CARIBBEAN FRESH AND BRACKISH WATER CHLOROPHYTA

by

C. VAN DEN HOEK

(Rijksherbarium, Leiden)

(Issued May 1st, 1959)

During his zoological collecting trips to the Antilles Dr. P. Wagenaar Hummelinck also gathered several samples of fresh and brackish water algae, which have been presented to the Rijksherbarium, Leiden. The present paper deals with the Chlorophyta of that collection, with the exception of *Enteromorpha.*

Wagenaar Hummelinck's localities 1936—1949 have been described in the "Studies on the Fauna of Curaçao", Vols. 1 (1940), 2 (1940) and 4 (1953). Sta. 76 A has been illustrated in Vol. 1, Plate Vb; Sta. 97 in Vol. 2, Plate IVa; Sta. 500, 382, 63 and 678 in Vol. 4, Plates Ib, IIa, IIb and Va, respectively. The 1955 localities will be described in a "Third List of Localities", to be published in a forthcoming volume of this series.

This study has been made possible by a grant from the "Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen" (Foundation for Scientific Research in Surinam and the Netherlands Antilles), to which organization I wish to express my sincere thanks.

I am grateful to Dr. Wagenaar Hummelinck who compiled the list of localities with its ecological data, and drew the map.

Frémy, in his paper on "Cyanophycées des Iles Bonaire, Curaçao et Aruba" (1941, p. 101—152) mentions the following freshwater Chlorophyceae:

Sta. 75 Curaçao, TANKI MAMAJA, 6. X. 1936: *Coelastrum microporum* Näg., *Oocystis solitaria* Wittr. var. *elongata* Printz, *Gloeotaenium loitlesbergerianum* Hansg., *Cosmarium portianum* Archer and *Closterium leibleinii* Kütz. (p. 131).

Sta. 61 Klein Bonaire, POS DI CAS, 15. XI. 1936 (abt 400 mg Cl/1): *Cladophora crispata* (Roth) Kütz. em. Brand, *Rhizoclonium fontanum* Kütz. (p. 132).

Sta. 50 Bonaire, TANKI GEORGE, Deenterra, 25. III. 1937 (60 mg Cl/1): *Tetraspora lubrica* (Roth) Ag. (p. 133).

Localities

In the list of localities data are given about the following items respectively: station number, locality, date, dimensions of water body in m, movement, permanency, origin, soil in the neighbourhood, bottom, vegetation, salinity in mg Cl′/1, and often HCO_3' in mg/1, total hardness in German degrees, pH, and temperature in centigrades, from Wagenaar Hummelinck 1940 (p. 28), 1940a (p. 2—21), 1953 (p. 32—56), and according to a "Third List of Localities" to be published in a forthcoming volume of the "Studies on the Fauna of Curaçao and other Caribbean islands".

Margarita

13 ESTANQUE LATO, 20. V. 1936. — 80 × 50 × ? 3; stagnant, dry for a short time; dug; schist debris; sand and mud, few algae with *Najas*. Cl 70, HCO_3 150, Germ.° 3, pH 6.8—7.1, 30—33°C. — *Chara zeylanica* f. *michauxii*.

17 TOMA DEL ENCAÑADO, 13. VII. 1936. — 1½ × ¼; flowing, with pools; natural; metamorphic rocks; sand, leaf decay with sinter, some algae. Cl 270, HCO_3 760, Germ.° 42, pH 7.9—8.1, 28°C. — *Pithophora polymorpha*.

18 LAGUNA HONDA, 16. V. 1936. — 20 × 30 × ? 1; stagnant, permanent?; natural; detritus with quartz; mud, many algae with *Najas*. Cl 150, HCO_3 160, Germ.° 5, pH 6.9—7.1, 26—32°C. — *Chara zeylanica*.

Bonaire

44 POS BRONSWINKEL, 27. III. 1937. — 8 × 8 × 2; stagnant, overflowing, permanent; dug near spring; porphyrite; debris, mud, and plant decay, crowded with algae. Cl 530, HCO_3 420, Germ.° 14, pH 7.5—8.0, 28—30°C. — *Microspora stagnorum*.

48a Spring of FONTEIN, 30. III. 1937. — 1/5 × 1/10; flowing, permanent?; cemented gutter of spring; limestone; brickwork, sinter, very few algae. Cl 360, HCO_3 370, Germ.° 20, pH 8.2—8.4, 28°C. — *Rhizoclonium hieroglyphicum*.

52f POS ICHI, 26. III. 1955. — Wet soil of dried pool; rather natural; limestone; sandy soil, some algae and remainders of *Chara*. — *Oedogonium howardii*.

53c POS BACA, 16. IX. 1948. — 1½ × 1½ × ½; stagnant, permanent; rather artificial; limestone; rock and black mud, many algae. Cl 2580, HCO_3 165, Germ.° 54. — *Rhizoclonium hieroglyphicum*.

53d POS BACA, 21. II. 1949. As before. Cl 550, HCO_3 365, Germ.° 17, pH ? 9.2. — *Rhizoclonium hieroglyphicum, Spirogyra minutipunctata*.

379a POS BACA GRANDI, 16. IX. 1948. — 8 × 7 × 1/10; stagnant, temporary; in sink hole; limestone; mud and rock, crowded with *Heleocharis* and *Chara*. Cl 1260, HCO_3 440, Germ.° 34. — *Chara zeylanica*.

379b POS BACA GRANDI, 27. XII. 1948. — 9 × 9 × 1/5; as before (fr. M. Arnoldo coll.). Cl 180, HCO_3 395, Germ.° 17. — *Chara zeylanica* f. *trichacantha*.

382a SABANA PUNT VIERKANT, 27. III. 1955. — Puddles drying up; natural; limestone; limestone, sinter and mud, much *Chara*. Cl 5400. — *Chara hornemanii*.

382c SABANA PUNT VIERKANT, 5. IV. 1955. — Puddles much dried up; as before. Cl 22900. — *Chara hornemanii*.

382d SABANA PUNT VIERKANT, 6. IV. 1955. — Puddles almost entirely dried up; as before. Cl 26200. — *Chara hornemanii*.

383 POS SOEDESTSOED, 21. IX. 1948. — 1 × 1 × ½; stagnant, permanent?; rather natural; limestone; rock and debris, many algae. Cl 370, HCO_3 530, Germ.° 31. — *Oedogonium howardii, Pithophora oedogonia*.

628 SABANA KRALENDIJK, 16. IV. 1955. — Sheet of water 80 × 30 × 2/3; drying up; natural; limestone and detritus; mud and sinter, some *Chara* and bluegreen algae. Cl 11200. — *Chara hornemanii*.

Klein Bonaire

61b POS DI CAS, 7. IX. 1948. — 6 × 2 × 1; stagnant, permanent; sink hole; limestone; rock and black mud, algae. Cl 620, HCO_3 480, Germ.° 37. — *Rhizoclonium hieroglyphicum*.

63c TANKI CALBAS, 7. IX. 1948. — 12 × 5 × ¼; stagnant, permanent?; in natural depression; limestone; mud and sinter, algae and small *Ruppia*. Cl 12160. — *Chara zeylanica* f. *armata, Chara zeylanica* f. *trichacantha*.

63d TANKI CALBAS, 1. IX. 1949. — As before; considerable growth of *Ruppia*. Cl. 12410, pH 9.2. — *Chara zeylanica* f. *armata*.

Klein Curaçao

387 POS N OF LIGHTHOUSE, 1. X. 1948. — 1½ × 1½ × ½; stagnant, permanent; artificial; limestone; rock with some debris, considerable growth of algae. — Cl 725, HCO_3 305, Germ.° 17. — *Palmodictyon varium, Oedogonium howardii*.

Curaçao

67 BAK DI HOFJE GROOT ST. JORIS, 20. X. 1936. — 15 × 5 × 1; stagnant, temporary; cemented cistern near windmill, with overflow; diabase; brickwork with leaf decay, few algae. — Cl 790, HCO_3 550, Germ.° 50, pH 7.7, 29—32°C. — *Rhizoclonium hieroglyphicum*.

67a Bak di Hofje Groot St. Joris, 9. IV. 1949. — As before; considerable growth of algae. Cl 745, HCO_3 365, Germ.° 49. — *Rhizoclonium hieroglyphicum.*

70 Tanki Koenoekoe Hatoen, 15. X. 1936. — 10 × 5 × 1; stagnant, temporary?; dug; diabase and limestone; clayish mud, algae, with much *Chara* and few *Najas*. Cl 690, HCO_3 400, Germ.° 27, pH 8.4—8.6, 28—34°C. — *Chara zeylanica.*

72A Bak di Boca di Leeuw, Hato, 13. X. 1936. — 2 × 2 × 1; renewing, temporary?; cemented tank with overflow near spring; limestone and shale; brickwork and leaf decay, sinterish algae. Cl abt. 210, HCO_3 ca 280, Germ.° ca 16, pH 7.6—8.0, 29—31°C. — *Rhizoclonium hieroglyphicum.*

75 Tanki Mamaja, Hato, 6. X. 1936. — 40 × 20 × 2; stagnant, permanent; natural; limestone and detritus; mud, many algae with *Najas*. Cl 450, HCO_3 230, Germ.° 13, pH 8.6—8.8, 27—32°C. — *Sphaerocystis schroeteri, Coelastrum cambricum, Oocystis eremosphaeria, Gloeotaenium loitlesbergerianum.*

75a Tanki Mamaja, 10. XI. 1936. — As before. Cl 380, HCO_3 225, Germ.° 12, pH 8.4—8.6?, 27—30°C. — *Pithophora oedogonia, Chara zeylanica.*

76Aa Bron Wandongo, Hato, 11. X. 1936. — 1 × 1 × ¼; turbulent, near spring, permanent?; spring; limestone and shales; mud, *Chara* and *Najas*. Cl 240, HCO_3 300, Germ.° 18, pH 7.2—7.4, abt 28°C. — *Chara zeylanica* f. *guatemalensis.*

82 Pos Europa, Dokterstuin, 27. X. 1936. — 10 × 8 × ? 3; stagnant, temporary; dug; diabase; mud and plant decay, many algae. Cl 470, HCO_3 700, Germ.° 36, pH 8.6—9.2?, 28—32°C. — *Microspora quadrata, Pithophora polymorpha.*

88b Pos Sjimarrón, Savonet, 11. II. 1949. — Almost dry pool near spring; siliciferous cherts; rock debris, some sinter, few algae. Cl 760, HCO_3 335, Germ.° 31, pH 7.2? — *Pithophora aequalis.*

89 Tanki di Hofje Savonet, 29. X. 1936. — 12 × 10 × 1½; stagnant, temporary; dug; diabase detritus; mud and brickwork, crowded with algae. Cl 3200, HCO_3 780, Germ.° 160, 28—34°C. — *Oedogonium howardii, Spirogyra fluviatilis, Chara zeylanica.*

390 Pool at Museum, 25. IV. 1949. — 8 × 9 × ½; stagnant; basin of brickwork dd. Feb. 1949; masonry with some mud and plant decay, with *Nymphaea, Hydrocotyle, Eichhornia,* etc. Cl 725, HCO_3 180, Germ.° 49, pH 8.2. — *Cylindrocapsa conferta, Oedogonium howardii, Coelastrum scabrum, Chara zeylanica* f. *michauxii.*

391 Poole from Chinese gardens, Julianadorp, 4. I. 1950. — 2 × 1 × ½; stagnant, temporary?; cemented basins; diabase detritus; masonry, some detritus, algae. Cl estimated at 600—1000 (J. G. de Jong coll.). — *Rhizoclonium hieroglyphicum, Pithophora aequalis, Pithophora polymorpha.*

395 Bron di San Pedro, S spring in Hofje, 13. II. 1949. — ? ½ × 1/20; rather rapidly flowing, permanent; spring; chiefly limestone; rock debris and sand, some leaf decay, few algae. Cl 405, HCO_3 335, Germ.° 18. — *Rhizoclonium hieroglyphicum.*

396 Tanki di Tera Corá, Middle Curaçao, 20. VIII. 1948. — 4 × 3 × ¼; stagnant, containing water since 2—3 weeks; weathered shales; thick mud, some very young *Chara* and *Ruppia*. Cl 335, HCO_3 90, Germ.° 21, 28.5°C. — *Chara zeylanica.*

396a Tanki di Tera Corá, 1. XII. 1948. — 20 × 20 × ? ½; as before; much algae and *Najas*. Cl 160, HCO_3 135, Germ.° 8, pH 9.2?, 29.5°C. — *Sphaerocystis schroeteri. Oedogonium capilliforme, Oedogonium capitellatum, Oedogonium infimum.*

396b Tanki di Tera Corá, 29. I. 1949. — 15 × 15 × ½; as before; many algae and *Ruppia*, some *Chara*. Cl estimated at about 300. — *Oedogonium capitellatum, Oedogonium infimum, Spirogyra minutipunctata.*

397a Tanki Martha-Koosje, near Kleine Berg, 1. XII. 1948. — 35 × 25 × ? 1½; stagnant, temporary; for the greater part dug; chiefly weathered shales near limestone; soft mud, much algae with *Najas*. Cl 125, HCO_3 305, Germ.° 8, pH 9.0?, 27—29°C. — *Sphaerocystis schroeteri, Oedogonium capitellatum, Oedogonium howardii, Zygnemopsis americana, Spirogyra nitida.*

397b Tanki Martha-Koosje, 29. I. 1949. — 30 × 25 × ? 1½; as before, much *Najas* and *Chara*, both overgrown with algae. Cl 240, HCO_3 180, Germ.° 15. — *Chara zeylanica.*

397c Tanki Martha-Koosje, 11. II. 1949. — As before. Cl 280, HCO_3 120, Germ.° 16, pH 9.0. — *Oedogonium howardii, Oedogonium infimum, Spirogyra fuellebornii.*

397d Tanki Martha-Koosje, 15. IV. 1949. — 20 × 15 × ? 1; as before; dense growth

of *Najas* and algae. Cl 510, HCO_3 150, Germ.° 11. — *Sphaerocystis schroeteri, Cylindrocapsa conferta, Coleochaete reticulata, Tetraedron regulare.*

Aruba

93b Pond of FONTEIN, 30. XII. 1948. — 20 × 15 × ½; stagnant, overflowing; permanent; rather artificial basin excavated near spring; chiefly limestone; rock, debris and leaf decay, thin coating of algae and floating algae masses. Cl 460, HCO_3 150, Germ.° 17. — *Rhizoclonium hieroglyphicum.*

93c Pond of FONTEIN, 12. VIII. 1955. — As before. Cl 510. — *Pithophora aequalis.*

97 TANKI MON PLAISIR, 15. XII. 1936. — 30 × 20 × 1; stagnant, temporary; dug and dammed; diorite-detritus; sandy mud and leaf decay, algae. Cl 60, HCO_3 140, Germ.° 4, pH 8.8—9.3, 27—32°C. — *Spirogyra distenta.*

99 TANKI TIBUSJI, 9. XII. 1936. — 15 × 5 × ¼; stagnant, temporary; dug; debris of schists and diorite; mud and debris, very few algae, few *Chara.* Cl 170, HCO_3 350, Germ.° 6, pH 8.5—9.0, 27—33°C. — *Chara zeylanica.*

104a BRON DI ROOI PRINS, 26. VIII. 1949. — Percolating water at spring, permanent?; natural; schists and diabase; debris, almost no algae, under pieces of rock. Cl 1345. — *Pithophora oedogonia.*

104Aa BRON DI ROOI PRINS, 26. VIII. 1949. — Some rapidly flowing water near spring, temporary; natural;schists and diabase; thin rock coating of algae. Cl 1345, HCO_3 670, Germ.° 40. — *Stigeoclonium lubricum.*

Paraguaná (Ven.)

105 POZA DE LA COMPAÑÍA, CARIRUBANA, 15. II. 1937. — 20 × 10 × 1½; stagnant, permanent?; dug in 1925; marls; marl debris, mud and oil residue, leaf decay; many algae with *Najas.* Cl 140, HCO_3 200, Germ.° 8, pH 9.0—9.4, 28—35°C. — *Spirogyra distenta, Spirogyra pseudospreiana.*

108 ESTANQUE DE MORUY, 18. II. 1937. — 100 × 30 × ? 3; stagnant, permanent?; natural?; limestone and hornblende rock; rock, sand and mud, algae with some *Najas.* Cl 50, HCO_3 200, Germ.° 6, pH 8.7—8.9, 28—31°C. — *Chara zeylanica* f. *michauxii.*

109 ESTANQUE DE SANTA FÉ, near MORUY, 18. II. 1937. — 30 × 30 × ? 1½; stagnant, permanent?; dug?; limestone and marl; clayish mud, algae with much *Chara, Najas* and *Ruppia.* Cl 120. HCO_3 250, Germ.° 5. — *Chara zeylanica.*

La Goajira (Col.)

114 LAGUNA DEL PÁJARO, 21. I. 1937. — 300 × 200 × ? 1½; stagnant, permanent?; natural; detritus; sand and clayish mud, few algae with *Najas,* grasses. Cl 820, HCO_3 450, Germ.° 19. — *Oedogonium crispum* var. *uruguayense, Chara zeylanica.*

Surinam

119 Trench behind the CULTUURTUIN, 2. V. 1936. — 10 × 1 × ¼; stagnant, permanent?; dug; detritus with shells; clayish mud with shells, crowded with algae and *Chara.* — Cl 30, 28—34°C. — *Oedogonium argenteum, Oedogonium crispum* var. *uruguayense, Oedogonium pusillum, Chara hydropitys.*

406 Swamp near CHARLESBURG, 2. VIII. 1948. ? 40 × 25 × 1; stagnant, permanent; partly dug; shell bearing sand; sand, some mud and plant decay, algae. Cl 18, HCO_3 30, Germ.° 3. — *Gloeotaenium loitlesbergerianum.*

Barbuda

667 BULL HOLE, 9. VII. 1955. — 20 × 20 × 1/3; stagnant, temporary; natural depression in limestone area; muddy, with much *Najas* and *Chara,* few *Ruppia,* Cl 2200. — *Chara zeylanica.*

674 LOW POND near VILLAGE, 5. VII. 1955. — 20 × 15 × 1; stagnant, permanent; natural or partly dug in low limestone area near shore; muddy, crowded with *Chara.* Cl 2650, 32°C. — *Rhizoclonium hieroglyphicum, Chara zeylanica.*

Nevis

500 NELSON'S SPRING, 28. VI. 1949. — ? 200 × 15 × 1½; stagnant, permanent; natural; clayish soil, swamp deposits; clay, mud, decay; considerable growth of algae with *Najas.* Cl 88, HCO_3 485, Germ.° 17, pH 8.6. — *Spirogyra distenta, Spirogyra punctiformis.*

St. Eustatius

510 SAMSON WELL, 10. VII. 1949. — 2 × 2 × ¾; stagnant, permanent?; artificial, 3½ m deep; vulcanic rock debris; debris, mud, plant decay, coating of small algae. Cl 2100, HCO_3 640, Germ.° 33, pH 7.9. — *Pithophora polymorpha* var. *polyspora.*

513 Cistern near ZEELANDIA, 8. VIII. 1949. — 3 × 2 × ½; stagnant, temporary?; old cistern; rock detritus, pasture; mud, plant decay, chiefly branches, some algae. Cl 35, HCO_3 210, Germ.° 10, pH 8.7. — *Pithophora polymorpha* var. *polyspora*.

St. Martin

528 Fresh-water pond of POINT BLANCHE, 17. V. 1949. — ? 100 × 80 × ? ½; stagnant, temporary; natural; rock detritus with limestone; sandy mud, *Chara* with *Ruppia* and few algae. Cl 7800, pH ? 9.2. — *Chara hornemanii*.

529 OLD BATTERY CISTERN, 18. V. 1949. — 10 × 2 × ¼; stagnant, temporary; old cistern of brickwork, 2 m deep; chiefly limestone debris; rock with debris and plant decay, dense growth of algae. Cl 105, HCO_3 270, Germ.° 16, pH 8.1. — *Pithophora oedogonia*, *Tetraedron bifurcatum*.

529a OLD BATTERY CISTERN, 17. III. 1937. — As before, Cl estimated at about 200, filled by groundwater. — *Oedogonium howardii*.

530a CRAB HOLE CISTERN, 2. VI. 1955. — 15 × 5 × ½; stagnant, permanent?; abandoned cistern of brickwork; rock debris, masonry, plant decay, much *Chara* with *Ruppia*. Cl 5200. — *Chara zeylanica* f. *trichacantha*.

532 Puddle in RAMBEAU VALLEY, 20. V. 1949. — 10 × ½ × 1/10; stagnant, temporary; drying rivulet; volcanic rock debris; mud and dirt, some small algae. Cl 380, HCO_3 1220, Germ.° 30, pH 7.2, 28°C. — *Rhizoclonium hieroglyphicum*.

538 DOCTOR'S WELL on rockland, 24. V. 1949. — 2½ × 2½ × 1; stagnant, permanent; dug, with stone wall, 2 m deep; weathered soil, pasture; mud with plant decay, debris, considerable growth of algae. Cl 355, HCO_3 1130, Germ.° 32, pH 8.0. — *Rhizoclonium hieroglyphicum*.

538a DOCTOR'S WELL, 29. VI. 1955. — As before. Cl 430. — *Rhizoclonium hieroglyphicum*, *Pithophora polymorpha*.

539 Puddle near DOCTOR'S WELL, 24. V. 1949. — 1/10 × 1/5 × 1/100; stagnant, temporary; weathered soil, pasture; mud trampled by cattle, few small algae. Cl 635, HCO_3 850, Germ.° 18, pH ? 8.0. — *Rhizoclonium hieroglyphicum*.

539a Puddle near DOCTOR'S WELL, 29. VI. 1955. — 15 × 3 × ½; as before. Cl 710. — *Rhizoclonium hieroglyphicum*, *Pithophora polymorpha*.

678 Fish nursery at ROLANDS CANAL, 7. VI. 1955. — 10 × 1 × ½; stagnant, permanent; cemented trough filled by ground water; weathered soil of salt pond; brickwork, decay, dense growth of *Chara*. Cl 5850. — *Chara zeylanica* f. *trichacantha*.

679 BLOOMENDALE CISTERN, 7. VI. 1955. — 8 × 4 × 1; stagnant, permanent?; cemented cistern filled with ground water; weathered soil; brickwork, some decay; dense growth of *Chara*. Cl 1890. — *Chara hornemanii*.

Anguilla

544 BEDNEY'S SPRING, 18. VI. 1949. — 2 × 1½ × 1/3; stagnant, permanent?, excavated, 1 m deep; limestone and detritus; rock debris, soft mud, algae with *Chara*. Cl 1505, HCO_3 365, Germ.° 47, pH 8.2. — *Rhizoclonium hieroglyphicum*, *Chara zeylanica*.

Dog Island (near Anguilla)

546 DOG ISLAND WELL, 17. VI. 1949. — 2 × 2 × ? 1; stagnant, permanent?; dug; limestone; rock, some mud, almost no algae. Cl 1410, HCO_3 610, Germ.° 37, pH ? 8.0. — *Pithophora zelleri*.

New Providence (Bahamas)

548 ARCHBOLDS POND near NASSAU, 23. VIII. 1949. — ? 200 × 20 × ? 1½; stagnant, permanent; more or less artificial; garden soil on limestone; mud, decay, considerable growth of algae with *Chara* and other plants. Cl 17, HCO_3 210, Germ.° 12. — *Chara zeylanica* f. *trichacantha*.

Species and localities of the fresh and brackish water Chlorophyta treated in this paper

Species	Bahamas	Lesser Antilles														S. American mainland			Figs.
		Windward Group							Leeward Group										
	New Providence	St. Croix	Dog Island	Anguilla	St. Martin	St. Eustatius	Nevis	Barbuda	Margarita	Bonaire	Klein Bonaire	Klein Curaçao	Curaçao	Aruba	La Goajira	Paraguaná	Surinam	
Tetrasporales																			
Palmodictyon varium												×						1—2
Sphaerocystis schroeteri													×					4
Ulotrichales																			
Microspora quadrata													×					5
— stagnorum										×								6
Cylindrocapsa conferta													×					7
Stigeoclonium lubricum														×				8
Coleochaete reticulata													×					9—19
Oedogoniales																			
Oedogonium argenteum																	×	20
— capilliforme													×					21
— crispum var. uruguayense															×		×	22—24
— pusillum																	×	25
— capitellatum													×					26
— howardii					×					×		×	×					27—28
— infimum													×					29
Cladophorales																			
Rhizoclonium hieroglyphicum				×	×			×		×	×		×					30—31
Pithophora oedogonia					×					×			×	×				32—35
— aequalis													×	×				36—43
— polymorpha					×				×				×					44—48
— pol. var. polyspora						×												47
— zelleri			×															49—56
Chlorococcales																			
Coelastrum cambricum													×					57
— scabrum													×					58
Oocystis eremosphaeria													×					59—60
Gloeotaenium loitlesberg.													×				×	61—62
Tetraedron bifurcatum					×													63—64
— regulare													×					65—66
Zygnematales																			
Zygnemopsis americana							×						×					67
Spirogyra distenta													×	×		×		68—72
— fuellebornii																		73
— nitida													×					74—75
— fluviatilis							×						×					76—79
— punctiformis													×					80—81
— pseudospreiana																×		82—83
— minutipunctata										×			×					84—87
Charales																			
Chara hornemanii					×			×		×								
— hydropitys																	×		
— zeylanica	×			×	×			×	×	×	×		×	×	×	×			
— zeyl. f. guatemalensis		×											×						
— zeyl. f. armata											×								
— zeyl. f. trichacantha	×				×					×	×								
— zeyl. f. michauxii									×				×			×			

CHLOROPHYCEAE

TETRASPORALES

Palmellaceae

Palmodictyon Kützing

Groups of spherical cells inclosed in an irregularly branched or anastomosing gelatinous strand. Chloroplasts one or two within a cell, parietal, laminate; one or sometimes two pyrenoids within a cell.

Palmodictyon varium (Naegeli) Lemmermann

Lemmerman, Brunnthaler & Pascher 1915, p. 37; Smith 1950, p. 118; Prescott 1951, p. 85 — *Palmodactylon varium* Naegeli, *Palmodactylon simplex* Naegeli, *Palmodactylon subramosum* Naegeli in Naegeli 1849, p. 70—71.

Cells without distinct individual sheaths, 4—11 μ in diam., arranged in linear series or irregularly crowded in irregularly branched or anastomosing gelatinous strands 20—110 μ in diam. — Fig. 1, *1, 2.*

Distribution: Europe, U. S. A., Antilles (Klein Curaçao).

Locality: Klein Curaçao 387 (725 mg Cl/l).

According to Lemmermann (1915, p. 35) and Smith (1950, p. 118) pyrenoids do not occur in cells of *Palmodictyon.* In Kützing's type material of *P. viride* (in the Rijksherbarium at Leyden), however, pyrenoids are present, one in every cell. Fig. 1. *3.*

Sphaerocystis Chodat

A free-floating spherical colony, consisting of 4-many cells enclosed in a hyaline envelope; cells spherical, with one cup-shaped chromatophore containing one pyrenoid.

Sphaerocystis schroeteri Chodat

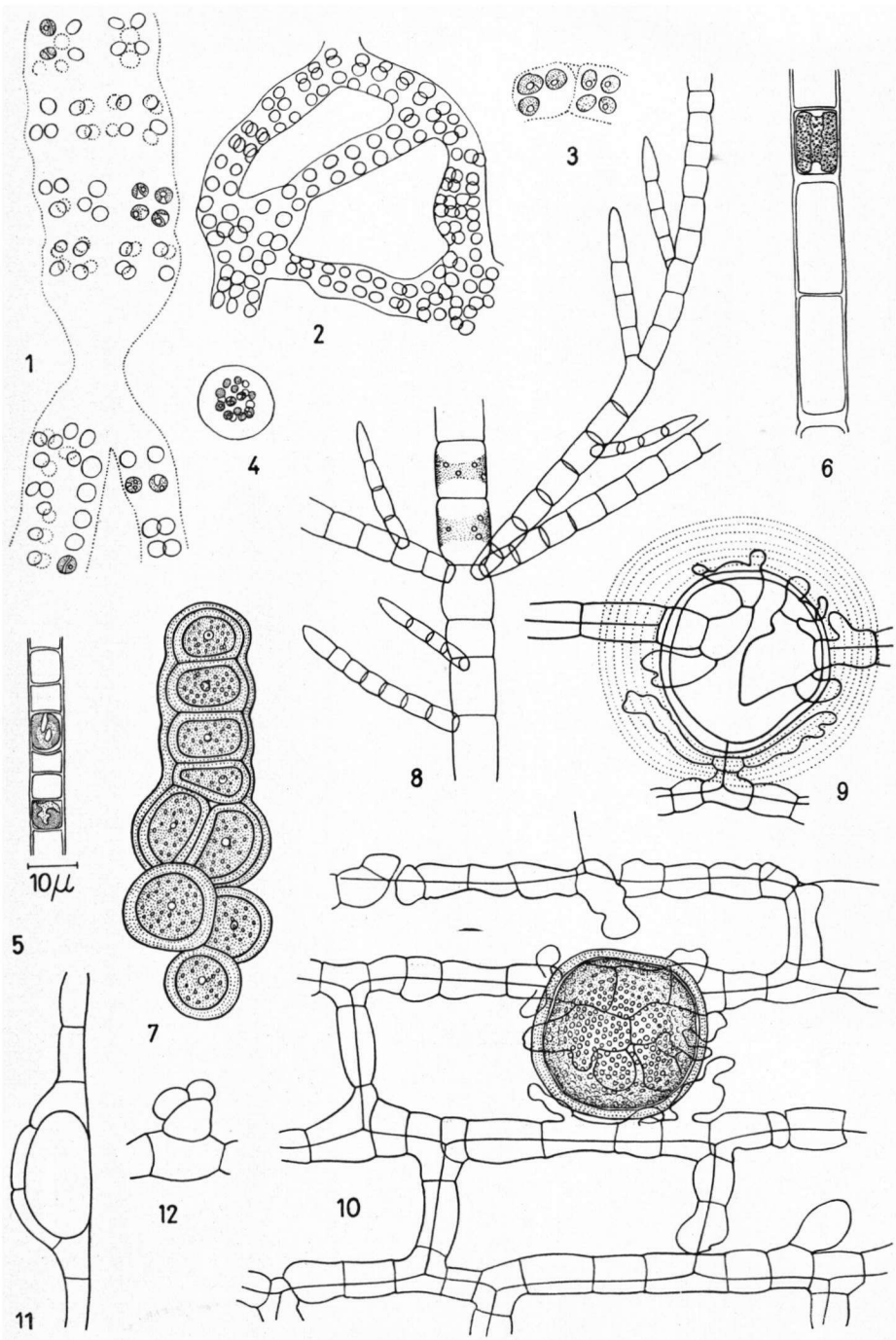
Chodat 1897, p. 119—120; Croasdale 1935, p. 44; Smith 1950, p. 166; Prescott 1951, p. 83; Tiffany & Britton 1952, p. 21; *Gloeococcus schroeteri* (Chodat) Lemmermann in Lemmermann, Brunnthaler & Pascher 1915, p. 31—32; Biswas 1949, p. 37.

Cells 2—7 μ in diam. in this material; according to other descriptions 6—22 μ. Colonies up to 75 μ in this material; according to other descriptions up to 500 μ. With characters of the genus. — Fig. 1. *4.*

Distribution: Europe, U. S. A., South Africa, India, Antilles (Curaçao).

Localities: Curaçao 75, 396a, 397a, 397d (125—510 mg Cl/l).

Fig. 1. *1, 2. Palmodictyon varium* from sta. 387, Klein Curaçao; *3. Palmodictyon viride,* type material of Kützing; *4. Sphaerocystis schroeteri* from sta. 397a, Curaçao; *5. Microspora quadrata* from sta. 82, Curaçao; *6. Microspora stagnorum* from sta. 44, Bonaire; *7. Cylindrocapsa conferta* from sta. 397d, Curaçao; *8. Stigeoclonium lubricum* from sta. 104Aa, Aruba; *9—12. Coleochaete reticulata* from sta. 397d, Curaçao, *9, 10.* ripe oospores, *11.* oospore, side view, *12. antheridia* (?).


1
2
3
4
6
8
9
10μ
5
7
12
10
11

ULOTRICHALES

Microsporaceae

Microspora Thuret

1. Microspora quadrata Hazen

Hazen 1902, p. 178; Heering 1914, p. 151; Croasdale 1935, p. 43; Prescott 1951, p. 108; Tiffany & Britton 1952, p. 29.

Vegetative cells 5—7 μ in diam., 1—$1^1/_2$ × as long as broad, walls thin, sections not evident. Chromatophore covering entire cell-wall. Reproduction by spherical akinetes (not observed), 5—7 μ in diam. — Fig. 1. *5.*

Distribution: Europe, U. S. A., Antilles (Curaçao).

Locality: Curaçao 82 (470 mg Cl/l).

2. Microspora stagnorum (Kützing) Lagerheim

Heering 1914, p. 151; Prescott 1951, p. 108; Tiffany & Britton 1952, p. 29.

Vegetative cells 8—14 μ in diam., 1—3 × as long as broad, cylindric or slightly constricted at the cross-walls; walls thin, sections not evident; chromatophore a granular plate, not covering entire cell-wall. — Fig. 1. *6.*

Distribution: Europe, U. S. A., Antilles (Bonaire).

Locality: Bonaire 44 (530 mg Cl/l).

Cylindrocapsaceae

Cylindrocapsa Reinsch

Filaments short, unbranched, uniseriate, biseriate or forming irregular cell-heaps; vegetative cells provided with thick lamellose walls; chromatophore a massive, dense body containing one central pyrenoid; oogamous.

Cylindrocapsa conferta W. West

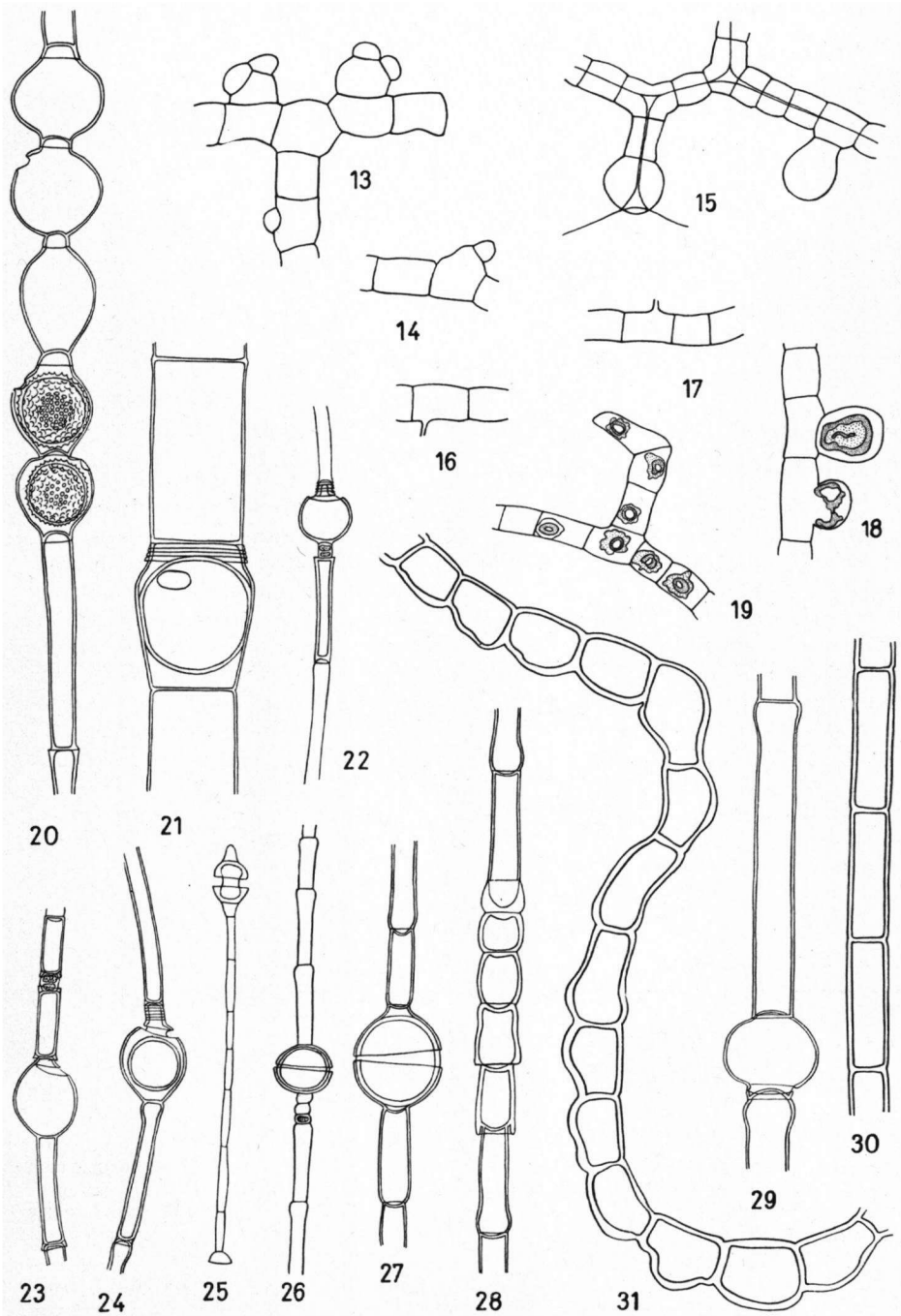
Heering 1914, p. 62—63; West & Fritsch 1927, p. 160; Printz 1927, p. 243, 244; Prescott 1951, p. 110.

Cells subrectangular or subrectangular-ovate, mostly shorter than broad, enclosed by a wide sheath of lamellate mucilage without envelope 20—30 μ broad, 13—32 μ long. Cells forming short filaments, or, by longitudinal and oblique divisions, irregular cell-heaps. Oogonia ± 40 μ in diam. (not observed). — Fig. 1. *7.*

Distribution: Europe (England), U. S. A. (Iowa, Wisconsin), Antilles (Curaçao).

Localities: Curaçao 390, 397d (510—725 mgCl/l).

Fig. 2. *13—19. Coleochaete reticulata* from sta. 397d, Curaçao, *13, 14.* antheridia (?), *15, 18.* young oogonia, *16, 17.* broken hairs, *19.* vegetative cells with chromatophores; *20. Oedogonium argenteum* from sta. 119, Surinam; *21. Oedogonium capilliforme* from sta. 396a, Curaçao; *22—24. Oedogonium crispum* var. *uruguayense* from sta. 119, Surinam ; *25. Oedogonium pusillum* from sta. 119, Surinam; *26. Oedogonium capitellatum* from sta. 397a, Curaçao; *27. Oedogonium howardii* from sta. 397d, Curaçao; *28. Oedogonium howardii* from sta. 387, akinetes, Klein Curaçao; *29. Oedogonium infinum* from sta. 396a, Curaçao; *30, 31. Rhizoclonium hieroglyphicum* from sta. 538, St. Martin.


13
15
14
17
16
18
19
20
21
22
23
24
25
26
27
28
29
30
31

Chaetophoraceae

Stigeoclonium Kützing

Stigeoclonium lubricum (Dillwyn) Kützing

Kützing 1845, p. 198; Collins 1905—1909, p. 298; Heering 1914, p. 81; Prescott 1951, p. 115; Tiffany & Britton 1952, p. 34.

Richly branched, with branches of 3, sometimes of 4 orders. Branches single, often whorled or nearly so. Branches ending in a blunt point or sometimes in a hyaline seta. Cells in the main filaments 14—19 μ in diam., $^2/_3$—2 × as long as broad. Cells of the branches of the last order 6—9 μ in diam., $^2/_3$—$2^1/_2$ × as long as broad. — Fig. 1. *8*.

Distribution: Europe, U. S. A., Antilles (Aruba).

Locality: Aruba 104Aa (1345 mg Cl/l).

Coleochaetaceae.

Coleochaete de Brébisson

Colechaete reticulata nov. spec.

Monoica; filamentis crescentibus in valleculis inter cellulas folii mortui exterioris partis Najadis, eo modo formantibus reticulum manifestum, raro consociatis in stratum pseudoparenchymatosum; cellulis visu rectangulis, 6—11 × 5—18 μ, transsectione compressis, interdum crine provisis hoc specimine semper defractis; cum uno chromatophoro parietali irregulari continente unum pyrenoidem magnum cuique cellulae; oosporis visu circulis vel irregulariter-circulis, diametro 18—30 μ, transsectione compressis, non totum opertis cortice composita ex cellulis irregularibus cum appendicibus inter se differentibus; oosporae membrana interna minute scrobiculata. — Fig. 1. *9—12*, 2. *13—19*.

Locality: Curaçao 397d (510 mg Cl/l) — *typus*.

It is impossible to state the presence of antheridia with certainty; most probably small papillose cells (3.5—7 × 6—8 μ) growing directly on the filaments or on one-celled side-branches are the antheridia.

OEDOGONIALES

Oedogoniaceae

Oedogonium Link

I. Dioecious, micrandrous — not present.
II. Monoecious or dioecious, macrandrous.
  A. Oogonia opening by a pore . . . . . *Porifera*
  B. Oogonia opening by a lid . . . . . *Operculata*

A. *Porifera.*

  a. Oogonia globose or obovoid-globose; pore superior; outer spore-wall scrobiculate; dioecious . . . . . **1. O. argenteum**
  b. Oogonia only very slightly swollen; pore superior; spore-wall smooth; dioecious . . . . . **2. O. capilliforme**

B. *Operculata.*

  a. Division of oogonium superior.
  Oogonia globose or obovoid-globose; spore-wall smooth; vegetative cells not capitellate, 7—14 × 30—70 μ; monoecious . . . . . **3. O. crispum**
  b. Division of oogonium median.

1. Monoecious; oogonia subbiconic-ellipsoid; oospores ellipsoid, constricted in the middle; vegetative cells not capitellate, 3—6 × 10—21 μ **4. O. pusillum**
2. Monoecious; oogonia globose or depressed-globose; spore-wall smooth; vegetative cells capitellate, 6—10 × 18—50 μ . . . **5. O. capitellatum**
3. Dioecious; oogonia globose; spore-wall smooth; vegetative cells capitellate, diam. 7—14 μ . . . . . **6. O. howardii**

c. Division of oogonium inferior.
Dioecious; oogonia globose or depressed-globose; division at the lowest extremity of oogonium; vegetative cells capitellate, 60—140 × 12—20 μ **7. O. infimum**

1. Oedogonium argenteum Hirn

Hirn 1900, p. 289; Tiffany 1930, p. 96—97; Gemeinhardt 1939, p. 164; Prescott 1951, p. 166.

Dioecious, macrandrous; oogonia 1—5 in a row, obovoid-globose to globose to somewhat depressed-globose, opening by a superior pore, 30—50 μ broad, 35—60 μ long; oospores ovoid-globose, entirely filling or not entirely filling the oogonium; outer layer of sporewall scrobiculate, inner layer smooth, 33—43 μ broad, 33—43 μ long; vegetative cells 4—18 μ in diam., 4—8 × as long as broad. — Fig. 2 *20.*

Distribution: Brazil (Matto Grosso), U. S. A. (Michigan), Surinam.

Locality: Surinam 119 (30 mg Cl/l).

2. Oedogonium capilliforme Kützing

Hirn 1900, p. 107; Tiffany 1930, p. 81; Gemeinhardt 1939, p. 123—124.

Dioecious, macrandrous; oogonium 1, slightly swollen, obovoid or subobovoid, with a superior pore, 39—45 × 50—60 μ; oospores not filling the oogonium, ovoid-globose, cylindric-globose, sub-globose or globose, 37—43 × 40—50 μ, spore-wall smooth; vegetative cells 25—32 μ in diam., $1^1/_2$—4 × as long as broad; antheridia 2—5 in a row, each with two sperms, division horizontal. — Fig. 2. *21.*

Distribution: U. S. A. (Missouri, Iowa, Ohio, Missisippi, Illinois), Europe (France, Russia, Sweden, Germany), South Africa, Patagonia, Antilles (Curaçao).

Locality: Curaçao 396a (160 mg Cl/l).

3. Oedogonium crispum (Hassall) Wittrock var. uruguayense Magnus & Wille

Hirn 1900, p. 164; Tiffany 1930, p. 114; Gemeinhardt 1939, p. 212—213.

Monoecious, macrandrous; oogonia single, obovoid-globose or globose, operculate, division superior, 25—32 × 32—40 μ; oospores globose, almost entirely filling the oogonium, diam. 22—27 u, spore-wall smooth; antheridium one, subepigynous or hypogynous, sperms 2, division horizontal; vegetative cells slightly or not capitellate, 7—14 × 30—70 μ. — Fig. 2. *22—24.*

Distribution: U. S. A. (Pennsylvania, Massachusetts), China, Uruguay, Brazil, Colombia, Surinam.

Locality: Colombia 114, Surinam 119 (30—820 mg Cl/l).

4. Oedogonium pusillum Kirchner

Hirn 1900, p. 299—300; Tiffany 1930, p. 161; Gemeinhardt 1939, p. 331—332.

Monoecious, macrandrous; oogonia single or sometimes in pairs, sub-

biconic-ellipsoid or subbiconic-globose, operculate, division median and wide, 14—17 μ in diam., length 14—21 μ; oospores ellipsoid or globose, slightly constricted in the middle, not entirely filling the oogonium, 9—11×11—14 μ, spore-wall smooth; vegetative cells not capitellate, 3—6 × 10—21 μ; antheridia 1 or 2, with 1 (?) sperm. — Fig. 2. *25*.

Distribution: Europe (Germany, France, Austria, Italy), Africa (Abessynia, Sudan, North-West Africa), Indonesia (Sumatra), U. S. A. (Iowa, Illinois, Massachusetts), Brazil, Surinam.

Locality: Surinam 119 (30 mg Cl/l).

5. Oedogonium capitellatum Wittrock

Hirn 1900, p. 149; Tiffany 1930, p. 104; Gemeinhardt 1939, p. 186.

Monoecious, macrandrous; oogonia single, subdepressed or depressed-globose; operculate, division median and narrow, diam. 21—26 μ, length 20—23 μ; oospores subdepressed or depressed-globose, entirely filling the oogonium, diam. 21—23 μ, length 18—21 μ, spore-wall smooth; vegetative cells capitellate, 6—10 × 18—50 μ; antheridia 1—3, hypogynous or sometimes subepigynous, each with one sperm. — Fig. 2. *26*.

Distribution: Europe (Färöer-islands, Denmark, Sweden, Finland), Manschuria, Turkestan, Birma, South-West China, Kaukasus, U. S. A. (Ohio, Illinois, Mississippi, Alabama, Florida, Oklahoma), British Columbia, Brazil (Ceará), Antilles (Curaçao).

Localities: Curaçao 396a, 396b, 397a (125—abt 300 mg Cl/l).

6. Oedogonium howardii West

Tiffany 1930, p. 101; Gemeinhardt 1939, p. 180.

Dioecious, macrandrous; oogonia 1—2, mostly globose, also slightly ellipsoid or depressed-globose, division median, distinct, 26—32 μ in diam., length 27—37 μ; oospore filling the oogonium, spore-wall smooth; vegetative cells capitellate, 7—14 μ in diam., $1^1/_2$—5 × as long as broad, basal cells subspherical-hemispherical; antheridia 1—16 in a row, each with two sperms. — Fig. 2. *27, 28*.

Distribution: U. S. A. (Ohio, Illinois, Florida, Oklahoma), Antilles (Barbados, Puerto Rico, Curaçao, Bonaire, St. Martin).

Localities: Bonaire 52f, 383; Klein Curaçao 387; Curaçao 89, 390, 397a, 397c; St. Martin 529a (125—3200 mg Cl/l).

In the material from Klein Curaçao 387 akinetes were found (Fig. 2. *28*), growing 3—6 intercalary in a row.

7. Oedogonium infimum Tiffany

Tiffany 1930, p. 101; Gemeinhardt 1939, p. 177.

Dioecious, macrandrous; oogonium 1, globose or depressed-globose, operculate, division at the lowest extremity of the oogonium, diam. 34—40 μ, length 30—40 μ; oospores filling the oogonium, membrane smooth; antheridia 1—10; sperms two (not observed); vegetative cells distinctly capitellate, (35—)60—140 μ × 12—20 μ; basal cell of filament sub-hemispherical, not elongated. — Fig. 2. *29*.

Distribution: U. S. A. (Iowa, Ohio), Antilles (Curaçao).

Localities: Curaçao 396a, 396b, 397c (160—280 mg Cl/l).

CLADOPHORALES

Cladophoraceae

Rhizoclonium Kützing

Rhizoclonium hieroglyphicum (C. A. Agardh) Kützing

Heering 1921, p. 20; Prescott 1951, p. 142; Tiffany & Britton 1952, p. 46.

Filaments long, unbranched, without lateral rhizoids; 10—50 μ in diam., cells (1—2)2—10(—14) × as long as broad; cell-walls usually thin in the most common form, but often of variable thickness. — Fig. 2. *30, 31.*

Distribution: Cosmopolitic; common in hard water.

Localities: Bonaire 48a, 53c, 53d; Klein Bonaire 61b; Curaçao 67, 67a, 72A, 391, 395; Aruba 93b; Barbuda 674; St. Martin 532, 538, 538a, 539, 539a; Anguilla 544. (430—2650 mg Cl/l).

The specimens from St. Martin 538, 538a, 539, 539a and Bonaire 53c, 53d consist of filaments composed of two types of cells, long cylindric cells, 14—25 μ in diam., 1—4 × as long as broad, and irregularly swollen cells 20—40 μ in diam., 1—2 × as long as broad. The filaments composed of irregular cells are twisted. The cell-walls are rather thick, viz. 3—9 μ.

In the material from Bonaire 48a the diam. varies from 10—50 μ, the length is 2—4 × the diam. The cell-walls are very thick, in filaments of 10 $\mu \pm 1.5$ μ, in filaments of 50 μ 9—14 μ thick. Also very few one-celled lateral rhizoids occur.

Pithophora Wittrock

Thallus filamentous, monosiphonous, with branches arising at right angles to the main axis, usually very close to the terminal cell-walls. Cells cylindrical or a little swollen, multinucleate. Chloroplast a parietal net, containing many pyrenoids. Reproduction asexual by akinetes, terminal or intercalary in the filaments. Akinetes dividing into two parts, of which one develops a short rhizoid, the other the initial cauloid filament of the future plant.

Sterile plants resembling very much *Cladophora,* differing from this genus by its rhizoids and its branches often opposite, arising at right angles to the main axis.

A. Akinetes all cask-shaped . . . . . *Isosporeae*
B. Akinetes cylindrical, irregular or cask-shaped . . . . . *Heterosporeae*

A. *Isosporeae.*

a. Filaments slender, main filaments of fertile plants (39—)45—75(—89) μ in diam.; in middle of akinete 1,2—3 × diam. at the base; end-walls of akinetes even . . . . . **1. P. oedogonia**
b. Filaments stouter, main filaments (58—)85—110(—129) μ in diam.; diam. in middle of akinete 1,2—1,8(—2) × diam. at the base; end-walls of akinetes rounded . . . . . **2. P. aequalis**

B. *Heterosporeae.*

a. Main filaments (58—)80—115(—164) in diam. . . . **3. P. polymorpha**
b. Main filaments (90—)100—140(—180) in diam. . . . . **4. P. zelleri**

1. Pithophora oedogonia (Montagne) Wittrock

Wittrock 1877, p. 55—58; Collins 1909, p. 363; Heering 1921, p. 62; Tiffany & Britton 1944, p. 42; Prescott 1951, p. 140; Glassmann 1952,

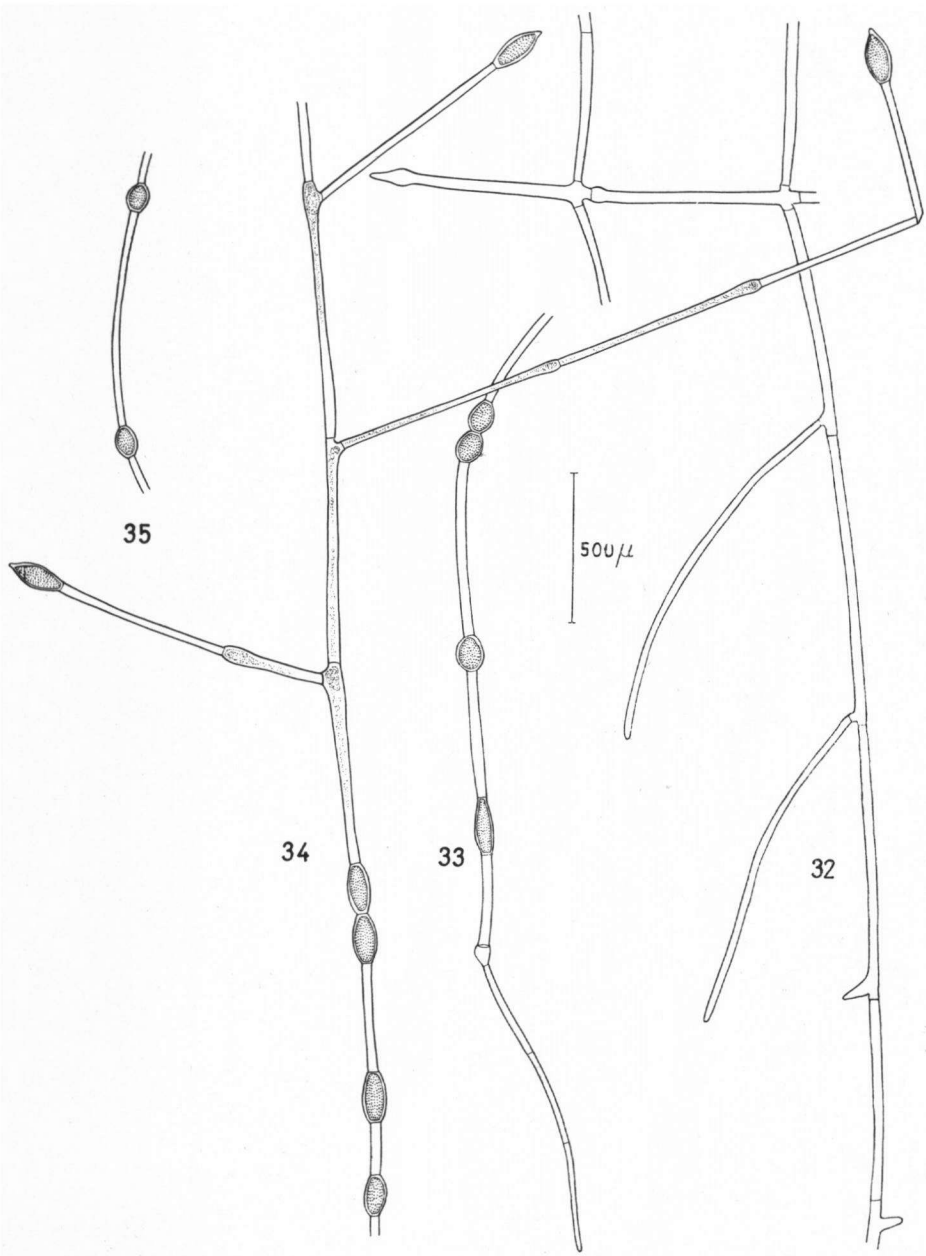


Fig. 3. *32—35. Pithophora oedogonia* from sta. 383, Bonaire.

p. 737; Tiffany & Britton 1952, p. 48. — Exsicc.: Collins, Holden & Setchell, Phycotheca Boreali-Americana 1636 (1909). — *Pithophora kewensis* Wittrock 1877, p. 52—55; Wolle 1887, p. 131; Collins 1912, p. 99; Heering 1921, p. 62. — Exsicc.: Collins, Holden & Setchell, Phycotheca Boreali-Americana 1636 (1909) and 2027 (1913). — *Pithophora affinis* Nordstedt 1878, p. 19. — Exsicc.: Heller, Plants of the Hawaiian Islands, collected on the Island Oahu, at Diamond Head, 2285 (1895).

Main filaments of sterile plants (60—)70—80(—117) μ in diam., with branches of first and sometimes of second order. Branches of first order solitary or sometimes opposite, branches of second order solitary; diam. of branches (36—)40—50(—71) μ. Main filaments of fertile plants (39—)45—75(—89) μ, with branches of first and sometimes, but very few, of second order. Branches of first order mostly solitary, very few opposite; diam. of branches (25—)30—40(—46) μ. Akinetes intercalary, sometimes in pairs, but usually in regular alternation with vegetative cells, and terminal, all cask-shaped. Akinetes in main filaments 107—210 × 71—150 μ, 1.0—1.2 × as long as broad, diam. in middle of akinete 1.2—2.2 × diam. at the base of akinete. Akinetes in branches 117—190 × 58—118 μ, 1.5—2.6 × as long as broad; diam. in middle of akinete 1.6—3 × diam. at the base. Terminal akinetes cask-shaped with blunt-conical apex, 107—236 × 54—75 μ, 1.7—3.3 × as long as broad, diam. in the middle of akinete 1.5—2.9 × diam. at the base. Wall of akinetes 4—14 μ thick. — Fig. 3. *32—35.*

Distribution: Europe (greenhouses, tropical aquaria), U.S.A. (Ohio, Illinois, Wisconsin, New Yersey, Nebraska, Pennsylvania), Bermuda, Antilles (Puerto Rico, St. Martin, Bonaire, Curaçao, Aruba), Caroline Islands, Hawaii, India, Burma.

Localities: Bonaire 383; Curaçao 75a; Aruba 104a; St. Martin 529 (105—1345 mg Cl/l).

2. **Pithophora aequalis** Wittrock

Wittrock 1877, p. 50—52; Frémy 1938, p. 22—24. — Exsicc.: Ferguson, Ceylon Algae 47.

Main filaments (58—)85—110(—129) μ diam. Branches of three, sometimes of four orders, opposite or solitary, (36—)55—75(—86) μ in diam. Akinetes intercalary always solitary and regularly alternating with vegetative cells, and terminal, all cask-shaped, with somewhat rounded ends. Akinetes in main filaments very few, diam. in the middle of the akinete 1.2—1.4 × diam. at the base. Akinetes in branches 75—114 × 114—171 μ, 1.4—2 × as long as broad, diam. in the middle of the akinete 1.2—1.8(—2) × diam. at the base. Terminal akinetes few, cask-shaped with blunt-conical to broadly rounded apex. Wall of akinetes 3.5—7.5 μ thick. — Fig. 4. *36—38,* 5. *39—43.*

Distribution: Ceylon, Venezuela, Antilles (St. Croix, St. John, Curaçao, Aruba).

Localities: Curaçao 391; Aruba 93c; Curaçao 88b(?) (510—760 mg Cl/l).

The description was made from the specimen from Curaçao 391. The size of its vegetative parts and the size and form of the akinetes agree fairly well with Wittrock's description. Also the akinetes, as in Wittrock's

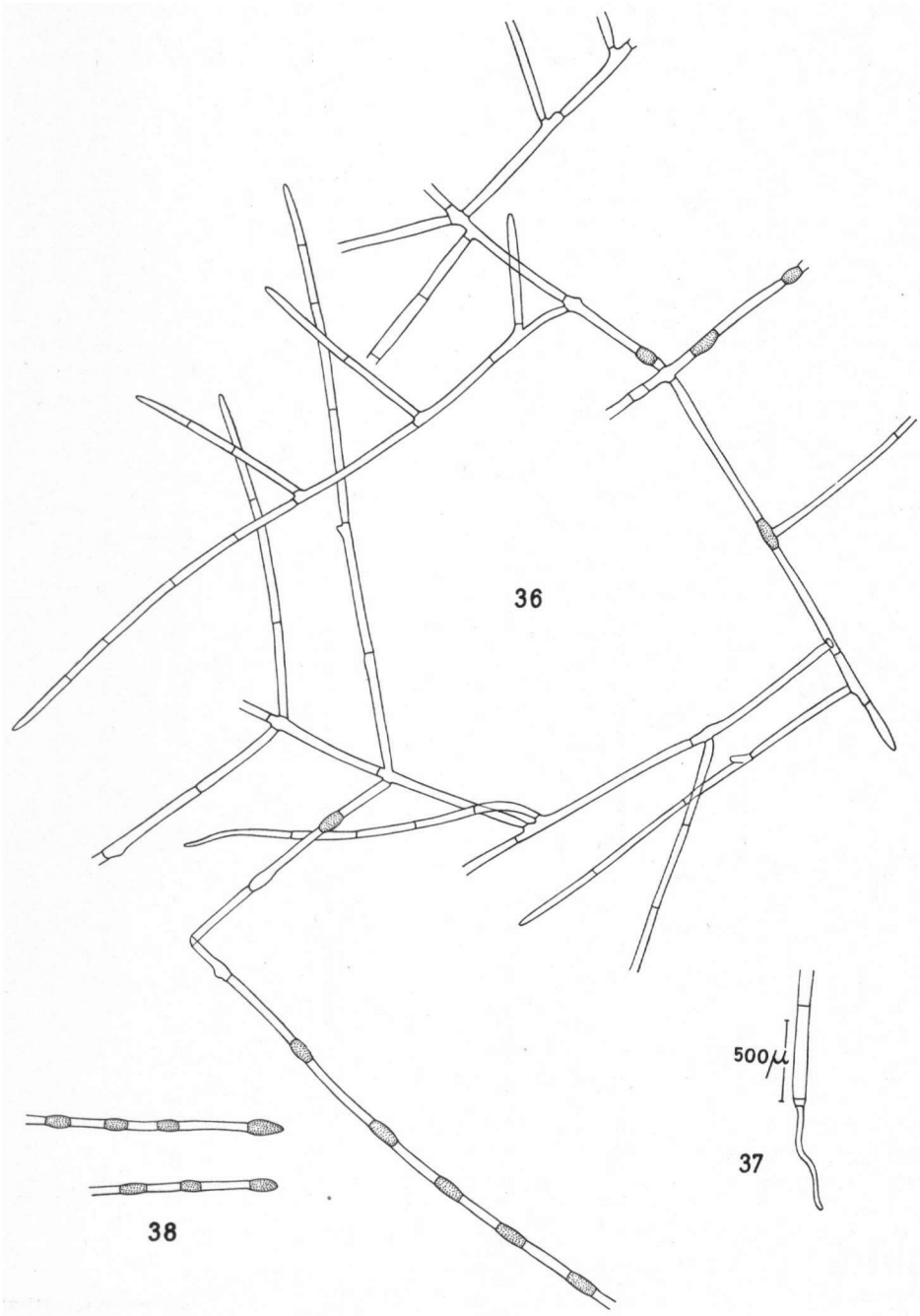


Fig. 4. *36—38. Pithophora aequalis* from sta. 391, Curaçao.

description, are single. The mode of ramification of this specimen, however, differs much from Wittrock's description. According to him there are plants with numerous short branches of only one order and plants with long branches of first order and short branches of second order. This specimen has branches of four orders.

Of the material from Curaçao 88b only the form of the akinetes is similar to that given by Wittrock. This specimen was very ripe, many akinetes germinating already, especially the akinetes in the main filaments.

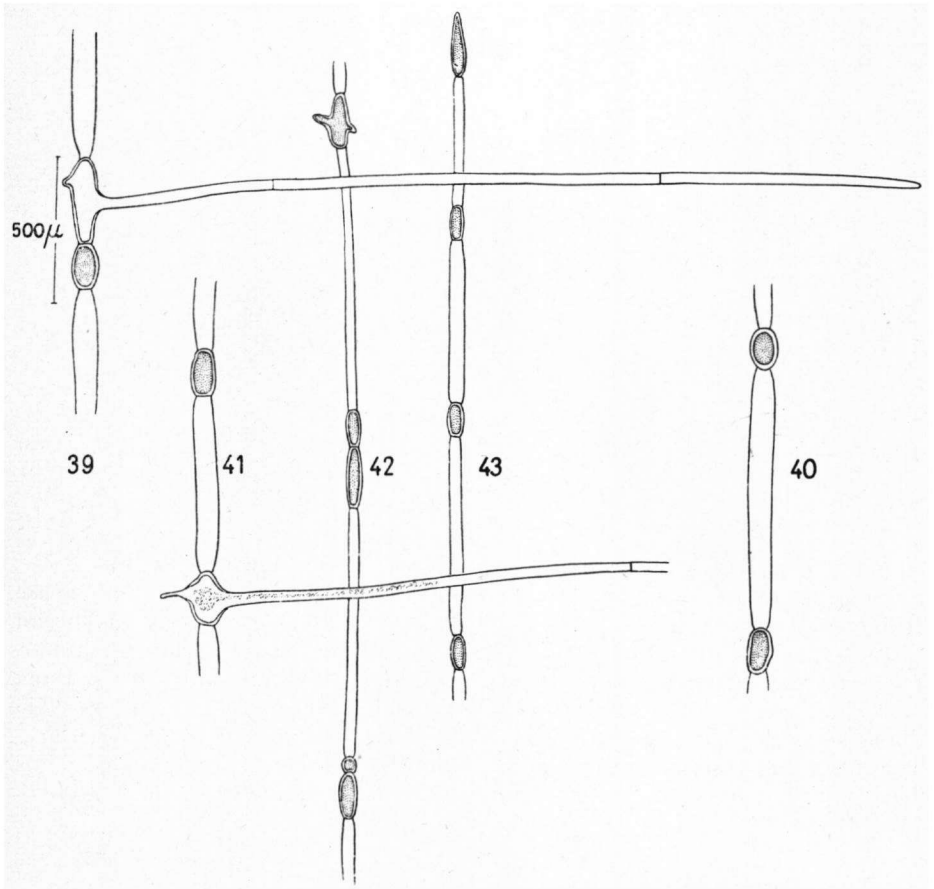


Fig. 5. *39—43. Pithophora aequalis* from sta. 88b, Curaçao.

The thallus, therefore, was much fragmented and it was impossible to detect the mode of ramification. Only branches of the first order could be observed with certainty. It seems useful to give a full description of this specimen:

Main filaments (89—)110—140(—157) μ in diam. Branches (54—) 60—80(—100) μ in diam. Vegetative cells swollen. Akinetes intercalary, then 1, 2, 3 and 4-seriate, and more rarely terminal, all cask-shaped, with

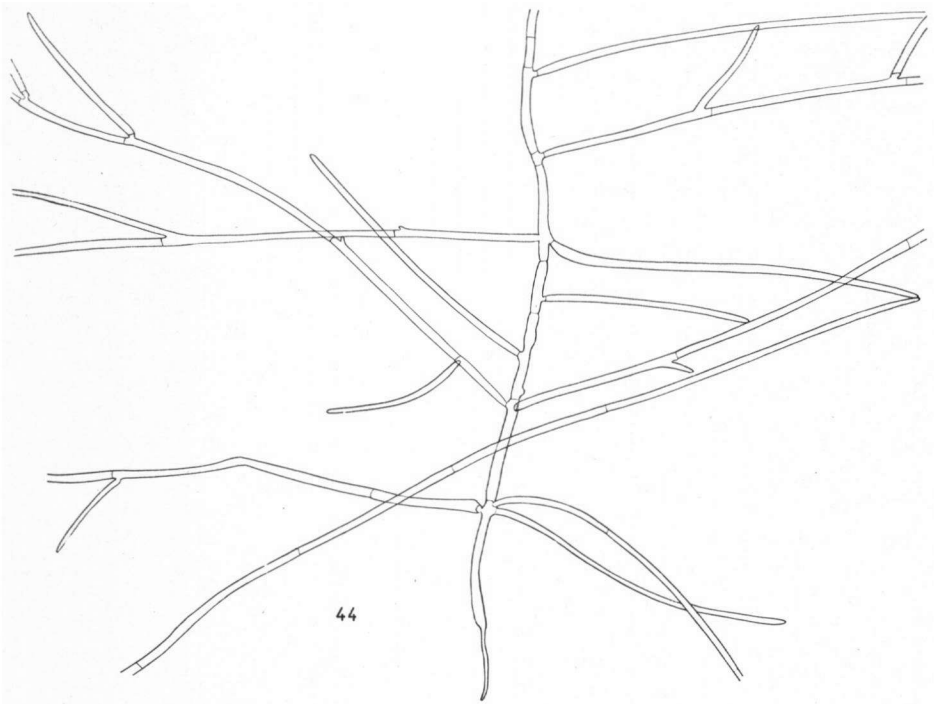


Fig. 6. *44. Pithophora polymorpha.*

rounded ends. Akinetes in main filaments 96—164 × 129—268 μ, 1.0—2.7 × as long as broad, diam. of akinete in middle 1—1.6 × diam. at the base. Akinetes in branches 60—104 × 100—215 μ, 1—2.5 × as long as broad, diam. of akinete in middle 1—2.1 × diam. at the base. Terminal akinetes few, cask-shaped with blunt-conical apex. Wall of akinetes 10—18 μ thick.

The specimen described by Frémy has branches of three orders. The diam. of the main filament is 140—160 μ, of the branches about 55—155 μ. The intercalary akinetes are single, slightly swollen, with rounded ends. They were not found in the main filament. Size of akinetes about 69—115 × 112—184 μ.

3. **Pithophora polymorpha** Wittrock

Wittrock 1877, p. 62—64; Wittrock 1880, p. 113—122; Dixit 1937, p. 20. — *Pithophora varia* Wille, in Collins, Holden & Setchell, Phycotheca Boreali-Americana 983 (1902); Collins 1909, p. 364; Tiffany & Britton 1944, p. 42; Prescott 1951, p. 140; Tiffany & Britton 1952, p. 48.

Main filaments (58—)80—115(—164) μ in diam., with branches of two orders or of three (sometimes four) orders. Branches of first order opposite or solitary, of second order opposite or solitary, branches of third

and fourth order solitary; diam. of branches (35—)40—70(—114) μ. Terminal cells 32—60 × 200—900 μ. Akinetes intercalary and terminal. Akinetes in main filaments usually irregular, sometimes cylindrical or cask-shaped, 1, 2 or 3-seriate, 71—160 × 114—286 μ, 0.8—4.2 × as long as broad. Akinetes in branches irregular, cylindrical or cask-shaped, 1, 2 or 3-seriate, often in regular alternation with vegetative cells, 39—132 × 89—265 μ, (0.8—)2.0—3.0 × as long as broad. Terminal akinetes usually cask-shaped with blunt-conical apex or broadly rounded apex, sometimes irregular, 54—89 × 143—261 μ, 2.1—3.9 × as long as broad. Wall of akinetes 3.5—13 μ thick. — Fig. 6. *44*, 7. *45, 46, 48.*

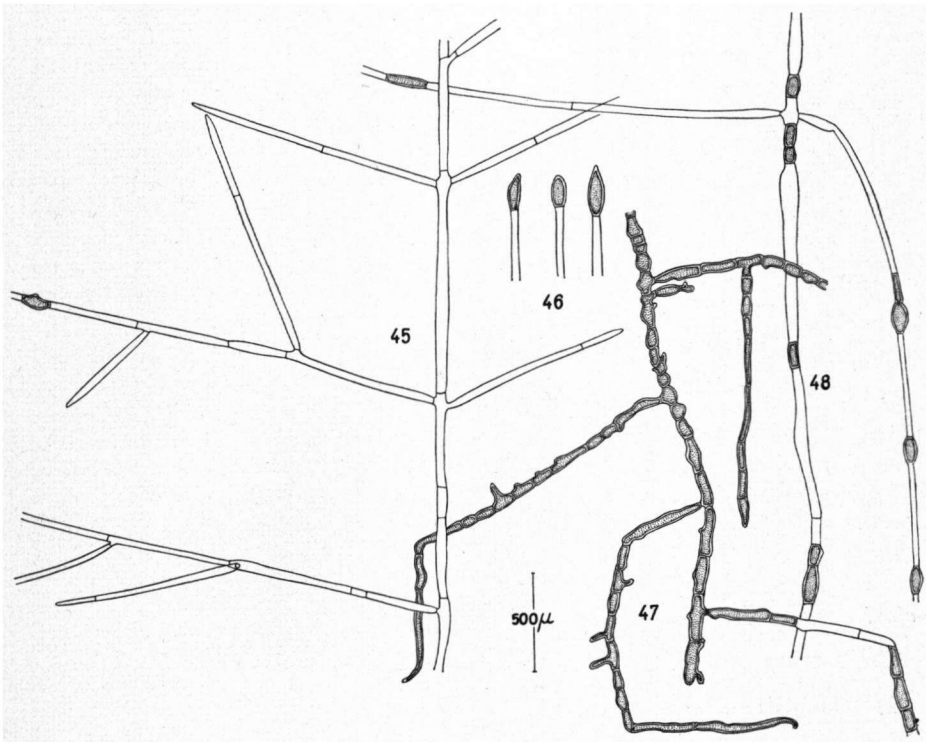


Fig. 7. *45, 46, 48. Pithophora polymorpha; 47. Pithophora polymorpha* var. *polyspora* from sta. 510, St. Eustatius.

Distribution: U. S. A. (Minnesota, Illinois, Michigan), Antilles (Puerto Rico, St. Martin, Margarita, Curaçao), India, Ceylon (forma magis ramosa Wittrock).

Localities: Margarita 17; Curaçao 391; St. Martin 538a, 539a (270—710 mg Cl/l).

The specimen from Curaçao has branches of third, sometimes of fourth order. The akinetes are generally single, sometimes 2—3-seriate. Most akinetes are cask-shaped.

var. **polyspora** nov. var.

Acinetae seriatae catenam saepe longam formantes.

The variety is characterized by long, uninterrupted chains of irregular akinetes. Often a whole plant consists of a chain of akinetes only. The remaining characters coincide with the above description. — Fig. 7. *47.*

Localities: St. Eustatius 510 and 513 (35—2100 mg Cl/l). The environmental conditions of these two stations were entirely different; this fact suggests that this variety is not caused by different ecological factors.

4. Pithophora zelleri (v. Martens) Wittrock

Wittrock 1877, p. 64—66.

Main filaments (90—)100—140(—180) μ in diam., with branches of first and second order, sometimes of third order. Branches of first order opposite or solitary, branches of second and third order solitary. Diam. of branches 70—125 μ. Terminal cells very long and slender, 1500—6000 μ long, 45—75 μ in diam. Akinetes intercalary and very few terminal. Akinetes in main axis usually cylindrical or slightly and mostly irregularly swollen; often in pairs; often in regular alternation with vegetative cells; 90—135 × 140—290 μ, 1.3—2.3 × as long as broad. Akinetes in branches cask-shaped, cylindrical or irregular; sometimes in pairs; usually in regular alternation with vegetative cells; 70—110 × 140—290 μ, 1.6—2.3 × as long as broad. Terminal akinetes very few, cask-shaped with blunt-conical apex. — Fig. 8. *49—56.*

Distribution: Japan, Antilles (Dog Island).

Locality: Dog Island 546 (1410 mg Cl/l).

According to Wittrock the most remarkable character of *P. zelleri* is that the akinetes in the principal filament occur as a rule in pairs, the upper akinete of a pair being cask-shaped, the lower one being cylindrical. Although such pairs were found in this specimen, many akinetes were single as well.

CHLOROCOCCALES

Coelastraceae

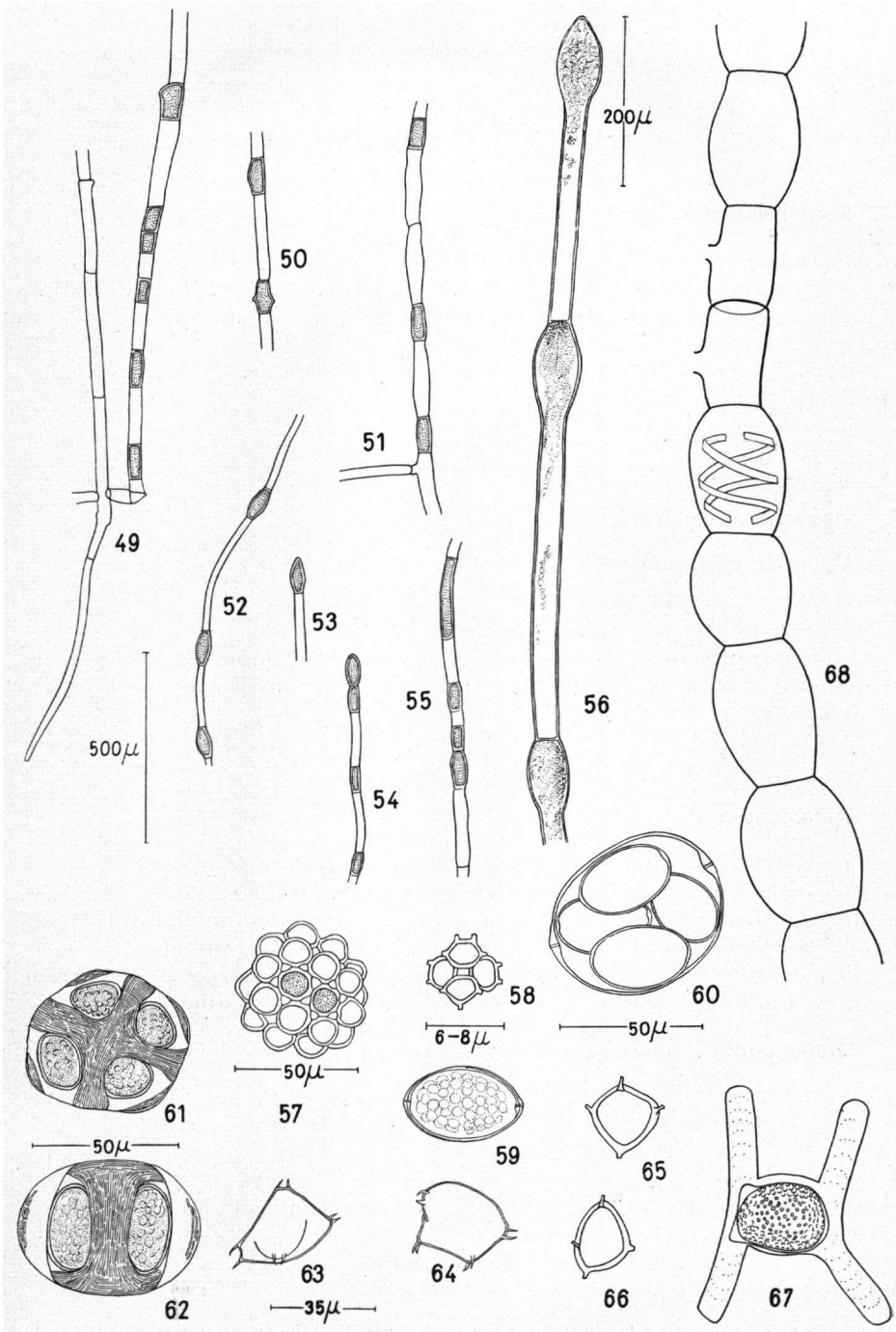
Coelastrum Naegeli

1. Coelastrum cambricum Archer

Borge 1896, p. 7; Collins 1909, p. 173; Lemmermann, Brunnthaler & Pascher 1915, p. 196; Borge 1918, p. 83; Borge 1925, p. 8; Gauthier-Lièvre 1931, p. 248; Skuja 1949, p. 69; Prescott 1951, p. 229; Tiffany & Britton 1952, p. 113.

Cells 10—12 angular, with a single truncate projection on the outer

Fig. 8. *49—56. Pithophora zelleri* from sta. 546, Dog Island (near Anguilla); *57. Coelastrum cambricum* from sta. 75, Curaçao; *58. Coelastrum scabrum* from sta. 390, Curaçao; *59, 60. Oocystis eremosphaeria* from sta. 75, Curaçao; *61, 62. Gloeotaenium loitlesbergerianum* from sta. 75, Curaçao; *63, 64. Tetraedron bifurcatum* from sta. 529, St. Martin; *65, 66. Tetraedron regulare* from sta. 397d, Curaçao; *67. Zygnemopsis americana* from sta. 397d, Curaçao; *68. Spirogyra distenta* from sta. 500, Nevis.


49
50
51
52
53
54
55
56
200μ
500μ
68
58
6-8μ
60
50μ
61
50μ
57
59
65
62
63
35μ
64
66
67

face, 7—13 μ in diam. Colonies composed of 8—128 cells, each cell connected with the neighbouring cells by 6 short connections so that triangular intercellular spaces result. — Fig. 8. *57.*

Distribution: Europe, North Africa, Ceylon, Burma, India, Australia, U. S. A., Brazil, Antilles (Puerto Rico, Curaçao).

Locality: Curaçao 75 (450 mg Cl/l).

2. Coelastrum scabrum Reinsch

Lemmermann, Brunthaler & Pascher 1915, p. 197; Prescott 1951, p. 230.

Cells angular-globose, with 3—6 short, wart-like and truncate projections on the outer surface, 6—10 μ in diam. Colonies composed of 4—16 cells Fig. 8. *58.*

Distribution: South Africa, South America, U. S. A. (Michigan), Antilles (Curaçao).

Locality: Curaçao 390 (725 mg Cl/l).

Oocystaceae

Oocystis Naegeli

Oocystis eremosphaeria G. M. Smith

Prescott 1951, p. 244.

Often solitary, sometimes in a group of 2, 3, 4 (very seldom 8) within the old mother cell-wall; cells ellipsoid, poles with a nodular thickening; chloroplasts numerous, about 25—60 parietal lenticular discs; cells 17—32 μ in diam., 21—41 μ long. — Fig. 8. *59, 60.*

Distribution: U. S. A. (Michigan, Wisconsin), Antilles (Curaçao).

Locality: Curaçao 75 (450 mg Cl/l).

Gloeotaenium Hansgirg

Cells spherical-ellipsoid, forming flat, round-quadrangular-ovate colonies of 2 or 4 cells enclosed within the persistent mother-cell-wall. Cells separated within the colony by dark coloured masses of mucilage containing calcium-carbonate, appearing in 2-celled colonies as a dark transverse band, in 4-celled colonies as a cross. Between the cells and the colonial membrane a cap of dark mucilage. Chloropast massive, form indistinct.

Gloeotaenium loitlesbergerianum Hansgirg

Collins 1909, p. 310; Lemmermann, Brunnthaler & Pascher 1915, p. 214; Tiffany & Britton 1942, p. 45; Skuja 1949, p. 70; Prescott 1951, p. 247, 248; Tiffany & Britton 1952, p. 115.

Characteristics as described for the genus. Cells 14—18 × 18—29 μ; 4-celled colonies 46—54 × 50—58 μ, 2-celled colonies 39—46 × 54—61 μ. — Fig. 8. *61, 62.*

Distribution: Europe, India, Burma, U. S. A., Antilles (Curaçao, Trinidad, Puerto Rico), Surinam.

Localities: Curaçao 75, Surinam 406 (18—450 mg Cl/l).

Tetraedron Kützing

1. Tetreadron bifurcatum (Wille) Lagerheim

Collins 1909, p. 165; Lemmermann, Brunnthaler & Pascher 1915, p. 156; Borge 1918, p. 81; Borge 1925, p. 7; Skuja 1949, p. 63; Prescott 1951, p. 263; Tiffany & Britton 1952, p. 119.

Cells irregularly tetrahedral, the angles 2-lobed, each lobe with a short spine. The margins of the cell between two lobes somewhat concave. Diam. of cells without spines 25—32 μ, with spines 32—39 μ. — Fig. 8. *63, 64.*

Distribution: Europe, India, Burma, U. S. A., Cuba, Brazil, Antilles (Puerto Rico, St. Martin).

Locality: St. Martin 529 (105 mg Cl/l).

2. Tetraedron regulare Kützing

Lemmermann, Brunthaler & Pascher 1915, p. 150; Prescott 1951, p. 269; Tiffany & Britton 1952, p. 119.

Cells tetragonal, pyramidal; sides convex; each angle narrowly rounded and provided with a short, blunt spine; 8.5—12 μ in diam. — Fig. 8. *65, 66.*

Distribution: Cosmopolitic.

Locality: Curaçao 397d (510 mg Cl/l).

According to Tiffany & Britton the diam. may vary between 14—45 μ.

ZYGNEMATALES

Zygnemataceae

Zygnemopsis Skuja

Zygnemopsis americana Transeau

Transeau in Transeau, Tiffany, Taft & Li 1934, p. 215; Kolkwitz & Krieger 1941, p. 284; Transeau 1951, p. 53—54; Prescott 1951, p. 327.

Vegetative cells 9—12 × 30—120 μ; conjugation scalariform; zygospores in the wide conjugation-tubes and extending far into each gametangium; gametangia filled with a transparent gel; zygospores irregularly quadrangular-ovoid; with rounded angles, 20—30 × 30—40 μ; parthenospores; median spore-wall minutely scrobiculate. — Fig. 8. *67.*

Distribution: U. S. A. (Michigan, Wisconsin), Canada (Ontario), Antilles (Curaçao).

Locality: Curaçao 397a (125 mg Cl/l).

Spirogyra Link

A. End-walls of cells plane . . . . . *Conjugata*
B. End-walls of cells replicate . . . . . *Salmacis*

A. *Conjugata*

a. Mesospore smooth.
1. Vegetative cells 40—45 μ in diam. Zygospores with broadly rounded ends **1. S. distenta**
2. Vegetative cells 40—46 μ in diam. Zygospores with sharply rounded ends **2. S. fuellebornii**
3. Vegetative cells 65—88 μ in diam. . . . . **3. S. nitida**

b. Mesospore sculptured.
1. Mesospore with irregular, longitudinally undulating ribs **4. S. fluviatilis**
2. Mesospore finely punctate . . . . . **5. S. punctiformis**

B. *Salmacis*

a. Mesospore smooth . . . . . **6. S. pseudospreiana**
b. Mesospore minutely punctate . . . . . **7. S. minutipunctata**

1. Spirogyra distenta Transeau

Transeau 1934, p. 420; Krieger 1944, p. 350; Transeau 1951, p. 174 — *S. decimina* (Müll.) Kütz. var. *inflata* Fritsch & Stephens 1921, p. 21, fig. 20.

Vegetative cells 40—54 μ in diam., 81—201 μ long, with plane end-walls; chromatophores 2—3, making 1½—2 turns; conjugation scalariform; conjugation-tubes distinct, formed by both gametangia; fertile cells cylindrical; conjugating cells 60—114 μ long; non-conjugating cells mostly regularly or irregularly inflated; zygospores ellipsoid with broadly rounded ends, cylindrical-globose, diam. 41—53 μ, 51—70 μ long; mesospore smooth, brown, 2 μ thick. — Fig. 8, *68*, 9, *69—72*.

Distribution: Antilles (Nevis, Aruba), South America (Venezuela), U. S. A. (Illinois, Ohio, Iowa, Kentucky), South Africa (Quingolo).

Localities: Aruba 97; Paraguaná (Ven.) 105; Nevis 500 (60—140 mg Cl/l).

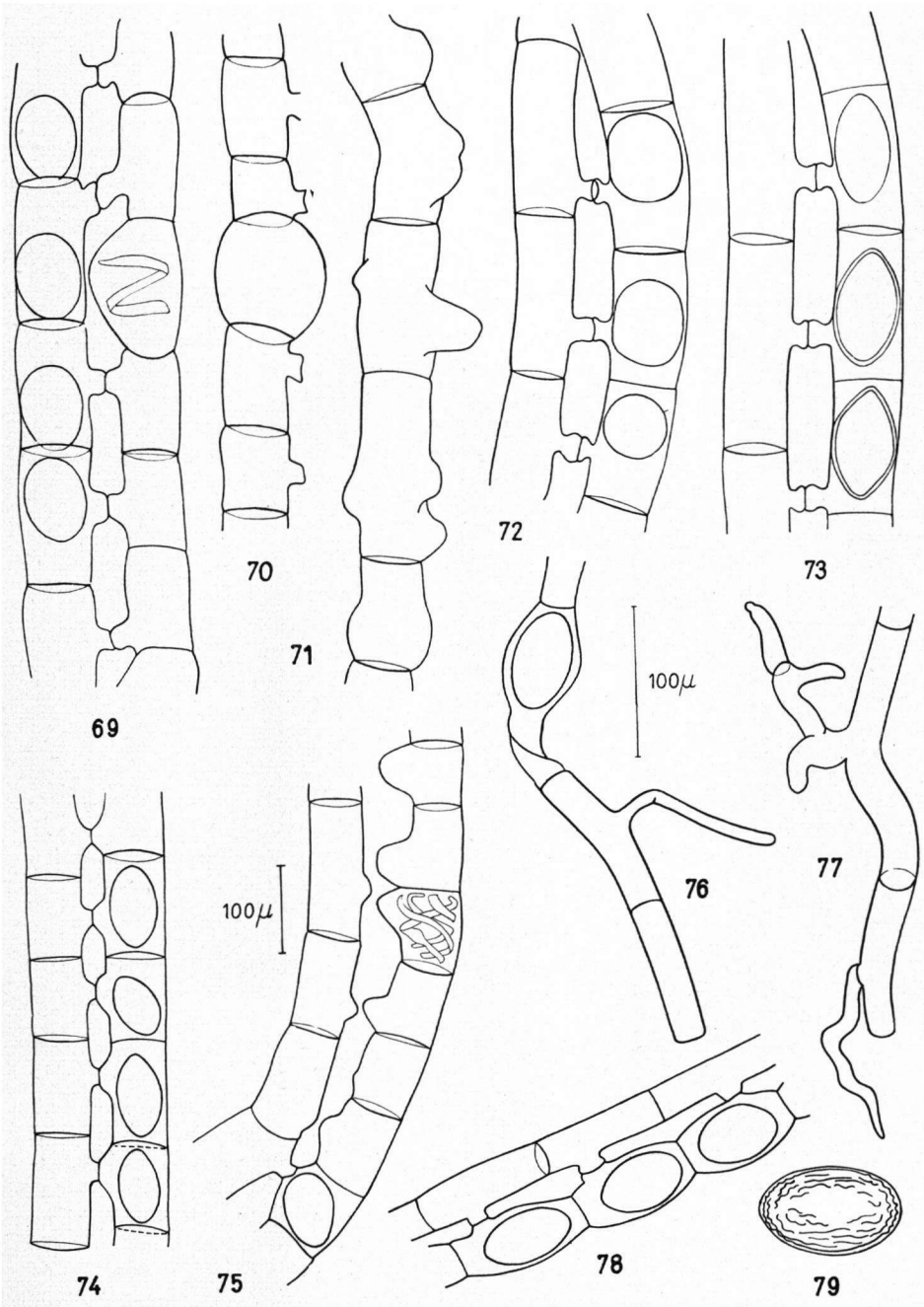
Krieger (1944, p. 350) mentions as a possible synonym of *S. distenta* Transeau *S. dubia* Kütz. var. *polymorphis* Rao (Rao 1938, p. 346, 347). This seems improbable. Rao does not say anything about inflated sterile cells. Further the fertile cells of *S. dubia* var. *polymorphis* are inflated, of *S. distenta* cylindrical.

The non-conjugating cells of the material from Nevis are regularly inflated, forming more or less ellipsoid or bullate sacs; such cells occur only on the male filaments. The non-conjugating cells of the material from Paraguanà are irregularly inflated, with one or more irregular bulges; the inflated cells occur on both male and female filaments. On both male and female filaments of the material from Aruba occur regularly as well as irregularly inflated non-conjugating cells.

According to Transeau (1951, p. 174) the zygospores of *S. distenta* are ovoid. In this material they are never ovoid, and in the original description of Fritsch (1921, p. 46) the zygospores are ellipsoid (with broadly rounded ends) to cylindrical-globose.

S. distenta Transeau differs from *S. bullata* Jao (Jao, 1935, p. 588, pl. IV, fig. 55) by its size and the number of chromatophores, from *S. hollandia* Taft (Taft 1947, p. 173) by its scalariform conjugation; *S. hollandia* has scalariform as well as lateral conjugation.

Fig. 9. *69—70. Spirogyra distenta* from sta. 500, Nevis; *71—72. Spirogyra distenta* from sta. 105, Paraguaná (Venezuela); *73. Spirogyra fuellebornii* from sta. 397c, Curaçao; *74, 75. Spirogyra nitida* from sta. 397a, Curaçao; *76—79. Spirogyra fluviatilis* from sta. 89, Curaçao.


69
70
71
72
73
74
75
100μ
76
100μ
77
78
79

2. Spirogyra fuellebornii Schmidle

Krieger 1944, p. 350; Prescott 1951, p. 315.

Vegetative cells 40—46 μ in diam., 80—170 μ long, with plane end-walls; chromatophores 2—4; conjugation scalariform; conjugation-tubes distinct, formed as much by the male cells as by the female cells; fertile cells cylindrical; zygospores ellipsoid with sharply rounded ends, 40—50 × 52—80 μ; mesospore smooth, brown, ± 2.5 μ thick. — Fig. 9, *73*.

Distribution: Central and South Africa, Burma, India, U.S.A. (Wisconsin), Antilles (Curaçao).

Locality: Curaçao 397c (280 mg Cl/l).

3. Spirogyra nitida (Dillwyn) Link

Dillwyn 1809, Taf. IV; Link 1820, p. 262; litterature and synonyms in Kolkwitz & Krieger 1941, p. 51 and Krieger 1944, p. 353; Skuja 1949, p. 102; Prescott 1951, p. 318; Transeau 1951, p. 171 — *Spirogyra hymerae* Britton et Smith, 1942, p. 70.

Vegetative cells 65—88 μ diam., 104—216 μ long, with plane end-walls; chromatophores 3—5, making 1½—4 turns; conjugation scalariform, conjugating cells in long, uninterrupted rows; conjugation-tubes distinct, formed as much by the male cells as by the female cells; fertile cells cylindrical; conjugating cels 62—73 μ diam., 65—156 μ long; non-conjugating cells cylindrical and inflated on the conjugating side of the filament; zygospores ellipsoid with sharply rounded ends, 55—62 μ diam., 78—91 μ long; mesospore smooth, brown, 2.5 μ thick. — Fig. 9. *74, 75*.

Distribution: Europe, North Asia, U.S.A., India, Burma, China, North and East Africa, Madagascar, Argentina, Antilles (Curaçao).

Locality: Curaçao 397a (125 mg Cl/l).

S. nitida differs from *S. distenta* Transeau by its broader cells and by its ellipsoid spores, *S. distenta* having cylindrical spores; from *S. neglecta* (Hass.) Kütz. by its larger cells and by its ellipsoid zygospores with sharply rounded ends; *S. neglecta* having ellipsoid zygospores with broadly rounded ends; from *S. setiformis* (Roth) Kütz. by its narrower cells.

4. Spirogyra fluviatilis Hilse emend. Skuja

Hilse 1863, 1476 (exsicc.); Wolle 1887, p. 216, T. 136, fig. 13; Borge 1913, p. 27; Skuja 1928, p. 106, T. I, fig. 5—7; Cedercreutz 1930, p. 131; Czurda 1932, p. 199, fig. 213; Krieger 1944, p. 406; Prescott 1951, p. 314, pl. 73, fig. 4—5; Transeau 1951, p. 184, pl. XXX, fig. 5 — *S. fluviatilis* forma Fritsch & Rich 1928, p. 49, fig. 12 D—G.

Vegetative cells 25—28 μ in diam., 77—245 μ long, with plane end-walls; 3—4 chromatophores, making ½—4 turns; conjugation scalariform; conjugation-tubes formed by the male gametangia only or almost only; fertile cells inflated, diam. 46—54 μ; conjugating cells 115—223 μ long; zygospores ellipsoid with rounded ends, 33—39 μ in diam., 54—66 μ long; mesospore with irregular longitudinally undulating ribs, 3 μ thick, brown, exospore smooth, hyaline, 1 μ thick; non-conjugating cells cylindrical; very often the conjugation-tube of a non-conjugating cell forms a branched or not-branched rhizoid. — Fig. 9. *76—79*.

Distribution: Europe, Belgian Congo, China, India, U.S.A., Antilles (Curaçao).

Locality: Curaçao 89 (3200 mg Cl/l).

This species grows in ponds and streams, at first attached to underwater objects, later floating free; characteristic are the conjugation-tubes growing into rhizoids.

According to Transeau (1951, p. 185) the plants described by Czurda (1932, p. 199) as *S. fluviatilis* Hilse are allied to *S. smithii* Transeau. Krieger follows Czurda's description. Czurda described two forms of different size, with ellipsoid spores and 3—5 chromatophores and the conjugation-tubes formed by the male cells. His illustration, however, shows two chromatophores and tubes formed by both gametangia.

On the other hand Skuja (1928, p. 106) describes plants with 3—6 chromatophores and the conjugation-tube formed mainly by the male cell. His illustrations agree with his description.

Also, according to Transeau, the description by Wolle (1887, p. 216) and by Borge (1913, p. 27) establish the species. Hilse only described a vegetative form. Wolle, however, does not say anything about the mesospore and the conjugation-tubes, and his illustration which suggests the conjugation-tubes being formed as much by the male as by the female cell is rather schematic. Nor does Borge say anything about the mesospore and the conjugation-tubes, but his illustration suggests the conjugation-tubes being formed by the male cells mainly.

So, after all, Skuja gives the first extensive and reliable description and illustrations. With those the present specimen agrees.

S. fluviatilis differs from *S. grosii* Schmidle in having narrower cells; from *S. smithii* Transeau in having no inner reticulate mesospore; from *S. dictyospora* Jao in having no reticulate mesospore.

5. **Spirogyra punctiformis** Transeau

Transeau 1914, p. 294, pl. 26, fig. 7; Czurda 1932, p. 165, fig. 168; Krieger 1944, p. 388, f. 576; Transeau 1951, p. 200, pl. XXXLV, fig. 5—6.

Vegetative cells 30—39 μ in diam., 236—295 μ long, with plane endwalls; 1—2 chromatophores, making 4—8 turns; conjugation scalariform, conjugation-tubes formed by the male gametangia mainly; fertile cells inflated, 45—51 μ in diam., 90—195 μ long; pairs of conjugating cells separate or two together, never forming long chains; zygospores cylindrical-ovoid-ellipsoid with broadly rounded ends, diam. 42—48 μ, 59—93 μ long; mesospore yellow, finely punctate. — Fig. 10. *80, 81.*

Distribution: U.S.A. (Iowa, Illinois), Antilles (Nevis).

Locality: Nevis 500 (88 mg Cl/l).

Only very few mature zygospores were present in this material.

S. punctiformis differs from *S. aequinoctialis* G. S. West in having broader cells and a smaller number of chromatophores, *S. aequinoctiales* having 2—3 chromatophores; from *S. schmidtii* in having a smaller number of chromatophores, *S. schmidtii* having 2—3 chromatophores.

6. Spirogyra pseudospreiana Jao

Jao 1935, p. 608, T. 9, fig. 103; Krieger 1944, p. 437, fig. 696; Transeau 1951, p. 211 — *Spirogyra croasdaleae* Blum 1943, p. 783.

Vegetative cells 16—23 μ in diam., 156—416 μ long, with replicate end-walls; one chromatophore, making 2½—10 turns; conjugation scalariform; conjugation-tubes often formed by the male gametangia only, often by the female gametangia as well; fertile cells inflated mainly on the conjugating side, diam. 30—44 μ; conjugating cells 104—273 μ long; zygospores ellipsoid with rounded ends; 26—31 μ in diam., 44—78 μ long; mesospore smooth, yellowish-brown at maturity, 2.5 μ thick. — Fig. 10. *82*, 11, *83*.

Distribution: South America (Paraguaná-peninsula, Venezuela), China.

Locality: Paraguaná 105 (140 mg Cl/l).

S. pseudospreiana Jao differs from *S. frigida* Gay in having cylindrical non-conjugating cells, *S. frigida* having inflated non-conjugating cells; from *S. austriaca* Czurda by having broader cells and ventricose fertile cells, *S. austriaca* having cylindrically swollen fertile cells; from *S. inflata* (Vauch.) Kütz. in having no lateral conjugation.

7. Spirogyra minutipunctata nov. spec.

Cellulis vegetativis 18—23 μ latis, 200—500 μ longis, dissepimentis replicatis; chromatophoro uno, anfractibus 3—10; conjugatione scalariformi; cellulis fructiferis valde inflatis maxime in conjugationis latere, 37—50 × 150—250 μ; tubulis conjugationis maxime ab cellulis masculinis, sed etiam ab cellulis femininis formatis; zygotis ellipsoideis obtuse terminatis, 29—37 × 41—60 μ; exosporio hyalino ± 0,5 μ crasso, mesosporio brunneo minute punctato ± 2 μ crasso. — Fig. 11. *84—87*.

Localities: Bonaire 35d — *typus*; Curaçao 396b (300—550 mg Cl/l).

In the samples 396a and 396c conjugating, but immature *Spirogyra* was found; the structure of the zygote-wall could not yet be observed, but most probably the specimens belong to *S. minutipunctata*.

S. minutipunctata differs from *S. pseudospreiana* in having a minutely punctate mesospore, *S. pseudospreiana* having smooth mesospore; from *S. inflata* (Vauch.) Kütz. in having no lateral conjugation and in having a minutely punctate mesospore; from *S. kunsamoensis* Hirn in having no lateral conjugation and in the larger diameter of the vegetative cells. In *S. kunsamoensis* the diameter of the cells is 13—17 μ.

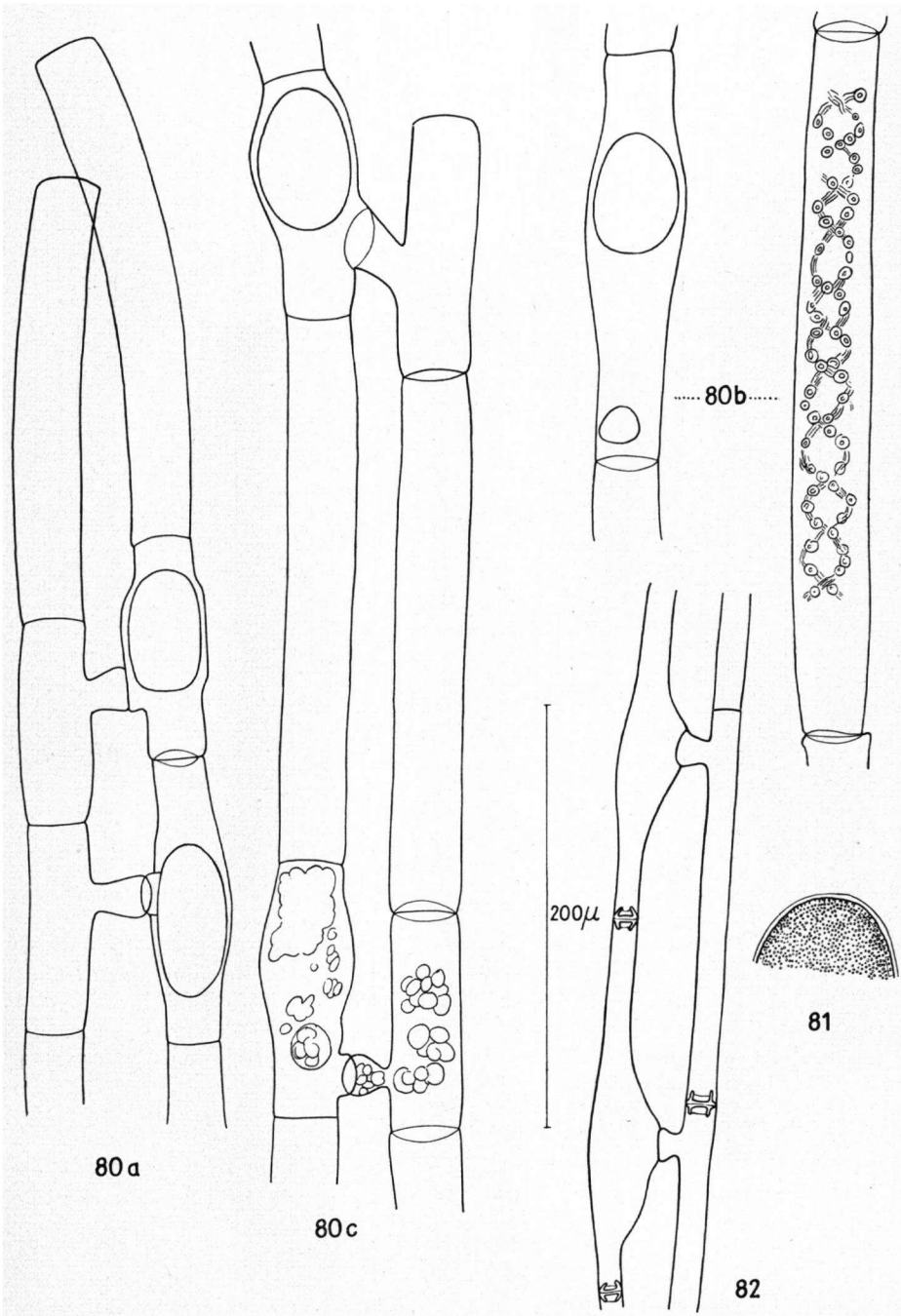
CHAROPHYCEAE

CHARALES

Chara Vaillant

H. and J. Groves (1911) described 11 species of *Nitella* and 5 species of *Chara* collected in the West Indies. In the material, collected by

Fig. 10. *80, 81. Spirogyra punctiformis* from sta. 500, Nevis; *82. Spirogyra pseudospreiana* from sta. 105, Paraguaná (Venezuela).


80a
80c
80b
200μ
81
82

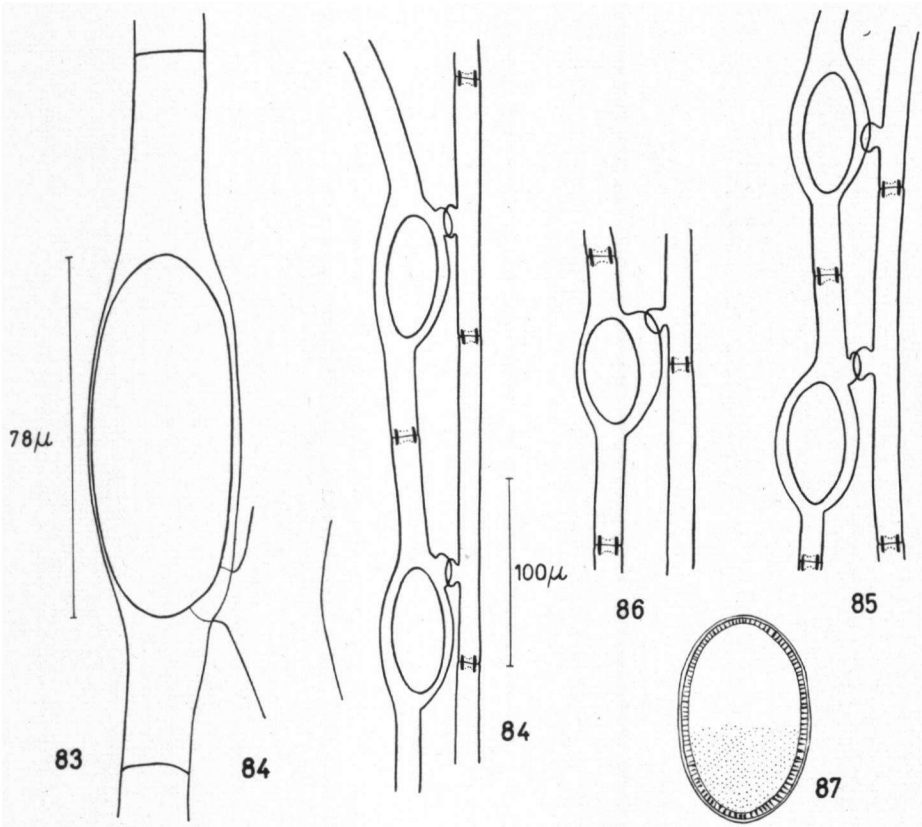


Fig. 11. *83. Spirogyra pseudospreiana* from sta. 105, Paraguaná (Venezuela); *84—87. Spirogyra minutipunctata* nov. spec. from sta. 396b, Curaçao.

Wagenaar Hummelinck, only three species of *Chara,* all of them also described by H. and J. Groves, could be detected.

Zaneveld (1941) made an enumeration of the *Chara*'s collected by Wagenaar Hummelinck in 1930, 1936 and 1937. He distinguished *Chara fibrosa* and seven forms of *Chara zeylanica.* The present author investigated the same material, and according to him Zaneveld's *Ch. fibrosa* must be brought to *Ch. hydropitys.* He did not distinguish as many forms of *Ch. zeylanica* as Zaneveld did, but only four.

1. Chara hornemanii Wallmann

Wallmann 1853, p. 60; Braun 1882, p. 122; Nordstedt 1889, p. 33; Allen 1900, p. 300; Robinson 1906, p. 277; H. et J. Groves 1911, p. 38; Britton & Millspaugh 1920, p. 617; Hasslow 1940, p. 288; Horn af Rantzien 1951, p. 355.

Plant robust, dioucious. Cortication of the stem diplostichous, primary cortical cell-series often more prominent than the secondary. Spine cells long, swollen, up to 3 × the stem-diameter, acuminate. Stipulodes in a

single row, two opposite one branchlet, long and swollen, acuminate. Branchlets 8—10 in a whorl, composed of 4—7 ecorticate articulations, the ultimate ones very short.

Distribution: Mexico, Bahama Islands, Vieques (Crab Island), Cuba, Key West, Venezuela, Brazil, Antilles (St. Martin, Antigua, Barbuda, Bonaire).

Localities: Bonaire 382a, 382c, 382d, 628; Barbuda (mud-flat south of Codrington Village, 4. VIII. 1955); St. Martin 528, 679 (1890—26200 mg Cl/l).

The specimen from Bonaire 628 is a slender form, which is to be distinguished from *Ch. fibrosa* Ag. ex Bruzelius by being dioecious.

2. Chara hydropitys Reichenbach

H. and J. Groves 1911, p. 30; Zaneveld 1940, p. 168—174.

Plant slender, monoecious. Cortication of the stem diplo-triplostichous, primary cortical cell-series equally developed as secondary. Spine cells few, very reduced. Stipulodes in a single row, two opposite each branchlet, long, slender ,acuminate. Branchlets 8—11 in a whorl, composed of 5—7 articulations of which the lowest and the terminal 1—4, or all, are ecorticate. Bract-cells 5—8, long, slender, acuminate, up to 7 × as long as the ripe oogonium, posterior ones about $^2/_3$ × anterior ones. Oogonia produced at the 1—3rd node.

Distribution: India, Ceylon, Malaysia, North Africa, U.S.A., Cuba, Mexico, Brazil, Surinam.

Localities: Surinam 119, Surinam, sandy ditch with shells at Krepi, Charlesburg, North of Paramaribo, 10. VI. 1955, leg. J. S. Zaneveld (30 mg Cl/l).

Zaneveld (1941, p. 142) attributed the specimen from Surinam 119 to *Ch. fibrosa* Agardh ex Bruzelius ssp.? *flaccida* (A. Braun) Zaneveld. Several characteristics of this material are not in accordance with the descriptions of *Ch. fibrosa*. The cortication of *Ch. fibrosa* is diplostichous, that of this specimen diplotriplostichous. The number of stipulodes of *Ch. fibrosa* ssp. *flaccida* is the same as that of the branchlets; in this material the number of stipulodes is 2 × that of the branchlets. The branchlets of *Ch. fibrosa* are entirely ecorticate, the second articulation of the branchlets of this material is sometimes corticate. As, however, most branches are entirely ecorticate, this specimen belongs probably to *Ch. hydropitys* f. *gymnophylla* A. Braun.

3. Chara zeylanica Willdenow

H. and J. Groves 1911, p. 40; Zaneveld 1940, p. 203; Zaneveld 1941, p. 142.

Monoecious. Cortication of the stem triplostichous, primary cortical cell-series equally developed as the secondary. Spine-cells numerous. Stipulodes in a double row. Branchlets 8—14 in a whorl. composed of 6—15 articulations, the short lowest and usually 1—3 terminal articulations ecorticate. A very variable species.

Distribution: Common throughout all tropical regions.

Localities: Margarita 13, 18; Bonaire 379a, 379b; Klein Bonaire 63d, 63c; Curaçao 70, 75a, 76Aa, 89, 390, 396, 397b; Aruba 99; Paraguaná 108, 109; La Goajira 114; Barbuda 667, 674; St. Martin 678; Anguilla 544; New Providence (Bahamas) 548 (50—12460 mg Cl/l).

f. **guatemalensis** (Nordstedt) Zaneveld 1941, p. 144. — *Chara gymnopus* A. Braun ssp. *guatemalensis* Nordstedt 1888, p. 193.

Branchlets always entirely ecorticate, consisting of 5—8 articulations. Anterior pair of bract-cells longer than the oogonium, lateral and posterior bract-cells shorter.

Distribution: Guatemala, Honduras, Antilles (Curaçao, St. Croix).

Localities: Curaçao 76Aa, St. Croix (Diamond pool, fresh water, near Rum Factory, Wagenaar Hummelinck 13-1-1955) (240 mg Cl/l).

f. **armata** (Meyen) Zaneveld 1940, p. 200. — *Chara armata* Meyen 1835, p. 31; Kützing 1857, p. 30.

Plants compact, internodes $^2/_3$ × as long as branchlets, full-grown branchlets 3—5 mm long. Stem-hairs very long; usually as long as the stem-diam. Branchlets 8—12 in a whorl, composed of 6—11 articulations, of which the lowest one and the ultimate one are corticulate (sometimes all of them). The lowest articulations are often not shortened.

Distribution: India, Indonesia (Sumatra, Java), Philippine Islands (Luzon), New Caledonia, Antilles (Klein Bonaire).

Localities: Klein Bonaire 63c, 63d (12160—12410 mg Cl/l).

f. **trichacantha** (A. Braun) H. et J. Groves 1911, p. 41; Zaneveld 1941, p. 143 — *Chara gymnopus* A. Braun var. *trichacantha* A. Braun 1882, p. 192.

Plants rather large and slender, internodes about 1—3 × as long as the branchlets; branchlets 13—20 mm long. Spine cells long, usually as long as the stem-diameter. Branchlets 11—13, composed of 8—10 articulations of which the first and the last are ecorticate. Anterior bract-cells about as long as the oogonium, posterior ones about half as long. Oogonia produced at the 1—3rd branchlet-node.

Distribution: U.S.A. (Key West, Texas, South Carolina), Bahamas, Antilles (Bonaire, St. Martin).

Localities: Bonaire 379b; Klein Bonaire 63c; St. Martin 530a, 678; New Providence 548 (17—12160 mg Cl/l).

f. **michauxii** (A. Braun) H. et J. Groves 1911, p. 42; Zaneveld 1941, p. 144—145.

Plants large. Anterior and lateral pairs of bract-cells short, shorter than the ripe oogonium, posterior bract-cells papilliform. Branchlets 9—14, composed of 9—12 articulations of which the lowest and ultimate ones are ecorticate. Stem hairs few, very short. Oogonia not produced at the lowest node.

Distribution: Haiti, U.S.A., Venezuela, Cuba, Jamaica, St. Domingo, Antilles (Margarita, Curaçao).

Localities: Margarita 13, Curaçao 390, Paraguaná 108 (50—725 mg Cl/l).

Fig. 12. *Netherlands Antilles*, with neighbouring islands and part of the South American continent.

Literature cited

ALLEN, T. F., The Characeae of America; New York, 1880—1896.
——, Three new Charas from California — Bull. Torrey Bot. Club, 27, 1900, p. 299—304.
BISWAS, K., Common fresh and brackish water algal flora of India and Burma — Rec. Bot. Surv. India, 15, 1949, p. 1—169.
BLUM, J. R., New species of Spirogyra — Am. Journ. Bot., 30, 1943, p. 782—783.
BORGE, O., Australische Süswasserchlorophyceen — Bih. Kgl. Sv. Vet. Ak. Handl., 22, afd. III (9), 1896, p. 1—32.
—— & PASCHER, A., In Pascher, Süsswasserfl. Deutschl., Oesterr. und der Schweiz, 9, 1913.
——, Die von Dr. A. Löfgren in São Paulo gesammelten Süsswasseralgen — Arkiv. f. Bot., 15 (13), 1918, p. 9—108.
——, Die von Dr. F. C. Hoehne während der Expedition Roosevelt-Rondon gesammelten Süsswasseralgen — Arkiv. f. Bot., 19 (17), 1925, p. 1—56.
BRAUN, A. & NORDSTEDT, O., Fragmente einer Monographie der Characeen — Abh. Kön. Ak. Wiss. Berlin, 1882, 1—211.
BRITTON, M. E. & MILLSPAUGH, C. F., The Bahama Flora; New York, 1920.
—— & SMITH, B. H., A new species of Spirogyra — Ohio Journ. Sci., 42, 1942, p. 70.
CEDERCREUTZ, C., Spirogyra fluviatilis Hilse, neu für Finnland — Mem. Soc. Fauna et Flora Fenn., 6, 1930, p. 131—132.
CHODAT, R., Algues pélagiques nouvelles — Bull. Herb. Boissier, 5, 1897, p. 119—120.
COLLINS, F. S., The green algae of North America — Tufts Coll. Stud., 2 (3), 1909, p. 79—480.
CROASDALE, H. T., The freshwater algae of Woods Hole, Massachusetts — Diss., Contr. Bot. Lab. and Morris Arbor. Univ. Pennsylvania, 1935, 1—134.
CZURDA, V., Zygnemales in Pascher, Süsswasserfl. Mitteleuropas, 9, Aufl. 2, 1932,
DILLWYN, L. W., British Confervae; London, 1809.
DIXIT, S. C., The Chlorophyceae of the Bombay presidency, India — Proc. Ind. Ac. Sci., 5, sect. B. (1), 1937, p. 16—25.
FRÉMY, P., Algues d'eau douce et subaériennes des anciennes Antilles danoises — Mém. Soc. Sci. nat. math. Cherbourg, 48, 1938, p. 22—24.
——, Cyanophycées des Illes Bonaire, Curaçao et Aruba — Revue Algol., 12, 1941, p. 101—152.
FRITSCH, F. E. & STEPHENS, E., Contributions to our knowledge of the freshwater algae of Africa — Trans. Roy. Soc. South Afr., 9 (1), 1921, 1—72.
——, Contributions to our knowledge of the freshwater algae of Africa — Trans. Roy. Soc. South Afr., 18 (1), 1930, p. 1—123.
GAUTHIER-LIÈVRE, L., Recherches sur la flore des eaux continentales de l'Afrique du Nord — Soc. d'hist. nat. Afr. du Nord, Mém. hors série, 1931.
GEMEINHARDT, K., Oedogoniales in Rabenhorst, Kryptogamenfl. v. Deutschl., Oesterr. und der Schweiz, 12 (4), 1939.
GLASSMANN, S. F., List of non-vascular plants from Ponape, Caroline Islands — Am. Midl. Nat., 48, 1952, p. 735—740.
GROVES, H. & J., Characeae in Urban, Symbolae Antillanae, 7 (2), 1911, p. 30—44.
HASSLOW, O. J., Einige Characeenbestimmungen III — Bot. Notiser, 1940, p. 287—288.
HAZEN, F. E., The Ulotrichaceae and Chaetophoraceae of the United States — Mem. Torrey Bot. Club, 11, 1902, p. 135—250.
HEERING, W., Chlorophyceae 4 in Pascher, Süsswasserfl. Deutschl., Oesterr. und der Schweiz, 7, 1921.
HELSE, L., Exsicc. in Rabenhorst, Algen Europa's, no. 1476, 1863.
HIRN, K. E., Monographie und Ikonographie der Oedogoniaceen; Helsingfors, 1900.
HORN AF RANTZIEN, H., Charophyta reported from Latin America — Arkiv. f. Bot. Vet. Ak., ser. 2, 1, 1951, p. 355—411.
JAO, C. C., Studies on the freshwater algae of China I. Zygnemataceae from Szechwan — Sinensia, 6 (5), 1935, p. 551—645.
KRIEGER, H., Systematischer Teil in Kolkwitz und Krieger, Zygnemales in Rabenhorst, Kryptogamenfl. v. Deutschl., Oesterr. und der Schweiz 13, (2), 1941—1944.
KÜTZING, F. T., Phycologia Germanica; Nordhausen, 1845.
LEMMERMANN, E., BRUNNTHALER, J. & PASCHER, A., Chlorophyceae 2 in Pascher, Süsswasserfl. Deutschl., Oesterr. und der Schweiz, 5, 1915.

LINK, H. F., Epistola de algis aquaticis in genera disponendis; Bonn, 1820.
MEYEN, J., Reise um die Erde II, 1835.
NÄGELI, C., Gattungen einzelliger Algen; Zürich, 1849.
NORDSTEDT, O., De Algis aquea dulcis et de Characeis ex insulis Sandvicensibus a Sv. Berggren 1875 reportatis; Lund, 1878.
——, Einige Characeenbestimmungen — Hedwigia 27, 1888, p. 181—196.
——, De Algis et Characeis — Lunds Univ. Arsskr. 25, 1889, p. 1—41.
PRESCOTT, G. W., Algae of the Western Great Lakes Area — Bull. Cranbrook Inst. Sci. 31, 1951.
PRINTZ, H., Chlorophyceae in Engler-Prantl, Nat. Pflanzenfam., 3, Aufl. 2, 1927.
RAO, C. B., The Zygnemoideae of the central provinces of India I — Journ. Ind. Bot. Soc., 17, 1938, p. 341—353.
ROBINSON, C. B., The Characeae of North America — Bull. New York Bot. Garden, 4, 1906, p. 244—308.
SCHMIDLE, W., Über einige von Prof. Hansgirg in Vorderindien gesammelten Süsswasseralgen — Alg. Bot. Zeitschr., 6, 1900, p. 17—19, 33—35, 53—55, 77—79.
SKUJA, A., Vorarbeiten zu einer Algenflora von Lettland IV — Act. Hort. Bot. Univ. Latv., 3, 1928, p. 103—218.
——, Zur Süsswasseralgenflora Burmas — Nov. Act. Reg. Soc. Sci. Upsal., ser. 4, 14 (5), 1949, 1—188.
SMITH, G. M., The freshwater algae of the United States, ed. 2; New York, Toronto, London, 1950.
TAFT, C. E., Spirogyra hollandia, a new species from New Guinea — Ohio Journ. Sci., 47, 1947, p. 173.
TIFFANY, L. H., The Ogdogoniceae; Columbus, 1930.
—— & BRITTON, M. E., Freshwater Chlorophyceae and Xanthophyceae from Puerto Rico — Ohio Journ. Sci., 44, 1944, p. 39—50.
——, The algae of Illinois; Chicago, 1952.
TRANSEAU, E. N., New Species of green algae — Am. Journ. Bot., 1, 1914, p. 289—301.
——, Notes on Zygnemataceae — Ohio Journ. Sci., 34, 1934, p. 420.
——, The Zygnemataceae; Columbus, 1951.
——, TIFFANY, L. H., TAFT, L. E., LI, L. C., New species of Zygnemataceae — Trans. Am. Micr. Soc., 53, 1934, p. 208.
WAGENAAR HUMMELINCK, P., Description of the Localities — Studies on the Fauna of Curaçao, Aruba, Bonaire and the Venezuelan Islands, 2, 1940, p. 1—42. — See also: General Information, 1, p. 1—57.
——, Description of New Localities — Studies on the Fauna of Curaçao and other Caribbean Islands, 4, 1953, p. 1—108.
WALLMANN, J., Försök till en systematisk uppställning af väk familjen Characeae — Kgl. Sv. Akad. Handl. 1852, p. 230—331.
WEST, G. S. & FRITSCH, F. E., A treatise on the British freshwater algae; Cambridge, 1927.
WITTROCK, V. B., On the development and systematic arrangement of the Pithophoraceae; Uppsala, 1877.
——, Algae aquae dulcis exsiccatae, etc. — Bot. Notiser 1880, (4), p. 113—117.
WOLLE, F., Freshwater algae of the United States, Bethlehem, Pa., 1887.
ZANEVELD, J. S., The Charophyta of Malaysia and adjacent countries — Diss., 1941, Blumea, 4, (1), 1940, p. 1—224.
——, Some notes on Charophyta collected in the Netherlands West Indies, North Venezuela and Columbia — Rec. Trav. Bot. Néerl., 38, 1941, p. 141—146.