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Aphanizomenon Elenkinii Kissel, an interesting variation

HIBBERT HILL*

ABSTRACT—A mature bloom of *Aphanizomenon elenkinii* Kissel, type II, appeared in a local lake in late April, early May, 1971. The appearance of the alga in late spring and changes in the structures of the alga from those previously reported are of interest.

Aphanizomenon elenkinii Kissel in Minnesota Lakes, as described by Hill (1969), included three types of trichomes, types I, II, and III, which over four seasons of observations had always been found together.

This paper describes a bloom of the type II trichome. This bloom occurred in late April and early May. It terminated with mature, akineted, trichomes. Akineted trichomes of any species are extremely rare at this season in Minnesota. The bloom was of interest also because the only trichome present in the plankton at the time was that of type II *A. elenkinii*.

The bloom occurred in Loch Gregor, in West St. Paul, Minnesota. This lake is about one-quarter mile in diameter. It has about a dozen well spaced and well kept residences around its shores. There is no farming activity around the lake, nor any discharge into the lake. The lake has a maximum depth of about 12 feet. Its bottom is of fine soil and organic material. The lake has a large population of minnows and some bullheads. A few years ago bass and sunfish were placed in the lake, but they have been killed by winter deficiency of oxygen. For a number of years the lake has been treated with copper sulfate, usually once in mid-summer, and then again towards the end of summer.

I do not know of any previous observations of Loch Gregor algae. In the present instance observations were made on May 2, 3, 9, 17, and 24, 1971. On May 2, 3, and 9, there was a plentiful population of *A. elenkinii*. On May 17 the population had greatly decreased. On May 24 only an occasional remnant was found. Ice left the lake on April 12, 1971. The water temperature on May 9 was estimated as about 60 degrees F. It thus appears that *A. elenkinii* had developed beneath the ice and had matured in late April and early May. The appearance and maturing of alga at these dates controverts the finding reported by Hill (1969) that the alga does not appear in the plankton in Minnesota until late July.

There was no anti-algal treatment of the lake until after May 17. The lake had been treated late in the summer of 1970.

Figure 1 illustrates the Loch Gregor alga.

Table 1 compares the Loch Gregor *A. elenkinii* with previous observations of the same alga in other lakes in

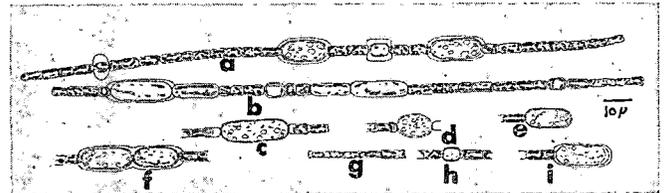


FIGURE 1. Loch Gregor, 1971. b, e, g, h, i, May 2, 1971. a, c, d, f, May 9, 1971.

a. Trichome May 9, 1971. Jelly around heterocysts, external wall around akinetes. b. Trichome May 2, 1971. No jelly around heterocysts, double akinetes forming. Enlarged ends of terminal cells is common. c, d. Akinetes with terminal cups, —contrast with i. The cups appear only on akinetes which do not have the external wall. e. Akinete terminal due to breakage. f. Double akinete and external wall. g. Trichome terminal cells. h. Heterocyst, May 2, 1971. i. Akinete terminal due to breakage. Broken end is typical of detached akinetes having the enclosing wall.

the same area of Minnesota. The Loch Gregor alga has usually an outer wall surrounding the akinete, not previously observed; the akinetes are wider and more oval, in general, than those previously reported; double akin-

TABLE 1. Type II *Aphanizomenon Elenkinii* Kissel

	In Loch Gregor	In Other Minnesota Lakes ¹
Trichome Length, u	to 478 u ²	to 456 u
Cell Width, u	(2.2)-2.5-3.0-(3.4)	(2.5)-3.0-4.0
Cell Length, u	(4.0)-4.5-6.0-(9.0)	4.0-10.0
Heterocyst Width, u	3.0-3.5-(4.5) ³	(3.2)-3.5-4.5
Heterocyst Length, u	(4.5)-5.5-7.0-(7.5)	(5.3)-6.0-10.0
Akinete Width, u	(6.0)-6.5-7.0-(8.0) ⁴	(4.0)-4.5-6.0-(7.0) ⁵
Akinete Length, u	(12) -14 -18 -(22)	(15) -20 -37
No. of Heterocysts	1 to 3 ⁶	1 to 3
No. of Akinetes	1 to 4-(8) ⁷	1 to 3

- Hill (1969)
- Most trichomes are 200 u or less.
- Many heterocysts (50%) have a wide (one u thick) jelly enclosure on May 9, but no such enclosure was seen on May 2-3.
- Width is to akinete wall, not to outer enclosure.
- Akinetes are cylindrical.
- 60% of trichomes have 1 heterocyst, 33% have two, and 7% have three. These figures are average of May 2 and 9 observations.
- 29% of trichomes have 1 akinete, 48% have 2, and 23% have 3 to very rarely 8. These figures are also average of May 2 and May 9 observations.

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etes (in one case triple) on one or both sides of the heterocyst were common; and the granules in mature akinetes were often round and prominent, as is seen in *Aphanizomenon flos aquae* in this area. Very occasionally a trichome contained two sets of heterocysts and akinetes. The jelly around almost all heterocysts seen on May 9 and 17, was unusual.

The Loch Gregor *A. elenkinii* has two forms of mature akinetes, those as in Fig. 1, a, having an inclosing outer wall, and those as in Fig. 1, c, d, e, which do not have this outer wall. Part of the akinetes in the second group have cups into which the adjacent trichome cells fit, Fig. 1, c, and d, and part do not have these cups, Fig. 1, e. Most

of the ripe akinetes seen had the outer wall. Perhaps 10 percent were in the second group.

The thickened hyaline wall of the akinete develops as the akinete ripens. There is no evidence of it at the early stage of Fig. 1, b.

The appearance of this alga in good quantity with no indication at all in the bloom of the type I or type III trichomes, seems to establish the type II *A. elenkinii* as a distinct sub-species.

Reference

HILL, H. 1969. *Aphanizomenon elenkinii* Kiesel in Minnesota Lakes. J. Minn. Acad. Sci. V. 36, No. 1, 1969.

Siphonaptera from Itasca State Park Region

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During the summer of 1968, Van Huizen made a collection of fleas incidental to a larger project on the reproductive biology of chipmunks. These parasites were taken from the vicinity of Lake Plantagenet, Hubbard County, Minnesota, about 15 miles northeast of Itasca State Park. During the same summer, Larson collected fleas in the Park itself. During the summer of 1970, Benton and Larson collected within the Park and in its immediate vicinity to the west, in Hubbard and Clearwater counties. These collections total 302 specimens of 17 species. Examination of specimens in the Entomology Collection at the University of Minnesota revealed one additional species from the Itasca region. This is *Oropsylla arctomys* (Baker), a common parasite of the woodchuck, *Marmota monax*. The single specimen from Itasca State Park was taken from a cabin.

Itasca State Park constitutes a part of the western edge of the mixed coniferous-deciduous forests of north central Minnesota. It includes a variety of habitats in Hubbard and Clearwater counties, and because of the presence there of the University of Minnesota biological station, its biology is well known. This paper, however, represents the first systematic effort to determine the species of Siphonaptera present in the area.

Nomenclature of the fleas follows Hopkins and Rothschild (1953 et seq.), while nomenclature of the mammals follows Hall and Kelson (1959). True hosts (i.e. those which satisfy the biological requirements of the flea species) are marked with an asterisk when known.

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Fox (1940) listed 15 species as occurring in Minnesota. Of these, seven have not been reported previously from the Itasca region. Five of the seven probably occur there, on the basis of the known distribution of the species or the presence there of suitable hosts. These are:

Ceratophyllus diffinis Jordan — of transcontinental occurrence on ground-nesting birds.

Ceratophyllus rossitensis swansoni (Liu) — the type locality is Fertile, Minnesota, about 75 miles west of Itasca State Park, on short-eared owl.

Orchopeas howardii (Baker) — the most common flea on gray squirrels, which occur in the Park region.

Nearctopsylla genalis (Baker) — a parasite of moles and less commonly shrews, occurring west to the Rocky Mountains.

Epitedia wenmanni (Rothschild) — common on deer mice and other small mammals, but usually taken in the fall, winter and spring months. It would not be expected to appear in our summer collections.

Order Siphonaptera

Family Hystrichopsyllidae

Hystrichopsylla dippiei ssp.

Two females from Hubbard county

Hosts: *Tamias striatus*, *Eutamias minimus*

On geographic grounds, we would expect these specimens to belong to the nominate subspecies. Females are not identifiable to subspecies, and no males have as yet been taken from this area.

Catallagia borealis Ewing

One female from Hubbard county

Host: *Clethrionomys gapperi**

While our specimen does not agree well with *C. borealis* from eastern localities, G. P. Holland has referred specimens from nearby Manitoba to this species. Females