

Original research paper

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Bacillariophyceae and Chlorophyta of the Zdzisławów peat-
bog at the village of Kwilno near the town of Piątek
(Łódź Province)

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Abstract

The Zdzisławów peat-bog is of a transitional character, and its water pH ranges from 4.8 to 6.4. A total of 148 algal taxa, including 67 Bacillariophyceae and 81 Chlorophyta, were identified. The highest number of taxa and specimens was recorded at a pH ranging from 6.0 to 6.4. The characteristic taxa of the peat-bog were *Anomoeoneis brachysira*, *A. vitrea*, *Eunotia incisa*, *E. muscicola*, *Fragilaria capucina* var. *austriaca*, *Navicula expecta*, *N. festiva*, *Nitzschia acidoclinata*, *N. perminuta*, *Pinnularia obscura*, *P. polyonca*, *Tabellaria quadrisepitata* and *T. ventricosa*. The Chlorophyta taxa were *Closterium lunula* var. *intermedium*, *Cosmarium humile* var. *glabrum*, *C. pseudoconnatum*, *Cosmoastrum orbiculare*, *Euastrum dubium*, *Micrasterias denticulata*, *Pleurotaenium ehrenbergii* var. *elongatum*, *Staurodesmus convergens* and *Teilingia excavata*.

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INTRODUCTION

The Zdzisławów peat-bog is located near the village of Kwilno in the Bzura River catchment, 10 km south of the town of Piątek, which is the geometric center of Poland. Peat was excavated there by the local community before and after World War II until the 1970s. At present, the peat-bog is slowly degrading due to the lowering of ground waters and land drainage as well as the expansion of low- and high-peat-bog vegetation. The peat-bog is surrounded by the Witowski Forest in which there are numerous dunes occurring up to an altitude of 128.8 m above sea level.

As a nature-landscape complex, the flora, fauna, and archeology (settlements originating 10,000 years ago were discovered) of the present study area has been well researched (Wolańska 2001).

The peat-bog is a transitional type, and its water pH ranges from 4.8 to 6.4.

The aim of the present study was to describe qualitatively and quantitatively diatoms and green algae. This included identifying dominant, constant, and characteristic taxa in this ecosystem in response to seasonal temperature and water pH variations.

MATERIALS AND METHODS

Samples were collected between March and December 2002 from the bottom of the peat-bog and by squeezing peat moss (*Sphagnum palustre* L.). Water temperature and pH were measured and recorded. The quantitative analysis of green algae was done with the quantitative estimation method (Starmach 1989), while diatoms were analyzed with the method described by Rakowska (2001).

Species that occurred in numbers exceeding 5% were considered dominant. Those that occurred in 81-100% of the samples were classified as constant, while those occurring in 61-80% were classified as frequent. Species that were noted only in the investigated peat-bog, but which are absent in other aquatic ecosystems, were considered to be characteristic species.

Green algae were identified using the following studies: Hirano (1972), Prescott Croasdale and Vinyard (1977), Hindák (1977, 1984, 1988, 1990), Růžička (1977), Palamar-Mordvinceva (1982), Komárek and Fott (1983), Croasdale and Flint (1986), Dillard (1990, 1991, 1993). Diatoms were identified using studies by Krammer and Lange-Bertalot (1986, 1988, 1991a, 1991b) and Lange-Bertalot (1994, 2001).

RESULTS

In nine benthic samples, 148 species of algae were identified, including 67 Bacillariophyceae and 81 Chlorophyta species (table 1). The highest number of taxa was recorded in May (pH=6.4) with 42 diatom and 46 green algae species. Diatoms were numerous as late as in December at a pH of 6.0 (54 taxa) and July at a pH of 6.0 (37 taxa), while green algae were most numerous in May (46 taxa) and November (45 taxa) at a pH of 6.0. It was determined that water pH ranging from 6.0 to 6.4 had the most favorable influence on the number of taxa and specimens.

Table 1

Number of taxa, pH, water temperature

pH	Month	Temperature	Bacillariophyceae	Chlorophyta
4.8	June	21.9	31	41
5.7	late September	18.0	27	40
6.0	mid September	17.8	26	33
6.0	October	10.5	29	40
6.0	November	11.5	36	45
6.0	July	21.7	37	38
6.0	December	8.0	54	34
6.4	late May	18.1	35	46
6.4	mid May	17.4	42	44

Table 2 presents 21 taxa of diatoms with high degrees of constancy of occurrence (class IV and V) and 11 diatom dominants (>5%) and 7 subdominants (2%-5%). Among the green algae, there were 13 species that belonged to constancy classes IV and V, while there were 6 dominants and 7 subdominants.

The following diatom taxa were considered characteristic for the peat-bog: *Anomoeoneis brachysira* (Brébisson) Grunow (pH=4.6), *A. vitrea* (Grunow) Ross (pH 4.8-6.4), *Eunotia incisa* Gregory (pH 4.8-6.4), *E. muscicola* Krasske (pH=6.4), *Fragilaria capucina* var. *austriaca* (Grunow) Lange-Bertalot (pH=6.4), *Navicula expecta* Van Landingham Kützing (pH=6.0), *N. festiva* Krasske (pH 4.8-6.4), *Nitzschia acidoclinata* Lange-Bertalot (pH 4.8-6.4), *N. perminuta* (Grunow) M. Peragallo (pH 4.8-6.4), *Pinnularia obscura* Krasske

(pH 4.8-6.4), *P. polyonca* (Brébisson) Müller (pH=6.0), *Tabellaria quadriseptata* Knudson (pH=6.0), *T. ventricosa* Kützing (pH 4.8-6.4).

Characteristic species of the Chlorophyta were: *Closterium lunula* var. *intermedium* Gutwiński (pH 4.8-6.4), *Cosmarium boeckii* Wille (pH 4.8-6.4), *C. humile* var. *glabrum* Gutwiński (pH=6.4), *C. pseudoconnatum* Nordstedt (pH 4.8-6.4), *Cosmoastrum orbiculare* (Ralfs) Palamar-Mordvinceva (pH 4.8-6.4), *Euastrum didelta* (Turpin) Ralfs (pH 4.8-6.4), *E. dubium* Nägeli (pH 4.8-6.4), *Micrasterias rotata* (Grev) Ralfs (pH=6), *Stauroidesmus convergens* (Ehrenberg) Teiling (pH 4.8-6.4), *Teilingia excavata* (Ralfs) Bourrelli (pH=4.8).

The following diatoms were rare for Poland: *Anomoeoneis brachysira*, *Eunotia incisa*, *E. muscicola*, *Navicula expecta*, *N. festiva*, *Nitzschia perminuta*, *Pinnularia obscura*, *P. polyonca*, *Tabellaria quadriseptata*, and *T. ventricosa*. The rare Chlorophyta included: *Dichotomococcus curvatus* Koršikov, *Raphidiastrum avicula* (Brébisson) Palamar-Mordvinceva, *Spondylosium planum* (Wolle) W. et G.S.West, *Stauroidesmus convergens* (Ehrenberg) Teiling, *Teilingia excavata* (Ralfs) Bourrelli, *Xanthidium smithii* var. *octocorne* (Ehrenberg) Palamar-Mordvinceva.

Table 2

List of constant, dominant, and subdominant taxa. Constancy class IV – 6-7 samples, constancy class V – 8-10 samples. Dominants were those that occurred >5%, subdominants - 2-5%

Bacillariophyceae			Chlorophyta		
Taxa	Con.	Dom.	Taxa	Con.	Dom.
<i>Achnanthes linearis</i> (W.Smith) Grunow	V	d	<i>Ankistrodesmus falcatus</i> (Corda) Ralfs	V	d
<i>A. minutissima</i> Kützing	V	d	<i>Closterium dtanae</i> Ehrenberg ex Ralfs	V	sd
<i>Anomoeoneis vitrea</i> (Grunow) Ross	V	d	<i>Cl. gracile</i> Brébisson ex Ralfs	V	sd
<i>Eunotia arcus</i> Ehrenberg	V	d	<i>Cosmarium humile</i> (Gay) Nordstedt	V	d
<i>E. bilunaris</i> (Ehrenberg) Mills	V	d	<i>C. pseudoconnatum</i> Nordstedt	V	sd
<i>E. exigua</i> (Brébisson) Rabenhorst	V	d	<i>Euastrum denticulatum</i> (Kirchner) Gay	IV	sd
<i>E. implicata</i> Nörpel	V	d	<i>E. oblongum</i> Ralfs	IV	sd
<i>Fragilaria elliptica</i> Schumann	IV	sd	<i>Pediastrum angulosum</i> (Ehrenberg) ex Meneghini	V	d
<i>Gomphonema acuminatum</i> Ehrenberg	V	-	<i>Scenedesmus communis</i> Hegewald	V	d
<i>G. gracile</i> Ehrenberg	V	sd	<i>S. aculeolatus</i> Reinsch	V	d
<i>Navicula pupula</i> Kützing	V	sd	<i>Spondylosium planum</i> (Wolle) W. et G. S. West	IV	sd
<i>Nitzschia acidoclinata</i> Lange-Bertalot	V	-	<i>Staurastrum paradoxum</i> Meyen	V	d
<i>N. palea</i> (Kützing) W. Smith	V	sd	<i>Stauroidesmus convergens</i> (Ehrenberg) Teiling	V	sd
<i>N. perminuta</i> (Grunow) M. Peragallo	V	d			
<i>Pinnularia borealis</i> Ehrenberg	IV	sd			
<i>P. interrupta</i> W. Smith	IV	-			
<i>P. microstauron</i> (Ehrenberg) Cleve	V	sd			
<i>P. subcapitata</i> Gregroy	V	d			
<i>P. viridis</i> (Nitzsch) Ehrenberg	V	sd			
<i>Tabellaria flocculosa</i> (Roth) Kützing	V	d			
<i>T. ventricosa</i> Kützing	V	d			

The constant and dominant species that occurred in the study area together with vascular plants allowed the present authors to classify the Zdzisławów peat-bog as transitional.

Threats to which peat-bogs are exposed encourage further investigations of these ecosystems and the search for methods to protect and conserve them.

REFERENCES

- Croasdale H., Flint E.A., 1986, *Flora of New Zealand. Freshwater algae, Chlorophyta, Desmids with ecological comments on their habitats*. 1. V. R. Ward, Government Printer, Wellington, New Zealand, pp. 133
- Dillard G.E., 1990, *Freshwater algae of the Southeastern United States, Part 3. Chlorophyceae: Zygnematales; Zygnemataceae, Mesotaeniaceae and Desmidiaceae* (Section 1). Bibliotheca Phycologica. 85. Berlin, Stuttgart, pp. 177
- Dillard G.E., 1991, *Freshwater algae of the Southeastern United States, Part 4. Chlorophyceae: Zygnematales; Zygnemataceae, Mesotaeniaceae and Desmidiaceae* (Section 2). Bibliotheca Phycologica. 89. Berlin, Stuttgart, pp. 205
- Dillard G.E., 1993, *Freshwater algae of the Southeastern United States, Part 6. Chlorophyceae: Zygnematales; Zygnemataceae, Mesotaeniaceae and Desmidiaceae* (Section 4). Bibliotheca Phycologica. 93. Berlin, Stuttgart, pp. 166
- Hindák F., 1977, *Studies on the Chlorococcal Algae (Chlorophyceae)* I. Biol. Práce. 23(4):1-190
- Hindák F., 1984, *Studies on the Chlorococcal Algae (Chlorophyceae)* III. Biol. Práce. 30(1):1-194
- Hindák F., 1988, *Studies on the Chlorococcal Algae (Chlorophyceae)* IV. Biol. Práce. 34(1-2): 1-263
- Hindák F., 1988, *Studies on the Chlorococcal Algae (Chlorophyceae)* V. Biol. Práce. 36: 1-225
- Komárek J., Fott B., 1983, *Das phytoplankton des Süßwassers. Systematik und Biologie. Chlorophyceae (Grünalgen) Ordnung: Chlorococcales [Phytoplankton of Freshwaters. Systematics and Biology. Chlorophyceae (Green-algae) Order: Chlorococcales.]*, [in:] *Die Binnengewässer. 16 (7/1), [Inland waters. 16 (7/1)]*, Huber-Pestalozzi, G. (ed.), E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, pp. 114 (in German)
- Krammer K., Lange-Bertalot H., 1986, *Bacillariophyceae 1. Naviculaceae*. [in:] Ettl, H., Gerloff, J., Heyning, H., Mollenhauer, D. (eds) *Süßwasserflora von Mitteleuropa 2/1*. G. Fischer Verlag. Jena, pp. 876
- Krammer K., Lange-Bertalot H., 1988, *Bacillariophyceae 2. Bacillariaceae, Epithemiaceae, Surirellaceae*. [in:] Ettl, H., Gerloff, J., Heyning, H., Mollenhauer, D. (eds) *Süßwasserflora von Mitteleuropa 2/3*. G. Fischer Verlag. Jena, pp. 600
- Krammer K., Lange-Bertalot H., 1991a, *Bacillariophyceae 3. Centrales, Fragilariaceae, Eunotiaceae*. [in:] Ettl, H., Gerloff, J., Heynig, H., Mollenhauer, D. (eds) *Süßwasserflora von Mitteleuropa 2/3*. G. Fischer Verlag. Stuttgart, Jena, pp. 600
- Krammer K., Lange-Bertalot H., 1991b, *Bacillariophyceae 4. Achnanthaceae. Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema*. [in:] *Süßwasserflora von Mitteleuropa*. Ettl, H., Gartner, G., Gerloff, J., Heyning, H., Mollenhauer, D. (eds) 2/4. G. Fischer Verlag. Stuttgart, Jena, pp. 437
- Lange-Bertalot H., 1994, *Benthische Diatomeen – Gesellschaften in Zuge veränderter Wasserqualitäten im Rhein zwischen Ludwigshafen und Lorch von 1974 bis 1993*. Diplomarbeit, Fachbereich Biologie der J. W. Goethe – Universität Frankfurt am Main, pp. 157

- Lange-Bertalot H., 2001, *Navicula sensu stricto, 10 Genera Separated from Navicula sensu lato, Frustulia*. [in:] Lange-Bertalot H. (ed.) *Diatoms of Europe*. A.R.G. Ganther Verlag K.G., pp. 526
- Palamar-Mordvinceva G.M., 1982, *Zelenye vodorosli klass konjugaty. Porjadok desmidevye. (Green algae. Class Conjugatophyceae. Order Desmidiiales)*. [in:] *Opredelitel presnovodnykh vodoroslej SSSR*. 11(2). Izdatelstvo Nauka, Leningrad, pp. 620
- Prescott G.W., Croasdale H., Vinyard W.C., 1977, *A synopsis of North American desmids. Part II. Desmidiaceae, Placodermatae*. Section 3. Lincoln, Nebraska, pp. 385
- Růžička J., 1977, *Die Desmidiaceen Mitteleuropas*. 1(1). E. Schweiz Verlag, Stuttgart, pp. 292 (in German)
- Rakowska B., 2001, *Studium różnorodności okrzemek ekosystemów wodnych Polski niżowej [Study of diatom diversity in aquatic ecosystems of Polish lowlands]*. Wydawnictwo Uniwersytetu Łódzkiego. Łódź, pp. 77 (in Polish)
- Starmach K., 1989, *Plankton roślinny wód słodkich [Freshwater phytoplankton]*. PWN Warszawa-Kraków, pp. 496 (in Polish)
- Wolańska A., 2001, *Funkcjonowanie zespołów przyrodniczo-krajobrazowych – nowej formy ochrony przyrody w Polsce [Functioning of nature-landscape complexes – a new form of nature protection in Poland]*. Manuscript (in Polish)