

Family I. Chroococcaceae, part 3

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Butler University
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Edited by

J. E. Potzger

The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana's vegetation in past decades. Authors were Butler faculty, current and former master's degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler's first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal's publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor's degrees and 75 master's degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner, included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master's students who made active contributions to the fields of botany and ecology include Dwight W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daudenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

Requests for use of materials, especially figures and tables for use in ecology text books, from the *Butler University Botanical Studies* continue to be granted. For more information, visit www.butler.edu/herbarium.

Chroococcus Weissii Boye Petersen, Bot. Icel. 2(2): 263. 1923. —Type from Bielatal in Bohemia (FC, L, UC).

Gloeocapsa palustris Nägeli ex Wille, Nyt Mag. Naturvid. 62: 195. 1925. —Type from Naumattweier, Switzerland (O).

Chroococcus turgidus var. *maximus* Nygaard, Vidensk. Medd. Dansk Naturh. Foren. Kjøbenhavn. 82: 201. 1926. —Type from the Kai islands, Indonesia (in the private collection of G. Nygaard).

Chroococcus giganteus var. *occidentalis* Gardner, Mem. New York Bot. Gard. 7: 8. 1927. *G. giganteus occidentalis* Gardner, New York Acad. Sci., Sci. Surv. Porto Rico 8: 255. 1932. —Type from Laguna Torruquero, Puerto Rico (NY). FIG. 106.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Chroococcus multicoloratus Wood, Proc. Amer. Philos. Soc. 11: 122. 1869.

Chroococcus turgidus var. *violaceus* West, Trans. Roy. Microsc. Soc. 1892: 741. 1892. *C. turgidus violaceus* West ex Gardner, New York Acad. Sci., Sci. Surv. Porto Rico 8: 256. 1932.

Gloeocapsa turgida f. *violacea* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 212. 1938. —G. S. West's sketch and notes in the British Museum (Natural History) are reproduced here: FIG. 107.

Chroococcus solitarius Eichler, Pflanzl. Fisyograf. 14(3): 134. 1896.

Chroococcus indicus Bernard, Protococc. & Desmid, d'Eau Douce, p. 47. 1908. *C. Bernardii* van Oye, Hedwigia 63: 177. 1921.

Chroococcus turgidus var. *japonicus* Bernard, Alg. Unicell. Récolt. dans Dom. Malais, p. 16. 1909.

Chroococcus turgidus var. *Pulloi* Bernard, Nova Guinea. Résult. de l'Exped. Sci. Néerl. Nouv.-Guinée en 1907 & 1909, 8(Bot. 2): 259. 1910.

Chroococcus turgidus var. *mipitanensis* Woloszynskia, Bull. Int. Acad. Sci. Cracovie, CI. Sci. Math. & Nat., ser. B, 1912: 692. 1913. *C. mipitanensis* Geitler in Pascher, Süswasserfl. 12: 79. 1925. *Gloeocapsa turgida* f. *mipitanensis* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 212. 1938.

Chroococcus turgidus var. *violaceus* f. *minor* Wille, Nyt Mag. Naturvid. 61: 76. 1924.

Chroococcus spelaus Ercegovic, Acta Bot. Inst. Bot. Univ. Zagreb. 1: 76. 1925.

Chroococcus spelaus var. *aeruginus* Ercegovic, Acta Bot. Inst. Bot. Univ. Zagreb. 1: 77. 1925.

Chroococcus spelaus var. *violaceus* Ercegovic, Acta Bot. Inst. Bot. Univ. Zagreb. 1: 77. 1925.

Chroococcus indicus var. *epiphyticus* Ghose, Journ. Burma Res. Soc. 16: 220. 1926.

Chroococcus quaternarius Zalesky, Rév. Gén. de Bot. 38: 33. 1926. *Gloeocapsa turgida* f. *quaternaria* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 212. 1938.

Chroococcus turgidus var. *solitarius* Ghose, Journ. Burma Res. Soc. 17(3): 245. 1927.

Synechococcus erythrus Beck-Mannagetta, Vestn. Král. Ces. Spolec. Nauk 1926: 17. 1927.

Chroococcus turgidus f. *minor* Wille, Deutsche Südpolar-Exped. 1901—03, 8: 415. 1928.

Chroococcus turgidus f. *lamellosus* Beck-Mannagetta, Lotos 77: 99. 1929.

Chroococcus turgidus f. *pallidus* Beck-Mannagetta, Lotos 77: 99. 1929.

Synechocystis sallensis Skuja, Acta Horti Bot. Univ. Latv. 4: 12. 1929.

Chroococcus luteolus Woronichin, Trav. Mus. Bot. Acad. Sci. U. R. S. 5: 443. 1932.

Chroococcus tenax var. *boeticus* Gonzalez Guerrero, Anal. Jard. Bot. Madrid 6: 242. 1946.

Chroococcus Muisii Gonzalez Guerrero, Anal. Jard. Bot. Madrid 7: 436. 1947.

Plantae aeruginosae, violaceae, roseae, vel olivaceae, praecipuius microscopicae 2—16-cellulares, cellulis in divisione binis truncato-hemisphaericis, aetate provecta truncato-globosis vel raro exacte sphaericis, diametro (8—)12—50 μ crassis, sine ordine (aut in seriebus eucapsoidis) per gelatinum vaginale distributis; gelatino vaginale hyalino (rarissime pallidi-luteo), tenue, homoganeo vel plus minusve lamellosum; protoplasmate aerugineo, violaceo, roseo, vel olivaceo, tenui- vel sparse grossi-granuloso. FIGS. 100—107.

In shallow fresh, brackish, and marine waters and in seepage, usually mixed with other algae; often encountered in the plankton. Macroscopic growth-forms of *Anacystis dimidiata* are rarely found; as a rule, a plant breaks in two before it reaches the 8-celled stage. Certain subaerial growths are reminiscent of and may be confused with enlarged cells of *Palmogloea protuberans* (Sm. & Sow.) Kütz. In marine collections, some cells may be suspected of originating from the super-

ficial layers of *Entophysalis densta*. Where the gelatinous matrix hydrolyzes completely, the cells may resemble somewhat certain short growth-forms of *Coccolobis aeruginosa*. The plants may become parasitized by chytridiaceous fungi.

Specimens examined:

NORWAY: ad Reiersdal in convalle Sättersdalen, O. Nordstedt, Jul. 1872 (as *Chroococcus surgidus* in Witttr. & Nordst., Alg. Exs. no. 100, FC, L). SWEDEN: in Lapponia Lulensi in alpe Njummats prope Quivikkjokk, G. Lagerheim, 5 Aug. 1883 (as *C. surgidus* in Witttr. & Nordst., Alg. Exs. no. 699, FC, L, S); Djurö, Uplandia, O. Borge, Jun. 1909 (S, TA); Möja, Uplandia, Borge, Aug. 1934 (S); Tjörnaus, Scania, Borge, May 1893 (S); Naturvetenskap. Station, Trane Lappmark, Borge, Jul. 1909 (S); Vaddö, O. P. Anderson, Jul. 1889 (S); in arena regionis littoralis ad Kristineberg Babusiæ, Lagerheim, Aug. 1882 (Type of *C. surgidus* var. *Hookeri* Lagerb., with *Holopodium subulicola* in Witttr., Nordst., & Lagerh., Alg. Exs. no. 1549, S; isotype, L [Fig. 102]). POLAND: Silesia: zwischen Sphagnum im "Moosbruch" bei Reibwiesen, J. Nave, Jul. 1861 (as *Chroococcus chalybeus* in Rabenh. Alg. no. 1144b, FC, FH, L, S); Ost-Schlesien, Nave (NY); Kochschlucht unterhalb des Kochelfalles im Riesengebirge, G. Hieronymus, Aug. 1889 (designated as Type of *C. surgidus* var. *tenax* Kirchb., as *C. tenax* in Hauck & Richt., Phyk. Univ. no. 549, W; isotypes, FH, L, NY, UC); Wasserflächen auf der weissen Wiese bei der Wiesenbaude im Riesengebirge, Hieronymus, Aug. 1887 (as *C. surgidus* var. *chalybeus* in Hauck & Richt., Phyk. Univ. no. 145, L), Hieronymus 751, Sept. 1887 (MICH); Wittgenauer Berge bei Grünberg, Grätzbergwiese auf Oebelhermsdorf zu, B. Schröder, Aug. 1890 (as *C. surgidus* var. *dimidiatus* in Hauck & Richt., Phyk. Univ. nn. 482, L, UC). GERMANY: Baden: im Hällenthal bei Freiburg im Breisgau, A. Braun, Sept. 1847 (Type of *Protococcus surgidus* Kütz. and β *fusciscens* Kütz., L [Fig. 100]); an feuchten, scharigen Felsen des Hirschsprunges im Hällenthal bei Freiburg im Breisgau, G. Schmidle, Aug. 1896 (Type of *Chroococcus intignis* Schmidle, ZT [Fig. 101]). Bavaria: prope Nürnberg, J. Kaulfuss, Jun. 1902 (S). Brandenburg: Torfsümpfe des Grunewaldes, P. Hennings, Jul. 1892 (as *C. surgidus* in Henn., Phyk. March. no. 49, FH, L), Jun. 1899 (S). Hesse-Nassau: unter Claphofa, Frankfurt am Main, G. Presenius (as *C. surgidus* in Rabenh. Alg. Suppl. no. 104, FC, FH, L, UC). Saxony: am Schöneck, P. Richter (UC); in einem Sumpfe zwischen den Raunensteinen, Gerstnborger, Oct. 1860 (as *C. thermalis* in Rabenh. Alg. no. 1413, FC, L, NY); bei Wurzeln, 1858, in herb. O. Kuntze (NY); Schönfeld bei Leipzig, Averswald (PH); bei Dresden, Biene, Apr. 1862 (as *C. surgidus* in Rabenh. Alg. no. 1333, L, NY, UC); Eschdorf, Dresden, Richter, Aug. 1879 (S), Jul. 1880 (as *C. surgidus* in Witttr. & Nordst., Alg. Exs. no. 472, S); in einem Sumpf bei Leipzig, L. Rabenhorst (as *C. surgidus* var. *chalybeus* in Rabenh. Alg. no. 65, L, UC); Leipzig, O. Bulnheim, Dec. 1860 (as *Protococcus chalybeus* in Roumeuguère, Alg. de Fr. no. 335, L). Thuringia: an feuchten Felsen der Ludwigsklamm, Eisenach, W. Migula, 23 Jul. 1931 (S; as *Chroococcus surgidus* in Mig., Krypt. Germ., Austr., & Helv. Exs., Alg. no. 254, FC, TA); in dem Moor der Teufelskreise am Schneekopf, A. Röse (as *Pleurococcus angulosus* in Rabenh. Alg. no. 327, FC); Bruchberg, Römer (NY); Nordhausen, in einer Wasserflasche, P. T. Kützing (Type of *Trochiscia dimidiata* Kütz., L [Fig. 105]).

CZECHOSLOVAKIA: Moravia: in stagnierenden Buchten der Tess bei Winkelsdorf, Kolonati, Sept. 1861 (as *Chroococcus chalybeus* in Rabenh. Alg. no. 1144, FC, L, UC). Slovakia: in fossa turfosa ad lacum Csorber-See in Tatra alta, V. Wittrock, 25 Jul. 1885 (as *C. surgidus* in Witttr. & Nordst., Alg. Exs. no. 799, FC, D, L, S). Bobemia: im Bielathale an nassen Felswänden, L. Rabenhorst (cotype of *C. Waitii* Boye Petersten, as *Pleurococcus surgidus* in Rabenh. Alg. no. 104, FC, L, UC); Davle a údol. Libric, A. Hanzig, Jul. 1887 (FC, W); Ouzice, Hanzig, Oct. 1883 (FC, W); in rupibus madidis prope Stechowic, Hanzig (Type of *Chroococcus surgidus* var. *subnudus* Hansg. in Fl. Exs. Austro-Hung. no. 23981, W; isotypes, FC, FH, MIN, MO, S), Apr. 1887 (FC, W). AUSTRIA: Ötcher, Lower Austria, G. de Beck (FC, W); lacus prope Ossiach et St. Leonhard ad Villach, A. Hanzig, Sept. 1889 (FC, UC); an der Oberfläche eines Moores des Leiterbergs (Tyrol) im hohen Gesecke, Kolonati, Sept. 1861 (as *C. chalybeus* in Rabenh. Alg. no. 1144, FC, L, UC); Matrei, Hanzig, 1891 (FC, W). JUGOSLAVIA: ex caverna (Jeleaska Jarna), Franzdorf (Slovenia), Hanzig, Aug. 1889 (FC, W); Laak prope Steinbrück, Slovenia, Hanzig, Aug. 1890 (FC, W); Fasano prope Pisino, Itria, Hanzig, Jul. 1889 (FC, W); lacus ad Boca-Niazzo prope Zaram, Hanzig, Aug. 1888 (FC, W). TRIESTE: in Salinen zwischen Capodistria und Zaule, Hanzig, Aug. 1889 (Type of *C. surgidus* var. *submarinus* Hansg., W; isotype, FC [Fig. 104]). SWITZERLAND: [Naumattweier, K. von Nägeli, Aug. 1948] (Type of *Gloeoapsis palustris* Näg. in the slide collection of N. Wille, O); am nördlichen Ufer des Katzensees, Zürich, C. Cramer & C. von Brügger, Jun. 1862 (as *Chroococcus surgidus* in Rabenh. Alg. no. 1444, UC). ITALY: Monfalcone, in aqua subsalsa, Hanzig, Aug. 1889 (FC, W); S. Margarita prope Ala, Hanzig, 1891 (FC, W); Abano, herb. Meneghini (Type of *Pleurococcus thermalis* Menegb., FI); therm. Egan., Meneghini (L. S, UC, W); S. Pietro, herb. Meneghini (FI); dans les grottes de St. Avendrace, Cagliari, Sardinia, Marcucci, 1866 (as *Gloeoapsis polydermatica* in Marcucci, Un. Itin. Crypt. no. XXVIII, FC).

BRITISH ISLES: on mosses, Scotland, herb. W. Joshua (FC); Bowness, Westmorland, W. West, Sept. 14 (Type of *Chroococcus giganteus* West, BIRM); Penzance, Cornwall, T. E. Hazen 3, 1 Aug. 1926 (FC, DA). NETHERLANDS: Friesland, W. P. R. Suringar 55, Jul. 1854 (L). FRANCE: flaques de marais tourbeux des environs de Falaise, Calvados, A. de Brébisson (as *C. surgidus* var. *dimidiatus* in Rabenh. Alg. no. 2033, FC); Falaise, de Brébisson (L, UC); dans les flaques des rochers élevés remplies d'eau salée, Le Croisic, G. Tbourat, Aug. 1873 (FC, FH, NY); flaques d'eau pluviale à Bercugnas (Pyénées Centrales), C. Pourcade (as *C. surgidus* in Roumequière, Alg. de Fr. no. 724, L). BRITISH TOGOLAND: Keta, G. W. Lawson A516, 30 Dec. 1952 (D). ANGOLA: ad rupes juxta rivum Coango, Golungo Alto, P. Welwitsch 5 (FC, UC), 139 (Type of *C. schizodermaticus* var. *radio-purpureus* W. & G. S. West, BM; isotype, BIRM), 140 (FC [Fig. 103], UC), May-Jun. 1856. BERMUDA: W. G. Parlow, Jan. 1900 (FH); Lovers lake, western St. Georges island, A. J. Bernatowicz 49-111, 1 Mar. 1949 (FC). LABRADOR: flaque d'eau sur un rocher de la toundra, Monts Torngat, col de Saglek, J. Rousseau 1097, Aug. 1951 (FC). NEW BRUNSWICK: brooklet, lower basin at falls, Grand Falls, H. Habeeb 10208, 10852, 2 Aug. 1947, 30 Sept. 1948 (FC, HA); pond, St. Anne, Madawaska county, Habeeb 11620, 22 Aug. 1950 (FC, HA); Island lake, 40—50 miles due south of Dalhousie, M. Le Messurier 2, Aug. 1953 (FC). MAINE: Ragged island, P. S. Collins 4858, Jul. 1903 (FH, NY). NEW HAMPSHIRE: on Sphagnum, bog pond, Lakewood, W. G. Parlow, Aug. 1917 (FH). MASSACHUSETTS: Salisbury Beach, Collins 1700, 1702, May 1890 (NY); rocks, Essex street, Saugus, Collins 1696, Jun. 1890 (NY); high ledge, Saugus, Collins 1560, Apr. 1890 (NY); Medford, Collins, May 1887 (NY); Cedar Swamp, Woods Hole, F. Drouot 1941, 13 Sept. 1936 (D); in tide pools near towa landing, Cutryhunk island, Gosnold, Drouot 2122, 3 Aug. 1937 (D, DT, FH, NY, S); in Sheep pond, Nantucket island, B. P. D. Runk, R. N. Webster, & F. Drouot 2236, 24 Jul. 1938 (D, FH, NY); in a brackish swamp (Chara pond) near Oyster pond, Falmouth, Drouot, R. Patrick, & C. Hodge 3564, 16 Jul. 1940 (FC); in Sphagnum, Lost pond, Brookline, C. Bullard, 14 Jul. 1910 (as *C. surgidus* var. *chalybeus* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1701, FC, L, TA, UC). RHODE ISLAND: tide-pool near Eastons point, Newport, Collins, Apr. 1898 (NY). CONNECTICUT: brackish ditches, Eastern point, Groton, W. A. Setchell, Jul. 1888 (UC).

QUEBEC: mousses d'un étang, embouchure de la Kogaluk, baie d'Hudson, J. Rousseau 208, 16 Jul. 1948 (FC); ruisseau de la toundra en fond humide d'une vallée suspendue, pic Rousseau dans les monts Orish, Rousseau 223, 398, Aug. 1949 (FC); Lac Tashwak, à la source de la rivière Kogaluk, 95 milles de la baie d'Hudson, Rousseau 591, 27 Jul. 1948 (FC); petit source tourbeuse au voisinage du Mt. Pyramid, Rousseau 823, 5 Aug. 1947 (FC); Lac Breñnen, Rawdon, Montcalm county, S. M. J. Endes 291, 29 Aug. 1941 (FC). NEW YORK: Bergen swamp, Genesee county, A. T. Hoiwick 222, 1949 (D); gorge below falls, Rensselaerville, M. S. Markle 1, 1 Jul. 1946 (FC). MARYLAND: Somerset county: marsh pool at Chance, P. W. Wolle & Drouot 2268, 22 Aug. 1938 (D, UC); marsh pool west of Ewell, Smiths island, Wolle & Drouot 2306, 26 Aug. 1938 (FC, D, PH); Tyleron, Smiths island, P. W. Wolle, 12 Aug. 1938 (FC); pools in the salt marsh south of Jenkins creek, Crisfield, Drouot & Wolle 3633, 3639, 3640, 23 Jul. 1940 (FC). VIRGINIA: wet rocks beside Cascades, Giles county, H. Silva 2787, 12 Jul. 1953 (FC, TENN); wet cliff by Moormans river in "Sugar Hollow", Albemarle county, J. C. Strickland 662, 6 Oct. 1940 (FC, ST); in ditch, Chincoteague island, Accomac county, L. C. Goldstein, E. S. Luitrell, & Strickland 1178, 7 Jun. 1942 (FC, ST). NORTH CAROLINA: Ocracoke, W. D. Hoyt, Aug. 1906 (NY); on rocks below Dry Falls, Highlands, Macon county, H. C. Bold H235, 29 Jun. 1939 (FC); outlet draining a salt marsh, Hatteras, Dare county, L. G. Williams 2a, 12 Jul. 1949 (FC); tidal flats, Cape Lookout near Beaufort, H. J. Humm & C. S. Nielsen 1797, 26 Aug. 1949 (FC, T). SOUTH CAROLINA: Walhalla tunnel, Walhalla, Oconee county, Bold H126a, H128, 12 June 1939 (FC). FLORIDA: Bivins Arm, Gainesville, M. A. Brannon 126, 7 Nov. 1942 (FC, PC); Marco island, Collier county, P. C. Standley 92809, 14 Mar. 1946 (FC); Starion 5 along Flamingo road, Everglades national park, Dade county, D. Bleke & R. Husko, 3 Feb. 1953 (FC, T); in a depression in sand dunes, shore of Apalachicola bay at the east end of John Gorrie causeway, west of Eastpoint, Franklin county, Drouot & C. S. Nielsen 10960, 16 Jan. 1949 (FC, T); on Ruppia, Hernando county, Brannon 559, 23 Oct. 1948 (FC, PC); region of Hendry Creek, about 10 miles south of Fort Myers, Lee county, Standley 73254, Mar. 1940 (FC); laboratory culture, Florida State University, Tallahassee, Nielsen 59, May 1948 (FC, T); with *Anacythis thermalis* in a brackish pond, Key West, M. A. Howe 1736, Nov. 1902 (FH, NY, UC); pools, Long key, Dry Tortugas, W. R. Taylor 21, 77, Jun. 1924 (TA); saline flats and drying pools, Big Pine key, Monroe county, E. P. Killip 41806, 43205, 22 Jan. 1952, 5 Apr. 1953 (FC, US).

OHIO: on moss and rock, Adams county, W. A. Daily 298, 300, 25 May 1940 (FC, DA); quarry pools, Kellys island, Erie county, C. E. Taft, 6 July 1938 (FC, DA); Eden park, Cincinnati, Daily 407, 3 July 1940 (FC, DA), P. K. Daily, 24 Aug. 1940 (FC, DA); "Seven Caves", Paint, Highland county, W. A. & P. K. Daily 322, 332, 334, 336, 16 June 1940 (FC, DA); sandstone, Old Mans Cave state park, Hocking county, W. A. & P. K. Daily 513, 527, 534, 535, 544, 548, 553, 27 July 1940 (DA, FC); Canewell Cliff state park, Hocking county, W. A. Daily 688, 693, 727, 731, Aug.-Sept. 1940 (DA, FC); in quarry, Junction City, Perry county, J. H. Hoskins & A. H. Blicke, 14 Oct. 1939 (DA, FC). KENTUCKY: sandstone, Natural Bridge state park, Powell county, W. A.

& P. K. Daily 372, 30 Jun. 1940 (DA, FC); sandstone, "Tight Holler" near Pine Ridge, Wolfe county, W. A. Daily, A. T. Cross, & J. Tucker 785, 6 Sept. 1940 (DA, FC); sandstone, Torrent, Wolfe county, W. A. & P. K. Daily & R. Kojanek 468, 470, 471, 475, 482, 484, 486, 493, 494, 14 Jul. 1940 (DA, FC). TENNESSEE: in lake, Hidden Lake, Davidson county, H. C. Bold 138b, 1 Oct. 1938 (FC); lily pool, Vanderbilt University, Nashville, Bold 10, 1937 (FC); wet limestone at entrance of Bellamy cave, Montgomery county, H. Silva 1405, 15 Jul. 1949 (FC, TENN); wet rocks etc., Ramsey Cascades, Sevier county, Silva 136, 2350b, Sept. 1941, 1950 (FC, TENN); Bold H352a, H353, 18 Jul. 1939 (FC). MICHIGAN: Livingston's Bog, Cheboygan county, A. H. Gustafson, 1937 (FC), H. K. Pbinney 2M40/2, 25 Jun. 1940 (FC, PHI); Mud lake, Douglas Lake region, Pbinney 515, 8 Aug. 1943 (FC, PHI); pool, North Fishtrail bay, Douglas Lake, Pbinney 151, 31 Jul. 1942 (FC, PHI); stream near Twin Lakes on highway M28, Luce county, Pbinney 20M40/51, 27 Jul. 1940 (FC, PHI); Echo lake, Bois Blanc island, Mackinac county, Pbinney 35, 8 Jul. 1942 (FC, PHI). INDIANA: limestone, Clifty Falls state park, Madison, Jefferson county, W. A. & P. K. Daily 675, 676, 4 Aug. 1940 (DA, FC); Daniels lake 5 miles southeast of North Webster, Kosciusko county, P. K. & W. A. Daily 2265, 26 Jul. 1950 (DA, FC); Hawk's marsh, Lake Maxinkuckee, Marshall county, H. W. Clark & B. W. Evermann 14, 41, 13 Aug. 1906 (FC, US); sandstone, Shades state park, Waveland, Montgomery county, F. K. & W. A. Daily 969, 6 Jun. 1942 (DA, FC); Genian lake 6 miles north of Angola, Steuben county, P. K. & W. A. Daily 2672, 24 Aug. 1953 (DA, FC); pond, Glenn Home, Vigo county, B. H. Smith 101, 3 Jul. 1929 (DA, FC); pond, Spring Hill, Vigo county, Smith 136, 18 Jul. 1929 (DA, FC); Richmond, L. J. King 131, 201, 371, Sept., Nov. 1940 (EAR, FC).

WISCONSIN: laboratory culture, University of Wisconsin, Madison, R. Evans, 6 Jun. 1949 (FC); bogs near Woodruff, Oneida county, and Sand Lake, Vilas county, G. W. Prescott 2W173, 3W279, 4 Jul. 1937, 2 Sept. 1938 (FC). ILLINOIS: Honey lake northeast of Barrington, in Lake county, P. C. Standley 92448, 29 Jul. 1945 (FC); salt marsh along creek, Illinois river bottoms 4 miles east of Starved Rock, La Salle county, J. A. Stoyermark & Standley 40632, 4 Jul. 1941 (FC); in swamp in the abandoned quarry at Stony Island avenue and 94th street, Chicago, Drouet & H. & J. Rubinstein 5798, 23 Aug. 1947 (FC). MISSISSIPPI: in seepage, south shore of Back bay between Keester Field and d'Iberville bridge, Biloxi, Drouet 10012, 15 Dec. 1948 (FC). MINNESOTA: Itasca state park, K. C. Pan 10395, 24 Jun. 1954 (D). IOWA: culture from the alkaline fen at Silver Lake, J. D. Dodd, 3 Jul. 1953 (FC). MISSOURI: in a jar of water in the greenhouse, University of Missouri, Columbia, Drouet 292, 24 Nov. 1928 (D); in salt water about the springs, Chouteau Springs, Cooper county, Drouet & H. B. Louderback 3648a, 25 Aug. 1945 (FC). LOUISIANA: in pools and shallow water, north shore of Lake Charles, Lake Charles, Drouet 8754, 8766, 28 Oct. 1948 (FC). NEBRASKA: shallow water, sandpit lakes, Fremont, Dodge county, W. Kiener 14637, 23 Jul. 1943 (FC, KI); cultures from floodplain pond southeast of Grand Island, Kiener 1636a,b, Apr., Jul. 1944 (FC, KI); culture from Lake McConaughy, Ogallala, Keich county, Kiener 23020a, 20 Aug. 1948 (FC, KI); drainage ditch, Kingsley dam, Ogallala, Kiener 24079, 31 Jul. 1948 (FC, KI); swampy bank of Whitehorse creek 5 miles north of North Platte, Kiener 17504, 1 Sept. 1944 (FC, KI). TEXAS: limestone grotto near Blowout, Blanco county, P. B. Plummer & P. A. Barkley 200, 20 Jun. 1943 (FC, TEX); Tornillo creek about 1 mile north of Hot Springs, Brewster county, E. Whitehouse 24640, 24 Dec. 1950 (FC); in ditch, municipal water plant, Brownsville, R. Runyon 3917a, 17 Jan. 1945 (FC); in seepage below sewage-disposal lake at Camp Berkeley, Taylor county, W. L. Tolstead 7351, 29 Jan. 1944 (FC); pool, Austin, F. A. Barkley 44alg22, 22 Jul. 1944 (FC), TEX). MONTANA: spring, Stillwater county, P. H. Ross 4029, 4056, Sept. 1940 (FC), COLORADO: siliceous ledge, South Colony creek, Custer county, W. Kiener 10393, 9 Jul. 1941 (FC, KI). UTAH: Steam Mill lake, Cache county, G. Piranian, 13 Aug. 1933 (FC); Zion canyon, Washington county, N. E. Gray 68, 13 Aug. 1941 (FC). ARIZONA: Cliff spring, north rim, Grand Canyon national park, Mohave county, Gray 53, Aug. 1941 (FC); in an irrigation pool on the campus, University of Arizona, Tucson, Drouet, D. Richards, D. M. Crooks, L. Benson, & R. Darrow 2783, 30 Oct. 1939 (FC). ALBERTA: in a warm pool below the main spring, Banff, H. M. Richards 6, 23 Aug. 1900 (FC, UC). NEVADA: in water, Sodaville, I. La Rivers 1792, 9 Jun. 1953 (FC); swamp 9 miles north of Glendale, Clark county, G. Piranian, 6 Apr. 1934 (FC). BRITISH COLUMBIA: with *Coccolithis aeruginosa* (Näg.) Dr. & Daily in wet moss near Glacier, W. R. Taylor 10, Aug. 1921 (FH). WASHINGTON: Whidbey island, W. A. Seitchell & N. L. Gardner 472 (UC).

CALIFORNIA: culture from an aerating tank, West Berkeley, Alameda county, N. L. Gardner 6743, 6 Oct. 1931 (FC, UC); campus, University of California, Berkeley, Gardner 3219, 3220, Jan. 1916 (UC); culture from soil on the University campus, Berkeley, Gardner 6758, 7 Jan. 1933 (FC, UC); water culture, botanical laboratory, University of California, Berkeley, N. L. Gardner, Jan. 1916 (as *Chroococcus turgidus* in Coll., Hold., & Seitch., Phyc. Bor.-Amer. no. 2202a, FC, L. MICH, TA), Mar. 1916 (as *C. turgidus* in Coll., Hold., & Seitch., Phyc. Bor.-Amer. no. 2202b, FC, D, L, MICH, TA); banks of Bear creek, Colusa county, J. P. Macbride & H. L. Mason 8018, 29 Sept. 1946 (FC); in stagnant water, Keough hot springs, Inyo county, M. J. Groesbeck 399, 7 Jul. 1941 (FC); stream in Gnome's Workshop, Death Valley, Inyo county, Groesbeck 215, 12 Oct. 1940 (FC); in rapid spring, Furnace creek wash, Death Valley national monument, Groesbeck 298,

1 Jan. 1941 (FC); first spring south of Triangle spring, Death Valley, J. & H. W. Grinnell 7626, 24 Oct. 1933 (FC, UC); Lagunitas Creek, Marin county, V. Duran 6604c, Jan. 1931 (FC, UC); laboratory culture from Marin county collected by H. E. Parks, Gardner 6386, 6387, 15 Jan. 1931 (FC, UC); in Benton's hot spring near Partzwick, in the northern part of Owen's valley, Mono county, Mrs. Partz, Aug. 1866 (Type of *Chroococcus isermophilus* Wood, PH; isotype, FC); hot springs on side of mountain, Bridgeport, Mono county, Groesbeck 46, 5 Apr. 1940 (FC); large warm pool in the travertine quarry, Bridgeport, Groesbeck 101, 16 Jun. 1940 (FC); culture (from R. Hecker), Hopkins Marine Station, Pacific Grove, M. B. Allen, 29 Jan. 1952 (FC); culture from the geyser, Calistoga, Napa county, Gardner 7247, 20 Apr. 1933 (FC, UC); in rock pools, Laguna, Orange county, Gardner, 27 Nov. 1908 (as *C. surgidus* var. *submarinus* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1551, FC, L, TA); salt marsh and brackish water west of Newport Beach, Orange county, G. J. Hollenberg 1361, 1625, 16 Aug. 1934 (FC); Waterman hot springs, San Bernardino county, W. A. Setchell 1554a, 19 Dec. 1896 (FC, UC); culture from Plath's greenhouse, San Francisco, Gardner 6964, 20 Apr. 1933 (FC, UC); in seepage on a cliff in the canyon of the Sacramento river, Dunsmuir, Siskiyou county, Drouet & D. Richards 4215, 15 Sept. 1941 (FC); in shallow water of the Tule river, Porterville, Tulare county, Drouet & Groesbeck 4449, 4 Oct. 1941 (FC).

BAHAMA ISLANDS: aquarium in Lerner Laboratory, Bimini, H. J. Humm 3a, 4 Apr. 1948 (FC); freshwater lake off Stafford creek, Andros, A. D. Pegg, 22 Aug. 1942 (FC). PUERTO RICO: in Laguna Tortugero, N. Wille 829e (NY), 849b (Type of *Chroococcus giganteus* var. *occidentalis* Gardn., NY [Fig. 106]), Feb. 1915; on damp earth, Coamo Springs, Wille 288, 304, Jan. 1915 (NY). BRITISH WEST INDIES: Cockburn Harbor, South Caicos, M. A. Howe 5384, Dec. 1907 (D, FH); with *Johannesbaptistia pellucida* (Dick.) Taylor & Dr. in basins of salt works, Cockburn Harbor, South Caicos, Howe 5384b, Dec. 1907 (NY); Bath, Jamaica, C. E. Pease (NY); among various algae, Jamaica, C. E. Pease & E. Butler, Jul. 1900 (as *Chroococcus surgidus* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 571, FC, NY, TA). MEXICO: Sonora: on exposed soil on mountains south of Hermosillo, D. Richards, Drouet, & L. D. Alvarado 584, 2 Nov. 1939 (FC); backwaters of Rio de Sonora, Unión, Hermosillo, Drouet, Richards, & Alvarado 2840, 4 Nov. 1939 (FC). Drouet & Richards 3032a, 24 Nov. 1939 (FC); on tidal flat, Playa Miramar, Guaymas, Drouet & Richards 3123, 5 Dec. 1939 (FC); in a slightly brackish pool by railroad near the station, Empalme, Drouet & Richards 3413, 23 Dec. 1939 (FC). Yucatan: with *Chara Hornemannii*, Progreso, G. F. Gaumer (FC). GUATEMALA: in warm water of hot spring, Baños de San Lorenzo near Tejar, Dept. Sacatepéquez, P. C. Standley 59839a, 14 Dec. 1938 (FC); in springs near Tajumulco, Dept. San Marcos, J. A. Steyermark 36890, 36923, 28 Feb. 1940 (FC). COSTA RICA: in pool, Ojo de Agua, along Pan-American Highway near Cerro Las Vueltas, R. W. Holm & H. H. Iliis 1008, 26 Jul. 1949 (FC, MO). PANAMA: in north arm of Gigante bay, Gatun lake, Canal Zone, C. W. Dodge, 9 Aug. 1925 (D, MO).

VENEZUELA: edge of pond, summit of Mount Roraima, Bolívar, J. A. Steyermark 58915, 28 Sept. 1944 (FC); sides of bluff between Cerro San José and Cerro Peonia, Anzoátegui, Steyermark 61567, 20 Mar. 1945 (FC); hot springs near La Toma, southeast of Cumaná, Sucre, Steyermark 62858a, 21 May 1945 (FC). BRAZIL: Pará: on mud along creek in Bosque Rodriguez Alves, Belém, Drouet 1304, 8 Jul. 1935 (D); on water plants, Lagôa Agua Preta, Belém, Drouet 1531, 29 Jun. 1935 (D); in reservoir 1 km. northeast of Santa Izabel, east of Belém, S. Wright 1612, 10 Jul. 1935 (D). Ceará: in lake at Maracãoahú, Maranguape, Drouet 1416, 13 Sept. 1935 (D); in a pool in Rio Pacoty at Fortaleza—Recife road, Pacaruba, Drouet 1503, 24 Nov. 1935 (D); in pool below dam, Açude Boa Agua, Quixadá, Drouet 1404, 2 Sept. 1935 (D). ECUADOR: in an inland salt pool near Albemarle point, north end of Isabela island, Galapagos islands, W. R. Taylor 123, 12 Jan. 1934 (D, TA). PERU: Laguna Saraja, Dept. Ica, A. Maldonado 93a, Feb. 1942 (FC); Cuistalima, Lago Chilca, Maldonado 65a, Jan. 1942 (FC); Las Delicias, Trujillo, N. Ibañez H. "I", 18 May 1952 (FC).

HAWAIIAN ISLANDS: in paludibus montis Mauna Koa, Hawaii, S. Berggren, 1875 (as *C. surgidus* in Witt. & Nordst., Alg. Exs. no. 250, S). MARSHALL ISLANDS: on outer reef and in channel, Amen island, Bikini atoll, R. P. Palumbo Y28, 27 Jul. 1949 (FC); water in bottom of bomb-crater, Utirik island, Utirik atoll, D. P. Rogers 1480, 2 Sept. 1946 (FC, NY); Igurin island, Eniwetok atoll, W. R. Taylor 46-316, 22 May 1946 (FC, MICH). SOCIETY ISLANDS: moist rocks, cliffs near Hnau, Tahiti, W. A. Setchell & H. E. Parks 5119, 5 Jun. 1922 (FC, UC). GILBERT ISLANDS: freshwater pit and brackish water pool, Norti island, Onorua, E. T. Moul 8166, 8346, Jul., Aug. 1951 (FC); in rare pit, southern fish-ponds of Nikunau, Mrs. R. Catala 18a, Jul. 1951 (FC). PHILIPPINES: embankment of stream at San Isidro, Puerto Galera, Mindoro, G. T. Velasquez 952, 23 Apr. 1941 (FC); Big Balatero, Puerto Galera, Mindoro, Velasquez 10, 6 May 1953 (FC, PUH); from Mr. Vincent's yard, Jolo, Sulu archipelago, Velasquez 3252, 22 May 1952 (FC, FUH). INDONESIA: kleine poel ten noorden van Kampong Gersik Poetib, Madoera island, L. G. M. Baas-Becking, Aug. 1936 (L); plankton of Lake Ohoitiel, Kai islands, H. Jensen & D. Hagerup, 1922 (Type of *Chroococcus surgidus* var. *maximus* Nygaard, in the private slide collection of G. Nygaard). CHINA: Lungchi bridges, Nanzhechwan, Szechwan, H. Chu 716, 7 Aug. 1945 (FC).

6. *ANACYSTIS AERUGINOSA* Drouet & Daily, *Lloydia* 11: 77. 1948. *Palmogloea aeruginosa* Zanardini, Mem. R. Ist. Veneto 17: 162. 1872. *Gloeocapsa Zanardinii* Hauck, Oesterr. Bot. Zeitschr. 27: 230. 1877. *Aphanocapsa Zanardinii* Hansgirg, Oesterr. Bot. Zeitschr. 39: 6. 1889. —Type from Sarawak (FI). FIG. 110.

Chroococcus Raspaigellae Hauck, Hedwigia 27: 16. 1888. *Aphanocapsa Raspaigellae* Frémy in Feldmann, Arch. de Zool. Exp. & Gén. 75 (Jubelaire, Fasc. 25): 389. 1933. —Type from Zaule, Trieste (L). FIG. 112.

Chroococcus smaragdinus Hauck, Hedwigia 27: 15. 1888. *Aphanocapsa smaragdina* Hansgirg, Oesterr. Bot. Zeitschr. 39: 6. 1889. —Type from Isola, Trieste (L). FIG. 108.

Aphanocapsa Howei Collins in Britton & Millspaugh, Bahama Fl., p. 618. 1920. —Type from Watling island, Bahama islands (NY). FIG. 109.

Aphanocapsa Feldmannii Frémy in Feldmann, Arch. de Zool. Exp. & Gén. 75 (Jubelaire, Fasc. 25): 395. 1933. —Type from Banyuls sur Mer, France (NY). FIG. 113.

Aphanocapsa sasciacensis Frémy, Bull. Mus. d'Hist. Nat. Paris 34: 383. 1928. —Type from Chausey islands, France (NY). FIG. 111.

Chroococcus sonorensis Drouet & Daily, Field Mus. Bot. Ser. 20: 127. 1942. —Type from Guaymas, Mexico (FC).

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Coelosphæriopsis halophila Lemmermann, Abh. Nar. Ver. Bremen 16: 353. 1899. *Coelosphærium halophilum* Geitler in Pascher, Süswasserfl. 12: 102. 1925.

Gloeocapsa endocodia Vouk, Rad Jugoslav. Akad. Znan. i Umjetn. Zagreb, Mat.-Prirod. Razr., 254(79): 6. 1936.

Plantae pallide aeruginosae, roseae, violaceae, vel decoloratae, primum microscopicae demum bullosae ad plura centimetra crassae, cellulisi in divisione binis depresso—sub-sphaericis, aetate protracta globosis diametro 6—12 (aut minoribus) μ crassis, sine ordine aut in seriebus eucapsoidis per gelatinum vaginale distributis; gelatino vaginale hyalino, homoganeo nonnumquam indistincte lamelloso, evidenter limitato vel (saepe omnino) diffulente; protoplasmate pallide aerugineo, roseo, vel violaceo, homoganeo vel sparse tenui-granuloso. FIGS. 108—113.

In brackish and more or less quiet marine waters, often forming gelatinous masses on rocks, wood, larger plants, and attached animals. Plants from deeper waters are usually more roseate in color than those developing near the surface. Young microscopic plants are often very similar to growth forms of *Anacystis thermalis*. In some cases where the plants grow as strata on rocks or other algae, the plants look as if they might have been produced by the hydrolyzation of the superficial layers of *Entophysalis deusta* or *E. conferta*.

Specimens examined:

JUGOSLAVIA: in Meere an Steinen, Parenzo, Istrien, P. Hauck, Sept. 1875 (L). TRIESTE: Zaule, [C von Marchesetti] (Type of *Chroococcus? Raspaigellae* Hauck, L [Fig. 112]); in der Rindenschichte von *Raspaigella brunnea* O. Schm. bei Zaule, A. Valle, Aug. 1887 (as *C. Raspaigellae* in Hauck & Richt., Phyk. Univ. no. 242, D, L, MIN); Isola, Hauck, Sept. 1887 (Type of *C. smaragdinus* Hauck, L). NETHERLANDS: along the Krabbekreek northwest of Oud-Vossemer, isle of Tholen, Zeeland, W. G. Boelsink 99, 11 Jul. 1952 (FC, L). FRANCE: Iles Chausey, P. Frémy, 25 Aug. 1926 (Type of *Aphanocapsa sasciacensis* Frémy, NY [Fig. 111]); dans une mare littorale, Ile aux Oiseaux, Iles Chausey, Frémy, Aug. 1926 (isotypes of *A. sasciacensis* Frémy in Hamel, Alg. de Fr. no. 56, FC, MICH); dans l'éponge *Hircinia variabilis* O. Schm., Banyuls-sur-Mer, Pyrénées Orientales, J. Feldmann (Type of *A. Feldmannii* Frémy, NY [Fig. 113]; isotype, S); Le Croisic, G. Thuret, Aug. 1873 (FC, FH); St. Malo, E. Bornet, 7 Aug. 1872 (NY); pointe de Querveville, Manche, Thuret, 2 Aug. 1856 (FH, L); sur les Cladophorae à haute mer, Cherbourg, Bornet, 2 Aug. 1856 (FH, NY); ad Cladophoras marinas parasitica, Cherbourg, Thuret, 2 Aug. 1856 (D, L, S, YU). BELGIAN CONGO: gelatinous crusts in salt water, J. J. Symoens 440 (FC). BERMUDA: on Penicillus in shallow water, Mangrove lake, Hamilton island, A. J. Bernotowicz 50-168, 17 Nov. 1950 (FC). MAINE: on Rhodymenia, Cape Rosier, Hancock county, P. S. Collins 3 (FH); Kennebunkport, Collins, Jul. 1883 (NY); on Rhodymenia, Spectacle island, Penobscot bay, Collins

2990, 2 Sept. 1895 (NY, UC). MASSACHUSETTS: on *Zostera*, East Falmouth, Collins 4, Jul. 1882 (FH); on *Zostera*, Little Harbor, Woods Hole, W. Trelease, 1 Aug. 1881 (FC, NY); rocks, entrance of Hadley Harbor, Naushon island, W. R. Taylor, 11 Jul. 1931 (D, TA); Menaubant, Collins, Jul. 1882 (NY), G. W. Perry, Aug. 1882 (NY); Eastham, Collins 6118, Sept. 1909 (NY); Gloucester, W. G. Farlow (MICH). RHODE ISLAND: Newport, Farlow (as *Polycystis pallida* in Parl., Anders., & Eaton, Alg. Am. Bot. Exs. no. 179, FC, FH, MICH, NY, UC). FLORIDA: Piney point, Tampa bay, Pinellas county, H. J. Humm 1, 2 Apr. 1946 (FC); Biscayne bay, Cutler, Dade county, Humm 11, 13 Jan. 1946 (FC); saline pool, southeast hammock, Big Pine key, Monroe county, E. P. Killip 42479, 7 Jan. 1953 (FC, US); 0.5 mile off Shell Point, Wakulla county, J. Morrill, 11 Sept. 1954 (D, T).

CALIFORNIA: San Diego, D. Cleveland 149 (FC); Pacific Beach, M. S. Snyder (UC); on Chaetomorpha, La Jolla, M. S. Snyder, 5 Nov. 1898 (as *Anacystis labens* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 2251, FC, NY, TA). BAHAMA ISLANDS: in 3 dm. of water in salt lake and the lagoon, Watling island, M. A. Howe 5091 (Type of *Aphanocapsa Howei* Coll., NY [Fig. 109]); isotypes, D, UC), 5092, 5100, 25 Nov. 1907 (NY); Waterloo lake near Nassau, Howe 3068, Apr. 1904 (NY); bay bottom opposite Lyon's estate, Bimini island, H. J. Humm 26, 1 Apr. 1948 (FC); pilings, Lerner Laboratory pier, Bimini, Humm 20, 27 Mar. 1948 (FC). PUERTO RICO: on Halodule, Condado lagoon, San Juan, H. L. Blomquist 12109, 31 Oct. 1941 (FC). GUADELOUPE: Les Saintes, dragué entre Terre de Haut et l'île à Cabrit, J. Feldmann 3391 bis, Mar. 1936 (TA). MEXICO: in brackish water near the beach 4 km. east of Guaymas, Sonora, Drouet & D. Richards 3296 (FC), 3298 (Type of *Chroococcus sonorensis* Dr. & Daily, FC), 16 Dec. 1939. ECUADOR: in mangrove swamps on southeast side of Narborough island, Galapagos islands, J. T. Howell 575, 1 Jun. 1932 (FC, UC). SOCIETY ISLANDS: rocks in 1 foot of water, Tufachau, at southernmost tip of Meheua, M. L. Grant 4667, 4773, 15 Dec. 1930 (FC, UC). PHILIPPINES: on sponge, Puerto Princesa, Palawan, R. C. McGregor, Oct. 1925 (FC, UC); Tangalan and Small Balatero coves, Puerto Galera, Mindoro, G. T. Volasquez 1671, 1880, 5 May 1948, 11 May 1949 (FC, PUH). SARAWAK: [Tangion Datu] at Sargassa, E. Beccari (Type of *Palmogloea aeruginosa* Zanard., FI; isotype, I [Fig. 110]). INDONESIA: Saleyer, A. Weber-van Boisse 1149, Jan. 1889 (FC, I). AUSTRALIA: on rock near beach, Curl Curl near Sydney, V. May 1158, 1 Dec. 1945 (FC); culture, Marion bay, South Australia, L. G. M. Baas-Becking, Aug. 1937 (I).

7. ANACYSTIS THERMALIS (Menegh.) Dr. & Daily.

Plantae aeruginosae, olivaceae, luteolae, violaceae, vel roseae, praecipuus microscopicae, cellulisi in divisione binis depresso—sub-sphaericis (raro truncato-hemisphaericis), actate provecta globosis, diametro (4—)6—12 μ crassis, sine ordine vel in seriebus eucapsoides per gelatinum vaginale distributis; gelatino vaginale hyalino, homogenero vel lamelloso, firmo vel (saepae omnino) diffluente; protoplasmate aerugineo, olivaceo, luteolo, violaceo, vel roseo, homogenero vel granuloso. FIGS. 114—132.

Key to forms of *Anacystis thermalis*:

- Plants 1—8-celled, sheaths thin and often lamellose, protoplasm usually granular 7a. f. THERMALIS
- Plants 8—128-celled, the cells distributed in more or less cubical (eucapsoid) arrangement within the ample gelatinous matrix, protoplasm usually homogeneous 7b. f. MAJOR

7a. ANACYSTIS THERMALIS f. THERMALIS. *A. thermalis* Drouet & Daily, Butler Univ. Bot. Stud. 10: 221. 1952. *Trochiscia thermalis* Meneghini, Consp. Algol. Eugean., p. 334. 1837. *Protococcus nudus* Kützing, Phyc. Germ., p. 145. 1845. *Pleurococcus nudus* Rabenhorst, Fl. Eur. Algar. 3: 26. 1868. —Type from the Eugean springs, Italy (PC).

Pleurococcus membraninus Meneghini, Mem. R. Accad. Torino, ser. 2, 5 (Sci. Fis. & Mat.): 34. 1843. *Protococcus membraninus* Meneghini in Kützing, Tab. Phyc. 1: 5. 1846. *Chroococcus membraninus* Nägeli, Gatt. Einzell. Alg., p. 46. 1849. *Gloeocapsa membranina* Drouet & Daily in Habeeb & Drouet, Rhodora 50: 68. 1948. —Type from the Eugean springs, Italy (FI). FIG. 123.

Pleurococcus cohaerens Brébisson in Meneghini, Mem. R. Accad. Torino, ser. 2, 5 (Sci. Fis. & Mat.): 35. 1843. *Protococcus cohaerens* Kützling, Tab. Phyc. 1: 5. 1846. *Cbroococcus cohaerens* Nägeli, Gatt. Einzell. Alg., p. 46. 1849. *Gloeoapsis cohaerens* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 231. 1938. —Type from Falsaise, France (PC); cotypes from Euganean springs, Italy (L, UC). FIG. 125.

Protococcus rufescens Kützling, Tab. Phyc. 1: 9. 1846. *Pleurococcus rufescens* Brébisson *pro synonym.* in Kützling, loc. cit. 1846. *Chroococcus rufescens* Nägeli, Gatt. Einzell. Alg., p. 45. 1849. —Type from Arromanches, Calvados, France (PC).

Protococcus pallidus Nägeli in Kützling, Sp. Algar., p. 201. 1849. *Cbroococcus pallidus* Nägeli, Gatt. Einzell. Alg., p. 46. 1849. —Type from Zürich, Switzerland (L). FIG. 129.

Palmella testacea A. Braun in Kützling, Sp. Algar., p. 211. 1849. *Aphanocapsa testacea* Nägeli, Gatt. Einzell. Alg., p. 52. 1849. *Microcystis testacea* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 138. 1938. —Type from Freiburg im Breisgau, Germany (L). FIG. 127.

Cbroococcus belueticus Nägeli, Gatt. Einzell. Alg., p. 46. 1849. —Type from Lucerne, Switzerland (FC); paratype from Zürich named by the author (FC). FIG. 114.

Cbroococcus decoriticus A. Braun, Betracht. ü. d. Erscheinung d. Verjüngung i. d. Natur, p. 194. 1849—50. *Gloeoapsis decoriticus* Richter ex Wille, Nyt Mag. Naturvid. 62: 186. 1925. —Type from St. Aubin, Switzerland (L). FIG. 128.

Cbroococcus turgidus var. *rufescens* Wartmann in Rahenhorst, Alg. Sachs. 63 & 64: 631. 1857. —Type from Zürich, Switzerland (FC).

Cbroococcus virens Hantzsch in Rahenhorst, Alg. Sachs. 133 & 134: 1332. 1862. *C. minutus* var. *virens* Hansgirg, Prodr. Algenfl. Böhmen 2: 162. 1892. —Type from Dresden, Germany (L). FIG. 116.

Cbroococcus obliteratus Richter in Hauck & Richter, Phyk. Univ. 1: 41. 1886; Hedwigia 25: 215. 1886. *C. minutus* var. *obliteratus* Hansgirg, Prodr. Algenfl. Böhmen 2: 162. 1892. —Type from Leipzig, Germany (L).

Cbroococcus minutus var. *salinus* Hansgirg, Oesterr. Bot. Zeitschr. 36: 333. 1886. —Type from Ouzic, Bohemia (W). FIG. 118.

Aphanocapsa salinarum Hansgirg, Physiol. & Algol. Stud., p. 153. 1887. —Type from Ouzic, Bohemia (W). FIG. 118.

Cbroococcus membranatus var. *crassior* Hansgirg, Sitzungsber. K. Böhm. Ges. Wiss., Math.-Nat. Cl., 1891(1): 360. 1891. —Type from Tüffer, Slovenia, Jugoslavia (W). FIG. 126.

Cbroococcus belueticus var. *aureo-fuscus* Hansgirg, Prodr. Algenfl. Böhmen 2: 162. 1892. —Type from Slichov, Bohemia (W). FIG. 119.

Cbroococcus belueticus var. *aurantiofuscus* Hansgirg, Prodr. Algenfl. Böhmen 2: 162. 1892. —Type from Podmoran, Bohemia (W). FIG. 122.

Cbroococcus turgidus var. *glomeratus* Hansgirg, Sitzungsber. K. Böhm. Ges. Wiss., Math.-Nat. Cl., 1892: 154. 1893. —Type from Kufstein, Tyrol, Austria (W). FIG. 120.

Gloeoapsis calcarea Tilden, Minnesota Bot. Stud., ser. 2, 1: 29. 1898; Amer. Alg. 3: 299. 1898. —Type from Osceola, Wisconsin (MIN). FIG. 124.

Cbroococcus polyhedriformis Schmidle, Engler Bot. Jahrb. 30: 241. 1901. —Type from Lake Nyasa, Tanganyika (ZT).

Cbroococcus medicinis Gardner, Mem. New York Bot. Gard. 7: 6. 1927. —Type from Laguna Torruero, Puerto Rico (NY). FIG. 121.

Cbroococcus subsparsus Gardner, Mem. New York Bot. Gard. 7: 6. 1927. —Type from Coamo Springs, Puerto Rico (NY). FIG. 117.

Cbroococcus aeruginosus Gardner, Mem. New York Bot. Gard. 7: 7. 1927. —Type from Coamo Springs, Puerto Rico (NY).

Cbroococcus turgidus var. *uniformis* Gardner, Mem. New York Bot. Gard. 7: 7. 1927. *C. turgidus uniformis* Gardner, New York Acad. Sci., Sci. Surv. Puerto Rico 8: 256. 1932. —Type from Coamo Springs, Puerto Rico (NY).

Cbroococcus haenglois Gardner, Mem. New York Bot. Gard. 7: 9. 1927. —Type from Utuado, Puerto Rico (NY).

Gloeoapsis acervata Gardner, Mem. New York Bot. Gard. 7: 10. 1927. —Type from near Arecibo, Puerto Rico (NY).

Gloeoapsis ovalis Gardner, Mem. New York Bot. Gard. 7: 11. 1927. —Type from near Adjuntas, Puerto Rico (NY). FIG. 115.

Synechocystis crassa var. *major* Geider, Arch. f. Hydrobiol., Suppl. XII, Trop. Binnengewässer 4: 623. 1933. —Type from Tjurup, Sumatra, Indonesia (in the collection of L. Geider).

Cbroococcus schizodermaticus var. *incolatus* f. *paucisratosus* Geider ex J. de Toni, Diagn. Alg. Nov., I. Myxophyceae 9: 833. 1946. —Type from Kuripan, Java (in the collection of L. Geider).

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Cbroococcus rufescens var. *uricensis* Nägeli, Gatt. Einzell. Alg., p. 46. 1849. *C. rufescens* f.

uricensis Nägeli ex Rabenhorst, Fl. Eur. Algar. 2: 33. 1865. *C. uricensis* Hansgirg, Physiol. & Algol. Stud., p. 165. 1887. —Notes and sketches of this were found in the notebooks of Carl Nägeli in the Pflanzenphysiologisches Institut, Eidgenössische Technische Hochschule, Zürich.

Aphanobacca globosa Elenkin, Kamchatskaya Eksped. Fiod. Pavlov, Ryakushinskavo, Bot. 2: 151. 1914.

Chroococcus bataviae van Oye, Hedwigia 63: 177. 1921.

Chroococcus cumulatus Bachmann, Mitt. Naturf. Ges. Luzern 8: 11. 1921.

Chroococcus minutus var. *amelobystacens* Wille, Deutsche Südpolar-Exp. 1901—03, 8: 383. 1924. *C. minutus* var. *amelobystacens* Wille ex Geider, Rev. Algol. 2: 345. 1925.

Chroococcus helveticus var. *consociato-dispersus* Elenkin, Not. Syst. Inst. Crypt. Hort. Bot. Petropol. 2: 23. 1923. *Globocapsa minuta* f. *consociato-dispersa* Hollerbach in Elenkin, Monog. Algar. Cyanophyc., Pars Spec. 1: 233. 1938.

Chroococcus Scherffelianus Kol, Folia Crypt. Szeged 1: 614. 1928.

Myxosarcina chroococcoides Geider, Arch. f. Protistenk. 60: 443. 1928.

Chroococcus irregularis Huber-Pest., Verb. Int. Ver. Theor. & Ang. Limnol. 4: 366. 1929.

Synechocystis crassa Woroniczin, Bull. Jard. Bot. Princip. U. R. S. S. 28: 31. 1929.

Chroococcus liibophilus var. *rolae* Gonzalez Guettero, Anal. Jard. Bot. Madrid 8: 266. 1948.

Myxosarcina sphaerica Proschkina-Lavrenko, Akad. Nauk S. S. S. R. Otd. Sporovykh. Rost. Bot. Mater. 6: 72. 1950.

Plantae aerugineae, olivaceae, luteolae, violaceae, vel roseae, microscopicae vulgo 1—8-cellulares, cellulis in divisione binis depresso—sub-sphaericis (raro truncato-hemisphaericis), aetate provecta globosis diametro (4—)6—12 μ crassis, sine ordine per gelatinum vaginale distributis; gelatino vaginale hyalino, tenue, homoganeo vel lamelloso, firmo vel (etiam omnino) diffuente; protoplasmate aerugineo, olivaceo, luteolo, violaceo, vel roseo, plerumque (saepè grossi-) granuloso. FIGS. 114—129.

Among other algae in seepage and in shallow fresh water, rarely in brackish water. Macroscopic plants of *Anacystis thermalis* f. *thermalis* rarely develop. In brackish water, plants interpreted as of this form may appear to be derived from the superficial cells of *Entophysalis crustacea*.

Specimens examined:

NORWAY: Valdres, in rupibus ad Skogstad, N. Wille, 31 Jul. 1879 (D). SWEDEN: Mōja, Uppland. O. Borge, Aug. 1933 (S); in fossa turfosa ad Källstorp par. Holm in Dalia, V. Wistrock, 22 Aug. 1878 (as *Merismopodia glauca* in Witr. & Nordst., Alg. Exs. no. 300. FC); in aquaeductu ad Nacka prope Stockholmiam, Wille, 1884 (D). POLAND: Silesia: an einem eisernen Brunnenrotte in Wüstewaldersdorf, B. Schröder 9, 4 Aug. 1893 (S, UC). GERMANY: Baden: Freiburg, A. Braun, Oct. 1847 (Type of *Palmella ustacea* A. Br., L [Fig. 127]; isotypes, L, NY), May 1850 (NY); Karlsruhe, in einem mit Bachwasser angesetzten Kulturtopf, W. Migula, Oct. 1904 (as *Chroococcus minutus* in Mig., Crypt. Germ., Austr., & Helv. Exs., Alg. no. 84. MICH, TA); Badensweiler, Braun 26, Aug. 1848 (L), Saxony: auf Torfmoorschlamme, cultivirt (as *C. minutus* in Rabenh. Alg. no. 1214, FC, L, TA); Dresden, gesammelt im Aug. 1860, cultivirt bis jetzt, C. A. Hantzsch, May 1862 (Type of *C. viridescens* Hantzsch in Rabenh. Alg. no. 1332, L; isotypes, FH, NY [Fig. 116], UC); Schönfeld bei Dresden, P. Richter, Aug. 1876 (FC), Aug. 1877 (L), Aug. 1875 (as *C. viridescens* in Rabenh. Alg. no. 2533, FC, L, NY, S, TA, UC); Étangs, Richter (as *C. viridescens* in Roumequière, Alg. de Fr. no. 506, L); Leipzig, in einem flachen Teller, C. Werner, Sept. 1885 (Type of *C. obliteratus* Richt. in Hauck & Richt., Phyk. Univ. no. 41, L; isotypes, MICH, MIN). CZECHOSLOVAKIA: Bohemia: Arnaud, A. Hansgirg, Jul. 1885 (FC, W); Eichwald, Hansgirg, Jul. 1883 (FC, W); Mühle am Olafgrund im Riesengebirge, Hansgirg, Jul. 1884 (FC, W); in stagnis subsalsis prope Ouzic ad Kralup, Hansgirg (with *Gomphosphavria aponina* Kürz. in Kerner, Fl. Exs. Austro-Hung. no. 3600, MO); in seichrem Wasser und im Schlamm der Salzwassersümpfe bei Ouzic nächst Kralup, Hansgirg, Oct. 1883 (Types of *Aphanocapsa salinarum* Hansg. and *Chroococcus minutus* var. *salinus* Hansg., W; isotype, FC [Fig. 118]); auf feuchten Felsen bei Podmoraz, Hansgirg, Jun. 1885 (Type of *C. helveticus* var. *aurantiofuscescens* Hansg., W; isotype, FC [Fig. 122]); in parieibus subhumidis caldariorum horti botanici Pragae, Hansgirg, 1883 (as *C. aurantio-fuscescens* in Witr. & Nordst., Alg. Exs. no. 700, FC, L, S); Sáza, Hansgirg, Sept. 1885 (FC, W); Selc u Roztok, Hansgirg, Nov. 1886 (FC, W); in rupibus madiis prope Selc in agro Pragensi, Hansgirg (as *C. helveticus* in Kerner, Fl. Exs. Austro-Hung. no. 2397 1., FC, FH, L, MO, S); auf feuchten Felsen bei Slichow, Hansgirg, May 1885 (Type of *C. helveticus* var. *auro-fuscescens* Hansg., W; isotype, FC [Fig. 119]); St. Prokop ad Tinonicum, Hansgirg, May 1885

(FC, W); skály pod Tetinem nad Berounkou, *Hansgirg*, Sept. 1888 (FC, W).

AUSTRIA: Lower Austria: in oppido Baden in receptaculo aquae salientis, *Stockmayer* (as *C. helveticus* in Kerner, Fl. Exs. Austro-Hung. no. 2397 II., FC, FH, L, MO, S); in lacu horri Bar. Dohlhoff in oppido Baden, *Stockmayer* (as *C. surgidus* f. *subnudus* in Kerner, Fl. Exs. Austro-Hung. no. 2398 II., FC, FH, L, MIN, S). Tyrol: im Längsee bei Kufstein, *Hansgirg*, 1891 (Type of *C. surgidus* var. *glomeratus* Hansg., W; isotype, FC [Fig. 120]). JUGOSLAVIA: Slovenia: Laak prope Steinbrück, *Hansgirg*, Aug. 1890 (FC, W); in Tüffet im Abflusse der warmen Quelle (im kleinen Wasserbasin), *Hansgirg*, Aug. 1890 (Type of *C. membraninus* var. *crassior* Hansg., W; isotype, FC [Fig. 126]); Veldes, *Hansgirg*, Sept. 1889 (FC, W); Podnart, *Hansgirg*, Aug. 1889 (FC, W). Istria: Fisinio, *Hansgirg*, Aug. 1889 (FC, W). Dalmatia: Spalatio, *Hansgirg*, Aug. 1889 (FC, W); ad caracram fluminis Kerkæ ad Scardonam, *Hansgirg*, Aug. 1888 (FC, W). SWITZERLAND: Luzern, an nassen Felsen, *K. von Nägeli*, Dec. 1847 (Type of *C. helveticus* Näg., FC; isotypes in Hauck & Richt., Phyk. Univ. no. 483, FH, L); in axis irrigatus prope Rehalp ad Zürich, *G. Winter*, Nov. 1878 (as *C. pallidus* in Witt. & Nordst., Alg. Exs. no. 400, FC, L, NY, S); auf feuchten Tuffelsen, St. Aubin am Neuchâtel See, *A. Braun* 114, 4 Sept. 1848 (Type of *C. decoricans* A. Br., L [Fig. 128]); an einem Brunnen bei Zürich, *Winter*, Aug. 1878 (S); an Felsen, Erlenhacher Tobel, Zürich, *Nägeli*, 10 Sept. 1848 (paratypes of *C. helveticus* Näg., FC [Fig. 114], FH); Zürich, *Nägeli* 304 (Type of *Protococcus pallidus* Näg. [= *Chroococcus pallidus* Näg.], L [Fig. 129]); isotype, UC); an feuchten Felsen bei Zürich, *Wartmann*, Jul. 1856 (Type of *C. surgidus* var. *rufescens* Warm., FC; isotypes, L, NY). ITALY: Görz, *A. Hansgirg*, 1891 (FC, W); in aquis thermalibus Thermae Euganeae, *Meneghini* (Type of *Trachiscia thormalis* Menegh., PC; isotype, L, idem (cotype of *Pleurococcus cohaerens* Bréb., L [Fig. 125]); in fossa del molino [therm. Euan.], *Meneghini*, Jun. 1838 (Type of *Pleurococcus membraninus* Menegh., FI [Fig. 123]; isotypes, L, S, UC).

NETHERLANDS: Drummenveel, Bergen, *A. Wöber-van Boisse* 102, Aug. 1885 (L). FRANCE: Calvados: Arramanches, *Brébisson* ex herb. Lenormand (Type of *Protococcus rufescens* Kütz., FC; isotype, UC); dans une cascade dans les Falaises près d'Arromanches, *A. de Brébisson* (as *P. rufescens* in Rabenh. Alg. no. 2034, FC); Bayeux, *de Brébisson* (S); Falaise, *de Brébisson* (Type of *Pleurococcus cohaerens* Bréb., PC; isotypes, FI, UC). Seine Inférieure: Falaises d'Eureac, *M. Gomont*, Jul. 1884 (FC). Basses Pyénées: sur la terrasse d'une maison, Guéthary, *C. Sauvageau*, May 1898 (FC). PORTUGAL: Oporto, *I. Newton*, 1887 (as *Aphanocapsa testacea* in Hauck & Richt., Phyk. Univ. no. 331, L). TUNISIA: Gafsa, *M. Sorpette* TL45, TL64, 15 Mar. 1948 (D). ALGERIA: Djendel, *F. Dabray*, May 1891 (NY). AZORES: in aqua fluente, *K. Boblin*, Aug. 1898 (as *Chroococcus membraninus* in Witt., Nordst., & Laget., Alg. Exs. no. 1538, L, NY). TANGANYIKA: an Gneissblöcken in der Nähe der Brandung, Langenburg am Nyassasee, *W. Goetze* 867, 23 Apr. 1899 (Type of *C. polyedriiformis* Schmidle, ZT).

ICELAND: in a hot spring, Uxahver, North Amt, *W. P. Palsson* 2, Jul. 1941 (FC). NEW BRUNSWICK: pools and ledges about the falls, Grand Falls, Victoria county, *H. Habeeb* 10264, 10380, 10671, 13455, Jul.—Aug., 1947—1948 (FC, HA); in lake 8 miles south of Grand Falls, *Habeeb* 11653, 22 June 1951 (FC, HA); Island lake, 40—50 miles due south of Dalhousie, *M. Le Masurier* 1, Aug. 1953 (FC). MASSACHUSETTS: on moss, Magnolia, *W. G. Parlow*, Sept. 1903 (FH). QUEBEC: sur roches, carrière d'Outremont, Mont-Royal, près Montréal, *C. Lamouisse* 104, 105, 109, 111, Sept. 1940 (FC). NEW YORK: incrustation on inside of spring barrel near the road culvert of Reed's Creek, Ontario county, *D. Hoskins* 49, 1944 (FC). VIRGINIA: on mud in drain on campus of Virginia Polytechnic Institute, Blacksburg, *A. B. Massey*, *E. S. Luttrell*, & *J. C. Strickland* 981, 15 Aug. 1941 (FC, ST). NORTH CAROLINA: in drippings from a wooden tank, Beaufort Chemical Corporation, Lenoxxville road, Beaufort, *H. J. Humm*, 25 May 1948 (FC); on wet rocks, Cullasaja gorge, Macon county, *H. C. Bold* FL157, 17 Jun. 1939 (FC); on wet rocks, Jackson county, *Bold* H33b, 7 May 1939 (FC). FLORIDA: Sand pond, Alachua county, *J. E. Davis* 19, 8 Oct. 1941 (FC, FC); on soil, Gainesville, *P. B. Smith* 37, 21 Jan. 1942 (FC, FC); Gainesville, *M. A. Brannon* 290, 305, Feb., Aug. 1945 (FC, FC); pond 4 miles west of Olustee, Baker county, *A. M. Scott* 102, 22 Oct. 1947 (FC); Hernando, Citrus county, *Brannon* 383, 20 Oct. 1946 (FC, FC); Marco island, Collier county, *P. C. Standley* 73391, 73529, 19 Mar. 1940 (FC), 92811, 14 Mar. 1946 (FC); salt meadow 20 miles southeast of Naples, Collier county, *J. A. Steyermark* 63165a, 10 Mar. 1946 (FC); wet sand in the greenhouse, Florida State University, Tallahassee, *P. Drouet* & *D. Crowson* 10453, 5 Jan. 1949 (FC, T); limestone canyon, Aspalaga on Apalachicola river, Liberty county, *C. S. Nielsen*, *G. C. Madison*, & *Crowson* 764, 12 Feb. 1949 (FC, T); floating in brackish pond, Key West, *M. A. Howe* 1736, Nov. 1902 (FH, NY); saline flats, east side of bay, Big Pine key, Monroe county, *E. P. Killip* 41807, 22 Jan. 1952 (FC, US); on flower pots, Orlando, *Brannon* 542, 606, May, Oct. 1948 (FC, FC).

OHIO: dripping cliff, Steam Furnace, Adams county, *M. Briston*, 11 Jun. 1937 (DA, FC); Sugar Creek Pond, Athens county, *A. H. Blickle* & *L. Mann* 50E, 22 May 1941 (DA, FC); water trough, the Flains, Athens county, *Blickle* & *M. Wright*, 10 Jul. 1941 (DA, FC); state hospital ponds, Athens, *Blickle*, 3 Oct. 1940 (DA, FC), and laboratory culture of the same, 1941 (DA, FC); on limestone, Clifton Gorge, Greene county, ex coll. *M. Britton*, 3 Apr. 1937 (DA, FC); Sharon woods, Sharonville, Hamilton county, *W. A. Daily* 307, 12 Jun. 1940 (DA, FC); Addyston pond, Hamilton county, *Daily* 163, 19 Oct. 1939 (DA, FC); reservoirs, Eden park, Cincinnati, *Daily* 412,

415, 3 Jul. 1940 (DA, FC); drain on university campus, Cincinnati, *Daily & R. Kosanke* 454, 11 Jul. 1940 (DA, FC); in quarry pool on Kellys island, Ottawa county, *C. E. Taft* 13, 6 Jul. 1938 (DA, FC); laboratory culture, Marietta College, Marietta, *L. Wulp* C41117, Nov. 1941 (FC); on sandstone in quarry near Constitution, Washington county, *H. Noland & P. K. & W. A. Daily* 897, 899—902, 11 Oct. 1941 (DA, FC). KENTUCKY: near Slade, Powell county, *A. T. Cross, J. Tucker, & W. A. Daily* 758, 5 Sept. 1940 (DA, FC); wet rock on U. S. highway 68 near Brooklyn Bridge, Woodford county, *B. B. McInteer* 1137, 1941 (DA, FC). TENNESSEE: ditch west of Clarksville, Montgomery county, *H. Sileo* 2080, 18 Mar. 1950 (FC, TENN). MICHIGAN: Little Lake Sixteen, Cheboygan county, *H. K. Phinney* 10M40/2, 13 Jul. 1941 (FC, PHI); bog on U. S. highway 2 south of Rudyard, Chippewa county, *Phinney* 30M41/5, 16 Aug. 1941 (FC, PHI); Sodon lake west of Bloomfield Hills, Oakland county, *S. A. Cain* C-1, 9 Dec. 1947 (FC). INDIANA: on limestone, Scenic Falls, Hartselle, Bartholomew county, *P. K. & W. A. Daily* 1043, 1045, 1047, 1048, 1052, 1058, 11 Oct. 1942 (DA, FC); Lake Shaffer dam, Monticello, Carroll county, *W. A. Daily* 872, 875, 30 Jul. 1941 (DA, FC); in seepage, Lake Freeman, Monticello, *P. K. & W. A. Daily* 889, 1 Jul. 1941 (DA, FC); floating in Lake Cicott near Logansport, Cass county, *P. K. & W. A. Daily* 1022, 10 Sept. 1942 (DA, FC); on wall of Lake McCoy dam near Greensburg, Decatur county, *P. K. & W. A. Daily* 1075, 11 Oct. 1942 (DA, FC); on limestone, North Vernon, Jennings county, *P. K. & W. A. Daily* 910, 1107, 23 May 1942 (DA, FC); on dam in Blue river at Edinburg, Johnson county, *P. K. & W. A. Daily* 1049, 11 Oct. 1942 (DA, FC); on floor in Pahuds greenhouse, Indianapolis, *P. K. & W. A. Daily* 1179, 20 May 1944 (DA, FC); plankton of White river near the sewage disposal plant, Indianapolis, *C. M. Palmer*, 16 Sept. 1931 (DA, FC); in a jar, Butler University, Indianapolis, *Palmer* 86, 17 Aug. 1926 (DA, FC); on limestone in a quarry south of Bloomington, Monroe county, *P. K. & W. A. Daily* 1009, 7 Sept. 1942 (DA, FC); gravel pit 3 miles north of Ade, Newton county, *P. K. & W. A. Daily* 2559, 28 Aug., 1951 (DA, FC); on limestone above falls in Echo canyon, McCormicks Creek state park, Owen county, *P. K. & W. A. Daily* 1817, 10 Aug. 1947 (DA, FC); Turkey Run state park, Parke county, *Palmer* 15, 20 May 1932 (DA, FC), *W. A. Daily* 1433, 11 May 1946 (DA, FC); on limestone in quarry near St. Paul, Shelby county, *P. K. & W. A. Daily* 1149, 1156, 3 Oct. 1943 (DA, FC); plankton of Lake Wehli, south of Germantown, Wayne county, *P. K. & W. A. Daily* 1461, 1468, 15 Jun. 1946 (DA, FC), *M. S. Markie & L. J. King* 739, 757, 7 Sept. 1942 (EAR, FC); on rocks and walls, Richmond, *L. J. King* 207, 1114, 1940—1943 (EAR, FC).

WISCONSIN: culture, University of Wisconsin, Madison, *R. Evans* B, 9 Dec. 1949 (FC); on boards where spring water drips, Osceola, *J. E. Tilden*, 15 Sept. 1897 (Type of *Gloeocephala calcarea* Tild., Amer. Alg. no. 299. MIN; isotypes, FC [Fig. 124], L). ILLINOIS: cultures, University of Chicago, Chicago, *P. D. Voth*, Dec. 1944, 27 Mar. 1945 (FC); Palos Park, Cook county, *L. J. King & J. O. Young*, Spring 1941 (FC); in seepage on spillway, Lake Glendale, Robbville recreational area in Shawnee national forest, Pope county, *H. K. Phinney* 973, 14 Jul. 1944 (FC, PHI). MINNESOTA: on moist wall in stone quarry near campus, University of Minnesota, Minneapolis, *G. Lilley*, 21 Nov. 1901 (as *Gloeocephala rupestris* in Tild., Amer. Alg. no. 599. FC); Elk spring, Itasca state park, *Drouet* 12185, 6 Jul. 1954 (D, MIN). MISSOURI: in a marianic spring, Kimmswick, Jefferson county, *J. A. Sieyermark*, 1 May 1934 (D); in an aquarium, William Jewell College, Liberty, Clay county, *C. J. Elmore*, 20 Feb. 1938 (D); in pond and pool, Thayer, Oregon county, *N. L. Gardner* 1406, 1410, Jul. 1904 (FC, UC); wet concrete about a spring, Chouteau Springs, Cooper county, *P. Drouet & H. B. Louderback* 5645, 25 Aug. 1945 (FC); sandstone cliffs, Mine La Motte, Madison county, *C. Russell* 36, Oct. 1899 (FC, UC). ARKANSAS: artificial lake, Crosssett, Ashley county, *M. Thomson* 234, 30 Jun. 1945 (FC). NEBRASKA: culture from pond in state park, Ravenna, Buffalo county, *W. Kiener* 20172b, 1 May 1946 (FC, KI); culture from sandpit north of David City, Butler county, *Kiener* 22391a, 10 Nov. 1947 (FC, KI); culture from rainwater basin, Schickley, Fillmore county, *Kiener* 22350a, 28 Oct. 1947 (FC, KI); culture from floodplain pond southeast of Grand Island, *Kiener* 16396b, 11 Jul. 1944 (FC, KI); cultures from spring, Lonergan creek, Lemoyne, Keith county, *Kiener* 23066—23068, 20 Aug. 1948 (FC, KI); culture from seepage, Blue creek north of Oshkosh, Garden county, *Kiener* 16218c, 4 Nov. 1945 (FC, KI); culture from Gimlet lake, Garden county, *Kiener* 16199c, 4 Nov. 1945 (FC, KI); culture from sandpit southwest of Phillips, Hamilton county, *Kiener* 17200c, 17 Sept. 1945 (FC, KI); culture from roadside ditch 9 miles east of North Platte, *Kiener* 16871, 13 Jul. 1944 (FC, KI); old gravel pit pond south of North Platte, *Kiener* 17957, 4 Nov. 1944 (FC, KI); culture from ice in cut-off pond, Platte river near Cedar Bluffs, Saunders county, *Kiener* 16373b,c, 16 Jul. 1944 (FC, KI). TEXAS: permanent pool, Austin, *F. A. Barkley* 44alg22, 25 Jul. 1944 (FC, TEX); creek, Austin, *B. C. Tharp*, 7 Oct. 1946 (FC, TEX); creek, Bastrop county, *Tharp*, 13 Oct. 1946 (FC, TEX); in water around bathhouse, Hot Springs, Big Bend national park, Brewster county, *E. Whitehouse* 19692, 19 Apr. 1948 (FC); in creek at sulphur well, Palmetto state park near Gonzales, *B. F. Plummer & Barkley* 1, 22 May 1943 (FC, TEX).

MONTANA: culture from flower pot saucer in greenhouse, Montana State University, Missoula, *Barkley* 4848, 14 Oct. 1940 (FC); in hot water, hot springs, Lo Lo, Missoula county, *D. Griffiths*, 17 Sept. 1898 (as *Cbroococcus varius* in Tild., Amer. Alg. no. 600. FC). WYOMING: on rocks, White Elephant Caves, and in lowestmost overflow of Cleopatra Terrace, Mammoth hot springs,

Yellowstone national park, W. A. Seebell 1978, 2008, 31 Aug. 1898 (FC, UC). NEW MEXICO: in hot springs, Montezuma (Hot Springs), San Miguel county, Drouet & D. Richards 2543, 2653, Oct. 1939 (FC); warm mineral spring, Jermez Springs, Sandoval county, A. A. Lindsey, 8 Jun. 1947 (FC). UTAH: in edge of pond from artesian well, Old Resort, Utah Lake, Utah county, E. Snow D26, 17 Aug. 1930 (FC, UC). ARIZONA: in a lily pool on campus of the University of Arizona, Tucson, Drouet, Richards, D. M. Crooks, L. Benson, & R. Darrow 2774, Oct. 1939 (FC). NEVADA: in cold pool, hot springs, Steamboat, Washoe county, M. J. Groesbeck 293, 25 Nov. 1940 (FC). WASHINGTON: scum on the ground in overflow from a warm spring, Olympic national park, W. B. Cooke, Aug. 1951 (FC); abandoned Epsom salt mine near Seattle, G. Anderson, 2 Jun. 1955 (D). OREGON: in "hot springs" near Madras, Crook county, L. E. Griffin, 23 Apr. 1939 (FC).

CALIFORNIA: edge of "the Lagoon", Niles, Alameda county, W. A. Seebell, 5 Nov. 1898 (as *Chroococcus membraninus* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1201, FC, L, TA); cultivated in the botanical laboratory, University of California, Berkeley, N. L. Gardner, May 1916 (as *C. helveticus* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 2201, FC, D), Gardner 7192, 23 Mar. 1933 (FC, UC), Gardner 8041, 24 Mar. 1937 (FC, UC); in a flowerpot in the Agricultural greenhouse, University of California, Berkeley, Gardner 6977, 21 Jan. 1932 (FC, UC), and culture, Gardner 7148, 7 Jan. 1933 (FC, UC); culture from soil in the northwestern part of the campus, University of California, Berkeley, Gardner 6757, 7 Jan. 1933 (FC, UC); Byron hot springs, Contra Costa county, Gardner 7614, 7718, 11 Apr. 1933, 21 Oct. 1933 (FC, UC); culture from Bad Water, Death Valley, R. M. Holman & L. Bonar 7799, 2 Apr. 1933 (FC, UC); cold alkaline stream at Gnome's Workshop, Death Valley, M. J. Groesbeck 295, 1 Jan. 1941 (FC); Nevares Springs near Cow Creek, Death Valley, P. A. Munz 2280.5, 7 Apr. 1937 (FC); in a saline pond about 2 miles north of Buckingham Park, Clear Lake, Lake county, Gardner 7561, 7 Aug. 1933 (FC, UC), and culture, Gardner 7700, 16 Apr. 1934 (FC, UC); culture from seepage in Live Oak canyon, La Verne, Los Angeles county, G. J. Hollenberg 1648, 12 Nov. 1934 (FC); dam in San Dimas canyon near La Verne, Hollenberg 2077a, 20 Apr. 1934 (D); Old El Encino hot springs, Los Angeles county, B. C. Tompkinson 1a, Jul. 1944 (FC); boiling pools, hot springs formation 2 miles southeast of Bridgeport, Mono county, A. M. Alexander & L. Kellogg, 30 Jun. 1944 (FC); in the travertine quarry, Bridgeport, Groesbeck 42, 101, 257, 342, 469, Apr. 1940—Jul. 1941 (FC); Hot Creek and Geysers, Mono county, Groesbeck 206, 25 Nov. 1940 (FC); culture from north end of beach at Carmel, Monterey county, Gardner 8013, 1 Dec. 1936 (FC, UC); near St. Helena, Napa county, Seebell 1091, Nov. 1895 (UC); at the geyser, Calistoga, Napa county, Gardner 6824, 6976, 22 Aug. 1931 (FC, UC), and cultures, Gardner 6968, 7012, 18 Jan. 1932, 10 Aug. 1932 (FC, UC); culture from an urn in Mountain View cemetery, Oakland, G. J. Hollenberg 8020a, 23 Nov. 1937 (FC, UC); on damp soil on bluff east of Fort point, San Francisco, Gardner 7104a, 25 Nov. 1932 (FC, UC), and culture, Gardner 7104, 26 Mar. 1933 (FC, UC); in a pond by the Art building of the 1915 World's Fair, San Francisco, Gardner 7193, 26 Mar. 1933 (FC, UC); culture from Laguna Salada, San Mateo county (collected by H. E. Parks), Gardner 7445, 4 Aug. 1933 (FC, UC); in shallow water of Tule river, Porterville, Tulare county, Drouet & Groesbeck 4443, 4 Oct. 1941 (FC).

PUERTO RICO: on rocks, Arroyo de los Corchos, Adjuntas to Jayuya, N. Wille 1695, Mar. 1915 (NY); on rocks, wood, walls, etc. in and about the hot spring, Coamo Springs, Wille 287a (Type of *Chroococcus surgidus* var. *uniformis* Gardn., NY), 382a (Type of *C. aeruginosus* Gardn., NY), 384a (NY), 402a (Type of *C. subsphaericus* Gardn., NY [Fig. 117]), 403a (NY), 408 (FC, NY); on limestone, Hacula to Arecibo, Wille 1390, 27 Feb. 1915 (Type of *Gloeocapsa acervata* Gardn., NY); ditch in a wet field, Ponce, Wille 1670c, Mar. 1915 (NY); on rocks about 20 km. north of Ponce, Wille 1753, 15 Mar. 1915 (D, NY); in Laguna Tortuguero, Wille 831b, Feb. 1915 (Type of *Chroococcus mediocris* Gardn., NY [Fig. 121]); on rocks about 12 km. north of Utuado, Wille 1512 (NY), 1537c (Type of *C. beanglois* Gardn., NY), Mar. 1915; on limestone, Uruado to Adjuntas, Wille 1640 (Type of *Gloeocapsa ovalis* Gardn., NY [Fig. 115]), 1640c,g, Mar. 1915 (NY). MEXICO: in pool by Rio de Sonora, Unión, Hermosillo, Sonora, Drouet & D. Richards 3039, 24 Nov. 1939 (FC). HONDURAS: wet rock, El Quebracho above El Zamorano, Dept. Morazan, P. C. Standley 310, 29 Nov. 1946 (FC); wet bank, Quebrada del Ingenio de los Angeles near Yuscarán, Dept. El Paraíso, Standley, E. D. Merrill, L. O. Williams, & A. Molina R. 4735, 28 Feb. 1947 (FC). NICARAGUA: on rock under trickling water, Sierra de Managua, region of Las Nubes, Standley 8705, 24 May 1947 (FC). PANAMA: rain water in ancient grinding stone, Panama City, G. W. Prescott CZ19, Aug. 1939 (FC); pit at Miraflores Locks, Canal Zone, Prescott CZ67, Aug. 1939 (FC). VENEZUELA: hot springs near La Toma, southeast of Cumaná, Sucre, Steyermark 62858a, 21 May 1945 (FC). BRAZIL: Ceará: in seepage from pond along the beach, Urubú, Fortaleza, Drouet 1327, 27 Jul. 1935 (D, S, UC); in outlet of Açude Choró, Quixadá, Drouet 1399, 1 Sept. 1935 (D). São Paulo: represa, Estação Experimental de Caça e Pesca, Pirassununga, H. Kleerekoper 1, 17 Apr. 1940 (FC); margem do Mogy-Guassú perto de Cachoeira, Kleerekoper 5, 17 Apr. 1940 (FC). PERU: in a reservoir, Malabrigo, Dept. Libertad, A. Maldonado 87, Feb. 1942 (FC, FH); in fresh water, Lago Villa,

Maldonado 40, Jan. 1942 (FC); agua alcalina, Las Delicias, Trujillo, N. Ibañez H. "H", 18 May 1952 (FC).

HAWAIIAN ISLANDS: high up in littoral, Kawela bay, Oahu, C. J. Engard, 23 Nov. 1940 (FC); rocks on cliff, Nuuanu Pali, Honolulu, G. T. Shigeura, 4 Mar. 1939 (FC). SOCIETY ISLANDS: on dripping rocks, cliffs near Huau, Tabiti, W. A. Setchell & H. E. Parks 5123, Jun. 1922 (UC); cliffs near mouth of Papeu river, Tabiti, Setchell & Parks 5350, Jun. 1922 (UC). GILBERT ISLANDS: in southern fish-pond of Nikunan, Mrs. R. Catala 11a, Jul. 1951 (FC). NEW ZEALAND: Wardell stream, Bay of Islands, A. Nash, 27 Jan. 1935 (in Tild., So. Pacific Pl., 2nd Ser., no. 488, FC). PHILIPPINES: in standing water, Cavite street, Manila, G. T. Velasquez 2437, 23 Jul. 1950 (FC, PUH); on dripping wall of race tracks, Santa Ana, Manila, J. D. Soriano 365, 11 Dec. 1949 (FC, PUH); on moist stone wall, Geliños, Sampaloc, Manila, Velasquez 2441, 24 Jul. 1950 (FC, PUH); on concrete pillar, University of the Philippines, Ermita, Manila, Soriano 166, 22 Oct. 1948 (FC, PUH); on exterior walk of the ice plant, Marikina, Rizal prov., Soriano 897, 27 Apr. 1952 (FC, PUH); on wall, San Nicolas, Rizal prov., Soriano 545, 10 Dec. 1949 (FC, PUH); in water at airstrip at Tacloban, Leyte, M. E. Britton 80, 83, 4 Jul. 1945 (FC); on moist sides of public Kiosko in the plaza, Cabatuan, Iloilo prov., Soriano 1112, 16 Nov. 1952 (FC, PUH); on cement floor, Bungao, Tawi-Tawi, Sulu archipelago, Velasquez 3206, 10 May 1952 (FC, PUH). INDONESIA: auf der Oberfläche vom Bach A. Djernib durchflossenes Thermalgebiet östlich von Tjurup, Suban Ajer Panas, Stromgebiet des Musi, Südsumatra, Deutsche Sunda-Expedition, May 1929 (Type of *Synococystis crassa* var. *major* Geitl., no. M4d in the collection of L. Geider); Travertin-Hügel von Kuripan, Java, Deutsche Sunda-Expedition, 1928—29 (Type of *Chroococcus schizodermaticus* var. *incoloratus* f. *paucistratosus* Geitl., slide no. BK5c in the collection of L. Geider). CHINA: on rocks, Omei-shan, Shan-Shan-Kow (Omei), and Thousand Gods Cliff at Nanzehwan, Szechwan, H. Chu 774, 1329, 1329a, Aug. 1941—45 (FC); on rock under dripping water, Hsiang-Shan, Peiping, Hoped, Y. C. H. Wang 186, 1930—31 (FC, UC); in Kyam spring in Chang-cheno valley north of Pang-gong Tso, western Tibet, G. E. Hutchinson L58, 20 Jul. 1932 (D). AUSTRALIA: in a dish in glasshouse, Brisbane, Queensland, A. B. Cribb 101, 14 Jun. 1949 (FC); in high littoral pools, Middle River, Kangaroo island, South Australia, H. B. S. Womersley A12664a, K13488a, 13 Jan. 1950 (FC).

7b. ANACYSTIS THERMALIS f. MAJOR (Lagerheim) Drouet & Daily, COMB. NOV. *Chroococcus helveticus* f. *major* Lagerheim ex Forti, Syll. Myxophyc., p. 17. 1907. *Gloeocapsa limnetica* f. *major* Drouet & Daily, Lloydia 11: 78. 1948. *A. limnetica* f. *major* Drouet and Daily, Butler Univ. Bot. Stud. 10: 221. 1952. —Type from Praestvandet near Tromsø, Norway (NY). FIGS. 131, 132.

Chroococcus limneticus Lemmermann, Bot. Centralbl. 76: 153. 1898. *C. minutus* var. *limneticus* Hansgirg, Beih. z. Bot. Centralbl. 8(2): 520. 1905. *Gloeocapsa limnetica* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 236. 1938. *Anacystis limnetica* Drouet & Daily, Butler Univ. Bot. Stud. 10: 221. 1952. —Paratype, annotated by W. A. Setchell: "fide Lemmermann", from Lough Neagh, Ireland, designated as the Type (FC).

Chroococcus limneticus var. *subsalsus* Lemmermann, Forschungsber. Biol. Sta. Plön 8: 84. 1901. —Paratype, annotated by W. A. Setchell: "fide Lemmermann", from Lough Corrib, Ireland, designated as Type (FC).

Chroococcus minor var. *dispersus* Keissler, Verh. Zool.-bot. Ges. Wien 52: 311. 1902. *C. dispersus* Lemmermann, Ark. f. Bot. 2(2): 102. 1904. *Gloeocapsa minor* f. *dispersa* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 239. 1938. —Type from Wolfgang-See, Salzburg, Austria (in the collection of C. Keissler, W).

Chroococcus Prescottii Drouet & Daily, Field Mus. Bot. Ser. 20: 127. 1942. —Type from West Falmouth, Massachusetts (D). FIG. 130.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Chroococcus minutus var. *lucustris* Chodat, Bull. Herb. Boissier 6: 59. 1898. *Chroococcus minutus* var. *carneus* Chodat, Bull. Herb. Boissier 6: 180. 1898. *C. limneticus* var. *carneus* Lemmermann, Ark. f. Bot. 2(2): 101. 1904.

Chroococcus purpureus Snow, Bull. U. S. Fish Comm. 1902: 388, 390. 1903. *C. limneticus* var. *purpureus* Tiffany & Ahlstrom, Ohio Journ. Sci. 31: 456. 1931.

Chroococcus limneticus var. *lucis* Lemmermann, Ark. f. Bot. 2(2): 102. 1904.

Chroococcus limneticus var. *disiani* G. M. Smith, Bull. Torr. Bot. Club 43: 481. 1916.

Gloeocapsa limnetica f. *disiani* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 236. 1938.

Chroococcus limneticus var. *elagans* G. M. Smith, Trans. Wisconsin Acad. Sci. 19: 619. 1918.

Chroococcus Gomontii Nygaard, Vidensk. Medd. Dansk Naturh. Foren. Kjøbenh. 82: 202. 1926.

Plantae aeruginosae, olivaceae, violaceae, vel roseae, microscopicae 8—128-cellulares, libere natantes, cellulae in divisione binis depresso—sub-sphaericis, aetate protracta globosis diametro (4—)6—12 μ crassis, obscure vel crebre in seriebus eucapsoidis per gelatinum vaginale distributis; gelatino vaginale hyalino, homogeneo, amplo; protoplasmate aerugineo, olivaceo, violaceo, vel roseo, homogeneo vel tenui-granuloso. FIGS. 130—132.

In the plankton of lakes and in shallow fresh (rarely brackish) water along their margins. The cubical (eucapsoid) arrangement of the cells is usually evident in plants growing in the limnoplankton, but it is conspicuous in the more compact plants which develop in shallow water.

Specimens examined:

NORWAY: in fossa turfosa ad Praestvander prope Tromsø, G. Lagerheim, May 1894 (Type of *Chroococcus helveticus* f. *major* Lagerb. in Wittr., Nordst., & Lagerh., Alg. Exs. no. 1537, NY; isotype, L [Figs. 131, 132]). SWEDEN: with *Gomphosphaeria Wichurae* (Hilse) Dr. & Daily, Frisksjön, Lofthammar, Smalod, O. Borge, Jun. 1914 (S); plankton of Björkesakrasjön, Malmöhus, B. Carlin-Nilsson 521, 17 Aug. 1937 (D). GERMANY: in alten Wasserrümpeln, Freiburg im Breisgau, A. Braun 28, May 1850 (L). AUSTRIA: Plankton von Aber- oder Wolfgang-See, Salzburg, C. Keissler, 1901 (Type of *Chroococcus minor* var. *dispersus* Keissl., slide in the collection of C. Keissler, W). IRELAND: Lough Neagh, W. West 23, May 1900 (designated as Type of *C. limneticus* Lemm., FC; isotype, UC); plankton, Lough Corrib, W. West, with *Gomphosphaeria lacustris* Chod. (designated as Type of *Chroococcus limneticus* var. *subsalsus* Lemm., FC; isotype, UC). SCOTLAND: Lake Shutterry and nearby Loch Chalium, A. J. Brook 3, 4, Jul., Sept. 1950 (D); Loch Kinardochy, Perthshire, Brook 5, 7 Oct. 1953 (D). NEW BRUNSWICK: in lake 8 miles south of Grand Falls, Victoria county, H. Habesh 11657, 22 Jun. 1951 (FC, HA). MAINE: sink hole, Hollis, F. C. Seymour, 11 Sept. 1938 (FC). MASSACHUSETTS: Desmid Haven pond, West Falmouth, C. M. Palmer 192, 27 Jul. 1936 (DA, FC), Aug. 1937 (Type of *C. Prescottii* Dr. & Daily, D [Fig. 130]; isotypes, DT, FH, L, NY, S, TA, UC), H. Croasdale, Jul. 1935 (D); Woods Hole, 12 Jul. 1935, comm. J. H. Hoskins (DA, FC); Tarpaulin pond, Naushon island, J. M. Furber, Aug. 1917 (as *C. limneticus* in Coll., Hold., & Serch., Phyc. Bor.-Amer. no. 2252, FC, TA). VIRGINIA: in Hargrove's pond, New Kent county, M. H. Wood, 25 Jun. 1939 (FC, ST). FLORIDA: in shallow water, Lake Harris in the municipal park, Leesburg, Lake county, F. Drouot & M. A. Brannon 11064, 19 Jan. 1949 (FC). OHIO: quarry pool near Columbus, C. E. Taft, 7 Aug. 1940 (DA, FC).

MICHIGAN: Livingston's bog, Douglas lake region, Cheboygan county, H. K. Pbinney 28M39-2, 28 Jul. 1939 (FC, FHI); Bryan's bog near Douglas lake, Cheboygan county, H. A. Gleason Jr., Jul. 1935 (TA); plankton of Manistique lake at Emory's resort, Luce county, Pbinney 9M41/14, 19 Jul. 1941 (FC, PHI). INDIANA: Lake Cicott, Cass county, F. K. & W. A. Daily 1024, 10 Sept. 1942 (DA, FC); Indiana lake, 5 miles north of Bristol, Elkhart county, F. K. & W. A. Daily 2630, 27 Aug. 1952 (DA, FC); in south end of Lake Wawasee at Johnson's Hotel, Syracuse, Kosciusko county, F. K. & W. A. Daily 2190, 2238, Jul. 1950 (DA, FC); in Dewart lake, Kosciusko county, F. K. & W. A. Daily 2119, 9 Jul. 1949 (DA, FC); plankton at Maxinkuckee boat landing, Lake Maxinkuckee, Marshall county, F. K. & W. A. Daily 1544, 5 Jul. 1946 (DA, FC); Bass lake, 5 miles south of Knox, Starke county, F. K. & W. A. Daily 1560, 1566, 6 Jul. 1946 (DA, FC); Lake George, 6 miles north of Angola, Steuben county, F. K. & W. A. Daily 1934A, 13 Sept. 1947 (DA, FC); Clear lake, 6 miles east of Fremont, Steuben county, F. K. & W. A. Daily 1933A, 2452, 13 Sept. 1947, 17 June 1951 (DA, FC); plankton of Hamilton lake at pier in Circle park, Hamilton, Steuben county, F. K. & W. A. Daily 2443, 17 Jun. 1951 (DA, FC); Fox lake, 1 mile southwest of Angola, Steuben county, F. K. & W. A. Daily 2487, 19 Jun. 1951 (DA, FC). WISCONSIN: in Pell lake near Lake Geneva, Walworth county, W. E. Lake, 29-30 Aug. 1942 (FC). WYOMING: inlet, Half Moon lake, Fremont county, Bond F264, 21 Aug. 1934 (FC); Fremont lake, Fremont county, Bond F259, F260, Aug. 1934 (FC). PUERTO RICO: in a pool, Mayaguez, N. Wille 1318a, Feb. 1915 (NY). BRAZIL: from an open cistern, Campina Graode, Faraiba, S. Wright 1593, 28 Aug. 1934 (D). HAWAIIAN ISLANDS: in pools in the swamp of an old crater in the mountains, Kauai, M. Reed 11, Aug. 1909 (FC, UC).

GENUS 3. JOHANNESBAPTISTIA

J. de Toni, Noter. Nomencl. Algol. 1: 6. 1934. *Cyanothrix* Gardner, Mem. New York Bot. Gard. 7: 30. 1927; non Schmidle, 1897. —Type species: *Cyanothrix primaria* Gardn.

Plantae microscopicae cylindricae elongatae rectae vel curvatae, cellulis discoideis (ad apices depresso-sphaericis) uniseriatim in gelatino vaginale dispositis; divisione cellululae in uno plano ad axem filii perpendiculare procedente; gelatino vaginale hyalino.

In this genus each discoid cell divides only in a plane along the diameter of the disc (perpendicular to the axis of the plant); such cell divisions result in a uniseriate arrangement of cells within a long cylindrical gelatinous matrix.

One species:

1. JOHANNESBAPTISTIA PELLUCIDA W. R. Taylor & Drouet in Drouet, Bull. Torr. Bor. Club 65: 285. 1938. *Hormospora pellucida* Dickie, Journ. Linn. Soc. Bot. 14: 365. 1874. —Type from Fernando de Noronha, Brazil (BM). FIG. 182.

Geminella scalariformis f. *marina* G. S. West in Collins & Hervey, Proc. Amer. Acad. Arts & Sci. 53: 31. 1917. —Isotype from Bermuda (FC).

Cyanobrix primaria Gardner, Mem. New York Bot. Gard. 7: 30. 1927. *Johannesbaptistia primaria* J. de Toni, Noter. Nomencl. Algol. 1: 6. 1934. *J. Gardneri* Frémy, Bull. Soc. Hist. Nat. Afr. du Nord 26: 95, 99. 1935. —Type from Laguna Tortuguero, Puerto Rico (NY). FIG. 184.

Cyanobrix Willei Gardner, Mem. New York Bot. Gard. 7: 31. 1927. *Johannesbaptistia Willei* J. de Toni, Noter. Nomencl. Algol. 1: 6. 1934. —Type from Laguna Tortuguero, Puerto Rico (NY). FIG. 184.

Nodularia? fusca W. R. Taylor, Carnegie Inst. Wash. Papers Tortugas Lab. 25: 48. 1928. —Type from Dry Tortugas, Florida (TA). FIG. 183.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Hormospora scalariformis G. S. West, Journ. of Bot. 42: 282. 1904. *Geminella scalariformis* G. S. West in Collins, Tufts Coll. Stud. 4(7): 55. 1918.

Cyanobrix Cavanillesii Gonzalez Guerrero, Anal. Jard. Bot. Madrid 6: 250. 1946.

Fila aeruginea vel olivacea, recta vel curvata, ad 1 mm. longa, cellulis discoideis vel sphaerico-discoideis, ad apices filorum rotundis, diametro 3—20 μ crassis, in gelatino vaginale uniseriatim distributis; gelatino vaginale hyalino, homoganeo obscure lamelloso, firmo vel (saepe omnino) diffuente; protoplasmate aerugineo, olivaceo, vel luteolo, homoganeo. FIGS. 182—184.

In shallow brackish, salt, or fresh water; often found among other algae in old marsh pools. Seurat & Frémy in Bull. Soc. d'Hist. Nat. de l'Afrique du Nord 28: 294 (1937) and Frémy & J. de Toni in Atti R. Inst. Veneto Sci., Lett. & Arti 99(2): 401—406 (1940) have contended that plants of *Johannesbaptistia pellucida* are growth-forms of *Lynghya semiplena* (Ag.) J. Ag. We have been unable to observe any transitional stages between filaments of this species and those of any of the hormogonial Myxophyceae. The absence of *Lynghya semiplena* from the several inland habitats occupied by *Johannesbaptistia pellucida* seems to give further support to our position that the latter is an autonomous species.

Specimens examined:

JUGOSLAVIA: Salona prope Spalato, Dalmatia, A. Hansgirg, Aug. 1889 (FC, W). BERMUDA: spray pool, south shore of Nonsuch island, A. J. Bernatowicz 49-307, 15 Mar. 1949 (FC, MICH); tide pool at entrance to Hungry bay, P. S. Collins, 23 Apr. 1912 (isotype of *Geminella scalariformis* f. *marina* G. S. West in Coll., Hold., & Setch., Phyc. Bor.-Amer. 2002, FC). MASSACHUSETTS: in a brackish swamp (Chara pond) near Oyster pond, Falmouth, F. Drouet, R. Patrick & C. Hodge 3569, 16 Jul. 1940 (FC). CONNECTICUT: Fresh pond, Stratford, I. Holden 1035, Sept. 1894 (D, FH). MARYLAND: in a marsh pool west of Ewell, Smiths island, P. W. Wolle & Drouet 2307, 26 Aug. 1938 (FC, D, FH); in the salt marsh south of Jenkins creek, Crisfield, Drouet & Wolle 3630, 3641, 23 Jul. 1940 (FC); marsh pools between Dames Quarter and Chance, Somerset county, P. W. Wolle, 30 Sept. 1951 (FC); in pools of brackish water, Jericho marshes west of Fairmount, Somerset

country, *Drouot & Wolle* 3649, 23 Jul. 1940 (FC). FLORIDA: Long Key, Dry Tortugas, W. R. Taylor, June 1925 (Type of *Nodularia? fusca* W. R. Taylor, TA [Fig. 183]; isotypes, D, N); on mud of sinkhole and marsh near the Inn, Big Pine key, Monroe county, E. P. Kallip 41729, 41943, 11 Jan., 18 Feb. 1952 (FC, US); in brackish pool, Marco island, Collier county, P. C. Sundley 73407, 19 Mar. 1940 (FC). INDIANA: bottom of Lake Wehi, south of Germantown, Wayne county, P. K. & W. A. Daily 1185, 16 Jul. 1944 (DA, FC). IOWA: pond near shore of Silver lake, J. D. Dodd, 2 Jul. 1953 (D, FC). TEXAS: on sand at Blind bayou, Galveston island, H. K. Phinney 2T41/2, 30 Aug. 1941 (FC, PH); permanent pool, Ausdin, F. A. Barkley 444g27, 25 Jul. 1944 (FC, TEX); southwest tip of lake west of Padre island, 65 miles north of Brownsville, in Kenedy county, J. O. Barry, 27 Sept. 1948 (FC); in a pool of fresh water (seepage from a tank) on a roof, Brownsville, R. Runyon 4207a, 19 Aug. 1946 (FC). CALIFORNIA: in brackish water west of Newport Beach, Orange county, G. J. Hollenberg 1533e, 26 Sept. 1934 (D).

BAHAMA ISLANDS: Lake Cunningham, New Providence, A. D. Peggs, 10 May 1941 (FC). BRITISH WEST INDIES: in basins of salt works, Cockburn Harbor, South Caicos, M. A. Howe 5584b, Dec. 1907 (NY). VIRGIN ISLANDS: lagoon, Lindbergh Field, Charlotte Amalie, St. Thomas, W. A. Hoffman 146/593 (D, TA). PUERTO RICO: Laguna Tortuguero, N. Wille 830b (Type of *Cyanoshris primaria* Gardn., NY [Fig. 184]), 830e (Type of C. Willei Gardn., NY [Fig. 184]), 5 Feb. 1915. MEXICO: in brackish water of a sand pit on beach 4 km. east of Guaymas, Sonora, *Drouot & D. Richards* 3297, 16 Dec. 1939 (FC). BRAZIL: in rock pools, Fernando de Noronha, H. N. Moseley on Challenger Expedition (Type of *Hormospora pellucida* Dickie, BM [Fig. 182]). ECUADOR: inland salt pool near Albemarle point, north end of Albemarle island, Galapagos islands, W. R. Taylor 123, 12 Jan. 1934 (D, TA). INDONESIA: binnenmeer van Roesa Liguette, van der Sande, 28 Mar., 21 Jul. 1908 (FC, L).

GENUS 4. AGMENELLUM

de Brébisson, *Mém. Soc. Acad. Sci., Art. & Belles-Lettres Falaise* 1839: p. 2 of reprint. 1839. —Type species: *Trochiscia quadruplicata* Menegh.

Original specimens of the Type species for the following generic and sub-generic names have not been available to us for study:

Gonidium Ehrenberg ex Meneghini, *Linnaea* 14: 213. 1849. —Type species: *Gonium glaucum* Ehrenb.

Merismopodia Kützinger, *Phyc. Gener.*, p. 163. 1843. *Merismopodia* Subgenus *Eumerismopodia* Ryppowa, *Acta Soc. Bot. Polon.* 3(1): 45. 1925. —Type species: *M. punctata* Meyen.

Holopodium Subgenus *Eubolopodium* Forti, *Syll. Myxophyc.*, p. 110. 1907. —Type species: *Merismopodia irregularis* Lagerb.

Coccolopia Troitzkaja, *Not. Syst. Inst. Crypt. Hort. Bot. Petropol.* 1: 131. 1922. *Holopodium* Subgenus *Coccolopia* Elenkin, *Not. Syst. Inst. Crypt. Hort. Bot. Petropol.* 2: 66. 1923. —Type species: *Coccolopia limnetica* Troitzk.

Pseudoholopodia Elenkin, *Monogr. Algar. Cyanophyc., Pars. Spec.* 1: 86. 1938. *Merismopodia* Subgen. *Pseudoholopodia* Ryppowa, *Acta Soc. Bot. Polon.* 3(1): 45. 1925. —Type species: *Merismopodia gigas* Ryppowa.

Plantae (laminae) microscopicae vel macroscopicae, cellulis sphaericis vel ovoideis vel cylindraceis, in lamina in seriebus regularibus aliis ad alias perpendicularibus dispositis; divisione cellularum seriatim in duobus planis aliquodque ad alia et ad superficiem laminae perpendicularibus procedente; gelatino vaginali hyalino.

In this genus, the plant is a flat or foliose plate in which the cells are arranged in series of rows in two directions at right angles to each other. Cell division proceeds successively in two planes perpendicular to each other and to the surface of the plate.

Key to species of *Agmenellum*:

Cells 1—3.5 μ in diameter, plants 1—256-celled 1. A. QUADRUPPLICATUM
Cells 4—10 μ in diameter, plants larger and often foliose 2. A. THERMALE

1. AGMENELLUM QUADRUPPLICATUM Brébisson, *Mém. Soc. Acad. Sci., Art. & Belles-Lettres de Falaise* 1839: 2 (of reprint). 1839. *Trochiscia quadruplicata*

Meneghini, Consp. Algal. Eugean., p. 334. 1837. *Gonidium quadruplicatum* Meneghini, Linnaea 14: 213. 1840. *Merismopoedia quadruplicata* Trevisan, Nomencl. Algar. 1: 28. 1845. —Paratype from Falaise, France, designated as Type (L).

Trochiscia Prasiola Meneghini, Consp. Algal. Eugean., p. 334. 1837. *Agmenellum Prasiola* Meneghini ex Brébisson, Mém. Soc. Acad. Sci., Art. & Belles-Lettres de Falaise 1839: 2 (of reprint). 1839. *Gonidium Prasiola* Meneghini, Linnaea 14: 214. 1840. *Merismopoedia Prasiola* Trevisan, Nomencl. Algar. 1: 28. 1845. —Isotype from Euganean springs, Italy (W).

Merismopoedia byalina subsp. *Warmingiana* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh., 40(2): 41. 1883. *M. Warmingiana* Lagerheim ex Forti, Syll. Myxophyc., p. 109. 1907. —Type from Kristineberg, Sweden (S).

Merismopoedia punctata f. *minor* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 41. 1883. —Type from Kristineberg, Sweden (S).

Merismopoedia glauca var. *fontinalis* Hansgirg, Sitzungsber. k. Böhm. Ges. Wiss., Math.-Nat. Cl., 1890(2): 98. 1891. —Type from Scr. Procop near Prague, Czechoslovakia (W). FIG. 133.

Merismopoedia affixa Richter, Sitzungsber. Naturf. Ges. Leipzig 19—21: 152. 1895; Hedwigia 34: 25. 1895; in Hauck & Richter, Phyk. Univ. 13: 648. 1895. —Type from Kiel, Germany (L).

Merismopoedia minima Beck, Ann. K. K. Nat.-Hist. Hofmus. Wien 12: 83. 1897. —Type from Bombay, India (W).

Merismopoedia elegans var. *remota* G. S. West, Journ. Linn. Soc. Bot. 38: 185. 1907. —Type from Baraka, Tanganyika (FC).

Merismopoedia convoluta f. *minor* Wille in S. Hedin, Southern Tibet 6(3, Bot.): 166. 1922. *M. convoluta* var. *minor* Tiffany & Ahlstrom, Ohio Journ. Sci. 31: 457. 1931. —Type from Pamir (O).

Merismopoedia byalina f. *salina* Wille in S. Hedin, Southern Tibet 6(3, Bot.): 183. 1922. —Material named by the author from Atjik-bulaks, Tibet, designated as the Type (O).

Holopedium pulchellum Buell, Bull. Torr. Bot. Club 65: 385. 1938. *Microcrocis pulchella* Geitler in Engler & Prand, Natürl. Pflanzenfam., ed. 2, 1b: 56. 1942. —The original specimens are reported by Dr. Helen Poot Buell and Dr. Josephine E. Tilden to have been lost. A topotype from the original locality in Minneapolis, Minnesota, has been designated as the Type (FC).

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Gonium tranquillum Ehrenberg, Abb. K. Akad. Wiss. Berlin 1833: 251. 1834. *Gonidium tranquillum* Ehrenberg ex Meneghini, Linnaea 14: 213. 1840. *Agmenellum tranquillum* Trevisan, Prosp. Fl. Eugean., p. 58. 1842. *Merismopoedia tranquillula* Trevisan, Nomencl. Algar. 1: 28. 1845.

Gonium glaucum Ehrenberg, Infusionsth., p. 58. 1838. *Merismopoedia glauca* Kützing, Phyc. Germ., p. 142. 1845.

Merismopoedia punctata Meyen, Neues Syst. Pfl.-Physiol. 3: 440. 1839. *M. Kuetzingii* Nägeli, Gart. Einz. Alg., p. 55. 1849. *Sarcina punctata* Meyen ex Bizzozero, Fl. Veneta Critog. 1: 22. 1885.

Merismopoedia glauca var. *punctata* Hansgirg, Prodr. Algenfl. Böhmen 2: 142. 1892.

Merismopoedia nova Wood, Proc. Amer. Philos. Soc. 11: 123. 1869.

Merismopoedia paludosa Bennett, Journ. Roy. Microsc. Soc. London, ser. 2, 6: 4. 1886.

Merismopoedia tenuissima Lemmermann, Bot. Centralbl. 76: 154. 1898.

Merismopoedia glauca var. *fontinalis* f. *irregularis* Selk, Jahrb. Hamburg. Wiss. Anstalt 25 (Beih. 3): 49. 1907.

Merismopoedia punctata var. *oblonga* Playfair, Proc. Linn. Soc. New South Wales 19: 135. 1914.

Merismopoedia cyanea Playfair, Proc. Linn. Soc. New South Wales 43: 501. 1918.

Merismopoedia duplex Playfair, Proc. Linn. Soc. New South Wales 43: 501. 1918.

Merismopoedia glauca f. *minor* Häyén, Bidrag t. Kännedom af Finlands Nat. & Folk 80(3): 92. 1921.

Coccolopia limnetica Troitzkaja, Not. Syst. Inst. Crypt. Horti Bot. Petropol. 1: 131. 1922.

Merismopoedia glauca f. *rosea* Geitler in Pascher, Süßwasserfl. 12: 106. 1925.

Merismopoedia insignis Schkhorbatow, Not. Syst. Inst. Crypt. Horti Bot. Petropol. 2: 89. 1923; Arch. Russes de Protistol. 6: 127. 1927. *M. glauca* f. *insignis* Geitler in Pascher, Süßwasserfl. 12: 106. 1925.

Merismopoedia punctata f. *arctica* Kossinskaja, Acta Inst. Bot. Acad. Sci. U. R. P. S. S., ser. 2, Pl. Crypt. 1: 47. 1933.

Coccolopia turkistanica Kisseliová ex Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 68. 1938. —We have been unable to find the original reference reported by Elenkin: Trav. de l'Inst. d'Ousbekistan de la Médecine Tropicale 1(3): 375. 1931.

Merismopoedia Hausmannii Kufferath, Bull. Soc. Roy. Bot. Belg. 74: 95. 1942.

Holopedium Mutisianum Gonzalez Guerrero, Anal. Jard. Bot. Madrid 6: 243. 1946.

Holopedium Clementei Gonzalez Guerrero, Anal. Jard. Bot. Madrid 6: 243. 1946.

Plantae (laminae) aeruginosae, olivaceae, violaceae, vel roseae, rectangulares, 1—256-cellulares, cellulis post divisionem globosis diametro 1—3.5 μ crassis, per gelatinum vaginale laxae vel conferte distributis; gelatino vaginale firmo vel (saepè omnino) diffuente; protoplasmate aerugineo, olivaceo, violaceo, vel roseo, homogeneo vel tenui-granuloso. FIG. 133.

In shallow fresh and brackish water and on mud and wet sand; often seen in the plankton of rivers and lakes. Among the specimens enumerated, there seems to be no good reason to separate a small-celled (ca. 1 μ in diameter) form prevalent especially in the plankton of rivers. It is a common phenomenon to find the sheath material hydrolyzed and the cells completely dissociated. Here the cells are apt to be confused with those of *Anacystis montana*. An occasional pseudovacuole may be observed in the cells of *Agmenellum quadruplicatum*, but all collections seen which are predominantly pseudovacuolate prove to be of the bacterium, *Erythroconis littoralis* Oerst.

Specimens examined:

SWEDEN: in arena regionis littoralis ad Kristineberg Bahusiae, G. Lagerheim, Aug. 1882 (Types of *Merismopodia punctata* f. *minor* Lagerh. and *M. hyalina* subsp. *Warmingtonum* Lagerh. with *Holopedium sabulicola* in Witt., Nordst., & Lagerh., Alg. Exs. no. 1549, S; isotype, L. MIN); Mjå, Uppland, O. Borge, Aug. 1933 (S); Vaddö, Uppland, O. F. Andersson, Aug. 1890 (S); Lassby backar, Uppala, Borge, Sept. 1884 (S). GERMANY: Kieler Fährde, T. Reinhold, Aug. 1889 (NY); Kiel, im Salzwasser, Reinhold (Type of *Merismopodia affixa* Richt. in Hauck & Richt., Phyk. Univ. no. 648, L; isotype, MIN); in einem Gartenbassin in Niedelössnitz bei Kotschenbroda, Dresden, R. Wollny, Nov. 1886 (as *M. irregularis* in Hauck & Richt., Phyk. Univ. no. 146, MIN, MICH); Leipzig, P. Richt. (L), um Grimma, Richt. (UC); Lössnitzgrund bei Dresden, C. A. Hamtisch (NY); Oberlössnitz bei Dresden in einem Bache, Hamtisch (as *M. violacea* in Rabenh. Alg. no. 857, FC, NY, UC); aus einem Moortümpel bei Berbruch um Lausigk, Richt., Aug. 1867 (as *M. glauca* in Rabenh. Alg. 2056, UC); Schönfeld bei Dresden, Richt., Aug. 1876 (FC); im Torftümpeln bei Wurzen, Bulnheim, 1857 (as *M. violacea* in Rabenh. Alg. no. 650, FC, L, NY); am Strande auf Wangerooge, Oldenb., F. T. Küssing, Jul. 1839 (L). CZECHOSLOVAKIA: am schlammigen Grunde in Felsenquellen bei St. Prokop nächst Prag, A. Hamtisch, May 1890 (Type of *M. glauca* var. *fontinalis* Hansg., W; isotype, FC [Fig. 133]). SWITZERLAND: Bieler See, Kt. Bern, Küssing (L). ITALY: ne'vassi delle piante acquatiche all'Orto Botanico di Pisa, Savi, 1867 (as *Microcystis olivacea* in Erb. Crit. Ital., ser. II, no. 30, L); aq. therm. Euganaei, Meneghini (isotype of *Trochiscia Pratiola* Menegh., W). NETHERLANDS: groene Strand, West Terschelling, J. T. Koster 177, 178, Jul. 1937 (L). FRANCE: *Agmenellum quadruplicatum* Bréb., Falaise, A. de Brébisson (designated here as Type of *Trochiscia quadruplicata* Menegh., L); ruisseau, Falaise, Brébisson 414 (L); Falaise, sur la vase d'un étang desséché, Brébisson (as *Protococcus minutus* var. *caeruleus* in Rabenh. Alg. no. 2035, FC, L, TA); flottaat dans les fossés et les flaques des marais spongieux, Falaise, Brébisson (as *Merismopodia aeruginea* in Rabenh. Alg. no. 1356, MIN, L). TANGANYIKA: with *Anabaena tanganyikae* G. S. West in plankton near Baraka, W. A. Cunningham 240, 24 Feb. 1905 (Type of *Merismopodia elegans* var. *remota* G. S. West, FC; isotype, UC). UNION OF SOUTH AFRICA: Zeekoe Vlei near Cape Town, Mrs. G. E. Hutchinson 35, 5 Feb. 1928 (D).

MAINE: Long pond, Mt. Desert island, P. S. Collins, July 1900 (NY). MASSACHUSETTS: pond on Naushton island, W. R. Taylor, Jul. 1921 (TA), H. T. Croasdale, 17 Jun. 1934 (D). RHODE ISLAND: Portsmouth, Collins, 14 Jun. 1883 (FC). FLORIDA: Robinson lake, Leesburg, M. A. Brannon 244, 28 Jul. 1944 (FC, PC); 7 miles south of La Belle, Lee county, J. E. Davis 20, 8 Oct. 1941 (FC, PC). OHIO: pond in Lakeview fish hatchery, Cincinnati, W. A. Daily 434, 8 Jul. 1940 (DA, FC); culture in University of Cincinnati greenhouse, Cincinnati, L. Lillick & I. Lee 603, 21 Feb. 1934 (DA, FC); pond at fish hatchery, Newton, Hamilton county, F. Brinley, 29 Oct. 1941 (DA, FC); Big Miami river, North Bend, Hamilton county, R. H. Fink 600, Aug. 1932 (DA, FC); Beaver creek near Celina, Mercer county, J. B. Lachey, 22 Aug. 1940 (DA, FC); above falls, Bear creek east of Foster, Warren county, J. H. Hoskins & Daily 230, 4 Nov. 1939 (DA, FC). KENTUCKY: pond on U. S. highway no. 31 south of Glasgow, Barren county, B. B. McIneer 612, 19 Aug. 1929 (DA, FC); new reservoir at Earlinton, Hopkins county, McIneer 592, 16 Aug. 1929 (DA, FC). TENNESSEE: in spring near Cherokee dam, Jefferson county, H. Silva 908, 908a, 25 Jun. 1949 (FC, TENN). MICHIGAN: Bryan's bog and Lancaster lake, near Douglas lake, Cheboygan county, C. E. Taft 42, 80, Jul. 1936 (DA, FC). INDIANA: in lake one mile north of Columbus, Bartholomew county, P. K. & W. A. Daily 1041, 11 Oct. 1942 (DA, FC), 2 miles north of Columbus, W. A. Daily, P. K. Daily, & C. Kanoyer 1162, 19 Sept. 1943 (DA, FC); Lake Papakeebee, Kosciusko county, B. H. Smith 146, 15 Sept. 1929 (DA, FC); Aubendaubee bay,

Lake Maxinkuckee, Marshall county, *F. K. & W. A. Daily* 1485, 30 Jun. 1946 (DA, FC); in a quarry pond at St. Paul, Shelby county, *F. K. & W. A. Daily* 1154, 19 Sept. 1946 (DA, FC); Lake Quary, lower basin, Pokagon state park, Steuben county, *F. K. & W. A. Daily* 1918A, 12 Sept. 1947 (DA, FC); stream east of Snow Lake, Steuben county, *C. M. Palmer* B34, Sept. 1933 (DA, FC); Fox Lake, Steuben county, *Palmer* 1019, Jul. 1933 (DA, FC); pond one mile north of Liggett creek, Vigo county, *B. H. Smith* 430, 4 Aug. 1930 (DA, FC); pond, Rose Polytechnic Institute, Terre Haute, *Smith* 120, 3 Jul. 1929 (DA, FC); Wabash river, Vigo county, *Smith* 406, 15 Aug. 1930 (DA, FC); in muck, north end of Lake Wehi, south of Germantown, Wayne county, *F. K. & W. A. Daily* 1457, 15 Jun. 1946 (DA, FC); culture from spray pond, Crystal Ice Company, Richmond, *L. J. King* 34, 22 Aug. 1940 (EAR, FC). WISCONSIN: in Pell lake near Lake Geneva, Walworth county, *W. E. Lake*, Aug. 1942 (FC). MINNESOTA: in Lake of the Isles lagoon, Minneapolis, *M. P. Buell, R. L. Cain, & M. P. Moore* C, 26 Jul. 1938 (Type of *Holopedium pulchellum* Buell, FC); Mud Lake Wildlife Refuge, Marshall county, *Drouet* 12092, 28 June 1954 (D, MN). IOWA: bottom ooze, Des Moines river, Boone county, *W. Starrett* 142B, 6 Sept. 1946 (D, FC).

ARKANSAS: in a pond in the fish hatchery, Mammoth Spring, Fulton county, *P. Drouet* 171, 19 Aug. 1928 (D). NEBRASKA: old gravel pit pond south of North Platte, *W. Kienor* 17955, 4 Nov. 1944 (FC, KI); plankton in pool, Lincoln, *Kienor* 16593, 15 May 1944 (FC, KI); in farm tank, Fremont, Dodge county, *Kienor* 14668, 23 Jul. 1943 (FC, KI). TEXAS: creek below spring near swimming pool, Lampasas, *E. Whitehouse* 24900, 18 Feb. 1951 (FC); permanent pool, Austin, *P. A. Barkley* 44alg20, 25 Jul. 1944 (FC, TEX). MONTANA: Logan pass, Glacier national park, 23 Aug. 1934 (FC). CALIFORNIA: Berkeley, *N. L. Gardner* 1361 (UC), 1698 (FC, UC), Apr. 1904, May 1906; on sandy ground, Lake Merced, San Francisco, *Gardner* 1107, Jun. 1903 (S; as *Merismopoedia glauca* var. *fontinalis* Hansg. in Coll., Hold., & Serch., Phyc. Bor.-Amer. no. 1156, FC, L, TA). BAHAMA ISLANDS: freshwater lake off Stafford creek, Andros, *A. D. Peggs*, 22 Aug. 1942 (PC). PUERTO RICO: in a pool 4 km. north of Mayaguez, *N. Wille* 1325, 1326a, 1327a, 1329d, Feb. 1915 (NY). COSTA RICA: Laguna del Misterio, al norte de San José, *J. M. Orozco* C. 53, 1953 (FC). VENEZUELA: moir bases of sandstone bluffs, Parí-tepui, Bolívar, *J. A. Sjöermark* 59871, 6 Nov. 1944 (FC). BRAZIL: Ceará: seepage from pond along beach, Urubú, Fortaleza, *Drouet* 1327, 27 Jul. 1935 (D); pond at Aroeiras, Quixadá, *Drouet* 1401, 1402, 2 Sept. 1935 (D); pool below the dam, Açude Cedro, Quixadá, *Drouet* 1393, 31 Aug. 1935 (D); pool in Rio Pacoty at Fortaleza-Recife road, Pacatuba, *Drouet* 1503, 24 Nov. 1935 (D). PERU: Cocha Zapote, Rio Pacuya, Bajo Ucayali, dept. Loreto, *P. Ancoña*, Jul. 1947 (FC); Laguna Saraja, dept. Ica, *A. Maldonado* 93a, Feb. 1942 (FC). FORMOSA: fish pond, Tainan, *C. C. Chow*, 11 May 1951 (D). TIBET: Atjik-bulaks, *S. Hedén*, 1 Aug. 1899 (designated as Type of *M. hyalina* f. *salina* Wille in the slide collection of N. Wille, O). PAMIR: *S. Hedén* 13 (Type of *M. convoluta* f. *minor* Wille in the slide collection of N. Wille, O). INDIA: in Victoria Garden, Bombay, *A. Hansgirg* (Type of *M. minima* Beck with *Polycystis insignis* Beck in Mus. Viadob. Krypt. Exs. no. 227, W; isotypes, DT, FC, L, S).

2. AGMENELLUM THERMALE (Kütz.) Dr. & Daily, COMB. NOV. *Merismopoedia thermalis* Kützing, Phyc. Gener., p. 163. 1843. *Aphanocapsa thermalis* Brügger, Jahresber. Naturf. Ges. Graubündens, N. F., 8: 244. 1863. *Sarcina thermalis* Kützing ex Bizzozero, Fl. Veneta Crittog. 1: 23. 1885. —Type from Bartaglia, Italy (L). FIG. 140.

Merismopoedia elegans A. Braun in Kützing, Sp. Algar., p. 472. 1849. —Since the original material from Freiburg-in-Breisgau (L) contains no plants as described, we have selected as the Type a specimen (L) from Leipzig, Germany, collected and annotated as of this species by the author. FIG. 134.

Merismopoedia aeruginosa Brébisson in Kützing, Sp. Algar., p. 472. 1849. *M. convoluta* var. *aeruginosa* Rabenhorst, Alg. Sachs. 71—72: 719. 1858. *M. convoluta* b. *aeruginosa* Rabenhorst, Fl. Eur. Algar. 2: 58. 1865. —Type from Palaise, France (L). FIG. 136.

Merismopoedia major Kützing, Sp. Algar., p. 472. 1849. *M. thermalis* b. *major* Rabenhorst, Fl. Eur. Algar. 2: 58. 1865. —Type from St. Hilaire, France (L). FIG. 135.

Merismopoedia convoluta Brébisson in Kützing, Sp. Algar., p. 472. 1849. *Pseudoholopedia convoluta* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec., 1: 86. 1938. —Type from Palaise, France (L). FIG. 139.

Merismopoedia elegans var. *marina* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 40. 1883. —Type from Kristineberg, Sweden (S).

Merismopoedia glauca subsp. *amathystina* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 41. 1883. *M. glauca* var. *amathystina* Lagerheim ex Forti, Syll. Myxophyc., p. 107. 1907. —Type from Kristineberg, Sweden (S). FIG. 138.

Merismopoedia sabulicola Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 43. 1883. *Holopedium sabulicola* Lagerheim, Nuova Notarisa 4: 210. 1893. *Microcrocis sabulicola* Geitler

in Engler & Prantl, Natürl. Pflanzenfam., ed. 2, lb: 56. 1942. —Type from Kristineberg, Sweden (S).

Prasiola Gardneri Collios, Phyc. Bor.-Amer. 24: 1185. 1904. *Merismopoedia Gardneri* Setchell in Gardner, Univ. Calif. Publ. Bot. 2: 238, 239. 1906. —Type from Alameda, California (NY). FIG. 141.

Merismopoedia aeruginea f. *ovata* Wille, Nyt Mag. f. Naturvidenskab. 61: 76. 1924. —Type from Husøy, Norway (O).

Merismopoedia Willei Gardner, Mem. New York Bot. Gard. 7: 3. 1927. —Type from Mayaguez, Puerto Rico (NY). FIG. 137.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Merismopoedia mediterranea Nägeli, Gatt. Einzeln Alg., p. 56. 1849. *M. glauca* f. *mediterranea* Collios in Collins, Holden & Setchell, Phyc. Bor.-Amer. 31: 1651. 1910. —Nägeli's sketches and notes, from his notebooks in the Pflanzenphysiologisches Institut, Eidgenössische Technische Hochschule, Zürich, are reproduced here: FIG. 142.

Merismopoedia irregularis Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 43. 1883. *Holopedium irregulare* Lagerheim, Nuova Notarisa 4: 209. 1893. *Microcrocis irregularis* Geitler in Engler & Prantl, Natürl. Pflanzenfam., ed. 2, lb: 56. 1942.

Merismopoedia revolutina Askenasy, Flora 78: 1. 1894; Askenasy in Bailey, Bot. Bull. Queensland Dept. Agric. 11: 49. 1895.

Merismopoedia elegans var. *ultracra* Bernard, Protococc. & Desmid. d'Eau Douce, p. 51. 1908.

Merismopoedia Terekii Henckel, Scripta Bot. Horti Univ. Imp. Petropol. 26: 55. 1908; *ibid.* 27: 120. 1909. *M. solitaria* Henckel, *ibid.* 27: 227. 1909.

Merismopoedia boreocaspica Henckel, Scripta Bot. Horti Univ. Imp. Petropol. 26: 55. 1908; *ibid.* 27: 120. 1909.

Merismopoedia caspica Henckel, Scripta Bot. Horti Univ. Imp. Petropol. 26: 55. 1908; *ibid.* 27: 120. 1909.

Merismopoedia elegans var. *constricta* Playfair, Proc. Linn. Soc. New South Wales 43: 501. 1918.

Merismopoedia elegans var. *major* G. M. Smith, Bull. Wisconsin Geol. & Nat. Hist. Surv. 57: 52. 1920. *M. major* Geitler in Pascher, Süßwasserfl. 12: 107. 1925. *M. Smithii* J. de Toni, Archivio Bot. 15: 290. 1939.

Merismopoedia gigas Rypkowa, Acta Soc. Bot. Polon. 3: 46. 1925.

Holopedium dadmenie Pevalek, Nuova Notarisa 1925: 293. 1925.

Merismopoedia elongata Kossioskaja, Bull. Jard. Bot. Princip. U. R. S. S. 29: 111, 128. 1930.

Merismopoedia Jeaneli Bachmann, Zeitschr. f. Hydrol. 8: 135. 1938.

Eucapsus salina Gonzalez Guerrero, Anal. Jard. Bot. Madrid 8: 267. 1948.

Pseudoholopedia convoluta var. *subsalina* Proschkina-Lavrenko, Akad. Nauk S. S. S. R. Ord. Sporovykh. Rost. Bot. Mater. 6: 69. 1950.

Planar (laminae) aerugineae, olivaceae, vel violaceae, primum rectangulares et microscopicae, deinde ad 4 cm. longae ambitu irregulares increscentes, cellulis post divisionem globosis, ovoideis, vel cylindraceis diametro 4—10 μ crassis, 4—20 μ longis, per gelatinosum vaginale plerumque conferre distributis; gelarino vaginale hyalino. firmo vel (saepe omnino) diffuente; protoplasmate aerugineo, homogeneo vel tenui-granuloso. FIGS. 134—142.

In shallow fresh, brackish, or salt water or on mud. After considerable restudy of the material at hand, we have come to the conclusion that, if there are two species of Agmenellum, the separation must be made on the basis of size of cells and size and configuration of the plate. In *A. thermale* there appears to be a gradual elongation of the cells in a direction at right angles to the surface of the plate as the plant ages and enlarges. Well developed plants with the cells somewhat disorganized can be mistaken for those of *Microcrocis geminata*. Where the gelatinous matrix has hydrolyzed completely, the single cells can be confused with those of *Anacystis* and *Coccochloris* spp.

Specimens examined:

NORWAY: [i ferskvand paa strandklipperne paa] Husøy, N. Wille, 23 Apr. 1919 (Type of

Merismopodia aeruginosa f. *ovata* Wille in slide collection of N. Wille, O). SWEDEN: in arena regionis littoralis ad Kristineberg Bahusiae, G. Lagerheim, Aug. 1882 (Types of *M. sabulicola* Lagerh., *M. glauca* subsp. *amethystina* Lagerh. [Fig. 138], and *M. elegans* var. *marina* Lagerh., as *Holopedium sabulicola* in Witttr., Nordst., & Lagerh., Alg. Exs. no. 1549, S; isotype, MIN, L); in fossa turfosa ad Källstorp par. Holm in Dalia, V. Wittrock, 22 Aug. 1878 (as *Merismopodia glauca* in Witttr. & Nordst., Alg. Exs. no. 300, FC, L, S; in Aresch., Alg. Scand. Exs., Ser. Nov., no. 430, FC, L, S). GERMANY: auf Elbschlamm kultivirt, Reinsche (as *M. convoluta* var. *aeruginosa* in Rabenh. Alg. no. 719, FC, L, MIN, UC); Eiseoach, Teich am Weg nach der Elfengrotte, W. Migula, Aug. 1930 (as *M. glauca* in Mig., Krypt. Germ., Austr., & Helv. Exs., Alg. no. 263, FC, TA); Leipzig, in dem grossen Lautzcher Teiche, O. Bulnheim, Mar. 1856 (as *M. elegans* in Rabenh. Alg. no. 515, FC, FH, L, NY, UC); Leipzig, A. Braun, May 1856 (designated as Type of *M. elegans* A. Br., L [Fig. 134]; isotype, S), P. Richtor, Jun. 1877 (S), Jul. 1877 (L); Leipzig, um Lausigk, Richtor, 1867 (as *Chroococcus cobarens* in Rabenh. Alg. no. 1852, L, NY, UC); Rassnitz bei Leipzig, Richtor (as *Merismopodia convoluta* in Hauck & Richt., Phyk. Univ. no. 682, L, S). AUSTRIA: in einer Quelle in der Längepiesing, Lower Austria, G. de Bock 367, May 1883 (FC, W). ITALY: auf dem Badenwasser von Battaglia, Meneghini (Type of *M. thormalis* Kütz., L [Fig. 140]). SCOTLAND: Loch Shurrery, Caithness, A. J. Brook 3, 12 Sept. 1950 (D). ENGLAND: edge of River Coln, Fairford, Gloucestershire, W. L. Tolstead 8451, 13 Sept. 1944 (FC). NETHERLANDS: Goes, van den Bosch 362 (L). FRANCE: Jardin des Plantes, Paris, M. Gomont, May 1888 (NY, DT); Falaise, herb. Lebel (FC), A. de Brébisson (S), Brébisson 415 (Type of *M. convoluta* Bréb., L [Fig. 139]; isotype, UC); dans les flaques d'un étang abandonné, Falaise, de Brébisson (as *M. convoluta* in Rabenh. Alg. no. 1355, L, MIN; as *M. convoluta* var. *aeruginosa* in Roumeigné, Alg. de Fr. no. 617, L); St. Hilaire, herb. Lenormand (Type of *M. major* Kütz., L [Fig. 135]); eaux saumâtres, parcs d'huîtres du Calvados, de Brébisson 448 (Type of *M. aeruginosa* Bréb., L [Fig. 136]); eaux saumâtres des environs de Brest, M. M. Crouan (as *M. glauca* in Desmaz., Pl. Crypt. Fr., ed. 2, no. 301, FC, UC). BRITISH TOGOLAND: Keta, G. W. Lawson 515, 30 Dec. 1952 (D).

MAINE: Long pond, Mt. Desert island, F. S. Collins 3964, Jul. 1900 (NY). MASSACHUSETTS: near Linden station, Malden, Collins 2074 (NY, UC), 2727 (NY), Jun. 1891, Oct. 1895; fresh water and mud, Woods Hole, W. Trelease, 1881 (MO). QUEBEC: in the St. Lawrence river, Longueuil near Montreal, J. Brunel 33, 30 Aug. 1930 (FC). NEW YORK: Van Cortlandt park, New York City, J. Cohn 108, 1933 (D). MARYLAND: in the Potomac river, Plummers island west of Cabin John, Montgomery county, F. Drouot, E. F. Killip, & D. Richards 5533, 6 Aug. 1944 (FC, US). FLORIDA: intertidal in St. Andrews bay, Cove Hotel, Panama City, Drouot & C. S. Nielsen 11625, 30 Jan. 1949 (FC, T); Dunnellon, Marion county, M. A. Brannon 380, 20 Oct. 1946 (FC, PC); in a very shallow stream near Tallahassee, Nielsen 48a, 2 May 1948 (FC, T); Cocoplum beach, Biscayne bay, Miami, H. J. Humm 2, 14 Jan. 1946 (FC); swamp 8 miles north of Sanderson, Baker county, A. M. Scott 149, 2 Jan. 1948 (FC). KENTUCKY: pond at St. Vincent, Union county, B. B. McInteer 970, 26 Jun. 1938 (DA, FC); pond on U. S. highway 60 one mile east of Winchester, Clark county, McInteer 673, 23 Aug. 1929 (DA, FC). TENNESSEE: Knoxville, H. C. Bold 6a, Jul. 1938 (FC). MICHIGAN: Livingston bog, Douglas lake, Cheboygan county, H. K. Phinney, 28 Jul. 1939 (DA, FC, PHI). INDIANA: in muck from North Mud lake 3 miles northeast of Pulton, F. K. & W. A. Daily 1473, 29 Jun. 1946 (DA, FC); artificial lake north of Marion, Grant county, F. K. & W. A. Daily 2657, 23 Aug. 1953 (DA, FC); in Tippecanoe lake, 2½ miles from North Webster, Kosciusko county, F. K. & W. A. Daily 2229, 25 Jul. 1950 (DA, FC); debris on bottom of Messick lake, 1½ miles north of Eddy, Lagrange county, F. K. & W. A. Daily 2690, 26 Aug. 1953 (DA, FC); Lake Sullivan in Riverside park, Indianapolis, F. K. & W. A. Daily 1035, 27 Sept. 1942 (DA, FC); Morgan county, C. M. Palmer M2, 5 Oct. 1925 (DA, FC); pond on state road no. 41, 2 miles north of Rockville, Parke county, F. K. & W. A. Daily 1879, 16 Aug. 1947 (DA, FC). MISSOURI: culture from mud in the lake north of Chouteau Springs, Cooper county, F. Drouot 562, 27 Apr. 1930 (D). LOUISIANA: roadside pool near Bastrop, G. W. Prevost L25, 26 Jun. 1938 (D). NEBRASKA: old gravel-pit pond south of North Platte, W. Kiener 17956, 17957, 4 Nov. 1944 (FC, KI); Dewey lake, Cherry county, E. Palmator & T. R. Porter 13775, 28 Jun. 1936 (FC, KI). TEXAS: on sand at Blind Bayou, Galveston island, H. K. Phinney 2741/2, 30 Aug. 1941 (FC, PHI); in a stream, Travis county, B. C. Sharp 46A500, 24 Oct. 1946 (FC, TEX); in a resaca pond south of Seventh street, Brownsville, R. Runyon 3891a, 28 Nov. 1944 (FC).

CALIFORNIA: floating in a pool of very salt water, Alameda, W. J. V. Osterhout & N. L. Gardner, 16 Sept. 1903 (Type of *Pratiola Gardneri* Coll. in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1185, NY; isotypes, FC [Fig. 141], TA); Richmond, Gardner 810, Sept. 1902 (TA); in a small spring near San Pablo, Gardner, 27 Sept. 1902 (as *Merismopodia glauca* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1155, PC, L, TA); on sand wet by spring water, Lake Merced, San Francisco, Gardner, 15 Nov. 1905 (as *M. glauca* f. *mediterranea* in Coll., Hold., & Setch., Phyc. Bor.-Amer. no. 1651, FC, L, TA), Gardner 1578, Nov. 1905 (FC, S). BAHAMA ISLANDS: aquarium, Lerzer Laboratory, Bimini, H. J. Humm 25a, 26 Mar. 1948 (FC). PUERTO RICO: in a pool about 4 km. north of Mayaguez, N. Wille 1310a, Feb. 1915 (Type of *M. Willii* Gardn.,

NY [Fig. 137]); with *Anacystis thormalis* (Menegh.) Dr. & Daily in a warm stream, Coamo Springs, Wille 384a, Jan. 1915 (NY). GUADELOUPE: shore, Vx. Bourg, A. Quetzel 255, 22 Feb. 1944 (FC, TA). BRAZIL: Estação Biológica do Alto da Serra, entre Santos e São Paulo, A. B. Joly 3, 4 May 1953 (D). NEW ZEALAND: Long Beach, Bay of Islands, M. A. Focock & V. F. Lindauer, 1950 (D, FC). PHILIPPINES: mud at Dagat-Dagatan, Navotas, Rizal prov., G. T. Velasquez 441, 442, 12 Feb. 1940 (FC). NEW GUINEA: with *Najas flexilis* Deile in brackish lagoon, H. J. Rogers NG9, 20 Sept. 1944 (FC).

GENUS 5. MICROCROCIS

Richter in Hauck & Richter, Phyk. Univ. 11: 548. 1892. —Type species: *M. Dieteli* Richt.

Holopedium Lagerheim, Nuova Notarisa 4: 209. 1893. *Merismopoedia* Subgenus *Holopedium* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 43. 1883. *Holopedium* Subgenus *Microcrocis* Forti, Syll. Myxophyc., p. 111. 1907. —Type species: *Merismopoedia geminata* Lagerh.

Plantae microscopicae vel sub-macroscopicae, cellulis cylindraceis vel ovoideo-cylindraceis, in lamina irregulariter dispositis; divisione cellulae seriatim in duobus planis unoquodque ad alium et ad superficiem laminae perpendicularibus procedente; gelatino vaginale hyalino.

It is highly probable that plants of this genus are growth-forms of *Agmenellum thormalis*, as indicated by Rabenhorst in Alg. Sachs. 71 & 72: 719 (1878): "Unter B finden sich Exemplare, wo die Gonidien nicht mehr der Gattung [*Merismopoedia*] entsprechend goerdnet sind." Earlier, O. Bulnheim in Rabenh. Alg. Sachs. 51 & 52: 515 (1856) said: "Was als grösseres grünes Häutchen der *Merismopoedia* sich findet, hält Hr. A. Braun nicht für eine *Prasiola*, sondern für einen höhern Alterszustand bei *Merismopoedia*, in welchem die Theilung minder regelmässig geworden . . ." The few specimens available for study are inadequate to allow us to satisfy ourselves on this point.

One species:

MICROCROCIS GEMINATA Geitler in Engler & Prantl, Natürl. Pflanzenfam., ed. 2, lb: 56. 1942. *Merismopoedia geminata* Lagerheim, Öfvers. K. Sv. Vet.-Akad. Förh. 40(2): 43. 1883. *Holopedium geminatum* Lagerheim, Nuova Notarisa 4: 209. 1893. —Paratype studied by the author, the type of *Microcrocis Dieteli* Richt. (L). See Lagerheim in Nuova Notarisa 1892: 207 and 1894: 655, and Richter, *ibid.* 1892: 292. The personal herbarium of G. Lagerheim is to be sought at the University of Quito. FIG. 181.

Microcrocis Dieteli Richter in Hauck & Richter, Phyk. Univ. 11: 548. 1892. *Holopedium Dietelii* Migula, Krypt.-Fl. Deutschl. 2(Alg. 1a): 41. 1905. —Type from Leipzig, Germany (L). FIG. 181.

Holopedium obsolutum Tiffany, Contrib. F. T. Stone Lab. Ohio State Univ. 6: 19. 1934. —Type from Put-in-Bay, Ohio (in the collection of L. H. Tiffany).

Original specimens have not been available to us for the following names: their original descriptions are here designated as the types until the specimens can be found:

Holopedium bellum Beck-Mannagetta, Arch. f. Protistenk. 66: 10. 1929. *Bockia bella* Elenkio, Monogr. Algar. Cyanophyc., Pars Spec. 1: 71. 1938.

Merismopoedia angularis Thompson, Univ. Kansas Sci. Bull. 25: 10. 1938.

Holopedium granulosum Skuja, Symbolae Bot. Upsal. 9(3): 41. 1948.

Plantae (laminae) aërugineae vel olivaceae, primum microscopicae deinde ad

1 mm. latae ambitu irregulares, cellulis post divisionem cylindraceis vel ovoideo-cylindraceis, ad apices rotundis, diametro 4—7 μ crassis, ad 15 μ longis, per gelatinum vaginale conferte distributis; gelatino vaginale hyalino, firmo vel diffluente; proroplasmate aerugineo vel olivaceo, homoganeo vel tenui-granuloso. FIG. 181.

In long-standing shallow pools, in old cultures, and seldom in the plankton.

Specimens examined:

GERMANY: Leipzig, in einem Wassergraben, F. Dietsch, Apr. 1891 (Type of *Microcrocis Dietschi* Richt. in Hauck & Richt., Phyk. Univ. no. 548, L; isotypes, FH, MIN, N [Fig. 181]; paratypes of *Merismopodia geminata* Lagerh.); Leipzig in dem grossen Lautzschens Teiche, O. Bulnheim, Mar. 1856 (with *M. elegans* in Rabenh. Alg. no. 515, FC, PH, L, NY, UC); auf Ebschlamme kultivirt, Reinicke (with *M. convoluta* var. *aeruginosa* in Rabenh. Alg. no. 719, FC, L). FRANCE: Calvados? ex herb. Lebel (PC). OHIO: Terwilliger's pond, Put-in-Bay, E. H. Ahlstrom, Aug. 1932 (Type of *Holopedium obovatum* Tiff. in the private collection of L. H. Tiffany).

GENUS 6. GOMPHOSPHAERIA

Kützing, Alg. Aq. Dulc. Germ. Dec. 16: 151. 1836. *Gomphosphaeria* Subgenus *Eugomphosphaeria* Elenkin, Not. Syst. Inst. Crypt. Horti Bot. Petropol. 2: 67. 1923. —Type species: *Gomphosphaeria aponina* Kütz.

Original specimens of the type species for the following names have not been available to us for study:

Coelocystis Nägeli in Kützing, Sp. Algar., p. 209. 1849. *Coelospaerium* Nägeli, Gatt. Einzell. Alg., p. 54. 1849. *Gomphosphaeria* Subgenus *Coelospaerium* Elenkin, Not. Syst. Inst. Crypt. Horti Bot. Petropol. 2: 67. 1923. —Type species: *Coelocystis Kuetzingianum* Näg. (= *Coelospaerium Kuetzingianum* Näg.)

Thamniastrum Reinsch, Notarisia 3: 513. 1888. —Type species: *T. cruciatum* Reinsch.

Murssonella Lemmermann, Ber. Deutsch. Bot. Ges. 18: 275. 1900. —Type species: *M. elegans* Lemm.

Woronichinia Elenkin, Acta Inst. Bot. Acad. Sci. U. R. P. S. S., ser. II, 1: 28. 1933. —Type species: *Coelospaerium Naegelianum* Ung.

Snowella Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 278. 1938. —Type species: *Coelospaerium roseum* Saow.

Plantae microscopicae, multicellulares, sphaericae vel ovoideae, varie tuberculosae et in divisione constrictae, cellulis sphaericis, ovoideis, cylindraceis, obovoideis, vel pyriformibus, radiatim in superficie thalli irregulariter aut in seriebus aliis ad alias perpendicularibus dispositis; divisione cellulae seriatim in duobus planis unoquodque ad alium et ad superficiem thalli perpendicularibus procedente; gelatino vaginale hyalino, homoganeo vel circum cellulas laminoso, saepe conspicua filiola dichotome ramosa a cellulis ad centrum thalli exhibente.

Plants of *Gomphosphaeria* are typically spherical, with the cells arranged radially in a single layer in the periphery of the gelatinous matrix. Cell division proceeds successively in two planes perpendicular to each other and radial within the plant. Individual sheaths are evident about the cells in many plants of *G. aponina* and *G. lacustris*; the remains of the old parts of these sheaths form a dichotomously branched structure extending radially toward the center of the gelatinous matrix. In some plants, the rest of the gelatinous matrix hydrolyzes, and the dichotomous structure remains intact.

Key to species of *Gomphosphaeria*:

Cells before division 3—5 μ in diameter, containing pseudovacuoles; plants developing as water blooms in fresh water J. G. WICHURAE

Cells before division 2—4 μ in diameter, without pseudovacuoles; plants not developing as water blooms2. G. LACUSTRIS

Cells before division 4—15 μ in diameter, without pseudovacuoles; plants not developing as water blooms3. G. APONINA

1. GOMPHOSPHERA WICHURAE Drouet & Daily, Butler Univ. Bot. Stud. 10: 222. 1952. *Coelosphaerium Wichurae* Hilse in Rabenhorst, Alg. Eur. 153—156: 1523. 1863; Hedwigia 1863: 151. 1863. —Type from Reichenbach, Silesia (FC). FIG. 173.

Hydroopicoicum genuense de Notaris, Erb. Critt. Ital., ser. 2, 4: 178. 1869; Hedwigia 1869: 86. 1869. *Coelosphaerium genuense* Ardissone & Srafforello, Enum. Alg. Liguria, p. 61. 1877. —Isotypes from Genoa, Italy (FC, FH, L, NY, UC). FIG. 174.

Coelosphaerium Naegelianum var. *Lemmermannii* Elenkin & Hollerbach, Not. Syst. Inst. Crypt. Hort. Bot. Petropol. 2: 156. 1923. *Woronichinia Naegeliana* var. *Lemmermannii* Elenkin & Hollerbach, Acta Inst. Bot. Acad. Sci. U. R. P. S. S., ser. 2, Pl. Crypt. 1: 32. 1933. *W. Naegeliana* f. *Lemmermannii* Elenkin in Elenkin & Hollerbach, loc. cit. 1933. —Specimens from Oswitz near Breslau, Silesia, designated as isotypes (L, S, TA).

Gomphosphaeria fusca Skuja, Symbolae Bot. Upsal. 9(3): 39. 1948. —Topotype from Erken, Uppland, Sweden, received from the author (D). FIG. 177.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Gomphosphaeria lilacea Virieux, Ann. Biol. Lac. 8: 69. 1916.

Microcystis elubens var. *major* Bachmann, Mitt. Naturf. Ges. Luzern 8: 11. 1921.

Synechococcus endobioticus Elenkin & Hollerbach, Not. Syst. Inst. Crypt. Hort. Bot. Petropol. 2: 160. 1923. *Synechocystis endobiotica* Elenkin & Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 23. 1938.

Plantae smaragdinae vel laete aeruginae, sphaericae vel ovoideae varie tuberculosae et constrictae, cellulis ovoideis vel ovoideo-cylindratis, diametro ante divisionem 3—5 μ crassis, in superficie thalli dense et irregulariter vel in seriebus aliis ad alias perpendicularibus ordinatis; gelatino vaginale hyalino, firmo vel (interdum omnino) diffuente, homogeneo vel filiola dichotoma ad centrum thalli inconspicue exhibente; protoplasmate aeruginoso, pseudovacuolis factis. FIGS. 173, 174, 177.

In the plankton of bodies of fresh water; often found as conspicuous and heavy water blooms during the warmer months of the year. In heavy water blooms, the cells of many plants of *Gomphosphaeria Wichurae* dissociate as the gelatinous matrix hydrolyzes. The firmer matrices of other plants may harbor bacteria, *Phormidium mucicola* Naum. & Hub., and other organisms. Gomphosphaerioid growth-forms of *Lamprocystis rosea* (Kütz.) Dr. & Daily, the cells of which contain a red pigment, are sometimes confused with plants of *Gomphosphaeria Wichurae*. Also a growth-form of *Anacystis cyanea* in which most of the cells are distributed in the periphery of the gelatinous matrix may simulate plants of this species.

Specimens examined:

SWEDEN: Järlasjön, Stockholm, G. Lagerheim, Sept. 1898 (S); Frisksjön, Loftahammar, Smolandia, O. Borge, Jun. 1914 (S); in rivulo, Ljusterö, Stockholm, K. Boblin, Aug. 1896 (S); Valloxen, Uplandia, Borge, Oct. 1897 (S); Erken, Uppland, H. Skuja, 1 Oct. 1950 (topotype of *Gomphosphaeria fusca* Skuja, FC [Fig. 177]); lacus ad Tenhult Smolandiae, O. Nordstedt, 13 Aug. 1900 (NY, S), 18 Jun. (as *Coelosphaerium Naegelianum* in Mus. Vindob. Krypt. Exs. no. 1631, FC, L, NY, S); Sövedsjön, Malmöhus, B. Carlin-Nilsson 520, 17 Aug. 1937 (D). POLAND: Silesia: auf einem Teiche am Schlosse von Habeodorf, Kr. Reichenbach, Hilse, Sept. 1862 (Type of *C. Wichurae* Hilse in Rabenh. Alg. no. 1523, FC [Fig. 173]; isotypes, L, NY, UC); in einem

Wasserloche hinter Oswitz bei Breslau, *O. Kirchner*, Aug. 1874 (designated as isotypes of *C. Naegelianum* var. *Lemmermannii* Elenk. & Hollerb. in Rabenh. Alg. no. 2423, L, S, TA). GERMANY: Boxheim im Plankton, *Lauterborn*, Aug. 1902 (as *C. Naegelianum* in Mig., Krypt. Germ., Austr., & Helv. Exs., Alg. no. 14, NY); Leipzig, Bernbruch bei Grünna, *F. Richter* (NY); auf einem Teiche in Bernbruch bei Lausigk, *Richter*, Jul. 1864 (as *C. Kuetzingianum* in Rabenh. Alg. no. 1791, NY), Jul. 1874 (TA); Lausigk, *Richter* (N); Dumetsweiher bei Kosback bei Erlangen, *H. Glück*, 9 Sept. 1865 (as *C. Kuetzingianum* in Hauck & Richt., Phyk. Univ. no. 683, L, NY, S). CZECHOSLOVAKIA: Bohemia: Jordan u Tábora, *A. Hanzig*, Aug. 1883 (FC, W); piscina Radov prope Blatná, *B. Folt*, 20 Sept. 1948 (FC); great pond of Doksy, *B. Folt*, 15 Sept. 1948 (FC). ITALY: in aquariis horti botanici Genuesis, *de Notaris*, 1868—69 (isotypes of *Hydrococcium genense* de Not. in Raebob. Alg. no. 2127, FC [Fig. 174], FH, L, NY, UC; Erb. Crit. Ital., ser. 2, no. 178, FH); in una vasca dell'Orto botanico di Pisa, *A. Mori* & *A. Lodi*, Aug. 1882 (as *Coelospiraum Kuetzingianum* in Erb. Crit. Ital., ser. 2, no. 1252, FC, UC). SCOTLAND: Loch Cbaluim near Loch Shurrery, Cairness, *A. J. Brook* 4, 4 Jul. 1950 (D). MASSACHUSETTS: Spot pond, Medford, *F. S. Collins*, 2 Oct. 1881 (NY); Hammond pond, Brookline, *B. M. Davis*, 20 Oct. 1893 (D, MICH, MO, YU); Fresh pond, Cambridge, *W. G. Farlow*, Oct. 1886 (MO); South Framingham, *Farlow*, Oct. 1879 (MO); Framingham, *A. K. Stone* (N); ad Framingham, *Farlow*, 1883 (as *C. Kuetzingianum* in Witr. & Nordst., Alg. Exs. no. 692, FC, L, NY, S); on Winchester reservoir, Winchester, *Collins*, 2 Oct. 1898 (as *C. Kuetzingianum* in Coll. Hold. & Seth., Phyc. Bot.-Amer. no. 553, FC, D, L, MICH, NY, TA), *Collins* 3554, 14 Aug. 1899 (NY), Aug. 1899 (as *C. Kuetzingianum* in Coll., N. Amer. Alg. no. 2, D, NY); Arlington, *E. Dewart* 2160, 27 Jul. 1891 (FC, D, L, NY, S, TA). CONNECTICUT: water-bloom, Housatonic river, *H. C. Bold* B-3, 30 Sept. 1939 (DA, FC); in Avery's brook, Ledyard, *W. A. Sotcboll* 549, Sept. 1892 (UC). NEW YORK: Basic reservoir, Rensselaerville, *M. S. Markle* 25, Jul. 1947 (EAR, FC); plankton of Lake Mohansic, Westchester county, *Bald* B121, 4 Oct. 1941 (FC).

NEW JERSEY: bloom on protected bay, Lake Farrington, New Brunswick, *E. T. Mont* 6108, 19 Sept. 1948 (FC). PENNSYLVANIA: Mercer county: Shenango river, New Hamburg, *L. Walp* & *W. Murchie* 1, 26 Jun. 1941 (FC), Greenville, Sharon, and Wheatland, *Walp* & *Murchie* 3—5, 6 Jul. 1941 (FC). ONTARIO: Experiment farm, Ottawa, *J. Fletcher*, Aug. 1888 (FH). OHIO: south reservoir, Portage Lake near Akron, *E. H. Ahlstrom*, 28 Dec. 1932 (DA, FC); Chippewa lake, *Ahlstrom*, 30 Aug. 1931 (DA, FC); Lake Erie, *L. H. Tiffany*, 1929 (DA, FC); Decker lake near Piqua, Miami county, *C. P. Clark*, 23 Oct. 1942 (DA, FC); plankton in Arlington cemetery lake, Cincinnati, *W. A. Daily* & *J. H. Hoskins* 108, 4 Oct. 1939 (DA, FC); in State Hospital pond, Athens, *A. H. Blickle*, 8 Oct. 1941 (DA, FC). MICHIGAN: Benton Harbor, *M. E. Britton*, Aug. 1939 (DA, FC); Sodon lake west of Bloomfield Hills, Oakland county, *S. A. Cain*, 9 Dec. 1947 (FC); in Marble lake near Quincy, *G. W. Prescott* M411a, 21 Sept. 1937 (FC); "Three Lakes", Ann Arbor, *L. N. Johnson* 5, 27 Sept. 1892 (FC). INDIANA: Anderson's pond 3 miles south of Hartsville, Bartholomew county, *F. K. & W. A. Daily* 1040, 11 Oct. 1942 (DA, FC); Jimmy Strahl lake, Brown County state park, *R. E. A.*, & *M. Frietze* 1—3, 2 Nov. 1947 (DA, FC); Lake Cicott, Cass county, *F. K. & W. A. Daily* 1023, 9 Sept. 1942 (DA, FC); Lake McCoy, 3—5 miles east of Greensburg, Decatur county, *F. K. & W. A. Daily* 1038, 1182, 11 Oct. 1942, 19 Sept. 1943 (DA, FC); Cups pond, 4 miles east of Greensburg, *F. K. & W. A. Daily* 1039, 11 Oct. 1942 (DA, FC); southeast shore of Heaton lake, 6 miles northeast of Elkhart, *F. K. & W. A. Daily* 2619, 2621, 26 Aug. 1952 (DA, FC); South Mud lake, 4 miles east of Fulton, *F. K. & W. A. Daily* 1482, 29 Jun. 1946 (DA, FC); in quarry on Washington street, Kokomo, *F. K. & W. A. Daily* 1026, 10 Sept. 1942 (DA, FC); west side of Dewart lake, Kosciusko county, *F. K. & W. A. Daily* 2115a, 9 Jul. 1949 (DA, FC); Center lake, Warsaw, *F. K. & W. A. Daily* 2180, 22 Jul. 1950 (DA, FC); Durham (Daniel) lake, Kosciusko county, *F. K. & W. A. Daily* 2262, 26 Jul. 1950 (DA, FC); Lake Wawasee, Syracuse, *F. K. & W. A. Daily* 221, 2238, 2245, 24—26 Jul. 1950 (DA, FC); Carr's lake northeast of Claypool, Kosciusko county, *F. K. & W. A. Daily* 2174, 22 Jul. 1950 (DA, FC); Tippecanoe lake near North Webster, *H. B. Metcalf* 2, 12 Oct. 1947 (DA, FC), *F. K. & W. A. Daily* 2228, 2229, 25 Jul. 1950 (DA, FC); Little Tippecanoe (James) lake, Kosciusko county, *F. K. & W. A. Daily* 2227, 25 Jul. 1950 (DA, FC); Wabee lake southeast of Milford, *F. K. & W. A. Daily* 2636, 28 Aug. 1952 (DA, FC); Webster lake at North Webster, *F. K. & W. A. Daily* 2222, 2226, 25 Jun. 1950 (DA, FC); Syracuse lake at city park, Syracuse, *F. K. & W. A. Daily* 2195, 23 Jul. 1950 (DA, FC); Atwood lake west of Wolcottville, Lagrange county, *F. K. & W. A. Daily* 2687, 26 Aug. 1953 (DA, FC); Indian lake near Fort Benjamin Harrison, Marion county, *F. K. & W. A. Daily* 1050, 1051, 18 Oct. 1942 (DA, FC); Lake Maxinkuckee, Marshall county, *G. T. Moore*, 28 Aug. 1899 (FC), *F. K. & W. A. Daily* 1533, 1542, 4-5 Jul. 1946 (DA, FC); small lake at north edge of Rome City, *F. K. & W. A. Daily* 2278, 29 Jul. 1950 (DA, FC); outlier of Sylvan lake, Rome City, *F. K. & W. A. Daily* 2277, 29 Jul. 1950 (DA, FC); Cree lake, 4 miles north of Kendallville, Noble county, *F. K. & W. A. Daily* 1914, 12 Sept. 1947 (DA, FC); Skinner lake, east of Albion, Noble county, *F. K. & W. A. Daily* 1912, 12 Sept. 1947 (DA, FC); Thomas lake east of Lena, Parke county, *F. K. & W. A. Daily* 2531, 25 Aug. 1951 (DA, FC); Eliza lake, Moss lake, and Spectacle lake near Valparaiso, Porter county, *F. K. & W. A. Daily* 2567, 2574, 2576, 30 Aug. 1951 (DA, FC); Bass lake, 6 miles west of Angola, *F. K. & W. A.*

Daily 1917, 12 Sept. 1947 (DA, FC); Hamilton lake, Hamilton, Steuben county, F. K. & W. A. *Daily* 2444, 2449, 17 Jun. 1951 (DA, FC); Hogback lake, Steuben county, C. M. Palmer 1015, Jul. 1933 (DA, FC); Lake James, Pokagon state park, Steuben county, F. K. & W. A. *Daily* & I. Spangler 1931, 13 Sept. 1947 (DA, FC); Lake Lonidaw, Pokagon state park, S. A. Joyner, 31 Aug. 1949 (DA, FC); Otter lake, Steuben county, 13 Sept. 1947 (DA, FC); Pleasant lake, Steuben county, F. K. & W. A. *Daily* 2458, 18 Jun. 1951 (DA, FC); Snow lake, 7 miles north of Angola, F. K. & W. A. *Daily* 1943, 1945, 13—14 Sept. 1947 (DA, FC); Shakamak lake, Shakamak state park, Sullivan county, Palmer B18, 8 Sept. 1933 (DA, FC), F. K. & W. A. *Daily*, F. Geisler, & P. Hueber 2378, 23 Sept. 1950 (DA, FC); pond at Rose Polytechnic Institute, Terre Haute, B. H. Smith 134, 30 Jul. 1929 (DA, FC); pond on state road no. 9 near Columbia City, Whitley county, F. K. & W. A. *Daily*, 14 Sept. 1947 (DA, FC).

WISCONSIN: Lake Mendota, Madison, W. Trelease, Oct. 1886 (D, FH), R. E. Blount, 2 Oct. 1886 (FC); small lake near Clear lake, Rock county, J. B. Lackey, Aug. 1943 (FC); Hog creek, Chippewa flowage, Sawyer county, G. W. Prescott 3W185, 30 Aug. 1938 (FC); Little Star lake, Prescott 3W95, 21 Aug. 1938 (FC). ILLINOIS: Cook county, M. E. Britton 987, 8 Sept. 1939 (DA, FC); Maple lake, Cook county, Britton 993, 8 Sept. 1939 (DA, FC); Lake Zurich, Fish lake, Petit lake, and Lake Marie, Lake county, Britton 916, 940, 956, 959, 1030, 1032, 1051, Aug.—Sept. 1939 (DA, FC); Channel lake 3 miles west of Antioch, Lake county, Britton 1038, 1043, 14 Sept. 1939 (DA, FC). MINNESOTA: Cass lake, Cass county, C. B. Reif, 11 Sept. 1936 (DA, FC); Lake Itasca, Clearwater county, S. Eddy, 20 Aug. 1905 (DA, FC); Lake of the Isles, Minneapolis, F. Drouet 5593, 19 Aug. 1944 (FC); Cross lake, just north of Minneapolis, C. B. Reif, 22 Sept. 1936 (DA, FC); Lake Minnetonka at Spring Park, Hennepin county, Drouet, A. A. Cohen, & E. Cohen 5007, 5016, 8 Aug. 1943 (FC); Waterville, Le Sueur county, J. C. Arthur (FH); Little Pelican and Star lakes, Ottertail county, S. Eddy, Jul.—Aug. 1940 (DA, FC); Keller lake north of St. Paul, Drouet & E. Cohen 5045, 5050, 9 Aug. 1943 (FC); Lake Gervais and Lake Owasso, Ramsey county, S. Eddy, 25 Jun., 15 Aug. 1931 (DA, FC); Poplar lake, Superior national forest, C. B. Reif, 28 Jun. 1935 (DA, FC); Osakis lake, Todd county, Reif, 19 Jul. 1938 (DA, FC); Long lake northeast of North St. Paul, in Washington county, Drouet & E. Cohen 5062, 9 Aug. 1943 (FC). MISSOURI: St. Charles, B. Ennis, 12 Nov. 1930 (D); Reed's lake, Callaway county, J. R. Hurt R-1, R-8, 14 Oct. 1939, 12 Jun. 1940 (FC); New and Old Fayette lakes near Fayette, Howard county, Hurt NF-2, OF-1, NF-11a, 24 Nov. 1939, 4 Jun. 1940 (FC). NEBRASKA: sandpit pond north of David City, Butler county, W. Kiener 21570a, 8 Nov. 1946 (FC, KI); sandpit lakes, Fremont, Dodge county, Kiener 19700, 23934, 1 Jul. 1948, 15 Sept. 1945 (FC, KI); lake 3 miles east of Stratton, Hitchcock county, Kiener 10470, 24 Jul. 1941 (FC, KI); pond in city park, Norfolk, Madison county, Kiener 22916, 15 Oct. 1947 (FC, KI). BRITISH COLUMBIA: Deer lake near Burnaby Lake, New Westminster county, J. E. Nielson 81, 91, 14 Jun. 1924, 22 Nov. 1925 (FC). WASHINGTON: Phantom Lake, W. T. Edmondson, 30 Jun. 1953 (FC); Fidalgo island, L. E. Griffin, summer 1938 (FC). CALIFORNIA: Big Bear lake, San Bernardino county, G. J. Hollenberg 469, 1624, 26 Aug. 1934 (FC, D, UC).

2. *GOMPHOSPHERA LACUSTRIS* Chodar, Bull. Herb. Boiss. 6: 180. 1898. *Coelosphaerium lacustre* Ostenfeld, Hedwigia 46: 396. 1907. —Topotypic material from Lac de Joux, Switzerland (in the collection of Otto Jaag).

Chroococcus minimus var. *minimus* Keissler, Verh. K. K. Zool.-bot. Ges. Wien 51: 394. 1901. *C. minimus* Lemmermann, Ark. f. Bot. 2(2): 102. 1904. *Gloeoopsis minima* Hollerbach in Elenkin, Monogr. Algar. Cyanophyc., Pars Spec., 1: 242. 1938. —Type from Attersee, Upper Austria (W).

Gomphosphæria lacustris var. *compacta* Lemmermann, Abh. Nat. Ver. Bremen 16: 341. 1899. *G. compacta* Ström, Naturw. Unters. Sarekeberges in Schwed.-Lappl. 3(Bot., Lief. 5): 446. 1923. —Material named by the author from Lake Wombsjön, Sweden, designated as the Type (S).

Coelosphaerium Collinsii Drouet & Daily in Daily, Amer. Midl. Nat. 27: 653. 1942. —Type from Naushon island, Massachusetts (D). FIG. 176.

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Coelocystis Kuetzingiana Nägeli in Kützing, Sp. Algar., p. 209. 1849. *Coelosphaerium Kuetzingianum* Nägeli, Gart. Einzell. Alg., p. 54. 1849. —Thorough search through the F. T. Kützing herbarium at Leiden and the Nägeli herbaria at Zürich and Munich has failed to discover that the original specimens were preserved. Nägeli's sketches and notes, from the notebooks in the Pflanzenphysiologisches Institut, Eidgenössische Technische Hochschule, Zürich, are reproduced here: FIG. 175.

Coelosphaerium Naegelianum Unger, Denkschr. K. Akad. Wiss. Wien, Math.-Nat. Kl., 7: 195. 1854. *Gomphosphæria Naegeliana* Lemmermann, Krypt.-Fl. Mark Bräudenb. 3: 80. 1907.

Woronichinia Naegelianii Elenkin, Acta Inst. Bot. Acad. Sci. U. R. P. S. S., ser. 2, Pl. Crypt. 1: 28. 1933.

Thamniastrum cruciatum Reinsch, Notarisia 3: 513. 1888. —See Taft in Bull. Torr. Bot. Club 72: 246. 1945.

Coelosphaerium aeruginosum Lemmermann, Bot. Centralbl. 76: 154. 1898. *C. anomalum* var. *aeruginosum* Hansgirg, Beih. z. Bot. Centralbl. 8(2): 516. 1905.

Marsionella elegans Lemmermann, Ber. Deutsch. Bot. Ges. 18: 275. 1900.

Coelosphaerium roseum Soow, Bull. U. S. Fish Comm. 1902: 387, 390. 1903. *Gomphosphaeria rosea* Lemmermann, Krypt.-Fl. Mark Brandenb. 3: 80. 1907. *Snowella rosea* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 278. 1938.

Gomphosphaeria lisoralis Häyten, Bidrag t. Kännedom Finlands Nat. och Folk 20(3): 91. 1921.

Coelosphaerium radiatum G. M. Smith, Roosevelt Wild Life Bull. 2: 136. 1924.

Coelosphaerium pusillum Van Goor, Rec. Trav. Bot. Neerl. 21: 318. 1924.

Coelosphaerium Geitleri Schiller, Sitzungsber. Oester. Akad. Wiss., Math.-Nat. Kl., I, 163: 131. 1954.

Plantae aeruginosae, olivaceae, violaceae, vel roseae, sphaericae vel ovoideae varie tuberculosae vel constrictae, cellulis globosis vel ovoideis, etiam obovoideis, diametro ante divisionem 2—4 μ crassis, in superficie thalli irregulariter aut in seriebus aliis ad alias perpendicularibus ordinatis; gelatino vaginale hyalino, firmo vel (interdum omnino) diffuente, homogenero vel filiola dichoroma ad centrum thalli vulgo exhibente; protoplasmate aerugineo, olivaceo, vel roseo, homogenero. FIGS. 175, 176.

In the plankton of lakes, ponds, and rivers, and in shallow water and pools along their margins. Plants of *Gomphosphaeria lacustris* developing in shallow water are usually firmer and more compact than those in the plankton, and their cells are often more ovoid or obovoid than are those of the latter. Growth-forms of the bacterial *Lamprocystis rosea* (Kütz.) Dr. and Daily, especially those in which the pseudovacuoles have been lost, are often confused with this species. Likewise, certain growth-forms of *Anacystis montana* may superficially resemble this species.

Specimens examined:

SWEDEN: Saxorp, Vestergötland, O. Nordstedt, Jun. 1883 (S); in lacu Wornsjön Scaniae, Nordstedt, Jun. 1901 (designated as Type of *Gomphosphaeria lacustris* var. *compacta* Lemm., S). AUSTRIA: Auersee, Upper Austria, C. von Keissler, 13 Aug. 1900 (Type of *Croococcus minutus* var. *minutus* Keissl. in the slide collection of C. Keissler, W). SWITZERLAND: Lac de Joux, Vaud, O. Jaag (topotype of *Gomphosphaeria lacustris* in the collection of O. Jaag). IRELAND: Lough Corrib, G. S. West 53 (FC, UC). NEW BRUNSWICK: pool, lower basin, Grand Falls, Victoria county, H. Habeck 10849, 30 Sept. 1948 (FC, HA). MAINE: Long Pond, Mr. Desert island, P. S. Collins 3964, July 1900 (NY, UC). MASSACHUSETTS: French Watering Place, Naushon island, P. Dronet 2125, 12 Aug. 1937 (Type of *Coelosphaerium Collinsii* Dr. & Daily, D [Fig. 176]); Fresh pond, Nobska point, Falmouth, Dronet 1948, 16 Sept. 1936 (D). QUEBEC: étang eovahi par les grandes marais, Baie Kopaluk (esuaire de rivière George), Ungava, J. Rousseau 1099a, 10 Aug. 1947 (FC). NORTH CAROLINA: Mullet pond, Shackelford Banks, Beaufort, H. J. Hamm & C. S. Nielsen 1792, 23 Aug. 1949 (FC, T). FLORIDA: Leesburg, M. A. Brannon 332, 31 May 1948 (FC, FC); on Chara, Battery Point, Hernando county, Brannon 554, 23 Oct. 1948 (FC, FC). OHIO: Terwilliger's pond, South Bass island, Ottawa county, E. H. Ahlstrom, 4 Sept. 1931 (DA, FC); ponds, Newtown fish hatchery, Hamilton county, J. B. Lackey, Jul. 1944 (FC). MICHIGAN: Lake La Grange northeast of Dowagiac, Cass county, L. P. Woods, L. L. Pray, & P. H. Leil, Aug. 1942 (FC); Interlochen, Grand Traverse county, J. H. Hoskins, 29 Aug. 1934 (DA, FC).

INDIANA: Elkhart county: Heaton lake 6 miles northeast of Elkhart, F. K. & W. A. Daily 2621, 26 Aug. 1952 (DA, FC). Jackson county: sluiceway of dam, Driftwood state fish hatchery 2 miles south of Vallonia, F. K. & W. A. Daily 2343, 26 Aug. 1950 (DA, FC). Kosciusko county: Dewart lake, F. K. & W. A. Daily 2119, 9 Jul. 1949 (DA, FC); Lake Wawasee, F. K. & W. A. Daily 2183, 2203, 2207, 2214, 2238, 2250, 2272, 23—26 Jul. 1950 (DA, FC); Wabec lake southeast of Milford, F. K. & W. A. Daily 2636, 28 Aug. 1952 (DA, FC). Marion county: Geist reservoir 8 miles northeast of Indianapolis, F. K. & W. A. Daily 2485, 16 Sept. 1951 (DA, FC). Porter county: Pilot lake 3 miles north of Valparaiso, F. K. & W. A. Daily 2569, 30 Aug. 1951 (DA,

FC). Starke county: pond, Bass Lake state fish hatchery 5 miles south of Knox, *E. Warkenton & F. K. & W. A. Daily* 1553, 6 Jul. 1946 (DA, FC). Steuben county: Bass lake 6 miles west of Angola, *F. K. & W. A. Daily* 1917A, 12 Sept. 1947 (DA, FC); Clear lake 6 miles east of Fremont, *F. K. & W. A. Daily* 2452, 17 Jun. 1951 (DA, FC); Crooked lake, *C. M. Palmer B49b*, Sept. 1933 (DA, FC); Fox lake, *Palmer 1019*, Jul. 1933 (DA, FC); Gentian lake 6 miles north of Angola, *F. K. & W. A. Daily* 2659, 2666, 2671, 2674, 24 Aug. 1953 (DA, FC); Hamilton lake, Hamilton, *F. K. & W. A. Daily* 2449, 17 Jun. 1951 (DA, FC); Lake James, Pokagon state park, *S. A. Joyner*, 6 Jul. 1949 (DA, FC), *F. K. & W. A. Daily* 2474, 2677, 19 Jun. 1951, 25 Aug. 1953 (DA, FC); Jimerson lake 7 miles northwest of Angola, *F. K. & W. A. Daily* 2479A, 18 Jun. 1951 (DA, FC).

WISCONSIN: Pell lake near Lake Geneva, Walworth county, *W. E. Lake*, Aug. 1942 (FC); Round lake and Connors lake, *G. W. Prescott* 3W181, 3W213 (DA, FC); small lake near Clear lake, Rock county, *J. B. Luckey*, Aug. 1945 (FC). MINNESOTA: Lida lake, Ottertail county, *S. Eddy*, 5 Aug. 1940 (DA, FC); Lake Itasca, Clearwater county, *Eddy*, 18 Aug. 1933 (DA, FC), *F. O. Forstch* 18, 22, 1 Jul. 1954 (D). NEBRASKA: Jackson lake 9 miles north of North Platte, Lincoln county, *W. Kiener 17516*, 1 Sept. 1944 (FC, KI). SASKATCHEWAN: Last Mountain lake, Humboldt county, *P. E. Kuehne*, 7 Sept. 1940 (FC). MONTANA: Middle Quartz lake, Glacier national park, *Long F175*, 1 Sept. 1934 (FC). WYOMING: Fayette lake, Fremont county, *Bond F268*, 23 Aug. 1934 (FC). NEW MEXICO: pond in the lava-beds 6—8 miles east of Grant, Valencia county, *A. A. Lindsey* 8, 12 Aug. 1944 (FC). UTAH: Steam Mill and Tony Grove lakes, Cache county, *G. Piconian*, 13—14 Aug. 1933 (FC).

3. *GOMPHOSPHERIA APONINA* Kützing, Alg. Aq. Dulc. Dec. 16: 151. 1836. *Sphaerastrium cuneatum* Kützing in Meneghini, Consp. Algol. Eugau., p. 337. 1837. —Type from Abano, Italy (L). FIG. 179.

Gomphosphaeria apoina var. *cordiformis* Wolle, Bull. Torr. Bot. Club 9: 25. 1882. *G. cordiformis* Hansgirg, Oesterr. Bot. Zeitschr. 36: 333. 1886. *G. apoina* b. *cordiformis* Wolle ex Hansg., Prodr. Algenfl. Böhmen 2: 144. 1892. *G. apoina* f. *cordiformis* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec., 1: 286. 1938. —Type from Bethlehem, Pennsylvania (FC), FIG. 178.

Gomphosphaeria cordiformis var. *olivacea* Hansgirg, Oesterr. Bot. Zeitschr. 36: 333. 1886. *G. apoina* var. *olivacea* Hansgirg, Prodr. Algenfl. Böhmen 2: 144. 1892. *G. apoina* f. *olivacea* Forti, Syll. Myxophyc., p. 98. 1907. —Type from Ouzic, Bohemia (W). FIG. 180.

Gomphosphaeria apoina var. *multiplax* Nygaard, Vidensk. Medd. Dansk Naturh. Foren. Kjöbenhavn. 82: 204. 1926. *G. apoina* f. *multiplax* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 286. 1938. —Type from Kai islands, Indonesia (in the collection of G. Nygaard).

Original specimens have not been available to us for the following names; their original descriptions are here designated as the Types until the specimens can be found:

Gomphosphaeria apoina var. *limnetica* Virieux, Ann. Biol. Lac. 8: 68. 1916. *G. apoina* f. *limnetica* Elenkin, Monogr. Algar. Cyanophyc., Pars Spec. 1: 286. 1938.

Gomphosphaeria apoina var. *delicatula* Virieux, Ann. Biol. Lac. 8: 69. 1916. *G. apoina* f. *delicatula* Elenkin, Monogr. Algar. Cyanophyc., Pars. Spec. 1: 286. 1938.

Gomphosphaeria apoina f. *major* Pevalek, Geobot. & Algol. Istraz. Cretova u Hrvatskoj & Sloven. Rad 230: 86. 1924.

Gomphosphaeria apoina var. *gelatinosa* Prescott, Hydrobiologia 2(1): 93. 1950.

Plantae aeruginosae, olivaceae, luteolae, violaceae, vel roseae, sphaericae vel ovoideae aereae protracta variae constrictae, cellulis ovoideis, cylindraceis, obovoideis, vel pyriformibus, in divisione saepe cordiformibus, diametro ante divisionem 4—15 μ crassis, in superficie thalli irregulariter vel in seriebus aliis ad alias perpendicularibus ordinatis; gelatino vaginale hyalino, vulgo fitmo nonnumquam (etiam omnino) diffuentes, homogenero vel lamellosa, filiola dichotoma ad centrum thalli plerumque exhibente; protoplasmate aeruginoso, olivaceo, luteolo, violaceo, vel roseo, homogenero vel tenui-granuloso. FIGS. 178—180.

In shallow fresh, brackish, and marine waters, in seepage, and in the plankton. Under certain conditions, the protoplasts shrink and evidently secrete additional material within their individual sheaths; later they may continue growth again as a strain with narrower cells. Where the plants of *Gomphosphaeria apoina* dis-

integrate, groups of cells sometimes remotely resemble those of *Anacystis thermalis*.

Specimens examined:

POLAND: Mergelsgruben bei Warkotsch bei Strehlen in Schlesien, *Bleich* (as *Gomphosphaeria aponina* in Rabenh. Alg. no. 1497, FC, UC). GERMANY: Leipzig, um Altmanndorf, *P. Richter* (L, UC); Pötzschau bei Leipzig, *Auerwald*, Aug. 1959 (UC); in einem Graben am Eisenbahndamme oberhalb Beiersdorf in Franken, *P. Reinisch*, 9 Oct. 1864 (as *G. aponina* in Rabenh. Alg. no. 1911, FC, L, UC). CZECHOSLOVAKIA: in seichtem Wasser und in Schlamm am Rande der Salzwassersümpfe bei Ouzic nächst Kralup in Böhmen, *A. Hansgig*, Apr. 1884 (Type of *G. cordiformis* var. *olivaacea* Hansg., W; isotype, FC [Fig. 180]; isotypes in Fl. Exs. Austro-Hung. no. 3600, L, MO, S, W). JUGOSLAVIA: Salona prope Spalato, *Hansgig*, Aug. 1889 (FC, W). ITALY: Abano, *F. T. Kützing* (DT, FC, L, MO, UC), May 1835, in *ca. Confoream aponinum* (Type of *Gomphosphaeria aponina* Kütz., L [Fig. 179]; isotypes in Kütz., Alg. Aq. Dulc. Dec. no. 151, L, UC); in *iberinis* Euganeis, *G. Monaghini* (L, S); Monfalcone, in aqua subsalsa, *Hansgig*, Aug. 1889 (FC, W). TRIESTE: in aqua subsalsa, Capo d'Istria, *Hansgig*, Aug. 1889 (FC, W). SCOTLAND: Loch Shurrey, Caithness, *A. J. Brook* 2, 3 Aug. 1950 (D). BERMUDA: Lovers lake (brackish), western St. Georges island, *A. J. Bernaiowicz* 49-111, 1 Mar. 1949 (FC, MICH). NEW BRUNSWICK: in a pond, St. Anne, Madawaska county, *H. Haboeb* 1617, 11620, 22 Aug. 1950 (FC, HA). MASSACHUSETTS: in Gardiner's ditch, Woods Hole, *F. Drouot* 1908, 10 Aug. 1936 (D, PH, NY); in tide-pools of harbor, Cuttyhunk island, Gosnold, *Drouot* 2122, 3 Aug. 1937 (D, DT, PH). CONNECTICUT: basin, Norwich, *W. A. Setchell*, Jul. 1888 (UC). PENNSYLVANIA: in stagnis ad Beihlehem, *F. Wolle*, 30 Aug. 1881 (Type of *G. aponina* var. *cordiformis* Wolle in Witttr. & Nordst., Alg. Exs. no. 498, FC [Fig. 178]; isotypes, L, S). MARYLAND: marsh pool between Chance and Dames Quarter, Somerset county, *P. W. Wolle*, 12 Jun. 1938 (D), *P. W. Wolle & Drouot* 2260, 22 Aug. 1938 (FC, D, FH). FLORIDA: pools, Long key, Dry Tortugas, *W. R. Taylor* 22, 501, Jun. 1924 (TA); with *Chara Hornemannii* Wallm., in deep water near bridge, Big Pine key to Torch key, Monroe county, *E. P. Killip* 41970b, 4 Mar. 1951 (FC, US); freshwater ditch, Hendry creek, about 10 miles south of Fort Myers, Lee county, *P. C. Standley* 73254, Mar. 1940 (FC); on a tidal flat along East river one mile northeast of St. Marks lighthouse, Wakulla county, *Drouot, G. C. Madson, & D. Crowson* 11771, 1 Feb. 1949 (FC, T).

OHIO: reservoirs in Eden park, Cincinoti, *F. K. Daily*, 24 Aug. 1940 (DA, FC), *W. A. Daily* 177, 404, 406, 24 Oct. 1939, 3 Jul. 1940 (DA, FC), *J. B. Lackey*, Sept. 1942 (FC). KENTUCKY: wet sandstone and soil, Torrent, Wolfe county, *W. A. & P. K. Daily & R. Kosanke* 457, 473, 478, 485, 489, 14 Jul. 1940 (DA, FC). MICHIGAN: pond on north side of Mackinac island, *P. K. & W. A. Daily* 1727, 24 May 1947 (DA, FC); slough on Northport road opposite Cedar lake, Leelanau county, *J. H. Hoskins*, 30 Aug. 1934 (DA, FC). INDIANA: Lake Cicott 8 miles west of Logansport, Cass county, *F. K. & W. A. Daily* 1099, 9 Sept. 1942 (DA, FC); Wabee lake southeast of Millford, *F. K. & W. A. Daily* 2636, 28 Aug. 1952 (DA, FC); in fish-hatchery pond 2 miles northwest of Culver, Marshall county, *F. K. & W. A. Daily* 1495, 1 Jul. 1946 (DA, FC); Flint lake 3 miles north of Valparaiso, Porter county, *F. K. & W. A. Daily* 2569, 30 Aug. 1951 (DA, FC); Crooked lake, Steuben county, *C. M. Palmer* B54, Sept. 1933 (DA, FC); Genista lake 6 miles north of Angola, *F. K. & W. A. Daily* 2669, 2675, 24 Aug. 1953 (DA, FC). MINNESOTA: in covered tank, Zoological Laboratory, University of Minnesota, Minneapolis, *J. E. Tilden*, 20 Apr. 1898 (as *Gomphosphaeria aponina* in Tild., Amer. Alg. no. 300, FC). NEBRASKA: old meander pond of Platte river, Scottsbluff, *W. Kienor* 22044, 20 May 1947 (FC, KI). TEXAS: on *Digenia simplex* (Wulf.) Ag., Rockport, *G. L. Fisher* 41090, 14 Aug. 1941 (FC). MONTANA: *P. A. Barkley*, 1940 (FC); just below forest boundary on Lolo creek, Missoula county, *P. H. Rose* 4211, 12 Jun. 1941 (FC). NEVADA: Springdale hot springs 10 miles north of Beatty, Nye county, *G. Waltenpiel* 1740, 8 Feb. 1953 (FC). WASHINGTON: Whidbey island, *W. A. Setchell & N. L. Gardner* 301, 472 (UC).

CALIFORNIA: Bad Water, Death Valley, Inyo county, *R. M. Holman & L. Bonar* 7213, 2 Apr. 1933 (FC, UC), *M. J. Groesbeck* 1, 217, 303, Feb., Oct. 1940, 1 Jan. 1941 (FC); in fresh water, Los Angeles, *S. P. Monks*, Nov. 1895 (UC); in the travertine quarry, Bridgeport, Mono county, *Groesbeck* 101, 161, 13 Jun. 1940, 3 Sept. 1940 (FC); Mooterey, *T. E. Hazen* (DA, FC); brackish water one mile west of Newport Beach, Orange county, *G. J. Hollenberg* 447b, 1618, 16 Aug. 1934 (FC, UC); pond north of Torrey Pines state park, San Diego county, *W. E. Allen* 41a, 8 Dec. 1935 (FC). JAMAICA: Morant cays, *V. J. Chapman*, 1939 (FC). GUATEMALA: *S. E. Meek* 84, 1906 (FC, US). ECUADOR: in stagno in Valle de Guano prope Riobamba, *G. Lagerheim*, Jul. 1891 (as *Gomphosphaeria aponina* in Witttr., Nordst., & Lagerh., Alg. Exs. no. 1545, L); salt pool near Albermarle point, north end of Isabela island, Galapagos islands, *W. R. Taylor* 123, 12 Jan. 1934 (D, TA). ARGENTINA: laguna freate al puerto, Mar del Plata, Buenos Aires, *S. A. Guarrera* 2729, 6 Apr. 1939 (FC). HAWAIIAN ISLANDS: Niibau island, *A. & S. Robinson* 33, Dec. 1907 (FC, UC); Hamauma bay, Oahu, *W. J. Neuhouse* 59, 3 May 1953 (FC). MARSHALL ISLANDS: rocks on reef flats, seaward side of Igin island, Eniwetok atoll, *W. R. Taylor* 46-316, 22 May 1946 (FC). RYUKYU ISLANDS: Unnen, Nakijin-son, *Y. K. Okada*, 3 Apr.

1937 (as *G. aponina* var. *multisplex* in Okada, Alg. Aq. Japon. no. 2, FC). INDONESIA: Lake Obotiel, Kai islands, H. Jensen & O. Hagerup, 1922 (Type of *G. aponina* var. *multisplex* Nyg. in the slide collection of G. Nygaard). WESTERN TIBET: in Kyam Spring, in Chang-chenmo valley north of Pang-gong Tso, G. E. Hutchinson L58, 19 Jul. 1932 (D, DT, FH, L, NY).

FAMILY II. CHAMAESIPHONACEAE

Borzi, N. Giorn. Bot. Ital. 10(3): 298. 1878. *Chamaesiphonaceae* Subfam. *Euchamaesiphonaceae* Hansgirg, Notarisia 3: 588. 1888. —Type genus: *Chamaesiphon* A. Br. & Grun.

Pleurocapsaceae Geitler, Beih. z. Bot. Centralbl., II, 41: 238. 1925. *Chamaesiphonaceae* Subfam. *Cystogoneae* Hansgirg, Notarisia 3: 588. 1888. —Type genus: *Pleurocapsa* Thur.

Eniophysalidaceae Geitler, Beih. z. Bot. Centralbl., II, 41: 235. 1925. —Type genus: *Eniophysalis* Kütz.

Chlorogloeaceae Geitler, Beih. z. Bot. Centralbl., II, 41: 236. 1925. —Type genus: *Chlorogloea* Wille.

Dermocarpaceae Geitler, Beih. z. Bot. Centralbl., II, 41: 247. 1925. —Type genus: *Dermocarpa* Crouan fr.

Siphononemataceae Geitler, Beih. z. Bot. Centralbl., II, 41: 251. 1925. —Type genus: *Siphononema* Geid.

Xanococcaceae Ercegovic, Bull. Int. Acad. Yougosl. Sci. & Arts, Cl. Sci. & Math., 26: 38. 1932. —Type genus: *Xanococcus* Thur.

Hyellaceae Ercegovic, Bull. Int. Acad. Yougosl. Sci. & Arts, Cl. Sci. Math. & Nat., 26: 38. 1932. —Type genus: *Hyella* Born. & Flah.

Original specimens of the type species of the type genus of the following family have been unavailable for our study:

Scopulonemataceae Ercegovic, Bull. Int. Acad. Yougosl. Sci. & Arts, Cl. Sci. Math. & Nat., 26: 38. 1932. —Type genus: *Scopulonema* Erceg.

Plantae uni—multi-cellulares, aquaticae, microscopicae vel macroscopicae, cellulis primum solitariis basim ad substratum affixis, unaquidque seriatim in cellulas-filias primo inaequales deinde aequales dividente et mox ab aliis cum gelatino vaginale se separante, deinde sursum supra superficiem substrati radiatim in stratum vel pulvinum solidum et deorsum intus substratum in fila ramosa increscentibus; cellulis quibuspiam se amplificare atque interne in paucas vel multas endosporas se dividere potentibus; reproductione a fragmentatione vel ab endosporis.

In this family, the plants, originally unicellular, grow eventually into strata or cushions from which filaments of cells penetrate the substratum. The solitary cells are basally attached to the substratum by a sheath of gelatinous material; cell division proceeds, at right angles to the axis of the cell, in an unequal fashion: the apical daughter cell is as a rule much smaller than the basal daughter cell. The upper part of the sheath is burst open, and the small daughter cell passes out of the mother cell sheath or develops *in situ* within the open sheath. By aggregate growth of these solitary cells and/or by successive equal divisions of the daughter cells in three planes perpendicular to each other, first a stratum, then a cushion (sometimes large and bulbose) of vaguely radial structure is formed. The basal cells of these cushions and strata elongate and grow as uni- or pluriseriate, often branched, filaments downward into the substratum. Any of the solitary cells and any of the cells in the superficial layers of the stratum or cushion may enlarge and divide internally, wholly or in part, into numerous small cells (endospores), each of which is capable of growing as a solitary cell or as an endosporangium. Reproduction takes place also by fragmentation of the cushions. The gelatinous matrix of the cushion often becomes hydrolyzed, and the cells are thus dissociated.

One genus: