. 10 and K.C.1. Distr. Cosmopolitan.

30. *Pediastrum tetras* (EHRENBERG) RALFS var. *tetraodon* (CORDA) HANSRIG; BRUNNTHALER, l.c., p. 103, 1915; SMITH, l.c., p. 174, pl. 48, f. 13–14, 1920; PHILIPSE, l.c. p. 129, f. 45d, e, g, 1967.

Hab. Anc. 4. Distr. Cosmopolitan.

31. *Planktonema lauterborni* SCHMIDLE; SKUJA, Nova Acta Reg. Soc. Sci. Upsal. Ser. 4, 16, p. 194, pl. 34, f. 8–10, 1956; HAGA, Bull. Jap. Soc. Phycol. 18, p. 134, f. 1–3, 1970.

Filament simple, composed of cylindrical cells arranged in a row with equidistant intervening space, inside a gelatinous sheath; cell 2.5–4  $\mu$  broad and 9–16  $\mu$  long.

Hab. 3. Distr. Europe, China and Japan. (Pl. 1, f. 12, Pl. 7, f. 4, 5)

32. *Pleodorina sphaerica* IYENGER; HUBER-PESTALOZZI, Binnengew. 16, pt. 5, p. 649, pl. 135, f. 899, 1961.

Hab. 3, 7, 11, 14–15, 20, 24 and 29. Distr. India.

33. *Scenedesmus abundans* (KIRCHNER) CHODAT; SMITH, Trans. Wiscon. Acad. Sci. Arts & Lett. 18, p. 465, pl. 30, f. 133–136, pl. 31, f. 137–140, 1916; PRESCOTT, Alg. W. Great Lakes Area, p. 274, pl. 61, f. 21, 1951.

Cell oblong; outer cell with 1–2 spines on each pole and lateral wall, inner cell with a spine at each pole; cell 4–7  $\mu$  broad and 7–12  $\mu$  long.

Hab. Ton. L. 3 and K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 5)

34. *Scenedesmus acuminatus* (LAGERHEIM) CHODAT; BRUNNTHALER, Suessw.-fl. 5, p. 163, 1915; PRESCOTT, l.c., p. 275, pl. 62, f. 16, 1951; UHERKOVICH, Scenedesmus-Arten Ungarns, p. 41, f. 45–66, 1966.

Cell lunate, with sharply pointed pole; cell 3–7  $\mu$  broad and 12–20  $\mu$  long.

Hab. K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 10, 10a)

35. *Scenedesmus armatus* (CHODAT) SMITH var. *ecornis* WOLOSZYNSKA; UHERKOVICH, l.c. p. 70, f. 358, 1966.

Cell oblong-ellipsoid and with a median, longitudinal ridge; terminal cell with a short spine at each pole; cell 3.5–4  $\mu$  broad and 9–11  $\mu$  long.

Hab. K.C.1. Distr. Europe and Japan. (Pl. 2, f. 7)

36. *Scenedesmus brasiliensis* BOHLIN; BRUNNTHALER, l.c., p. 165, f. 222, 1915; PRESCOTT, l.c., p. 277, pl. 63, f. 5–6, 1951; UHERKOVICH, l.c., p. 77, f. 441–444, 1966.

Cell ovate-ellipsoid, with 1–4 short teeth at each pole and a longitudinal median ridge; cell 5–7  $\mu$  broad and 10–22  $\mu$  long.

Hab. Kg. Lu. 4, Anc. 4 and K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 1, 1a)

37. *Scenedesmus circumfusus* HORTBAGYI; UHERKOVICH, l.c., p. 71, f. 364–369,

1966.

Cell oblong-ellipsoid, with 2-3 short spines at each pole and longitudinal row of small teeth; cell 3-6  $\mu$  broad and 8-16  $\mu$  long.

Hab. Ton. R. 1, Anc. 4 and K.C.1. Distr. Europe and Japan. (Pl. 2, f. 11, 11a-b)

38. *Scenedesmus ecornis* (RALFS) CHODAT; BRUNNTHALER, l.c., p. 167, 1915 (ut *S. bijugatus* (TURPIN) KUETZING); PRESCOTT, l.c., p. 276, pl. 63, f. 2, 1951 (ut *S. bijuga* (TURPIN) LAGERHEIM); UHERKOVICH, l.c., p. 45, f. 84-109, 1966.

Cell ovate or oblong, without spines or teeth; cell 4-8  $\mu$  broad and 8-16  $\mu$  long.

Hab. Ton. R. 1, Anc. 4, Anc. 8 and K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 6, 6a-b)

39. *Scenedesmus granulatus* WEST, W. & G. S., Journ. Roy. Micros. Soc. London, 1897, p. 500, pl. 7, f. 1-2, 1897; BRUNNTHALER, l.c., p. 165, f. 218, 1915; UHERKOVICH, l.c., p. 62, f. 254-282, 1966.

Cell oblong or ovate, wall with longitudinal rows of granule; cell 4-6  $\mu$  broad and 9-16  $\mu$  long.

Hab. Anc. 4. Distr. Cosmopolitan. (Pl. 2, f. 2, 2a)

40. *Scenedesmus opoliensis* RICHTER; SMITH, l.c., p. 159, pl. 41, f. 8-11, 1920; PRESCOTT, l.c., p. 279, pl. 63, f. 18, 1951; UHERKOVICH, l.c., p. 96, f. 618-630, 1966.

Cell naviculoid, outer cell with a long spine at each pole; cell 6-8  $\mu$  broad and 14-26  $\mu$  long.

Hab. M.R.5. Distr. Cosmopolitan. (Pl. 2, f. 14)

41. *Scenedesmus perforatus* LEMMERMAN; BRUNNTHALER, l.c. p. 166, f. 230, 1915; PRESCOTT, l.c., p. 279, pl. 46, f. 24-25, 1951; UHERKOVICH, l.c., p. 89, f. 542, 1966.

Cell subrectangular with concave lateral wall, thus forming intercellular spaces; terminal cell with a long, curved spine at each pole; cell 5-8  $\mu$  broad and 10-20  $\mu$  long.

Hab. Anc. 4 and Anc. 6. Distr. Europe, U.S.A., Paraguay and Japan. (Pl. 2, f. 3)

42. *Scenedesmus producto-capitatus* SCHMULA; BRUNNTHALER, l.c., p. 167, f. 236, 1915; ARAI & YAMAGISHI. Journ Jap. Bot. 44, p. 244, f. 10a-b, 1969.

Cell ellipsoid, with 1-2 protuberances at each pole; cell 5-8  $\mu$  broad and 15-20  $\mu$  long.

Hab. Anc. 4. Distr. Europe and Japan. (Pl. 2, f. 4)

43. *Scenedesmus quadricauda* (TURPIN) BREBISSE; BRUNNTHALER, l.c., p. 165, 1915; PRESCOTT, l.c., p. 280, pl. 64, f. 2, 1951; UHERKOVICH, l.c., p. 78, f. 446-460, 1966.

Cell cylindric, terminal cell with a long, curved spine at each pole; cell 3-18  $\mu$

broad and 9–35  $\mu$  long.

Hab. Anc. 5 and K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 8)

44. *Scenedesmus quadricauda* (TURPIN) BREBISSON var. *mirificus* (HORTBAGYI) UHERKOVICH; l.c., p. 86, f. 519–520, 1966.

Wall granulate; cell 5–7  $\mu$  broad and 18–22  $\mu$  long.

Hab. Anc. 11. Distr. Europe. (Pl. 2, f. 13)

45. *Scenedesmus quadricauda* (TURPIN) BREBISSON var. *quadrispina* SMITH; Trans. Wiscon. Acad. Sci. Art. & Lett. **18**, p. 479, pl. 43, f. 167–170, 1916; UHERKOVICH, l.c., p. 83, f. 491–500, 1966.

Cell ovate; terminal cell with a short, recurved spine at each pole; cell 6–8  $\mu$  broad and 16–24  $\mu$  long.

Hab. K.C.1. Distr. Cosmopolitan. (Pl. 2, f. 9)

46. *Scenedesmus serratus* (CORDA) BOHLIN; BRUNNTHALER, l.c. p. 165, f. 217, 1915; PRESCOTT, l.c. p. 281, pl. 64, f. 8, 1951; UHERKOVICH, l.c. p. 66, f. 313–314, 1966.

Cell oblong ovate, with 2–4 small teeth at each pole; the outer cell with one, the inner cell two longitudinal rows of small teeth; cell 4–7  $\mu$  broad and 15–20  $\mu$  long.

Hab. Anc. 4. Distr. Europe, U.S.A. and Japan. (Pl. 2, f. 12, 12a)

47. *Selenastrum gracile* REINSCH; SMITH, Bull. Wiscon. Geol. & Nat. Hist. Sur. **57**, p. 133, pl. 31, f. 5, 1920; PRESCOTT, l.c., p. 257, pl. 57, f. 11, 1951; PHILIPSE, l.c. p. 219, f. 128, 1967.

Hab. 16. Distr. Cosmopolitan. (Pl. 7, f. 3)

48. *Schizomeris leibleinii* KUETZING; WEST, G. S. & FRITSCH, Brit. Freshw. Alg. p. 153, 1927; PRESCOTT, l.c., p. 105, pl. 7, f. 11–13, 1951.

Hab. Kg.Lu.4. Distr. Cosmopolitan.

49. *Sorastrum americanum* (BOHLIN) SCHMIDLE; BRUNNTHALER, l.c. p. 201, f. 330, 1915; PRESCOTT, l.c., p. 228, pl. 50, f. 8, 1951.

Cell heart-shaped or subpyramidal, each of the 4 angles of the outer free wall with a long, stout spine; cell 7–20  $\mu$  broad and 5–20  $\mu$  long.

Hab. Anc. 4. Distr. Europe, U.S.A., Brazil and Paraguay. (Pl. 1, f. 4)

50. *Sorastrum spinulosum* NAEGELI; BRUNNTHALER, l.c., p. 201, f. 328, 1915; PRESCOTT, l.c., p. 228, pl. 53, f. 1, 1951.

Cell rhomboidal or reniform, each angle of outer free side with two short spines; cell 5–8  $\mu$  broad and 8–14  $\mu$  long.

Hab. Anc. 4. Distr. Cosmopolitan. (Pl. 1, f. 3)

51. *Sphaerocystis schroeteri* CHODAT; SMITH, l.c., p. 101, pl. 19, f. 3–4, 1920; PRESCOTT, l.c., p. 83, pl. 3, f. 6–7, 1951.

Hab. Anc. 4 and Anc. 8. Distr. Cosmopolitan.

52. *Spirogyra inflata* (VAUCHER) KUETZING; TRANSEAU, Zygnemataceae, p. 203, pl. 35, f. 28, 1951.

Hab. Ton. R.1. Distr. Europe, S. Africa, U.S.A., S. America, Australia, New Zealand, China and Japan.

53. *Tetrademus wisconsinensis* SMITH, Bull. Torrey Bot. Club, **40**, p. 76, pl. 1, f. 1-2, 1913; Bull. Wiscon. Geol. & Nat. Hist. Surv. **57**, p. 150, pl. 37, f. 7-11, 1920.

Hab. Anc. 4. Distr. U.S.A. and Japan.

54. *Tetraedron gracile* (REINSCH) HANS GIRG; BRUNNTHALER, l.c., p. 157, f. 201, 1915; SMITH, l.c., p. 122, pl. 26, f. 1-5, 1920; PRESCOTT, l.c., p. 265, pl. 60, f. 1, 1951.

Cell rectangular and the margin concave, the angle projected into narrow, twice furcated processes which are tipped with 1-3 short spines; cell 15-30 $\mu$  in diameter.

Hab. Anc. 8 and Anc. 10. Distr. Europe, N. America, India, China and Japan. (Pl. 3, f. 11)

55. *Tetraedron minimum* (BRAUN) HANS GIRG; BRUNNTHALER, l.c., p. 147, f. 155, 1915; PRESCOTT, l.c., p. 267, pl. 60, f. 12-15, 1951.

Cell tetragonal, the angle rounded and the margin concave; cell 8-15 $\mu$  in diameter.

Hab. Anc. 4. Distr. Cosmopolitan. (Pl. 1, f. 6)

56. *Tetraedron pentaedricum* WEST, W. & G. S., Trans. Linn. Soc. London Bot. **5**, p. 84, pl. 5, f. 15-16, 1895; BRUNNTHALER, l.c., p. 152, f. 174, 1915; SMITH, BULL. Wiscon. Geol. & Nat. Hist. Surv. **57**, p. 120, pl. 25, f. 13-17, 1920.

Cell five sides, the margin deeply concave, the angle rounded and the apex with a sharp spine; cell 12-20  $\mu$  in diameter.

Hab. Anc. 4 and K.C.1. Distr. Madagascar and U.S.A. (Pl. 1, f. 8)

57. *Tetraedron regulare* KUETZING; BRUNNTHALER, l.c., p. 150, f. 167, 1915; SMITH, l.c., p. 118, pl. 24, f. 14, 1920; PRESCOTT, l.c., p. 269, pl. 60, f. 24-26, 1951.

Cell pyramidal, the side convex or slightly concave, the angle broadly rounded and with a short spine; wall smooth; cell 16-20  $\mu$  in diameter.

Hab. 1, 11 and K.C.1. Distr. Cosmopolitan. (Pl. 1, f. 7, 7a)

58. *Tetraedron regulare* KUETZING var. *granulata* PRESCOTT, Farlowia, **1**, p. 359, 1944; PRESCOTT, Alg. W. Great Lakes Area, p. 269, pl. 61, f. 2-3, 1951.

Wall covered with small granules; cell 28-30  $\mu$  in diameter.

Hab. Anc. 4. Distr. U.S.A. (Pl. 1, f. 9)

59. *Tetraedron trigonum* (NAEGELI) HANS GIRG; BRUNNTHALER, l.c., p. 149, f. 163, 1915; SMITH, l.c. p. 117. pl. 23, f. 14-16, 1920; PRESCOTT, l.c., p. 270, pl. 61, f. 11-12, 1951.

Cell triangular, the margin convex, the angle rounded and with a spine; cell 20-25  $\mu$  in diameter.

Hab. 6, Kg. Lu. 3, Kg. Lu. 6, Ton. L. 4 and Anc. 4. Distr. Cosmopolitan. (Pl. 3, f. 9)

60. *Tetraedron trigonum* (NAEGELI) HANS GIRG var. *gracile* (REINSCH) De TONI; BRUNNTHALER, l.c., p. 149, 1915; PRESCOTT, l.c. p. 270, pl. 61, f. 14-16, 1951.

The angle narrower and more produced than in the typical form; cell 35-45  $\mu$  in diameter.

Hab. 6 and Ton. R. 1. Distr. Europe and U.S.A. (Pl. 3, f. 7, 7a)

61. *Tetraedron trigonum* (NAEGELI) HANS GIRG var. *arthrodesmiforme* WEST, G. S.; BRUNNTHALER, l.c., p. 150, f. 164, 1915.

Cell about rectangular, the margin concave and the angle projected into a stout, curved spine; cell 6-13  $\mu$  in diameter.

Hab. Anc. 11. Distr. Africa (Nyasaland). (Pl. 3, f. 12)

62. *Tetraedron tumidulum* (REINSCH) HANS GIRG; BRUNNTHALER, l.c., p. 148, f. 157, 1915; PRESCOTT, l.c., p. 270, pl. 61, f. 17-18, 1951.

Cell pyramidal, the margin straight or concave, the angle bluntly rounded; cell 20-30  $\mu$  in diameter.

Hab. Ton. L. 3 and Ton. L. 4. Distr. Europe, U.S.A. and Japan. (Pl. 1, f. 5, 5a)

63. *Tetraedron verrucosum* SMITH, Trans. Wiscon. Acad. Sci. Art. & Lett. 19, p. 632, 1918; PRESCOTT, l.c., p. 270, pl. 61, f. 24-25, 1951.

Cell pyramidal, the margin concave, the angle rounded and with a blunt spine; wall coarsely verrucose; cell 35-45  $\mu$  in diameter.

Hab. Ton. L. 4 and K. C. 1. Distr. U.S.A. (Pl. 3, f. 10)

64. *Tetraedron victoriae* WOLOSZYNSKA var. *major* SMITH, Bull. Wiscon. Geol. & Nat. Hist. Surv. 57, p. 119, pl. 24, f. 22-29, 1920; PRESCOTT, l.c., p. 270, pl. 61, f. 28-29, 1951.

Cell pyramidal, the margin straight or concave, the angle tapering and ending into a long, stout spine; cell 15-20  $\mu$  broad and 60-65  $\mu$  long.

Hab. 21, Anc. 10 and Anc. 11. Distr. U.S.A. and India. (Pl. 3, f. 8)

65. *Trochiscia erlangensis* HANS GIRG, Hedwigia, 27, p. 129, 1888; BRUNNTHALER, l.c. p. 205, 1915; PRESCOTT & CROASDALE, Amer. Midl. Natur. 27, p. 672, pl. 1, f. 10, 1942.

Cell globose; wall thick and decorated with a coarse reticulate thickening; cell 15-26  $\mu$  in diameter.

Hab. Anc. 4. Distr. Europe, U.S.A. and Alaska.

66. *Uronema confervicolum* LAGERHEIM; HEERING, Suessw.-fl. 6, p. 36, f. 17, 1914; RAMANATHAN, Ulotrichales, p. 50, pl. 13, f. A-G, 1954.

Filament many celled and attached by a disk of basal cell, terminal cell straight and pointed; cell 3.5-8  $\mu$  broad and 4-30  $\mu$  long.

Hab. Ton. L. 3. Distr. Europe, Africa, N. America and Burma.

## EUGLENOPHYTA

1. *Euglena acus* EHRENBERG; LEMMERANN, Suessw.-fl. 2, p. 129, f. 209, 1919; HUBER-PESTALOZZI, Binnengew. 16, pt. 4, p. 96, pl. 16, f. 75, 1955.  
Cell 9–13  $\mu$  broad and 172–180  $\mu$  long.  
Hab. 25 and Kg.Lu.3. Distr. Europe, U.S.A. and Japan. (Pl. 3, f. 1)
2. *Euglena acus* EHRENBERG var. *longissima* DEFLANDRE; HUBER-PESTALOZZI, l.c., p. 97, 1955.  
Cell about 10  $\mu$  broad and 250–263  $\mu$  long.  
Hab. 27. Distr. Europe.
3. *Euglena charkowiensis* SWIRENKO; HUBER-PESTALOZZI, l.c., p. 61, pl. 6, f. 37, 1955.  
Cell rigid, elongate cylindric and slightly twisted; chloroplast disc-shaped; paramylon rod-like, 2–3; cell 15.5–20  $\mu$  broad and 88–136  $\mu$  long.  
Hab. 11, 15, 23 and 28. Distr. Soviet. (Pl. 3, f. 2)
4. *Euglena tripteris* (DUJARDIN) KLEBS; LEMMERANN, l.c., p. 130, f. 201, 1913; HUBER-PESTALOZZI, l.c., p. 62, pl. 6, f. 39, 1955.  
Cell rigid, elongate cylindric and spirally twisted; chloroplast disc-shaped; paramylon rod-like, two; cell about 14  $\mu$  broad and 100–125  $\mu$  long.  
Hab. 28. Distr. Europe, U.S.A. and Japan. (Pl. 3, f. 3)
5. *Euglena tripteris* (DUJARDIN) KLEBS var. *crassa* SWIRENKO; HUBER-PESTALOZZI, l.c., p. 63, pl. 6, f. 39A, 1955.  
Cell 15–17  $\mu$  broad and 60–70  $\mu$  long.  
Hab. Ton.L.4. Distr. Europe. (Pl. 3, f. 4)
6. *Lepocinclis marssonii* LEMMERANN; l.c., p. 135, f. 228, 1913; HUBER-PESTALOZZI, l.c., p. 140, pl. 26, f. 119, 1955.  
Cell cylindric-fusiform, 9–11  $\mu$  broad and 36–40  $\mu$  long.  
Hab. Ton.L.4. Distr. Europe and Australia. (Pl. 3, f. 5)
7. *Lepocinclis ovum* (EHRENBERG) LEMMERANN var. *dimidio-minor* DEFLANDRE; LEMMERANN, l.c., p. 134, f. 216, 1913; HUBER-PESTALOZZI, l.c., p. 151, pl. 30, f. 151–152, 1955.  
Cell ovoid, 10–11  $\mu$  broad and 16–20  $\mu$  long.  
Hab. Ton.L.4. Distr. Europe, Egypt and S. Africa. (Pl. 3, f. 6)
8. *Phacus acuminatus* STOKES; LEMMERANN, l.c., p. 138, f. 233, 1913; HUBER-PESTALOZZI, l.c., p. 192, pl. 33, f. 224, 1955.  
Cell broadly ovoid, with a short, blunt apiculation; cell 20–22  $\mu$  broad and 23–25  $\mu$  long.  
Hab. Ton.L.4, Anc. 11 and K.C.1. Distr. Europe, S. Africa, U.S.A. and Japan. (Pl. 5, 12)

9. *Phacus acuminatus* STOKES var. *discifera* (POCHMANN) HUBER-PESTALOZZI; l.c., p. 193, pl. 38, f. 225, 1955.

Cell 22–32  $\mu$  broad and 26.5–37  $\mu$  long.

Hab. 11 and 25. Distr. Erance. (Pl. 5, f. 10)

10. *Phacus caudatus* HUEBNER; LEMMERMANN, l.c. p. 138, f. 237, 1913; PRESCOTT, Alg. W. Great Lakes Area, p. 98, pl. 87, f. 13, 1951; HUBER-PESTALOZZI, l.c., p. 196, pl. 39, f. 236, 1955.

Cell oblong-ovoid, posterior end projected into a sharp, straight tail; paramylon disc-like; cell about 26.5  $\mu$  broad and 35  $\mu$  long; the striation of periplast delicately seen.

Hab. 1 and Anc. 10. Distr. Europe, Siberia, S. China and Japan.

11. *Phacus circumflexus* POCHMANN; HUBER-PESTALOZZI, l.c. p. 224, pl. 50, 1955.

Cell rhomboid and asymmetric, one side of upper lateral margin somewhat concave and other side convex; posterior end projected into a long straight tail; cell 32–39.5  $\mu$  broad and 84–86  $\mu$  long.

Hab. 24, Kg.Lu.3 and Ton.L.4. Distr. Europe and India. (Pl. 5, f. 6)

12. *Phacus minutus* (PLAYFAIR) POCHMANN; HUBER-PESTALOZZI, l.c., p. 211, pl. 45, f. 277, 1955.

Cell ovoid, with obliques tail; about 22  $\mu$  broad and 28  $\mu$  long.

Hab. Ton.L.4. Distr. Australia. (Pl. 5, f. 11)

13. *Phacus nordstedtii* LEMMERMANN; l.c., p. 139, f. 244, 1913; HUBER-PESTALOZZI, l.c., p. 230, pl. 53, f. 320, 1955.

Hab. Ton.L.4. Distr. Europe, U.S.A., Alaska, China and Japan. (Pl. 5, f. 7)

14. *Phacus orbicularis* HUEBNER; LEMMERMANN, l.c., p. 138, f. 256, 1913; HUBER-PESTALOZZI, l.c., p. 209, pl. 45, f. 272, 1955.

Cell broadly ovoid, with obliquely projected and curved tail; cell 60–67  $\mu$  broad and 85–95  $\mu$  long.

Hab. 21, 25 and Ton.L.4. Distr. Europe, N. America, China, Manchuria and Sunda Islands. (Pl. 5, f. 3)

15. *Phacus pleuronectes* (MUELLER) DUJARDIN; LEMMERMANN, l.c., p. 138, f. 236, 1913; HUBER-PESTALOZZI, l.c., p. 211, pl. 45, f. 276, 1955.

Cell ovoid, with obliquely projected and curved tail; cell 28–32  $\mu$  broad and 40–45  $\mu$  long.

Hab. Ton.L.4 and Anc. 8. Distr. Europe and Japan. (Pl. 5, f. 9)

16. *Phacus ranula* POCHMANN; HUBER-PESTALOZZI, l.c., p. 227, pl. 52, f. 313, 1955.

Cell elliptic, posterior projected into a long, robust and sharp tail; cell 40–44  $\mu$  broad and 75–88  $\mu$  long.

Hab. 4, 16, 18, 23, 27, Ton.R.1 and Anc. 10. Distr. Indo China and W. Java. (Pl. 5, f. 1)

17. *Phacus stokesii* LEMMERMANN f. *minor* CONRAD; HUBER-PESTALOZZI, l.c., p. 180, pl. 33, f. 194, 1955.

Hab. Ton.L.4. Distr. Poland, N. America and Manchuria. (Pl. 5, f. 5)

18. *Phacus suecicus* LEMMERMANN; l.c., p. 139, f. 241, 1913; HUBER-PESTALOZZI, l.c., p. 237, pl. 55, f. 338, 1955.

Hab. Ton.L.4. Distr. Europe, U.S.A., Australia, Venezuela and Japan. (Pl. 5, f. 2)

19. *Phacus tortus* (LEMMERMANN) SKVORTZOV; PRESCOTT, l.c., p. 404, pl. 88, f. 20, 1951; HUBER-PESTALOZZI, l.c., p. 225, pl. 51, f. 309, 1955.

Cell broadly fusiform and twisted; cell 50–51  $\mu$  broad and 114–118  $\mu$  long.

Hab. 28. Distr. Europe, S. Africa, China, Sunda Island and Japan. (Pl. 5, f. 4)

20. *Phacus triqueter* (EHRENBERG) DUJARDIN; LEMMERMANN, l.c., p. 138, f. 239, 1913; HUBER-PESTALOZZI, l.c., p. 213, pl. 46, f. 284, 1955.

Cell broadly ovoid; the dorsal surface with a higher flange; cell 28–32  $\mu$  broad and 37–45  $\mu$  long.

Hab. Ton.L.4. Distr. Europe, U.S.A., India, Java, Venezuela and Japan. (Pl. 5, f. 8)

21. *Trachelomonas abrupta* SWIRENKO var. *angustata* DEFLANDRE; HUBER-PESTALOZZI, l.c., p. 321, pl. 69, f. 632, 1955.

Test cylindric ovoid, without collar; wall punctate; test 12–14  $\mu$  broad and 22–25  $\mu$  long.

Hab. Ton.L.4 and Anc. 7. Distr. Venezuela and Japan. (Pl. 4, f. 9)

22. *Trachelomonas armatus* (EHRENBERG) STEIN var. *steinii* LEMMERMANN; l.c., p. 150, 1913; PRESCOTT, l.c., p. 411, pl. 83, f. 26, 1951; HUBER-PESTALOZZI, l.c., p. 309, pl. 67, f. 585, 1955.

Test broadly ovoid, flagellum aperture surrounded by a circle of spines; wall spiny, spines of posterior end longer and larger than those of the anterior ones; test 30–34  $\mu$  broad and 35–40  $\mu$  long without spines.

Hab. Anc.4 and Anc. 8. Distr. Europe, N. America, Argentine, Sunda Islands, Manchuria and Japan. (Pl. 4, f. 8)

23. *Trachelomonas bernardinensis* VISCHER; HUBER-PESTALOZZI, l.c., p. 352, pl. 75, f. 760, 1955.

Test ellipsoid and narrowed posteriorly into a short conical projection; collar cylindric and circled with a spiny margin; wall densely punctate; cell 18–22  $\mu$  broad and 34–43  $\mu$  long.

Hab. Ton.L.4. Distr. Europe. (Pl. 4, f. 3)

24. *Trachelomonas curta* Da CUNHA; HUBER-PESTALOZZI, l.c., p. 269, pl. 59, f. 425, 1955.

Test compressed globose, without collar; wall smooth; test 16–20  $\mu$  broad and 13–16  $\mu$  long.

Hab. Ton.R.1, Kg.Lu.4 and Kg.Lu.5. Distr. Europe, Venezuela, Australia and Japan. (Pl. 4, f. 10)

25. *Trachelomonas dubia* SWIRENKO var. *lata* DEFLANDRE; HUBER-PESTALOZZI, l.c., p. 355, pl. 72, f. 699, 1955.

Test oblong, collar cylindric; wall smooth; test about 16  $\mu$  broad and 30–31  $\mu$  long.

Hab. Anc. 5. Distr. Europe and Java.

26. *Trachelomonas intermedia* DANGEARD; LEMMERMANN, l.c., p. 146, f. 257, 1913; HUBER-PESTALOZZI, l.c., p. 280, pl. 61, f. 467, 1955.

Test globose to ovoid, without a collar; wall punctate; test 12–15  $\mu$  broad and 15–18  $\mu$  long.

Hab. Anc. 4 and Anc. 14. Distr. Europe, Congo, U.S.A., Venezuela, Manchuria, Burma and Japan.

27. *Trachelomonas kelloggii* SKVORTZOV; HUBER-PESTALOZZI, l.c., p. 300, pl. 64, f. 543, 1955.

Test broadly elliptic, without a collar; wall punctate and spiny in the anterior and posterior portions with a few minute spines; test (22)- 30–34  $\mu$  broad and (27)-38–42  $\mu$  long.

Hab. Anc. 4. Distr. Europe, U.S.A., Venezuela, Manchuria and Japan. (Pl. 4, f. 12)

28. *Trachelomonas lacustris* DREZEPOLSKI; HUBER-PESTALOZZI, l.c., p. 290, pl. 63, f. 504, 1955.

Test cylindrical, without a collar; wall punctate; test 8.5–9  $\mu$  broad and 15.5–16  $\mu$  long.

Hab. 11. Distr. Europe, U.S.A., Argentina and Australia. (Pl. 4, f. 2)

29. *Trachelomonas mirabilis* SWIRENKO var. *obesa* (MESSIKOMMER) CONRAD; HUBER-PESTALOZZI, l.c., p. 313, pl. 68, f. 602, 1955.

Test broadly elliptic to ovoid; collar margin circled with short spines; wall beset with short spines; test 18–20  $\mu$  broad and 31–32  $\mu$  long.

Hab. 11. Distr. Europe. (Pl. 4, f. 4)

30. *Trachelomonas oblonga* LEMMERMANN var. *australica* PLAYFAIR; HUBER-PESTALOZZI, l.c., p. 280, pl. 61, f. 462, 1955.

Hab. K.C.1. Distr. France, Australia, Argentina and Japan.

31. *Trachelomonas pulcherrima* PLAYFAIR; HUBER-PESTALOZZI, l.c., p. 289,

pl. 62, f. 467, 1955.

Hab. Anc. 4. Distr. Europe, U.S.A., Australia, Burma and Japan.

32. *Trachelomonas robusta* SWIRENKO; HUBER-PESTALOZZI, l.c., p. 305, pl. 66, f. 568, 1955.

Hab. K.C.1. Distr. Europe, U.S.A., S. America and Japan.

33. *Trachelomonas rotunda* SWIRENKO; HUBER-PESTALOZZI, l.c., p. 267, pl. 59, f. 419, 1955.

Test globose, without a collar; wall punctate; test 22–26  $\mu$  in diameter.

Hab. Anc. 8 and Anc. 14. Distr. Europe, U.S.A. and Argentina. (Pl. 4, f. 7)

34. *Trachelomonas varians* (LEMMERMANN) DEFLANDRE; PRESCOTT, l.c., p. 418, pl. 83, f. 4–5, 1951; HUBER-PESTALOZZI, l.c., p. 256, pl. 57, f. 366, 1955.

Test globose; flagellum aperture surrounded by a cylindrical canal extended inwardly to the test cavity; wall smooth; test about 23  $\mu$  in diameter.

Hab. Anc. 8. Distr. Europe. (Pl. 4, f. 11)

35. *Trachelomonas verrucosa* STOKES var. *granulosa* (PLAYFAIR) CONRAD; HUBER-PESTALOZZI, l.c., p. 261, pl. 57, f. 393, 1955.

Test globose, without collar; wall verrucose; test 13–14  $\mu$  in diameter.

Hab. Ton.R.1. Distr. Europe and Australia. (Pl. 4, f. 5)

36. *Trachelomonas volvocina* EHRENBERG; LEMMERMAN, l.c., p. 145, f. 246, 1913; HUBER-PESTALOZZI, l.c., p. 251, pl. 56, f. 349, 1955.

Hab. Ton.R.1, Kg.Lu.5, Ton.L.4, Anc. 3 and Anc. 4. Distr. Cosmopolitan.

37. *Trachelomonas volvocina* EHRENBERG var. *papillata* LEMMERMAN; l.c., p. 146, 1913; HUBER-PESTALOZZI, l.c., p. 252, pl. 46, f. 352, 1955.

Hab. 1, 5 and Anc. 4. Distr. Europe and Japan. (Pl. 4, f. 6)

38. *Trachelomonas volvocina* EHRENBERG var. *punctata* PLAYFAIR; HUBER-PESTALOZZI, l.c., p. 252, pl. 46, f. 354, 1955.

Hab. Anc. 4. Distr. Europe, U.S.A., Australia, Venezuela and Japan.

## PYRROPHYTA

1. *Ceratium hirundinella* (MUELLER) DUJARDIN; HUBER-PESTALOZZI, Binnengew. 16, pt. 3, p. 260, f. 277, 1950; PRESCOTT, Alg. W. Great Lakes Area, p. 437, pl. 92, f. 4–5, 1951.

Hab. 3, 6, 7, 10, 13, 16–18, 20, 22, 24 and 27. Distr. Cosmopolitan.

## CHRYSTOPHYTA

1. *Botryococcus braunii* KUEUZING; SMITH, Bull. Wiscon. Geol. Nat. Hist. Surv. 57, p. 84, pl. 15, f. 5, 1920; PRESCOTT, l.c., p. 232, pl. 52, f. 1–2, 1951.

Hab. 4, 11, 14, 16 and 29. Distr. Cosmopolitan.

2. *Centritractus belonophorus* (SCHMIDLE) LEMMERMAN; Suessw.-fl. 11, p. 53, f. 35, 1925; HUBER-PESTALOZZI, Binnengew. 16, pt. 2-1, p. 323, f. 404; 1941, PRESCOTT, l.c., p. 361, pl. 95, f. 37-38, 1951.

Cell elongate-cylindric, straight or slightly curved, with a long, slender spine at each pole; cell 7.5-9.5  $\mu$  broad and 35-143  $\mu$  long.

Hab. 3, 6, 11, 25, B.A.3, Kg.Lu.5 and Ton.L.4. Distr. Cosmopolitan. (Pl. 4, f. 1, 1a)

3. *Dinobryon bavaricum* IMHOF; SMITH, l.c., p. 73, pl. 13, f. 10, 1920; PRESCOTT, l.c., p. 377, pl. 98, f. 6, 1951; SKUJA, Nova Acta Reg. Soc. Sci. Upsal. Ser. 4, 18: 3, p. 307, pl. 63, f. 22-23, 1964.

Hab. 3, 9 and 25. Distr. Europe and N. America.

4. *Dinobryon sertularia* EHRENBERG; PASCHER, Suessw.-fl. 2, p. 72, f. 114, 1913; SMITH, l.c., p. 74, pl. 13, f. 13, 1920; PRESCOTT, l.c., p. 378, pl. 98, f. 10, 1951; SKUJA, l.c., p. 305, pl. 63, f. 14-18, 1964.

Hab. 3, 5, 7, 11-12, 14-15, 20-21, 23, 27, 29 and C.T.M. Distr. Cosmopolitan.

5. *Ophiocytium capitatum* WOLLE; SMITH, l.c., p. 86, pl. 15, f. 12-13, 1920; PRESCOTT, l.c., p. 363, pl. 94, f. 21, 1951.

Cell cylindric, strongly curved, with a short spine at each pole; cell 5-6  $\mu$  broad and 40-55  $\mu$  long.

Hab. Anc. 4 and Anc. 13. Distr. N. America. (Pl. 4, f. 16)

6. *Ophiocytium cochleare* BRAUN; LEMMERMAN, Hedwigia 38, p. 30, pl. 3, f. 10-12, 1899; PASCHER, Suessw.-fl. 11, p. 77, f. 60, 1925.

Cell cylindric, spirally twisted, one end truncate and the other with a spine; cell 6-8  $\mu$  broad.

Hab. 12. Distr. Europe and U.S.A. (Pl. 4, f. 13)

7. *Ophiocytium elongatum* WEST, W. & G. S., Ann. Roy. Bot. Gard. Calcutta, 6, p. 232, pl. 11, f. 11-12, 1907; PRESCOTT, l.c., p. 364, 1951.

Cell cylindric, irregularly curved or strongly twisted at one end; one end truncate and the other with a spine; cell 5-6  $\mu$  broad.

Hab. 23. Distr. U.S.A. and Burma. (Pl. 4, f. 14)

8. *Ophiocytium parvulum* (PERTY) BRAUN; LEMMERMAN, l.c., p. 33, pl. 4, f. 30-33, 1899; PASCHER, l.c., p. 80, f. 64, 1925.

Cell cylindric and strongly curved or spiral, truncated at both ends; cell 6-7  $\mu$  broad.

Hab. 23. Distr. Europe. (Pl. 4, f. 15)

9. *Uroglenopsis americana* (CALKINS) LEMMERMAN, Suessw.-fl. 2, p. 58, f. 90,

1913; SMITH, l.c., p. 71, pl. 13, f. 1-4, 1920; PRESCOTT, l.c., p. 380, pl. 99, f. 1-5, 1951.

Hab. 15. Distr. U.S.A.

## CYANOPHYTA

1. *Anabaena circinalis* RABENHORST; SMITH, Bull. Wiscon. Geol. Nat. Surv. **57**, p. 59, pl. 9, f. 4-5, 1920; GEITLER, Krypt.-fl. **14**, p. 891, f. 572a, 1932; HUBER-PESTALOZZI, Binnengew. **16**, pt. 1, p. 214, f. 135, 1938; DESIKACHARY, Cyanophyta, p. 414, pl. 77, f. 2, 1959.

Trichome irregularly coiled and sometimes straight, about 8-15  $\mu$  in diameter; cell barrel-shaped or spherical, filled with pseudovacuoles; heterocyst spherical or elliptical and sometimes hexagonal, 11-13  $\mu$  broad and 10-11  $\mu$  long; resting spore elliptical or cylindrical, end rounded, 16-18  $\mu$  broad and 18.5-32  $\mu$  long, single or in pair and disposed generally away from the heterocysts.

We have found two forms of this species having broad trichome in different stations of the Lake Tonle Sap. One form has a straight trichome and the other has a coiled one. These two forms were collected in different stations respectively but in some other places two forms are found in mixed state. Most of the trichomes collected in many different stations have elliptical resting spores but some specimens have cylindrical ones though the latter is rather few in number. In the trichome having cylindrical spores the breadth of cells are rather smaller than those having elliptical spores.

Hab. 4-6, 10, 12-18, 22, 29, M.R.3 and M.R.5. Distr. Europe, N. America and India. (Pl. 7, f. 2; Pl. 8, f. 2, 5)

2. *Anabaena Viguierei* DENIS & EREMY in GEITLER, Binnengew. **16**, p. 206, f. 115, 1938.

Trichome 6.5-7.5  $\mu$  in diameter.

Hab. 4. Distr. Europe.

3. *Aphanocapsa elachista* W. & G. S. WEST; GEITLER, Suessw.-fl. **12**, p. 65, f. 55, 1925; l.c., **14**, p. 156, f. 69b, 1932; HUBER-PESTALOZZI, l.c., p. 138, pl. 6, f. 7, 1938; DESIKACHARY, l.c., p. 132, pl. 21, f. 5, 1959.

Colony spherical; cell spherical, about 1.3  $\mu$  in diameter.

Hab. 4, 9, 12 and 14. Distr. Europe, West Indies, Burma, India, Java, Borneo, Sumatra and Japan. (Pl. 8, f. 4)

4. *Aphanocapsa grevillei* (HASS.) RABENHORST; GEITLER, l.c., **12**, p. 65, f. 57, 1925; l.c., **14**, p. 159, f. 71, 1932; HUBER-PESTALOZZI, l.c., p. 139, pl. 7, f. 14, 1938; DESIKACHARY, l.c., p. 134, pl. 21, f. 9, 1959.

Cell almost spherical or slightly oblong, 4.5-6  $\mu$  in diameter; colony indistinct.

The specimens obtained from Lake Tonle Sap are slightly larger in cell size

than those of the forms described from Europe and others.

Hab. 4, 15 and 18. Distr. Europe, U.S.A., Africa, Nepal, Ceylon, China and Japan. (Pl. 8, f. 3)

5. *Aphanocapsa roeseana* De BARY; GEITLER, l.c., **14**, p. 157, 1932; HUBER-PESTALOZZI, l.c., p. 139, 1938; DESIKACHARY, l.c., p. 131, 1959.

Cell spherical, 8.5–9  $\mu$  in diameter, roughly disposed in gelatinous matrix.

Hab. M.R.1. Distr. Europe and India.

6. *Aphanothece stagnina* (SPRENG.) A. BRAUN; SMITH, l.c., **57**, p. 45, pl. 6, f. 2, 1920; GEITLER, l.c., **14**, p. 164, f. 72, 75a–b, 1932; HUBER-PESTALOZZI, l.c., p. 141, pl. 8, f. 16, 1938; DESIKACHARY, l.c. p. 173, pl. 21, f. 10, 1959.

Colony small, about 44  $\mu$  in diameter; cell elliptical, about 3  $\mu$  broad and 4.5  $\mu$  long, roughly disposed in gelatinous matrix.

Hab. 17. Distr. Europe, U.S.A. and India.

7. *Chroococcus limneticus* LEMMERMANN; SMITH, l.c., **57**, p. 29, pl. 1, f. 4, 1920; GEITLER, l.c., **14**, p. 234, f. 113a, 1932; HUBER-PESTALOZZI, l.c., p. 148, pl. 11, f. 33, 1938; DESIKACHARY, l.c., p. 107, pl. 26, f. 2, 1959.

Hab. M.R.4. Distr. Europe, Africa, N. America and India.

8. *Chroococcus turgidus* (KUETZ.) NAEGELI; SMITH, l.c., **57**, p. 31, pl. 1, f. 9, 1920; GEITLER, l.c., **14**, p. 228, f. 109b, 110, 1932; DESIKACHARY, l.c., p. 101, pl. 26, f. 6, 1959.

Hab. Anc. 4. Distr. Cosmopolitan.

9. *Coelosphaerium kuetsingianum* NAEGELI; SMITH l.c., **57**, p. 34, pl. 3, f. 4–5, 1920; GEITLER, l.c., **14**, p. 253, f. 121c–d, 1932; HUBER-PESTALOZZI, l.c., p. 154, pl. 15, f. 44, 1938; DESIKACHARY, l.c., p. 148, pl. 28, f. 7–8, 1959.

Colony spherical; cell spherical, about 2.2  $\mu$  in diameter.

Hab. Anc. 4. Distr. Europe, U.S.A. and Burma.

10. *Cylindrospermum* cf. *stagnale* (KUETZ.) BORNET & FLAHAULT; GEITLER l.c., **14**, p. 819, f. 520c, 1932; DESIKACHARY, l.c., p. 363, pl. 65, f. 9, 1959.

Trichome about 3  $\mu$  in diameter, constricted at the cross wall; cell barrel-shaped; heterocyst oval, about 4.5  $\mu$  broad and 5.3  $\mu$  long; resting spore cylindrical, about 7  $\mu$  broad and 19–20  $\mu$  long.

The cell dimensions of the present specimen are somewhat smaller than those of European forms.

Hab. Anc. 4. Distr. Europe, India and Ceylon.

11. *Hapalosiphon hibernicus* W. & G. S. WEST; GEITLER, l.c., **14**, p. 533, f. 331, 1932; SKUJA, Nova Acta Reg. Soc. Sci. Ups. Ser. 4, 14:5, p. 25, 1949; DESIKA-

CHARY, l.c. p. 593, 1959.

Main filament 8.8–9  $\mu$  in diameter, slightly constricted at the cross wall, enveloped with thin sheath; cell quadrate or cylindrical; heterocyst cylindrical, about 8.8  $\mu$  broad and 13  $\mu$  long; lateral branch erect or obliquely erect, projected in both sides, diameter about the same as the main filament.

Hab. Anc. 4. Distr. Europe, India, Burma and Japan.

12. *Lyngbya aerugineo-coerulea* (KUETZ.) GOMONT, Monogr. Oscill. p. 146, pl. 4, f. 1–3, 1892; GEITLER, l.c., 14, p. 1062, f. 670f–g, 1932; DESIKACHARY, l.c., p. 315, pl. 48, f. 9, 1959.

Trichome not constricted at the cross wall; sheath thin and firm; cell 4–6  $\mu$  broad and about 1/2 times as long as broad.

Hab. Kg.Lu. 2. Distr. Cosmopolitan.

13. *Lyngbya amplivaginata* Van GOOR; GEITLER, l.c., 14, p. 1050, 1932.

Trichome not constricted at the cross wall; sheath fairly thick; cell about 1.5  $\mu$  broad and 1.5–3  $\mu$  long.

Hab. Anc. 10. Distr. Europe.

14. *Lyngbya birgei* SMITH, l.c., 57, p. 54, pl. 7, f. 14–15, 1920; GEITLER, l.c., 14, p. 1048, f. 663, 1932; HUBER-PESTALOZZI, l.c., p. 249, pl. 55, f. 210, 1938; DESIKACHARY, l.c., p. 296, pl. 50, f. 7–8, 1959.

Cell short, about 20  $\mu$  broad and 2–3  $\mu$  long.

Hab. M.R.1. Distr. Europe, N. America and India.

15. *Lyngbya ceylanica* WILLE; GEITLER, l.c., 14, p. 1054, f. 668a–b, 1932; DESIKACHARY, l.c., p. 299, pl. 54, f. 4, 1959; HIRANO, Res. Kyoto. Univ. Sci. Exp. Karak. Hind. 3, p. 176, 1964.

Trichome 8.8–14  $\mu$  in diameter, end broadly rounded; sheath thin, not lamellose; cell 8–12  $\mu$  broad and 1/2–1/3 times as long as broad.

Hab. Kg.Lu.3 and 4. Distr. Afghanistan, India, Ceylon and Thailand.

16. *Lyngbya digneti* GOMONT; GEITLER, l.c., 14, p. 1058, f. 656e, 1932; DESIKACHARY, l.c., p. 310, pl. 53, f. 8, 1959.

Trichome narrow, not constricted at the cross wall; cell short, about 3  $\mu$  broad and 1–1/2 times as long as broad.

Hab. Kg.Lu. 3. Distr. Europe and India.

17. *Lyngbya gracilis* (MENEGH.) RABENHORST; GEITLER, l.c., 14, p. 1040, f. 657a, 1932; FREMY, Mem. Soc. Nat. Math. Cherb. 41, p. 102, pl. 26, f. 3, 1934; DESIKACHARY, l.c., p. 285, pl. 52, f. 2, 1959.

Trichome about 5.7  $\mu$  in diameter, constricted at the cross wall, apex rounded and not attenuated; sheath thin but firm; cell 1–1/2 times as broad as long and 2.8–

4.6  $\mu$  long.

Hab. M.R.2. Distr. Europe, India and Ceylon.

18. *Lyngbya hieronymusii* LEMMERMANN; GEITLER, l.c., 14, p. 1047, f. 656a, 1932; HUBER-PESTALOZZI, l.c., p. 248, pl. 55, f. 209, 1938; DESIKACHARY, l.c., p. 297, pl. 48, f. 4, 1959.

Trichomes 12–12.5  $\mu$  in diameter, not constricted at the cross wall, apex broadly rounded and not attenuated; cell 11–13  $\mu$  broad and 2.5–4  $\mu$  long, filled with pseudo-vacuoles.

Hab. Anc. 4. Distr. Europe, Africa, N. America, India and Japan.

19. *Microcystis aeruginosa* KUETZING; SMITH, l.c., 57, p. 39, pl. 5, f. 2–3, 1920; GEITLER, l.c., 14, p. 137, f. 59d, 1932; HUBER-PESTALOZZI, l.c., p. 132, pl. 1, f. 4, 1938; DESIKACHARY, l.c., p. 93, pl. 17, f. 1–2, 6, pl. 18, f. 10, 1959.

Hab. 4–6, 9, 12–13, 15–20, 22–25 and M.R.3. Distr. Cosmopolitan. (Pl. 8 f. 1)

20. *Microcystis flos-aquae* (WITTR.) KIRCHNER; SMITH, l.c., 57, p. 39, pl. 5, f. 1, 1920; GEITLER, l.c., 14, p. 138, f. 59e–f, 1932; HUBER-PESTALOZZI, l.c. p. 135, pl. 4, f. 5, 1938.

Hab. 3–5, 7, 10, 16–17 and M.R.2. Distr. Europe, N. America, India, Burma, Ceylon and Japan.

21. *Oscillatoria lemmermanii* WOLOSZYNSKA; GEITLER, l.c., 14, p. 975, f. 618i, 1932; HUBER-PESTALOZZI, l.c., p. 241, pl. 51, f. 192, 1938; DESIKACHARY, l.c., p. 237, pl. 40, f. 10, 1959.

Trichome about 2.6  $\mu$  in diameter, not constricted at the cross wall, gradually attenuated toward the apex, apical cell elongate conical; cell with small granules at each cross wall.

Hab. Anc. 4. Distr. Europe, India and Java.

22. *Oscillatoria limosa* AGARDH; GEITLER, l.c., p. 944, f. 598d, 1932; FREMY, l.c., 41, p. 117, pl. 30, f. 4, 1934; HUBER-PESTALOZZI, l.c., p. 232, pl. 48, f. 174, 1938; DESIKACHARY, l.c., p. 206, pl. 42, f. 11, 1959; HIRANO, Nature Life SE Asia 5, p. 6, 1967.

Hab. Anc. 1 and Anc. 4. Distr. Europe, S. Africa, India, Burma, Malaya, Borneo, Thailand, China and Japan.

23. *Oscillatoria perornata* SKUJA, l.c., p. 47, pl. 8, f. 7–9, 1949; DESIKACHARY, l.c., p. 205, pl. 41, f. 8–9, 1959.

Trichome almost straight and not curved at the apex, delicately constricted at the cross wall, 10–17  $\mu$  in diameter, gradually attenuated near the apex; cell short, about 4.5  $\mu$  long; cell filled with granules and with a large vacuole at the cross wall.

The present specimens coincided with the forms reported by SKUJA from Burma,

but the former is slightly broader and has a straight apical part and the less constricted lateral side of the trichome.

Hab. 12, 15 and 25. Distr. Burma.

24. *Phormidium* cfr. *corium* (AG.) GOMONT; GEITLER, l.c., **14**, p. 1018, f. 649b-c, 1932; FREMY, l.c., **41**, p. 89, pl. 23, f. 6, 1934; DESIKACHARY, l.c., p. 269, pl. 44, f. 10-11, 1959.

Trichome straight, not constricted at the cross wall, about  $3\mu$  in diameter; cell 1.5-2 times longer than broad and without any special granules in content.

Hab. 4. Distr. Cosmopolitan.

25. *Spirulina gigantea* SCHMIDLE; GEITLER, l.c., **14**, p. 930, 1932; HUBER-PESTALOZZI, l.c., p. 227, f. 169, 1938; DESIKACHARY, l.c., p. 197, pl. 36, f. 12, 14-17, 1959.

Hab. Anc. 7. Distr. Africa and India.

### DESMIDIACEAE (ADDENDA)

1. *Arthrodesmus quiriferus* W. & G. S. WEST; Monogr. Brit. Desm. **4**, p. 101, pl. 115, f. 6-7, 1911.

var. *minus* HIRANO var. nov.

Cellulae minores,  $14\mu$  longae sine spinis,  $12\mu$  latae sine spinis, et isthmo  $3\mu$  latae. Sinu late aperto et excavato ad verticem.

Hab. Anc. 4.

2. *Closterium gracile* BREBISSE; KRIEGER, Krypt.-fl. **13**, Abt. 1, p. 310, pl. 30, f. 7-9, 1935.

Cell  $110\mu$  long and  $4\mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

3. *Closterium libellula* FOCKE var. *interruptum* (W. & G. S. WEST) DONAT; KRIEGER, l.c., p. 256, pl. 12, f. 6, 1935.

Cell  $112\mu$  long and  $21\mu$  broad.

Hab. Anc. 4 and Anc. 8. Distr. Malay, Sumatra, Ceylon, Japan, Europe, and U.S.A.

4. *Closterium littorale* GAY; KRIEGER, l.c., p. 298, pl. 20, f. 3-5, 1935.

Cell  $146\mu$  long and  $20\mu$  broad. Cell slightly tumid in the middle.

Hab. Anc. 13. Distr. China, Japan, Europe, Africa, and U.S.A.

5. *Cosmarium angulosum* BREBISSE; W. & G. S. WEST, l.c., **3**, p. 93, pl. 72, f. 35-36, 1908.

Cell  $15\mu$  long,  $6\mu$  broad, and isthmus  $3.5\mu$  broad.

Hab. Ton. R.1 and K.C.2. Distr. Cosmopolitan.

6. *Cosmarium australe* (RACIB.) LUETKEMUELLER; HIRANO, Contr. Biol. Lab. Kyoto Univ. 2, p. 86, pl. 15, f. 7-8, 1956.  
Cell  $95\ \mu$  long,  $45\ \mu$  broad, and isthmus  $44\ \mu$  broad.  
Hab. Anc. 8. Distr. Malay and Japan.
7. *Cosmarium blyttii* WILLE; W. & G. S. WEST, l.c., 3, p. 225, pl. 86, f. 1-4, 1908.  
Cell  $16\ \mu$  long,  $15\ \mu$  broad, and isthmus  $5\ \mu$  broad.  
Hab. Anc. 4. Distr. Cosmopolitan.
8. *Cosmarium humile* (GAY) NORDSTEDT var. *glabrum* GUTWINSKI; W. & G. S. WEST; l.c., 3, p. 225, pl. 85, f. 23-24, 1908.  
Cell  $11\ \mu$  long,  $10\ \mu$  broad, and isthmus  $4\ \mu$  broad.  
Hab. Ton. R.1. Distr. Europe.
9. *Cosmarium laeve* RABENHORST; W. & G. S. WEST, l.c., 3, p. 99, pl. 73, f. 8-19, 1908.  
Cell  $21\ \mu$  long,  $8\ \mu$  broad, and isthmus  $5\ \mu$  broad.  
Hab. Ton. L.3. Distr. Cosmopolitan.
10. *Cosmarium norimbergense* REINSCH f. *depressa* W. & G. S. WEST; l.c., 3, p. 53, pl. 69, f. 28-29, 1908.  
Cell  $16\ \mu$  long,  $16\ \mu$  broad, and isthmus  $5.5\ \mu$  broad.  
Hab. Anc. 8. Distr. Thailand, Burma, Ceylon, Japan, Europe, U.S.A., and Africa.
11. *Cosmarium obtusatum* SCHMIDLE; W. & G. S. WEST, l.c., 3, p. 7, pl. 65, f. 13-14, 1908.  
Cell  $54\ \mu$  long,  $46\ \mu$  broad, and isthmus  $15\ \mu$  broad.  
Hab. K.C.1. Distr. Cosmopolitan.
12. *Cosmarium quadratum* (GAY) De TONI; W. & G. S. WEST, l.c., 3, p. 121, pl. 72, f. 33, 1908.  
Cell  $11\ \mu$  long,  $12.5\ \mu$  broad, and isthmus  $5\ \mu$  broad.  
Hab. Kg.Lu.4. Distr. China, Europe, Australia, Japan, and Canada.
13. *Cosmarium subalatum* W. & G. S. WEST; l.c., 3, p. 255, pl. 90, f. 1-3, 1908.  
Cell  $29\ \mu$  long,  $29\ \mu$  broad, and isthmus  $10\ \mu$  broad.  
Hab. Ton-L.4. Distr. Burma, Japan, Europe, Madagascar, and Africa.
14. *Cosmarium variolatum* LUND; W. & G. S. WEST, l.c., 2, p. 203, pl. 64, f. 14-16, 1905.  
var. *depressum* HIRANO var. nov.  
Cellulae submediocres, circiter 1-1/3- plo longiores quam latiores, profunde constrictae ad medium, sinu angusto-lineari extremo ampliato; semicellulae pyrami-

dato-semicirculares vel semiellipticae, angulis basalibus late rotundatis, apice anguste recto; semicellulae a latere visae ovalis, membrana granulata; granulis in serie radialibus infra marginem et leviter irregulariter ad centrum ordinatis. Cellulae 33–34  $\mu$  longae, 20–27  $\mu$  latae et isthmo 8  $\mu$  latae.

Hab. Anc. 12.

15. *Cosmarium venustum* (BRÉB.) ARCHER var. *brevius* BERNARD; HIRANO, l.c., 4, p. 137, pl. 20, f. 35, 1957.

Cell 25  $\mu$  long, 20  $\mu$  broad, and isthmus 6  $\mu$  broad.

Hab. Ton-R.1. Distr. Java, Australia and Japan.

16. *Euastrum dubium* NAEGELI; W. & G. S. WEST, l.c., 2, p. 43, pl. 38, f. 5–8, 1905.

Cell 30  $\mu$  long, 21  $\mu$  broad, and isthmus 4  $\mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

17. *Euastrum insulare* (WITTR.) ROY; W. & G. S. WEST, l.c., 2, p. 68, pl. 40, f. 11–13, 1905.

Cell 19  $\mu$  long, 13  $\mu$  broad, and isthmus 3.5  $\mu$  broad.

Hab. Anc. 4. Distr. Japan, Thailand, Ceylon, Siberia, Europe and N. America.

18. *Hyalotheca dissiliens* (SM.) BREBISSE; WEST, G. S. & CARTER, l.c., 5, p. 229, pl. 161, f. 16–27, 1923.

Cell 11–12  $\mu$  long, 19  $\mu$  broad, and isthmus 18  $\mu$  broad.

Hab. Anc. 4 and Anc. 12. Distr. Cosmopolitan.

19. *Hyalotheca mucosa* (MERT.) EHRENBURG; WEST, G. S. & CARTER, l.c., 5, p. 235, pl. 162, f. 1–4, 1923.

Cell 11–12  $\mu$  long and 11  $\mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

20. *Micrasterias pinnatifida* (KUETZING) RALFS; W. & G. S. WEST, l.c., 2, p. 80, pl. 41, f. 7–11, 1905.

Cell 54  $\mu$  long, 57  $\mu$  broad, and isthmus 8  $\mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

21. *Onychonema laeve* NORDSTEDT; WEST, G. S. & CARTER, l.c., 5, p. 218, pl. 160, f. 15–16, 1923.

Cell 14  $\mu$  long, 19  $\mu$  broad without spine, and isthmus 4  $\mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

22. *Spondylosium secedens* (DE BARY) ARCHER; WEST, G. S. & CARTER, l.c., 5, p. 225, pl. 161, f. 8–11, 1923.

Cell 6  $\mu$  long, 6.5  $\mu$  broad, and isthmus 3.5  $\mu$  broad.

Hab. Ton.R.1. Distr. Australia and Europe.

23. *Staurastrum inconspicuum* ARCHER; W. & G. S. WEST, l.c., 4, p. 86, pl. 141, f. 4-7, 1911.

Cell  $11\ \mu$  long,  $10\ \mu$  broad, and isthmus  $5\ \mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

24. *Staurastrum orbiculare* RALFS var. *depressum* ROY & BISSET; W. & G. S. WEST, l.c., 4, p. 158, pl. 124, f. 17-19, 1911.

Cell  $22\ \mu$  long,  $25\ \mu$  broad, and isthmus  $9\ \mu$  broad.

Hab. Anc. 4. Distr. Cosmopolitan.

Plate 1 (Figs. 1-14,  $\times$  ca. 1000)

1. *Aphanochaete polychaete* (HANSG.) FRITSCH
2. *A. repens* BRAUN.
3. *Sorastrum spinulosum* NAEG.
4. *S. americanum* (BOHLIN) SCHMIDLE
- 5, 5 a. *Tetraedron tumidulum* (REINSCH) HANSG.
6. *T. minimum* (BRAUN) HANSG.
- 7, 7 a. *T. regulare* KÜTZ.
8. *T. pentaedricum* WEST
9. *T. regulare* var. *granulata* PRESCOTT
10. *Ankistrodesmus fusiformis* CORDA
11. *Dicranochaete reniformis* HIERONYMUS
12. *Planktonema lauterborni* SCHMIDLE
13. *Elakatothrix viridis* (SNOW) PRINTZ
14. *Lagerheimia splendens* WEST

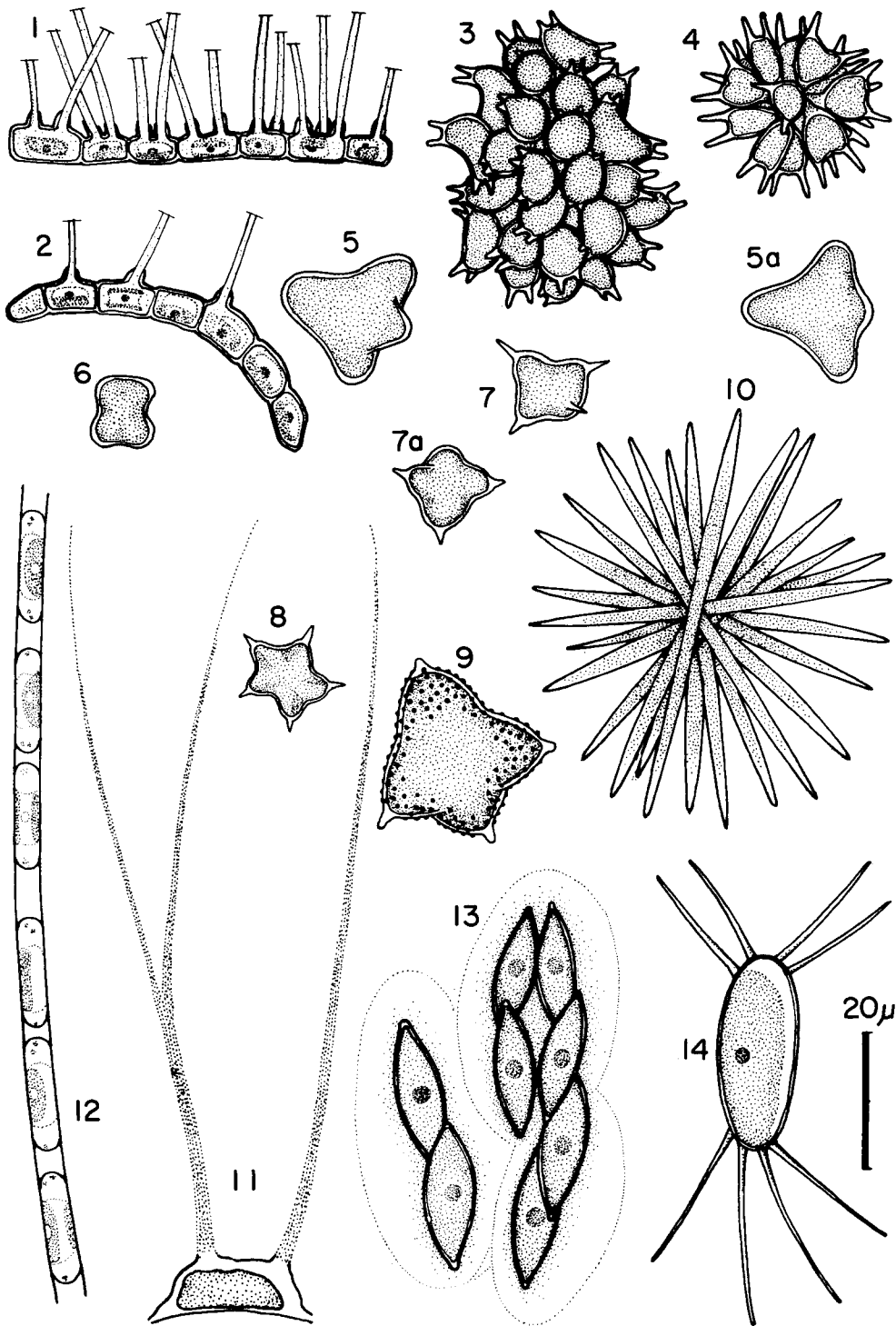


Plate 2 (Figs. 1-14,  $\times$  ca. 1000)

- 1, 1 a. *Scenedesmus brasiliensis* BOHLIN
- 2, 2 a. *S. granulatus* WEST
- 3. *S. perforatus* LEMM.
- 4. *S. producto-capitatus* SCHMULA
- 5. *S. abundance* (KIRCHN.) CHODAT
- 6, 6 a-b. *S. ecornis* (RALFS) CHODAT
- 7. *S. armatus* var. *ecornis* WOLOSZ.
- 8. *S. quadricauda* (TURPIN) BRÉB.
- 9. *S. quadricauda* var. *quadrispina* SMITH
- 10, 10 a. *S. acuminatus* (LAGERH.) CHODAT
- 11, 11 a-b. *S. circumfusus* HORTBAGYI
- 12, 12 a. *S. serratus* (CORDA) BOHLIN
- 13. *S. quadricauda* var. *mirificus* (HORTBAGYI) UHERKOVICH
- 14. *S. opoliensis* RICHTER

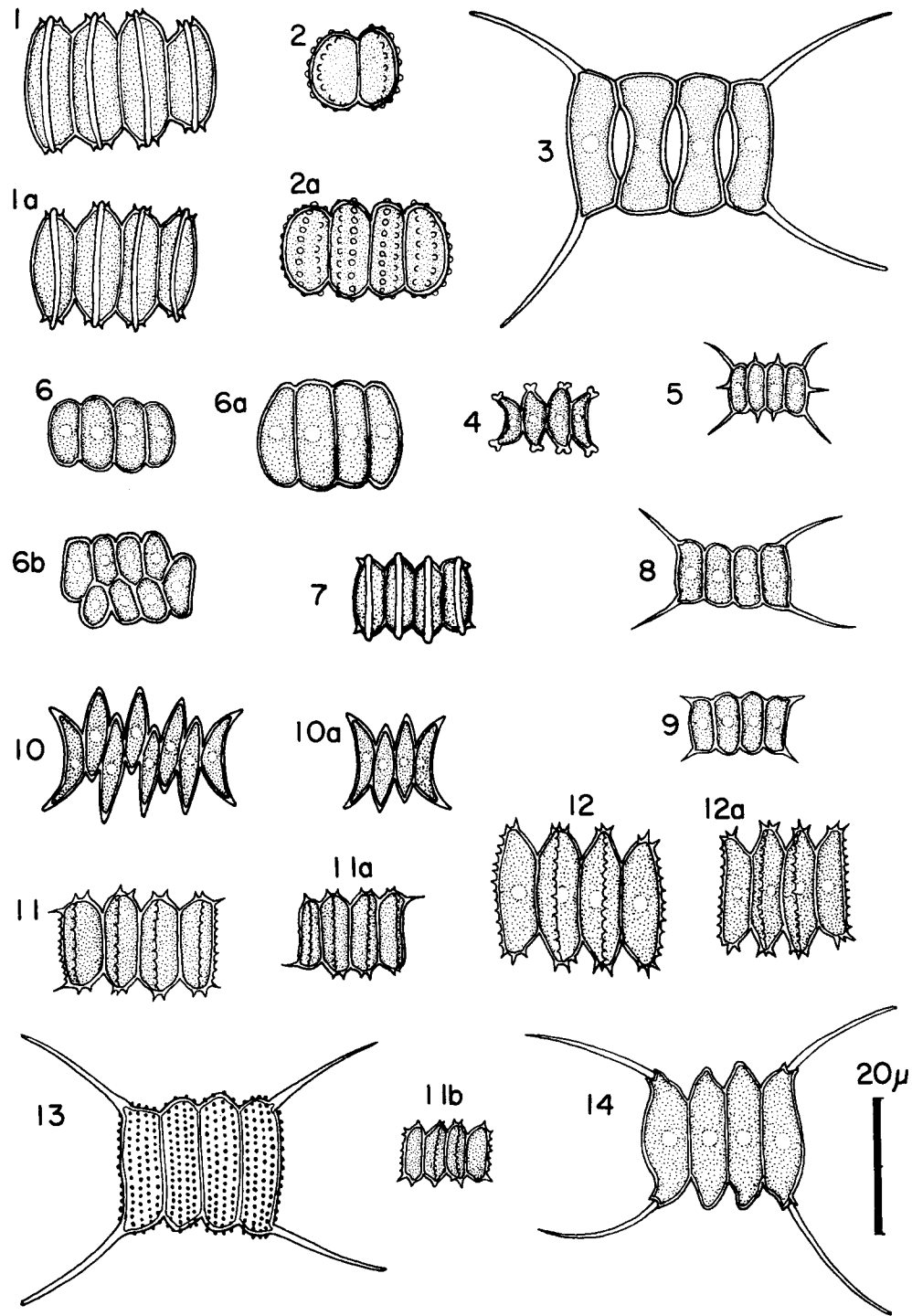


Plate 3 (Figs. 1–12,  $\times$  ca. 1000)

1. *Euglena acus* EHRENB.
2. *E. charkowiensis* SWIR.
3. *E. tripteris* (DUF.) KLEBS
4. *E. tripteris* var. *crassa* SWIR.
5. *Lepocinclis marssonii* LEMM.
6. *L. ovum* var. *dimidio-minor* DEFL.
- 7, 7a. *Tetraedron trigonum* var. *gracile* (REINSCH) De TONI
8. *T. victoriae* WOLOSZ. var. *major* SMITH
9. *T. trigonum* (NAEG.) HANSG.
10. *T. verrucosum* SMITH
11. *T. gracile* (REINSCH) HANSG.
12. *T. trigonum* var. *arthrodesmiforme* WEST

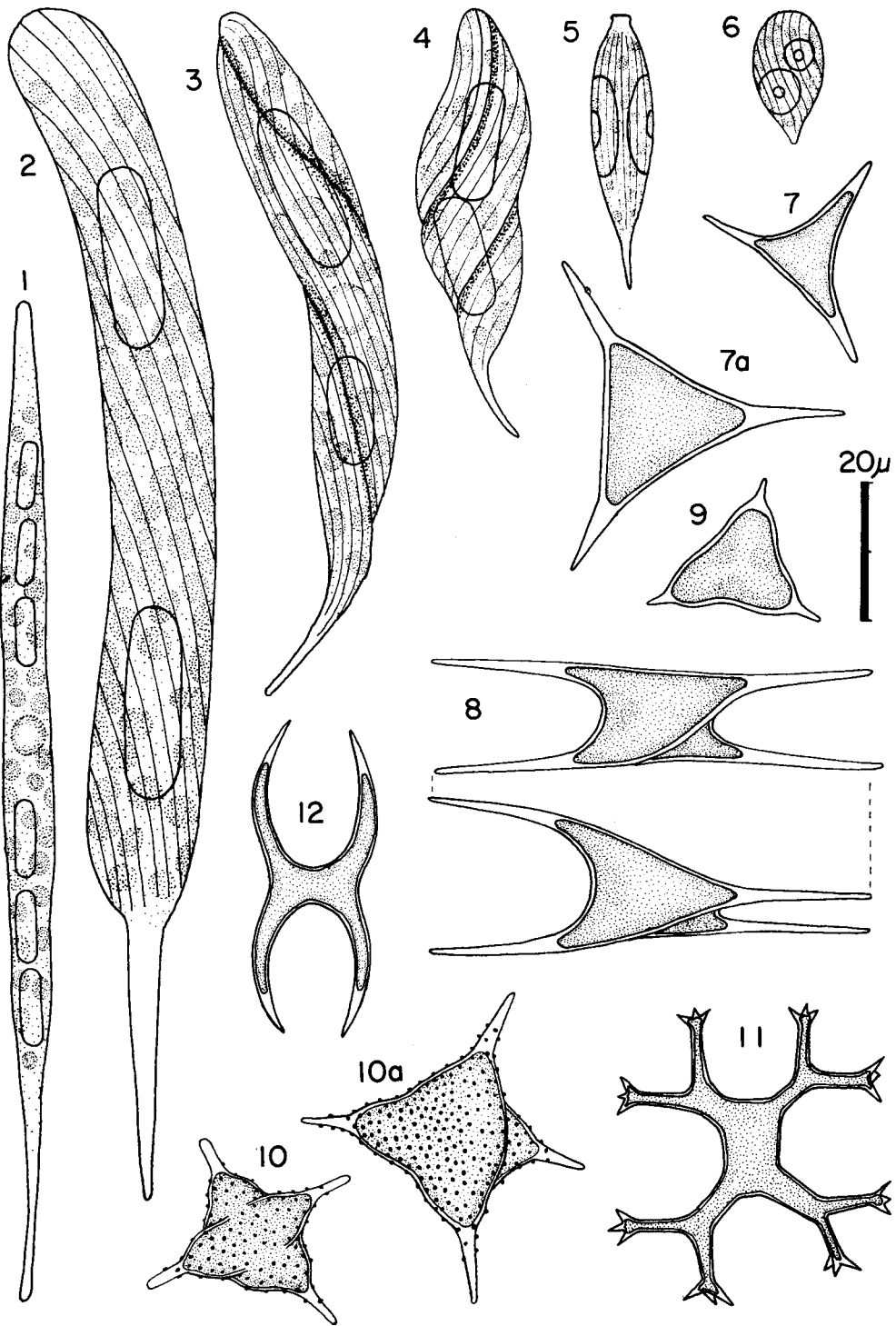


Plate 4 (Figs. 1-16,  $\times$  ca. 1000)

1. *Centritractus belonophorus* (SCHMIDLE) LEMM.
2. *Trachelomonas lacustris* DREZEPOLSKI
3. *T. bernardinensis* VISCHER
4. *T. mirabilis* SWIR. var. *obesa* (MESSIK.) CONRAD
5. *T. verrucosa* STOKES. var. *granulosa* (PLAYFAIR) CONRAD
6. *T. volvocina* EHRENB. var. *papillata* LEMM.
7. *T. rotunda* SWIR.
8. *T. armata* (EHR.) STEIN var. *steinii* LEMM.
9. *T. abrupta* var. *angustata* DEFLANDRE
10. *T. curta* Da CUNHA
11. *T. varians* (LEMM.) DEFLANDRE
12. *T. kelloggii* SKVORTZOV
13. *Ophiocytium cochleare* BRAUN.
14. *O. elongatum* WEST
15. *O. parvulum* (PERTY) BRAUN.
16. *O. capitatum* WOLLE

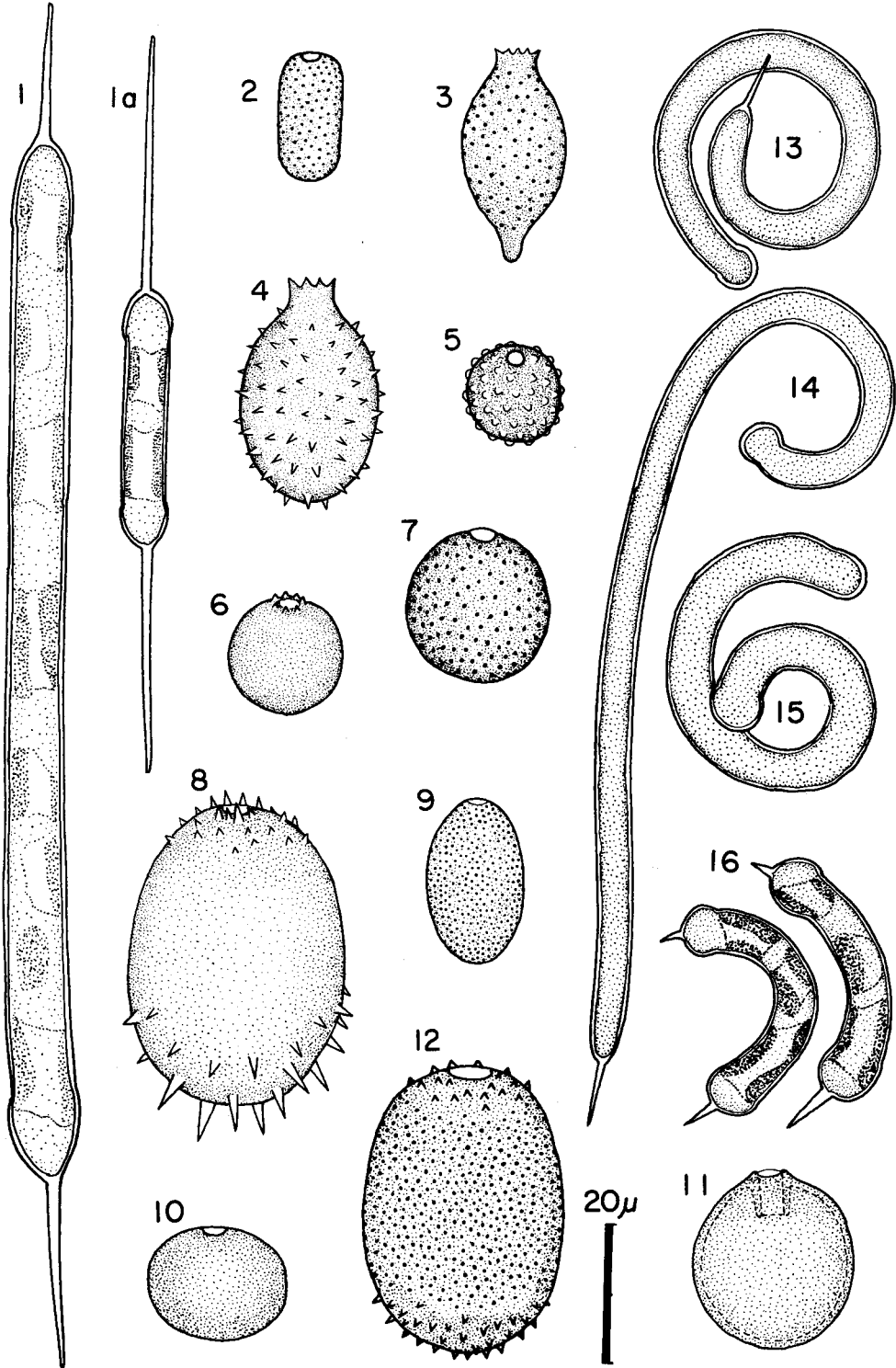


Plate 5 (Figs. 1-12,  $\times$  ca. 1000)

1. *Phacus ranula* POCHMANN
2. *P. suecicus* LEMM.
3. *P. orbicularis* HÜBNER
4. *P. tortus* (LEMM.) SKVORTZOV
5. *P. stokesii* LEMM. f. *minor* CONRAD
6. *P. circumflexus* POCHMANN
7. *P. nordstedtii* LEMM.
8. *P. triqueter* (EHRENB.) DUJ.
9. *P. pleuronectes* (MÜLLER) DUJ.
10. *P. acuminatus* STOKES var. *discifera* (POCHMANN) HUBER-PESTALOZZI
11. *P. minutum* (PLAYFAIR) POCHMANN
12. *P. acuminatus* STOKES

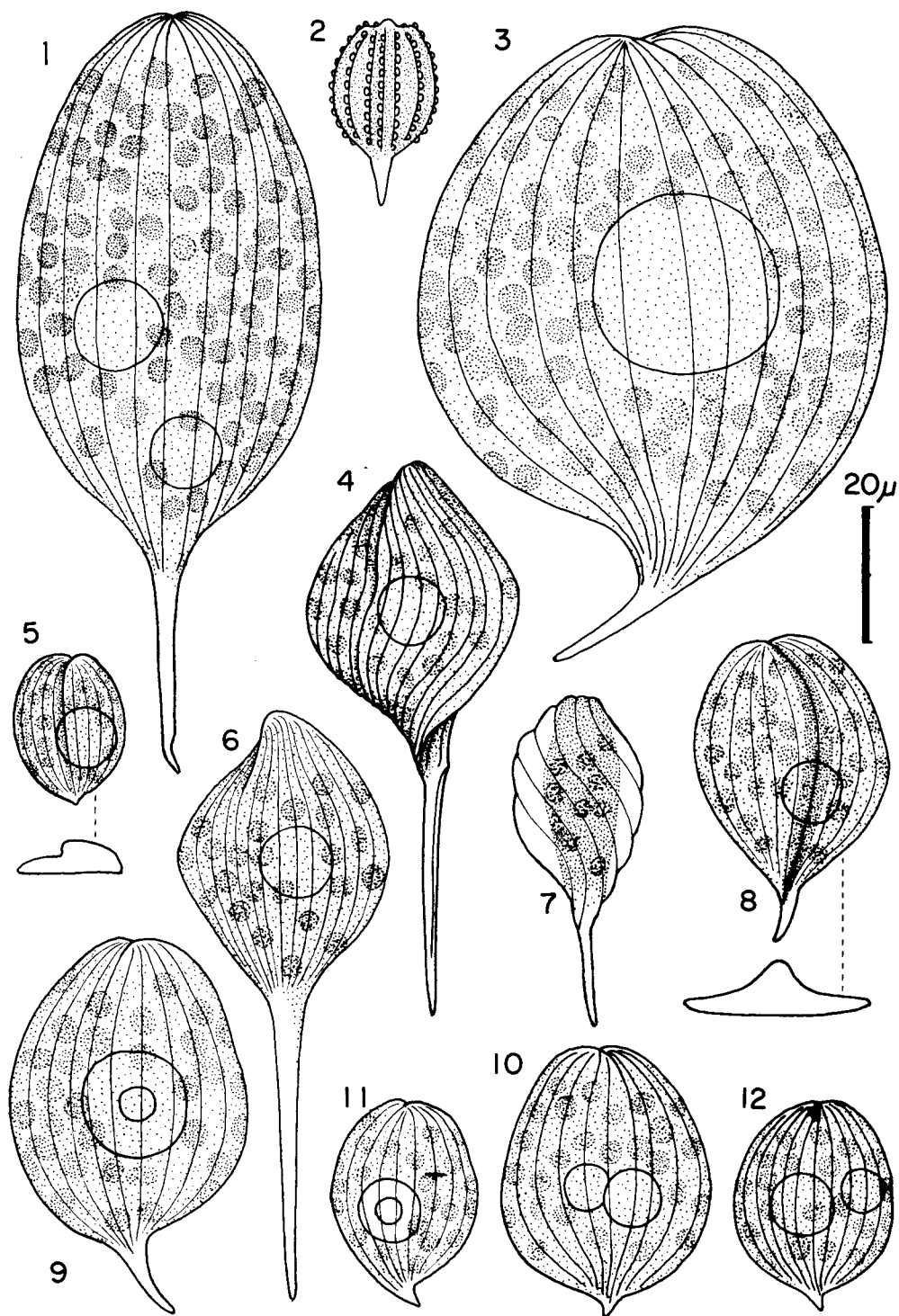
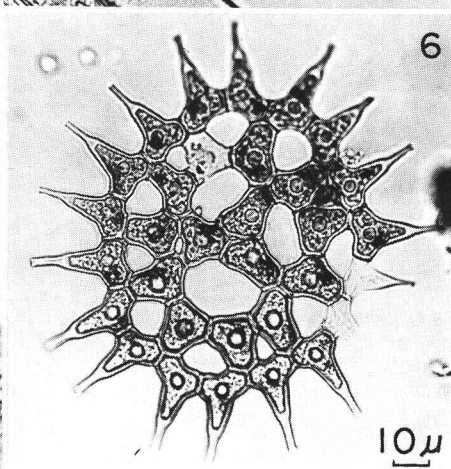
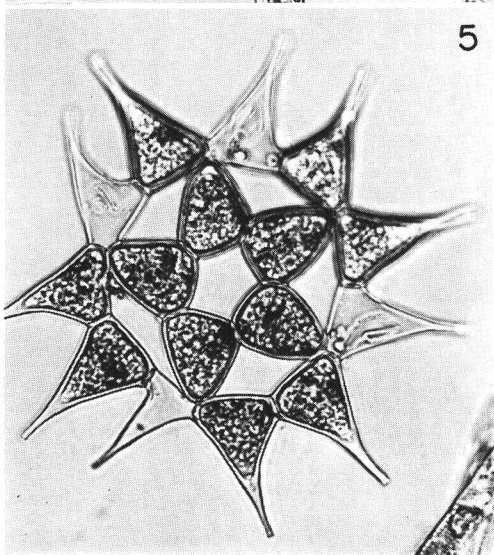
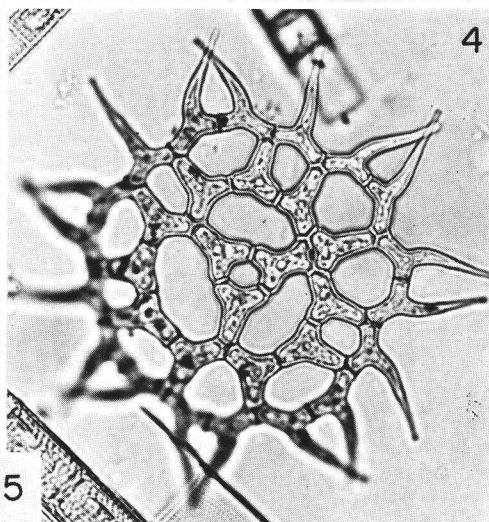
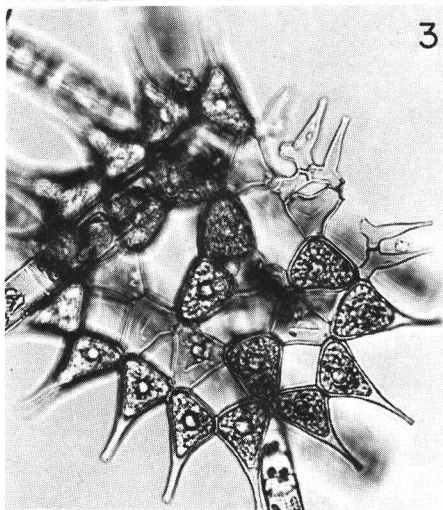
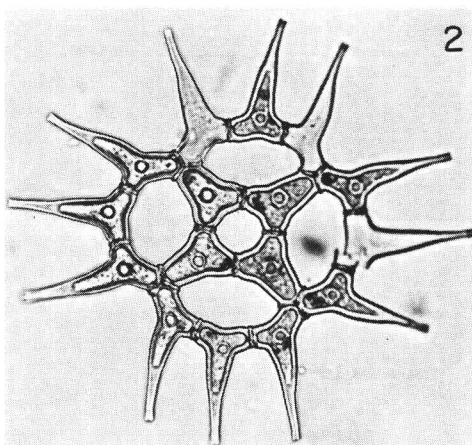
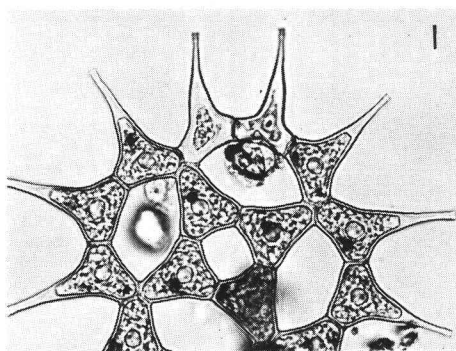


Plate 6

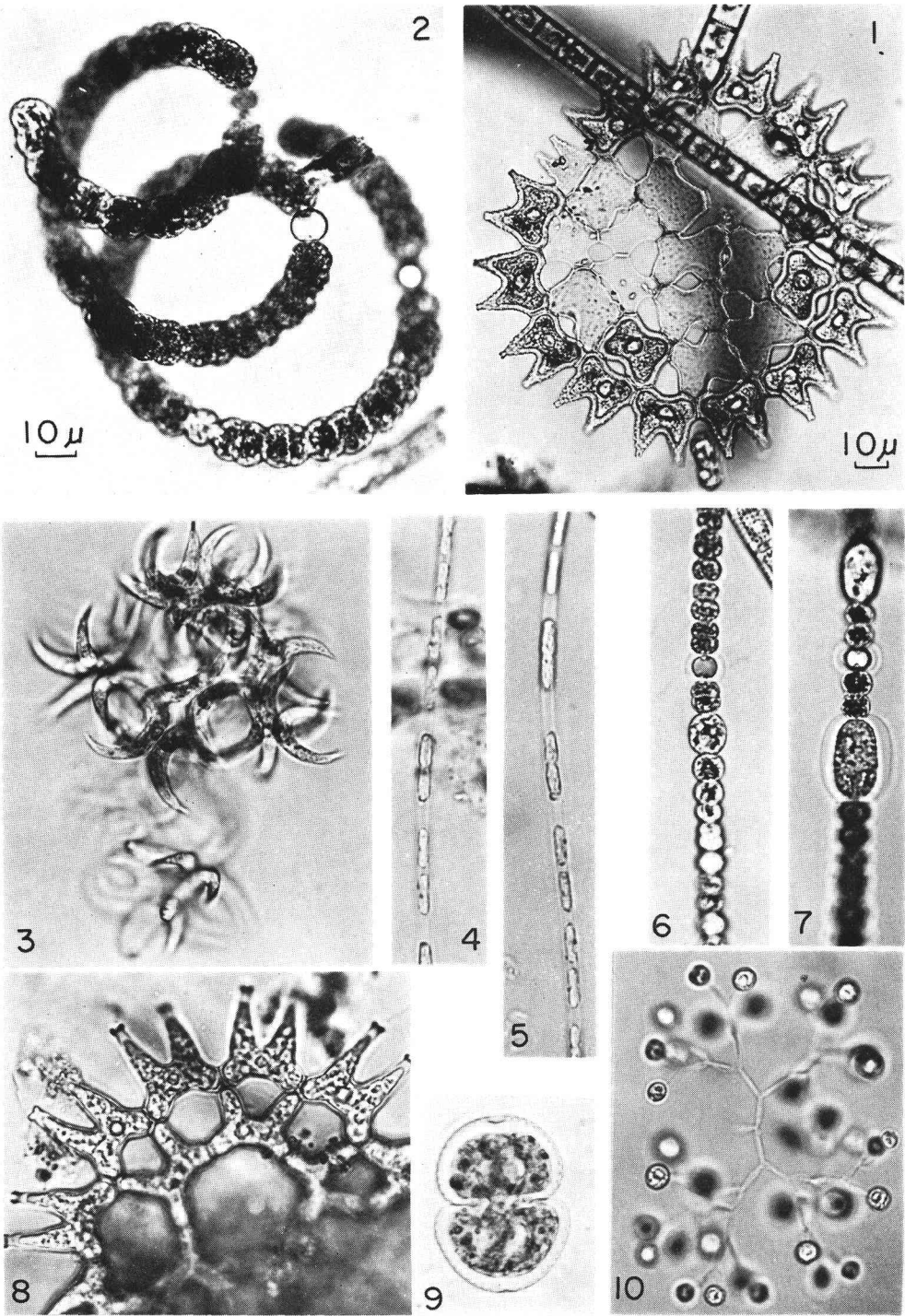
1-6. *Pediastrum simplex* MEYEN

1-6: same scale



## Plate 7

1. *Pediastrum duplex* MEYEN var. *subgranulatum* RACIB.
  2. *Anabaena circinalis* RABENH.
  3. *Selenastrum gracile* REINSCH
  - 4, 5. *Planktonema Lauterborni* SCHMIDLE
  - 6, 7. *Anabaena Viguieri* DÉNIS & FRÉMY
  8. *Pediastrum duplex* MEYEN var. *gracillimum* WEST
  9. *Cosmarium variolatum* LUND. var. *depressum* HIRANO, var. nov.
  10. *Dictyosphaerium pulchellum* WOOD
- 2-10: same scale



## Plate 8

1. *Microcystis aeruginosa* KÜTZ.
  - 2, 5. *Anabaena circinalis* RABENH.
  3. *Aphanocapsa grevillei* (HASS.) RABENH.
  4. *Aphanocapsa elachista* W. & G. S. WEST
- 2-5: same scale

