Algal flora of subalpine peat bog pools in the Krkonoše Mts

Řasy tůní krkonošských subalpínských rašelinišť

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During a two-year investigation of the Úpské rašeliniště peat bog and the Pančavské rašeliniště peat bog in the Krkonoše Mts (Czech Republic) about 228 taxa of cyanobacteria and algae were found. The diatoms were the dominant group in most of the investigated samples. The relationship between algal flora and the environmental characteristics of the pools was studied. The pH, shading and type of bed were most important factors influencing algal communities in the pools.

K e y w o r d s : algae, peat bog, Krkonoše Mts, ecology

Introduction

The first phycological records from the Krkonoše Mts were published by Zacharias and his associates (Zacharias 1896, 1898, Lemmermann 1896, Müller 1898, Schröder 1898) but only Lemmermann studied algae in the peat bogs. Also Beck-Managetta (1927, 1929) and Pochmann (1940) collected algae from various sites in the Krkonoše Mts, including peat bogs. Kalina (1969a, 1969b, 1970) described new taxa, i.e. *Gloeochrysis montana* Kalina, *Mallomonas corcontica* (Kalina) Péterfi, *Exanthemachrysis* (*Corcontochrysis*) *noctivaga* (Kalina) Gayral, from the "Úpské rašeliniště" peat bog. Recently a research project devoted to the silica-scaled chrysophytes of the Czech Republic has been carried out (Němcová et al. 2001). In contrast to sporadic research on the Czech side of the border in the last fifty years, Matula (1980a, 1980b, 1995 etc.) was intensively concerned about the taxonomy and ecology of algae in the Polish Karkonosze Mts.

Localities

The studied peat bogs occur at two summit plateaus above the timberline, which are important spring areas (the Elbe, Pančava, Úpa, and White Elbe rivers). The Pančavské rašeliniště peat bog (50°45'55"N, 15°32'30"E) lies at an average altitude of 1335 m and occupies an area of 26 ha. The Úpské rašeliniště peat bog (50°44'10"N, 15°42'40"E) extends on both sides of the Czech-Polish border at an average altitude of 1425 m and its area is about 10 ha.

Both these raised bogs differ from mires occurring in other Central European mountains and according to phytosociology and microtopography, they resemble bogs in the Alps and Scandinavian peatlands (Rudolph et al. 1928, Jeník & Soukupová 1992). There are two soil types in the area: loamy soils of a humic podzol type and shallow peat soils

(Mejstřík & Straka 1964). The vegetation consists of oligotrophic communities belonging to the *Oxycocco-Sphagnetea*, and of minerotrofic fen communities of the class *Scheuchzerio-Caricetea fuscae* (Jeník & Soukupová 1992).

Fourteen pools at the Pančavské rašeliniště and seven pools at the Úpské rašeliniště were selected for examination. In trying to record the total range of variation of the peat bog waterbodies, more than just characteristic peaty pools were studied. The deeper pools in the peat bog area, whose beds reach the loamy soil because of a very thin peat layer, and pools in streams were examined too.

Material and methods

Samples of water were taken in 4–6-week intervals from May 1998 to October 1999. Submerged mosses and other plants and surface sediments of the pools were also collected to obtain metaphytic and benthic algae. At the same time the water temperature, pH and conductivity were measured by the conductivity/pH meter Gryf 107.

Most of the taxa were identified directly from fresh samples, although some species must have been cultivated. The diatoms and silica-scaled chrysophytes were examined after preparation according to Kramer & Lange-Bertalot (1986). A light microscope was used to determine the majority of the taxa; the scale-bearing chrysophytes were determined by the transmission electron microscope Philips 300.

The presence of species in samples and the environmental data (Table 1) were analysed by multivariate statistical methods using the programme CANOCO (ter Braak & Šmilauer 1998).

Table 1. – Characteristics of the pools studied. Locality: PR – Pančavské rašeliniště, UR – Úpské rašeliniště; Shading: 0 – no shade, 1 – partly shaded, 2 – intensive shade; Flow: 0 – lentic biotope, 1 – lotic biotope, bed: 0 – peaty, 1 – loamy. Note: $^{+}$ very changeable, $^{++}$ impossible to measure maximum depth

Sampl. site	Locality	Area (m^2)	Relative depth (%)	Shadowing	Flow	Bed	pH	Conductivity ($\mu S \cdot cm^{-1}$)
1	PR	3.5	2.37	1	0	0	3.9–4.5	12–41
2	PR	0.8	6.93	2	0	0	4–4.3	27–38
3	PR	0.1	19.61	2	0	0	3.8–4	35–52
4	PR	0.8	6.93	2	0	0	3.8–4.3	31–51
5	PR	2.5	33.62	0	0	0	4.4–5.4	20–32
6	PR	1.5	14.47	1	0	0	5–5.3	20–27
7	PR	1.8	13.21	0	0	0	4.4–5.7	25–29
8	PR	450	> 2.4^{++}	0	0	0	3.6–5.4	7–31
9	PR	0.5	18.79	0	1	1	3.4–5.5	13–55
10	PR	6.5	13.9	0	0	1	3.5–4.2	30–57
11	PR	2	6.26	0	0	0	3.7–4.6	18–69
12	PR	5	1.19	0	1	0	4.1–5.2	15–24
13	PR	4	3.54	0	0	0	3.7–4.5	21–34
14	PR	3	40.92	0	1	1	4.1–5.6	21–29
15	UR	55	1.79	0	1	1	4.4–6.4	21–45
16	UR	2.5	> 28^{++}	0	0	1	5.2–6.2	14–37
17	UR	4	6.65	1	0	0	3.9–4.6	24–42
18	UR	17	1.07	0	0	0	3.8–4.6	19–91
19	UR	± 200^{+}	± 1.3	0	0	0	5.8–6.8	15–116
20	UR	1100	> 1.4^{++}	0	0	0	3.8–4.8	7–38
21	UR	30	> 4.9^{++}	0	0	0	3.9–4.6	11–42

Results

Two hundred and twenty eight species of cyanobacteria and algae were found (Table 2). The most frequent group of algae were diatoms (*Bacillariophyceae*, 68 species); desmids (*Conjugatophyceae*, 51 species) were the second most dominant group. *Pinnularia viridis, Frustulia rhomboides, Pinnularia subcapitata,* members of the genus *Eunotia*, *Chroococcus turgidus* and *Cylindrocystis brebissonii* belonged to the most frequently found species.

Table 2. – Distribution of species in the pools studied. Occurrence in sampling sites (expressed as the number of samples in which the species occurred), total occurrence and percentage of all samples in which the species appeared are presented. The system of classes follows van den Hoek et al. (1995). See Table 1 for characteristics of sampling sites. The species codes correspond to Fig. 3.

Sampling site (number of samples taken)	Code	1 (7)	2 (6)	3 (5)	4 (5)	5 (7)	6 (7)	7 (6)	8 (9)	9 (7)	10 (7)	11 (9)	12 (9)	13 (8)	14 (8)	15 (11)	16 (10)	17 (10)	18 (9)	19 (10)	20 (11)	21 (11)	Total (172)	Total (%)
Cyanophyceae:																								
Anabaena inaequalis (Kütz.) Bornet et Flahault	ANBINQ	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9	3	–	–	8	–	–	20	11.6
Aphanocapsa hyalina (Lyngbye) Hansg.	APCHYA	2	1	–	1	4	–	–	2	–	4	6	2	6	–	–	2	5	5	4	5	6	55	32.0
Aphanothece microscopica Näg.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	1	–	–	3	–	–	10	5.8
Aphanothece sp.		–	–	–	–	–	–	–	1	–	–	–	2	4	–	–	–	–	–	–	–	–	7	4.1
Chroococcus turgidus (Kütz.) Näg.	CHRTUR	7	–	–	1	7	6	3	7	3	2	9	9	8	4	2	1	10	9	4	10	11	113	65.7
Cyanothece cf. *aeruginosa* (Näg.) Komárek		–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	0.6
Geitlerinema cf. *amphibium* (Ag. ex Gom.) Anagn.		–	–	–	–	–	–	–	4	–	–	–	5	5	2	5	2	–	–	5	3	1	32	18.6
Geitlerinema splendidum (Grev. ex Gom.) Anagn.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	6	3.5
Gloeocapsa sp.		2	–	–	–	–	–	–	–	1	–	5	4	4	2	–	1	1	6	3	1	2	32	18.6
Merismopedia glauca (Ehrenb.) Kütz.		–	–	–	–	–	–	–	4	–	–	–	1	1	–	6	–	10	6	5	4	4	41	23.8
Phormidium cf. *animale* (Ag. ex Gom.) Anagn.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3	1.7
Phormidium formosum (Bory ex Gom.) Anagn.		–	–	–	–	–	–	–	–	–	–	–	7	2	–	–	–	–	–	2	–	–	11	6.4
Phormidium tergestinum (Kütz. ex Gom.) Anagn.	PHOTER	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	9	–	–	10	5.8
Pseudanabaena cf. *catenata* Lauterborn	PSACAT	–	–	–	–	–	–	3	–	–	–	–	–	–	–	1	–	–	–	3	–	2	9	5.2
Snowella sp.	SNOWSP	1	–	–	–	–	–	–	–	–	4	–	–	–	–	3	–	–	–	2	–	1	11	6.4
Rhodophyceae:																								
Batrachospermum sp.		–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Dinophyceae:																								
Peridinium umbonatum Stein	PERUMB	1	–	–	–	1	–	–	1	–	–	4	3	1	–	–	1	2	1	3	3	3	24	14.0
cysts		2	–	–	–	1	–	–	–	–	1	2	–	1	–	–	–	1	2	3	4	4	21	12.2
Cryptophyceae:																								
Chilomonas oblonga Pascher	CHIOBL	3	1	1	–	2	–	–	2	–	1	2	6	7	–	–	–	2	7	–	4	6	44	25.6
Cryptomonas cylindrica Ehrenb.	CRYCYL	1	2	–	3	–	–	3	–	1	1	2	1	2	1	–	–	–	2	–	1	–	20	11.6
Cryptomonas reflexa Skuja		–	–	–	–	–	–	3	–	2	–	–	–	–	3	2	1	5	–	1	–	2	19	11.0
Cryptomonas obovata Skuja	CRYOBO	1	1	–	1	–	–	–	5	6	4	1	1	3	1	–	–	5	4	–	3	5	41	23.8
Cryptomonas phaseolus Skuja		–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	0.6
Cryptomonas pyrenoidifera Geitler		–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	1	–	1	–	–	4	2.3
Cryptomonas sp. 1	CRYSP1	1	–	2	–	1	–	–	–	3	–	1	–	1	–	–	–	1	–	–	1	1	12	7.0
Cryptomonas spp.		2	3	1	2	4	4	3	1	–	4	3	3	4	5	3	1	3	3	2	7	6	64	37.2
Chrysophyceae:																								
Chrysocapsa sp.		–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	3	1.7
Chrysococcus triporus Matv.	CRSTRI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	2	–	–	6	3	–	14	8.1
Dinobryon divergens Imhof	DINDIV	–	–	–	–	2	–	–	8	3	–	6	–	3	1	–	–	2	8	–	7	–	40	23.3
Mallomonas calceolus Bradley		–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	1.2
Mallomonas crassisquama (Asmund) Fott		–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Mallomonas flora Harris et Bradley		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	0.6
Mallomonas papillosa Harris et Bradley		–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Mallomonas pillula Harris		–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	2	1.2
Mallomonas spp.		–	–	–	–	3	1	2	–	–	–	2	4	4	2	3	1	–	3	–	2	–	27	15.7
Ochromonas sp.		1	–	–	–	1	–	–	–	1	2	–	1	1	3	3	5	2	–	1	–	–	21	12.2
Paraphysomonas vestita (Stokes) De Saedeleer		–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Synura echinulata Korshikov		–	–	–	–	–	2	1	–	–	–	–	2	–	–	3	–	–	2	–	–	–	10	5.8
Synura petersenii Korshikov		–	–	–	–	–	1	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	4	2.3
Synura sphagnicola Korshikov		–	–	–	–	–	–	–	–	–	–	1	–	–	2	–	–	–	–	–	–	–	3	1.7
Synura spp.		–	–	–	–	3	1	2	–	–	–	4	1	2	–	2	1	–	1	–	–	–	17	9.9
Bacillariophyceae:																								
Achnanthes cf. *lanceolata* (Bréb.) Grunov	ACHLAN	–	–	–	–	–	–	–	–	1	1	–	–	–	–	5	2	–	–	–	–	1	10	5.8
Achnanthes minutissima Kütz.		–	–	–	–	1	4	4	–	3	1	3	2	4	6	9	3	1	–	4	–	2	47	27.3

Sampling site (number of samples taken)	Code	1 (7)	2 (6)	3 (5)	4 (5)	5 (7)	6 (7)	7 (6)	8 (9)	9 (7)	10 (7)	11 (9)	12 (9)	13 (8)	14 (8)	15 (11)	16 (10)	17 (10)	18 (9)	19 (10)	20 (11)	21 (11)	Total (172)	Total (%)
Achnanthes scotica Flower	ACHSCO	–	–	–	–	–	–	7	–	1	–	–	1	–	5	7	5	–	1	2	–	–	29	16.9
Amphora sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	2	1.2
Anomoeoneis brachysira (Bréb.) Grunov	ANOBRA	–	–	–	–	6	7	–	–	1	–	2	9	5	4	–	–	–	3	–	–	–	37	21.5
Anomoeoneis serians (Bréb.) Cleve	ANOSER	1	–	–	–	–	–	–	–	1	2	–	8	1	3	2	1	–	1	1	–	1	22	12.8
Aulacoseira ambigua (Grunov) Simonsen		2	–	–	–	–	–	–	–	–	–	–	2	1	–	–	–	–	1	1	–	1	8	4.7
Aulacoseira distans (Ehrenb.) Simonsen	AULDIS	–	–	–	–	3	6	2	–	–	1	–	1	3	6	10	9	1	3	1	1	1	48	27.9
Aulacoseira pfaffiana (Reinsch) Krammer		–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	0.6
Caloneis bacillum (Grunov) Cleve		–	–	–	–	–	–	–	–	1	6	–	–	–	–	–	–	–	–	–	–	–	7	4.1
Caloneis silicula (Ehrenb.) Cleve	CALSIL	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	4	–	–	–	–	–	14	8.1
Caloneis sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	2	1.2
Cocconeis placentula Ehrenb.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	1	–	–	–	5	2.9
Cyclotella cf. *radiosa* (Grunov) Lemmerm.		–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	2	1	–	1	1	7	4.1
Cymatopleura sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
Cymbella amphicephala Näg.	CMBAMP	–	–	–	–	–	–	–	–	–	–	1	1	–	–	11	10	–	2	10	–	1	36	20.9
Cymbella gracilis (Ehrenb.) Kütz.	CMBGRA	–	–	–	–	–	4	4	–	–	1	–	–	1	2	10	9	–	–	3	–	–	34	19.8
Cymbella hebridica (Grunov) Cleve	CMBHEB	–	–	–	–	–	7	1	–	–	–	–	–	–	8	3	1	–	–	–	–	–	20	11.6
Cymbella minuta Hilse	CMBMIN	–	–	–	–	–	–	4	–	–	–	1	1	2	–	11	10	1	2	9	–	2	43	25.0
Diatoma mesodon (Ehrenb.) Kütz.	DIAMES	1	–	–	–	–	–	6	–	–	1	1	1	–	–	8	9	–	1	1	–	–	29	16.9
Diploneis elliptica (Kütz.) Cleve	DIPELI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	3	–	–	2	–	–	12	7.0
Diploneis puella (Schumann) Cleve		1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Epithemia sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	2	–	–	4	2.3
Eunotia arcus Ehrenb.		–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	–	1	–	–	7	4.1
Eunotia bilunaris (Ehrenb.) Mills	EUNBIL	3	–	–	–	7	7	4	5	4	1	3	9	8	8	11	10	–	5	9	2	6	102	59.3
Eunotia exiqua s.l. (Ehrenb.) Rabenh.	EUNEXI	5	3	4	4	6	6	3	3	2	7	7	8	8	5	2	1	8	8	3	11	9	113	65.7
Eunotia glacialis Meister		1	–	–	–	7	7	4	–	2	5	–	9	8	4	4	2	2	1	–	–	1	57	33.1
Eunotia lapponica Grunov		2	–	–	–	2	–	–	–	–	–	3	9	5	7	2	1	9	8	2	–	2	52	30.2
Eunotia meisteri Hust.		–	–	–	–	–	–	–	–	1	–	–	–	–	2	7	1	–	–	–	–	–	11	6.4
Eunotia nymanniana Grunov		–	–	–	–	–	3	–	–	–	–	–	8	8	8	3	2	–	–	1	3	1	37	21.5
Eunotia praerupta Ehrenb.		–	–	–	–	–	–	6	–	1	3	–	2	2	4	1	1	–	1	1	–	–	22	12.8
Eunotia rhomboidea Hust.	EUNRHO	–	–	–	–	7	7	3	–	–	1	3	8	5	5	–	6	–	4	1	–	–	50	29.1
Eunotia soleirolli (Kütz.) Rabenh.	EUNSOL	–	–	–	–	2	6	6	–	1	2	1	1	2	2	11	10	4	1	1	–	5	55	32.0
Eunotia tenella (Grunov) Hust.	EUNTEN	6	–	–	–	7	7	6	1	5	5	7	9	8	8	11	10	7	6	3	3	8	117	68.0
Eunotia spp.		2	–	–	–	–	–	–	–	2	2	2	2	–	2	–	–	–	–	2	–	–	14	8.1
Fragilaria constricta Ehrenb.		–	–	–	–	1	2	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	4	2.3
Fragilaria virescens Ralfs	FRGVIR	4	–	–	–	2	7	6	2	1	1	4	2	1	7	11	10	–	2	1	2	1	64	37.2
Fragilaria sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	2	1.2
Frustulia rhomboides (Ehrenb.) De Toni	FRURHO	7	2	1	2	7	7	4	5	6	7	9	9	8	8	10	9	10	9	8	11	11	150	87.2
Gomphonema gracile Ehrenb.		–	–	–	–	–	–	4	–	–	2	–	–	–	–	–	–	–	–	–	–	–	6	3.5
Gomphonema parvulum Kütz. (Kütz.)	GOMPAR	1	–	–	–	–	–	6	–	–	2	2	2	7	1	11	10	1	3	9	2	3	60	34.9
Gyrosigma acuminatum (Kütz.) Rabenh.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
Hantzschia amphioxys (Ehrenb.) Grunov	HANAMP	1	–	–	–	–	–	–	1	–	1	–	3	4	–	3	4	3	3	4	1	4	32	18.6
Meridion circulare (Grev.) Ag.	MRDCIR	–	–	–	–	–	–	2	–	–	–	–	–	–	–	11	10	–	1	1	–	–	25	14.5
Navicula heimansii Van Dam et Kooyman	NAVHEI	–	–	–	–	–	–	1	–	1	–	–	–	–	–	9	9	–	2	10	–	–	32	18.6
Navicula pupula Kütz.	NAVPUP	–	–	–	–	–	–	–	–	–	–	1	–	–	5	11	9	1	1	3	–	–	31	18.0
Navicula radiosa Kütz.	NAVRAD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11	9	–	–	3	–	–	23	13.4
Navicula sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	1	–	–	–	–	–	6	3.5
Neidium affine (Ehrenb.) Pfitz.	NEIAFF	–	–	–	–	–	1	6	–	1	1	1	1	–	5	6	–	–	1	4	–	1	28	16.3
Neidium bisulcatum (Lagerst.) Cleve	NEIBIS	–	–	–	–	–	–	1	–	–	1	–	–	4	–	7	2	–	1	5	–	1	22	12.8
Neidium hercynicum A. Mayer		–	–	–	–	–	–	3	–	–	6	–	2	7	8	7	4	–	–	4	1	–	42	24.4
Neidium iridis (Ehrenb.) Cleve		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	1	–	–	4	2.3
Nitzschia recta Hantzsch		–	–	–	–	–	–	–	–	–	2	–	2	–	1	–	–	–	–	–	–	1	6	3.5
Nitzschia palea (Kütz.) W. Smith	NITPAL	1	–	–	–	1	2	6	–	–	–	–	4	1	–	11	9	–	4	10	1	1	51	29.7
Pinnularia borealis Ehrenb.		–	–	–	–	–	–	–	–	–	–	3	1	2	–	4	3	3	4	6	–	1	27	15.7
Pinnularia divergens W. Smith		–	–	–	–	–	1	5	–	–	2	1	–	–	–	–	–	–	–	–	–	–	9	5.2
Pinnularia interupta W. Smith	PININT	–	–	–	–	–	–	–	–	–	–	–	–	–	1	11	10	–	3	10	–	–	35	20.3
Pinnularia lata (Bréb.) W. Smith		–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Pinnularia microstauron (Ehrenb.) Cleve	PINMIC	1	–	–	–	7	7	6	–	–	–	3	9	7	6	11	10	2	6	9	–	2	86	50.0
Pinnularia subcapitata Greg.	PINSUB	5	4	5	4	4	7	6	1	7	7	3	9	7	8	11	10	4	8	8	–	2	120	69.8
Pinnularia viridis (Nitzsch) Ehrenb.	PINVIR	7	3	5	1	7	7	6	3	7	7	9	8	8	8	11	10	10	9	10	9	11	156	90.7
Stauroneis anceps Ehrenb.	STNANC	–	–	–	–	–	6	6	–	–	–	–	–	–	2	6	4	–	3	10	–	2	39	22.7
Stauroneis phoenicenteron (Nitzsch) Ehrenb.	STNPHO	2	–	–	–	1	5	6	–	–	–	–	1	–	3	11	9	–	1	9	–	–	48	27.9
Stauroneis smithii Grunov	STNSMI	–	–	–	–	–	–	–	–	–	–	–	–	–	1	7	–	–	–	2	–	–	10	5.8
Stephanodiscus cf. *alpinus* Hust.		–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	2	1.2
Surirella angusta Kütz.	SURANG	–	–	–	–	–	–	–	–	–	–	–	–	1	2	11	5	–	1	8	–	–	28	16.3
Surirella biseriata Bréb.		–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	4	2.3
Surirella minuta Bréb.	SURMIN	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	3	–	–	3	–	–	11	6.4
Tabellaria flocculosa (Roth) Kütz.		7	1	–	–	7	6	5	1	1	3	7	9	6	8	8	8	1	6	8	2	4	98	57.0
Xanthophyceae:																								
Characiopsis obtusa Ettl	CHAOBT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	8	–	–	6	–	–	15	8.7
Characiopsis sphagnicola Pascher		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
Characiopsis spp.		–	–	–	–	–	–	–	–	–	–	–	1	–	–	2	–	–	–	–	–	–	3	1.7

Sampling site (number of samples taken)	Code	1 (7)	2 (6)	3 (5)	4 (5)	5 (7)	6 (7)	7 (6)	8 (9)	9 (7)	10 (7)	11 (9)	12 (9)	13 (8)	14 (8)	15 (11)	16 (10)	17 (10)	18 (9)	19 (10)	20 (11)	21 (11)	Total (172)	Total (%)
Ophiocytium capitatum Wolle	OPHCAP	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	8	–	–	2	–	–	11	6.4
Ophiocytium cochlaere (Eichwald) A. Braun		–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2	–	–	4	–	–	8	4.7
Ophiocytium lagerheimii Lemmerm.	OPHLAG	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	1	–	–	9	2	–	15	8.7
Ophiocytium parvulum (Perty) A. Braun	OPHPAR	–	–	–	–	–	–	5	–	1	–	2	–	–	–	8	10	–	–	3	–	–	29	16.9
Tribonema regulare Pascher		–	–	–	–	–	–	2	–	–	–	–	–	–	–	3	1	–	–	4	–	–	10	5.8
Tribonema spirotaenia Ettl	TRISPI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	–	–	9	–	–	14	8.1
Tribonema subtilissimum Pascher		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	5	–	–	7	4.1
Tribonema spp.		–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	1	–	–	–	–	–	4	2.3
Haptophyceae:																								
Pseudodendromonas vlkii (Vlk) Bourr.		–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	–	1	–	3	1.7
Euglenophyceae:																								
Anisonema spp.		–	–	–	1	–	1	1	–	–	–	–	–	–	–	3	–	–	–	3	1	2	12	7.0
Astasia curvata Klebs	ASTCUR	3	–	–	–	2	2	4	–	–	–	–	2	1	–	2	1	–	–	7	–	1	25	14.5
Astasia spp.		4	–	–	–	–	1	2	–	1	–	–	–	–	–	1	2	1	2	5	1	1	21	12.2
Euglena adhaerens Matv.	EUGADH	4	–	–	–	–	–	–	3	–	4	6	2	2	–	7	–	5	4	3	–	2	42	24.4
Euglena mutabilis Schmitz	EUGMUT	3	–	1	–	–	–	1	2	3	5	4	2	4	4	–	–	1	3	–	3	5	41	23.8
Euglena limnophila Lemmerm.	EUGLIM	4	6	5	4	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20	11.6
Euglena spirogyra Ehrenb.	EUGSPI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	5	–	–	2	–	–	13	7.6
Euglena spp.		–	–	–	–	–	–	–	–	3	–	–	1	1	–	2	–	–	1	5	–	–	13	7.6
Heteronema acus (Ehrenb.) Stein	HETACU	3	3	3	3	1	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	15	8.7
Menoidium pellucidum Perty		–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	5	2.9
Petallomonas mediocanellata Stein	PETMED	–	–	–	–	–	1	–	–	–	–	–	3	–	–	5	–	–	2	8	–	–	19	11.0
Petallomonas steinii Klebs		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	2	1.2
Phacus curvicauda Svirenko	PHACUR	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	8	–	–	3	–	–	13	7.6
Phacus pyrum Ehrenb.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	3	1.7
Rhabdomonas costata (Korshikov) Pringsh.	RHACOS	2	5	5	5	2	2	2	–	1	2	–	–	1	–	–	–	1	2	–	–	2	32	18.6
Rhabdomonas incurva Fres.		–	–	–	–	–	–	1	–	–	–	–	2	–	–	3	–	–	–	3	–	–	9	5.2
Trachelomonas hispida (Perty) Stein em. Deflandre	TRAHIS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	1	1	–	4	–	–	13	7.6
Trachelomonas oblonga Lemmerm.	TRAOBL	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9	6	–	–	9	2	–	26	15.1
Trachelomonas volvocinopsis Svirenko	TRAVOL	–	1	–	–	4	1	4	–	–	–	–	7	3	–	7	4	–	1	2	3	3	40	23.3
Trachelomonas spp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	2	1.2
Tropidoscyphus octocostatus Stein		1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	1	1	–	5	2.9
Prasinophyceae:																								
Monomastix opistostigma Scherffel		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	1.2
cf. *Pedinomonas minutissima* Skuja		2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	5	2.9
Scourfieldia cordiformis Takeda		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
Chlorophyceae:																								
Ankistrodesmus fusiformis Corda	ANKFUS	–	–	–	–	–	–	5	–	–	–	–	–	–	–	1	3	–	–	10	–	–	19	11.0
Binuclearia tectorum (Kütz.) Beger in Wichmann	BINTEC	5	–	–	1	6	1	1	7	2	1	2	–	1	–	–	1	8	3	–	9	10	58	33.7
Botryosphaerella sudetica (Lemmerm.) Silva		–	–	–	–	–	–	–	–	–	–	2	–	7	–	–	–	2	–	–	–	–	11	6.4
Bulbochaete sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	5	2.9
Carteria spp.		–	–	–	–	–	–	–	–	2	1	–	–	–	–	–	–	–	–	1	–	–	4	2.3
Chaetophora sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	5	2.9
Chlamydomonas rotula Playfair		–	–	–	–	4	3	1	–	–	–	–	–	–	3	3	5	–	3	–	–	–	22	12.8
Chlamydomonas sp. 1	CHLSP1	–	–	–	–	–	1	–	1	3	3	1	–	–	2	2	–	4	1	1	1	–	20	11.6
Chlamydomonas sp. 2		1	–	–	–	–	–	1	–	–	–	1	–	1	–	5	2	1	2	–	1	–	15	8.7
Chlamydomonas sp. 3		–	–	–	–	–	–	2	–	1	–	–	–	1	–	1	1	–	–	2	1	–	9	5.2
Chlamydomonas sp. 4		–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	4	–	–	5	2.9
Chlamydomonas spp.		1	2	–	1	2	2	3	–	3	5	3	1	1	4	4	3	3	3	7	1	3	52	30.2
Chlorella spp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	3	4	2.3
Chlorococcum sp.		–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Chlorogonium elongatum Dang.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	3	–	–	4	2.3
Chlorogonium sp.		–	–	–	–	–	2	–	–	–	–	2	–	1	–	1	–	1	1	–	1	2	11	6.4
Chloromonas sp. 1	CHLMSP	1	6	5	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17	9.9
Chloromonas spp.		–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	1	–	–	2	–	–	6	3.5
Choricystis chodattii (Jaag) Fott		–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Coccomyxa confluens (Kütz.) Fott		–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	2	1.2
Coccomyxa lacustris (Chodat) Pascher	COCLAC	–	–	–	2	–	1	–	–	–	1	3	–	–	–	–	–	2	–	–	1	1	11	6.4
Coenochloris sphagnicola Hindák	COESPH	2	–	–	–	3	2	–	–	–	–	7	–	–	–	–	1	7	5	–	3	–	30	17.4
Dicranochaete reniformis Hieron.		–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	1.7
Dictyosphaerium sphagnale Hindák		7	–	–	–	–	–	–	4	–	1	–	–	–	–	–	–	–	–	4	3	–	19	11.0
Gloeocystis polydermatica (Kütz.) Hindák		–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	2	–	–	–	–	8	4.7
Gonium sociale (Dujard.) Warming		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
Lobomonas rostrata Hazen		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3	1.7
Microspora quadrata Hazen		1	–	–	–	–	–	–	2	1	–	–	–	–	–	–	–	1	–	–	–	–	5	2.9
Microspora stagnorum (Kütz.) Lagerh.		1	–	–	–	–	–	2	3	1	1	1	–	–	–	–	3	–	–	–	1	–	13	7.6
Microspora spp.		2	–	–	1	1	–	1	–	1	1	1	2	1	–	–	–	–	–	–	3	3	17	9.9
Oedogonium sp.	OEDOSP	6	–	–	–	7	2	2	6	–	–	–	3	–	–	5	3	–	1	5	10	9	59	34.3
Oocystis solitaria Wittr.	OOCSOL	7	–	–	–	2	1	–	8	–	–	8	5	4	–	1	–	2	7	2	11	10	68	39.5
Oocystis spp.		–	–	1	–	–	–	2	–	–	–	–	–	–	–	1	1	–	–	3	2	–	10	5.8
Palmodictyon varium (Näg.) Lemmerm.	PALVAR	–	–	–	–	3	6	2	–	–	–	–	–	–	–	–	8	–	–	–	–	–	19	11.0

Sampling site (number of samples taken)	Code	1 (7)	2 (6)	3 (5)	4 (5)	5 (7)	6 (7)	7 (6)	8 (9)	9 (7)	10 (7)	11 (9)	12 (9)	13 (8)	14 (8)	15 (11)	16 (10)	17 (10)	18 (9)	19 (10)	20 (11)	21 (11)	Total (172)	Total (%)
cf. *Pseudodictyochloris dissecta* Vinatzer		–	–	–	1	–	–	1	–	–	–	2	–	–	–	–	1	–	1	–	1	–	7	4.1
Scenedesmus acuminatus (Lagerh.) Chodat	SCEACM	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	10	1	–	12	7.0
Scenedesmus acutiformis Schröd.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	7	–	–	8	4.7
Scenedesmus acutus Meyen		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	9	–	–	10	5.8
Scenedesmus ecornis (Ehrenb.) Chodat	SCEECO	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	–	–	6	–	–	11	6.4
Scenedesmus obliquus (Turpin) Kütz.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	4	–	–	5	2.9
Scenedesmus ovalternus Chodat		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	3	–	–	5	2.9
cf. *Schizochlamydella delicatula* (G. S. West) Korshikov		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	0.6
Trebouxiophyceae:																								
Microthamnion kützingianum Näg.	MITKUT	6	3	3	3	–	2	1	7	–	1	5	1	1	1	2	–	7	–	4	2	2	51	29.7
Conjugatophyceae:																								
Actinotaenium cucurbita (Bréb.) Teiling	ACTCUC	–	–	–	–	–	–	–	4	–	–	–	8	5	–	–	–	1	8	–	7	8	41	23.8
Arthrodesmus incus (Bréb.) Hassall	ARTINC	–	–	–	–	5	1	–	1	–	–	7	7	2	–	–	–	–	8	–	1	1	33	19.2
Bambusina brebissonii Kütz.		–	–	–	–	–	–	–	8	–	–	–	–	–	1	–	1	–	–	–	4	8	22	12.8
Closterium acerosum (Schrank) Ehrenb.	CLOACE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	5	–	–	1	–	–	14	8.1
Closterium cornu Ehrenb. ex Ralfs		–	–	–	–	1	5	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	8	4.7
Closterium directum W. Archer		–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	5	2.9
Closterium nilssonii Borge		–	–	–	–	–	–	–	–	–	–	–	9	–	–	–	2	–	6	3	–	–	20	11.6
Closterium parvulum Näg.	CLOPAR	–	–	–	–	–	–	2	–	–	–	–	–	–	–	7	1	–	–	1	–	–	11	6.4
Closterium pronum Bréb.	CLOPRO	1	–	–	–	6	5	2	3	–	–	2	–	1	–	–	–	3	2	5	9	4	43	25.0
Closterium rostratum Ehrenb. ex Ralfs	CLOROS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	7	–	–	–	–	–	14	8.1
Closterium striolatum Ehrenb. ex Ralfs	CLOSTR	–	–	–	–	–	–	4	4	–	–	–	5	–	–	8	3	–	–	–	1	–	25	14.5
Closterium sp.	CLOSSP	–	–	–	–	–	–	–	–	–	–	–	–	1	–	4	8	–	–	–	–	–	13	7.6
Cosmarium decedens (Reinsch) Racib.		–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Cosmarium cf. *ochtodes* Nordst.	COSOCH	–	–	–	–	–	–	1	–	–	–	–	–	–	–	7	1	–	–	2	–	–	11	6.4
Cosmarium ralfsii Bréb.		–	–	–	–	–	–	–	–	–	–	–	5	2	–	–	–	–	–	–	–	–	7	4.1
Cosmarium cf. *subarctoum* (Lagerh.) Racib.	COSSUB	–	–	–	–	–	–	–	–	–	–	–	1	–	–	4	–	–	5	9	1	–	20	11.6
Cosmarium spp.		–	–	–	–	–	–	2	–	–	–	1	–	1	1	6	2	–	–	2	1	–	16	9.3
Cylindrocystis brebissonii Menegh.	CYLBRE	5	–	–	–	7	–	–	5	–	6	7	9	7	6	–	–	9	8	–	11	9	89	51.7
Euastrum bidentatum Näg.		–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2.3
Euastrum binale (Turpin) Ehrenb. ex Ralfs	EUABIIN	6	–	–	–	1	–	2	3	–	–	7	–	2	–	1	–	6	2	–	8	4	42	24.4
Euastrum elegans (Bréb.) Kütz ex Ralfs		–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Euastrum humerosum Ralfs	EUAHUM	–	–	–	–	6	5	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	13	7.6
Euastrum insigne Hassall ex Ralfs	EUAINS	–	–	–	–	–	–	–	–	–	–	–	9	8	1	–	–	–	–	–	–	–	18	10.5
Hyalotheca dissiliens (J. E. Smith) Bréb.	HYADIS	–	–	–	–	1	–	1	–	–	–	–	5	6	1	–	–	–	–	–	–	–	14	8.1
Micrasterias thomassiana W. Arch.	MISTHO	–	–	–	–	–	4	6	–	–	–	–	–	–	–	–	–	–	–	–	1	–	11	6.4
Micrasterias truncata (Corda) ex Bréb.		–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Mougeotia sp. 1	MOUSP1	2	–	–	–	3	–	3	6	–	1	7	3	3	–	–	2	–	3	2	5	2	42	24.4
Mougeotia sp. 2	MOUSP2	5	–	–	–	4	1	1	–	–	–	–	7	–	1	–	1	8	1	–	7	1	37	21.5
Mougeotia sp. 3	MOUSP3	–	–	–	–		1	–	8	–	–	–	–	–	–	–	–	–	1	–	7	9	26	15.1
Netrium digitus (Ehrenb.) Itzigs. et Rothe	NETDIG	4	–	–	–	5	3	–	7	–	–	1	5	5	2	–	–	–	7	–	10	8	57	33.1
Penium cylindrus (Ehrenb.) ex Bréb.	PENCYL	–	–	–	–	4	–	–	–	–	–	–	2	6	1	–	–	–	2	–	–	–	15	8.7
Penium polymorphum Perty (Perty)	PENPOL	6	–	–	–	2	–	–	–	–	–	7	9	5	–	–	–	7	4	–	10	8	58	33.7
Penium spirostriolatum J. Barker		–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.6
Pleurotaenium sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	0.6
Spondylosium planum (Wolle) W. et G. S. West	SPOPLA	–	–	–	–	4	–	–	–	–	–	–	8	5	2	–	–	5	6	7	2	1	40	23.3
Spondylosium pulchellum W. Arch.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	10	12	7.0
Spirogyra sp.		–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Spirotaenia cf. *minuta* Thuret		–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.2
Staurastrum aciculiferum O. F. Andersson	STAACU	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	–	–	–	–	10	6	22	12.8
Staurastrum avicula Bréb.		–	–	–	–	4	–	–	–	–	–	9	2	5	1	–	–	–	–	–	11	–	32	18.6
Staurastrum cf. *glabrum* Ehrenb. ex Ralfs		–	–	–	–	–	–	5	–	–	–	1	–	1	–	–	–	8	8	2	1	–	26	15.1
Staurastrum hirsutum Ehrenb. ex Ralfs		–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	1.7
Staurastrum margaritaceum Ehrenb. ex Ralfs	STAMAR	6	1	–	–	1	–	–	–	1	7	7	–	1	–	–	–	6	2	–	–	3	35	20.3
Staurastrum merianii Reinsch		–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	2	1.2
Staurastrum cf. *muricatum* (Ehrenb.) Ralfs	STAMUR	7	–	–	–	–	–	–	–	–	6	–	7	5	–	–	–	4	6	–	6	2	43	25.0
Staurastrum omearae W. Arch.	STAOME	4	–	–	–	5	1	3	4	–	1	9	1	–	–	–	–	10	9	3	6	3	59	34.3
Staurastrum punctulatum Bréb.		–	–	–	–	–	1	5	–	–	–	2	–	1	–	3	–	–	2	2	1	–	17	9.9
Staurastrum senarium Ehrenb. ex Ralfs		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	–	–	8	4.7
Staurastrum sexcostatum Bréb. ex Ralfs		–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	1.7
Tetmemorus laevis (Kütz.) Ralfs	TETLAE	–	–	–	–	–	–	–	–	–	–	–	8	4	–	–	–	–	5	–	–	–	17	9.9
Xanthidium antilopeum Kütz.		–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	6	7	4.1
Zygogonium ericetorum Kütz.	ZYGERI	3	–	–	–	5	1	1	1	–	1	4	2	1	1	1	4	1	3	–	2	4	35	20.3
Klebsormidiophyceae:																								
Klebsormidium nitens (Menegh. in Kütz.) Lokhorst		–	–	–	–	–	–	2	1	1	1	1	1	–	1	1	–	–	–	1	1	1	12	7.0
Stichococcus mirabilis Gay		–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	–	–	–	–	–	–	7	4.1

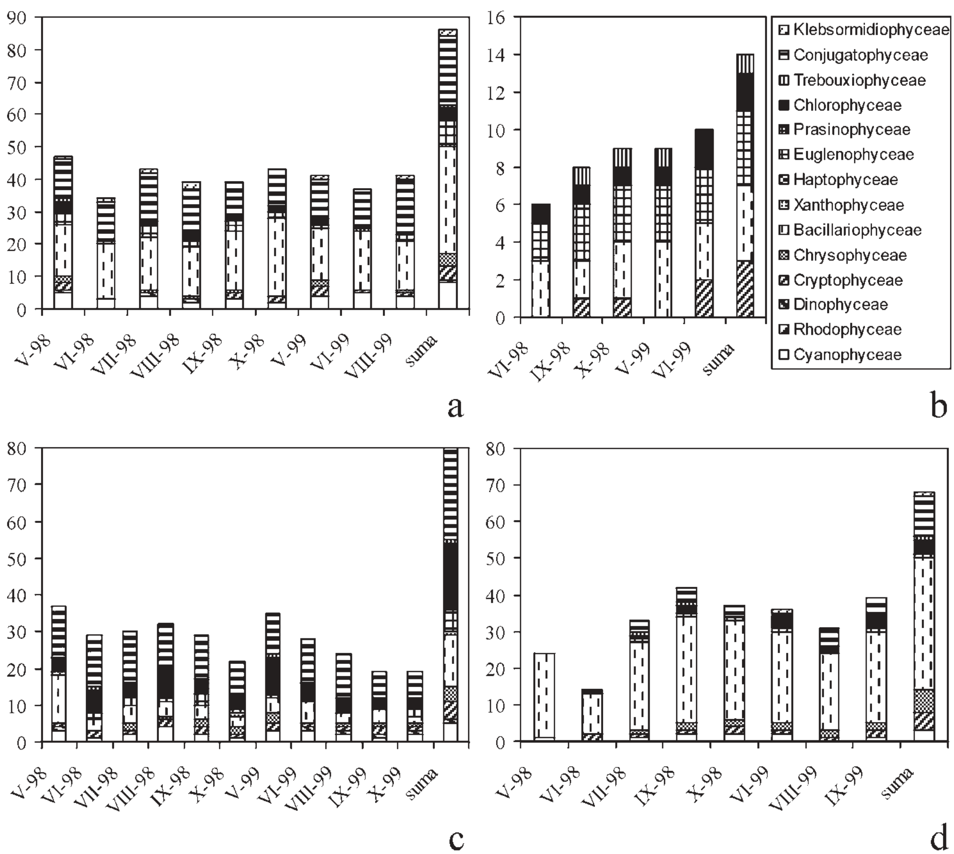

Fig. 1. – Composition of algal flora in different types of waterbodies in 1998–1999: a – bog lake (UR–20), b – intensively shaded pool (PR–3), c – shallow peaty pool (PR–12), d – loamy–bed pool (PR–14). PR – Pančavské rašeliniště, UR – Úpské rašeliniště.

Besides ubiquitious species such as *Achnanthes minutissima, Pinnularia subcapitata* and *P. viridis*, many typical acidophilic and oligotrophic species were found [*Chroococcus turgidus, Synura sphagnicola, Eunotia rhomboidea, Botryosphaerella sudetica*, described by Lemmerman (1896) from Úpské rašeliniště, *Oocystis solitaria, Closterium nilssonii, Euastrum humerosum, E. insigne, Netrium digitus, Penium polymorphum* etc.], psychrophilic species (e.g. *Eunotia glacialis, Pinnularia lata, Pedinomonas minutissima, Scourfieldia cordiformis, Binuclearia tectorum*) or species with arctic-alpine distribution (*Anomoeoneis brachysira, Cymbella hebridica, Frustulia rhomboides, Pinnularia lata, Penium cylindrus*). The occurrence of these species coresponds well to the type of the locality (subarctic-subalpine peat bog). On the other hand some eutrophic species (*Cyclotella radiosa, Heteronema acus, Surirella angusta, Scenedesmus acutus, S. ecornis*) were recorded, too.

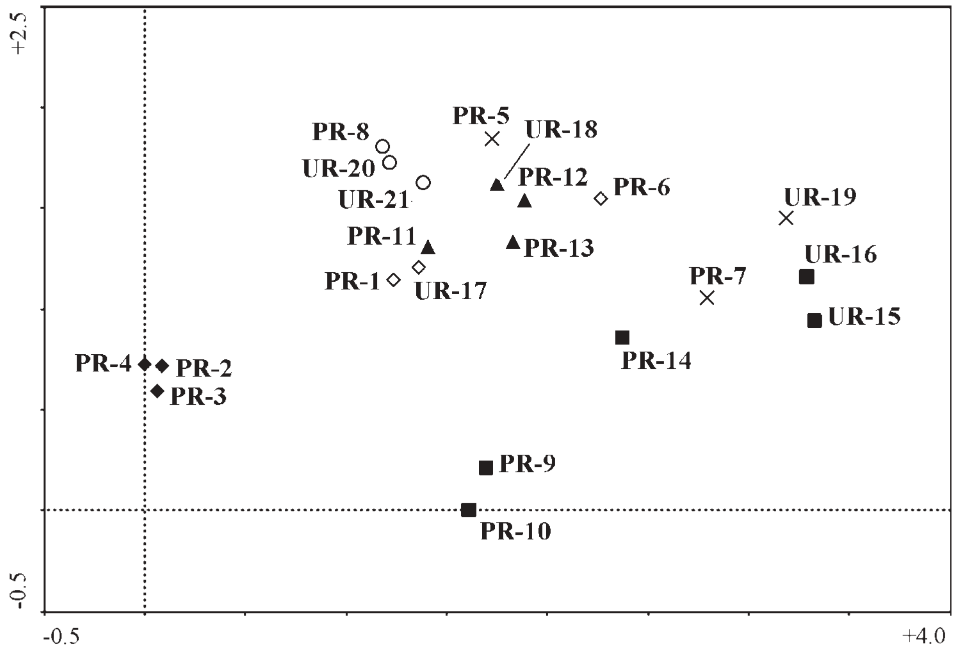

Fig. 2. – DCA ordination diagram showing the position of localities; ○ – bog lakes (Blänk or Kolk in German), ♦ – intensively shaded pools, ◇ – partly shaded pools, ▲ – shallow peaty pools, ■ – pools with loamy bed, ✕ – others (not classified). PR – Pančavské rašeliniště, UR – Úpské rašeliniště.

The location of the pools in particular bogs did not influence the algal flora; differences in species composition were caused by the character of the pools. On DCA plot (Fig. 2), pools of a similar type form clusters. Four categories could be distinguished in accordance with the morphology of pools and composition of their algal flora (Figs 1, 2):

1. Bog lakes (“Blänk” or “Kolk” in German, Fig. 1a). Planktonic species prevail, mainly the members of *Zygnematophyceae* and *Chlorophyceae*; the diatoms (*Bacillariophyceae*) were less represented.
2. Shallow peaty pools (Fig. 1c) had the most diversified algal flora with the dominance of desmids (*Desmidiales*, *Zygnematophyceae*) and diatoms.
3. Intensively shaded pools (Fig. 1b) comprised very poor communities
4. Loamy-bed pools (deep waterbodies, pools in streams, Fig. 1d). In spite of great differences in the species composition due to dissimilar pH, a high proportion of the diatoms is characteristic for these biotopes.

Algal flora of the partly shaded pools shared features of shallow peaty pools and intensively shaded pools; some other water bodies did not belong to any of these categories.

CCA demonstrated pH, shading and type of bed as the most important factors influencing the diversity of algae; pH affected especially the species composition (Figs 3a, b). This effect was most evident in the presence of the *Xanthophyceae*, which were found only in the pools with higher pH values, and in the occurrence of the dominant *Bacillariophyceae*: *Frustulia*

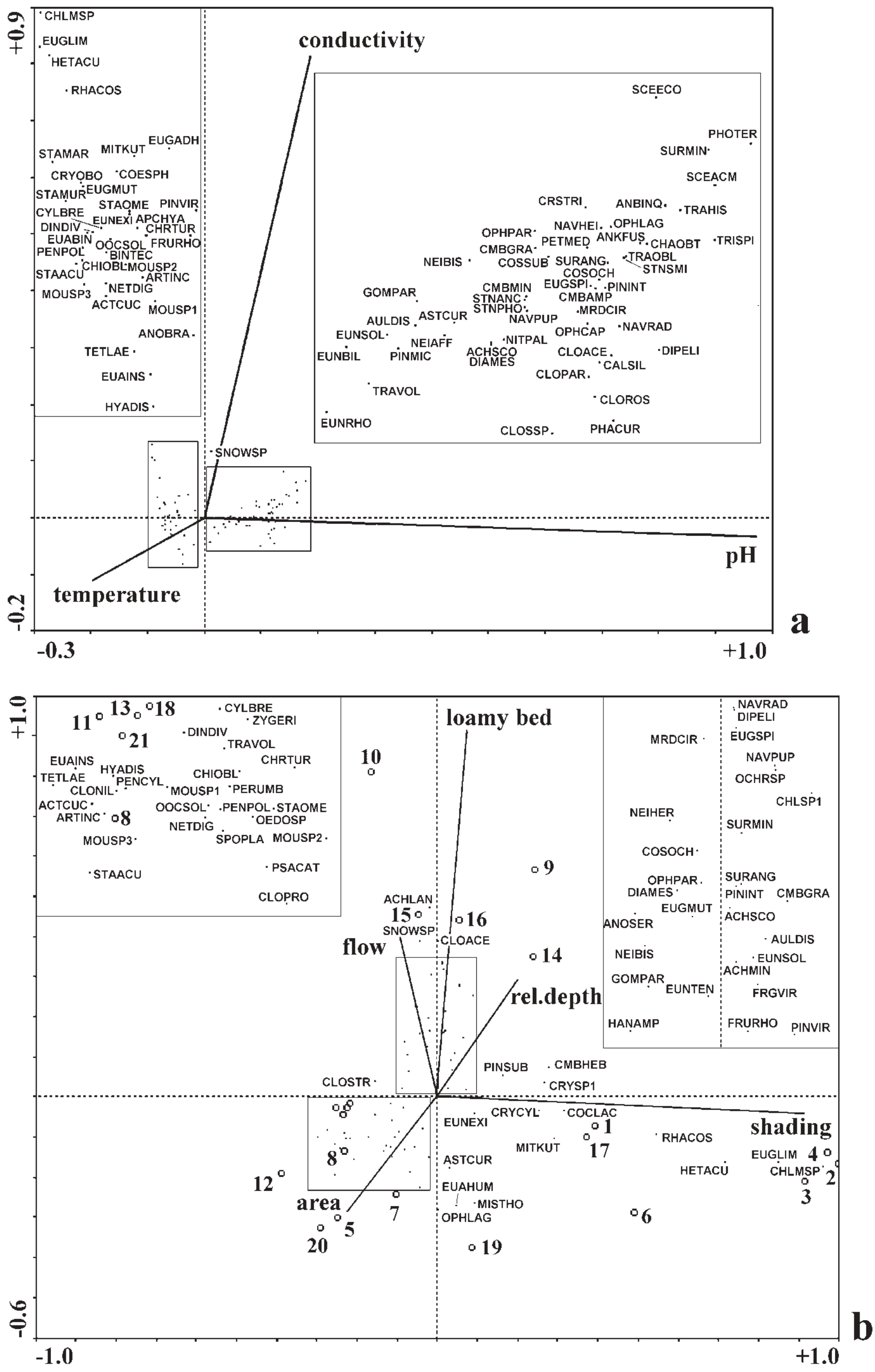

Fig. 3. – CCA ordination diagrams showing the position of species with respect to: a – physical and chemical water parameters, b – morphological characteristics of the pools. See Table 2 for species codes. Only well fitting species are displayed.

rhomboides was the most abundant diatom in the acid pools with average pH < 5. Where pH varied around 5, *F. rhomboides* shared the dominance with *Fragilaria virescens,* and in more alkaline pools, *F. virescens* and representatives of the genus *Navicula* dominated. The number of species increased with rising pH-values as well. On the other hand, shading decreased the number of species. The presence of few unique species (*Euglena limnophila, Heteronema acus, Rhabdomonas costata, Chloromonas* sp. 1), together with some common taxa (*Pinnularia subcapitata, Cryptomonas* sp. div.), was typical of the intensively shaded pools. The type of bed determined the dominant group of algae.

The group of species in the bottom left corner of Fig. 3b seems to correlate remarkably with the variable "area", but in fact, it reflects a negative position to the variables "shading" and "loamy bed". Majority of these species are similar to the left, "acidophilic" cluster in Fig. 3a and it is exactly these species that could be considered as typical for the peat bogs.

Discussion

It is difficult to compare the present occurrence of algae with former records from the same area because of the investigators' unequal interest in various groups of algae and taxonomic changes. For example Lemmermann (1896) did not determine the diatoms, Beck-Managetta (1927) dealt only with *Cyanophyceae*, *Chlorophyceae* and *Zygnematophyceae*. Most of the dominant algae were finally identified, and their occurrence was confirmed. However, lot of species (some of them rather distinctive) have not been found. This need not to be necessarily caused by the local extinction of these species but could reflect the fact that they become abundant only in certain years. Another reason could be the spatial heterogeneity of algal communities. Some species were found only in one or a few pools. Considering the fact that the number of the observed pools represents only a small part of the pools in the peat bogs, further research could bring new results.

One hundred and ninety taxa of algae were found in the samples from the Úpské rašeliniště peat bog. Matula (1995) encountered 114 species of algae in the same locality during his investigation. Although the overall portion of the three dominant groups (*Bacillariophyceae*, *Chlorophyceae*, *Zygnematophyceae*) was in both cases about 70%, their individual ratios differ distinctly (Table 3). Unfortunately no details are available as I was interested more in the differences between the bogs than between the microbiotopes within particular bogs.

Table 3. – Comparison of the composition of algal flora from the Úpské rašeliniště peat bog as recorded by Matula (1995) and in the present study.

Author Period of data collation	Matula 1986–90	Nováková 1998–99
Total number of taxa	114	190
Bacillariophyceae (%)	13	31
Chlorophyceae (%)	26	18
Zygnematophyceae (%)	31	19
others %	30	32

The ecology of algae in the Czech mountain bogs was studied in the Jizerské hory Mts and in the Šumava Mts. Gessner (1933) and Perman (1961) dealt with plankton production according to nutrient content and other physico-chemical factors in peat bog lakes in the Jizerské hory Mts. Perman (1961) found the chrysophytes, the cryptomonads and also the diatoms dominating in plankton. The high diatom abundance is in contradiction with the results of Gessner (1933) who referred to diatoms as being in minority. Although the diatoms dominated in most samples from the Krkonoše Mts bogs, they were found only in small quantities in larger lakes (PR–8, UR–20) where plankton formed the main part of algal flora.

Lederer (1997, 1998) investigated several peat bogs in the Šumava Mts and concentrated on the ecology of algae found in various aquatic and subaerophytic microbiotopes. He concluded that algal flora of particular microbiotopes varied more than between various localities (peat bogs). This conclusion is in agreement with my results. Lederer found 193 taxa of algae in the Šumava Mts bogs, but among these only 26 species (13%) were diatoms. However, he determined an unusually high number of *Cyanophyta* (30 species); some of these taxa were rare and one species was newly described (Lederer 1995a, 1995b).

It should be questioned to what extent these differences in proportions of algal classes are caused by real dissimilarities in algal communities in various bogs and to what extent by the authors' interest in different classes of algae. This fact is evident in most of the papers dealing with the ecology of algae in other European bogs, which concentrate only, or mainly, on desmids (e.g. Péterfi 1974, Wurm 1991, Wurm & Krisai 1993, Tomaszewisz 1994).

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Souhrn

Během dvouletého výzkumu tůní Úpského a Pančavského rašeliniště v Krkonoších bylo nalezeno 228 taxonů sinic a řas. Nejhojnější skupinou byly rozsivky, následované krásivkami. Poloha sledovaných tůní v různých rašeliništích neměla vliv na druhové složení řas, rozdíly v algoflóře byly dány rozdílným charakterem stanovišť. Studium vztahů mezi algoflórou a proměnnými prostředí ukázalo, že faktory nejvýznamněji ovlivňující řasová společenstva byly pH, zastínění a charakter dna tůně.

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