

## 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

Lenka Šejnohová, Pavel Škaloud,  
Jiří Neustupa, Sylvie Nováková,  
Magda Řezáčová & Lucie Ošlejšková

Department of Botany, Charles University of Prague, Benátská 2,  
Prague 2, CZ-128 01

e-mail: [sejnhova.lenka@tiscali.cz](mailto:sejnhova.lenka@tiscali.cz)

### 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 Pláničský pond the centric diatom *Aulacoseira cremolata* 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 Pláničský 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, Pláničský and Olšina pond, and Lipno I. reservoir near the village of Černá v Pošumaví. At these localities, the basic physico-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 chrysofites 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 cremulata* dominated the plankton of Pláničský. This species has very long T-shaped linking spines. *A. cremulata* 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. cremulata* 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 Smrčinský 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).

#### **Acknowledgements**

The authors would like to express their special thanks to Doc. RNDr. Tomáš Kalina, CSc. for his valuable advice and help with the use of transmission electron microscopy (TEM). We would also like to thank RNDr. Václav Houk for the determination of centric diatoms *Aulacoseira crenulata* and *Cyclostephanos invisitatus* and his comments on other centric diatom species. The work has been supported by the research project no. J13/98113100004 of the Czech Ministry of Education and by the FRVŠ grant no. 2355/2002.

#### **References**

- ASAUL, Z. I. (1975): Viznačnik evglenovích 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): Klúč 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 PFF UK, Benátská 2, Praha 2].
- KALINA, T.; NĚMCOVÁ, Y. & NEUSTUPA, J. (2000): Silica-scaled chrysophytes of the Czech Republic 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 Mollehnauer, 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 Mollehnauer, 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 Mollehnauer, 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 Mollehnauer, 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 Mollehnauer, 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., ŠEJNOHOVÁ, 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 Chaetophorales 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 Mollehnauer, 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* – Pláničský pond, *MPP* – Malý Pláničský pond, *vPP* – the vicinity of Pláničský pond, *aSS* – area of Smrčinský pond, *PNP* – pond in Nová Pec village

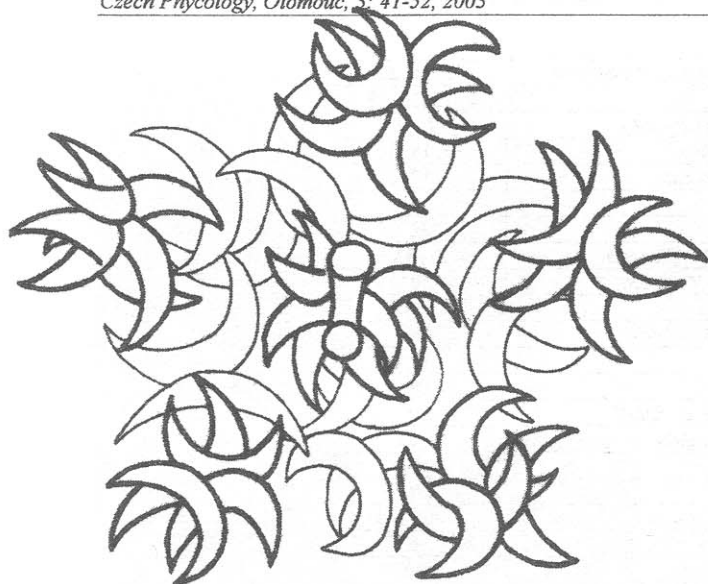
| No. | Loc. | Description   | Date  | Temp. (°C) | pH   | Cond. (µS.cm <sup>-1</sup> ) |
|-----|------|---|-------|------------|------|------------------------------|
| 1   | M    | squeezed <i>Sphagnum</i>  | 26.9. | 7          | 3,7  | 129                          |
| 2   | M    | sediment from peat-bog 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 Pláničský pond                                    | 27.9. | 8          | 6,88 | 220                          |
| 19  | MPP  | plankton from Malý Pláničský pond                               | 27.9. | 8          | 6,84 | 265                          |
| 20  | PP   | the growth on the dam of Pláničský pond                         | 27.9. | 8          | 6,88 | 220                          |
| 21  | MPP  | the growth on wetted stone in Pláničský stream                  | 27.9. | 8          | 6,84 | 265                          |
| 22  | MPP  | submersed tufts in Malý Pláničský 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 <i>Typha</i>                     | 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

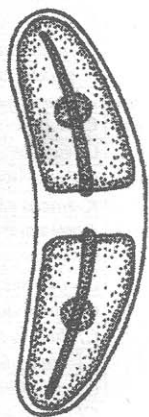
| Name  | Designation of localities |
|---|---------------------------|
| <b>Cyanophyta</b>   |                           |
| <i>Anabaena subcylindrica</i> BORGE   | 29                        |
| <i>Anabaena</i> sp.   | 15, 16                    |
| <i>Chroococcus turgidus</i> (KÜTZ.) NÄGELI  | 14  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

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

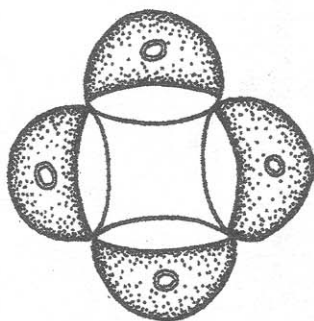




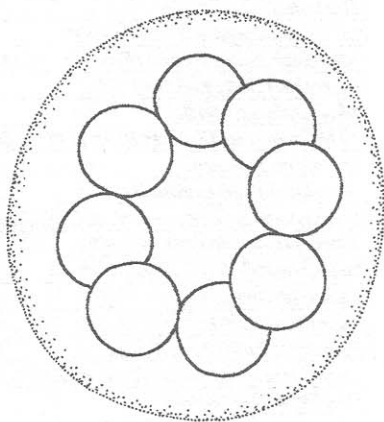
— 16



— 17



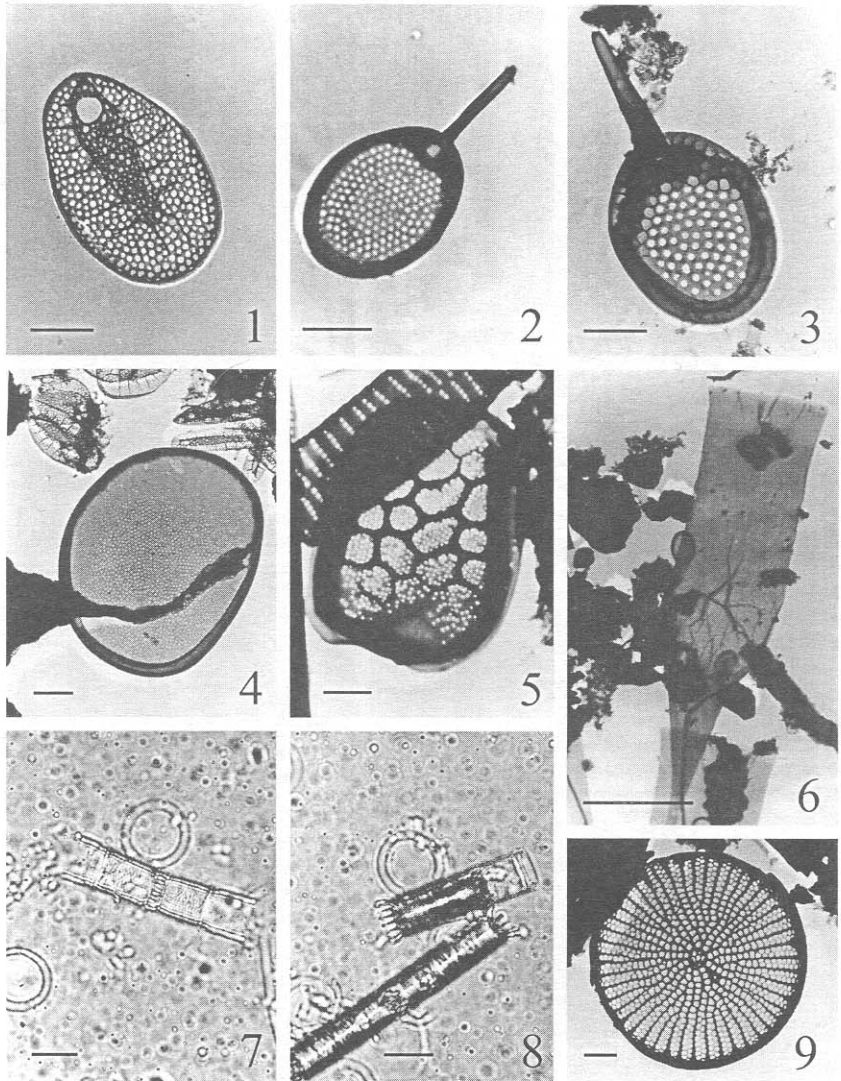
— 18



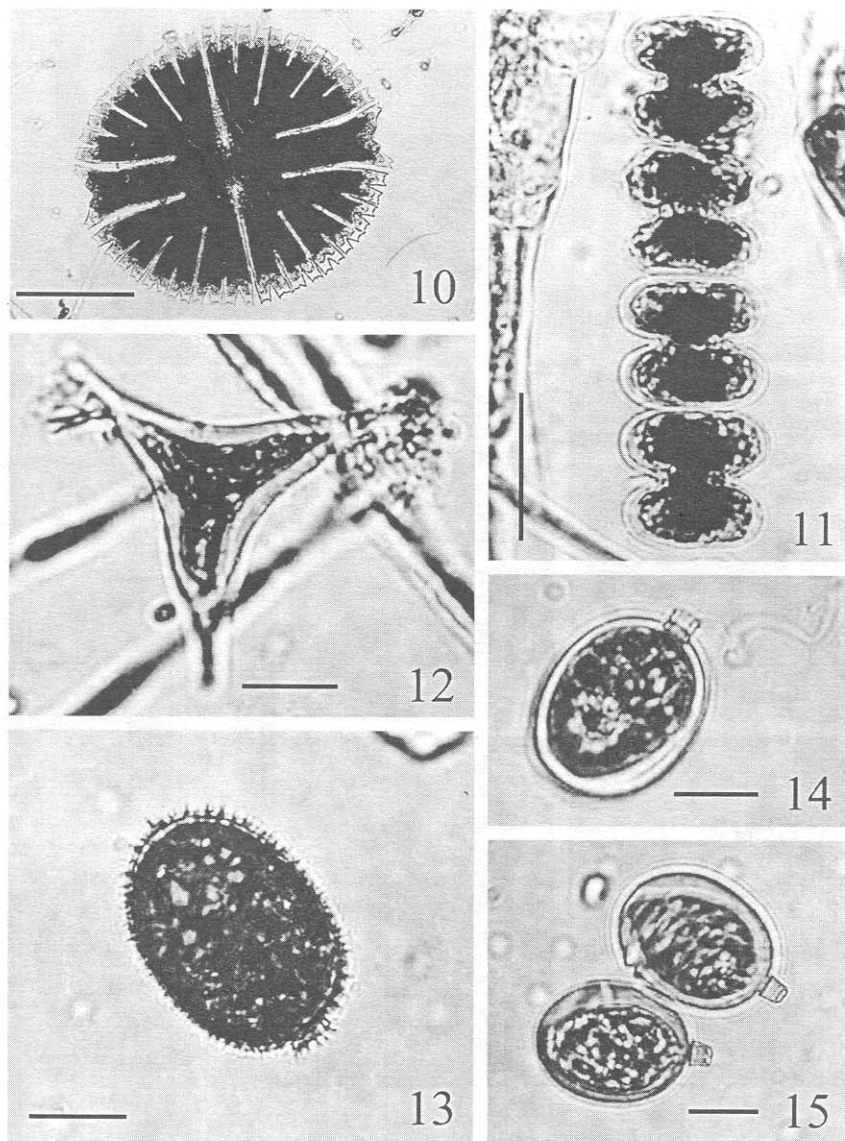
— 19

Figs 16 – 19. 16: *Ankistrodesmus gracilis*; 17: *Closterium pusillum*, 18: *Crucigenia quadrata*, 19: *Eutetramorus planctonicus*. (Bars: Figs 16, 17, 19: 10  $\mu$ m; Figs 18: 5  $\mu$ m)

|   |               |
|---|---------------|
| <i>Pediastrum boryanum</i> (TURPIN) MENEGHINI         | 15, 18, 20    |
| <i>P. duplex</i> MEYEN                                | 2, 15, 16, 18 |
| <i>Scenedesmus acuminatus</i> (LAGERH.)               | 17, 18        |
| <i>S. quadricauda</i> (TURP.) BRÉB.                   | 16, 18, 31    |
| <i>Ulothrix quaternaria</i> PLAYFAIR                  | 17            |
| <b>Charophyceae</b>                                   |               |
| <i>Coleochaete scutata</i> BRÉB.                      | 32            |
| <i>Klebsormidium flaccidum</i> (KÜTZ.) SILVA et al.   | 21, 33        |
| <i>K. nitens</i> (MEN. in KÜTZ.) LOKHORST             | 30            |
| <b>Zygnematophyceae</b>                               |               |
| <i>Closterium acerosum</i> SCHRANK ex RALFS           | 28            |
| <i>Cl. intermedium</i> RALFS                          | 35            |
| <i>Cl. limneticum</i> LEMM.                           | 16            |
| <i>Cl. lunula</i> (MÜLL.) NITZSCH ex RALFS            | 29            |
| <i>Cl. moniliferum</i> (BORY) EHRENB.                 | 19, 28        |
| <i>Cl. praelongum</i> BREB.                           | 35            |
| <i>Cl. pusillum</i> HANTZSCH.                         | 30            |
| <i>Cl. striolatum</i> EHRENB. ex RALFS                | 29            |
| <i>Cl. cf. striolatum</i>                             | 31            |
| <i>Cosmarium speciosum</i> LUND.                      | 28, 29        |
| <i>Cylindrocystis brebissonii</i> (MEN. ex RAL.) BARY | 3, 4, 10, 30  |
| <i>Euastrum verrucosum</i> EHRENB. ex RALFS           | 28            |
| <i>Mesotaenium caldariorum</i> (LAGERH.)<br>HANSGIRG  | 9             |
| <i>M. chlamydosporum</i> (BARY) BARY                  | 4, 6, 9, 13   |
| <i>Micrasterias americana</i> (EHR.) ex RALFS         | 35            |
| <i>M. rotata</i> GREV. ex RALFS                       | 35            |
| <i>Mougeotia sp. steril.</i>                          | 28            |
| <i>Netrium digitus</i> (EHR. ex BRÉB.) ITZ. & ROTHE   | 29            |
| <i>Spirogyra sp. steril.</i>                          | 16, 20, 28    |
| <i>Spirotaenia condensata</i> BRÉB.                   | 29            |
| <i>Spondylosium papillosum</i> W. & G. S. WEST        | 35            |
| <i>Staurastrum avicula</i> BRÉB. ex RALFS             | 16            |
| <i>St. cingulum</i> (W. & G. S. WEST) G. M. SMITH     | 16            |
| <i>St. dispar</i> BRÉB.                               | 28            |
| <i>St. inflexum</i> BRÉB.                             | 28            |
| <i>St. polytrichum</i> (PERTY) RAB.                   | 35            |
| <i>Staurodesmus dejectus</i> (BRÉB. ex RALFS.) TEIL.  | 15, 16        |
| <b>Flagellatae incertae sedis</b>                     |               |
| <i>Rhipidodendron huxleyi</i> 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  $\mu\text{m}$ ; Figs 6-8: 10  $\mu\text{m}$ )



Figs 10 – 15. 10: *Micrasterias rotata*; 11: *Spondylosium papilosum*, 12: *Goniochloris contorta*, 13: *Trachelomonas hispida*, 14 – 15: *Trachelomonas playfairii*. (Bars: Figs 10: 100  $\mu\text{m}$ ; Figs 11-15: 10  $\mu\text{m}$ )