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A Synopsis of the Coccoid Myxophyceae

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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, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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A SYNOPSIS OF THE COCCOID MYXOPHYCEAE

By FRANCIS DROUET AND WILLIAM A. DAILY

During the past ten years we have examined large numbers of specimens of this group in the field and in American and European herbaria. Most of the more than one thousand type specimens involved in the nomenclature were found and studied. Many of these proved to be representatives of the twenty-eight species listed here; the remainder are material of Chlorophyceae, Rhodophyceae, bacteria, fungi, and other plants and animals. The following synopsis and keys are offered as a summary of the chief morphological features of the various taxa. It is hoped that a detailed revision, complete with synonymy and lists of specimens, can be published in a short time.

These plants are difficult of classification because, with no differentiation into hard parts, the cells vary considerably according to the nature of the environment. The species seem to be of world-wide distribution. Some inhabit only fresh water or salt water, while others grow well in both. Some are strictly planktonic, while others survive equally in shallow water, in the plankton, and in aerial habitats.

CHROOCOCCACEAE Näg.

Gatt. einz. Alg., p. 44. 1848.—Plants uni- to multicellular, of diverse shapes and sizes, free-floating or on various substrata; cells spherical, discoid, ovoid, cylindrical, or pyriform, each dividing into two cells of equal size and soon becoming separated from each other by sheaths of gelatinous material; reproduction by fragmentation. Type genus, *Chroococcus* Näg., *ibid.*, p. 45. 1848.

KEY TO GENERA

1. Cells spherical or discoid 2
   Cells ovoid, cylindrical, or pyriform 3
2. Cells dividing in three planes perpendicular to each other ..... Anacystis
   Cells dividing in two planes perpendicular to each other, plant laminate ..... Merismopedia
   Cells dividing in one plane, plant a uniseriate filament ..... Johannesbaptistia
3. Cells dividing in planes perpendicular to the long axes ..... Coccochloris
   Cells dividing in planes parallel with the long axes 4
4. Plant laminate ..... Microcrocis
   Plant spherical, the cells arranged radially at the periphery .. Gomphosphaeria

ANACYSTIS Menegh

Consp. Algol. Eugan., p. 324. 1837. —Type species, *A. marginata* Menegh., *loc. cit.* 1837.

KEY TO SPECIES

1. Cells without pseudovacuoles, plants not developing as water-blooms..... 3
   Cells containing pseudovacuoles, plants developing as water-blooms..... 2
2. Cells 3—6 (rarely 2—10)μ diam.....*A. cyanea* (Kütz.), comb. nov.[1]
   Cells 1—2μ diam.....*A. incerta* (Lemm.), comb. nov.[2]
3. Cells 1—1.5μ diam.....*A. nidulans* (Richt.), comb. nov.[3]
   Cells larger 4
4. Cells chiefly over 6μ diam..... 5
   Cells 2—6μ diam. (larger where parasitized by fungi), the sheaths developing red, blue, or brown pigment in aerial situations...*A. montana* (Lightf.), comb. nov.[4]
   Cells 2—4μ diam. (larger where parasitized by fungi), sheaths usually distinct and becoming colored in aerial situations.....f. *montana*
   Cells 2—3μ diam., sheaths hyaline and diffluent, plants aquatic.....
   .....f. *minor* (Wille), comb. nov.[5]
   Cells 5—6μ diam., sheaths hyaline and diffluent, plants aquatic.....
   .....f. *gelatinosa* (Henn.), comb. nov.[6]
5. Cells chiefly 6—12μ diam., cells soon becoming spherical after division..... 6
   Cells 12—50μ diam., often remaining angular for long periods after division.....
   .....*A. dimidiata* (Kütz.), comb. nov.[7]
6. Plants microscopic, in freshwater habitats..... 7
   Plants of indeterminate growth, often macroscopic, marine; protoplasm blue-green or red; homogeneous; sheaths diffluent.....*A. aeruginosa* (Zanard.) Dr. & Daily
7. Sheaths narrow, protoplasm often sparsely large-granulate, plants chiefly subaerial
   .....*A. thermolis* (Meneghi.), comb. nov.[8]
   Sheaths broad and diffluent, plants planktonic.....*A. limnetica* (Lemm.), comb. nov.[9]
   Cells widely spaced, not in compact cubical arrangement.....f. *limnetica*
   Cells in compact cubical arrangement.....f. *major* (Lagerh.), comb. nov.[10]

MERISMOPEDIA Meyen

Neues Syst. Pflanzen-Physiol. 3: 440. 1839. —Type species, *M. punctata* Meyen, *loc. cit.* 1839. Two species:

Cells 1—4μ diam., plants 2—64-celled.....*M. tranquilla* (Ehrenb.) Trevis.
Cells 5—10μ diam., plants larger and often laminate.....*M. thermolis* Kütz.

JOHANNESBAPTISTIA J. de Toni

Not. Nomencl. Algol. 1: 6. 1934. —Type species, *Cyanothrix primaria* Gardn., Mem. New York Bot. Gard. 7: 30. 1927.

A single species, the cells 4—20μ diam.....*J. pellucida* (Dickie) Taylor & Dr.

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[1] *Palmella cyanea* Kütz., Phyc. gener., p. 172. 1843.

[2] *Polycystis incerta* Lemm., Forschungsber. biol. Sta. Plön 7: 132. 1899.

[3] *Aphanothece nidulans* Richt. in Wittr. & Nordst., Alg. exs. 14: 694. 1884; Bot. Not. 1884: 128. 1884; Hedwigia 23: 66. 1884.

[4] *Ulva montana Lightf.*, Fl. Scot. 2: 973. 1777.

[5] *Aphanothece saxicola* β *aquatica* f. *minor* Wille, Öfvers. K. Sv. Vet.-Ak. Förh. 36(5): 22. 1879.

[6] *Aphanothece stagnina* f. *gelatinosa* Henn., Phyk. March. 1: 43. 1893; ex Forti, Syll. Myx., p. 77. 1907.

[7] *Trochiscia dimidiata* Kütz., Linnaea 8: 593. 1833.

[8] *Trochiscia thermalis* Menegh., Consp. Algol. Eugan., p. 334. 1837.

[9] *Chroococcus limneticus* Lemm., Bot. Centralbl. 76: 153. 1898.

[10] *Chroococcus helveticus* f. *major* Lagerh. ex Forti, Syll. Myx., p. 17. 1907.

COCCOCHLORIS SPRENG.

Fl. Halens. Mant. 1: 14. 1807. —Type species, *C. stagnina* Spreng., *loc. cit.* 1807. Four species:

Cells ovoid, 10—25μ diam., 1—3 times as long as broad..*C. aeruginosa* (Näg.), comb. nov.[11]
Cells ovoid, 4—8μ diam., 1.5—3 times as long as broad.....*C. stagnina* Spreng.
Cells cylindrical, 2—6μ diam., 3—8 times as long as broad..*C. elabens* (Bréb.) Dr. & Daily
Cells cylindrical, 1—3μ diam., 3—12 times as long as broad.....
.....*C. Peniocystis* (Kütz.) Dr. & Daily

GOMPHOSPHAERIA Kütz.

Alg. Aq. Dulc. Dec. 16: 151. 1836. —Type species, *G. aponina* Kütz., *loc. cit.* 1836. Three species:

Cells 3—5μ diam., containing pseudovacuoles; plants developing as water-blooms in fresh water .....*G. Wichurae* (Hilse), comb. nov.[12]
Cells 2—3μ diam., without pseudovacuoles.....*G. lacustris* Chod.
Cells 4—10μ diam., without pseudovacuoles.....*G. aponina* Kütz.

MICROCROCIS Richt. in Hauck & Richt.

Phyk. Univ. 11: 548. 1892. —Type species, *M. Dietelii* Richt., *loc. cit.* 1892.

One species, with cells 5—7μ diam.....*M. geminata* (Lagerh.) Geitl.

CHAMAESIPHONACEAE BORZI

N. Giorn. Bot. Ital. 14:298. 1882.—Plants uni- and multicellular, the cells separated from each other by sheath material; solitary cells spherical, ovoid, or cylindrical, basally attached to a substratum, dividing at first into daughter cells of unequal size and further developing (chiefly by cell divisions in planes parallel with the substratum) into cushions of radial structure, the basal cells often growing downward into the substratum; endosporangia formed from any cells which enlarge and divide internally, wholly or in part, into few or many endospores; reproduction by fragmentation or by endospores. —Type genus, *Chamaesiphon* A. Br. & Grun. in Rabenh., Fl. Eur. Algar. 2:148. 1865. One genus:

ENTOPHYSALIS KÜTZ.

Phyc. Gener., p. 177. 1843. —Type species, *E. granulosa* Kütz., *loc. cit.* 1843.

KEY TO SPECIES

1. Marine 2
   Freshwater 4
2. On rocks, wood, and shells; cells chiefly 4—6μ diam...*E. crustacea* (J. Ag.), comb. nov.[13]
   On larger algae or animals 3

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[11] *Synechococcus aeruginosus* Nag., Gatt. einz. Alg., p. 56. 1848.

[12] *Ceolosphaerium Wichurae* Hilse in Rabenh., Alg. Eur. 153—156: 1523. 1863; Hedwigia 1863: 151. 1863.

[13] *Myrionema crustaceum* J. Ag., Alg. Mar. Medit. & Adriat., p. 32. 1842.

3. Cells 1—2μ diam., plants yellowish in color.....*E. endophytica* (Howe) Dr. & Daily
Cells larger, plants blue-green or reddish.....*E. conferta* (Kütz.) Dr. & Daily
4. On rocks, wood, or shells
Basal cells ovoid.....*E. rivularis* (Kütz.) Dr.
Basal cells cylindrical.....*E. papillosa* (Kütz.) Dr. & Daily
On larger plants
Solitary cells spherical to cylindrical, not long-stipitate.....
.....*E. Brebissonii* (Menegh.) Dr. & Daily
Solitary cells spherical to linear-cylindrical and long-stipitate.....
.....*E. elongata* (Wille), stat. nov.[14]

CLASTIDIACEAE, fam. nov.[15]

Plants microscopic, solitary, epiphytic, cylindrical, basally attached to the substratum, at first unicellular, then dividing internally into a uniseriate chain of spherical cells which do not appear to be separated from each other by sheath material; sheath thin, closely investing the entire plant, enlarged at the base and adhering to the substratum; reproduction by the bursting of the sheath and the dissociation of the cells of the chain. —Type genus, *Clastidium* Kirchn., Jahresh. Ver. Vaterl. Naturk. Württemb. 36:195. 1880.

Two genera:

Plant terminating above in a hair-like extension of the sheath....
.....Clastidium
Plant smooth at the apex.....Stichosiphon

CLASTIDIUM KIRCHN. *loc. cit.* 1880.

Type species, *C. setigerum* Kirchn., *ibid.*, p. 196. 1880.

One species, with cells 2—4μ diam.....*C. setigerum* Kirchn.

STICHOSIPHON Geitl., in Rabenh.

Krypt.-Fl. 14: 411. 1931. —Type species, *S. regularis* Geitl., *ibid.*, p. 412. 1931.

One species, with cells 3—6μ diam.....*S. sansibaricus* (Hieron.), comb. nov.[16]

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[14] *Chamaesiphon gracilis* f. *elongata* Wille, Bih. t. K. Vet.-Akad. Handl. 8(18): 28. 1884.

[15] Plantae microscopicae, solitariae, epiphyticae, cylindricae, basim affixae, primum unicellulares demum interne in catenam cellularum sphaericarum uniseriatam dividentes; vagina tenue, ad apicem clausa, ad basem incrassata et substrato adhaerenti; reproductio dissolutione catenae cellularum et vaginae.

[16] *Chamaesiphon sansibaricus* Hieron. in Engler, Pflanzenw. Ostafr. C: 8. 1895.