DIVERSITY OF PHYTOPLANKTON IN THE LEDNICE PARK

DIVERZITA FYTOPLANKTONU LEDNICKÉHO PARKU

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ABSTRACT

The Lednice Park consists of two ponds called the Zámecký and the Růžový ponds. A section of the Dyje River (Stara Dyje) also passes through the Park. Both ponds are characterized by high concentration of nutrients. To assess their current condition the phytoplankton communities and their biomass, physical and chemical factors of those ponds and also the Dyje River were investigated. In this paper, the mean seasonal cycles of phytoplankton abundance, community structure and species diversity are discussed. Seasonal cycles of microplankton and nanophytoplankton densities are also characterized by high frequency of *Microcystis aeruginosa* with fast increasing bloom especially in Zámecký pond. The highest densities of this species occurred in August and September. Despite the short time scale variability of phytoplankton density, composition and diversity recurrent followed an evidenced pattern.

Chrysophyta were the dominant phytoplankton in spring with showing highest density of centric genera in Růžový pond. *Stephanodiscous hanzschii* and *Cyclostephanos invisitatous* and *Cyclotella meneghiniana were most commen centric genera. Nitzschia hoflarian and Navicula gregaria* represent the pennales in the Dyje and Zámecký pond. With increasing temperature *Clostrium microprom, Senedesmus quadricauda*, and *Pediastrum duplex* were represent dominant chlorophyta division in Růžový pond. But *Microcystis aeruginosa, M. ichtyoblabe M. wesenbergii. M. flos-aquae, M. Viridsi* were dominant *in Dyje and* Zámecký pond.

ABSTRAKT

V lednickém parku se nacházejí dva rybníky Zámecký a Růžový. Parkem protéká i jedno rameno Dyje (Stará Dyje). Oba rybníky mají vysokou koncentraci živin. Byl sledován vliv průtoku na společenstva fytoplanktonu a jejich biomasu, fyzikální a chemické faktory obou rybníků i řeky Dyje. v práci je diskutován roční cyklus abundance fytoplanktonu, složení společenstva a jeho druhová diverzita. Roční cyklus mikroplanktonu a nanofytoplanktonu je charakterizován vysokou četností sinice *Microcystis aeruginosa* s rychlým rozvojem zvláště v Zámeckém rybníku. Nejvyšší hustota tohoto druhu se vyskytla v srpnu a v září. Přes krátké časové období sledování se opakovala variabilita hustoty fytoplanktonu a jeho druhové složení dle následujícího modelu. Na jaře dominující složkou fytoplanktonu byla Chrysophyta, nejvyšší hustota centrických rozsivek byla v Růžovém rybníku. Nejčetnějšími druhy zde byly

Stephanodiscus hantzschii, Cyclostephanos invisitatous a *Cyclotella meneghiniana*. V řece Dyji a v Zámeckém rybníku se vyskytovaly rozsivky *Nitzchia hoflarian* a *Navicula gregaria*. S rostoucí teplotou vody v Růžovém rybníku dominovaly Chlorophyta s druhy *Closterium microprom, Scenedesmus quadricaudata* a *Pediastrum duplex*. V řece Dyji a v Zámeckém rybníku však dominovaly ve stejném období sinice *Microcystis aeruginosa, M. ichtyoblabe, M. wesenbergii, M. flos-aquae, M. viridis*.

INTRODUCTION

Lednice park located in the southern Moravia. There are two ponds in this park with elevation about 160 m above sea level. The area of the Zámecký and Růžový ponds are 30.12 ha and 1.57 ha respectively. The Dyje River flowing through the park is the main water source of these ponds. This area is the most temperate area in the Czech Republic (Bana and Sukop, 1999). It lies on the lowest layer of sediment rock. Over this layer Jurassic limestone and dolomite occurs which influences the environmental condition of the region (Bayer and Bajkov, 1929). Literature reviews show that algal bloom and eutrophication is not new for the Lednice national park water bodies (Bayer and Bajkov, 1929; Zapletalek, 1932a, b; Jirovec, 1939). Water bodies in the Lednice Park (Zámecký and Růžový ponds) are used for fish culture. Since 2001 there has been slight reduction in fish stocking density and subsequent fertilizer application as the area is considered protected area.Although these measures have been taken but algal bloom and eutrophication are dominant phenomena in these ponds.

MATERIALS AND METHODS

Phytoplankton samples were taken at 3 sampling sites shown in figure 1. Sampling was carried out in two week intervals during the growth seasons of the year 2002 and 2003. A special modified bottle was used for sampling from zero depth (20 cm below water surface) to the bottom. Phytoplankton samples were fixed in Lugol and formalin (4%) solution separately. Samples were counted using an inverted microscope according to the standard methods. Secchi disc depth were determined at each sampling site. Concentration of dissolved oxygen were measured in the field using digital Oxygenmeter (Hanna- H1 9145). Air and water temperature and pH were determined using (Hanna- H1 9025C) digital instrument. BOD and COD were measured in the labrotory according to the standard methods (ASTM, 1996). The Canoco, Statistica 6 and Excel softwares were used for data analyzing.

Figure 1: Map of the study areas and sampling sites

RESULT & DISCUSSION

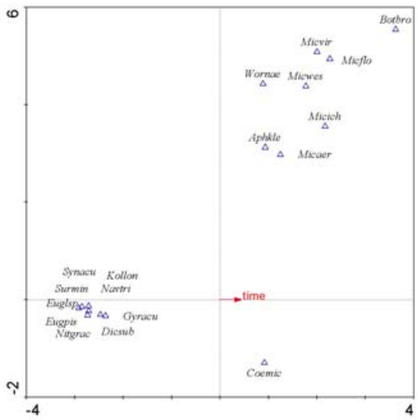
Physical and chemical parameters are shown in table 1. Seasonal distribution in ponds show high densities of Chrysophyta in early spring. Diatoms form more than 80% of the community of Chrysophyta. Chlorophyta showed the highest biomass in late spring and early summer. Community structure and biomass of phytoplankton in the Zámecký pond changes rapidly and phytoplankton specis belonging to Cyanophyta imediately start to form algal bloom. This event lasts untill the end of the September.

Table 1: Values of chemical and physical factors measured at 3 sampling localities during the growth season 2002- 2003

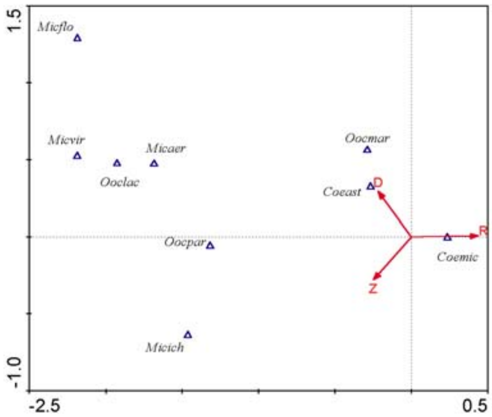
	Dyje			**Ružový**			**Zámecký**		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Temp. ^{o}c	5,4	25,2	17,7	5,1	25,2	18,4	5,3	25,2	18,4
Depth cm	70	110	90	75	85	80	50	110	83
Secchi depth (cm)	35	95	55	10	65	28	0	80	44
Sat.Oxygen %	35	265	76	45	234	117	37	145	79
DO (mg/l)	2,9	30,9	7,7	4,0	25,9	10,8	3,2	15,9	7,3
pH	7,55	9,6	8,34	7,88	10	8,67	7,64	9,65	8,58
COD (mg/l)	8	130	41	15	137	69	13	170	61
BOD (mg/)l	4	20	10	6	72	24	3	37	16

The main phytoplankton species involved in algal bloom are *Anabaena flos-aquae*, *Microcystis aeruginosa, M.ichtyoblabe M. wesenbergii*. *M. flos-aquae* and *Aphanocapsa incerta.* Detailed relation between phytoplankton and environmental factor are shown in Figure 2a. Algal flora of the Růžový pond showed considerably different developmental pattern in comparison to those of the Zamecky pond and the Dyje River. Althoug there was not specific spesies of phytoplankton in this pond but while chlorophyta had biomass of 50% in the Růžový pond its concentration in the Zámecký pond sometimes at the same time was zero. Statistic evalution depicted significant diffrences between phytoplankton species of the the Růžový pond with the Zámecký pond and Dyje (Figure 2b). Some of the chemical factors did not show such pronounced differnces.

Figure 2: a. CCA analysis of species with time b.CCA analysis of species in diffrent lokality. (For the spesies acronomy see Appendix 1).



a



b

To distinguish similarity of spesies present in diffrent lokality, the DCA analysis was showen present three grope during liner transect and in order to succession of community of phytoplankton was seen in lokality(Figure 3). First grop is *Tetrastrum glabrum, Lagerheimia genevensis, Monoraphidium arcuatum, Chroomonas caudata.* Second grop is *Pediastrum duplex, Pediastrum boryanum, Colastrum astroideand* . Third grop is *Microcystis aeruginosa, M.ichtyoblabe M. wesenbergii*. *M. flos-aquae* and *M. Viridis.* Index of diversity according to Shannon and equitability according to Sheldon were determined and the results are presented in figure 4.

Figure 3: Species distribution at different locality along the linear transects by DCA ordination.(For the species acronomy see Appendix1)

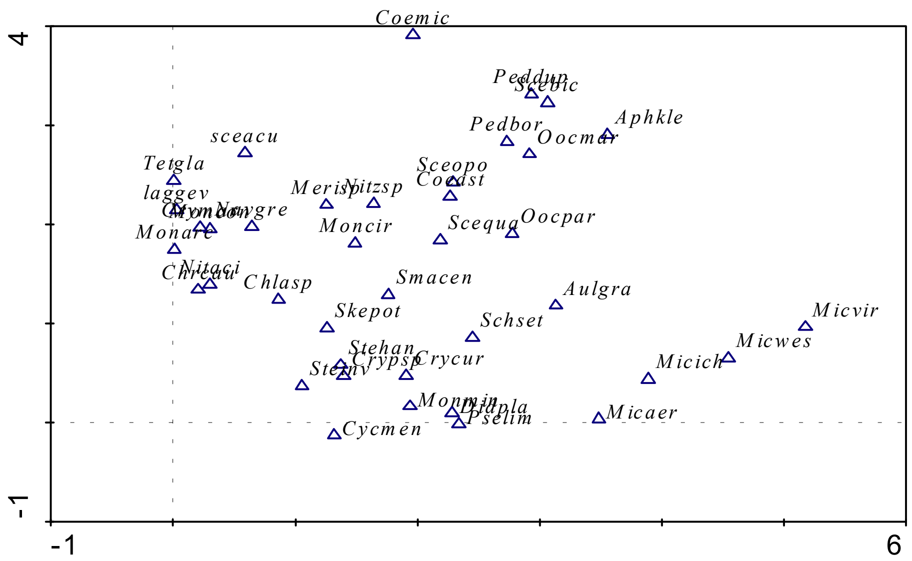
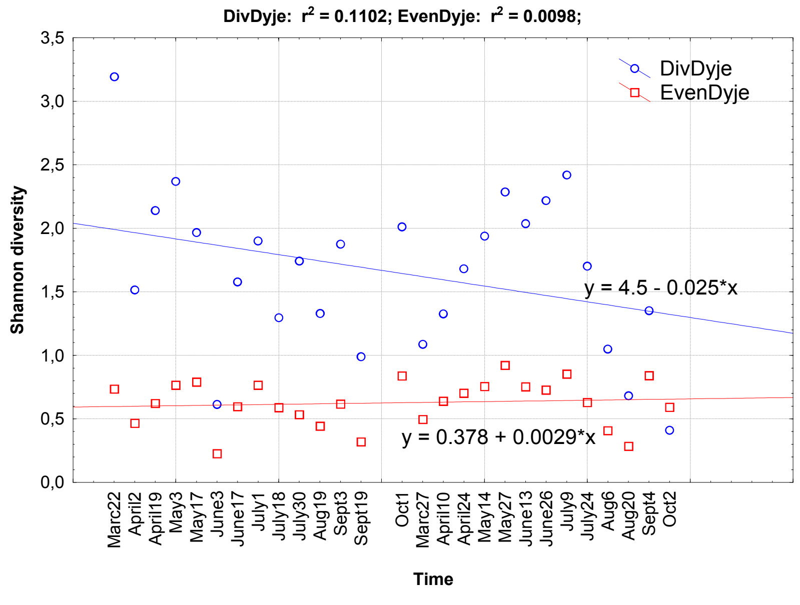
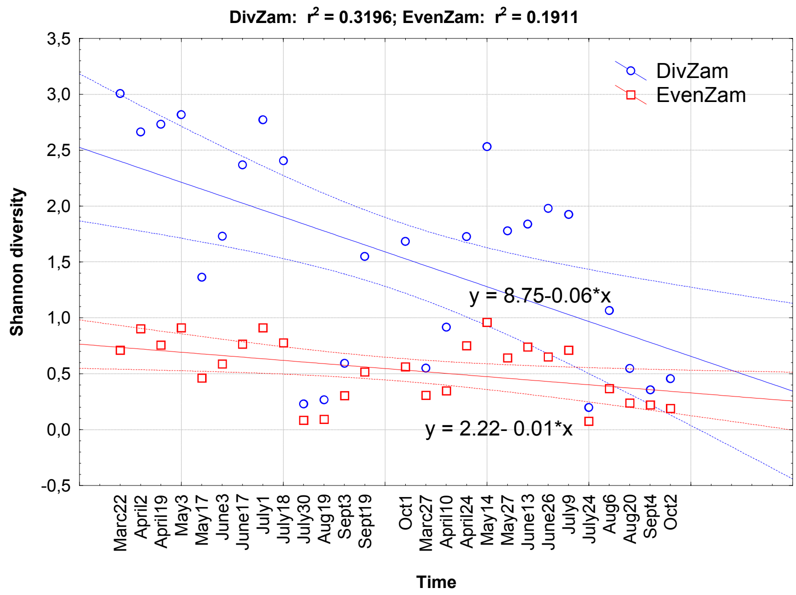
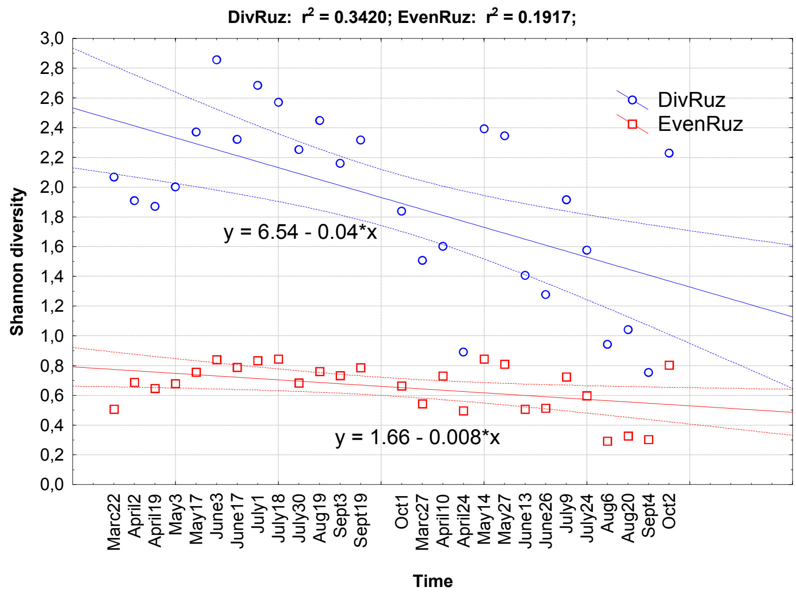


Figure 4: Index of diversity and equitability of the phytoplankton species at sampling sites







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Apendix 1:

Anabaena flos-aquae (Anaflo),
Aphanizomenon klebanii (Aphkle)
Aphanocapsa incerta (Apains)
Merismopedia tenuissima (Merten)
Botrycoccus brownii (Botbro)
*Microcystis aeruginosa (*Micaer)
M.viridis (Micvir)
Microcystis flos-aquae (Micflo)
M. Wesenbergii (Micwes)
Woronichinia naegeliana (Wornae)
M. Ichtyoblabe (Micich)
Coelastrum microporum (Coemic)
Koliella longiseta,(Kollon)
Synedra acus (Synacu)
Surirella minuta (Surmin)
Navicula tripunctata (Navtri)
Euglena sp. (Euglsp)
Euglena pisciformis (Eugpis)
Dictyosphaerium subsolitarium (Dicsub)
Gyrosigma acuminatum (Gyracu)
Nitzschia gracilis (Nitgrac)
Skeletonema potamos (Skepot)
Cyclotella meneghiniana (Cycmen)
Small centrales (Smacen)
Chroomonas caudata (Chrcau)
Cymbella minuta (Cymmin)
Coelastrum microporum (Coemic)
Monoraphidium arcuatum (Monarc)
Scenedesmus opoliensis (Sceopo)
Scenedesmus quadricauda (Scequa)
Tetrastrum glabrum (Tetgla)