Planktic Cyanobacteria of the Central and Northern Moravia

Planktonní sinice střední a severní Moravy

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Abstract

Phytoplankton of 51 fishponds and reservoirs of the Central and Northern Moravia were studied from August to September 2001. Selected ecological parameters were measured in situ (temperature, pH, conductivity, oxygen content). High distribution of *Planktothrix agardhii* and *Anabaena* spp. was found, other cyanobacteria were less represented.

Introduction

Planktic cyanobacteria were previously studied especially in South Bohemia and partly in South Moravia. Other regions of the Czech Republic are still little known from this of view. The importance of cyanobacteria is increasing because of their production of toxins and allergens. Central Moravia is characterizated by small and shallow fishponds of various trophic level. Some oligo- to mesotrophic fishponds without water blooms can be found in the Central Moravia (KITNER & POULÍČKOVÁ 2000), but the majority of Moravian fishponds tends to eutrophic or even hypertrophic status. These situations are caused by changes in the managment of the fish production and agriculture in surrounding countryside (PECHAR 1995). The compositon of cyanobacterial blooms is influenced by the increasing eutrophication SCHEFFER et al. (1997).

Material and Methods

Samples were collected during the occurrence of cyanobacterial water bloom at 51 localities from August to September 2001 (Map 1). Temperature, conductivity, oxygen and pH were measured „in situ“ using field instruments (Oxymeter GRYF 463, Cunductivity meter GRYF 106 L, pH meter LEYBOLD DIDACTIC GMBH). Samples were fixed by Lugol solution and by 2%

formaldehyde; cyanobacteria were identified in light microscope according to ANAGNOSTIDIS & KOMÁREK (1988), MARŠÁLEK et al. (1996), STARMACH (1966).

Results and discussion

The values of selected ecological parameters together with the occurrence of individual species are presented in table (Tab.1). The identified species are described in following review.

1. ***Microcystis aeruginosa*** (KÜTZ.) KÜTZ. 1846, Fig. 1

Microscopic or macroscopic colonies among structureless and diffluent mucilage, colonies ± spherical, elongated, irregular, with sharply limited openings. Cells spherical, 3-6 μm in diameter, with numerous aerotopes.

M. aeruginosa occurred only in 4 ponds, always forming dense water bloom. KERŠNER (1999) recorded this species as common at fishponds in Southern Moravia and Bohemia.

2. ***Microcystis viridis*** (A.BR.) LEMM.1903, Fig. 2

Microscopic, later macroscopic colonies from packed-like to irregular, clearly-three-dimensional, mucilage colourless, ± copying the margin of cell groups. Cells spherical, 3-7 μm in diameter, with aerotopes.

This species was found in 3 ponds with conductivity below 500 $\mu S.cm^{-1}$, similarly as *M. aeruginosa* and *M. flos-aquae*.

3. ***Microcystis flos-aquae*** (WITTR.) KIRCHN.1898, Fig 3

Microscopic or macroscopic colonies, from spherical to irregularly rounded without holes,with colourless mucilage, with irregular density of spherical cells, 2,5-5 μm in diameter.

M. flos-aquae is the most frequent representative of this genus in the Central and Northern Moravia. The water blooms were created only by this species at two sites Pavlov and Nová Hradečná.

4. ***Woronichinia naegeliana*** (UNGER) ELENK.1933, Fig. 4

Microscopic, later macroscopic colonies, spherical, elliptical and kidney-shaped. Cells oval, 5-7x2,5-3,5 μm in diameter, more or less radialy and denslly arranged, attached at the ends of mucilaginous tubular stalks. This species is present relatively often, but with the lower abundance then previous species.

5. ***Snowella lacustris*** (Chodat) KOM. et HIND. 1988, Fig 5

Spherical microscopic colonies, cells slightly elongated, 2-4x1,5-3,5 μm at mucilaginous, thin stalks, radially situated. This species was found at two localities in subdominant abundance.

6. ***Merismopedia glauca*** (EHRENB.) KÜTZ. 1845, Fig 6

Microscopic, flat colonies with oval or spherical cells, 3-6 μm in diameter, often from 16 to 64 cells per colony, regularly arranged, with slightly diffluent mucilage on the surface of the colony. It was found only in Žermanice reservoir in a low abundance.

7. ***Merismopedia punctata*** MEYER 1839, Fig 7

Flat, tabular colonies, often 64 celled, mucilage diffluent, colourless. Cells spherical or oval, 2,5-3 μm in diameter. It was found in 2 ponds, with the highest abundance at Bílá Lhota fishpond.

8. ***Planktothrix agardhii*** (GOM.) ANANG. ET KOM. 1985, Fig 8

Free living filamentous species, trichomes 4-6 μm wide, straight or slightly wavy-shaped, with cylindrical and ±izodiametrical cells. *P. agardhii* was found at 43% of investigated localities, mostly in high abundancy. The high values of pH and oxygen concentration were typical in these situations (pH~10, oxygen~20 $mg.l^{-1}$, Tab.1). Quantity of *Planktothrix agardhii* at Vrbice pond (conductivity 1357 $\mu S.cm^{-1}$) was lower then elsewhere. Generally, the common distribution of *P. agardhii* corresponds with the present trend in our shallow waters (PECHAR 1995).

9. ***Pseudanabaena limnetica*** (LEMM.) KOM. 1974, Fig. 9

Single trichomes, 1-2,5 μm wide, straight or wavy, cells cylidrical. This species was found in two ponds. It was found at Heřmanice pond with the high conductivity (1660 μS.cm-1).

10. ***Anabaenopsis elenkinii*** MILL. 1923, Fig. 10

Free living, trichomes desintegrated into shorter parts from half to two threads, with terminal hetrocysts. Cells from ellipticall to cylindrical 3-12x3-8 μm with many aerotopes. This species was identified from two samples with the low representation.

11. ***Anabaenopsis arnoldii*** APT. 1926, Fig. 11

Free living, trichomes sometime fragmented into shorter parts, disintegrating at interkalar heterocytes, with diffluent mucilaginous envelopes. Cells spherical, 9x6-10 μm, heterocytes spherical or slightly elongated, akinetes elliptical or oval. *A.arnoldii* was found in five ponds with the similar abundances as the previous species.

12. ***Anabaena flos-aquae*** (LYNGB.) BRÉB. ex BORN. et FLAH. 1888, Fig. 12

Trichomes regular to irregular coiled in colourless, diffluent and indistinct mucilage. Cells spherical or after division hemispherical with many aerotopes, 6-9 μm in diameter, heterocytes from spherical to elliptical, 5-10x4-10 μm, akinetes from oval to cylindrical 12-35x5-17 μm. This species was frequent especially in the Northern Moravia (protected landscape area Poodří).

13. ***Anabaena perturbata*** HILL 1976, Fig. 13

Trichomes from irregular to regular coiled in colourless, diffluent and narrow mucilage. Cells spherical with many aerotopes, 6-10 μm in diameter, heterocytes spherical 6-9x7-10 μm, akinetes oval, elongated or kidney-shaped 11-23x9,5-14 μm. It was found as the main species of this genus in the Northern Moravia, but it can be present elsewhere with other cyanobacteria.

14. ***Anabaena viguieri*** DENIS et FRÉMY 1923, Fig. 14

Trichome free living, straight without mucilaginous envelopes. Cells spherical, isodiameric, with brown aerotopes 3-10x5-9 μm, heterocytes spherical or shortly

elongated 4-10 μm in diameter, akinetes elliptical or oval 13,5-30x8-16 μm. This species was more frequent in the North of Moravia.

15. ***Aphanizomenon issatschenkoi*** (USAČ.) PROŠK.-LAVR. 1962, Fig 15

Trichomes free living, straight or slightly wavy, apical parts of trichomes narrow, pointed, straight or curved. This species was found in low abundancy at the locality Šumperk.

16. ***Aphanizomenon yezoense*** WATAN. 1991, Fig 16

Free living or in microscopic colonies, trichomes straightly or slightly wavy without distinct cell wall constrictions and mucilaginous envelopes. Cells 3-10x2-4 μm with small aerotopes, heterocytes cylindrical or oval 4-11x2-5 μm, akinetes created rarely, long and cylidrical, 31-49x5-7 μm. Rare at the same locality as *A. issatschenkoi*.

17. ***Aphanizomenon flos-aquae*** (L.) RALFS ex BORN. et FLAH. 1888, Fig 17

Trichomes in long macroscopic colonies, from 5 to 20 mm. Cells cylindrical, in centre of a trichom isodiametric, with many aerotopes, 4-12x4-8 μm, terminal cells long cylindrical, without aerotopes, heterocytes elliptical or cylindrical 10-18x5-8 μm, akinetes long cylindrical, 40-200x6-11 μm. *A.flos-aquae* was present only at one pond (protected landscape area Poodří).

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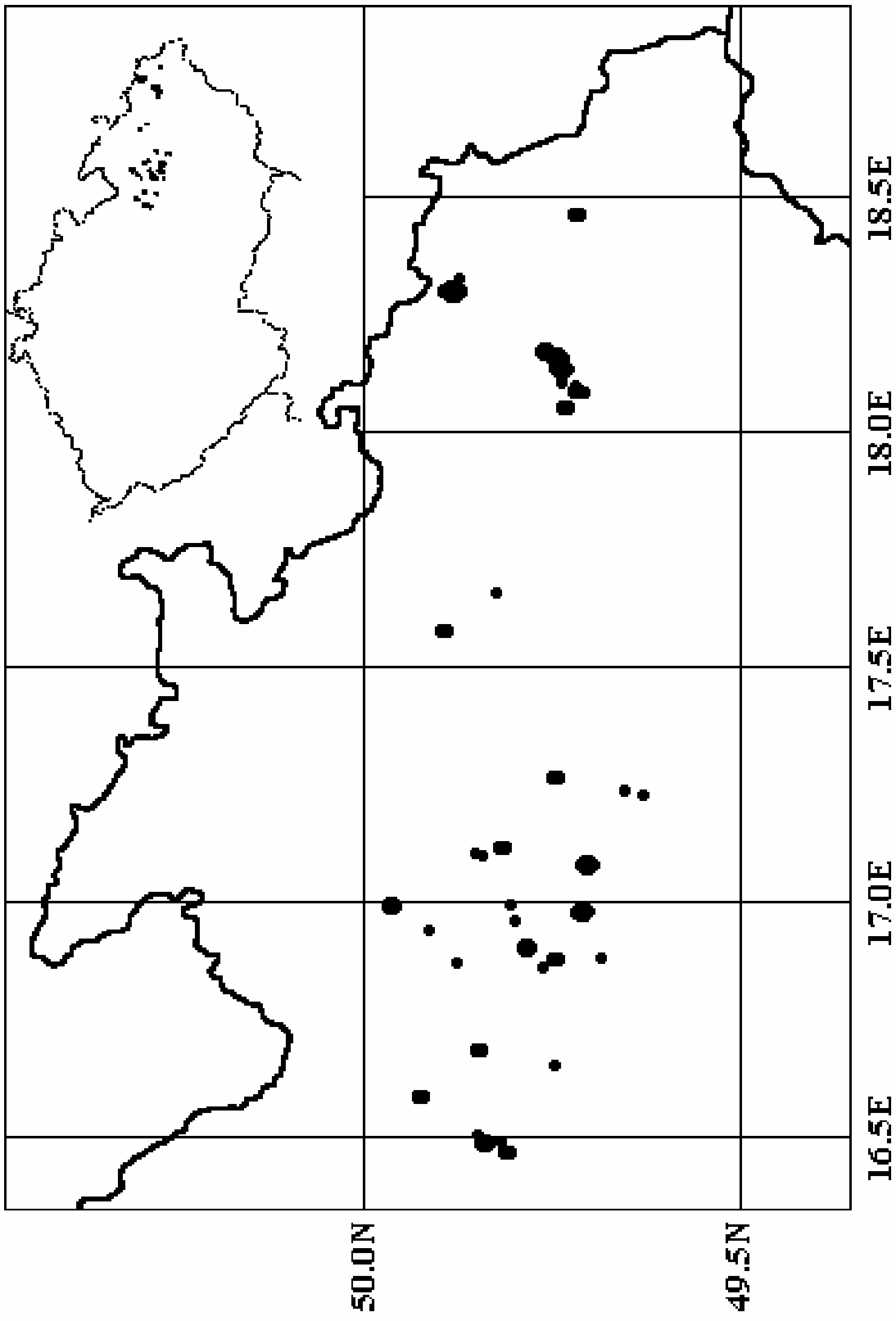

Map. 1: Distribution of investigated localities of the Central and Nothern Moravia

Table 1: Localities,their coordinates,selected ecological parameters and occurrence of individual taxa

Locality	**Location**	**t/°C**	**pH**	**H/µS.cm^{-1}**	**O_2/mg.l^{-1}**	*Taxon*
OPATOVEC[2]	49°48´N;16°28´E	16,7	7,56			8,12,
NOVÝ[2]	49°50´N;16°29´E	16,7	7,89			2,11
HVĚZDA[2]	49°50´N;16°30´E	16,5	7,45			12
OLŠOVÝ[2]	49°55´N;16°35´E	16,8	7,58			1,5
PROSTŘEDNÍ[2]	49°50´N;16°41´E	16,9	7,86			2,13
BORŠOV[2]	49°44´N;16°39´E	16,4	7,44			8
LÍŠNICE[2]	49°45´N;16°51´E	16,9	7,79	367	10,2	1
PAVLOV[2]	49°44´N;16°52´E	17,8	8,43	456	12,3	2,3
LECHOVICE1[2]	49°44´N;16°53´E	17,8	8,68	487	11,5	8
LECHOVICE2[2]	49°44´N;16°53´E	17,8	8,84	463	11,8	8
VRANOVÁ LHOTA[2]	49°42´N;16°49´E	17,3	7,54			1
BLÁŽOV[2]	49°41´N;16°53´E	17,4	7,83			8
KOVÁŘOV[2]	49°41´N;16°56´E	18,5	7,89			8
MĚNÍK[2]	49°42´N;16°58´E	18,4	8,05	465	9,8	8,12
LHOTA BÍLÁ[2]	49°42´N;16°58´E	24,8	9,82	400	20,1	7,8,12
LHOTA ČERVENÁ[2]	49°43´N;16°58´E	23,5	9,55	432	18,7	8
LITOVEL1[2]	49°42´N;17°04´E	18,9	7,44	489	9,7	8,9,14
LITOVEL2[2]	49°42´N;17°04´E	18,9	7,69	476	9,9	5,8,9,14
PODĚBRADY[3]	49°37´N;17°13´E	13,5	7,03	351	5,4	12
CHOMOUTOV[3]	49°39´N;17°14´E	13,4	6,97	258	3,8	12
KŘEMAČOVSKÝ[2]	49°47´N;16°54´E	20,4	7,87	458	10,8	8,10,11
ZÁBŘEH[2]	49°52´N;16°52´E	19,5	8,04	436	14,2	4
SUDKOV[2]	49°54´N;16°56´E	18,5	8,06	421	10,3	8
ŠUMPERK[2]	49°57´N;16°59´E	18,9	7,45	397	9,7	7,15,16
TŘEŠTINA[2]	49°47´N;16°57´E	22,1				8
POLICE[2]	49°48´N;16°59´E	23,1				1,8
NOVÁ HRADEČNA[2]	49°50´N;17°05´E	22,5				3
ŠUMVALD1[2]	49°48´N;17°07´E	22,9				4,8
ŠUMVALD2[2]	49°49´N;17°06´E	22,8				8
DOLNÍ LIBINA[2]	49°51´N;17°06´E	22,9				8
ŠTERNBERK[2]	49°44´N;17°15´E	22,3				3
KRUŽBERK[1]	49°49´N;17°39´E	22,5				4
SLEZSKÁ HARTA[1]	49°53´N;17°34´E	22,0				4,8
KAČÁK[2]	49°42´N;18°05´E	13,5	7,76	478	9,1	17
VELKÁ PODRÁŽKA[2]	49°42´N;18°05´E	13,8	7,82	361	9,3	8,13
BUDNÍ[2]	49°44´N;18°07´E	13,8	7,78	389	9,2	1,12
VELKÝ BDENÝ[2]	49°43´N;18°06´E	13,8	7,88	398	9,4	10,14
MALY OKROUHLÝ[2]	49°43´N;18°05´E	13,8	7,91	402	9,5	6,13,14
VELKÝ OKROUHLÝ[2]	49°43´N;18°06´E	13,8	7,95	398	9,4	8,12
SÍTINOVÝ[2]	49°43´N;18°07´E	13,9	7,89	387	9,5	8,12,14
PRŮTOCNÝ[2]	49°44´N;18°06´E	13,9	7,84	392	9,4	12
STARÝ[2]	49°44´N;18°08´E	13,9	7,98	384	9,5	3,8,12
POLÁRKOVÝ[2]	49°45´N;18°10´E	13,8	7,85	367	9,3	3,11
KŘIVÝ[2]	49°44´N;18°09´E	13,9	7,83	378	9,5	8,11,12,14
NOVÁ LOUKA[2]	49°43´N;18°03´E	13,9	7,96	395	9,4	11,12
AMERIKA1[3]	49°52´N;18°17´E	15,8	7,74	549	10,3	3,4,8,15
AMERIKA2[3]	49°53´N;18°18´E	15,8	8,06	552	9,9	8,13
AMERIKA3[3]	49°53´N;18°58´E	15,8	8,13	951	9,2	9
VRBICE[3]	49°52´N;18°18´E	15,6	8,27	1357	7,8	8
HEŘMANICE[2]	49°52´N;18°19´E	15,8	8,25	1660	8,2	9
ŽERMANICE[1]	49°43´N;18°27´E	14,7				6,13,14

[1] reservoir, [2] shallow lake, [3] gravel-pit

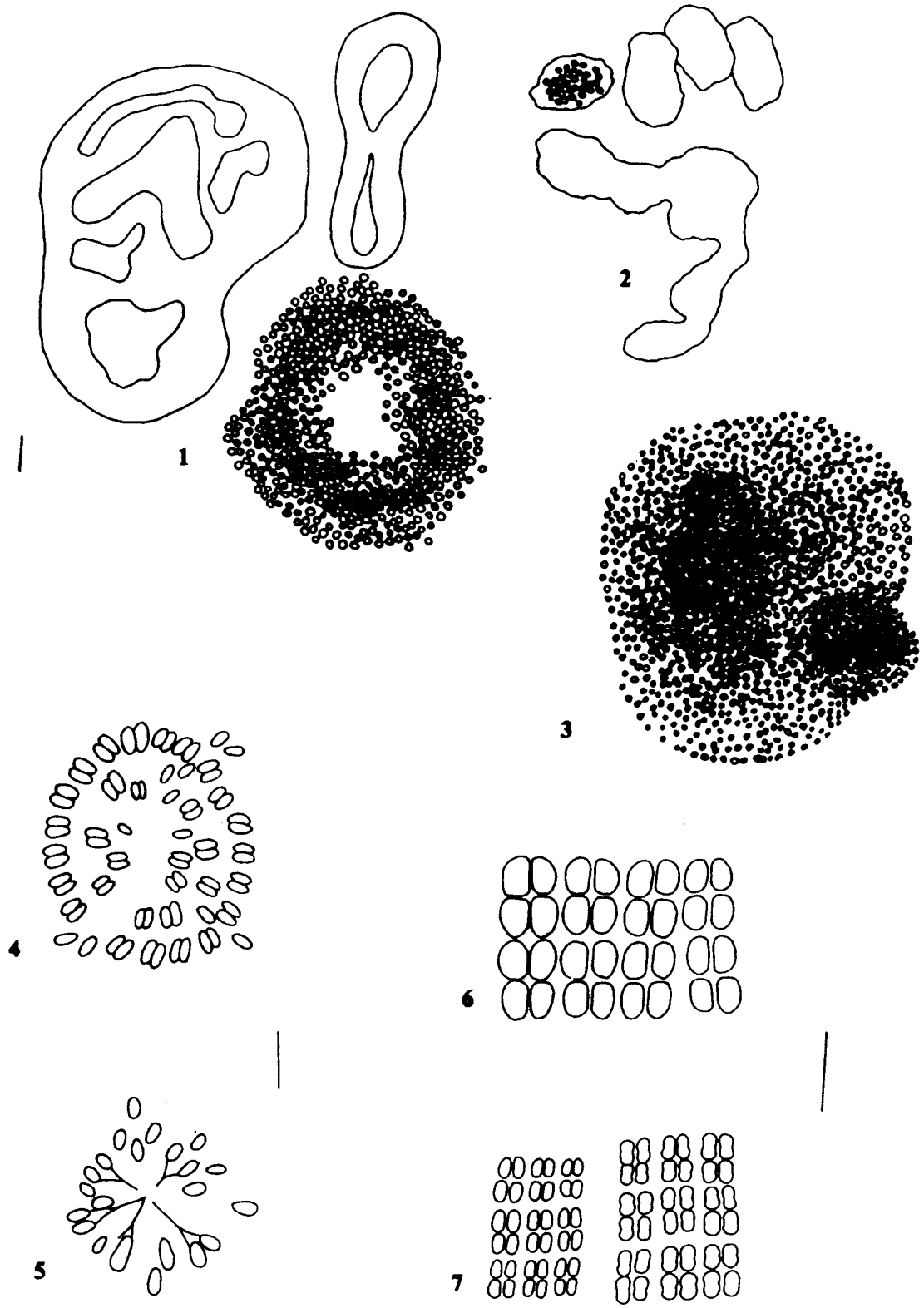

Fig. 1 – *Microcystis aeruginosa*, 2 – *M. viridis*, 3 – *M. flos-aquae*, 4 – *Woronichinia naegeliana,* 5 – *Snowella lacustris*, 6 – *Merismopedia glauca*, 7 – *M. punctata*
(bar 10 μm)

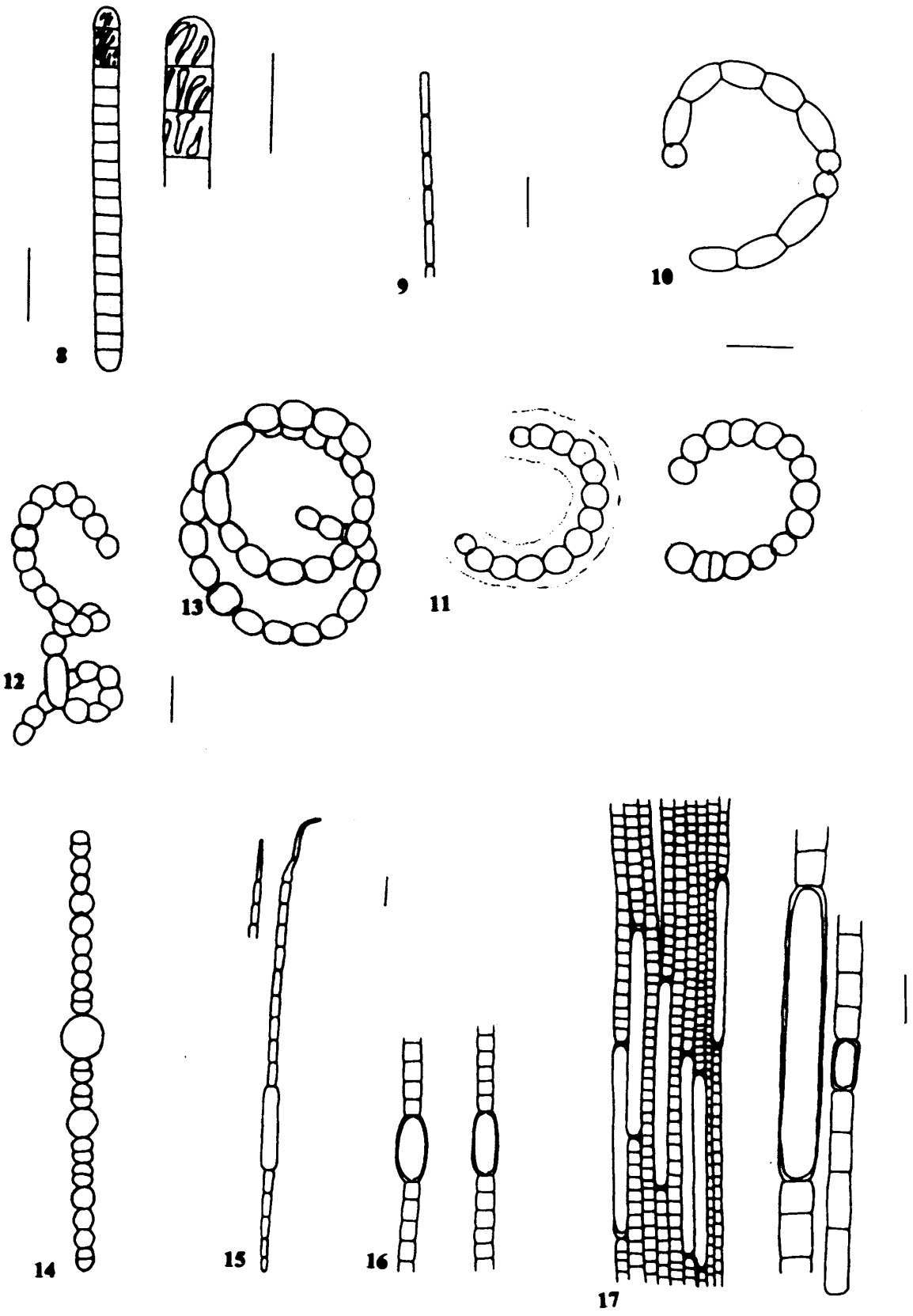

Fig. 8 – *Planktothrix agardhii*, 9 – *Pseudanabaena limnetica*, 10 – *Anabaenopsis elenkinii*, 11 – *Anabaenopsis arnoldii*, 12 – *Anabaena flos-aquae*, 13 – *A. perturbata*, 14 – *A. viguieri*, 15 – *Aphanizomenon issatschenkoi*, 16 – *A. yezoense*, 17 – *A. flos-aquae*
(bar 10 μm)