Proceedings of the Iowa Academy of Science

Volume 76 | Annual Issue Article 9

1969

Notes on Iowa Diatoms IX: Variation in the Genus Eunotia

C. L. Christensen
Iowa Central Community College

Notes on Iowa Diatoms IX: Variation in the Genus *Eunotia*[1]

C. L. Christensen[2]

Abstract. Diatoms of the genus *Eunotia* are identified from collections made in a soft water-acid environment. The observed variations in the taxa are noted.

This study is a continuation of a large project begun several years ago (Dodd and Stoermer, 1962). The diatom collections for this research were made from Dead Man's Lake, Pilot Knob State Park, Hancock County, Iowa. This area has been described by Grant and Thorne (1955).

Dead Man's Lake was selected because of its physiochemical environment which is unique in the state. While most naturally occurring bodies of water in Iowa tend to be hard, studies show this lake contains soft water of low pH (Smith and Bovbjerg, 1958).

This paper is limited to the genus *Eunotia*. Species of this genus are commonly found in soft water lakes of low calcium and chlorine content. Some species are often found in bogs containing oligotropic or dystropic water (Patrick and Reimer, 1966). Collections made by the author from Dead Man's Lake contain diatoms of the genus *Eunotia* in large numbers. In one sample this genus represented 27% of the total diatom population observed.

Method

This report is based on a collection made from the interface between the floating sphagnum mat and the open lake. This area is designated as collection station six and the sample has been given the number 6-7. The collection was made in the following manner. A handful of that mat was squeezed and the water collected directly in a 50 ml collecting bottle. Next, a small piece of the mat was placed in the bottle and agitated vigorously. Most of the moss material was then removed.

A water analyses was made from this location immediately after the sample was collected. A Hatch Engineers Portable Water Testing Laboratory was used and the results are as follows:

Water temperature, 17.5°C; pH, 5.8; total hardness 20 ppm; Nitrate, 4.3 ppm; Nitrite, trace; Sulfate, 78 ppm; Phosphate (Ortho), 2.8 ppm; Oxygen (dissolved), 2 ppm; Silica, 2.6 ppm.

[1] This work was supported in part by AAAS research funds awarded by IAS.

[2] Life Science Department, Iowa Central Community College, Webster City, Iowa 50595.

The sample was treated using the hydrogen peroxide-potassium dichromate method described in detail in previous papers (Dodd and Stoermer, 1962) and a permanent set of slides was prepared using Hyrax. These slides are designated 6-7a1—6-7a7 and will be deposited in the Iowa Lakeside Laboratory Diatom Herbarium.

Each diatom considered was identified, measured and its position on the slide was noted by circling with a diamond marker. This information along with the general location on the slide has been duly recorded. For further reference, each valve considered was drawn to scale and, in many instances, photographed.

Where possible, series of valves in each taxa were observed. In those taxa where striae count and other factors appeared stable, length was given major consideration. It is interesting to note that although the series were assembled on a random basis the entire minimum—maximum length range of most taxa was covered with only 3-6 micron gaps.

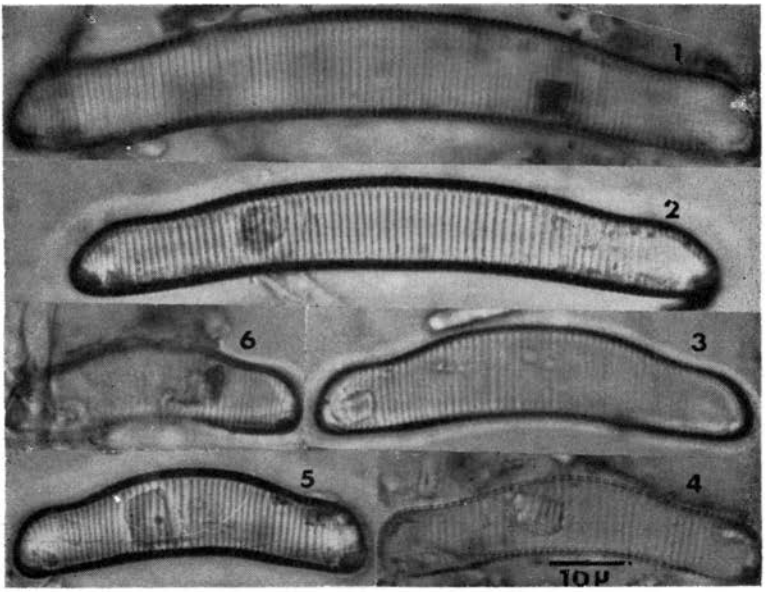

Plate 1. Figs. 1-6. *Eunotia indica* Grun. var. *indica*.

Systematic Section

Eunotia curvata (Kutz.) Lagerst. var. *curvata*. Patr. and Reimer. (Plate 10, Fig. 4.)

E. curvala was the most common of the *Eunotia* taxa observed in this collection. Patrick and Reimer (1966) list the size ranges

as length, 20-150 μ and breadth, 3-6 μ and the striae count as 13-18 in 10 μ. They also state that abnormal forms with margin indents on the valve are common.

The author has observed specimens in this one collection which demonstrate the entire range in both length and breadth. It was also noted that the striae count was somewhat greater near the ends of the valves than across the centers. Abnormal forms had one or two indentations, always on the ventral margin.

This taxon appears to occur in a wide spectrum of ecological conditions and has been reported from many locations in Iowa, even in slightly alkaline water.

Eunotia formica Ehr. var. *formica.* Patr. and Reimer (Plate 10, Fig. 7.)

This is one of the larger, more common diatoms found in this collection. In nearly every case, near the ventral margin one puncta was missing from each stria, resulting in a distinct line just above the ventral margin. It is best observed at the ventral swellings in the middle and near the ends of the valve. The striae count is 9-12 in 10 μ over the center of the valve and increases to 14-16 in 10 μ at the ends. Valve breadth, 12-14 μ. Length, 32-171 μ.

The observed length range is somewhat greater than 40-160 μ as given by Patrick and Reimer (1966). A series showing the entire length variation was observed by the author from this one collection. Geitler (1932) cultured *E. formica* and obtained an even larger variation from a clone. He illustrated a great variety of atypical forms which occurred when the length diminished below 40 μ

Eunotia formica is reported as being found in acid to circumneutral soft water, standing or slow moving (Patr. and Reimer, 1966). The pH at collecting station six was 5.8. Since Dead Man's Lake has no natural drainage, all water loss must be by soil seepage or evaporation.

Eunotia valida Hust. var. *valida.* Patr .and Reimer (Plate 10, Fig. 11.)

Frustules of this taxon are considered rare in this collection as only five were observed. The valve gives the appearance of being surrounded by a heavy dark line because its walls are much thicker than in most other diatoms.

The length of the observed valves ranged from 50-70 μ which is about the center of the 30-150 μ range given by Patrick and Reimer (1966). The striae count of 12 in 10 μ and the 3.5 μ breadth for the observed specimens also fit nicely into the descriptive ranges.

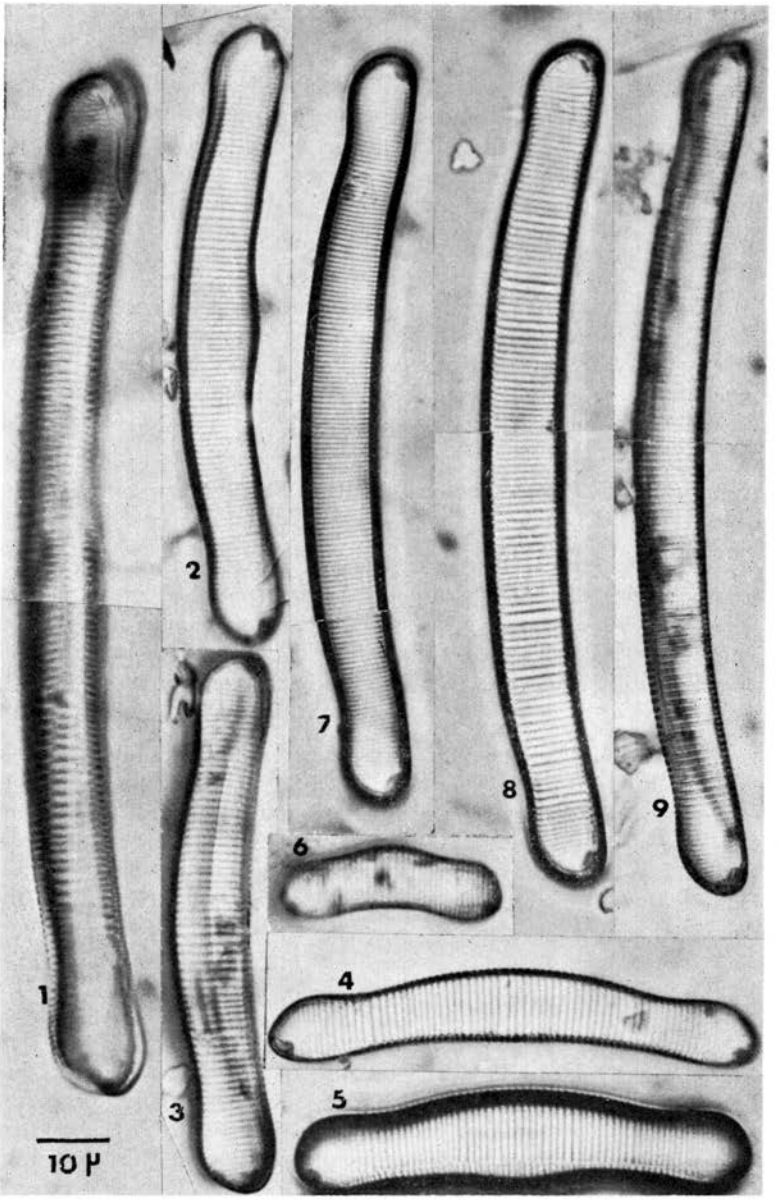

Plate 2. Figs. 1-6. *Eunotia formica* Ehr. var. *formica;* 7-9. *Eunotia indica* Grun. var. *indica.*

Ecologically, it is reported to prefer cool, acid water. The author's collection data appear to be in agreement with this.

Eunotia indica Grun. var. *indica.* Patr. and Reimer (Plate 11 Fig. 2.)

The taxon is not common in this collection. The distinctly capitate, wedge-shaped apices separate it from other *Eunotia* taxa of this group. Observed valves had a breadth of 10-12 μ. Striae counts ranged from 10-12 in 10 μ across the center of the valve, to 16 striae in 10 μ at the ends. The frustules varied in length from 36-134 μ which exceeds the described range of 50-100 μ as given by Patrick and Reimer.

Observations of the series of specimens discussed here show that all characteristics other than length ranges are stable and in close agreement with the descriptions of Patrick and Reimer. It is proposed that the length range for this taxa be extended to include the observed range of 36 to 134 μ.

Eunotia pectinalis var. *minor* (Kutz.) Rabh. Patr. and Reimer (Plate 2 Fig. 13-14.)

There appears to be a great deal of variation, not only in the length of this diatom but also in the shape of the dorsal margin, which can vary from being slightly convex to having two distinct undulations (Patrick and Reimer, 1966). Size seems to have no effect on this feature, as both long and short ones may exhibit the two humps.

Patrick and Reimer (1966) list striae count is 14-16 in 10 μ, breadth as 4-7 μ and length as 20-60 μ. It is found in acid to circumneutral water and can tolerate more calcium than many other species of *Eunotia.* Observed specimens included only the shorter two-thirds of the length range, the longest observed frustule being only 43 μ. Breadth and striae counts fit well within the described ranges.

Eunotia sp. (See plate 3.)

This species appears to belong to the *E. pectinalis* group. The length range of 9 to 19 μ and breadth of 3 to 4.5 μ places it just below *E. pectinalis* var. *minor* (Kutz) Rabh. As this group gets smaller the valve features become more indistinct. The above information makes the correct taxonomic position of this entity difficult to determine. The author hesitates to assign it to *E. pectinalis* var. *minor* (Kutz) Rabh. until after further study.

Discussion

There are a number of interesting features of the *Eunotia* species in this habitat. The most obvious feature is the large num-

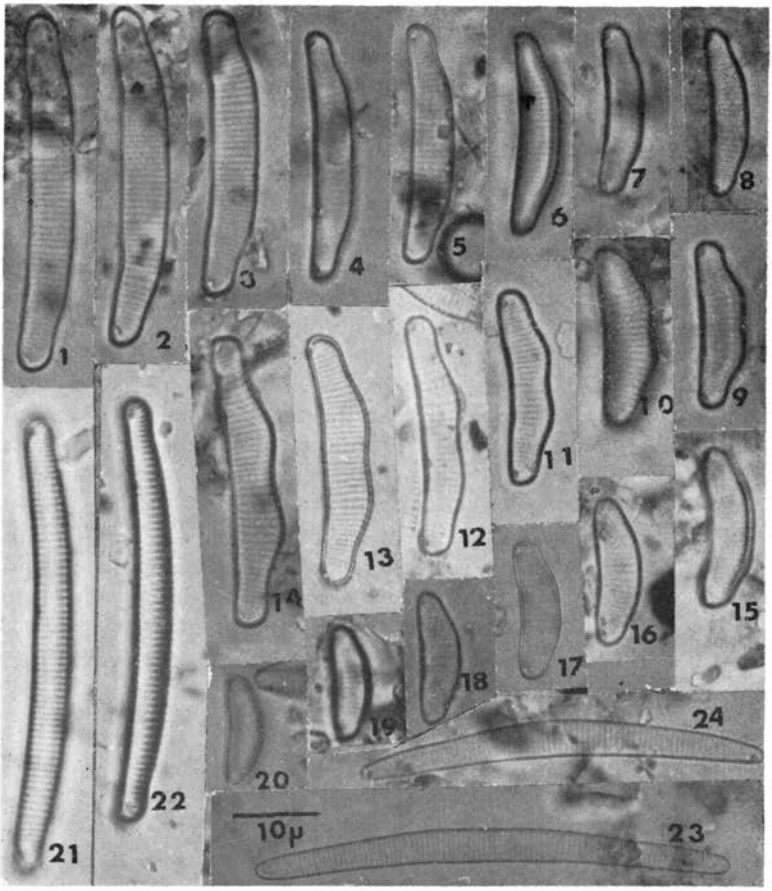

Plate 3. Figs. 1-14. *Eunotia pectinalis* var. *minor* (Kutz.) Rabh.; 15-20. *Eunotia sp.;* 21-22 *Eunotia valida* Hust. var. *valida.;* 23-24 *Eunotia curvata* (Kutz) Lagerst. var. *curvata.*

bers present in the collections. This suggests to the author the rapid development commonly associated with optimum environmental conditions.

Another feature, seemingly related to the first, is the great size range exhibited by each *Eunotia* species found in this single collection. The author feels that this collection represents a single habitate, or perhaps, because of the size and care of collection, a microhabitat. In the case of *Eunotia,* length seemed to show the greatest variation, often extending beyond the described ranges at both ends. This also suggests rapid growth. Myers (1898) in his work on Iowa diatoms records observations of great length variations far exceeding the described limits.

The third feature observed was the thickness or density of the valves. The frustules of various species, but particularly those of *Eunotia,* appear to be heavier than those collected from other Iowa waters. The author has not measured this parameter quantitatively so the feature is based on judgment. Diatom literature indicates that light refraction causes thick walled diatoms to appear to have a heavy dark line around them and, at times, a halo effect is seen. Both phenomena were observed frequently in this study.

The three features mentioned probably reflect diatom response to the special environmental conditions of the habitat. The combination of rich organic and high silicon content of the water of Dead Man's Lake sets it apart from other bodies of water in the area. The fact that silica compounds tend to become less soluble under acid conditions may in part help to explain the observed phenomena (Jorgensen, 1957). From diatom culture studies it has been observed that sulfate ions may be needed for silica uptake and may even act as a triggering agent (Lewin, 1954).

Published studies of requirements for the culture of diatoms reveal that culture media rich in organics and silica produce rapid growth, great size variations and increase in valve thickness in some species. In the cultured species, a large number of atypical forms appeared (Geitler, 1932). This condition was not expected to occur in nature and was not encountered.

Acknowledgments

The author wishes to thank Dr. J. D. Dodd, ISU, Ames and Dr. C. W. Reimer, Academy of Natural Sciences of Philadelphia for their helpful suggestions and advice.

Literature Cited

Dodd, J. D. & E. F. Stoermer, 1962. Proc. Iowa Acad. Science, Vol. 69:83-87.

Geitler, L. 1932. Arch. Protistenkunde 78:1-226.

Grant, M. L. & R. F. Thorne, 1955. Proc. Iowa Acad. Science, Vol. 62:197-210.

Jorgansen, E. G. 1957. Dansk Botanisk Arkiv., Bind 18 Hefte 1, p. 1-54.

Lewin, J. C. 1954. J. Gen. Physiol, 37:489-599.

Myers, P. C. 1898. Proc. Iowa Acad. Science. Vol Vi p. 47-52.

Peterson, J. B. 1950. Dansk Bolanisk Arkiv, Bind 14 Nr. 1 p. 1-19.

Patrick, Ruth, 1941. Proc. Acad. Science Phil. Vol. XCII p. 191-226.

Patrick, R. & C. W. Reimer. 1966. Acad. Nat. Science Phil. Monograph No. 13. p. 183-236.

Smith, P. E. & R. V. Bovbjerg. 1958. Proc. Iowa Acad. Science, Vol. 65:546-553.