Algae and cyanoprokaryotic species from peat bogs, streams, ponds and aerial biotopes in the region of South Šumava Mts.

Řasy a sinice z rašelinišť, vodních toků, nádrží a aerických biotopů jižní Šumavy

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Abstract

This paper presents the algological floristic investigation of the South Šumava Mts. in the vicinity of the Lipno I. reservoir. In total, 137 taxa were determined. The most interesting species found in Olšina pond were *Crucigenia quadrata* and *Eutetramorus planctonicus*; in Plániczký pond the centric diatom *Aulacoseira crenulata* and silica-scaled chrysophytes (*Mallomonas caudata* and *Synura petersenii*) dominated plankton community. An interesting filamentous green alga *Draparnaldia mutabilis* occurred in a small periodic stream near Plániczký pond. *Coleochaete scutata* grew epiphytically on submersed vegetation in a small pond on the Smrčinský stream. An interesting autumn plankton community developed in a small pond in the village of Nová Pec, with dominant species *Uroglena americana*, *Micrasterias americana* and a very rare desmid species *Spondylosium papillosum*.

Introduction

The vicinity of the village Nová Pec in the South Šumava Mts. is a very interesting area for algological investigation. Nová Pec is situated in the upper part of Lipno I. reservoir. This reservoir flooded 45 km of the River Vltava with some of the most valuable peat bogs and backwaters in Bohemia. Localities in the vicinity of the reservoir and in the core zone of Šumava NP „Vltavský luh" are very important as a refugium for algal species formerly occurring in the area flooded by Lipno I.

The presented study follows the floristic investigation conducted in the nearby catchment area of the River Křemelná in Šumava National Park (NEUSTUPA et. al. 2002).

Localities and methods

The investigated samples were collected from various microbiotopes (Table 1) in the following investigated areas: acidophilous peat bog Mrtvý luh, Smrčinský, Plániczký and Olšina pond, and Lipno I. reservoir near the village of Černá v Pošumaví. At these localities, the basic physic-chemical variables, such as temperature, pH and conductivity, were measured with portable electronic WTW 330 pH-meter and WTW LF 315 conductometer. The microphotographs were taken from fixed samples with the light microscope Olympus BX 51 and microphotographic equipment Olympus Z300. The samples with a significant proportion of silica-scaled chrysophytes were fixed with Lugol's solution. The preparation for transmission electron microscopy (TEM) was made by oxidation in hydrogen peroxide according to KALINA et al. (2000) and examined with the TEM Philips T 300.

The samples were determined according to the following publications: ASAUL (1975); ASMUND & KRISTIANSEN (1986); ETTL (1978); GEITLER (1932); HINDÁK a kol. (1978); HINDÁK (1996); KOMÁREK & ANAGNOSTIDIS (1999); KOMÁREK & FOTT (1983) KRAMMER & LANGE-BERTALOT (1986, 1988, 1991a, 1991b); LENZENWEGER (1996, 1997, 1999); LOKHORST (1999), PRINTZ (1964); RŮŽIČKA (1977, 1981); STARMACH (1985).

Results and discussion

In the course of the investigation, we found 137 algal and cyanoprokaryotic species in samples from the given region (Table 2).

Peat bog Mrtvý luh

This extremely acidophilous peat-bog locality presents rather poor algal flora (KALINA et al. 1993). In peat-bog pools, *Mesotaenium chlamydosporum*, *Cylindrocystis brebissonii* and two species of genus *Microspora* (*M. floccosa*, *M. pachyderma*) were dominant. The rarely reported acidophilous cryptophycean species *Chilomonas oblonga* occurred in epiphytic mucilaginous growths in this locality.

Small eutrophic pool by the town of Volary

This pool does not share the overwhelming dystrophic nature of most water and wetland localities in the region. The plankton community in the pool was dominated by euglenoid species *Euglena acus*, *Trachelomonas hispida* (Fig. 13) and *T. playfairii* (Figs 14, 15). The later species has been reported only sporadically from ephemeral pools and wetlands in temperate zone (ASAUL 1975).

Olšina pond

This pond is situated on the upper flow of the River Olšina. With the extent of 138 ha and altitude 731 meters a.s.l. Olšina pond is one of the biggest artificial ponds in the region of Šumava and also the highest elevated artificial pond in Bohemia. Centric diatom *Aulacoseira ambigua* dominated the plankton of Olšina pond. The rarely reported coccal green algae *Crucigenia quadrata* (Fig. 18) and *Eutetramorus planctonicum* (Fig. 19) were repeatedly found in the samples. Three species of silica-scaled chrysophytes – *Mallomonas acaroides*, *M. punctifera* (Fig. 5) and *Synura petersenii* (Fig. 1) – were found, which indicated mesotrophic to eutrophic environmental conditions with higher pH (NĚMCOVÁ et al. 2000).

Pláničský pond

Centric diatom *Aulacoseira crenulata* dominated the plankton of Pláničský. This species has very long T-shaped linking spines. *A. crenulata* is sometimes considered the same as *A. italica*, although both species differ considerably in their ecology. *A. italica* occurs in more or less eutrophic waters while *A. crenulata* is typical for the benthos of oligotrophic water bodies, which corresponds well with our findings. The species has a cosmopolitan distribution, but the findings are very sporadic (KRAMMER & LANGE-BERTALOT 1991a). A population of *Ankistrodesmus gracilis* – sometimes a hardly interpretable species with a sporadic distribution - was found in a typical form in plankton community. *Closterium pussilum* (Fig. 17), which was reported from backwater in the mountains by Lunz am See (LENZENWEGER 1996), was found in growths on a sand dam of Pláničský pond. In running water of a periodic stream, green alga *Draparnaldia mutabilis* was found in filamentous growths. Besides the frequently occurring *D. glomerata*, this species is the second well defineable *Draparnaldia* species in the Šumava Mts.

Lipno I. reservoir

Besides the typical cyanobacterial water bloom with *Microcystis flos-aquae* and *Anabaena* spp., an interesting green alga *Dictyosphaerium tetrachotomum* was sporadically observed in plankton. This species has been rarely reported, but this accounts rather for frequent misinterpretation for *D. pulchellum* than for a really sporadic distribution (KOMÁREK & FOTT 1983).

Area of the Smrčínský stream

Plankton of a small forest pond on the Smrčinský stream was dominated by chrysophytes (*Dinobryon divergens* (Fig. 6), *Mallomonas punctifera* (Fig. 5), *M. tonsurata* and three *Synura* (Figs 1-3) species), and *Asterionella formosa*. A rare xanthophycean species *Goniochloris contorta* (Fig. 12), which has been reported only from type locality in France (small peat-bog pool), was also found in this pond. The filamentous algal growth in acidic periodic forest puddle was dominated by two *Microspora* species: *Microspora pachyderma*, which

frequently occurs in the Šumava Mts., and *M. amoena* with a rather sporadic distribution in the investigated region.

Small pond in the village of Nová Pec

In this small artificial pond, a very interesting plankton community dominated by desmids and chrysophytes was revealed. *Micrasteria rotata* (Fig. 10), *M. americana* and *Staurastrum polytrichum* occurred frequently. A rare filamentous desmid species *Spondylosium papillosum* (Fig. 11), occurring very rarely in peat-bog localities within temperate Europe (LENZENWEGER 1997), was found in this locality. Apparently, this species should be currently considered as one of the most interesting desmids of the Šumava Mts. region. A rare chrysophyte species *Uroglena americana* was also found in this locality indicating rather mesotrophic to eutrophic environmental conditions of the pond (STARMACH 1985).

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References

ASAUL, Z. I. (1975): Viznačnik evglenovich vodorostěj ukrainskoj RSR, Naukova dumka, Kyjev. 406p.

ASMUND, B. & KRISTIANSEN, J. (1986): The genus *Mallomonas*. - Opera Botanica 85: 5 – 128.

ETTL, H. (1978): Xanthophyceae 1. Teil. - In: ETTL, H., GÄRTNER, G. et HEYNIG, H.: Süßwasserflora von Mitteleuropa, G. Fisher Verlag, Jena. 530p.

GEITLER, L. (1932): Cyanophyceae. - Akademische Verlagsgesellschaft, Leipzig. 1196p.

HINDÁK, F. a kol. (1978): Sl'adkovodné riasy. SPN Bratislava. 724p.

HINDÁK, F. (1996): Kl'úč na určovanie nerozkonárených vláknitých rias (Ulotrichineae, Ulotrichales, Chlorophyceae). - Slovenská. bot. spol. při SAV. Bratislava, 77p.

KALINA, T.; POPOVSKÝ, T. & PUNČOCHÁŘOVÁ, M. (1993): Sinice, řasy, prvoci a některé druhy bezobratlých. – In: Biodiverzita přírodních ekosystémů Šumavy. – ms. [Zpráva o výsledcích projektu (grant 124 (FDR)) za rok 1993 depon. in Knihovna botaniky PřF UK, Benátská 2, Praha 2].

KALINA, T.; NĚMCOVÁ, Y. & NEUSTUPA, J. (2000): Silica-scaled chrysophytes of the Czech Rebublic 1. Distric Česká Lípa (Northern Bohemia) and part of the Central Bohemia. – Algol. Stud. 96: 29-47.

KOMÁREK, J. & ANAGNOSTIDIS, K. (1999): Cyanoprokaryota. - In: ETTL, H., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 19/1, G. Fisher Verlag, Jena. 548p.

KOMÁREK, J. & FOTT, B. (1983): Das Phytoplankton des Süsswassers, 7. Teil, 1. Hälfte, Stuttgart. 1044p.

KRAMMER, K. & LANGE-BERTALOT, H. (1986): Bacillariophyceae, 1. Teil. - In: ETTL, H., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 2/1, G. Fisher Verlag, Jena. 875p.

KRAMMER, K. & LANGE-BERTALOT, H. (1988): Bacillariophyceae, 2. Teil. - In: ETTL, H., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 2/2, G. Fisher Verlag, Jena. 596p.

KRAMMER, K. & LANGE-BERTALOT, H. (1991a): Bacillariophyceae, 3. Teil. - In: ETTL, H., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 2/3, G. Fisher Verlag, Jena. 576p.

KRAMMER, K. & LANGE-BERTALOT, H. (1991b): Bacillariophyceae, 4. Teil. - In: ETTL, H., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 2/4, G. Fisher Verlag, Jena. 436p.

LENZENWEGER, R. (1996): Desmidiaceenflora von Österreich, Teil 1. - Bibliotheca Phycologia Band 101, J. Cramer, Berlin-Stuttgart. 162p.

LENZENWEGER, R. (1997): Desmidiaceenflora von Österreich, Teil 1. - Bibliotheca Phycologia Band 102, J. Cramer, Berlin-Stuttgart. 216p.

LENZENWEGER, R. (1999): Desmidiaceenflora von Österreich, Teil 3. - Bibliotheca Phycologia Band 104, J. Cramer, Berlin-Stuttgart. 218p.

LOKHORST, G. M. (1999): Taxonomic study of the genus *Microspora* THURET (Chlorophyceae). – Algol. Stud. 93: 1-38.

NĚMCOVÁ, Y., NOVÁKOVÁ, S. & NEUSTUPA, J. (2000): Silica-scaled Chrysophytes of Czech Republic. - www site - http://www.natur.cuni.cz/botany/chryso/

NEUSTUPA, J., NOVÁKOVÁ, S., ŠEINOHOVÁ, L., ŠKALOUD, P. & ŘEZÁČOVÁ, M. (2002): Algae from aquatic, peat bog, and aerial biotopes in the catchment area of the River Křemelná in Šumava National Park. – Czech Phycology 2: 47 – 60.

PRINTZ, H. (1964): Die Chaetophoralen der Binnengewässer. Verlag Dr. W. Junk – den Haag.

RŮŽIČKA, J. (1977, 1981): Die Desmidiaceen Mitteleuropas. Band 1, 2, Schweizerbart, Stuttgart. 736p.

STARMACH, K. (1985) : Chrysophyceae und Haptophyceae. - In: ETTL, H., GERLOFF, J., GÄRTNER, G., HEYNIG, H. et MOLLENHAUER, D.: Süßwasserflora von Mitteleuropa, Band 1, G. Fisher Verlag, Jena. 515p.

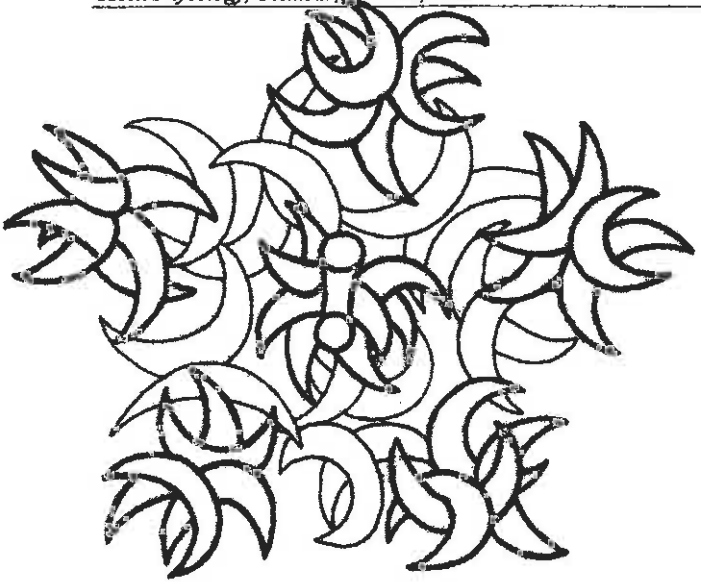
Table 1: List of localities.
M – peat bog Mrtvý luh, EP – small eutrophic pool by Volary town, SS – Smrčinský stream, PSS – ponds on Smrčinský stream, O – Olšina pond, L – Lipno I. reservoir, PP – Plánický pond, MPP – Malý Planičský pond, vPP – the vicinity of Planičský pond, aSS – area of Smrčinský pond, PNP – pond in Nová Pec village

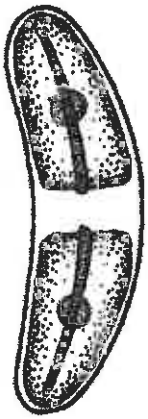
No.	Loc.	Description	Date	Temp. (°C)	pH	Cond. ($\mu S.cm^{-1}$)
1	M	squeezed *Sphagnum*	26.9.	7	3,7	129
2	M	sediment from peat-bog pool	26.9.	7	3,62	95
3	M	sediment from the fallen-tree pool	26.9.	7	3,6	126
4	M	the mucilaginous growth on the submersed wood	26.9.	7	3,84	72
5	M	the mucilaginous growth on the bottom of the peat-bog pool	26.9.	7	4	71
6	M	a peat-bog puddle	26.9.			
7	M	the subaerial mucilaginous growth on a moss	26.9.			
8	M	the mucilaginous growth on the bottom of a peat-bog puddle	26.9.			
9	M	the subaerial mucilaginous colony	26.9.			
10	M	the mucilaginous growth on a wood in peat-bog pool	26.9.			
11	M	subaerial algal growth on spruce bark	26.9.			
12	M	subaerial mucilaginous growth on bare wood	26.9.			
13	M	the subaerial growth on a wet stem base	26.9.			
14	EP	small eutrophic pool by Volary town	26.9.	7	5,98	242
15	O	plankton from Olšina pond	27.9.	8	6,93	110
16	L	plankton from Lipno reservoir	27.9.	8	6,72	68
17	L	epipellic growth in Lipno reservoir	27.9.	8	6,72	68
18	PP	plankton from Plánický pond	27.9.	8	6,88	220
19	MPP	plankton from Malý Plánický pond	27.9.	8	6,84	265
20	PP	the growth on the dam of Plánický pond	27.9.	8	6,88	220
21	MPP	the growth on wetted stone in Plánický stream	27.9.	8	6,84	265
22	MPP	submersed tufts in Malý Plánický pond	27.9.	8	6,84	265
23	vPP	filamentous growth in a waterlogged ditch	27.9.			
24	vPP	the growth on stones in small periodic stream	27.9.			
25	vPP	filamentous growth in periodic stream	27.9.			
26	PSS	small pond on Smrčinský stream	28.9.	10	6,47	52
27	PSS	the wet moss on the bottom of waterless pond	28.9.	10	6,22	50
28	PSS	the metaphytic filamentous growth	28.9.	10	6,36	64
29	PSS	small pool	28.9.	10	6,22	50
30	PSS	growths on a sand dam of a pond	28.9.			
31	PSS	mucilaginous filamentous growth on the bottom of waterless pond	28.9.			
32	PSS	epiphytic growths on submersed *Typha*	28.9.			
33	aSS	wet moss on the wooden roof of a forest hut	28.9.			
34	aSS	the growth in a forest puddle	28.9.	10	6,39	104
35	PNP	small pond in Nová Pec village	28.9.	9	6,55	40
36	SS	filaments on a sand bottom of Smrčinský stream	28.9.			

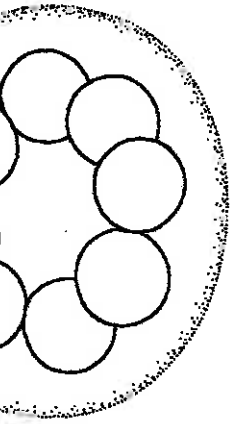
Table 2. List of species

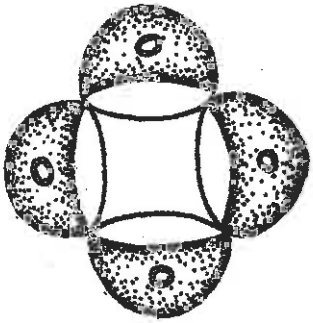
Name	Designation of localities
Cyanophyta	
Anabaena subcylindrica BORGE	29
Anabaena sp.	15, 16
Chroococcus turgidus (KÜTZ.) NÄGELI	14
Leptolyngbya sp.	11, 17
Merismopedia cf. glauca	17
Microcystis flos-aquae (KÜTZ.) KÜTZ.	16
Oscillatoria sp.	17, 33
Phormidium autumnale GOM.	17
Phormidium sp.	19, 21
Pseudanabaena cf. catenata	17
Dinophyta	
Ceratium hirundinella (O. F. MÜLLER) SCHRANK	16
Cryptohyta	
Cryptomonas marsonii SKUJA	14
C. splendida CZOSN.	14
C. sp.	15, 31
Chilomonas oblonga PASCHER	4
Peridinium sp.	14
Chrysophyceae	
Chrysococcus sp.	*6*
Dinobryon bavaricum IMHOF	*18*
Dinobryon divergens IMHOF	*18, 19, 26, 35*
Uroglena americana CALKINS	35
U. sp.	18
Synurophyceae	
Mallomonas acaroides PERTY	*15, 35*
M.caudata IVANOV emend. KRIEGER	16, 18
M. punctifera KORŠIVKOV	15, 26, 35
M. tonsurata TEILING emend. KRIEGER	26
Synura petersenii KORŠIVKOV	15, 16, 18, 26, 35
S. sphagnicola (KORŠIVKOV) KORŠIKOV	16, 26, 35
S. spinosa KORŠIKOV	16, 26, 35
Bacillariophyceae	
Achnanthes lanceolata (BRÉB.) GRUN.	*34*
Asterionella formosa HASS.	*15, 16, 26, 35*
Aulacoseira ambigua (GRUNOV) SIMONSEN	15, 18, 26, 35
A. cremulata (EHRENB.) THWAITES	34
A. granulata (EHRENB.) SIMONSEN	15, 18
Cocconeis placentula EHRENB.	28
Cyclostephanos invisitatus (HOHN & HELLERMANN) THERIOT, STOERNER & HAKANSSON	15
Cymatopleura sp.	18
Eunotia bilunaris (EHRENB.) MILLS	2
E. soleirolii (KÜTZ.) RABENH.	26
E. tenella (GRUN.) CL.	2, 34
Fragillaria crotonensis KITT.	*16*
Fragillaria sp.	*18, 19*
Gomphonema acuminatum EHRENB.	18
G. angustatum (KÜTZ.) RABENH.	34
G. augur EHRENB.	28
G. truncatum EHRENB.	18, 28
Gyrosigma sp.	21

Hantzschia amphioxys (EHRENB.) GRUN.	21, 33
Meridion circulare (GREVILLE) AGARDH	34
Navicula cryptocephala KÜTZ.	28, 34
N. lanceolata (AG.) KÜTZ.	35
Nitzschia intermedia HANTZSCH	35
N. vermicularis (KÜTZ.) GRUN.	27, 29
N. cf. palea	35
Pinnularia acrosphaeria RABENH.	29, 34
P. dactylus EHRENB.	33
P. maior (KÜTZ.) RABENH.	29, 35
P. subcapitata GREG.	5
P. viridis (NITZSCH) EHRENB.	28,29
Surirella angusta KÜTZ.	28, 29
S. biseriata BRÉB.	34
S. robustra EHRENB.	26, 29
S. sp.	18
Synedra cf. ulna	18
Tabellaria fenestrata (LYNG.) KÜTZ.	28
T. flocculosa (ROTH) KÜTZ.	28
Xanthophyceae	
Characium cf. enciforme	17
Goniochloris contorta (BOURRELLY) ETTL	26
Tribonema vulgare PASCHER	23
Vaucheria sp. steril.	25
Euglenophyta	
Colacium cyclopicola (GYCKL.) WORONICH.	*18*
Euglena adhaerens MATV.	*10*
E. cf. adhaerens	*1, 3*
E. acus EHR.	14, 26
E. spirogyra EHR.	15, 26, 28, 31
Euglena sp.	5, 6, 14
Phacus longicauda (EHR.) DUJ.	15, 18, 26, 28, 35
Rhabdomonas costata (KORŠ.) PRINGSH.	1, 2
Rhabdomonas sp.	5
Trachelomonas hispida (PERTY) STEIN emend.DEFL.	14, 21, 31
Trachelomonas playfairii DEFL.	14, 18
Chlorophyceae s.l.	
Actinastrum rhaphidioides (REINSCH) BRUNNTH.	28
Ankistrodesmus fusiformis CORDA	28
A. gracilis (REINSCH) KORŠ.	18
Botryococcus braunii KÜTZ.	26
Chlamydomonas sp.	6, 17
Cladophora glomerata (L.) KÜTZ.	22
Coccomyxa confluens (KÜTZ) FOTT	4, 7, 9, 11, 12, 13
Crucigenia quadrata MORREN	15
Dictyosphaerium ehrenberianum NÄG.	26
D. pulchelum WOOD	15
D. tetrachotomum PRINTZ	16
Draparnaldia glomerata	37
D. mutabilis (ROTH) CEDERGREN	24
Eutetramorus planctonicus (KORŠ.) BOURR.	15
Gonium pectorale O. F. MÜLLER	26
G. sociale WARM.	28
Microspora amoena (KÜTZ.) RABENH.	34
M. floccosa (VAUCH.) THURET	2, 5, 6, 10, 13, 14
M. pachyderma (WILLE) LAGERHEIM	5, 8, 13, 34
Monoraphidium griffithii (BERK.) KOM.-LEGN.	17
Pandorina morum (O.F. MÜLLER) BORY	16, 31



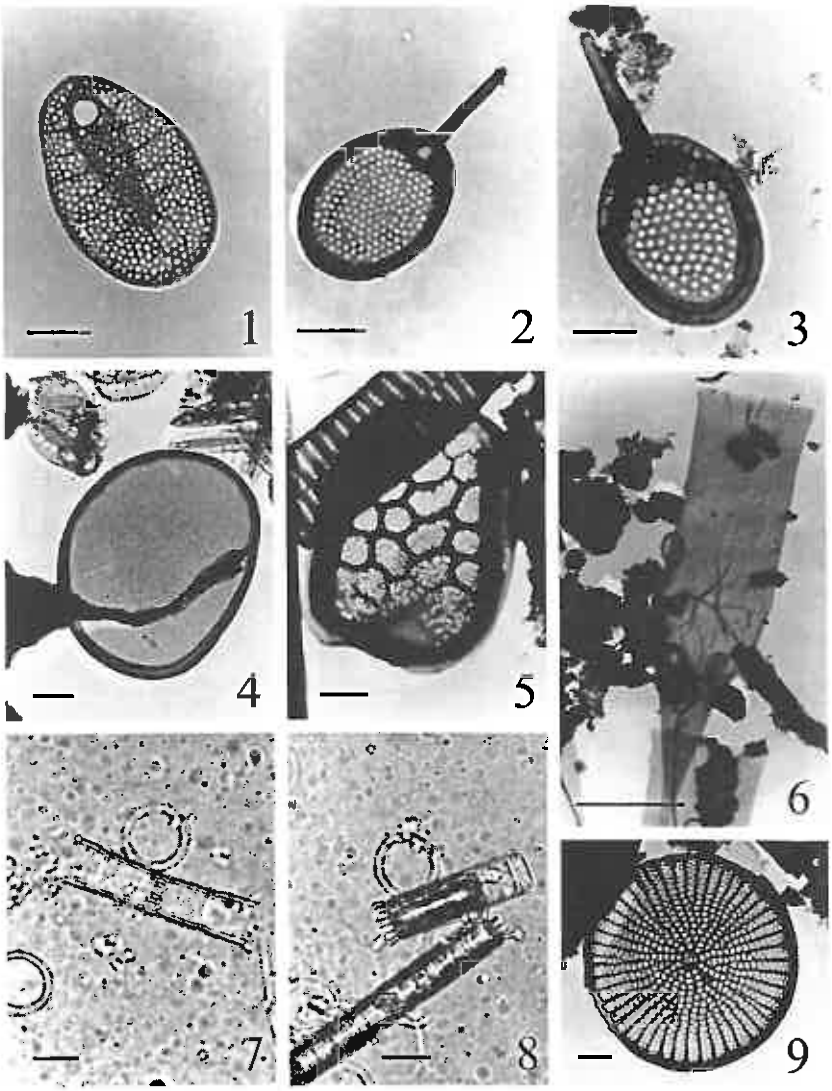




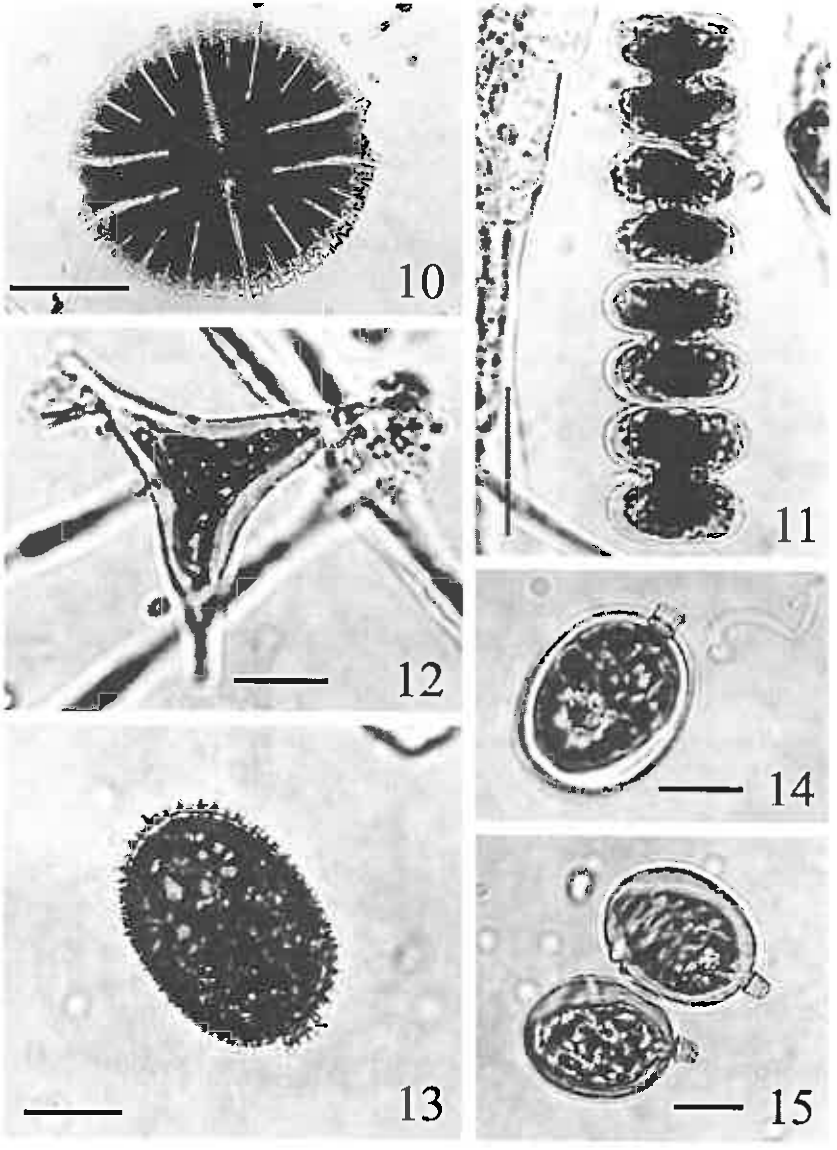


Figs 16 – 19. 16: *Ankistrodesmus gracilis*; 17: *Closterium pussilum*, 18: *Crucigenia quadrata*; 19: *Eutetramorus planctonicus*. (Bars: Figs 16, 17, 19: 10 μm; Figs 18: 5 μm)

Pediastrum boryanum (TURPIN) MENEGHINI	15, 18, 20
P. duplex MEYEN	2, 15, 16, 18
Scenedesmus acuminatus (LAGERH.)	17, 18
S. quadricauda (TURP.) BRÉB.	16, 18, 31
Ulothrix quaternaria PLAYFAIR	17
Charophyceae	
Coleochaete scutata BRÉB.	32
Klebsormidium flaccidum (KÜTZ.) SILVA et al.	21, 33
K. nitens (MEN. in KÜTZ.) LOKHORST	30
Zygnematophyceae	
Closterium acerosum SCHRANK EX RALFS	28
Cl. intermedium RALFS	35
Cl. limneticum LEMM.	16
Cl. lunula (MÜLL) NITZSCH ex RALFS	29
Cl. moniliferum (BORY) EHRENB.	19, 28
Cl. praelongum BREB.	35
Cl. pusillum HANTZSCH.	30
Cl. striolatum EHRENB. ex RALFS	29
Cl. cf. striolatum	31
Cosmarium speciosum LUND.	28, 29
Cylindrocystis brebissonii (MEN. ex RAL.) BARY	3, 4, 10, 30
Euastrum verrucosum EHRENB. ex RALFS	28
Mesotaenium caldariorum (LAGERH.) HANSGIRG	9
M. chlamydosporum (BARY) BARY	4, 6, 9, 13
Micrasterias americana (EHR.) ex RALFS	35
M. rotata GREV. ex RALFS	35
Mougeotia sp. steril.	28
Netrium digitus (EHR. ex BRÉB.) ITZ. & ROTHE	29
Spirogyra sp. steril.	16, 20, 28
Spirotaenia condensata BRÉB.	29
Spondylosium papilosum W. & G. S. WEST	35
Staurastrum avicula BRÉB. ex RALFS	16
St. cingulum (W. & G. S. WEST) G. M. SMITH	16
St. dispar BRÉB.	28
St. inflexum BRÉB.	28
St. polytrichum (PERTY) RAB.	35
Staurodesmus dejectus (BRÉB. ex RALFS.) TEIL.	15, 16
Flagellatae incertae sedis	
Rhipidodendron huxlei KENT	28



Figs 1 – 9. 1: *Synura petersenii*; 2: *Synura sphagnicola*; 3: *Synura spinosa*; 4: *Mallomonas caudata*; 5: *Mallomonas punctifera*; 6: *Dinobryon divergens*; 7, 8: *Aulacoseira crenulata*; 9: *Cyclostephanos invisitatus*. (Bars: Figs 1-5, 9: 1 μm; Figs 6-8: 10 μm)



Figs 10 – 15. 10: *Micrasterias rotata*; 11: *Spondylosium papilosum*, 12: *Goniochloris contorta*, 13: *Trachelomonas hispida*, 14 – 15: *Trachelomonas playfairii*.(Bars: Figs 10: 100 μm; Figs 11-15: 10 μm)