A List of Myxophyceae from Wayne County, Indiana

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It is interesting to note that the first list of algae for the state of Indiana came from Wayne County. This list by E. T. Cox in 1876 (3) included the genus *Oscillatoria*, and a number of genera of desmids and diatoms. The next contribution to Wayne County algae was that of Ruth Trueblood in 1903 (13). In this paper she describes 36 species including 6 species of *Myxophyceae*. A more comprehensive study was that of M. S. Markle in 1910 (10). This paper describes 46 species including 11 species of *Myxophyceae*. More recent records are included in the investigations of Daily (4), and Drouet (5).

The collections listed here were made in the years 1939 to 1942 inclusive. Some early collections were made by Dr. M. S. Markle of Earlham College, later ones being made by the writer and some jointly with Dr. Markle. Many of the collections have been made in the vicinity of Richmond, while some have been made at other points in the county. The collections have all been examined and determined by Dr. Francis Drouet of the Field Museum of Natural History. The specimens of *Chroococcaceae* have been studied in large part by William A. Daily, and these species were cited by him in his study of that family (4).

In this list of 61 forms there are 3 varieties, 30 species, and 3 genera of *Myxophyceae* which are new records for Indiana. In looking over the published lists of *Myxophyceae* from Indiana the scarcity of soil and rock forms is particularly noticeable. In collections from Wayne County an especial effort has been made to collect forms from these habitats.

Since there are abundant outcroppings of rock throughout the southeastern part of the county, these provide a wide variety of habitats. Collections have been made from many places at Thistlethwaite's Falls on the Whitewater River, and from many points on the rock ledges through the length of the gorge to the south. Whitewater gorge at Richmond is about 3 miles long, 200-300 feet wide and up to 100 feet or more in depth (11, 12). The rock here is the Hudson River limestone series of the Ordivician. Collections have been made from the ledges at the Middleborough quarry (Clinton or Niagara series of limestone) 3 miles northeast of Richmond; the rocks at Tufa Falls just south of the Elliott's Mills bog 2 miles southeast of Richmond; and at Elkhorn Falls 3 miles southeast of Richmond. Another rich source for rock forms has been the interiors of several large stone tunnels at the Pennsylvania R.R. yards just northeast of Richmond. Such a habitat was the only source for *Pleurocapsa varia*. This was found in the crevices of the stonework of one tunnel, and in another it was growing as large circular colonies some 8-10 cm. in diameter on the smooth moist surface of the concrete wall. The only station for *Schizothrix lateritia* was in the calcareous incrustations in the crevices of the stonework of a small tunnel north of Richmond. In all of these tunnels the light intensity was quite

low. Planktonic species were mostly collected at Lake Wehi just south of Germantown, in the drainage pool of the ice company spray pond at Richmond, and at various places in the Whitewater River.

Species found chiefly on alternately wet and dry rock or clay-shale in the Whitewater gorge were *Hassallia byssoidea*, *Schizothrix purpurascens*, *Microcoleus acutissimus*, *Plectonema purpureum*, and *Phormidium incrustatum*. The species of *Schizothrix* listed here were almost entirely restricted to rock habitats or to calcareos material. Frequently these species were associated with *Calothrix parietina*. *Nostoc microscopicum* has been found as minute dark discolorations on some of the projecting rock slabs above Thistlethwaite's Falls in very dry exposed situations—in such habitats as the lichens, *Caloplaca cerina* and *Lecanora Hageni*, occur. In summer and fall many of these habitats are quite dry, but during the winter months these rock ledges are quite moist. In the areas at the waterfalls many more rock species are found.

The only location for *Nostoc humifusum* was on the clay-shale under the shade of spreading shrubs of *Rhus aromatica* growing along the upper ledges of Whitewater gorge. Here rather extensive growths were found. Here as well as in other places on the rock ledges the species of *Myxophyceae* together with mosses appeared to form the pioneer stages in these bare areas. It is probable that such pioneer stages of succession may occur at many points on the bare areas in the gorge. Such algal succession for denuded soil areas in Kansas and Oklahoma has been described by Booth (1).

Species of *Cylindrospermum* were perhaps the most frequently collected soil forms—especially *C. muscicola*. The one station for *C. catenatum* was in a small depression on the moist soil in Elliott's Mills bog. In the genus *Nostoc*, *N. Muscorum* was the most frequently collected soil species. Both *N. ellipsosporum* and *N. spongiiforme* were found on moist sand or sandy soil near streams.

A large number of collections were made at the spray pond of the Crystal Ice Co. at Richmond. The spray pond, built in 1916, serves to cool the water used in the ice manufacturing machinery. The large area, 72 by 44 feet, is divided into two parts. The western half is an expanse of concrete that serves as a drain for the pool occupying the eastern half. Some of the sprays operate over the concrete area and some extend over the pool.

The water is slightly thermal—especially during the summer months. According to data supplied the writer the water from the sprays is quite warm, 46° C., approaching 35-40° C. where it reaches the drainage area. The water in the pool may reach a temperature of 41° C. The water in the pool is quite alkaline. Samples determined with a hydrogen electrode gave a pH value of 8.5.

The whole area is unique in that the growths of many of the species of *Myxophyceae* found there are quite extensive. Many of the species have a rather definite zonation in the area. The one species which is perhaps the most abundant there is *Lyngbya purpurea*. This species is of interest because of its rarity. It was first described by J. D. Hooker and W. H. Harvey in 1845 from Kerguelen in the south Indian ocean near Antarctica (8, 9). There it was first found in rivulets covering mosses

and water plants at an altitude of 3,700 feet. The authors believed it belonged to the genus *Oscillatoria* and so named it *O. purpurea*. Maurice Gomont in his classical *Monographie des Oscillariées* (7) placed the species in the genus *Lyngbya*. He based his determination on the original material in the Dublin Museum. He measured the trichomes and in addition noted that the purple color, for which the species had been named, had entirely disappeared from the specimen. The only other published record which the writer has located is that of G. S. West in 1907 from Lake Tanganyika in central Africa (6, 14).

The species is characterized by its small size, 1.4 to 1.8 microns, and its purple to reddish-orange (or even blue-green) color. It generally has been found attached to a substratum, and growing in very dense tufts. At the spray pond the species covers many square feet of the moist concrete of the drainage area. Here it has been found growing in association with *Calothrix parietina*. In these incrusted mats the true purplish color of the species is evident. Elsewhere on the iron pipes and the concrete posts near the pool, the species is orange in color in the surface masses; while the undersurface masses are blue-green. In September, 1942 numerous floating masses of this species were observed in Lake Wehi.

At the spray pond the growth of the *Lyngbya* was almost entirely restricted to the areas kept moist by the sprays, and where water was standing when the sprays were functioning. In an outer zone at the south end where the amount and movement of the water was not as great there were extensive growths of *Scytonema figuratum*. In this more aerial habitat this species grew in a pure form in spongy mats 3 to 4 mm. thick. On the outer limits of the area where only occasionally wind-blown spray falls the flora is considerably different. Here in this area of washed-in gravel and debris on the outer limits of the spray pond such species as *Microcoleus vaginatus, Phormidium autumnale, Schizothrix lardacea* and *Chroococcus rufescens* were growing.

The spray pond pool was about 4½ feet deep with an extensive deposit of sediment in the bottom. The sediment was almost entirely made up of algae. Species found here included *Plectonema Nostocorum, Lyngbya aestuarii, Oscillatoria tenuis* var. *tergestina, Chroococcus turgidus*, and *Merismopoedia glauca*. Numerous floating masses in the pool included *Oscillatoria limosa, O. princeps, O. splendida, Chroococcus turgidus*, and *M. glauca*. In the drainage ditch from the pool in the moving water were extensive growths of *Phormidium subfuscum* var. *Joannianum*. Conditions in this pool approach the conditions as described by Copeland for Yellowstone thermal *Myxophyceae* (2). He found that the greater number of species occurred in alkaline situations at pH 8.0, and at a temperature of about 35° C.

Specimens of all species listed here have been placed in the herbarium of the Field Museum of Natural History in Chicago. Duplicates of these have been placed in the Earlham College herbarium in Richmond. The collection numbers when not otherwise designated refer to those of the writer. Those species listed from the spray pond are all from the spray pond of the Crystal Ice Co. at Richmond. Those species marked with an asterisk are new records for the state of Indiana.

Chroococcaceae

Chroococcus rufescens (Kütz.) Näg.—With *Schizothrix lardacea* on gravel at edge of ice company spray pond at Richmond, *30*, Aug. 13, 1940. With *Anacystis rupestris* on nearly submerged rocks at Elkhorn Falls, *207*, Sept. 7, 1940. With *A. marginata* in sediment at edge of Lake Wehi, *Markle & King 737*, Sept. 7, 1942. In algal masses attached to floating cat-tail stump in Lake Wehi, *Markle & King 739*, Sept. 7, 1942. In floating masses in Lake Wehi, *Markle & King 757*, Sept. 7, 1942.

Chroococcus turgidus (Kütz.) Näg.—With *Oscillatoria limosa* and *O. princeps* in ice company spray pond at Richmond, *50*, Aug. 15, 1940. With *Anacystis Peniocystis* and *Schizothrix fuscescens* on wall of cave at Elkhorn Falls, *201*, Sept. 7, 1940. In sediment from bottom of spray pond at Richmond, *371*, Nov. 10, 1940.

Pleurocapsa varia (A. Br.) Drouet & Daily—With *Plectonema Nostocorum* in calcareous material in the crevices of stonework, inside wall of R.R. tunnel ½ mile north of Richmond (near Union Pike), *61*, *62*, Aug. 18, 1940. On smooth concrete wall in north end of south tunnel of Pennsylvania R.R. yards (near Morton Lake) east of Richmond, *76*, *77*, Aug. 29, 1940.

Merismopoedia glauca (Ehrenb.) Kütz.—In sediment from pool of spray pond, *34*, Aug. 22, 1940.

Anacystis marginata Menegh.—With *Chroococcus rufescens* in sediment at edge of Lake Wehi, *Markle & King 737*, Sept. 7, 1942. Identified since the publication of Daily's paper (4).

Anacystis rupestris (Lyngb.) Drouet & Daily—With *Plectonema roseolum* and *Oscillatoria granulata* in laboratory culture at Earlham College, *Markle 4*, 1939. On moist soil and among mosses at School Street gravel pit ½ mile west of Richmond, *12*, *13*, July 9, 1940. With *Chroococcus rufescens* on nearly submerged rocks at Elkhorn Falls, *207*, *209*, Sept. 7, 1940. With *Microcoleus vaginatus* on moist soil of swamp just south of Lake Wehi, *Markle & King 738*, Sept. 7, 1942. With *Schizothrix fuscescens* in crevices of cliff at Elkhorn Falls, *203*, Sept. 7, 1940.

Anacystis Peniocystis (Kütz.) Drouet & Daily—With *Chroococcus turgidus* and *Schizothrix fuscescens* on wall of cave at Elkhorn Falls, *201*, Sept. 7, 1940.

Chamaesiphonaceae

**Chamaesiphon polonicus* (Rostaf.) Hansg.—Scraped from the fountain at east side of courthouse at Richmond, *160a*, Nov. 10, 1940.

Stigonemataceae

**Fischerella ambigua* (B.&F.) Gom.—On rocks of north ledge of bluffs (near spring) at Thistlethwaite's Falls, *39*, Aug. 14, 1940. New genus for Indiana.

Nostocaceae

Nostoc Muscorum B.&F.—With *Cylindrospermum majus* on soil in swamp, Friedline farm north of Richmond, *10*, July 7, 1940. On soil by entrance to biology laboratory (Bundy Hall), Earlham College, *17*, Aug. 1, 1940. On moist soil of recently exposed swamp bed in large swamp north of Williamsburg, *83*, Aug., 1940. On moist mud, Butler St. cliff of Whitewater gorge at Richmond, *402a*, July, 1941.

Nostoc commune B.&F.—Under overhanging rock at Tufa Falls, *49*, Aug. 10, 1940.

**Nostoc microscopicum* B.&F.—Under overhanging rock at Tufa Falls, *Markle & King 7*, Oct., 1939. On sandy soil in pasture between two R.R. tunnels northwest of Crosley plant, Richmond, *57*, Aug. 18, 1940. On concrete wall of tunnel, Pennsylvania R.R. yards (near Morton Lake) east of Richmond, *75*, Aug. 29, 1940. This specimen is partially lichenized. With *Calothrix parietina* in peelings taken from the south rock ledge above Thistlethwaite's Falls, *160*, Oct. 20, 1940.

**Nostoc ellipsosporum* B.&F.—On moist sand of bank of Whitewater River about 1,000 feet down from Thistlethwaite's Falls—forming wine-red patches on sand, *52*, *53*, Aug. 15, 1940. With *Scytonema Hoffmanii* on moist sandy soil in pasture between two R.R. tunnels northwest of Crosley plant, Richmond, *67*, Aug. 8, 1940.

**Nostoc humifusum* B.&F.—Extensive growths on the clay-shale under the shade of spreading *Rhus aromatica*, Butler Street cliff, Whitewater gorge at Richmond, *232*, Sept. 18, 1940.

**Nostoc spongiiforme* B.&F.—On moist sand of bank of Whitewater River about 1,000 feet down from Thistlethwaite's Falls, *104*, July, 1940.

Cylindrospermum majus B.&F.—With *Nostoc Muscorum* on moist soil in swamp, Friedline farm north of Richmond, *10*, *99*, July 7, 1940. At edge of stream on sandy soil in pasture between two R.R. tunnels northwest of Crosley plant at Richmond, *58*, Aug. 18, 1940. On soil near drainage ditch south of pumping station in Elliott's Mills bog, *114*, July 4, 1940. On moist swamp soil just south of Lake Wehi, *Markle & King 759*, Sept. 7, 1942.

**Cylindrospermum licheniforme* B.&F.—On moist soil of foot path in greenhouse at Centerville, *5a*, April, 1940. On open soil east end of Elliott's Mills bog, *9*, *113*, July 4, 1940. Under ledge at Tufa Falls, *38*, Aug. 14, 1940. On moist soil of recently exposed swamp bed north of Williamsburg, *69*, *380*, Aug. 20, 1940.

**Cylindrospermum muscicola* B.&F.—On exposed soil bank of sewage stream near back pasture at Earlham College, *1*, Sept. 9, 1939. On moist sand edge of Whitewater River below Thistlethwaite's Falls, *36*, *41*, Aug. 14, 1940. On moist sand river's edge below Thistlethwaite's Falls, *117*, July, 1940. On reddish soil near pumping station; and on soil around crayfish excavation—in Elliott's Mills bog, *109*; *110*, July 4, 1940.

On moist sand by river below Thistlethwaite's Falls, *124*, July 27, 1940. With *Dichotomosiphon tuberosus* under falls at Elkhorn, *218*, Sept. 8, 1940.

**Cylindrospermum catenatum* B.&F.—In small depression of soil, east end near pumping station at Elliott's Mills bog, *112*, July 4, 1940.

Rivulariaceae

Calothrix parietina B.&F.—With *Scytonema figuratum* at edge of spray pond, *26*, Aug. 13, 1940. With *Schizothrix lardacea* in shallow water at edge of spray pond, *27*, Aug. 13, 1940. With *Lyngbya purpurea* in shallow water at spray pond, *28*, Aug. 13, 1940. With *Nostoc microscopicum* in peelings taken from rock surface of north ledge above Thistlethwaite's Falls, *160*, Oct. 26, 1940. With *Schizothrix lardacea* in reddish films on shale in north "corner" of Thistlethwaite's Falls, *161*, Aug. 1940. With *S. lardacea* on wet rocks; and in scrapings from rocks—all at Elkhorn Falls, *205*; *205a*, Sept. 7, 1940. With *Schizothrix calcicola* on rock near water at Elkhorn Falls, *216*, Sept. 7, 1940. From surface growth on pipe; and in scrapings from concrete post—all at spray pond, *301*; *374*, Nov. 10, 1940.

**Hassallia byssoidea* B.&F.—Under south rock ledge near old thorn tree, below Thistlethwaite's Falls, *175*, Sept. 5, 1940. New genus for Indiana.

**Scytonema alatum* B.&F.—At Tufa Falls south of Elliott's Mills bog, *Markle & King 7*, Oct., 1939.

Scytonema figuratum B.&F.—With *Calothrix parietina* at edge of spray pond, *26*, Aug. 13, 1940. Growing in compact masses some 3 mm. thick on concrete at edge of spray pond, *29*, Aug. 13, 1940. On edge of rock shelf at Tufa Falls, *130*, 1940. Forming blackish film on rock and on mosses under ledge at Tufa Falls, *Markle & King 762*, Sept. 7, 1942.

**Scytonema Hoffmanii* B.&F.—Film on moist soil (and on rock) under ledge at Tufa Falls, *48*, Aug. 10, 1940. With *Nostoc ellipsosporum* on moist sandy soil in pasture between two R.R. tunnels northwest of Crosley plant at Richmond, *67*, Aug. 18, 1940.

**Scytonema ocellatum* B.&F.—In dense mat on cement wall of coal bin in greenhouse at Centerville, *4*, March, 1940. Small scattered tufts on cracked mud of ditch in woods across from Lewis Woods near Williamsburg, *157*, Aug., 1940. On sandy soil among grass of stream bank near Springwood, *158*, Aug., 1940. On dry clay soil near top of bank of Whitewater gorge near Mt. Auburn, *190*, Sept., 1940. On moist clay-shale near Tufa Falls, *Markle & King*, *764*, Sept. 7, 1942.

**Scytonema crustaceum* B.&F.—Forming brown, felty masses on moist soil of swamp area south of Lake Wehi, *Markle & King*, *752*, Sept. 7, 1942.

Oscillatoriaceae

**Schizothrix purpurascens* Gom.—With *Microcoleus vaginatus* on wet limestone ledges by road just north of Richmond Baking Co., *267*, Sept. 27, 1940. New genus for Indiana.

**Schizothrix Friesii* Gom.—With *Lyngbya aestuarii* on moist sand wedged at base of grass plant at edge of Whitewater River near Mt. Auburn, *21*, Aug. 5, 1940.

**Schizothrix lacustris* Gom.—Extensive reddish-orange growths on vertical faces of moist rock, Whitewater gorge behind Garr-Scott Bldgs., *430*, July 28, 1941.

**Schizothrix lardacea* Gom.—With *Calothrix parietina* in shallow water at edge of spray pond; forming little calcareous mounds at edge of spray pond, *27*; *32*, Aug. 13, 1940. With *Chroococcus rufescens* in moist gravel at edge of spray pond, *30*, Aug. 13, 1940. Covering moist rock of north bluff at Thistlethwaite's Falls, *40*, Aug. 14, 1940. In calcareous material in crevices of stonework, inside wall of R.R. tunnel ½ mile north of Richmond (near Union Pike), *64*, Aug. 18, 1940. With *Calothrix parietina* forming reddish films on shale in north "corner" of Thistlethwaite's Falls, *161*, Aug., 1940. With *Calothrix parietina* on wet rocks at Elkhorn Falls, *205*, Sept. 7, 1940.

**Schizothrix calcicola* Gom.—In incrustations from spray pond, *356a*, *356b*, Nov. 10, 1940. In calcareous material in crevices of stonework inside wall of railroad tunnel ½ mile north of Richmond (near Union Pike), *118*, July 19, 1940. With *Calothrix parietina* on rock by edge of water at Elkhorn Falls, *216*, Sept. 8, 1940.

**Schizothrix fuscescens* Gom.—With *Anacystis Peniocystis* and *Chroococcus turgidus* on wall of cave at Elkhorn Falls, *201*, Sept. 7, 1940. With *Anacystis rupestris* in crevices of cliff at Elkhorn Falls, *203*, Sept. 7, 1940.

**Schizothrix lateritia* Gom.—In calcareous material in crevices of stonework inside wall of R.R. tunnel ½ mile north of Richmond (near Union Pike), *59*, Aug. 18, 1940.

**Microcoleus acutissimus* Gardn.—Dry eroded soil of steep bank of Whitewater River near bridge at Mt. Auburn, *200*, Sept, 7, 1940.

**Microcoleus lacustris* Gom.—With *Microcoleus vaginatus* on moist cracked mud first cliff below Thistlethwaite's Falls. Bright green and noticeable at some distance, *18*, Aug. 5, 1940. With *Lyngbya aestuarii* on mud near Whitewater River, *22*, Aug. 5, 1940.

**Microcoleus vaginatus* Gom.—With *Symploca Muscorum* on mud accumulated in opening of drainage pipe under Nolands Fork Bridge on Greens Fork Pike, *5*, June, 1940. With *Microcoleus lacustris* on moist cracked mud first cliff down river from Thistlethwaite's Falls, *18*, *19*, Aug. 5, 1940. With *Phormidium autumnale* on moist edge of spray pond, *31*, *33*, Aug. 13, 1940. Peelings from horizontal rock and soil surface of

moist ledge by river at Middleborough, *359*, Dec. 23, 1940. With *Anacystis rupestris* on moist soil of swamp just south of Lake Wehi, *Markle & King 738*, Sept, 7, 1942.

**Plectonema roseolum* Gom.—With *Anacystis rupestris* and *Oscillatoria granulata* in laboratory culture at Earlham College, *Markle 4*, 1939.

**Plectonema Nostocorum* Gom.—Beneath dried *Chara* in receded pond area at School St. gravel pit, *46*, Aug., 1940. With *Pleurocapsa varia* in calcareous material in crevices of stonework inside wall of R.R. tunnel ½ mile north of Richmond (near Union Pike), *62*, Aug. 18, 1940. In slime of *Euglena* growths on moist sand at edge of Whitewater River below Thistlethwaite's Falls, *71*, Aug. 22, 1940. With *Oscillatoria tenuis* var. *tergestina* and *Lyngbya aestuarii* in sediment from pool of spray pond, *356*, Nov. 10, 1940. In undersurface masses on floating cat-tail stump in Lake Wehi, *Markle & King 763*, Sept. 7, 1942.

**Plectonema purpureum* Gom.—Mt. Auburn cliff face, Whitewater gorge, *193*, Sept, 17, 1940. On rock shelf at Elkhorn Falls, *214*, Sept. 8, 1940.

**Symploca elegans* Gom.—Very extensive growths on sand, mud, and twigs at edge of stream (water slightly thermal due to waste from Crosley plant) in Crosley woods, north of Richmond, *16*, July 30, 1940.

Symploca Muscorum Gom.—With *Microcoleus vaginatus* on mud accumulated in opening of drainage pipe under Nolands Fork bridge on the Greens Fork Pike, *5*, June, 1940. Twining up the stems of grasses and mosses in the swamp on Friedline farm near Springwood, *6*, July 7, 1940. On tufa formation at Tufa Falls, *47*, Aug. 10, 1940. In a clump of moss on stone by Whitewater River below Thistlethwaite's Falls, *63*, Aug. 15, 1940. On moist rocks on bank of Whitewater River back of Starr Piano Co., *79*, Sept. 2, 1940.

Lyngbya aestuarii Gom.—In quarry pond at Middleborough, *Markle 10*, 1939. On moist cracked mud of dried-up puddle, School Street gravel pit, *15*, July 30, 1940. With *Schizothrix Friesii* on moist sand, edge of Whitewater River, *21*, Aug. 5, 1940. With *Microcoleus lacustris* on mud near Whitewater River, *22*, Aug. 5, 1940. With *O. tenuis* var. *tergestina* and *Plectonema Nostocorum* in sediment from pool at spray pond, *356*, Nov. 10, 1940. On mud near Whitewater Boulevard at Richmond, *119*, Aug., 1940. With *Phormidium autumnale* on moist soil by Whitewater River at Richmond, *400a*, July, 1941. Floating in Lake Wehi, *Markle & King*, *740*, Sept. 7, 1942.

Lyngbya Diguetii Gom.—On submerged stick from Elliott's Mills bog, *8*, June, 1940. Scraped from rocks under spring near Ratliff home by Thistlethwaite's Falls, *37*, Aug. 14, 1940.

**Lyngbya purpurea* Gom.—With *Calothrix parietina* in shallow water of spray pond, *28*, Aug. 13, 1940. From extensive growths on iron pipes at spray pond, *301*, *352*, Nov. 10, 1940. Scraped from rocks at

spring near Ratliff home, *401a*, July, 1941. Little tufts attached to bottom in shallow water, edge of Lake Wehi, *756*; with *Chroococcus rufescens* floating in Lake Wehi, *753*, *754*; bright orange tufts attached to floating cat-tail stump in Lake Wehi, *758*—all by *Markle & King* Sept. 7, 1942.

Phormidium tenue Gom.—In bottom of shallow stream between R.R. tunnels ½ mile north of Richmond (near Union Pike), *68*, Aug. 18, 1940. With *Oscillatoria tenuis* and *O. princeps* in floating masses at edge of Lake Wehi, *Markle & King 742*, Sept. 7, 1942.

Phormidium Retzii Gom.—At Tufa Falls southeast of Richmond, *133*, Aug. 1940.

**Phormidium subfuscum* var. *Joannianum* Gom.—Extensive and thick mats on sluice gate at dam of Whitewater River at Richmond, *25*, Aug. 9, 1940. On moist rocks near stream outlet back of Starr Piano Co., *80*, Sept. 2, 1940. In drainage ditch of spray pond, *422*, *429*, July 28, 1941.

Phormidium uncinatum Gom.—On rock in shallow water at sewer outlet near G. St. bridge, Sept. 27, 1940. On moist soil near sewage outlet and pumping station in back pasture at Earlham, *144*, July, 1940. Extensive growths on falls at Middleborough, *362*, Dec. 23, 1940. From a number of observations made in December this species seemed to be the dominant alga growing at this time of the year on the falls at Middleborough and also on the rocks at Thistlethwaite's Falls.

Phormidium autumnale Gom.—In standing water in small limestone depression below Thistlethwaite's Falls, *20*, Aug. 5, 1940. With *Microcoleus vaginatus* at edge of spray pond, *33*, Aug. 13, 1940. On low damp ground back of pump house back of Earlham, *129*, July, 1940. On damp soil along Whitewater Blvd. near R.R. bridge, *106*, Aug., 1940. With *Lyngbya aestuarii* on moist soil by Whitewater River at Richmond, *400a*, July, 1941.

Phormidium incrustatum Gom.—On dry calcareous shale by sewer outlet just north of G. St. bridge, *166*, Sept. 2, 1940. Growing on tufa at edge of large formation at Tufa Falls, *Markle & King 761*, Sept. 7, 1942.

Phormidium minnesotense (Tild.) Drouet—With *Oscillatoria formosa* on muddy Whitewater River bank behind Starr Piano Co., *81*, Sept. 2, 1940. With *O. tenuis* at Whitewater River at Richmond, *433*, July 28, 1941. Reported by Drouet (5) for Wayne County.

**Oscillatoria granulata* Gardn.—In laboratory culture at Earlham College, *Markle 4*, 1939.

Oscillatoria princeps Gom.—With *Oscillatoria limosa* and *Chroococcus turgidus* in floating masses in pool of spray pond, *50*, Aug. 15, 1940. Very extensive floating masses behind dam of Whitewater River at Richmond, *24*, *55*, Aug. 9 & 15, 1940. With *O. limosa* in floating masses in pool of spray pond, *72*, Aug., 1940. In about 2 in. of water in Whitewater River at base of cliffs near Bridge Ave., *367*, Sept. 24, 1940. With

Phormidium tenue and *O. tenuis* in floating masses at edge of Lake Wehi; with *O. tenuis* in small hatchery pond just south of Lake Wehi—both *Markle & King 742* and *765*, Sept. 7, 1942.

Oscillatoria proboscidea Gom.—On moist sandy soil on bank of Whitewater River behind Starr Piano Co., *78*, Sept. 2, 1940.

Oscillatoria limosa Gom.—With *O. princeps* and *Chroococcus turgidus* in floating masses in pool of spray pond; with *O. princeps* in floating masses in same pool, *50*, *72*, Aug. 15, 1940.

Oscillatoria tenuis Gom.—On soil by old ditch back of Starr Piano Co., *168*, Sept. 2, 1940. With *Phormidium minnesotense* at Whitewater River near Natco bldgs. at Richmond, *433*, July 28, 1941. With *O. splendida* floating in Lake Wehi, *736*, *749*; with *P. tenue* and *O. princeps* in Lake Wehi, *742*; with *O. princeps* in small hatchery pond just south of Lake Wehi, *765*—all *Markle & King*, Sept. 7, 1942.

**Oscillatoria tenuis* var. *natans* Gom.—In shallow inlet of water by Whitewater River near Mt. Auburn at Richmond, *23*, Aug. 9, 1940. Floating in pool below Thistlethwaite's Falls, *92*, July 7, 1940.

**Oscillatoria tenuis* var. *tergestina* Gom.—With *Plectonema Nostocorum* and *Lyngbya aestuarii* in sediment from bottom of pool of spray pond, *356*, Nov. 10, 1940. In floating masses in pool of spray pond, *426*, July 28, 1941.

Oscillatoria splendida Gom.—In floating material from pool of spray pond, *375*, Nov. 10, 1940. With *O. tenuis* floating in Lake Wehi, *Markle & King 736*, *749*, Sept. 7, 1942.

Oscillatoria formosa Gom.—With *Phormidium minnesotense* on mud bank of Whitewater River behind Starr Piano Co., *81*, Sept. 2, 1940. On rocks in shallow water at edge of Whitewater River below Main St. bridge, *82*, Sept. 2, 1940.

Spirulina major Gom.—On moist soil in Elliott's Mills bog, *7*, July 4, 1940.

Acknowledgments

The writer wishes to express his gratitude to Dr. Francis Drouet for the determinations of the material included in this paper, and for generous advice and criticism; to William A. Daily for the identification of certain specimens; to Dr. M. S. Markle, of Earlham College, for encouraging the writer's interest in the algae as well as making possible some of the material included here; and to Dr. C. M. Palmer for aid in the preparation of this work.

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