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THE ALGÆ OF MICHIGAN.*

EDGAR NELSON TRANSEAU.

The following notes on the algæ of Michigan are based primarily upon collections made during the summer of 1915. Under the direction of the Michigan Biological Survey, the writer visited the ponds, lakes and streams on the west side of the lower peninsula during the last week of May and the first week of June. A second trip was made during the first two weeks of August to Mackinaw and points on the northern peninsula. The writer also examined some collections made by Mr. T. L. Hankinson in the course of his work on the fishes of Michigan. Several collections from Isle Royale were furnished by Dr. Wm. S. Cooper, and collections from the vicinity of Douglas Lake were sent me by Dr. Alexander Ruthven, Director of the Survey.

The list includes only the species which could be identified to the specific name. Many species belonging to the genera *Spirogyra*, *Zygnema*, *Nostoc* and *Oedogonium* were present in a vegetative condition.

As no work on the algæ of Michigan has been reported in recent years, the records for species are for the most part new to the state.

*Contribution from the Botanical Laboratory, Ohio State University, No. 96.

In addition to the records, there are some indications regarding the distribution of the freshwater algæ that are of interest. Taken in connection with the extensive collections made by the writer in central Illinois, it is very evident that as one goes northward the variety and abundance of the green algæ decrease notably. The genera *Spirogyra* and *Oedogonium* are represented by but few species north of Berrien County. In Illinois the same number of collections made at corresponding dates would have contained many more species. The genus *Microspora* is poorly represented in Illinois, but increases in abundance and variety in the upper part of the lower peninsula and in the northern peninsula. The Blue Green Algæ also form an increasingly conspicuous part of the algæ of the northern parts of the state.

The occurrence of *Zygnema cyanospermum* Cleve at Manistique and Mackinaw is of interest, as this species has been previously reported only from Greenland.

The study of the distribution of algæ, in both Michigan and Illinois, shows that the bulk of the algæ grows in pools, ditches, ponds and swamps. This has an important bearing on the matter of fish culture in Michigan lakes. The lakes with large shallow-water areas and swampy margins are the lakes in which algæ are most important. Those without such margins, and with sand beaches are comparatively free of algæ. As the algæ furnish the primary food of all fishes, it is readily seen that only those lakes with an abundant algal flora can ever support a large number of fish. The secondary food supply of fishes is made up of crustacea; Chironomous, mosquito and other insect larvæ. These too depend absolutely on the algæ. It is evident, therefore, that a quantitative survey of the algæ of a lake is a sure indication as to whether a lake is worth stocking with fish or not.

Lakes with rapidly sloping sand beaches are the best for summer resorts because of their comparative freedom from mosquitoes. They are not adapted to the growing of fish, however, and it is useless for the state to stock this type of lake with fish fry, as the food supply is adequate for only a limited number of fish.

MYXOPHYCÆ.

CHROOCOCCACEÆ.

- Chroococcus minutus** (Kütz) Näg. Previously recorded by Collins from Maine. On soil in bog near Carp Lake, Emmet Co., Aug. 9, 1915.
- Chroococcus turgidis** (Kütz) Näg. Carp Lake, Emmet Co., Aug. 9, 1915; Twin Lake, Muskegon Co., June 2, 1915.
- Aphanocapsa grevillei** (Hass.) Rabenh. Indian River, Manistique, Aug. 11, 1915.
- Gloeocapsa atrata** (Turp.) Kütz. Trout Lake, Chippewa Co., Aug. 10, 1915. Previously reported from Alaska.
- Gomphosphaeria aponina** Kütz. Railroad ditch, Manistique, Aug. 11, 1915; bog pool, Mackinaw, Aug. 9, 1915.
- Coelosphaerium kuetsingianum** Näg. Seney, Aug. 12, 1915.
- Aphanothece stagnina** (Spreng.) A. Br. Walnut Lake, Oakland Co., May, 1906 (Hankinson).
- Aphanothece saxicola** Nägeli. Pond, Manistique, Aug. 11, 1915.
- Merismopedium glaucum** (Ehrenb.) Näg. Trout Lake, Chippewa Co., Aug. 10, 1915; bog near Carp Lake, Emmett Co., Aug. 9, 1915.
- Merismopedium elegans** A. Br. Carp Lake, Emmet Co., Aug. 9, 1915; Twin Lake, Muskegon Co., June 2, 1915.
- Merismopedium tenuissimum** Lemmerman. Carp Lake, Aug. 9, 1915.

OSCILLATORIACEÆ.

- Oscillatoria chalybea** Mertens. Seney, Aug. 12, 1915.
- Oscillatoria princeps** Vaucher. Whitefish Point, Aug., 1913, (Hankinson); Trout Lake, Aug. 10, 1915.
- Lyngbya estuarii** (Mert.) Liebman. Breedsville, Van Buren Co., June 4, 1915; Bangor Lake, Van Buren Co., June 4, 1915; Caloma Junction, Berrien Co., pasture pools, June 4, 1915.
- Microcoleus lacustris** (Rabenh.) Farlow. Seney, Aug. 15, 1915; Manistique, Aug. 11, 1915.

NOSTOCACEÆ.

- Anabaena flos-aquæ** (Lyng.) Bréb. Walnut Lake, Oakland Co., June 24, 1916, (Hankinson).
- Anabaena variabilis** Kütz. Railroad ditch, New Buffalo, May 31, 1915.
- Anabaena circinalis** Rabenh. Trout Lake, Aug. 10, 1915.

SCYTONEMACEÆ.

- Scytonema ocellatum** (Dillwyn) Thuret. Walnut Lake, May 19 1906. (Hankinson).
Tolypothrix tenuis Kütz. Twin Lake, June 2, 1915; Lake Rowland, Houghton Co., 1905. (Hankinson); Caloma Junction, June 4, 1915.
Tolypothrix lanata (Desvaux) Wartmann. Bog near Carp Lake, Emmet Co., Aug. 9, 1915.
Tolypothrix limbata Thuret. Pasture pools, Caloma Junction, June 4, 1915; railroad ditch, Mackinaw, Aug. 9, 1915.

STIGONEMACEÆ.

- Stigonema informe** Kütz. Railroad pools, Mackinaw, Aug. 9, 1915.

RIVULARIACEÆ.

- Rivularia compacta** Collins. Whitefish Point, Aug., 1913, (Hankinson). Previously reported from Massachusetts and Connecticut.
Rivularia natans (Hedwig) Welwitsch. Carp Lake, Aug. 9, 1915; Trout Lake, Aug. 10, 1915.
Rivularia pisum Ag. Trout Lake, Aug. 10, 1915; Breedsville, June 4, 1915; Carp Lake, Aug. 9, 1915; Walnut Lake, 1906. (Hankinson).

CHLOROPHYCEÆ HETEROKONTÆ.

TRIBONEMACEÆ.

- Chlorobotrys regularis** (West) Bohlin. Railroad pool, Mackinaw, Aug. 9, 1915.
Ophiocytium cochleare (Eichwald) A. Br. Railroad ditch, Breedsville, June 2, 1915; Carp Lake, Aug. 9, 1915; stagnant pool, Seney, Aug. 12, 1915.
Conferva minor Klebs. Railroad ditch, Breedsville, June 2, 1915.
Conferva bombycina Ag. Railroad ditch, New Buffalo, May 31, 1915; Seney, Aug. 12, 1915; Spring, Manistique, Aug. 11, 1915; Saugetuck, June 1, 1915; Isle Royale, 1911, (Cooper).
Conferva bombycina forma **tenuis** (Hazen) Collins. Railroad ditch, Breedsville, June 2, 1915.
Conferva utriculosa Kütz. Railroad pool, New Buffalo, May 31, 1915; Seney, Aug. 12, 1915; Spring, Manistique, Aug. 11, 1915; Saugetuck, June 1, 1915; Orchard Lake, Aug. 15, 1915.

AKONTÆ.

DESMIDIACEÆ.

- Netrium digitus** (Ehrenb.) Itzigs. & Rothe. Bog near Caffey, Mackinaw Co., Aug. 13, 1915.
- Penium margaritaceum** (Ehrenb.) Bréb. Small stream, New Buffalo, May 31, 1915.
- Penium spirostriolatum** Barker. Bog north of Twin Lake, June 2, 1915.
- Closterium angustatum** Kütz. Bog near Caffey, Aug. 13, 1915.
- Closterium striolatum** Ehrenb. Bog near Caffey, Aug. 13, 1915; railroad ditch, New Buffalo, May 31, 1915.
- Closterium cuspidatum** Bailey. Twin Lake, June 2, 1915. Probably should be in another genus. The terminal spines are 15-20 μ in length, chromatophore with 6 prominent ridges and several pyrenoids in each half. Outer margin about 180° of arc; greatest diameter about 85 μ , length between apices 165 μ .
- Closterium pseudodianæ** Roy. Pond near Orchard Lake, Aug. 15, 1915.
- Closterium intermedium** Ralfs. Bog east of Caffey, Aug. 13, 1915.
- Closterium rostratum** Ehrenb. Pond near Orchard Lake, Aug. 15, 1915.
- Closterium ehrenbergii** Menegh. Bog near Saugetuck, Allegan Co., June 1, 1915; Caffey, Aug. 13, 1915; pond near Orchard Lake, Aug. 15, 1915.
- Closterium kuetzingii** Bréb. Bog near Caffey, Aug. 13, 1915; Seney, Aug. 12, 1915.
- Closterium lineatum** Ehrenb. Bog near Saugetuck, June 1, 1915.
- Closterium leibleini** Kütz. Bangor Lake, June 4, 1915.
- Closterium acerosum** (Schrank) Ehrenb. Breedsville, June 4, 1915.
- Closterium didymotocum** Corda. Twin Lake, June 2, 1915.
- Pleurotaenium nodosum** (Bail.) Lund. Twin Lake, June 2, 1915.
- Pleurotaenium coronatum** (Bréb.) Rabenh. Twin Lake, June 2, 1915.
- Pleurotaenium truncatum** (Bréb.) Nag. Twin Lake, June 2, 1915.

- Pleurotaenium ehrenbergii** (Bréb.) DeBary. Bog pool, Seney, Aug. 12, 1915; Twin Lake, June 2, 1915.
- Pleurotaenium ehrenbergii** var. **elongatum** West. Pond near Orchard Lake, Aug. 15, 1915.
- Pleurotaenium trabecula**. Bog north of Blaney, Schoolcraft Co., Aug. 12, 1915.
- Pleurotaenium trabecula** (Ehrenb.) Näg. var. **rectum** (Delp.) W. & G. S. West. Twin Lake, June 2, 1915.
- Euastrum gemmatum** Bréb. Twin Lake, June 2, 1915.
- Euastrum ansatum** Ralfs. Twin Lake, June 2, 1915.
- Euastrum bidentatum** Näg. Seney, Aug. 12, 1915.
- Euastrum denticulatum** (Kirchn.) Gay. Twin Lake, June 2, 1915; bog near Carp Lake, Aug. 9, 1915.
- Euastrum pinnatum** Ralfs. Bog east of Caffey, Aug. 13, 1915.
- Euastrum didelta** (Turp.) Ralfs. Bog near Carp Lake, Emmet Co., Aug. 9, 1915.
- Euastrum crassum** (Bréb.) Kütz. Bog near Carp Lake, Aug. 9, 1915; bog near Twin Lake, June 2, 1915.
- Euastrum verrucosum** Ehrenb. Railroad ditch, New Buffalo, May 31, 1915.
- Euastrum verrucosum** var. **planctonicum** W. & G. S. West. Railroad ditch, New Buffalo, May 31, 1915.
- Micrasterias oscitans** Ralfs. Twin Lake, June 2, 1915; Trout Lake, Aug. 10, 1915.
- Micrasterias oscitans** var. **mucronata** (Dixon) Wille. Bog near Carp Lake, Aug. 9, 1915.
- Micrasterias radiata** Hass. Twin Lake, Muskegon Co., June 2, 1915.
- Micrasterias rotata** (Grev.) Ralfs. Bog near Caffey, Mackinaw Co., Aug. 13, 1915; bog pond near Mackinaw City, Cheboygan Co., Aug. 9, 1915; bog north of Blaney, Aug. 12, 1915.
- Micrasterias crux-melitensis** (Ehrenb.) Hass. Bog pond near Mackinaw City, Aug. 9, 1915.
- Micrasterias pinnatifida** (Kütz) Ralfs. Twin Lake, June 2, 1915.
- Micrasterias papillifera** Bréb. Twin Lake, June 2, 1915.
- Micrasterias papillifera** var. **glabra** Nordst. Twin Lake, June 2, 1915.
- Micrasterias apiculata** (Ehrenb.) Menegh. Twin Lake, June 2, 1915.

- Micrasterias americana** (Ehrenb.) Ralfs. Railroad ditch, New Buffalo, May 31, 1915.
- Micrasterias denticulata** Bréb. var. **angulosa** (Hantzsch) W. & G. S. West. Twin Lake, June 2, 1915.
- Micrasterias torreyi** (Bailey) Ralfs. Twin Lake, June 2, 1915.
- Micrasterias truncata** (Corda) Bréb. Bog near Carp Lake, Aug. 9, 1915; railroad pool near Seney, Aug. 15, 1915; bog near Caffey, Mackinaw Co., Aug. 13, 1915.
- Cosmarium subcostatum** Nordst. Carp Lake, Aug. 9, 1915.
- Cosmarium taxichondrum** Lund. Twin Lake, June 2, 1915.
- Cosmarium cyclicum** Lund. Carp Lake, Aug. 9, 1915.
- Cosmarium botrytis** Menegh. Carp Lake, Aug. 9, 1915; bog pond near Mackinaw City, Aug. 9, 1915.
- Cosmarium portianum** Arch. Twin Lake, June 2, 1915.
- Cosmarium pachydermum** Lund. Bog north of Balney, Aug. 12, 1915.
- Xanthidium antilopæum** (Bréb.) Kütz. Twin Lake, June 2, 1915.
- Staurostrum meriani** Reinsch. Small stream, New Buffalo, Berrien Co., May 31, 1915.
- Staurostrum punctulatum** Bréb. Small stream, New Buffalo, May 31, 1915.
- Staurostrum arctiscon** (Ehrenb.) Lund. Twin Lake, June 2, 1915.
- Arthrodesmus triangularis** Lagerh. forma **triquetra** W. & G. S. West. Twin Lake, June 2, 1915.
- Cosmocladium constrictum** (Arch.) Josh. Pool near Seney, Schoolcraft Co., Aug. 12, 1915.
- Cosmocladium pulchellum** (Arch.) Josh. Twin Lake, June 2, 1915.
- Sphaerosozma excavatum** Ralfs. Twin Lake, June 2, 1915.
- Spondylosium papillatum** W. & G. S. West. Trout Lake, Chippewa Co., Aug. 10, 1915.
- Spondylosium pulchellum** Archer. Twin Lake, June 2, 1915; bog near Caffey, Aug. 13, 1915.
- Hyalotheca dissiliens** (Sm.) Breb. Railroad pool, Manistique, Aug. 11, 1915; Twin Lake, June 2, 1915; bog near Sauge-tuck, June 1, 1915; bog north of Blaney, Aug. 12, 1915.
- Desmidium baileyi** (Ralfs) De Bary. Railroad pool, Seney, Aug. 12, 1915.

- Desmidium swartzii** Ag. Railroad pool, Seney, Aug. 12, 1915; Manistique, Aug. 11, 1915; Twin Lake, June 2, 1915; bog north of Blaney, Aug. 12, 1915.
- Desmidium cylindricum** Grev. Twin Lake, June 2, 1915.
- Gymnozyga moniliformis** Ehrenb. Bog east of Caffey, Aug. 13, 1915; Twin Lake, June 2, 1915.

ZYGNEACEÆ.

- Spirogyra affinis** (Hass.) Kütz. Small stream, Saugetuck, June 1, 1915. Very typical material. Previously reported from Jamaica and Alaska.
- Spirogyra varians** (Hass.) Kütz. Slow stream near Douglas Lake, July 21, 1914; railroad pool, New Buffalo, May 31, 1915; estuary, Holland, June 3, 1915; bog north of Blaney, Aug. 12, 1915.
- Spirogyra dubia** Kütz. Bog stream, Saugetuck, June 1, 1915; stagnant pool, Orchard Lake, Aug. 16, 1915.
- Spirogyra jugalis** (Dillw.) Kütz. Trout Lake, Aug. 10, 1915.
- Spirogyra nitida** (Dillw.) Link. New Baltimore, Aug. 8, 1915.
- Spirogyra ellipsozona** Transeau. New Baltimore, Aug. 8, 1906 (Hankinson); Saugetuck, June 1, 1915.
- Spirogyra fluviatilis** Hilse. New Baltimore, Aug. 8, 1906 (Hankinson); White Fish Point, Aug. 17, 1914 (Hankinson). Vegetative material, probably of this species, was found in all parts of the state.
- Spirogyra reflexa** Transeau. Railroad pools, New Buffalo, May 31, 1915. Previously recorded only from prairie ponds in south central Illinois. This material is of particular interest as it contains aplanospores as well as zygospores.
- Spirogyra protecta** Wood. Stream pool, Breedsville, Van Buren Co., June 4, 1915. This material contained a few aplanospores, together with the zygospores.
- Spirogyra tenuissima** (Hass.) Kütz. Railroad ditch, New Buffalo, May 31, 1915.
- Spirogyra majuscula** Kütz. Lake, Bangor, June 4, 1915.
- Spirogyra maxima** (Hass.) Wittr. Van Etten Creek, Oscoda, Iosco Co., Aug. 12, 1916, (Hankinson).
- Mougeotia calcarea** (Cleve) Wittr. Carp Lake, Emmet Co., Aug. 9, 1915. This material contains zygospores abundantly. The diameter of the vegetative cells varies from 8 to 10 microns. Previously recorded from Illinois, but there found only with aplanospores.

- Mougeotia bicalyptrata** Wittrock. Carp Lake, Emmet Co., Aug. 9, 1915. Occurring with the last, with vegetative cells 10 to 12 microns in diameter. The zygospores resemble in every particular the type material for this species. It is evidently closely related to *M. calcarea*, and perhaps should be recognized as a variety rather than as a distinct species.
- Mougeotia parvula** Hassall. Small stream, New Buffalo, May 31, 1915.
- Mougeotia gracillima** (Hass.) Wittrock. Bog north-east of Twin Lake, June 2, 1915.
- Mougeotia elegantula** Wittrock. Twin Lake, June 2, 1915.
- Mougeotia viridis** (Kütz.) Wittr. Bog stream, Saugetuck, June 1, 1915. This material contains scattered aplanospores as well as zygospores, and adds another species to the list in which both spore forms have been found.
- Mougeotia robusta** (DeBary) Wittr. var. **biornata** Wittrock. Railroad pool, New Buffalo, May 31, 1915.
- Mougeotia** (?) **genuflexa** (Dillw.) Ag. Common in many of the collections. The dimensions and genuflexing habit are characteristic for this species, but I have not found any spores.
- Mougeotia quadrangulata** Hass. Railroad pool, Mackinaw City, Aug. 9, 1915; pond, Saugetuck, June 1, 1915.
- Debarya decussata** Transeau. Trout Lake, Chippewa Co., Aug. 10, 1915. Abundant in all the collections from this lake. The material contained only zygospores and vegetative filaments.
- Zygnema cyanospermum** Cleve. Railroad ditch, Manistique, Aug. 11, 1915; railroad pool, Mackinaw City, Aug. 9, 1915. Previously reported only from Greenland.

ISOKONTÆ.

VOLVOACEÆ.

- Gonium pectorale** Müller. New Buffalo, May 31, 1915.
- Pandorina morum** (Müll.) Bory. New Buffalo, May 31, 1915; Breedsville, June 4, 1915.
- Eudorina elegans** Ehrenb. Seney, Aug. 12, 1915; small stream, New Buffalo, May 31, 1915.

PALMELLACEÆ.

- Palmodactylon varium** Näg. Seney, Aug. 12, 1915. Previously reported only from Maine.
- Tetraspora lubrica** (Roth) Ag. Breedsville, June 4, 1915; Saugetuck, June 1, 1915. All of the specimens seen were less than four inches in length. In Illinois specimens a foot in length are common and lengths of four feet are attained.
- Tetraspora lubrica** var. **lacunosa** Chauvin. Pool in swamp near Douglas Lake, July 10, 1914. (Ruthven).
- Tetraspora cylindrica** (Wahl.) Ag. Rocky shores of Isle Royale, July, 1911. (Cooper).
- Tetraspora limnetica** W. & G. S. West. Bog stream near Blaney, Aug. 12, 1915. No pseudocilla present. Cell diameter, 4μ .
- Apiocystis Brauniana** Nägeli. Lake, Bangor, June 4, 1915; Trout Lake, Aug. 10, 1915.
- Gloeocystis gigas** (Kütz) Lagerh. Ponds, New Buffalo, May 31, 1915; railroad ditches, Breedsville, June 4, 1915; bog near Caffey, Aug. 13, 1915.

DICTYOSPHAERIACEÆ.

- Dictyosphaerium pulchellum** Wood. Trout Lake, Chippewa Co., Aug. 10, 1915.
- Ineffigiata neglecta** W. & G. S. West. Railroad pools, Manistique, Aug. 11, 1915; Twin Lake, Muskegon Co., June 12, 1915; bog north of Twin Lake, June 2, 1915.

PROTOCOCCACEÆ.

- Coelastrum microporum** Nägeli. Carp Lake, Emmet Co., Aug. 9, 1915; railroad pool, Seney, Aug. 12, 1915.
- Coelastrum sphericum** Nägeli. Twin Lake, June 2, 1915; Seney, Aug. 12, 1915; Carp Lake, Aug. 9, 1915.
- Coelastrum cambricum** Archer. Twin Lake, June 2, 1915; Carp Lake, Aug. 9, 1915; bog near Carp Lake, Aug. 9, 1915.
- Coelastrum scabrum** Reinsch. Railroad pool, Mackinaw City, Aug. 9, 1915; bog near Carp Lake, Aug. 9, 1915. Not previously reported from America.
- Coelastrum proboscidium** Bohlin. Railroad ditch, New Buffalo, May 31, 1915.
- Sorastrum spinulosum** Nägeli. Seney, Aug. 12, 1915.

- Crucigenia rectangularis** (A. Br.) Gay. Railroad ditches, New Buffalo, May 31, 1915. Previously reported from Greenland, Massachusetts and Illinois.
- Scenedesmus bijugatus** (Turp.) Kütz. Carp Lake, Emmet Co., Aug. 9, 1915; Manistique, Aug. 11, 1915; New Buffalo, May 31, 1915.
- Scenedesmus denticulatus** Lagerheim. Carp Lake, Aug. 9, 1915.
- Scenedesmus obliquus** (Turp.) Kütz. New Buffalo, May 31, 1915; Carp Lake, Aug. 9, 1915.
- Scenedesmus quadricauda** (Turp.) Bréb. Manistique, Aug. 11, 1915; Twin Lake, June 2, 1915; Carp Lake, Mackinaw, Aug. 9, 1915.
- Dimorphococcus lunatus** A. Br. Twin Lake, June 2, 1915. Not previously reported from America.
- Ankistrodesmus falcatus** (Corda) Ralfs. New Buffalo, May 31, 1915.
- Ankistrodesmus falcatus** var. *spiralis* West. New Buffalo, May 31, 1915.
- Quadrigula closterioides** (Bohlin) Printz. New Buffalo, May 31, 1915; Twin Lake, June 2, 1915. Not previously reported from America.
- Kirchneriella lunaris** var. *dianæ* Bohlin. Twin Lake, June 1, 1915.
- Oocystis elliptica** West. Twin Lake, June 1, 1915; railroad pool, Manistique, Aug. 11, 1915. Not previously reported from America.
- Oocystis crassa** Wittrock. New Buffalo, May 31, 1915.
- Nephrocytium agardhianum** Nägeli. Railroad ditch, Manistique, Aug. 11, 1915.
- Nephrocytium obesum** West. Railroad ditch, Manistique, Aug. 11, 1915. Not previously reported from America.
- Zoochlorella conductrix** Brandt. Twin Lake, June 2, 1915, in Hydra.

HYDRODICTYACEÆ.

- Pediastrum tricornutum** Borge. Twin Lake, Muskegon Co., June 2, 1915. Previously reported from Greenland.
- Pediastrum duplex** Meyen. Trout Lake, Aug. 10, 1915.
- Pediastrum duplex** var. *clathratum* A. Braun. Trout Lake, Aug. 10, 1915.

Pediastrum vagum Kütz. Twin Lake, June 2, 1915.

Pediastrum tetras (Ehrenb.) Ralfs. Twin Lake, June 2, 1915.

Pediastrum boryanum (Turp.) Menegh. Carp Lake, Emmet Co., Aug. 9, 1915; railroad ditch, Manistique, Aug. 11, 1915.

SIPHONÆ.

Vaucheria dillwynii (Web. & Mohr) Ag. Cedar Swamp, on soil, near Douglas Lake, Aug. 17, 1914. (Ruthven.)
Reported previously from Maine and New Jersey.

Vaucheria sessilis (Vauch.) De Candolle. Pool in swamp, Douglas Lake, Aug. 17, 1914. (Ruthven.)

Vaucheria geminata (Vauch.) DeCandolle. Pool in swamp, Douglas Lake, Aug. 17, 1914. (Ruthven.)

Vaucheria geminata var. **racemosa** (Vauch.) Walz. Pool in pasture, Douglas Lake, July 13, 1914; Breedsville, June 4, 1915.

Vaucheria geminata var. **depressa** nov. var. Similar to the type, except that the fertile branch is shorter, and the oogonial branches are longer and depressed, bringing the oogonia down to the level of the main filament or below.

Filamentis antheridiis et oogoniis ut in typo; ramo sporifero curto; oogoniis 2-4, pedicellatis; pedicellis oogonii longis, recurvatis et depressis.

New Buffalo, May 31, 1915; previously collected at several stations in central Illinois. In none of these collections have forms been found intergrading with the species.

Vaucheria orthocarpa Reinsch. New Buffalo, May 31, 1915. Previously reported from California.

Dichotomosiphon tuberosus (A. Br.) Ernst. Walnut Lake, 1906, (Hankinson).

CLADOPHORACEÆ.

Chaetomorpha chelonium Collins. Walnut Lake, 1906 (Hankinson). Record based on the type material.

Rhizoclonium hieroglyphicum (Ag.) Kütz. White Fish Point, 1913 (Hankinson; Holland, June 3, 1915).

Rhizoclonium crassipellitum W. & G. S. West. Estuary, Holland, June 3, 1915. Although not previously reported from America, the specimens seem best classified under this name. The filaments are unbranched, 40-48 μ in diameter, with cell walls 8-12 μ in thickness.

- Cladophora callicoma** Kütz. Little Traverse Bay, Aug. 21, 1916. (Hankinson).
- Cladophora glomerata** (L.) Kütz. Manistee River, Manistee, Aug. 29, 1916. (Hankinson); . Swift stream, Caloma Junction, June 4, 1915.
- Cladophora fracta** (Dillw.) Kütz. Estuary, New Buffalo, May 31, 1915; lake, Holland, June 1, 1915.
- Pithophora varia** Wille. Alma, Gratiot Co., Oct., 1905.

ULOTRICHACEÆ.

- Ulothrix zonata** (Web. & Mohr) Kütz. Isle Royale, July 30, 1910 (Cooper); White Fish Point, Aug. 1913 (Hankinson). On rocky shores along all the Great Lakes.
- Ulothrix tenuissima** Kütz. Trout Lake, Aug. 10, 1915. Previously reported from New York and Alaska.
- Geminella interrupta** Turp. Railroad ditches, New Buffalo, May 31, 1915. New to America.
- Radiofilum irregulare** (Wille) Brunthaler. Carp Lake, Emmet Co., Aug. 9, 1915. Not previously reported from America.
- Radiofilum flavescens** G. S. West. Twin Lake, June 2, 1915. Not previously reported from America.

HERPOSTEIRACEÆ.

- Herpoteiron confervicola** Nägeli. New Buffalo, May 31, 1915; lake, Bangor, June 4, 1915; ditch, Mackinaw City, Aug. 9, 1915; bog pool, Manistique, Aug. 11, 1915.

CHAETOPHORACEÆ.

- Chaetophora elegans** (Roth) Ag. New Buffalo, May 31, 1915; Saugetuck, June 1, 1915; railroad ditch, Breedsville, June 4, 1915; Trout Lake, Chippewa Co., Aug. 10, 1915; bog pools, Manistique, Aug. 11, 1915.
- Chaetophora incrassata** Hazen. Indian River, Manistique, Aug. 11, 1915; Vermillion Lake, Chippewa Co., Aug. 1, 1913 (Hankinson); Trout Lake, Aug. 10, 1915; slow stream, Douglas Lake, July 3, 1914 (Ruthven); Carp Lake, Aug. 9, 1915; New Buffalo, May 31, 1915; bog stream, Saugetuck, June 1, 1915. All the specimens are small when compared with the specimens from Illinois.
- Stigeoclonium amoenum** Kütz. Ditch near Douglas Lake, July 3, 1914 (Ruthven); Saugetuck, June 1, 1915.

- Stigeoclonium lubricum** (Dillw.) Kütz. Lake Rowland, Houghton Co., 1915 (Hankinson).
Stigeoclonium aestivale (Hazen) Collins. Lake Rowland, Houghton Co., 1905 (Hankinson), (fide Collins).
Stigeoclonium tenue (Ag.) Kütz. Carp Lake, Emmet Co., Aug. 9, 1915.
Stigeoclonium glomeratum (Hazen) Collins. Bog stream, Sauge-tuck, June 1, 1915; bog north of Blaney, Aug. 12, 1915.
Draparnaldia plumosa (Vauch) Ag. Walnut Lake, Oakland Co., May 1, 1906. (Hankinson); ditch, Douglas Lake, May 1, 1906 (Hankinson); stream, New Buffalo, May 31, 1915; Carp Lake, Aug. 9, 1915.

MICROTHAMNIACEÆ.

- Microthamnium exiguum** Reinsch. Bog near Caffey, Mackinac Co., Aug. 13, 1915; bog pool, Seney, Aug. 12, 1915.
Gongrosira lacustris Brand. Au Sable River, Grayling, Crawford Co., Aug. 24, 1916 (Hankinson). Not previously reported from America.

COLEOCHAETACEÆ.

- Coleochaete irregularis** Pringsheim. New Buffalo, May 31, 1915.
Coleochaete nitellarum Jost. Twin Lake, Muskegon Co., June 2, 1915. On *Chara* sp.?
Coleochaete scutata Brébisson. Railroad pool, New Buffalo, May 31, 1915; pond east of Manistique, Aug. 11, 1915.
Coleochaete pulvinata A. Br. Trout Lake, Chippewa Co., Aug. 10, 1915.

CYLINDROCAPSACEÆ.

- Cylindrocapsa geminella** Wolle. Sauge-tuck, June 1, 1915; ditch at Breedsville, June 4, 1915.

MICROSPORACEÆ.

- Microspora stagnorum** (Kütz.) Lagerh. Beach pools, Isle Royale, Aug. 1, 1910 (Cooper).
Microspora amoena (Kütz) Rabenh. Pools, New Buffalo, May 31, 1915; Twin Lake, June 2, 1915; bog, Sauge-tuck, June 1, 1915.
Microspora crassior (Hansg.) Hazen. Bog pool, Sauge-tuck, June 1, 1915; ditch, Breedsville, June 4, 1915.
Microspora pachyderma (Wille) Lagerh. Pool, New Buffalo, May 31, 1915.

OEDOGONIACEÆ.

- Oedogonium acrosporum** DeBary. Railroad pool, New Buffalo, May 31, 1915; pool, Seney, Aug. 12, 1915.
- Oedogonium borisianum** Wittrock. New Buffalo, May 31, 1915.
- Oedogonium concatenatum** Wittrock. New Buffalo, May 31, 1915.
- Oedogonium crenulato-costatum** Wittrock. Carp Lake, Emmet Co., Aug. 9, 1915.
- Oedogonium crassum** Wittrock. New Buffalo, May 31, 1915; bog north of Blaney, Aug. 12, 1915.
- Oedogonium crispum** Wittrock. New Buffalo, May 31, 1915.
- Oedogonium crispum** var. **inflatum** Hirn. New Buffalo, May 31, 1915. Variety new to America.
- Oedogonium cryptoporum vulgare** Wittrock. New Buffalo, May 31, 1915.
- Oedogonium cyathigerum** Wittrock. Saugetuck, June 1, 1915.
- Oedogonium fragile** Wittrock. New Buffalo, May 31, 1915.
- Oedogonium gracillimum** Wittr. & Lund. New Buffalo, May 31, 1915.
- Oedogonium braunii** Kütz. Railroad pool, Seney, Schoolcraft Co., Aug. 12, 1915.
- Oedogonium grande** Kütz. New Buffalo, May 31, 1915; Saugetuck, June 1, 1915.
- Oedogonium grande** var. **angustum** Hirn. Ditch, Breedsville, June 4, 1915.
- Oedogonium irregulare** Wittrock. Saugetuck, June 1, 1915.
- Oedogonium laeve** Wittrock. Saugetuck, June 1, 1915.
- Oedogonium paludosum** var. **parvisporum** Hirn. New Buffalo, May 31, 1915.
- Oedogonium pratense** Transeau. Railroad ditch, Mackinaw City, Aug. 9, 1915.
- Oedogonium rufescens** Wittrock. New Buffalo, May 31, 1915; Saugetuck, June 1, 1915.
- Oedogonium rugulosum** Nordstedt. New Buffalo, May 31, 1915.
- Oedogonium americanum** sp. nov. Dioecious, macrandrous; oogonia single, globose to depressed-globose, pore superior; oospore globose, ellipsoid-globose, or depressed-globose, filling the oogonium or only partly filling it, spore wall

of three layers, median layer scrobiculate; male filaments somewhat smaller than the female; antheridia 1-5-celled, frequently alternating with vegetative cells; sperms two, division horizontal; basal cell of filament elongated; terminal cell obtuse.

Diam. veg. cells, female, 28-48 μ ; length 40-100 μ

Diam. veg. cells, male, 24-30 μ ; length 40-100 μ .

Diam. oogonia, 40-76 μ ; length 48-70 μ .

Diam. oospore, 38-74 μ ; length 46-56 μ .

Diam. antheridial cells, 20-28 μ ; length 4-12 μ .

Oedogonium dioicum, macrandrium; oogoniis singulis, globoso-ellipsoideis vel globosis vel depresso-globosis, poro superiore apertis; oosporis globoso-ellipsoideis vel globosis vel depresso-globosis, oogonia complementibus vel fere complementibus, membrana triplici; episporio (in latere exteriore) laevi, mesosporio scrobiculato, endosporio laevi; plantis masculis paulo gracilioribus quam femineis; antheridiis 1-5-cellularibus, saepe cum cellulis vegetativis alternis; spermatozoidis binis, divisione horizontali ortis; cellula fili basali forma, ut vulgo, elongata, cellula terminali apice obtusa; crassit, cell, veget. plant. fem. 28-48 μ , altit. 40-100 μ ; crassit, cell, veget. plant. masc. 24-30 μ , altit. 40-100 μ ; crassit oogon. 40-76 μ , altit. 40-70 μ ; crassit oospor. 38-74 μ , altit. 46-56 μ ; crassit cell. antherid, 20-28 μ , altit. 4-12 μ .

New Buffalo, May 31, 1915. Originally found in pool on Newmans farm, northeast of Charleston, Illinois, May 21, 1914.

Oedogonium undulatum (Bréb.) A. Br. White Fish Point, Chippewa Co., July, 1913. (Hankinson).

Oedogonium undulatum* var. *americanum nov. var. A new variety with vegetative cells as in the type, but with oogonia much larger, diameter 58-68 μ ; length 60-80 μ ; oospore 48-60 μ x 48-56 μ .

Var. cellulis vegetativis ut in typo; oogoniis comparate ad cellulas vegetativas magis tumidis, crassit, 58-68 μ , altit. 60-80 μ ; oosporis oogonia complementibus vel fere complementibus, crassit. 48-60 μ , altit. 48-56 μ .

Trout Lake, Aug. 10, 1915.

Bulbochaete crassiuscula Nordst. Mackinaw City, Aug. 9, 1915.

Bulbochaete crenulata Pringsheim. New Buffalo, May 31, 1915.

Bulbochaete insignis Pringsheim. New Buffalo, May 31, 1915.

Bulbochaete rectangularis Wittrock. New Buffalo, May 31, 1915.

Bulbochaete varians Wittrock. New Buffalo, May 31, 1915.