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Diatoms (Bacillariophyceae) from Sheeder Prairie, Guthrie County, Iowa[1]

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Seventy-four diatom species, varieties, and forms representing 15 genera were found in collections from Sheeder Prairie. The most widely distributed taxa were *Navicula mutica* Kütz., *Hantzschia amphioxys* (Ehr.) Grun., and *Pinnularia borealis* Ehr. Three taxa which had not previously been reported from Iowa are *Navicula charlatii* f. *simplex* Hust., *Navicula contenta* var. *parallela* Petersen, and *Navicula dismutica* Hust.

Marked differences in the floras from upland and lowland collections were observed. The greatest diversity of species was found at the two sites where standing water occurred occasionally. Fifty-six taxa were found in collections from one of these sites; 31 taxa were found in samples from the other. In contrast, 3-5 taxa were found in samples from upland sites considered to be relatively dry.

INDEX DESCRIPTORS: Bacillariophyceae, soil diatoms, Iowa algae

Algae are generally regarded as inhabitants of bodies of water. Numerous taxa, however, are able to survive and reproduce in a variety of non-aquatic habitats. They are found in and on the soil; on bark, wood, mosses, and rocks; in caves; and on snow and ice.

Algae have been found in soils of all types and at various depths. They are usually most abundant at or near the soil surface. Members of the Chlorophyceae, Cyanophyceae, Chrysophyceae, Xanthophyceae, Bacillariophyceae, Euglenophyceae, and Rhodophyceae have been reported from soils (Petersen, 1935; Fehér, 1936; Fritsch and John, 1942; Bold, 1970). Representatives of the Chlorophyceae and the Cyanophyceae are usually reported as most common, but Lund (1945) found diatoms to be more abundant than the Cyanophyceae and about as abundant as the Chlorophyceae in direct observation of 66 soils.

With one exception, no attempt to study intensively the diatom flora of prairie soils in the United States has been made. The major objective of this investigation was, therefore, to examine and report the diatom flora of an Iowa prairie soil which has been relatively unmodified by man's activities. A secondary objective was to determine whether or not certain taxa are associated with particular prairie habitats.

METHODS AND MATERIALS

Description of Study Area

Sheeder Prairie is one of 4 prairie remnants in the Iowa preserve system. It is located in the SW ¼, Section 33, Seely Township, Guthrie County, Iowa. The preserved area totals 10.1 HA, of which 9.3 HA are native prairie. The remaining 0.8 HA is composed of areas around the edges of the plot that were formerly under cultivation but are now reverting to prairie vegetation.

Sheeder Prairie is diverse physically as well as in its vegetation. It is located in the Shelby-Sharpsburg-Macksburg soil association area. The soils have developed under prairie vegetation from five types of parent material — loess, glacial till, alluvium, till-derived sediments over till, and paleosol. The topography includes ridges, slopes varying in degree from steep to slight, drainage ways, and relatively flat alluvial areas. The combination of slope position, aspect, and soil parent material provides a range of moisture conditions.

A detailed analysis of the higher plant vegetation as it is related to slope position was presented by Kennedy (1969). He characterized the prairie as a mesic, tall-grass dominated upland prairie. Two belt transects with a common origin were positioned to encompass the maximum variations in altitude and parent materials. On the basis of slope position and parent material he established 18 stands along the two transects. According to the prairie continuum analysis performed, the continuum index values of the stands ranged from 347.3 (dry-mesic) to 265.5 (wet-mesic).

For the study of the diatoms of Sheeder Prairie, 19 collection sites were chosen to represent a number of habitats present in the prairie. Wooden stakes were used to mark the sites. No attempt was made to quantify the vascular plant vegetation at the sampling sites.

Brief descriptions of the collection sites are given below. Plant species occurring at the sampling sites are listed, together with the soil parent material when it is known. Each of the 10 sites corresponding to locations on Kennedy's transects is identified by a hyphenated number. The first part of the number designates transect 1 or 2; the second is the distance in meters from the common origin of the transects.

Station 1 — *Ambrosia trifida* L., *Helianthus laetiflorus* Pers., *Verbena hastata* L.

Station 2 — *Heliopsis helianthoides* (L.) Sweet, *Silphium integrifolium* Michx., *Monarda fistulosa* L., *Ratibida pinnata* (Vent.) Barnh.

Station 3 (1-210) — *Monarda fistulosa* L., *Ratibida pinnata* (Vent.) Barnh., *Silphium integrifolium* Michx., *Poa pratensis* L., *Phleum pratense* L. Parent material: alluvium

Station 4 (1-170) — *Phlox pilosa* L., *Ratibida pinnata* (Vent.) Barn., *Zizia aurea* (L.) Koch
Parent material: till-derived sediment over till

Station 5 (1-150) — *Pedicularis canadensis* L., *Poa pratensis* L., *Zinzia aurea* (L.) Koch, *Eryngium yuccifolium* Michx.
Parent material: Nebraskan till

Station 6 (1-130) — *Stipa spartea* Trin., *Poa pratensis* L., *Panicum leibergii* (Vasey) Scrib., *Zizia aurea* (L.) Koch
Parent material: Aftonian paleosol

Station 7 (1-100) — *Pedicularis canadensis* L., *Euphorbia corollata* L., *Poa pratensis* L., *Echinacea pallida* Nutt., *Stipa spartea* Trin.
Parent material: Kansan till

Station 8 (1-70) — *Phlox pilosa* L., *Pedicularis canadensis* L., *Ceanothus ovatus* Desf., *Euphorbia corollata* L., *Poa pratensis* L.
Parent material: Sangamon paleosol

Station 9 (1-10) — *Phlox pilosa* L., *Panicum scribnerianum* Nash, *Poa pratensis* L.
Parent material: loess

Station 10 — *Prunus americana* Marsh., *Rhus radicans* L.

Station 11 — *Rhus radicans* L., *Solidago rigida* L., *Aster simplex* Willd.

Station 12 — *Phlox pilosa* L., *Zizia aurea* (L.) Koch, *Silphium integrifolium* Michx., *Panicum scribnerianum* Nash, *Poa pratensis* L.,

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Equisetum sp.

Station 13 (2-150) — *Ratibida pinnata* (Vent.) Barnh., *Silphium integrifolium* Michx., *Poa pratensis* L., *Stipa spartea* Trin., *Equisetum* sp.
Parent material: alluvium

Station 14 (2-260) — *Aster sericeus* Vent., *Ceanothus ovatus* Desf., *Phlox pilosa* L., *Elymus canadensis* L., *Euphorbia corollata* L.
Parent material: Kansan till

Station 15 (2-240) — *Ceanothus ovatus* Desf., *Elymus canadensis* L., *Stipa spartea* Trin., *Poa pratensis* L.
Parent material: Kansan till

Station 16 — *Acer negundo* L., *Elymus virginicus* L., *Cornus stoloni fera* Michx., *Vitis riparia* Michx., *Geum virginianum* L., *Convolvulus sepium* L.

Station 17 — *Cannabis sativa* L., *Ambrosia trifida* L., *Chenopodium album* L.

Station 18 — *Acer negundo* L.

Station 19 — *Acer negundo* L., *Amblystegium varium* (Hedw.) Lindb.

Collecting and Preserving Techniques

Collections from the 19 sites described above were made on the following dates:

September 21, 1969
January 25, 1970
April 11, 1970
June 6, 1970
September 23, 1970
October 28, 1970
December 6, 1970

Supplementary collections, studied less intensively, were made on the following dates:

May 19, 1969
June 15, 1969
July 20, 1969
October 11, 1970
November 15, 1970

The May collections were made at various locations on the prairie. In June and July samples were taken at 10-m intervals along Kennedy's transects. On the last 2 dates collections were made at the 19 sites described above.

All of the collections made except those from stations 18 and 19 were of litter from the surface of the soil. The following procedure was followed in collecting litter samples. Decaying vegetation on the surface of the soil from an area about 25 cm^2 and no further than about 30 cm from the marker stake was removed and placed in labeled plastic sandwich bags. Localized areas where the soil was obviously disturbed were avoided. At station 18 the soil surface from an area of about 25 cm^2 was scraped up or chipped out and placed in a bottle or plastic bag. On May 19, 1969, when water was standing at this site, the bottom sediments were collected with a small pipette. Mosses growing on soil at station 19 were removed with as little soil as possible and placed in a bottle or plastic bag. All samples were transferred to labeled vials and preservative (formalin or Transeau's solution) was added.

Samples were treated using a modification of the nitric acid-potassium dichromate method of Hohn and Hellerman (1963). Occasionally, large amounts of organic matter remained after treatment. In such cases the sample was flooded with 72% H_2SO_4 (w/v) and allowed to stand overnight. Dilution was carried out as described in the above procedure. Permanent slides were prepared using Hyrax (Custom Research & Development, Inc.) mounting medium.

RESULTS

A total of 74 taxa from 15 genera were observed during the course of this study. Several taxa remain unidentified and have been assigned species numbers. All taxa encountered are listed alphabetically in Table 1 with the occurrence of each indicated for each sampling site. Table 2 lists the taxa represented by only a single specimen in all of the collections examined. Following the tables are notes on certain taxa which deviated from published descriptions or are rare in or unreported from Iowa collections. The treatment of each taxon includes the reference which was used in making the identification and a voucher slide number. Voucher slides, which have been added to the Iowa State University diatom collection, are identified by a two-part numbering system. The first part is the date of collection of the sample. The second part consists of the station number (preceding the colon) and the slide number. An "S" preceding the station number indicates that the collection was made at a supplementary collection site which is described on the slide label. Ecological comments of other investigators and their reports of occurrence in non-aquatic habitats are summarized. Descriptions of morphological variability are presented where appropriate.

Notes on Selected Taxa

Navicula charlatii var. *charlatii* f. *simplex* Hust. (Fig. 2)
Reference: Hustedt 1966; p. 603, Text Fig. 1607b, c.
Slide: 9-21-69 6:1

Hustedt (1966) described the species as a freshwater form of apparently cosmopolitan distribution. He noted that in aerial habitats it is predominantly found living on moist mosses and on wet cliffs and, in such habitats, is often abundant.

Navicula contenta var. *parallela* Petersen
Reference: Hustedt 1930; p. 277, Text Fig. 458b.
Slide: 6-15-69 S2-100:3

Hustedt (1957) regarded this taxon as an aerobiontic form. Krasske (1932) stated that although it is one of the most abundant of the xeric forms, it is also abundant on moist rocks and mosses.

Navicula dismutica Hust. var. *dismutica* (Fig. 3)
Reference: Hustedt 1966, p. 595, Text Fig. 1600.
Slide: 4-11-70 18:6

Hustedt (1966) reported this taxon to be very abundant in mosses from the alps.

Navicula mutica Kütz. var. *mutica*
Reference: Bock 1963, p. 229, Plate 1, Fig. 8-11, 14-17, 35-38, 54-65.
Slides: 5-19-69 S5:4; 6-15-69 13:1; 9-21-69 14:4; 1-25-70 7:1

Several forms of *Navicula mutica* have been observed. Descriptions and illustrations of these variations are presented in Loescher (1972). Because unsolved taxonomic problems exist in the *Navicula mutica* complex, the forms observed have not been assigned to infraspecific categories.

Navicula mutica is generally regarded as the most common of all soil diatoms. Hustedt (1957) stated that it is often aerophilous. It has been found on bryophytes (Krasske 1932, 1948; Beger, 1928; Dodd and Stoermer, 1962); on soils (Lund, 1946; Hayek and Hulbary, 1956; Forest et al., 1959; Reimer, 1970); and in dry lakes (VanLandingham, 1966).

Navicula mutica var. *mutica* f. *intermedia* (Hust.) Hust. (Fig. 4)
Reference: Hustedt 1966, p. 585, Text Fig. 1593a, b.
Slide: 6-15-69 6:1

Every cell observed fit the description cited above but differed from the illustrations in that the isolated punctum was formed by an oblique instead of a perpendicular pore.

Krasske (1948) called this taxon an aerophilic moss form of the tropics. Hustedt (1937) stated that it is abundant only in aerated habitats in springs and brooks and on wet mosses. It was found by Reimer (1970) in a collection from a prairie swale and by Bock (1970) in a layer of soil from a wall.

Table 1. *Occurrence of taxa at sampling stations (+ indicates presence, − indicates absence)*

	Sampling Station*																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	other
Achnanthes lanceolate (Bréb.) Grun. var. *lanceolata*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	+
Achnanthes lanceolata var. *dubia* Grun.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Amphora montana Krasske var. *montana*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	+
Amphora submontana Hust. var. *submontana*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Caloneis amphisbaena (Bory) Cl. var. *amphisbaena*	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−
Caloneis bacillum (Grun.) Cl. var. *bacillum*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Cymbella triangulum (Ehr.) Cl. var. *triangulum*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Cymbella ventricosa Kütz. var. *ventricosa*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Fragilaria brevistriata Grun. var. *brevistriata*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Fragilaria construens var. *venter* (Ehr.) Grun.	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Fragilaria vaucheriae (Kütz.) Petersen var. *vaucheriae*	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Fragilaria virescens Ralfs var. *virescens*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Frustulia vulgaris (Thwaites) DeT. var. *vulgaris*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Gomphonema angustatum(Kütz.) Rabh. var. *angustatum*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Gomphonema angustatum var. *sarcophagus* (Greg.) Grun.	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Hantzschia amphioxys (Ehr.) Grun. var. *amphioxys*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Hantzschia amphioxys var. *amphioxys* f. *capitata* O. Müll.	−	−	−	+	+	+	+	−	−	−	−	+	−	−	−	−	−	+	−	−
Meridion circulare (Grev.) Ag. var. *circulare*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Navicula americana Ehr. var. *americana*	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−
Navicula atomus (Kütz.) var. *atomus*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−
Navicula charlatii var. *charlatii* f. *simplex* Hust.	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	+
Navicula cincta var. *rostrata* Reim.	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Navicula contenta var. *biceps* (Arn.) V.H.	+	−	−	−	+	−	−	−	−	+	+	+	+	−	−	+	−	+	−	−
Navicula contenta var. *parallela* Petersen	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
Navicula cryptocephala var. *cryptocephala* f. *terrestris* Lund	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
Navicula cuspidata (Kütz.) Kütz. var. *cuspidata*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula cuspidata var. *ambigua* (Ehr.) Cl.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula cuspidata var. *heribaudi* M. Perag. *in* Heribaud	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula decussis Østrup var. *decussis*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
Navicula dismutica Hust. var. *dismutica*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−

Table 1 (Continued)

	Sampling Station*																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	other
Navicula minuscula Grun. var. *minuscula*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula mutica Kütz. var. *mutica*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Navicula mutica var. *mutica* f. *intermedia* (Hust.) Hust.	+	−	+	−	+	−	−	−	−	+	+	+	+	−	−	−	−	+	−	+
Navicula mutica var. *undulata* (Hilse) Grun.	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Navicula neoventricosa Hust. var. *neoventricosa*	−	−	−	−	+	−	−	−	−	−	−	−	−	−	+	−	−	+	+	+
Navicula nigrii DeNotaris var. *nigrii sensu* Granetti	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Navicula pseudatomus Lund var. *pseudatomus*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula tantula Hust. var. *tantula*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+
Navicula tenelloides Hust. var. *tenelloides*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula viridula var. *argunensis* Skv.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula sp. 1	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Navicula sp. 4	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Navicula sp. 6	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−
Navicula sp. 7	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+
Navicula sp. 9	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Neidium affine (Ehr.) Pfitz. var. *affine*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Neidium affine var. *capitata* Mölder	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Neidium bisulcatum (Lagerst.) Cl. var. *bisulcatum*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Neidium bisulcatum var. *baicalense* (Skv. & Meyer) Reim.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Neidium sp. 1	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Neidium sp. 2	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Nitzschia amphibia Grun. var. *amphibia*	+	+	+	−	−	−	−	−	−	−	+	−	−	−	−	−	−	+	+	−
Nitzschia apiculata (Greg.) Grun. var. *apiculata*	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Nitzschia communis var. *hyalina* Lund	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Nitzschia denticula Grun. var. *denticula*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
Nitzschia linearis (Ag.) W. Smith var. *linearis*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Nitzschia parvula var. *terricola* Lund	+	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−	−	+	−	+
Nitzschia sp. 1	+	−	−	−	−	−	−	−	−	−	−	+	+	−	−	+	−	+	+	+
Nitzschia sp. 2	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Pinnularia borealis Ehr. var. *borealis*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+	+	+
Pinnularia borealis var. *congolensis* Zanon	−	−	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Pinnularia brebissonii (Kütz.) Rabh. var. *brebissonii*	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Pinnularia brebissonii var. *diminuta* (Grun.) Cl.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Pinnularia obscura Krasske var. *obscura*	−	−	−	−	+	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−
Pinnularia viridis var. *intermedia* Cl.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Pinnularia sp. 1	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−
Stauroneis anceps Ehr. var. *anceps*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−
Stauroneis borrichii (Petersen) Lund var. *borrichii*	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	+	−	−
Stauroneis phoenicenteron (Nitz.) Ehr. var. *phoenicenteron*	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−

Table 1 (Continued)

	Sampling Station*																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	other
Stauroneis sp. 1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–
Stauroneis sp. 2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–
Surirella angusta Kütz. var. *angusta*	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–
Surirella ovata Kütz. var. *ovata*	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–
Surirella ovata var. *pinnata* W. Smith	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–

*Descriptions of the sampling stations are found in Materials and Methods

Table 2. *Taxa represented by a single specimen*

Amphora submontana
Caloneis amphisbaena
Cymbella triangulum
Fragilaria brevistriata
Fragilaria construens var. *venter*
Fragilaria vaucheriae
Fragilaria virescens
Navicula americana
Navicula cryptocephala f. *terrestris*
Navicula decussis
Navicula dismutica
Navicula mutica var. *undulata*
Navicula pseudatomus
Navicula sp. 6
Neidium sp. 2
Nitzschia apiculata
Nitzschia denticula

Pinnularia borealis Ehr. var. *borealis*

Reference: Cleve-Euler 1955, p. 32, Fig. 1937a, b, d, h.

Slides: 9-21-69 14:4; 1-25-70 6:1; 6-6-70 14:2.

Great variation in shape, striae length and angle, and central area was found in the cells observed. Assignment of specimens to infraspecific categories was not made because of the great variability and possible intergradations between some of the described varieties and forms. The cells measured ranged from 20-45 μm in length, from 5-9 μm in breadth, and had 4-6 striae in 10 μm. The valve ends varied from rounded and slightly tapered to rectangular. The striae ranged from marginal (very short) to long (nearly reaching the raphe). The longer striae were usually radiate at the center of the valve and convergent at the ends. Cells with long striae had central areas formed by either the shortening or the absence of central striae. Central areas were lacking in cells with short marginal striae.

The taxon was found in collections from all stations except station 16. It is generally regarded as one of the most common soil diatoms. It has been found among bryophytes (Beger, 1927; Krasske, 1932) and in soils (Petersen, 1928; Lund, 1946; Forest, 1962). It was found by Bock (1963, 1970) in numerous collections from extremely dry habitats.

Pinnularia borealis var. *congolensis* Zanon (Fig. 1)

Reference: Zanon 1938, p. 641, Plate 1, Fig. 27.

Slide: 6-6-70 6:5

This taxon was reported from Iowa by Christensen (1979) as rare in collections from a *Sphagnum* bog. No reports of this variety from aerial habitats have been found.

DISCUSSION

During the course of this study 74 diatom species, varieties, and forms belonging to 15 genera were encountered. Of these, 3 taxa have not been previously reported from Iowa. They are *Navicula charlatii* f. *simplex*, *Navicula contenta* var. *parallela*, and *Navicula dismutica*. Seventeen of the 74 taxa encountered were represented by only a single specimen in all the material examined and were therefore considered to be accidentals. Several investigators (Brown, Larson, and Bold, 1964; Luty and Hoshaw, 1967; Schlichting 1961, 1964; Loescher, unpublished data) have found viable diatoms in the atmosphere. The diatoms I have regarded as accidentals may have been transported in various ways as empty frustules or as living cells incapable of reproducing on the prairie. Except for *Navicula cryptocephala* f. *terrestris*, *Navicula dismutica*, *Navicula pseudatomus*, and *Nitzschia denticula*, these taxa have not been reported from aerial habitats.

In a study of the diatoms of another Iowa prairie, Cayler Prairie, Reimer (1970) reported 70 species, varieties, and forms belonging to 14 genera. He examined 6 collections, 2 of which were plankton net samples from standing water. Three were collections from a swale, and 1 was from a drier upland site. Of the 70 taxa encountered in Cayler Prairie, only 3 taxa were restricted to the plankton collections.

A comparison of the diatom floras of Sheeder and Cayler prairies shows that the 2 areas have 11 genera in common. They are *Achnanthes*, *Amphora*, *Caloneis*, *Fragilaria*, *Gomphonema*, *Hantzschia*, *Meridion*, *Navicula*, *Nitzschia*, *Pinnularia*, and *Stauroneis*. Of those genera not represented in both floras, *Diploneis*, *Eunotia*, and *Rhopalodia* were found only in Cayler Prairie; *Cymbella*, *Frustulia*, *Neidium*, and *Surirella* were found only in the Sheeder flora. Although at least 70 species, varieties, and forms were encountered in each study, only 19 were found in both prairies. The dissimilarity of the floras is not surprising when the differences in water availability at the collection sites are considered. Only one of the Cayler collections was made from a relatively dry habitat, whereas most of the Sheeder Prairie collection sites are considered relatively dry. Of the 19 taxa common to the 2 prairies, 7 were found only at the wettest of the Sheeder collection sites (stations 18 and 19) and 4 were found at the wettest sites as well as

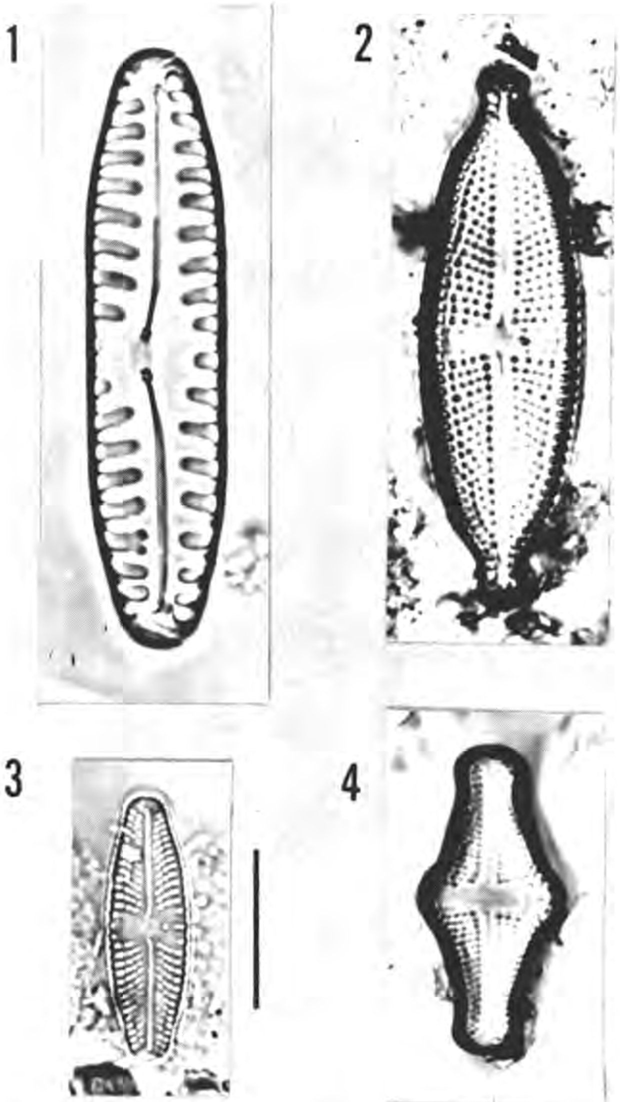

Fig. 1-4. *Selected diatom taxa. Scale = 10μm.* Fig. 1. Pinnularia borealis *var.* congolensis. Fig. 2. Navicula charlatii *f.* simplex. Fig. 3. Navicula dismutica. Fig. 4. Navicula mutica *f.* intermedia.

at a station down the drainage way from them (station 1). Two of the taxa were considered to be accidentals. Thus 13 of the 19 taxa found in both prairies were encountered at fewer than four collection sites on Sheeder Prairie. Differences in taxonomic philosophy may account for a few taxa not being reported in both studies.

Many factors — the availability of light, water, and nutrients; temperature; interactions with other organisms; etc. — affect the survival and reproduction of diatom species and, as a result, influence the composition of the flora of a particular habitat. Because little is known of the requirements of individual taxa, the presence of particular taxa at certain sites on Sheeder Prairie cannot, for the most part, be explained. The availability of water in aerial habitats, however, apparently has a marked effect on the diversity of the flora. The difference between the number of taxa observed at upland and lowland sites on Sheeder Prairie is particularly striking. Collections from 3 upland sites, stations 9, 14, and 15, all of which were located in stands regarded by Kennedy (1969) as relatively dry, yielded 5, 3, and 4 taxa, respectively. In contrast, 56 and 31 taxa were found at stations 18 and 19, respectively, the only stations where standing water was observed. A similar difference in diversity was noted by Reimer (1970), who found 8 taxa in a collection from a Cayler Prairie upland site and 47 taxa in a collection made the same day from a prairie swale.

Two collections from station 1 (those made on September 21, 1969, and June 6, 1970) contained many taxa which were otherwise encountered only in collections from stations 18 and 19. Because other collections from station 1 contained few specimens, and because station 1 is located below stations 18 and 19 in the same drainage way, it is probable that the additional taxa were carried downslope by runoff water.

No more than a few diatom cells were found in any collection from station 17, the site of a haystack about 1965. No explanation for the depauperate flora can be given. Collections from stations 2 and 3, which were located in similar low alluvial areas but which had not been recent haystack sites, yielded 4 and 5 taxa, respectively, and these were present in moderate numbers.

The 3 diatom taxa that are generally considered to be the most common in non-aquatic habitats all were found in collections from Sheeder Prairie. Two of these, *Hantzschia amphioxys* var. *amphioxys* and *Navicula mutica* var. *mutica*, were found in collections from all sampling stations, while one, *Pinnularia borealis* var. *borealis*, was found in collections from all stations except station 16. *Navicula contenta* var. *biceps* and *Navicula mutica* f. *intermedia* were each found at 8 stations; *Hantzschia amphioxys* f. *capitata* and *Nitzschia amphibia* var. *amphibia* were found in collections from six sampling sites. All of these latter four taxa have been found in non-aquatic collections by several investigators (Beger, 1928; Bock, 1963, 1970; Fritsch and John, 1942; Reimer, 1970). The common taxa of Sheeder Prairie are therefore characteristic of xeric habitats.

Further, it is recognized that most terrestrial diatom taxa belong to the order Pennales and that most of these also have a true raphe (Petersen, 1915, 1928; Patrick and Reimer, 1966). Because the diatoms that possess a raphe are motile, it is thought that they are able to move into moister areas as the soil dries and to return to the soil surface after being washed into deeper layers by rain (Petersen, 1928, 1935; Lund, 1945; Patrick and Reimer, 1966). Lund (1945) observed that when water films were no longer seen around soil particles, diatom movement ceased; when water was then added, many of the cells began to move again.

Only two of the 15 genera represented in the Sheeder Prairie flora, *Fragilaria* and *Meridion*, are rapheless. Each of the four *Fragilaria* taxa observed was represented by only a single cell or valve and was therefore considered to be an accidental. *Meridion circulare*, which was found, often abundantly, in all collections from station 18, is considered to have been growing at this site. This taxon was also found at station 19, whereas at the adjacent station 18, standing water was observed on two occasions. The specimens of *M. circulare* observed in collections from station 1 may have been carried down the drainage way by runoff water.

The five rapheless taxa found by Reimer (1970) in the Cayler Prairie flora also belong to *Fragilaria* (three species) and *Meridion* (two varieties). Of these only *Fragilaria crotonensis* Kitton was not found in soil and duff collections. Other studies of non-aquatic diatom floras in Iowa have yielded similar results. Stoermer (1962) observed one species of centric diatom (*Melosira roeseana* Rabh.) and no pennate diatom taxa that lack raphes in a collection from the base of a waterfall. Among diatoms associated with lichens and mosses, Dodd and Stoermer (1962) found one centric species (*Melosira roeseana*) and no pennate diatoms lacking raphes. With the exception of one frustule of

Cyclotella kuetzingiana Thwaites, Hayek and Hulbary (1956) found no diatom species not possessing at least one raphe in the soils they studied. Bock (1963, 1970) found a number of rapheless taxa in two studies of diatoms from extremely dry habitats in Europe. Many, however, were apparent accidentals represented by broken specimens or single valves. In the one study, only 9 of 107 taxa encountered were rapheless and 7 of these were considered accidentals (Bock, 1963). In collections from dry rocks and walls, 22 of 119 taxa were rapheless and 12 were considered accidentals (Bock, 1970). Thus, data from Sheeder Prairie are consistent with these other reports supporting the suggestion that in xeric or soil habitats there is selection against rapheless species.

REFERENCES

BEGER, H. 1927. Beiträge zur Ökologie und Soziologie der luftlebigen (atmophytischen) Kieselalgen. Ber. Deutsch. Bot. Ges. 45: 385-407.

BEGER, H. 1928. Atmophytische Moosdiatomeen in den Alpen. Beiblatt zur Vierteljahrsschrift der naturforschenden Gesellschaft in Zürich, Festschrift Hans Schinz, No. 15, Jahrgang 73: 382-404.

BOCK, W. 1963. Diatomeen extrem trockener Standorte. Nova Hedwigia 5: 199-254.

BOCK, W. 1970. Felsen und Mauern als Diatomeenstandorte. Beih. Nova Hedwigia 31: 395-441.

BOLD, H.C. 1970. Some aspects of the taxonomy of soil algae. Ann. N.Y. Acad. Sci. 175: 601-616.

BROWN, R.M., JR., D.A. LARSON, and H.C. BOLD. 1964. Airborne algae: their abundance and heterogeneity. Science 143: 583-585.

CHRISTENSEN, C.L. 1976. Notes on Iowa diatoms XI: A study of the genus *Pinnularia* from Dead Man's Lake. Proc. Iowa Acad. Sci. 83: 81-87.

CLEVE-EULER, A. 1955. Die Diatomeen von Schweden und Finnland. Teil IV. Biraphideae 2. Kongl. Svenska Vet.-Akad. Handl., Fjärde Ser., 5(4): 1-232.

DODD, J.D., and E.F. STOERMER. 1962. Notes on Iowa diatoms. I. An interesting collection from a moss-lichen habitat. Proc. Iowa Acad. Sci. 69: 83-87.

FEHÉR, D. 1936. Untersuchungen über die regionale Verbreitung der Bodenalgen. Arch. Mikrobiol. 7: 439-476.

FOREST, H.S. 1962. Analysis of the soil algal community. Trans. Amer. Microscop. Soc. 81: 189-198.

FOREST, H.S., D.L. WILLSON, and B. ENGLAND. 1959. Algal establishment on sterilized soil replaced in an Oklahoma prairie. Ecology 40: 475-477.

FRITSCH, F.E., and R.P. JOHN. 1942. An ecological and taxonomic study of the algae of British soils. II. Consideration of the species observed. Ann. Bot., N.S., 6: 371-395.

HAYEK, J.M.W., and R.L. HULBARY. 1956. A survey of soil diatoms. Proc. Iowa Acad. Sci. 63: 327-338.

HOHN, M.H., and J. HELLERMAN. 1963. The taxonomy and structure of diatom populations from three eastern North American rivers using three sampling methods. Trans. Amer. Microscop. Soc. 82: 250-329.

HUSTEDT, F. 1930. Bacillariophyta (Diatomeae). *In* A. Pascher (ed.), Die Süsswasser-Flora Mitteleuropas. Heft 10. Gustav Fischer Verlag, Jena. 466 p.

HUSTEDT, F. 1937. Systematische und ökologische Untersuchungen über die Diatomeen-Flora von Java, Bali und Sumatra nach dem Material der Deutschen Limnologischen Sunda-Expedition. Systematischer Teil. Arch. Hydrobiol., Suppl. B., 15: 187-295.

HUSTEDT, F. 1957. Die Diatomeenflora des Flusssystems der Weser im Gebiet der Hansestadt Bremen. Abh. Naturwiss. Ver. Bremen 34: 181-440.

HUSTEDT, F. 1966. Die Kieselalgen Deutschlands, Österreichs und der Schweiz unter Berücksichtigung der übrigen Länder Europas sowie der angrenzenden Meersgebiete. *In* L. Rabenhorst, (ed.), Kryptogamen-Flora von Deutschland, Österreich und der Schweiz. Band 7, Teil 3, Lieferung 4. Akademische Verlagsgesellschaft Geest und Portig K.-G., Leipzig. p. 577-816.

KENNEDY, R.K. 1969. An analysis of tall-grass prairie vegetation relative to slope position, Sheeder Prairie, Iowa. M.S. thesis, Iowa State University, Ames.

KRASSKE, G. 1932. Beiträge zur Kenntnis der Diatomeenflora der Alpen. Hedwigia 72: 92-134.

KRASSKE, G. 1948. Diatomeen tropischer Moosrasen. Svensk Bot. Tidskr. 42: 404-443.

LOESCHER, J.E.H. 1972. Diatoms from a native Iowa prairie. Ph.D. diss., Iowa State University, Ames.

LUND, J.W.G. 1945. Observations on soil algae. I. The ecology, size and taxonomy of British diatoms. Part I. New Phytol. 44: 196-219.

LUND, J.W.G. 1946. Observations on soil algae. I. The ecology, size and taxonomy of British diatoms. Part II. New Phytol. 45: 56-110.

LUTY, E.T., and R.W. HOSHAW. 1967. Airborne algae of the Tucson and Santa Clara mountain areas. J. Ariz. Acad. Sci. 4: 179-182.

PATRICK, R., and C.W. REIMER. 1966. The diatoms of the United States. Vol. 1. Acad. Nat. Sci. Phil. Monogr. No. 13. 688 p.

PETERSEN, J.B. 1915. Studier over danske aërofile Alger. Kongl. Danske Vidensk. Selsk. Skr., 7 Raekke, Naturv. Math. Afd. 12: 269-360.

PETERSEN, J.B. 1928. The aërial algae of Iceland. Pages 325-447 *in* L.K. Rosenvinge and E. Warming (eds.), The botany of Iceland, Part II. J. Frimodt, Copenhagen.

PETERSEN, J.B. 1935. Studies on the biology and taxonomy of soil algae. Dansk Bot. Ark. 8: 1-180.

REIMER, C.W. 1970. Some diatoms (Bacillariophyceae) from Cayler Prairie. Beih. Nova Hedwigia 31: 235-249.

SCHLICHTING, H.E., JR. 1961. Viable species of algae and protozoa in the atmosphere. Lloydia 24: 81-88.

SCHLICHTING, H.E., JR. 1964. Meterological conditions affecting the dispersal of airborne algae and protozoa. Lloydia 27: 64-78.

STOERMER, E.F. 1962. Notes on Iowa diatoms. II. Species distribution in a subaerial habitat. Proc. Iowa Acad. Sci. 69: 87-96.

VANLANDINGHAM, S.L. 1966. Diatoms from dry lakes in Nye and Esmeralda counties, Nevada, U.S.A. Nova Hedwigia 11: 221-241.

ZANON, D.V. 1938. Diatomee della regione del Kivu (Congo Belga). Pontif. Acad. Sci. Comment. 2: 535-668.