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A NEW FLORISTICAL SURVEY OF THE ALGAL FLORA OF THE BABAT VALLEY, HUNGARY

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During a recent algological survey, carried out in 2001 at 6 small ponds of the Babat valley near Gödöllő, central Hungary, 209 taxa were recorded, of which 122 are new records. Two of the ponds (Nos 10–11) are semi-natural, in these we identified 65 and 91 algae, respectively. Adjacent to the shore of two other ponds (Nos 8–9) goose breeding is going on, with 56 and 41 taxa recorded in these manure-polluted ponds. The polluted water from these ponds runs directly to two further (lower) ponds, with 85 and 66 taxa identified, respectively. Several diatoms appear to be new for the flora of the Babat farm, which is attributed to the methodological differences between an earlier study and the recent survey. Surprisingly, *Cylindrospermopsis raciborskii*, the very common, toxic cyanobacteria, was found only in one, semi-natural pond having a unique, diverse alga flora. *Chara canescens* was found in the upper pond in the spring.

Key words: algal flora, Babat valley, nature conservation

INTRODUCTION

The Babat valley, with the Aranyos stream flowing through it, is situated near Gödöllő, central Hungary (Fig. 1). Between 1930 and 1940, 11 dams were built to create a number of small ponds. The algae of the Babat valley have attained special significance of algologists and hydrobiologists in Hungary. At the end of the sixties and the beginning of the seventies Lajos Hajdu conducted here a case study for developing and the application of new statistical methods, e.g. diversity indices and cluster analyses. He examined the phytoplankton in two "fishponds" ("No. 8" and "No. 10" in his work) month by month during the year of 1969. At that time both ponds were 2.0–2.5 m deep at their deepest point, their surface was around 2 hectares each. During his qualitative analyses 191 algae taxa were identified, but with accessory investigation the number of taxa increased to 229. His results were presented in several publications (HAJDU 1974, 1976, 1977*a*, *b*, 1978*a*, *b*). Further reports with new data were published by HEGEWALD et al. (1975, 1981).

The present work is part of a new botanical and zoological survey of the Babat valley organised by the Institute of Environmental Management of Szent István University in 2001 and aimed at compiling a record of the algae living in the ponds, and to estimate the diversity of this flora. Here we provide a floristical overview based on the investigation conducted in 2001.

The area is part of the conservation land called Gödöllő Hills Landscape Protection Area (231/TK/90) administered with the auspices of the Duna–Ipoly National Park.

MATERIAL AND METHODS

The study area

Instead of names, the ponds were given numbers at the time of construction (Fig. 1). The uppermost one was marked as No. 11, and the lowest one No. 1. Due to the changes in the landscape, today only 9 ponds are there (and figured on the maps), but the old numbers are used: the two lowest ponds having No. 3–4 and No. 1–2, respectively.

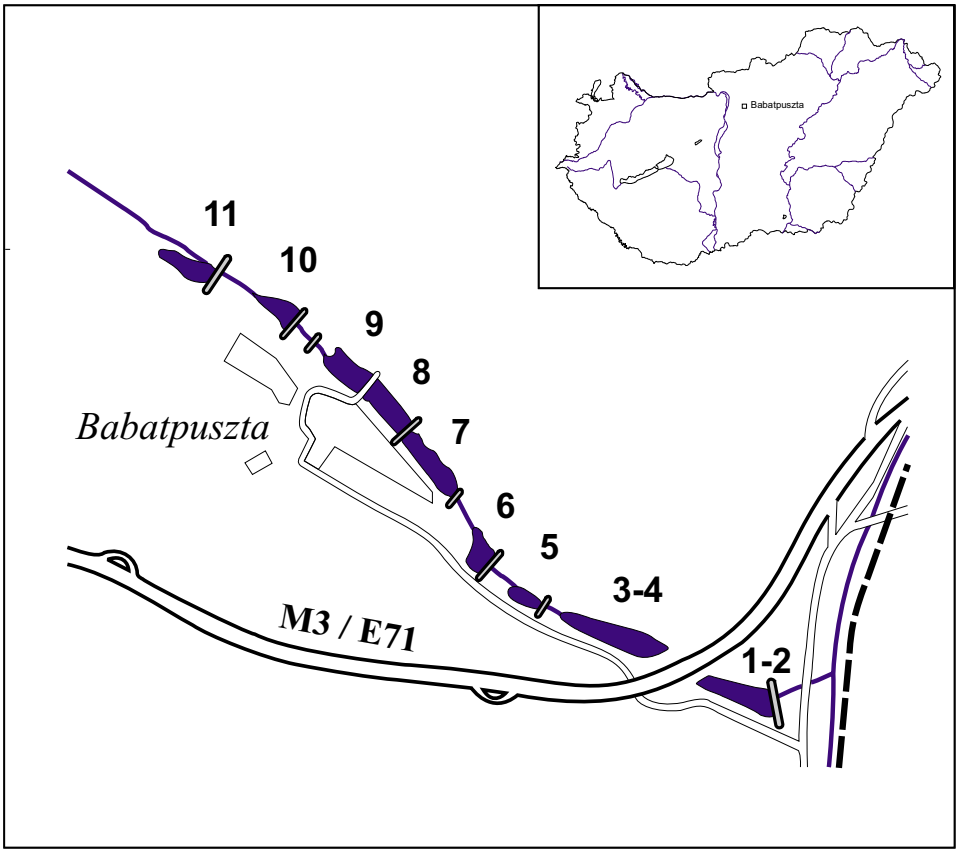

Fig. 1. Location map of the studied area.

The uppermost ponds (Nos 10 and 11), surrounded by *Salix* spp., *Populus* ssp. and *Alnus glutinosa*, form a semi-natural habitat. Next to the shores of the ponds Nos 8 and 9 goose breeding takes place all year round. Here, *Phragmites australis* and *Typha* ssp. are living in the littoral zone of the ponds, but near the goose breeding place a considerably long section of the shore is covered by concrete. The water of these ponds is fertilised by manure of goose. The water of Aranyos stream flows from pond to pond, so the lower part of the pondsystem is also effected by the goose farm.

The following names will be used for the ponds: No. 11 = Upper Pond, No. 10 = Alder Swamp Pond, No. 9 = Upper Goose Pond, No. 8 = Lower Goose Pond, No. 3–4 = Angler Pond, and No. 1–2 = Lower Pond.

Methods

Alga samples were collected tree times in 2001 (11.03.2001, 18.05.2001 and 28.07.2001). Attached algae from different substrata (*Phragmites*, *Carex* sp., *Typha* sp., different branch pieces, *Ceratophyllum* sp., *Lemna*, mosses, e.g. *Drepanocladus, Chara* sp., etc.), alga mats as well as phytoplankton samples were collected, to examine as many algae habitats as possible.

For identification the following monographs and books were consulted: ANAGNOSTIDIS and KOMÁREK 1985, 1988, FELFÖLDY 1972, 1985, GRIGORSZKI et al. 1999, HINDÁK 1996, KOMÁREK 1974, KOMÁREK and ANAGNOSTIDIS 1989, 1999, KRAMMER and LANGE-BERTALOT 1986, 1988, 1991*a*, *b*, SCHMIDT and FEHÉR 1998, 1999, and NÉMETH 1997*a*, *b*. MOORE's handbook (1986) was used for the identification of *Chara canescens*, and it was verified by KRAUSE's work (1997). Due to difficulties in the identification of filamentous algae (in every algal phyllum) and the Centrales (Chrysophyta) group the present survey is not complete.

Laboratory methods

Each sample was preserved by formaldehyde solution (end concentration 2–4%). Permanent diatom slides were made, these treated with H_2O_2, then the preparata were embedded into Styx. The samples and permanent slides have been deposited in the Collection Algarum of the Botanical Department of the Hungarian Natural History Museum (BP) and marked with the following collecting numbers: 2001/1–2001/14, 2001/33–2001/49, 2001/70–2001/82.

RESULTS AND DISCUSSION

Total number of identified taxa is 209 (Cyanobacteria: 25, Heterocontophyta: 93, Dinophyta: 4, Cryptophyta: 1, Euglenophyta: 21, Chlorophyta: 65) (Table 1). Most taxa belong to the diatoms, highly characteristic for the attached algal flora. 65 taxa come from the Chlorophyta. Interestingly, Lajos Hajdu in 1969 found most taxa belonging to Chlorophyta (115), with the genus *Scenedesmus* being the mostly represented. The differences in the distribution of taxa are due to the differences of the basic concept and methods of sampling: Lajos Hajdu worked only with phytoplankton, while my work focused on a different habitat. The phyto-

Table 1. The list of alga taxa were found in ponds at the Babat valley (A = 11.03.2001, B = 18.05.2001, C = 28.07.2001). Exclamation mark (!) indicates the new occurrences to the Babat valley.

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
CYANOBACTERIA																		
!*Chroococcus minor* (Kütz.) Naeg.	*						*											
!*Chroococcus minutus* (Kütz.) Naeg.		*	*									*	*	*				
Chroococcus turgidus (Kütz.) Naeg.	*			*						*						*		
!*Merismopedia glauca* (Ehr.) Kütz.		*																
!*Merismopedia minima* Beck.			*															
!*Merismopedia punctata* Meyen	*																	
Microcystis aeruginosa Kütz.					*					*	*	*		*	*			*
Microcystis flos-aquae (Wittr.) Kirchn.			*		*	*			*									
Anabaena circinalis Rabh.																		*
!*Anabaena spiroides* Kleb.					*													
!*Cylindrospermopsis raciborskii* (Wolosz.) Seenayya et Subba-Raju					*													
!*Limnothrix planctonica* (Wolosz.) Meffert	*	*													*			
!*Lyngbya hyeronymusii* Lemm.														*				
Oscillatoria limosa Agh.										*			*					
!*Phormidium chalybeum* (Mert. ex Gom.) Anagn. et Kom.									*						*			*
!*Phormidium irriguum* (Kütz.ex Gom.) Anagn. et Kom.	*																	
Phormidium mucicola Naum. et Huber-Pest.									*									
!*Phormidium tenue* (Ag. ex Gom.) Anagn. et Kom.													*	*				
Planktolyngbya subtilis (W. West) Anagn. et Kom.			*		*	*					*	*		*				
!*Planktothrix raciborskii* (Wolosz.) Anagn. et Kom.																		*
Psedanabaena limnetica (Lemm.) Kom.				*												*		
Pseudanabaena articulata Skuja		*																
Pseudanabaena cateneta Lauterb.		*					*			*			*	*	*	*	*	
Spirulina laxa Smith	*			*								*						
Spirulina subtilissima Kg.																		*

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
HETEROCONTOPHYTA																		
Bacillariophyceae																		
Acanthoceras zachariasii (Brun) Simonsen														*				
!*Achnanthes hungarica* (Grun.) Grun.										*	*	*	*	*	*	*		*
!*Achnanthes lanceolata* (Bréb.) Grun. ssp. *lanceolata*	*		*	*		*	*	*	*					*				
!*Achnanthes lanceolata* (Bréb.) Grun. ssp. *frequentissima* Lange-Bert.	*			*														
!*Achnanthes minutissima* Kütz.	*	*	*	*	*	*										*		
!*Achnanthes ploenensis* Hust.				*														
Amphora ovalis (Kütz.) Kütz.	*	*		*														
!*Amphora pediculus* (Kütz.) Grun.	*						*		*							*	*	
!*Amphora veneta* Kütz.					*	*			*	*	*	*	*	*	*	*	*	
Anomoeoneis spaerophora (Ehr.) Pfitzer													*	*	*		*	
!*Aulacosiera italica* (Ehr.) Sim.																		*
Aulacosiera sp.													*					
Caloneis bacillum (Grun.) Cleve			*	*														
Caloneis silicula (Ehr.) Cleve				*														
Centrales sp.								*		*								
!*Cocconeis placentula* Ehr. var. *placentula*	*	*		*	*	*				*	*	*						*
!*Cocconeis placentula* Ehr. var. *klinoraphis* Geitler												*						
!*Cyclotella meneghiniana* Kütz.		*	*		*				*	*		*		*	*		*	*
!*Cymbella affinis* Kütz.															*			
!*Cymbella amphicephala* Naeg.	*																	
!*Cymbella cistula* (Ehr.) Kirchner	*	*	*													*	*	
!*Cymbella microcephala* Grun.	*	*	*															
!*Cymbella naviculiformis* Auerswald		*	*															
!*Cymbella subaequlis* Grun.	*						*											
!*Diatoma ehrenbergii* Kütz.								*										
!*Diatoma mesodon* (Ehr.) Grun.													*					
!*Diatoma tenuis* Agardh	*	*			*													

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
!*Diatoma vulgaris* Bory		*			*		*		*	*				*				*
!*Diploneis ovalis* (Hilse) Cleve				*														
!*Epithemia adnata* (Kütz.) Bréb.													*	*		*		
!*Epithemia turgida* var. *granulata* (Ehr.) Brun.					*	*												
!*Epithemia sorex* Kütz.																	*	
!*Eunotia bilunaris* (Ehr.) Mills				*	*													
!*Fragilaria bicapitata* Mayer																*		
!*Fragilaria biceps* (Kütz.) Lange-Bert.	*			*														
!*Fragilaria capucina* Desm. var. *capucina*	*		*													*	*	
!*Fragilaria capucina* Desm. var. *gracilis* (Oestrup) Hust.																*		
!*Fragilaria capucina* Desm. var. *mesolepta* Rabh.										*								
!*Fragilaria capucina* Desm. var. *rumpens* (Kütz.) Lange-Bert.				*														
Fragilaria crotonensis Kitton					*													
!*Fragilaria pinnata* Ehr.			*															
Fragilaria ulna (Nitzsch) Ehr. var. *ulna*	*	*		*						*	*			*	*		*	
Fragilaria ulna (Nitzsch) Ehr. var. *acus* (Kütz.) Lange-Bert.	*	*		*						*								
!*Gomphonema acuminatum* Ehr.	*	*								*				*		*		
!*Gomphonema angustatum* (Kütz.) Rabh.						*												
!*Gomphonema augur* Ehr.													*	*	*		*	
!*Gomphonema minutum* (C. Ag.) C. Ag.	*			*	*	*				?								
!*Gomphonema olivaceum* (Hornemann) Bréb.				*	*						*	*		*				
!*Gomphonema parvulum* Kütz.	*			*		*			*	*	*	*		*		*	*	
!*Gomphonema truncatum* Ehr.				*						*			*	*	*	*	*	
!*Hantzschia amphyoxis* (Ehr.) Grun.				*			*	*	*		*							
!*Melosira varians* Ag.											*			*				
!*Navicula accomoda* Hust.		*								*			*			*	*	
!*Navicula bacillum* Ehr.		*			*													
!*Navicula cincta* (Ehr.) Ralfs			*															
!*Navicula contenta* Grun.							*										*	

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
!*Navicula cryptocephala* Kütz.	*		*	*		*	*	*						*		*	*	
!*Navicula cuspidata* Kütz.													*	*	*			*
!*Navicula elginensis* (Gregory) Ralfs	*			*														
!*Navicula halophila* (Grun.) Cleve						*								*			*	
!*Navicula lanceolata* (Agardh) Kütz		*			*						*			*	*			
!*Navicula lenzii* Hust.											*			*				
!*Navicula mutica* Kütz.							*											
!*Navicula oblonga* Kütz.	*	*	*	*										*	*			
!*Navicula pupula* Kütz.	*			*														*
!*Navicula radiosa* Kütz.	*	*	*	*	*	*		*										
!*Navicula cf. saprophila* Lange-Bert. et Bonik											*							
!*Navicula cf. subminuscula* Manguin			*			*		*	*								*	
!*Navicula tripunctata* (O. Müller) Bory									*									
!*Navicula veneta* Kütz.	*		*		*				*			*						
!*Navicula viridula* (Kütz.) Ehr.						*				*	*					*		
Nitzschia acicularis (Kütz.) W. Smith	*	*														*	*	*
!*Nitzschia angustatula* Lange-Bert.	*																	
!*Nitzschia communis* Rabh.	*																	
!*Nitzschia dissipata* Grun.													*					
!*Nitzschia amphibia* Grun.	*			*	*	*		*	*		*			*		*		
Nitzschia palea (Kütz.) W. Smith															*		*	
!*Nitzschia perminuta* (Grun.) M. Peragallo	*																	
!*Nitzschia recta* Hantzsch												*						
!*Nitzschia sigmoidea* (Nitzsch) W. Smith									*									
Nitzschia sp.					*	*					*		*				*	*
!*Pinnularia gibba* Ehr.	*																	
!*Pinnularia microstauron* var. *brébissonii* Kütz. Mayer	*																	
!*Pinnularia viridis* (Nitzsch) Ehr.				*														
!*Rhopalodia gibba* (Ehr.) O. Müller		*			*	*							*				*	

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
!*Rhoicosphaenia abbreviata* (Agardh) Lange-Bert.	*																	
!*Stauroneis anceps* Ehr.		*																
!*Stauroneis phoenicenteron* (Nitzsch) Ehr.													*	*				
!*Stauroneis smithii* Grun.		*																
Stephanodiscus sp.										*	*	*	*	*				*
!*Surirella ovalis* Bréb.				*														
Chrysophyceae																		
!*Dinobryon sociale* Ehr.	*									*								
Xanthophyceae																		
Ophiocytium cochleare A. Br.		*																
DINOPHYTA																		
!*Peridinium cinctum* Ehr.	*	*	*		*													
!*Peridinium palatinum* Lauterb.		*																
!*Peridinium umbonatum* Stein	*	*																
Dinophyta sp.															*			
CRYPTOPHYTA																		
Cryptomonas sp.	*				*												*	
EUGLENOPHYTA																		
!*Colacium simplex* Hub.-Pest.													*					
Euglena acus Ehr.													*					
!*Euglena oxyuris* Schmarda													*					
Euglena spathirhyncha Skuja													*	*		*		
Euglena polymorpha Dang.				*								*						
!*Euglena spirogyra* Ehr.														*				

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Euglena tripteris (Duj.) Klebs													*			*		
Euglena sp.			*											*				
Lepocinclis conica (All. et Lef.) Németh															*			
Phacus caudatus Hübn.															*			
Phacus curvicauda Swir.			*															
Phacus hamatus Pochm.					*													
Phacus orbicularis Hübn.										*								
Phacus pyrum (Ehr.) Stein										*			*					
Strombomonas sp.?										*								
!*Trachelomonas crebea* Kellicott										*								
!*Trachelomonas granulosa* Swirenko									*	*								
!*Trachelomonas hispida* (Perty) Stein														*				
!*Trachelomonas oblonga* Lemm.										*							*	
Trachelomonas volvocina Stokes		*								*					*			*
Trachelomonas volvocinopsis Swir.														*				
CHLOROPHYTA																		
Actinastrum hantzschii Lagerh.									*									*
!*Ankistrodesmus bernardii* Kom.		*																
Ankistrodesmus falcatus (Corda) Ralfs	*																	
Ankistrodesmus gracilis (Reinsch) Kors.											*							
Chlamydomonas sp.	*									*						*		
Chloromonas rodhei (Skuja) Gerl. et Ettl															?			
Coelastrum microporum Naeg. in A. Br.		*																
Coelastrum pseudomicroporum Kors.									*									
Coelastrum sphaericum Naeg.		*												*				*
Crucigenia tetrapedia (Kirchn.) W. et G. S. West					*													
Dictyosphaerum pulchellum Wood										*								
Francea ovalis (Francé) Lemm.									*									

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Golenkinia radiata Chodat															*			
!*Gonium pectorale* O. F. Müll.		*																
Kirchneriella obesa (W. West) Schmidle			*						*								*	
!*Lobomonas ampla* Pasch.													*		*			*
Micractinium pusillum Fresenius							*	*	*	*					*			*
Monoraphidium arcuatum (Kors.) Hind.	*	*	*															
Monoraphidium contortum (Thur.) Kom.-Legn.									*			*			*			
Oocystis elliptica W. West.															*			
Oocystis lacustris Chodat			*		*							*						
Pandorina morum (O. F. Müll.) Bory															*			*
Pediastrum boryanum (Turpin) Meneghini			*						*						*			
Pediastrum duplex Meyen														*	*			
Phacotus lenticularis (Ehr.) Stein													*	*				*
Pseudocarteria peterhofiensis (Kisselev) Ettl																*		
!*Scenedesmus aculeato-granulatus* var. *bicaudatus* Hortobágyi															*			
Scenedesmus acuminatus (Lagerh.) Chodat var. *acuminatus* f. *acuminatus*	*		*							*	*				*	*		*
!*Scenedesmus acuminatus* (Lagerh.) Chodat var. *acuminatus* f. *maximus* (Uherkovich) Uherkovich														*				
Scenedesmus acuminatus (Lagerh.) Chodat var. *acuminatus* f. *tortuosus* (Skuja) Uherkovich																		*
!*Scenedesmus acuminatus* (Lagerh.) Chodat var. *tetradesmoides* G. M. Smith																*		
Scenedesmus acutus Meyen var. *acutus* f. *acutus*												*			*		*	*
!*Scenedesmus acutus* Meyen var. *acutus* f. *costulatus* (Chodat) Uherkovich											*							
!*Scenedesmus apiculatus* (W. et G. S. West)														*				
Scenedesmus arcuatus (Lemm.) Lemm.		*							*									
Scenedesmus armatus Chodat var. *armatus*		*																
!*Scenedesmus armatus* Chodat var. *suecicus* Uherkovich										*								
Scenedesmus costato-granulatus Skuja														*			*	*

Table 1 (continued)

Pond number	11			10			9			8			3–4			1–2		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Scenedesmus dispar Bréb.		*																
Scenedesmus ecornis (Ralfs) Chodat			*			*			*					*	*			
!*Scenedesmus gutwinskii* Chodat														*			*	
Scenedesmus opoliensis P. Richter									*	*				*				
Scenedesmus protuberans Fritsch et Rich									*					*	*			*
!*Scenedesmus quadricauda* var. *longispina* (Chodat) G. M. Smith f. *longispina*													*	*				
Scenedesmus quadricauda var. *longispina* f. *capricornus* (Skuja) Uherkovich														*			*	
Scenedesmus quadricuda (Turpin) Bréb.		*	*						*	*			*	*	*	*	*	*
Scenedesmus spinosus Chodat		*	*						*						*			*
Tetraedron minimum (A. Br.) Hansg.			*															
!*Tetraedron pentaedricum* W. et G. B. West									*									
Tetrastrum sp.							*											
Tetrastrum triangulare (Chodat) Kom.										*								
!*Closterium acerosum* (Schrank) Ehr.														*				
!*Closterium ehrenbergii* Meneghini					*	*												
!*Closterium incurvum* Bréb.			*		*													
!*Closterium limneticum* Lemm. var. *tenue* Lemm.			*		*											*		
!*Cosmarium humile* (Gay.) Nordst.					*	*												
!*Cosmarium ornatum* Ralfs			*		*	*												
!*Cosmarium undulatum* Corda var. *undulatum*		*				*												
!*Cosmarium undulatum* Corda var. *minutum* Wittr.															*			
Staurastrum sp.					*													
Klebsormidium flaccidum (Kütz.) Silva, Mattox et Blackwell														*				
Oedogonium sp.				*														
Spirogyra sp.	*				*									*	*			
!*Chara canescens* Desv. et Lois.		*																

plankton played marginal role in my study, since more interesting results were expected from the littoral algae communities.

This floristical study is a contribution to the knowledge of algal flora of the Babat valley. Compared to the records of a recent country survey, a comprehensive study of the algal flora of the Nature protection areas of Hungary (NÉMETH 2002), in the present article 122 of the full number of records (209) are new (Table 1).

In order to have a clearer picture of the overall algal flora of the area, it would be useful to make further comparisons our data with the earlier ones. Lajos Hajdu's results were based on a very thorough research, but these are hardly comparable with ours, since his approach and methodology (spatiality, time scale, sampling methods) were quite different.

In spite of the tough anthropogenic influence experienced in the study area, the algal flora of the ponds (even of the "Goose Ponds") is remarkably diverse. In this study the great variety of identified taxa could be attributed to the fact that the survey was conducted mainly in the littoral zone, where diatoms occur in large quantities and these were recorded as new for the flora of the ponds.

Upper Pond (No. 11)

With 91 taxa identified this undisturbed, shallow pond is the most "species rich" among the ponds in concern. The early spring sample was predominated by Cryptophyta taxa and diatoms, with abundant presence of *Achnanthes minutissima*, *Diatoma tenuis*, *Nitzschia communis* and *Nitzschia palea*. In May, *Chara canescens* was found in the lakeshore's shallow water, but it disappeared by July. *Cymbella microcephala* was the dominant diatom in the summer sample; this is often found among the attached algae, but rarely a dominant species in the periphyton. The presence of Dinophyta (*Dinobryon sociale, Peridinium cinctum, P. palatinum* and *P. umbonatum*) was characteristic for this pond in the time frame of the study.

Alder Swamp Pond (No. 10)

A 2-hectare pond back in 1969, its surface appeared small (almost without open water surface) especially during the first collecting trip. Presently the water surface is mosaicous, and the bed of the pond is largely covered by a moss species (*Drepanocladus aduncus*).

The algal flora of this pond is a unique one among those in the chain of ponds. It has diverse species composition, altogether 65 taxa, and remarkably, 18 taxa were found only in this "Alder Swamp Pond" but completely absent in the rest of

the ponds. *Closterium ehrenbergii, Cosmarium humile* (Zygnematales, Chlorophyta) can be mentioned as well as a *Staurastrum* species as some of the uncommon species. In March, *Oedogonium* sp. was found. *Eunotia bilunaris* is a noteworthy diatom; it is a common and character species of swamps at least in Hungary. *Rhopalodia gibba* individuals of huge size (up to 250 μm) were very peculiar in the microscopic view.

Surprisingly, *Cylindrospermopsis raciborskii*, the very common, toxic cyanobacteria, being quite often the mass forming species of water blooms, was found in this clear pond and only here, nowhere else in the Babat valley.

The Goose Ponds (Nos 8 and 9)

The smallest number of taxa per lake (41) was identified in the Upper Goose Pond (No 9). In spring, the dominance of flagellated algae and Chlorophyta was the most characteristic. In March, *Micractinium pusillum* was the dominant species in the ponds, while in summer *Microcystis aeruginosa* was a mass forming one, causing water bloom.

There is a small hole at the sluice gate of the Upper Goose Pond. The gate was made of concrete; inside the hole, on the concrete wall a thick brown layer was collected which mainly consisted of diatoms. The species composition of this sample reminded us the flora of cave entrances. Aerophytic species, *Hantzschia amphyoxis, Navicula mutica* and *N. contenta* was also identified, and *Nitzschia palea* was well represented in this layer.

Angler Pond (No. 3–4)

The dominance of flagellated algae is the main character of the algal flora of this pond. In summer, *Microcystis aeruginosa* caused water bloom. The presence of Chlorococcales (Chlorophyta) is also peculiar, experienced parallel with the decrease of diatoms. This is a well-known feature of eutrophic ponds and lakes.

Lower Pond (No. 1–2)

There are no significant differences between the flora of these and the upper (Angler Pond, No. 3–4) ponds. No surprise; the distance between the source of pollution and the inflow is short, and the amount of incoming water of the Aranyos stream is small. These factors are insufficient to absorb the effects of manure.

Anomoeoneis sphaerophora and *Navicula cuspidata,* the two big-size diatoms may be mentioned from the attached algal flora. *Epithemia sorex* was dominant.

During the collecting trip made in the summer this pond was almost completely dry. Aerophytic diatoms (e.g. *Navicula contenta*) have appeared on its shore line.

* * *

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