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Plankton food web structure during cyanobacteria bloom in the highly eutrophic Lake Gineitiškės

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Plankton community structure (algae, bacteria, heterotrophic flagellates, ciliates, rotifers, crustaceans) was studied in the highly eutrophic Lake Gineitiškės during June–October 2004. In the warm vegetation period, cyanobacteria (especially *Microcystis* and *Anabaena*) dominated in phytoplankton both by the abundance (87–98%) and biomass (55–91%), while in the early summer a considerable part of the phytoplankton biomass (37%) was made by green algae (*Pediastrum*) too. Among metazoan plankton, rotifers were dominant in density throughout the whole study period, but cladocerans prevailed in the metazoan plankton biomass from June to August (in July also rotifers), while copepods and rotifers formed zooplankton biomass in October. The zooplankton biomass (1120.45 μg C l^{-1}), mainly ciliates and crustaceans, was highest in early summer and positively correlated with the highest amount of edible algae, whereas the abundance and biomass of cladocerans diminished 2–20 and of copepods 2–4 times during the mass development of cyanobacteria. Bacteria had the dominant role in the microbial loop, while heterotrophic flagellates' density was low during the study period. The proportion of different groups in the total heterotrophic organisms' biomass showed that herbivorous crustaceans did not control directly a larger part of phytoplankton biomass under cyanobacteria bloom conditions, and in this period the role of bacteria and rotifers in the organic carbon pool increases.

Key words: phytoplankton, microbial loop, metazoan plankton, highly eutrophic lake

INTRODUCTION

Phytoplankton is a primary producer of the new particulate organic matter in pelagic systems. This organic matter pool transfer to higher trophic levels can be performed both through the classic food chain – grazing algae by zooplankton – and by the way of microbial food web. Azam, Smith (1991) and Biddanda et al. (2001) have stated that the proportion of primary production that flows through the microbial loop, as opposed to direct utilization by metazoan grazers, is highest in oligotrophic and least in eutrophic environments. Although, Weisse et al. (1990) demonstrated that almost 50% of carbon passed through the microbial loop in a meso-eutrophic lake. The size of prevailing algal cells or colonies determines the efficiency of their incorporation into a food web and, therefore, influences the structure of zooplankton (Kosprzak, Lathrop, 1997). Gliwicz, Lampert (1993) and DeMott et al. (2001) have noted that large colonies forming cyanobacteria prevailing in phytoplankton reduce the amount of large filtrators, and simultaneously their significance in the transformation of primary production decreases. On the other hand, different species of cyanobacteria and succession phases of toxic cyanobacteria blooms may differently affect the microbial food web structure (Christoffersen et al., 2002; Engstrom-Ost et al., 2002; Moustaka-Gouni et al., 2006).

The high nutrient loading from the catchment area causes a massive development of cyanobacteria, leading to water bloom which is considered to be one of the most undesirable consequences of eutrophication. Kavaliauskienė (1996), Olenina (1998) and Kasperovičienė (2001) have reported cyanobacteria blooms in Lithuanian inland waters at the end of the last century. *Anabaena, Aphanizomenon*, *Microcystis*, *Planktothrix* species formed blooms mainly in shallow polymictic lakes. Several potentially toxic cyanobacteria species became more abundant and produced longer bloom periods during the last decades (Kasperovičienė et al., 2005). However, information on the plankton food web structure

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during cyanobacteria bloom in Lithuanian inland waters is rather scarce.

The aim of the present study was to examine the structure of plankton community (algae, bacteria, heterotrophic flagellates, ciliates, rotifers, crustaceans) and to evaluate a possible role of different plankton groups in the organic carbon pool during cyanobacteria bloom in the shallow highly eutrophic Lake Gineitiškės.

STUDY AREA AND METHODS

Study area. Lake Gineitiškės is located in the vicinity of Vilnius (SE Lithuania) and belongs to the small river Sudervė catchment (area 52.1 km^2) with a high level of human impact. Lake Gineitiškės is small, shallow (surface area 0.236 km^2, max. depth 3 m, mean depth 1.5 m) and surrounded by an urbanized area with individual homesteads and roads. According to previous hydrochemical-biological studies (Paviršinio…, 1995; Kavaliauskienė, 1996), Lake Gineitiškės was assigned to the hypertrophic type with low self-purification facilities.

Sampling and analysis. Ivestigations of the physical-chemical parameters and plankton groups were carried out in the euphotic zone of the central part (depth 2.5–2.7 m) of the lake during June–October 2004. Temperature, pH, conductivity, water transparency were measured *in situ* with a portable universal multiLine F/Set-3 meter (WTW) and Secchi disk; dissolved oxygen content was evaluated by Winkler's method. Nutrient and organic matter analyses were performed according to Merkienė and Čeponytė (1994). Chlorophyll *a* was extracted with 90% acetone and analysed spectrophotometrically (Jeffrey, Humphrey, 1975).

About 15 l of water was collected with a Ruttner sampler from the upper water column (0.5–1.0 m) into a plastic container, gently stirred and dispensed into individual vessels for the phytoplankton, bacterioplankton, flagellates, protozoa and metazoan plankton study.

Formaldehyde-preserved (4% final concentration) phytoplankton samples (1 l) were concentrated by sedimentation up to 20–30 ml (Starmach, 1989) and analysed with a Biolar light microscope (600×). Phytoplankton was counted in a Nageotte chamber (volume 0.05 cm^3) estimating over 500 counting units. Biomass was calculated from the cell number and specific volumes, and carbon biomass was recalculated using conversion factors (Olrik et al., 1998). The 40 µm size of algae cells and colonies was chosen to separate edible and inedible fractions following Akopian et al. (1999).

A study of heterotrophic flagellates (HF) was carried out within 2–3 hours after sampling. 50–100 ml of fresh sample was concentrated by gentle filtration (pore size 0.9 µm) up to 5–10 ml. Then HF were analysed similarly to the phytoplankton methodology with a light microscope.

Bacteria were enumerated under the epifluorescence microscopy after DAPI staining on black Millipore filters (pore size 0.2 µm) (Kemp et al., 1993). At least 200 bacterial cells on 20 fields of the filter were counted with an Olympus IX70 epifluorescence microscope (1000$^\times$). Carbon biomass was estimated using the conversion factor of 20 fg carbon / cell (Lee, Fuhrman, 1987; Loferer-Krößbacher et al., 1998). Bacterioplankton production was determined using the ^{3}H-thymidine (specific activity 52 Ci/mmmol, Amersham) uptake method (Fuhrman, Azam, 1982; Bell, 1993). Triplicate 10 ml samples were incubated for 30 min with 20 nM ^{3}H-thymidine at the in situ temperature, then preserved with formaldehyde, extracted with ice-cold TCA (5% final concentration) and filtered through 0.2 µm Millipore filters. Activity was measured with a liquid scintillation Beckman counter. The conversion factor of 2.0×10^{18} cells mol^{-1} thymidine was applied for the calculation of bacterial production.

Ciliates were studied within 2–3 hours after sampling. 100 ml of fresh sample was concentrated up to 10 ml by gentle filtration as described in Mazeikaite (1969). Live organisms were counted (in triplicates) in a Bogorov chamber under a binocular (MBS-1; 75×). A Biolar light microscope (600×) was used for species identification.

A formaldehyde-preserved (4% final concentration) metazoan plankton sample (2 l) was concentrated by sedimentation (up to 100 ml). Organisms were identified by light microscopy (600×) and counted in a Bogorov chamber using a binocular (Kiselev, 1969). Crustaceans were counted in the whole concentrated sample and while rotifers were checked in triplicates in part of the sample depending on their density. Ciliate and metazoan plankton fresh weight biomass was determined from the organisms' number and specific volumes. Carbon biomass of zooplankton groups was recalculated under assumption that the carbon content makes about 50% of the dry weight and dry weight makes about 15% of the fresh weight. Statistical analysis was performed using SPSS software.

RESULTS

Abiotic parameters. The main physical and chemical parameters determined during the warm vegetation period in Lake Gineitiškės are presented in the Table 1. Temperature of the upper water layer varied from 12.3 (in October) to 21.7 °C (in July). The water pH was alkaline in all the study period and ranged from 8.7 to 9.6. Water transparency values did not exceed 0.5 m, while the lowest (0.25 m) was in the most productive period (July–August). The mean value of total phosphor was 0.22 mg l^{-1}, but a deficiency of inorganic P was observed in summer. The mean values of total nitrogen reached 1.66 mg l^{-1} and of inorganic nitrogen 0.118 mg N l^{-1}. From the latter, nitrates prevailed, while ammonium ions were totally absent. The water of Lake Gineitiškės was contaminated with organic matter, the average $C_{org.}$ being 27.6 mg l^{-1} and BOD_7 over 7 mg O_2 l^{-1}.

Phytoplankton. Phytoplankton abundance ranged between 67.6 and 475.7×10^6 units l^{-1} and biomass values within 1748–7712 µg C l^{-1} throughout the study. The phytoplank-

Table 1. **Physical and chemical characteristics of Lake Gineitiškės, 2004**

Parameter	Sampling date			
	08.VI	**20.VII**	**16.VIII**	**05.X**
Transparency, S_h, m,	0.55	0.25	0.25	0.5
Temperature, °C	18	21.7	18.7	12.3
pH	9.2	9.6	8.7	8.9
O_2, mg/l	8.0	8.0	5.12	8.0
Conductivity, μS/cm	155	146	145	–
NH_4^+, mg N/l	0.0	0.0	–	0.0
NO_2^-, mg N/l	0.0	0.01	–	0.068
NO_3^-, mg N/l	0.125	0.088	–	0.064
$N_{min.}$, mg/l	0.125	0.098	–	0.132
N_{total}, mg /l	1.324	2.441	–	1.213
$P_{min.}$, mg P/l	0.0	0.0	–	0.056
P_{total}, mg /l	0.231	0.173	–	0.256
DOC, mg/l	22.6	36.6	–	23.5
BOD_7, mg O_2/l	6.5	>7,0	–	6.2
Chlorophyll *a*, μg/l	42.9	161.4	71.6	23.2

– no data.

ton abundance and biomass were the lowest in the beginning of June. Cyanobacteria made up to 55% of the phytoplankton biomass in which the genus *Microcystis* prevailed (Fig. 1, Table 2). The contribution of *Chlorophyceae* (especially *Pediastrum* spp.) to the phytoplankton biomass was also significant (37%) in this period. The relative biomass value of edible phytoplankton was also highest (38%) in comparison to the other study periods. Small-size *Pediastrum boryanum*, *Coelastrum astroideum* and *Scenedesmus* spp. prevailed in this fraction.

The maximum of phytoplankton abundance and biomass was observed in the middle of July and August. Cyanobacteria continued their absolute dominance from July to October, reaching up to 98% in abundance and 91% in total biomass (Fig. 1). Species from the genera *Anabaena* and *Microcystis* predominated in the biomass during different periods of cyanobacteria bloom (Table 2). *Anabaena* cf. *lemmermanii* (47.8%) and *Limnothrix redekei*, *Microcystis flos-aquae*

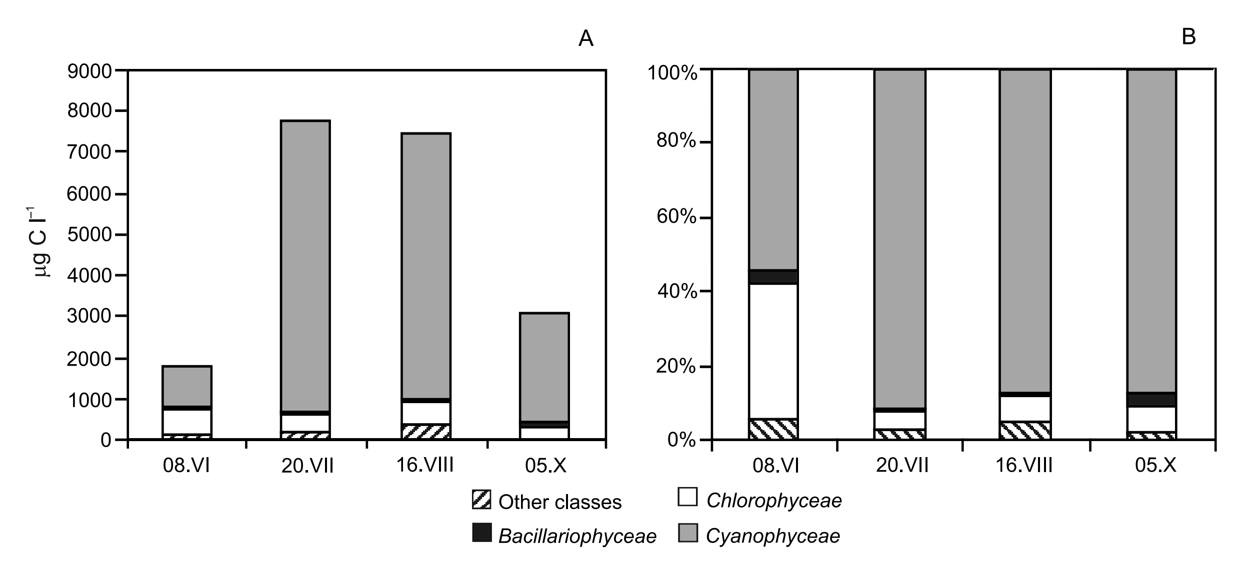

Fig. 1. Phytoplankton taxonomic groups in Lake Gineitiškės, June–October 2004
(A – total carbon biomass, B – relative contribution of taxonomic groups to the total carbon biomass)

Table 2. **Phytoplankton carbon biomass divided according to the size of fractions and dominating algae species in Lake Gineitiškės, 2004**

Date	Size fractions	μg C/l	Dominating species (percentage of biomass)
08.VI	<40 μm	672.20	*Microcystis viridis* (A. Braun) Lemmermann (20.1%), *Microcystis flos-aquae* (Wittrock) Kirchner (10.8%), *Pediastrum duplex* Meyen (9.1%), *Pediastrum boryanum* (Turp.) Menegh (8.0%), *Anabaena spiroides* Klebahn (6.4%)
	>40 μm	1083.60	
	Total	1755.80	
20.VII	<40 μm	648.80	*Anabaena lemmermanii* P. Richter (47.8%), *Limnothrix redekei* Van Goor (12.4%), *Microcystis flos-aquae* (Wittrock) Kirchner (11.3%), *Raphidiopsis mediterranea* Skuja (7.7%), *Microcystis wesenbergii* (Komarek) Komarek (5.9%)
	>40 μm	7070.80	
	Total	7719.60	
16.VIII	<40 μm	896.70	*Anabaena lemmermanii* P. Richter (23.6%), *Microcystis viridis* (A. Braun) Lemmermann (22.1%), *Microcystis flos-aquae* (Wittrock) Kirchner (13.5%), *Microcystis wesenbergii* (Komarek) Komarek (12.7%)
	>40 μm	6566.60	
	Total	7463.30	
05.X	<40 μm	468.10	*Microcystis wesenbergii* (Komarek) Komarek (29.2%), *Microcystis viridis* (A. Braun) Lemmermann (14.6%), *Planktothrix agardhii* (Gomont) Anagn. et Komarek (10.4%)
	>40 μm	2549.80	
	Total	3017.90	

dominated in July. In August, water bloom was caused mainly by *Microcystis* species (48%), whereas *Anabaena* cf. *lemmermanii* biomass was reduced to 23.6% of the total phytoplankton biomass. In October, phytoplankton abundance and biomass decreased by half; however, the relative values of cyanobacteria biomass in community remained as high as in the midsummer. The filamentous cyanobacteria *Planktothrix agardhii* joined the dominating *Microcystis* species in this period. In summer and autumn, large algae prevailed, whereas edible ones made up only 8–15% of the total phytoplankton biomass.

Microbial community. Microbial loop organisms (bacteria, heterotrophic flagellates, ciliates) comprised 10 to 25% of the total carbon of heterotrophic organisms (Fig. 2). The major part of the microbial biomass was contributed by bacteria, especially in the midsummer (up to 94%). The abundance values of bacteria in Lake Gineitiškės correspond to those of high trophic level water bodies, reaching their maximum (9.8 × 10^6 cells ml^{-1}) in July (Fig. 3). Bacterial production ranged between 3.27 and 89.67 μg C l^{-1} d^{-1}, reaching the highest values in summer (79.56–89.67 μg C l^{-1} d^{-1}). It should be noted that the density of heterotrophic flagellates was low throughout the whole study period, reaching the highest number in early summer.

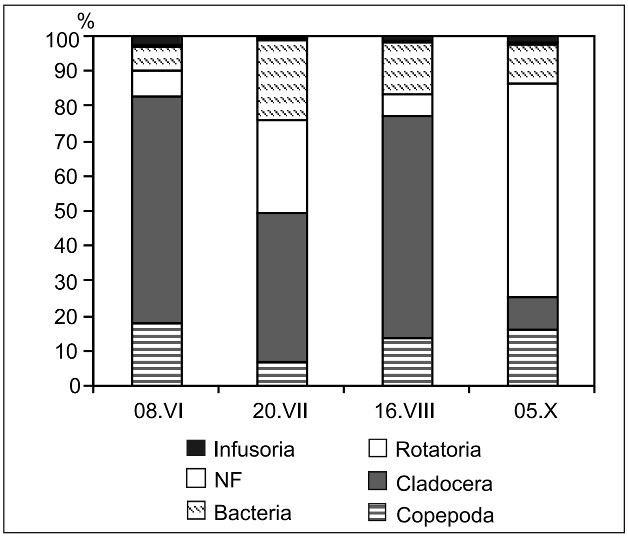

Fig. 2. Share of microbial community and metazooplankton in heterotrophic biomass in Lake Gineitiškės, June–October 2004

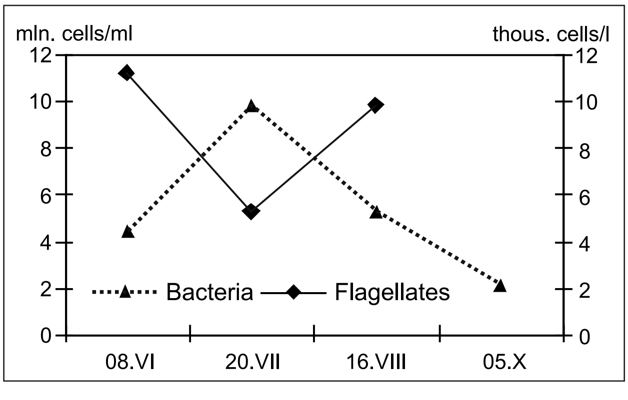

Fig. 3. Abundance of bacteria and heterotrophic flagellates in Lake Gineitiškės, June–October 2004

In Lake Gineitiškės, there were found 23 species of ciliates belonging to the classes *Oligohymenophorea*, *Prostomatea*, *Spirotrichea* and *Litostomatea*. In general, the species diversity of ciliates was relatively low, their abundance and biomass reaching 1.6–14 × 10^3 units l^{-1} and 7.0–35.3 μg C l^{-1}, respectively, with the maximum in early summer and the minimum in midsummer (Fig. 4). Bacterivorous *Epistylis anastatica*, *Epistylis rotans*, *Vorticella microstoma* (cl. *Oligohymenophorea*), histiophagous *Coleps hirtus* (cl. *Prostomatea*) and predacious *Spathidium spathula*, *Didinium nasutum* (cl. *Litostomatea*) prevailed, with differences in the dominating species complex during a particular period of investigation.

Metazoan plankton. Rotifers, cladocerans and copepods represented from 75% (in August) to 90% (in June) of the heterotrophic organisms' total carbon (Fig. 2). Rotifers were particularly abundant in the lake plankton during all the study period (abundance 1.6–5.6 × 10^3 ind. l^{-1}, biomass 39.6–219.8 μg C l^{-1}), reaching the highest values in July (Fig. 4). Predator species contributed the major part of rotifers' biomass (25–90%). In the early summer (in June), filter feeders rotifers *Keratella tecta, K. cochlearis* prevailed by abundance, while predatory *Trichocerca cylindrica* (48% of total rotifers biomass) by biomass. Predatory *Trichocerca birostris* as well as non-predatory *Keratella tecta* and *Filinia longiseta* were abundant in July and August, although the major contributors to rotifers' biomass (45%) were predators such as *Asplanchna priodonta* and *Trichocerca birostris*. In October, *Keratella tecta* dominated by abundance and *Asplanchna priodonta* by biomass. The abundance of cladocerans decreased from 635 ind. l^{-1} in June to 33 ind. l^{-1} in October and the biomass from 808.6 to 32.6 μg C l^{-1}, respectively (Fig. 4). The filtrating *Daphnia cucullata*, *Bosmina* sp., *Chydorus sphaericus* and *Ceriodaphnia* sp. formed the major part of biomass of these organisms. Similarly as in cladocerans, the abundance and biomass values of copepods were highest in June (585 ind. l^{-1} and 220.9 μg C l^{-1}), while the lowest values were observed in July (166 ind. l^{-1}and 53.1 μg C l^{-1}). Carnivorous cyclopoids (the genus *Mesocyclops*) and copepodites prevailed, making from 33% in August to 80% of copepods' biomass in July. It should be noted that the relatively small number of initial metazoan plankton samples could lead to a slight overestimation of large crustaceans' biomass.

A comparison of rotifers', cladocerans' and copepods' biomass showed that cladocerans prevailed in the metazoan plankton biomass from June to August (in July also rotifers), while copepods and rotifers formed zooplankton biomass in October (Fig. 2).

Relations between plankton groups. In Lake Gineitiškės, statistically significant relations were found between the biomass of zooplankton groups (ciliates, cladocerans, copepods)

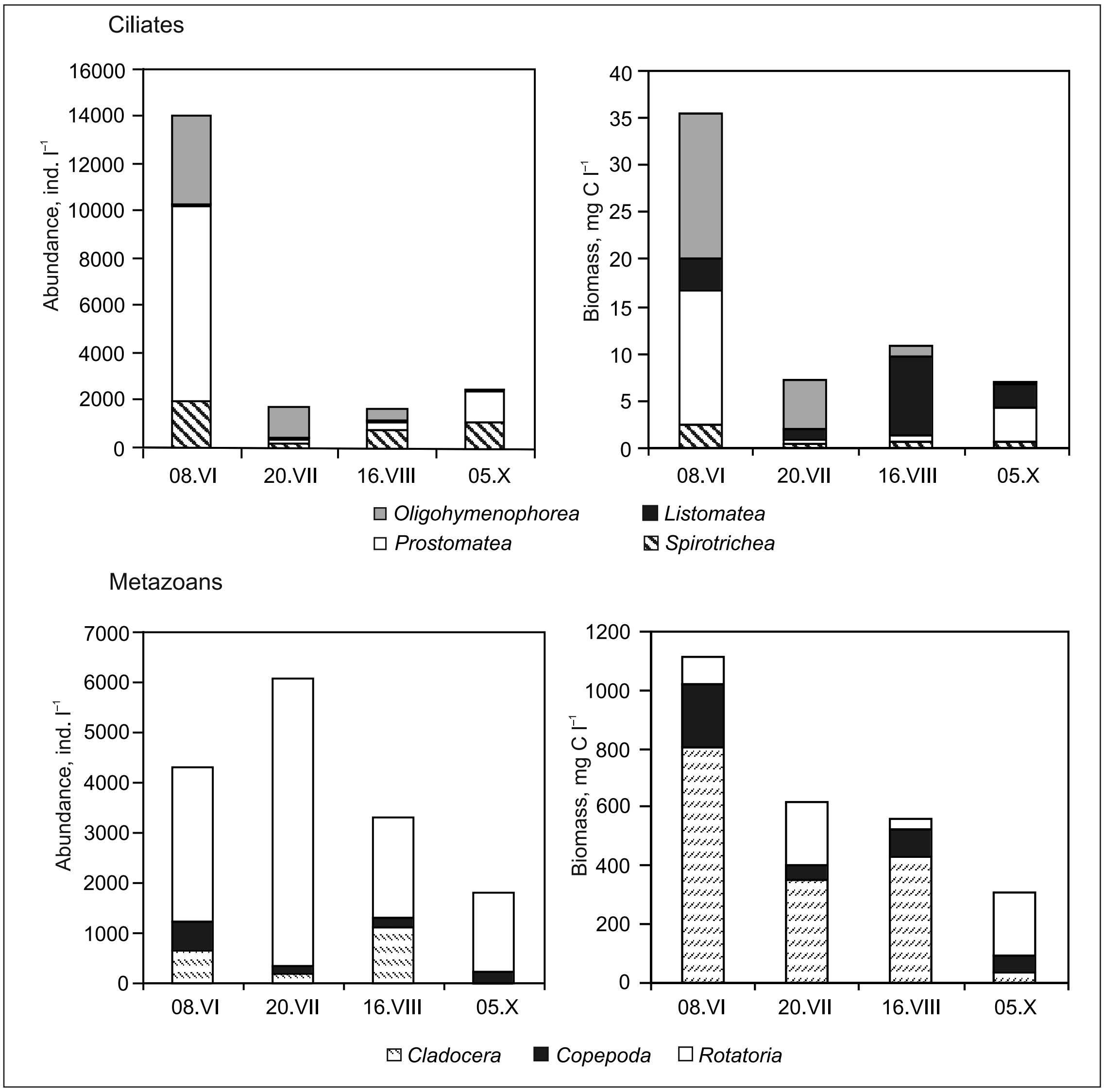

Fig. 4. Abundance and carbon biomass of ciliates and metazoan plankton groups in Lake Gineitiškės, June–October 2004

Table 3. **Pearson's correlation coefficient among the groups of planktonic organisms in Lake Gineitiškės. B – biomass, A – abundance, ns – not significant, significant correlations at $p < 0.05$**

	Edible / inedible phytoplankton ratio (B)	Bacteria (A)	Phytoplankton (B)	Copepods (B)	Cladocerans (B)
Cladocerans B)	0.77	ns	ns	–	–
Copepods (B)	0.97	ns	ns	ns	ns
Rotifers (B)	ns	0.50	ns	ns	ns
Rotifers (A)	–	0.94	–	–	–
Ciliates (B)	0.98	ns	ns	0.996	0.88
Bacterial production	–	–	0.99	–	–

and the edible (<40 µm) algae relative biomass in phytoplankton (Table 3). The number of rotifers positively correlated with bacterial density; however, no significant direct relation was found between bacteria and ciliates as well as between bacteria and cladocerans. Bacterial production depended on the biomass of phytoplankton.

DISCUSSION

According to R. Wetzel's (1983) trophic scale, chlorophyll *a* values (range 23.2–161.4 µg l^{-1}, mean 75.0 µg l^{-1}) measured in Lake Gineitiškės indicate the lake to be hypereutrophic. Its P_{total}, N_{total}, C_{org} values correspond to those of hypereutrophic lakes as well (Brönmark, Hansson, 1998). The autotrophs / heterotrophs carbon ratio in Lake Gineitiškės exceeded 1 and varied from 1.4 (June) to 11 (August) depending on community structure. This indicates the predominance of autotrophs in the system, which is common in eutrophic waters (Simon et al., 1992).

Cyanobacteria, mainly *Microcystis* and *Anabaena,* predominated in the phytoplankton from July to October. The peak of phytoplankton abundance and biomass occurred in the middle of July and August. *Anabaena* cf. *lemmermanii, Limnothrix redekei, Microcystis flos-aquae* was responsible for the water bloom in July and mainly *Microcystis* spp. in August. It is known that the genera *Anabaena*, *Microcystis* include species that have been documented to produce toxins (Kurmayer et al., 2003; Chan et al., 2004). However, the total concentration of microcystins in Lake Gineitiškės was relatively low and varied within 0.2–0.61 µg/l throughout the study period (Kasperoviciene et al., 2005). The microcystin values were lower compared with the other European freshwater *Microcystis* hepatotoxic blooms (Frank, 2002; Maatouk et al., 2002).

Edible plankton algae constituted a small fraction of the autotrophic biomass under blooming conditions in Lake Gineitiškės. Their highest contribution (38%) to autotrophic biomass was observed in June, while it ranged from 8–16% of phytoplankton biomass in the other months. The latter values were determined by the intensive development of colonial and filamentous cyanobacteria which are well defended against grazing of microphagous herbivores to control cyanobacterial biomass. Based on the indices of biotic interactions (Bulyon, 2002), zooplankton press to phytoplankton in Lake Gineitiškės on average was moderate during the study period (the ratio of zooplankton to phytoplankton carbon biomass (ZC/PC) 0.21) was strongest in June (ZC/PC 0.6) and weakest in August (ZC/PC 0.07). According to E. Jeppesen et al. (2007), the zooplankton / phytoplankton carbon biomass ratio and the grazing pressure of large zooplankton on phytoplankton increase with decreasing the trophic conditions in lakes.

In Lake Gineitiškės, the biomass of zooplankton groups positively correlated with the relative biomass of edible algae in the phytoplankton. The early summer phytoplankton was characterized by an enlarged number of chlorococcal algae species suitable for zooplankton nutrition. Simultaneously, zooplankton biomass, especially of ciliates, cladocerans and copepods, was also the highest (1120.45 µg C l^{-1}). The abundance and biomass of cladocerans decreased on average by half during cyanobacteria bloom in July and August and about 20 times in October as compared with their values in the early summer. Copepod values decreased 2–4 times, too. A more intensive development of small zooplankters (rotifers) took place in July and October under a diminished crustacean press. The abundance reduction of larger crustaceans resulted in their replacement by smaller zooplankton and organisms of microbial loop during the bloom of cyanobacteria (*Aphanizomenon flos-aquae*) also in the Curonian Lagoon (Krevš et al., 2008). The exclusion of large crustaceans is due to the difficulty of avoiding ingestion of inedible algae along with the more edible food items (Christoffersen et al., 1990). In Lake Gineitiškės, the major part of phytoplankton biomass was inedible and started accumulating in the water column, promoting bloom as well as its sedimentation to the bottom. This part of phytoplankton biomass could be involved in the food web only through the detritus food chain and microbial loop. Bacteria had a dominant role in the microbial loop. The high amounts of utilizable dissolved organic matter ($BOD_7 \geq 7$ mg $O_2\, l^{-1}$) and detritus stimulated the development of bacteria in the eutrophic environment. A positive relationship between bacterial production and phytoplankton biomass ($R = 0.99$; $n = 8$; $p < 0.05$) indicates that an increase in phytoplankton biomass is followed by an increase in the abundance of substratum and detritus for bacteria. According to Riemann and Sondergaard (1986), the lysis products from cyanobacteria comprised the major part in the bacterial production.

Bacteria are grazed by a wide range of organisms such as heterotrophic flagellates, ciliates, rotifers and cladocerans (Sanders et al., 1989). According to our data, flagellates contributed least to the total heterotrophic carbon biomass and played a minor role in the food web during *Microcystis* and *Anabaena* blooms in Lake Gineitiškės. These organisms were found in low densities during toxic cyanobacterial bloom in a eutrophic lake in Greece (Moustaka-Gouni et al., 2006). On the contrary, flagellates were abundant during *Aphanizomenon flos-aquae* blooming in the Curonian Lagoon (Krevš et al., 2008). Šimek et al. (1998) and Kalinowska (2004) showed that the role of small bacterivorous ciliates in bacteria grazing increases with increasing the trophic status of lakes. In the present study, ciliate abundance and biomass decreased during cyanobacteria bloom, while at the same time larger bacterivores (rotifers) were abundant. Competition for food resources with crustaceans is the main factor influencing the structure of ciliates and rotifers in the food web. Consequently, bacterivorous and histiophagous ciliates as well as filter feeders and predator rotifers dominated in Lake Gineitiškės. Probably these bacterivores as well as filtrating cladocerans (especially in summer) controlled the bacterial biomass. Evidently, predatory rotifers (especially *Asplanchna priodonta*) as well as crustaceans controlled the abundance of ciliates.

To summarize, in the higly eutrophicated Lake Gineitiškės, the abundance and biomass of ciliates and crustaceans decreased during the intensive blooming of cyanobacteria (especially of *Anabaena* and *Microcystis*). Filter feeders and predatory rotifers were particularly abundant at that time. The proportion of different groups in the total heterotrophic organisms' biomass have shown that during the mass development of cyanobacteria the role of bacteria and rotifers in the organic carbon pool increased, whereas cladocerans dominated in carbon biomass in summer. Herbivorous crustaceans did not control directly a larger part of phytoplankton biomass under the colonial and filamentous cyanobacteria bloom conditions. This part of phytoplankton biomass could be involved in the food web only through the detritus food chain and microbial loop. As a result, a decrease of matter and energy transfer efficiency from autotrophs to top predators took place.

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TROFINĖ PLANKTONO STRUKTŪRA MELSVABAKTERIŲ ŽYDĖJIMO METU HIPEREUTROFINIAME GINEITIŠKIŲ EŽERE

Santrauka

2004 m. birželį–spalį hipereutrofiniame Gineitiškių ežere buvo atlikti skirtingų planktono bendrijos grupių (dumblių, bakterijų, heterotrofinių žiuželinių, infuzorijų, verpečių, vėžiagyvių) tyrimai. Intensyvios vegetacijos laikotarpiu fitoplanktone pagal biomasę vyravo melsvabakterės, ypač *Microcystis* ir *Anabaena,* tačiau vasaros pradžioje žymią fitoplanktono biomasės dalį (37 %) sudarė žaliadumbliai (*Pediastrum*). Didžiausias fitoplanktono gausumas (iki 475,7 mln. vnt. l^{-1}) ir biomasė (iki 7712 µg C l^{-1}) buvo nustatyti liepos viduryje ir rugpjūtį. Liepą vandens „žydėjimą“ sukėlė *Anabaena* cf. *lemmermanii*, *Limnothrix redekei*, *Microcystis flos-aquae*, tuo tarpu rugpjūtį – *Microcystis* rūšys. Didžiausia zooplanktono biomasė (1120,45 µg C l^{-1}), ypač infuzorijų ir vėžiagyvių, buvo vasaros pradžioje, t. y. tuo metu, kai daugiausia buvo jų mitybai tinkamų dumblių (38 % fitoplanktono biomasės). Melsvabakterių „žydėjimo“ metu šakotaūsių vėžiagyvių gausumas ir biomasė sumažėjo 2–20 kartų, irklakojų – 2–4 kartus, palyginus su jų rodikliais vasaros pradžioje. Sumažėjus vėžiagyvių poveikiui gausesnės buvo verpetės. Mikrobinėje kilpoje vyravo bakterijos, tuo tarpu heterotrofinių žiuželinių vaidmuo pelaginiame mitybos tinkle buvo menkas. Melsvabakterių „žydėjimo“ metu, sprendžiant iš heterotrofinių organizmų biomasės santykių, stambus zooplanktonas tiesiogiai negalėjo kontroliuoti didesnės fitoplanktono biomasės dalies, tuo tarpu didėjo bakterijų ir verpečių reikšmė organinės medžiagos srautuose.

Raktažodžiai: fitoplanktonas, mikrobinė kilpa, metazooplanktonas, hipereutrofinis ežeras