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Variability in the Diatom *Fragilaria floridana* Hanna

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Periphyton diatom collections from the South Branch Forked River, Ocean County, New Jersey, included a species which resembled *Fragilaria floridana* Hanna. Comparison of these specimens in the New Jersey samples with the original material of Hanna (1933) indicates that these specimens are indeed *F. floridana*. These are the first living specimens reported since Hanna's original description from fossil diatomaceous material. Some ecological data are included.

INDEX DESCRIPTORS: Bacillariophyceae, Diatoms, *Fragilaria floridana*, New Jersey Pine Barrens.

Hanna (1933) first described *Fragilaria floridana* from a peat deposit collection 1½ miles northeast of Milton, Santa Rosa County, Florida. Its most distinguishing features were the strongly inflated center, missing pseudoraphe, and the transverse striae not reaching outwardly to the swollen margins at the center of the valves.

Since its description, *F. floridana* has been reported in a diatomaceous peat sample from the southeast portion of Santa Rosa County (Gunter and Ponton, 1933). However, these fossil collections are the only known published reports of this diatom.

During a study on the effects of thermal discharges on the structure of periphytic diatom communities in New Jersey (Hein, 1979), a diatom which I identified as *Fragilaria floridana* was collected and observed growing in the South Branch Forked River, which empties into the cooling canals of a nuclear power plant. Presented in this paper are the morphological variation observed in this species and the physical and chemical parameters of the site from which it was collected.

MATERIALS AND METHODS

Between October 1975 and December 1976, a study was conducted on the effects of thermal discharges on the structure of the periphytic diatom communities in the saline cooling canals of the Oyster Creek Nuclear Generating Station located at Forked River, New Jersey (Hein, 1977). As part of this study, the periphytic diatom community in the South Branch Forked River (a freshwater stream which empties into the canals) was sampled at monthly intervals using 5.08 cm (2") diameter styrofoam balls as the artificial substrate. Samples were cleaned with nitric acid and potassium dichromate after the procedure of Lowe (1972). The cleaned diatoms were mounted in Hyrax mounting medium and examined with an American Optical Series 10 Microstar trinocular microscope at a magnification of 1,000×. Photographs were also taken at 1,000× using Panatomic-X film. Physical and chemical parameters of the stream were measured on every collection date.

Hanna's original slides of the deposit material near Milton, Florida, were studied and specimens photographed from one of the slides (FGS-S2485) at the Bureau of Geology in Tallahassee, Florida.

OBSERVATIONS AND RESULTS

In the New Jersey stream collections, *Eunotia exigua* (Bréb.) Rabh. comprised the largest percentage of the community during the year except in March and April when *Tabellaria flocculosa* (Roth) Kütz. was more abundant. *Pinnularia subcapitata* Greg. var. *hilseana* (Janish) O. Müll and *Eunotia repens* A. Berg. var. *arcuata* (Naeg.) A. Cl. were also common during the cooler months (Hein, 1977).

Fragilaria floridana was first observed in the periphytic collections from November 22, 1975 and was subsequently found each month for the remainder of the study. However, even when it was most abundant during February and October, it still comprised less than 1 percent of the periphytic stream community. The ecological factors governing the

seasonal occurrence of this species are not definitely known. Attempts to isolate and culture it were unsuccessful. However, physical and chemical characteristics of its habitat during February and October (when it was most abundant in the stream) do provide some indication of the growth requirements.

The South Branch Forked River is a shallow, clear, freshwater stream which drains approximately 5.12 km² of the New Jersey Pine Barrens. In February and October, 1976, the temperature in the stream ranged from approximately 8° to 13°C with a pH between 3.5 and 3.9. Conductivity ranged between 53 and 170 μmhos • cm⁻¹ and silica ranged between 0.2 to 0.6 mg/l. Sulfate and calcium ranged between 10 to 38 mg/l and 20 to 110 mg/l respectively. During the sampling period, there was no detectable nitrate nitrogen, ortho phosphate, or phenolphthalein alkalinity in the stream (Hein, 1977).

SYSTEMATICS AND DISCUSSION

Fragilaria floridana Hanna
Family *Fragilariaceae*

In his description of *Fragilaria floridana*, Hanna (1933) did not give a size range or a range for the number of striae per 10 μ for his specimens. Instead, Hanna only listed these parameters for the holotype and paratype specimens. These values are listed in Table 1. Hanna also made no mention of the presence of either spines on the valve margin or of the presence of intercalary bands.

Table 1. Described and Observed Features of *Fragilaria floridana*

| | Described by Hanna | | Observed from | Observed from |
|---|--|----------|------------------|---------------------|
| | Holotype | Paratype | Hanna's Material | New Jersey Material |
| Length | 45.3 μ | 26.9 μ | 17 - 45 μ | 20 - 59 μ |
| Width | 15.2 μ | 16.5 μ | 10 - 16 μ | 14 - 19 μ |
| Striae/10 μ | 11.6 | 13.7 | 12 - 19 | 11 - 17 |
| Spines/10 μ | | | 11 - 15 | 9 - 12 |
| Striae reaching margins at center | | NO | Yes & No | Yes & No |
| Pseudoraphe absent | | YES | Yes & No | Yes & No |
| Proposed Characteristics of <i>Fragilaria floridana</i> | | | | |
| Length | 17 - 47 (59) μ | | | |
| Width | 10 - 19 μ | | | |
| Striae | 11 - 19/10 μ | | | |
| Spines | 9 - 15/10 μ | | | |
| Striae at center | | | | |
| inflation | May or may not reach margin | | | |
| Pseudoraphe | Partially obliterated or entirely absent | | | |

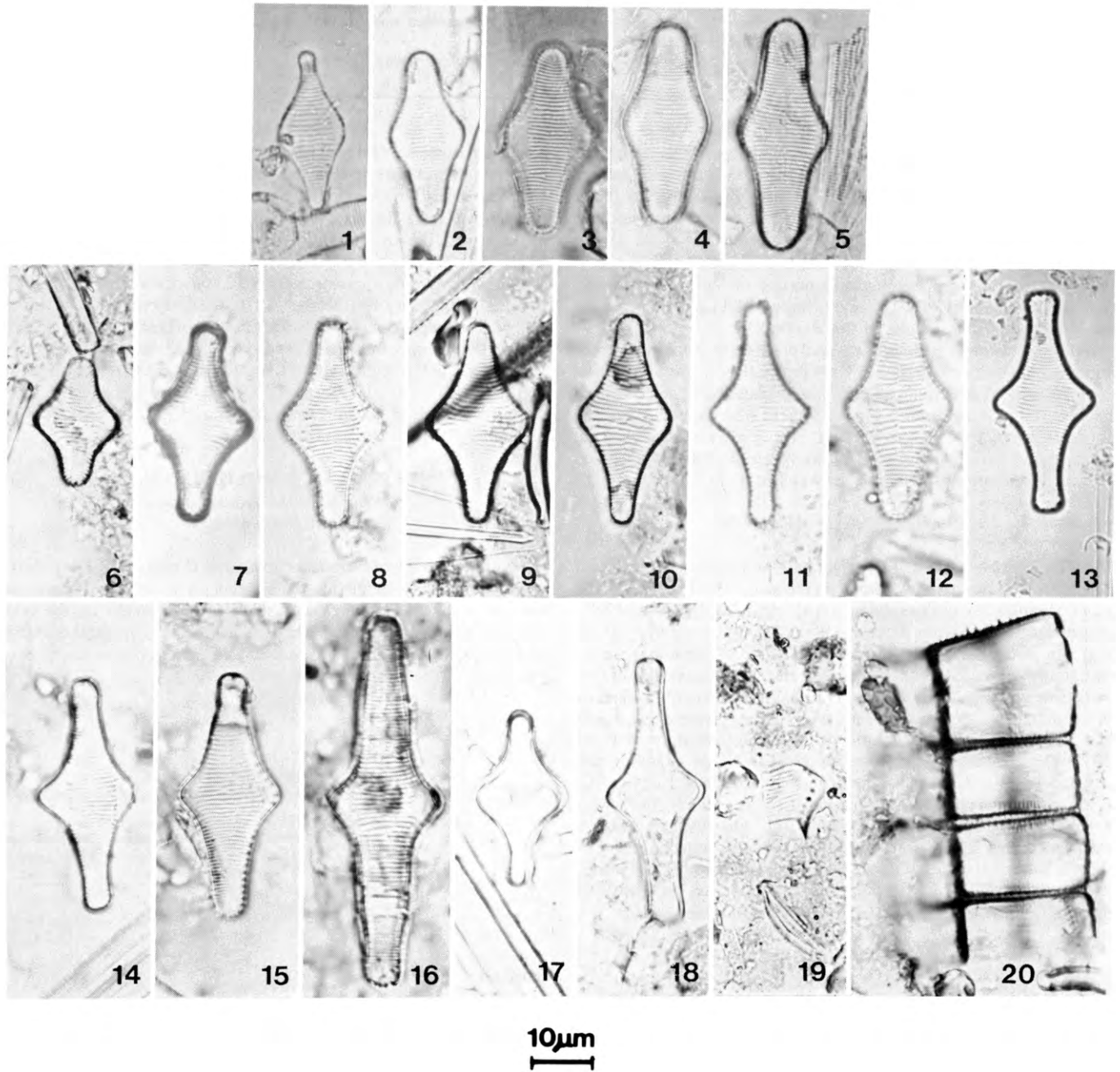


Fig. 1-5. *Fragilaria floridana* from Hanna's (1933) slide (FGS-S2485). $\times 1000$. Fig. 6-20. *Fragilaria floridana* from the New Jersey material. $\times 1000$. Fig. 17, 18. Intercalary bands. Fig. 19. Valve fragment showing spines and valve mantle. Fig. 20. Chain of cells in girdle view.

Following tentative identification of specimens of *Fragilaria floridana* in the New Jersey collections, Hanna's type specimen slide and slides from the collection upon which he based his 1933 publication were examined. Specimens as small as $17\ \mu\text{m}$ long by $10\ \mu\text{m}$ wide were observed. The number of striae also varied from 12 to as many as 19 per $10\ \mu\text{m}$ and the number of spines ranged from 11-15 in $10\ \mu\text{m}$. In contrast to Hanna's description, specimens were observed on his slides in which the striae reached the margins of the inflated central portion of the valve (see Fig. 1-5).

Examination of the New Jersey collections revealed further variability in cells of *F. floridana*. In these collections, cells of *Fragilaria floridana* occurred singly or in short chains of 4-6 cells. The valve length varied from 20-59 μm with a width of 14-19 μm (Fig. 6-20). There were 9-12 spines (usually plainly visible) in $10\ \mu\text{m}$ along the valve margin. The striae varied from 11 to 17 in $10\ \mu\text{m}$, either reaching the margin of the inflated center or occurring as a strip the length of the valve with the striae at the central area terminating some distance from the valve mantle. The pseudoraphe was usually obliterated, but in a few specimens it remained fairly distinct (Fig. 8, 12). Several free intercalary bands were also observed in the collections (Fig. 17, 18). Only one specimen with a length of 59 μm was observed, however, (Fig. 16) and this may represent a post-auxospore cell size. Table 1 summarizes the information on the observed specimens from Hanna's material and from the New Jersey material.

CONCLUSIONS

Due to the variability observed in specimens of *Fragilaria floridana* from Hanna's original material and in collections from the South Branch Forked River, New Jersey, it is concluded that the variability of *F. floridana* is much greater than described by Hanna in 1933. Specimens both smaller and larger than the holotype and paratype specimens were observed. The number of striae per $10\ \mu\text{m}$ was also observed to be greater in some specimens than Hanna originally reported. Features of *F. floridana* were also observed of which Hanna made no mention in his description such as the presence of spines on the valve margin and the presence of intercalary bands.

Therefore, *F. floridana* Hanna is more accurately described by the correction and addition of the following to Hanna's description: length 17-47 (59) μm ; width 10-19 μm ; striae 11-19 in $10\ \mu\text{m}$; and 9-15 spines

present along the margin in $10\ \mu\text{m}$. The striae may or may not reach the margin of the valve at the inflations but the pseudoraphe is usually partially obliterated or may be entirely absent. Spines are normally visible along the valve margin and intercalary bands may be present.

The physical and chemical parameters measured during February and October when *F. floridana* had the greatest relative abundance in the New Jersey stream, suggest that this taxon will be found most frequently in acidic freshwater of low mineral content and under cool water conditions.

Hanna characterizes the diatom flora he found in the fossil material (Pleistocene) as essentially a presently northern flora, known chiefly from Canada, northeastern United States, and northern Europe. The presence of *F. floridana* living in the New Jersey Pine Barrens today provides evidence to support Hanna's idea that the climate in northern Florida at the time of the peat deposition may indeed have been very similar to that in the northeastern U.S. today.

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