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STUDY OF PHYTOPLANKTON DIVERSITY AND HYDROCHEMICAL REGIME OF BISTRICA DAM LAKE

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Abstract

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Taxonomic structure of phytoplankton community and dynamics of hydrochemical regime as determining factors of trophic conditions were studied in Bistrica Dam Lake. Seventy seven taxa in six divisions of planktonic algae were found: Cyanoprokaryota (8 species, 10.38%), Chlorophyta (34 species, 44.15%), Euglenophyta (6 species, 7.79%), Streptophyta (3 species, 2.59%), Pyrrhophyta (3 species, 3.88%), Ochrophyta (24 species) including class Synurophyceae (3 species, 3.89%) and class Bacillariophyceae (21 species, 27.27%). Dominant and sub-dominant species were identified and seasonal dynamic of phytoplankton community was established of Bistrica Dam Lake. Diatoms – *Synedra acus* Kützing*, Aulacoseira granulata* (Ehrenberg) Simonsen and *Stephanodiscus hantzschii* Grunow predominated in May *Scenedesmus communis* (Breb.) Hegewald*, Scenedesmus acuminatus* (Lagerheim) Chodat and *Hyaloraphidium contortum* Pascher and Korshikov were the majority in the summer-time populations*,* while diatoms – *Asterionella formosa* Hassall *Stephanodiscus hantzschii* Grunow and *Synedra ulna* (Nitzsch) Ehrenberg were the sub-dominant species. *Stephanodiscus hantzschii* Grunow and *Aulacoseira granulata* (Ehrenberg) species increased their numbers again in the autumn. The average phytoplankton biomass for the studied period (0.333 mg.l^{-1}) determined the oligothrophic status of the Bistrica Dam Lake.

Key words: taxonomic structure, trophic conditions, dominant and sub-dominant taxa, oligothrophic status, phytoplankton biomass
Abbreviations: (WFD, EC2000/60/WE) – Water Framework Directive

Introduction

Algae are important primary producers for freshwater and marine aquatic habitats. They provide biomass that is the base of various food chains in lots of lakes and rivers (Bellinger and Sigee, 2010). Phytoplankton plays significant role in material mobility and energy flow in aquatic ecosystems (Ariyadej et al., 2008). The dynamic changes in phytoplankton communities' structure are due to water quality variation. Phytoplankton biomass variability is primary related to these changes (Brettum and Andersen, 2005). Algae's number increases or decreases depending of the aquatic environmental variables. The total amount and the structure of phytoplankton describe trophic conditions of the laces better than total phosphorus for instance because algae's abundance and diversity represent in cumulative way how the physico-chemical factors affect the phytoplankton communities (Brettum and Andersen, 2005). Quantitative and qualitative variables of the phytoplankton are an example of organism's adaptation to their changing environment (Kozak, 2005). Water Frame Directive of European Commission (WFD, EC2000) set a new standard in managing a protecting the water quality in Europe (Marchetto et al., 2009). The phytoplankton is a good biological indicator of the water quality therefore it is a required tool for implementing the WFD in Europe (Padisak et al., 2006). According to WFD the total biomass and diver-

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sity of the phytoplankton are the basic parameters for evaluation of the waters' ecological status and they have been applied in many countries (Padisak et al., 2006; Mischke et al., 2008). Knowing of the phytoplankton diversity and the abundance of the species is the key for optimal managing and exploitation of the various water recourses (Salmaso, 2002). According to Ramirez et al. (2000) the phytoplankton community in every ecosystem is represented of groups and specific forms and their diversity, abundance of the species and alignment depends of their adaptation to biotic and abiotic variables of the ecosystem.

The trophic changes of the lakes could be identified by studying the structure and the diversity of plankton communities and furthermore supported from recording the most important phisico-chemical factors of the water (Margaritora et al., 2005). The phytoplankton possesses a good ecological plasticity and it is widely applied in the monitoring programs of the trophic status of the marine and oceanic ecosystems as well as of the rivers, natural and artificial reservoirs. It is a key tool for evaluation of the waters' status and quality as regulated in European WFD (2000/60/EC, WFD). The objective of the research presented was to study the changes in the diversity and the structure of the phytoplankton community along with the dynamic of the hydro-chemical environment of the Bistrica Dam Lake.

Materials and Methods

Phytoplankton community

The present research was conducted from May to October in 2012. Nineteen samples at the depth of 0–0.5 m were collected from five stations along the whole water area of Bistrica Dam Lake. Water samples then were collected in 1000 ml water sampler. They were preserved in formalin of concentration up to 4 per cent. Quantitative analysis of the phytoplankton was performed using sampling camera of „Burker" by method of (Laugaste, 1974). The abundance of the species of the phytoplankton was defined simultaneously in conservative and non-conservative samples using light microscope „Carl Zeiss Axioscope 2 plus"of 200x and 400x total amplification. The volume of the species which biomass was missing in the tables was estimated using special coefficient. The number was recorded individually (by cell, filament and colony). The density was expressed as number of cells per litter ($\times 10^{-6}$ cells.l^{-1}). The biomass of certain species was calculated using relevant geometrical equations and was expressed in mg.l^{-1} (Deisinger, 1984). The phytoplankton biomass was estimated on the basis of tables with the standard weight of the phytoplankton organisms (Laugaste, 1974; Fedorov, 1979 and Rott, 1983). The diatoms (Bacillariophyceae) were defined without special treatment. The textbook of (Cox, 1996) was used to identify the species.

Physico-chemical factors

The water samples were collected using standard methods and according the Bulgarian regulations and European regalements (EU Water Framework Directive 2000/60/EC). The water status was defined by analysis of the following parameters:

Water temperature (T, °C) – measured by thermometric method using microprocessor oximeter WTW 315/SET (BDS 17.1.4.01-77). Measurements in situ were recorded at the water surface by oximeter WTW Oxi 1970 i;

Dissolved oxygen, mg.l^{-1} – by electrochemical method using microprocessor oximeter WTW 315/SET (BDS EN 25814-2002). Measured in situ along with water temperature at the water surface by WTW Oxi 1970 i;

Hydrogen parameter, pH determination – by electrometrical method, using pH-meter WTW 315/SET (BDS 3424-81, ISO 10523, 1994);

Total nitrogen – estimated as a sum of ammonium nitrogen and nitrate nitrogen in the water;

Orthophosphates $P\text{-}PO_4$, mg.l^{-1} – by spectrophotometer (BDS EN ISO 6878-1:2004). The method is based on spectrophotometric at λ 690 nm determination of blue-colored compound derived from the reaction of phosphate ions in ammonium molybdate and stannous chloride solution.

Geographical and hydrological characteristic of Bistrica Dam Lake

Bistrica Dam Lake is located at 31 km northwest from Sofia and 9 km from Slivnica, near the land of Kostinbrod municipally, next to the village of Bezden (Figure 1). It is a karst area with over 20 karst springs. The climate is continen-

Fig. 1. Satellite image of Bistrica Dam Lake

Table 1

Geographical and morphometrical characteristics of Bistrica Dam Lake

Latitude	42°52′49″ N
Longitude	23°5′42″ E
Altitude, m	589
Maximum length, m	80–100
Average width, m	30–40
Maximum depth, m	4
Tributary	Karstric springs

tal with hot summer, cool winter and low average amount of the rainfalls. The average month rainfalls and temperatures in May, June, August and October were as followed: (78.73 mm, 15°C; 4.05 mm, 22°C; 42.67 mm, 23°C; 29.72 mm, 14°C). Land relief is hilly and plain with average altitude of 700 m above the sea. Bistrica Dam-lake is located in semi-mountain area with geographical coordinates: 42°52′49″ N and 23°5′42″ E, and elevation of 589 m; its total area reaches up to 204 da, and its maximum depth is about 4 m (Table 1). The reservoir is supplied by several karst springs with water debit of 70 $l.s^{-1}$. A fish farm is established in its area for warm-water fish species – carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), northern pike (*Esox lucius*), silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*). There are also crucian carp (*Carassius carassius*), perch (*Perca fluviatilis*), common roach (*Rutilus rutilus*) and common rudd (*Scardinius erythropthalmus*) in this reservoir.

Results

Hydrochemical variables of the water of Bistrica Dam Lake

Mean seasonal temperature of the water of the studied stations varied from 20.4°C to 21.3°C, with maximum recorded in August (25.1°C) and minimum in October (16.6°C). The pH was determined at the range of 7.98–8.15 units, where 8.46 was the maximum and 7.67 – the minimum value recorded. The recorded level of dissolved oxygen were optimal during the studied season (8.3 $mg.l^{-1}$ – 13.7 $mg.l^{-1}$), and mean seasonal levels are from 9.9 to 10.6 $mg.l^{-1}$ (Table 2). Mean seasonal values of total oxygen residues varied from 3.06 $mg.l^{-1}$ to 3.22 $mg.l^{-1}$, and were in optimal ranges for this parameter (2 $mg.l^{-1}$), having dynamic levels as the nitrate nitrogen since their comparative share of the total nitrogen (TN) is limited (Table 2). Phosphorus amount of the studied stations ranged from 0.08 $mg.l^{-1}$ to 1.02 $mg.l^{-1}$, having meant seasonal levels from 0.40 $mg.l^{-1}$ (station 1) to 0.55 $mg.l^{-1}$ (station 3, Table 2).

Taxonomic structure of the phytoplankton communities

Analysis of the phytoplankton diversity of Bistrica Dam-lake included 19 water samples from 5 stations. Seventy seven taxa from 6 division were identified: Cyanoprokaryota (8), Chlorophyta (34), Euglenophyta (6), Streptophyta (2), Pyrrhophyta (3), and division Ochrophyta (24) included classes Synurophyceae (3) and Bacillariophyceae (21 taxa) (Table 3). The percentage distribution of phytoplankton communities in the Bistrica Dam-lake by divisions was as follows: Cyanoprokaryota (10.38%), Chlorophyta (44.15%), Euglenophyta (7.79%), Streptophyta (2.59%), Pyrrhophyta (3.88%), Synurophyceae (3.89%) and Bacillariophyceae (27.27%) (Figure 2). Green algae (Chlorophyta), diatoms (Bacillariophyceae) and Cyanoprokaryota were of the richest abundance of species (Figure 2). Twenty one taxa of 4 division of plankton algae were identified in May 2012 in Bistrica Dam-lake as

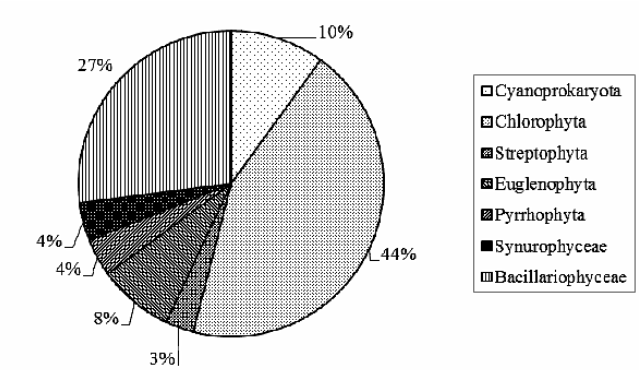

Fig. 2. Distribution of phytoplankton in Bistrica Dam Lake (2012)

Table 2

Average seasonal values of physico-chemical parameters of water in Bistrica Dam Lake

Parameter	Measure	Station 1	Station 2	Station 3	Station 4	Station 5
Water temperature (T°C)	°C	21	20.8	20.4	21.3	13
(pH)		7.98	8.07	8.09	8.15	7.77
Dissolved oxygen (O_2)	$mg.l^{-1}$	9.9	10.2	10.2	10.6	9.9
Total nitrogen (TN)	$mg.l^{-1}$	3.06	3.09	3.22	3.17	10.56
Phosphates (PO_4^{3-})	$mg.l^{-1}$	0.4	0.5	0.55	0.51	0.42

Table 3

Taxonomic composition of phytoplankton in Bistrica Dam Lake

Taxa	Month			
	V	VI	VIII	X
Cyanoprokaryota				
Aphanocapsa sp.			+	+
Chroococcus limneticus Lemmermann	+			
Coelosphaerium sp.			+	
Merismopedia glauca (Ehrenberg) Kützing				+
Micricystis aeroginosa (Kützing) Kützing		+	+	+
Oscilatoria limosa C.Agardh ex Gomont			+	
Oscilatoria sp.				+
Synechococcus linearis (Schmidle & Lauterborn) Komárek				+
Chlorophyta				
Actinastrum hantzschii Lagerheim		+		
Chlamydomonas sp.		+		+
Coelastrum microporum Nägeli in A. Braun		+	+	
Coelastrum sphaericum Nägeli		+	+	
Crucigenia quadrata Morren		+	+	+
Crucigenia tetrapedia (Kirchner) Kuntze	+		+	+
Dictyosphaerium pulchellum HC Wood		+	+	
Dydimocystis planctonica Korsikov				+
Golenkinia radiata Chodat	+	+	+	+
Hyaloraphidium contortum Pascher & Korshikov		+	+	+
Kirchneriella lunaris (Kirchner) K.Möbius		+		
Kirchneriella obesa (West) West & G.S.Wes		+		+
Micractinium pusillum Fresenius		+	+	
Oocystis borgei J.Snow			+	
Oocystis lacustris Chodat	+			+
Pandorina morum (O.F.Müller) Bory de Saint-Vincent			+	
Pediastrum duplex Meyen		+	+	
Pediastrum simplex Meyen		+	+	+
Pediastrum tetras (Ehrenberg) Ralfs			+	
Scenedesmus acuminatus (Lagerheim) Chodat	+	+	+	+
Scenedesmus acuminatus var. elongatus G.M.Smith			+	
Scenedesmus acuminatus var.biseriatus (Lagerheim) Chodat incl. Reinch			+	
Scenedesmus arcuatus (Lemmermann) Lemmermann		+	+	
Scenedesmus bicaudatus Dedusenko		+	+	+
Scenedesmus bijugatus Kützing	+		+	+
Scenedesmus communis (Breb.) Hegewald	+	+	+	+
Scenedesmus obliquus (Turpin) Kützing		+	+	+
Scenedesmus opoliensis P.G.Richter		+	+	+
Scenedesmus protuberans F.E.Fritsch & M.F.Rich		+	+	+
Scenedesmus spinosus Chodat	+	+	+	+
Schroederia spiralis (Printz) Korshikov	+			+
Tetraedron minimum (A.Braun) Hansgirg				+
Tetrastrum glabrum (Y.V.Roll) Ahlstrom & Tiffany		+	+	
Tetrastrum staurogeniaforme (Schröder) Lemmermann	+		+	
Streptophyta				

Table 3 Continued

Taxa	Month			
	V	VI	VIII	X
Closterium pronum Brébisson				+
Cosmarium spp.			+	
Euglenophyta				
Euglena acus (O.F.Müller) Ehrenberg			+	
Euglena polymorpha P.A.Dangeard			+	+
Euglena sp.		+		
Phacus longicauda (Ehrenberg) Dujardin				+
Tetraedriella sp.			+	+
Trachelomonas sp.			+	+
Pyrrhophyta				
Ceratium hirundinella (O.F.Müller) Dujardin	+	+	+	
Peridinium sp.	+		+	
Gymnodinium sp.	+			
Ochrophyta				
Synurophyceae				
Dinobryon divergens O.E.Imhof			+	+
Mallomonas elongata Reverdin			+	+
Mallomonas sp.			+	
Bacillariophyceae				
Amphiphrora sp.	+			
Anomoeoneis sphaerophora E.Pfitzer			+	+
Asterionella formosa Hassall		+		
Aulacoseira granulata (Ehrenberg) Simonsen	+	+	+	+
Aulacoseira islandica O. Mull.		+		
Caloneis amphisbaena (Bory de Saint Vincent) Cleve	+			
Cocconeis placentula Ehrenberg		+		+
Cyclotella meneghiniana Kützing	+		+	+
Cymbella sp.		+		
Cymbella cistula (Ehrenberg) O.Kirchner			+	
Cymbella cymbiformis C.Agardh		+		+
Cymbella ventricosa (C.Agardh) C.Agardh			+	
Diatoma vulgare Bory	+			
Diploneis sp.			+	
Fragilaria capucina Desmazières		+		
Fragilaria consrtuens (Ehrenberg) Grunow				+
Navicula sp.		+	+	
Stephanodiscus astraea (Ehrenberg) Grunow			+	
Stephanodiscus hantzschii Grunow	+	+	+	+
Synedra acus Kützing	+		+	+
Synedra ulna (Nitzsch.) Ehrenberg	+	+		+

follows: Cyanoprokaryota (1 or 5%), Chlorophyta (9 or 43%), Pyrrhophyta (3 or 14%) and Ochrophyta (8 or 38%) with class Bacillariophyceae included, (Table 3; Figure 3). Diatoms – *Synedra acus* Kützing, *Aulacoseira granulata* (Ehrenberg) Simonsen and *Stephanodiscus hantzschii* Grunow, green algae – *Scenedesmus communis* (Breb.) Hegewald and Pyrrhophyta algae – *Peridinium* sp. и *Ceratium hirundinella* (O.F.Müller) Dujardin dominated at all studied stations (Figure 4).

Thirty five taxa of 5 phytoplankton groups were defined in June as follows: Cyanoprokaryota (1 or 3%), Chlorophyta (22 or 63%), Euglenophyta (1 or 3%), Pyrrhophyta (1 or 3%) and class Bacillariophyceae (10 taxa or 28%) (Table 3; Figure

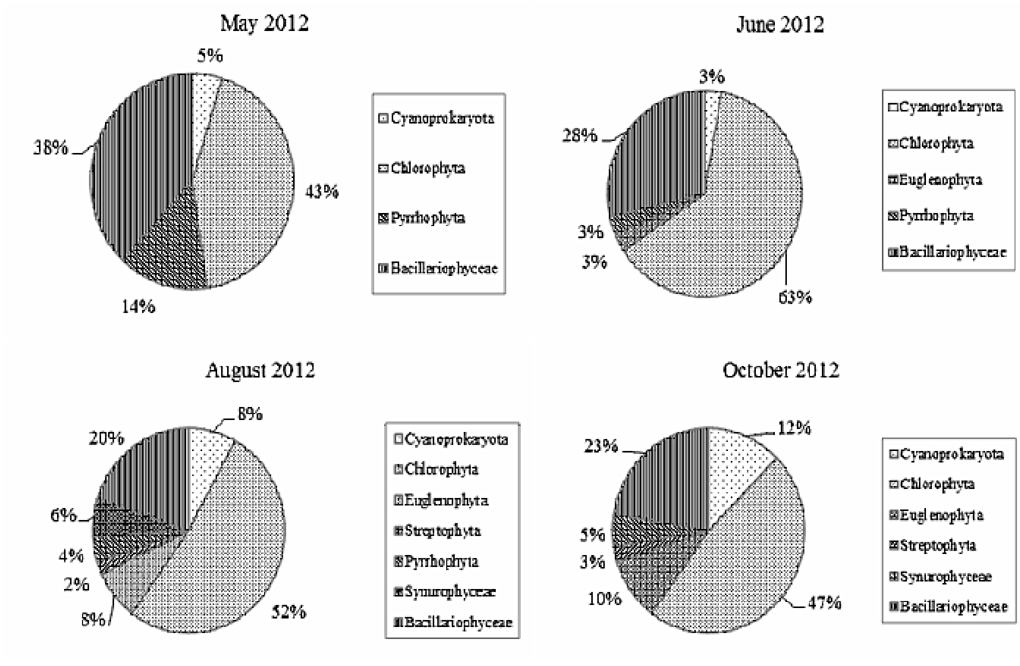

Fig. 3. Distribution of phytoplakton in Bistrica Dam Lake (May-October 2012)

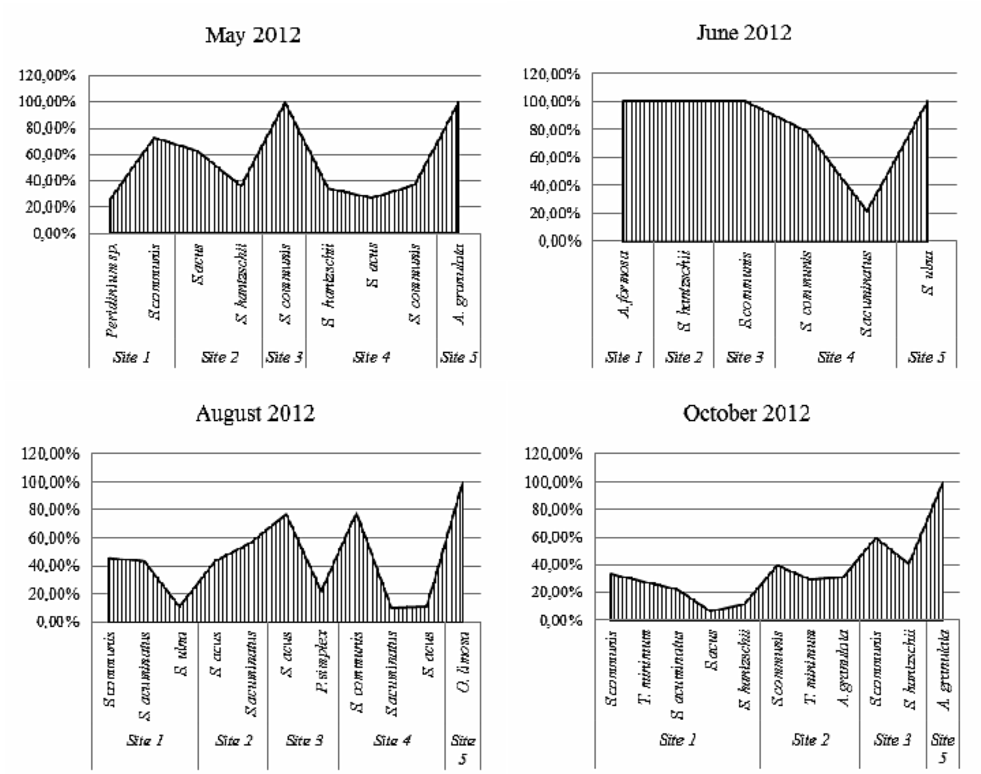

Fig. 4. Dominant phytoplankton taxa in Bistrica Dam Lake (2012)

3). Green algae – *Scenedesmus communis* (Breb.) Hegewald, *Scenedesmus acuminatus* (Lagerheim) Chodat and diatoms, *Asterionella formosa* Hassall, *Stephanodiscus hantzschii* Grunow *Synedra ulna* (Nitzsch) Ehrenberg dominated in June. Fifty taxa of six division of phytoplankton were identified in August as follows: Cyanoprokaryota (4 or 8%), Chlorophyta (26 or 52%), Euglenophyta (4 or 8%), Streptophyta (1 or 2.5%), Pyrrhophyta (2 or 4%), Ochrophyta (12) (Synurophyceae (2 or 5%) and Bacillariophyceae (10 or 20 %) (Table 3; Figure 3). For this period dominant part has green algae *Scenedesmus acuminatus* (Lagerheim) Chodat, *Scenedesmus communis* (Breb.) Hegewald, *Hyaloraphidium contortum* Pascher and Korshikov, as well as diatom *Synedra acus* Kützing. Sub-dominant for the same period was: *Synedra ulna* (Nitzsch) Ehrenberg (Bacillariophyceae), *Pediastrum simplex* Meyen (Chlorophyta) and *Oscillatoria limosa* C. Agardh ex Gomont of Cyanoprokaryota (Figure 4).

Forty taxa of five division of phytoplankton were identified in October 2012 as follows: Cyanoprokaryota (5 or 12%), Chlorophyta (19 or 47%), Euglenophyta (4 or 10%), Streptophyta (1 or 2.5%), Ochrophyta (11) taxa, (Synurophyceae – 2 or 5% and Bacillariophyceae – 9 or 23%) (Table 3; Figure 3). Most numerous representatives were from Bacillariophyceae: *Aulacoseira granulata* (Ehrenberg) Simonsen, *Stephanodiscus hantzschii* Grunow, and Chlorophyta (*Tetraedron minimum* (A.Braun) Hansgirg and *Scenedesmus acuminatus* (Lagerheim) Chodat) were the sum-dominant (Figure 4).

Quantitative dynamics of the phytoplankton community (density and biomass)

In May maximum levels of the phytoplankton size and biomass were recorded at station 4 (42.7×10^{-6} cells.l^{-1}, 0.508 mg.l^{-1}), and minimum – at station 5 (1.4×10^{-6} cells.l^{-1}, 0.019 mg.l^{-1}, Table 4; Figure 5). Maximum levels of the same variables in June were recorded also at station 4 (34.04×10^{-6} cells.l^{-1}, 0.456 mg.l^{-1}), and minimum – at station 5 next to de karst spring (0.95×10^{-6} cells.l^{-1}, 0.013 mg.l^{-1}, Table 4; Figure 5). The levels of these parameters in August were again highest at station 4 and lowest at station 5 (39.5×10^{-6} cells.l^{-1}, 0.501 mg.l^{-1} and 0.58×10^{-6} cells.l^{-1}, 0.005 mg.l^{-1}, respectively, Table 4; Figure 5). Maximum levels of the phytoplankton density of Bistrica Dam-lake in October were at station 1 (69.5×10^{-6} cells.l^{-1}, 0.787 mg.l^{-1}) and minimum ones – at station 5 (0.97×10^{-6} cells.l^{-1}, 0.011 mg.l^{-1}) (Table 4; Figure 5).

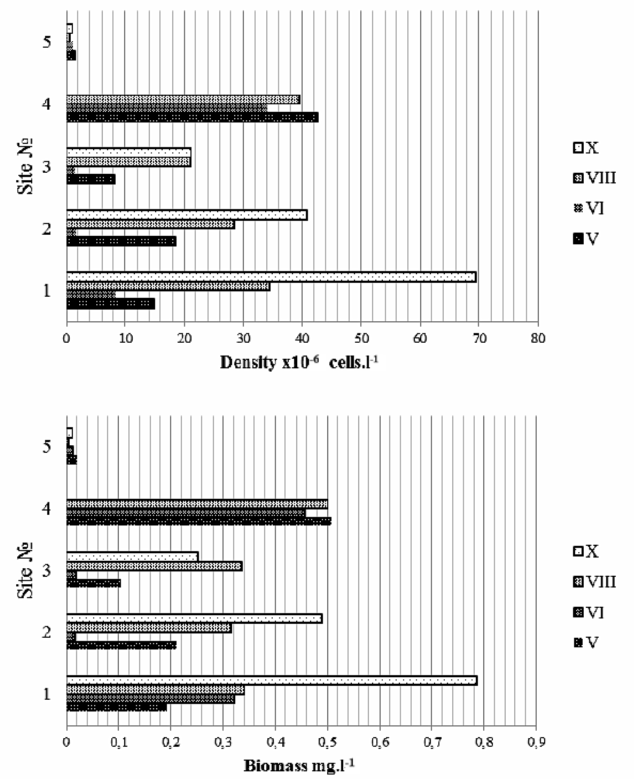

Fig. 5. Density (x10^{-6} cells.l^{-1}) and biomass (mg.l^{-1}) of phytoplankton in Bistrica Dam Lake (2012)

Table 4

Density (10^{-6} cells. l^{-1}) and biomass (mg. l^{-1}) of phytoplankton in Bistrica Dam Lake

Site №	Parameter	21.V.	26.VI.	09.VIII.	18.X.	Average for site
1	density	14.9	8.25	34.4	69.5	31.76
Dam wall	biomass	0.193	0.321	0.342	0.787	0.41
2	density	18.55	1.63	28.4	40.89	22.37
Cages	biomass	0.211	0.016	0.316	0.489	0.258
3	density	8.2	1.42	21	21.2	12.95
Limnetic zone	biomass	0.106	0.018	0.336	0.253	0.178
4	density	42.7	34.04	39.5		38.75
Tail of the dam	biomass	0.508	0.456	0.501		0.488
5	density	1.4	0.95	0.58	0.97	0.97
Karstic springs	biomass	0.019	0.013	0.005	0.011	0.012

Maximum average levels of the phytoplankton density and biomass were recorded at station 4 (density – 38.75 × 10^{-6} cells.l^{-1} and biomass – 0.488 mg.l^{-1}), and minimum average levels– at station 5 near the karst spring, respectively (density – 0.97 × 10^{-6} cells.l^{-1} and biomass – 0.012 mg.l^{-1} (Table 4). At stations 2, 3 and 4 located in the central part of the reservoir number and biomass levels ranged from 1.42 × 10^{-6} cells.l^{-1} and 0.018 mg.l^{-1} at station 3 in June to 42.70 × 10^{-6} cells.l^{-1}, 0.508 mg.l^{-1} at station 4 in May (Table 4). Maximum absolute levels of the above mentioned parameters were recorded in October at station 1 near the reservoir wall (69.50 × 10^{-6} cells.l^{-1} and 0.787 mg.l^{-1}, respectively) (Table 4, Figure 5). Minimum absolute levels of number and biomass of the phytoplankton were recorded at station 5 near the karst spring in August (0.58 × 10^{-6} cells.l^{-1} and 0.005 mg.l^{-1}) (Table 4, Figure 5). Trophic status of the Bistrica Dam Lake was determined for the studied period according to average levels of the phytoplankton number and biomass. Average level of the biomass for the studied period was 0.333 mg.l^{-1}, which is an indicator for oligotrophic status of the reservoir (Uzunov and Kovachev, 2002).

Discussion

Seasonal variation of phytoplankton density and diversity are caused by water chemical and physical variables of each reservoir (Kozak, 2005). High density of the phytoplankton is a result from the high concentration of nitrogen and phosphorus, but in many cases they are not the limiting factor for the phytoplankton development (Kozak et al., 2014). Trophic status of the reservoir is the major factor that affects the abundance of the phytoplankton (Kozak et al., 2014). Physic-chemical parameters of the water are important factors for the development of the phytoplankton communities (Tavernini et al., 2009). Water temperature for instance and dissolved oxygen concentration are important factors that characterized the reservoirs, as the first affects much more certain water parameters (Sipkoska-Gastarova et al., 2008). Thermal stratification observed in the dams, which results from the temperature dependence of water density has a direct impact on the levels of dissolved oxygen in the water layers (Sipkoska-Gastarova et al., 2010). In the present study established seasonal average values of the main hydrochemical variables of the water in the Bistrica dam-lake were within the optimal.Water temperature varied from 20.4 °C to 25.1 °C, pH were within 7.98–8.46 units, and the level of dissolved oxygen were among 8.3 mg.l^{-1} – 13.7 mg.l^{-1}. Total nitrogen amount varied from 3.06 mg.l^{-1} to 3.22 mg.l^{-1}, and phosphate levels were within 0.08 mg.l^{-1} and 1.02 mg.l^{-1}. Like other publications concerning the study of the phytoplankton in Bulgaria in a number of dams among which are Iskar, Pchelina, Yasna polyana, Kardzali, Trakiec and Vacha (Kalchev et al., 2005; Beshkova and Saiz, 2006; Belkinova et al., 2007; Teneva et al., 2009; Teneva et al., 2010) green algae, followed by diatoms are the most species-rich and dominate the taxonomic structure of phytoplankton communities. In the present study the dynamics of changes and seasonal succession of the phytoplankton community of the Bistrica Dam Lake followed the development model of small and medium-sized dams and reservoirs, which is dominated by diatoms (Bacillariophyceae) in the spring when the waters are cool and richer in nutrients. Dominant species were *Synedra acus* Kützing, *Aulacoseira granulata* (Ehrenberg) Simonsen and *Stephanodiscus hantzschii* Grunow. In warmer waters during the summer they were substituted from the green algae (Chlorophyta). The most abundant species were *Scenedesmus acuminatus* (Lagerheim) Chodat, *Scenedesmus communis* (Breb.) Hegewald and *Hyaloraphidium contortum* Pascher & Korshikov, while sub-dominant were diatoms *Asterionella formosa* Hassall, *Stephanodiscus hantzschii* Grunow and *Synedra ulna* (Nitzsch) Ehrenberg. The two species *Stephanodiscus hantzschii* Grunow and *Aulacoseira granulata* (Ehrenberg) Simonsen increase their number again in the autumn. Analogous data was reported for other Bulgarian dams as well. According to (Saiz, 1977; Beshkova, 1996) the intensity of diatoms (Bacillariophyceae) development has decreases in the summer months when water temperature has increased, while decreasing of water temperature during the cooler season increased the number of the diatoms in Batak and Pchelina dams. Maximum absolute values of the phytoplankton density and biomass of the Bisatrica Dam Lake for the studied period were recorded at station 1 in October (69.5 × 10^{-6} cells.l^{-1}, 0.787 mg.l^{-1}), while minimum ones were recorded at station 5 in August 2012 (0.58 × 10^{-6} cells.l^{-1} and 0.005 mg.l^{-1}). Maximum average levels for the above mentioned factors were recorded at station 4 (35.75 × 10^{-6} cells.l^{-1}, 0.488 mg.l^{-1}) at the dam tailing while minimum – at station 5 (0.97 × 10^{-6} cells.l^{-1}, 0.012 mg.l^{-1}) at the karst spring that feed the reservoir. There were not determined significant differences in the taxonomic structure of the phytoplankton between the stations observed. At station 5 localized in the karst spring quantitative indicators in the dynamics of the phytoplankton were more than 20 times lower as compared to stations located in the dam area. In comparison with the clear trend of increase of the phytoplankton total number in the direction from the wall to the tail of the dam showed in the research of (Beshkova, 1996; Traykov, 2005; Tzanev and Belkinova, 2008) for other dams in Bulgaria, in our study, the number of phytoplankton decreases in the direction from the wall of the dam to the karst springs, with the exception of station 4. The probable reason for this is the presence of cages for breeding fish near the dam wall, the exploitation of which usually leads to higher levels of nutrient and hence an increase in phytoplankton density. According to the results from the research made by Kalchev et al. (2005) on two large reservoirs Iskar Dam Lake is eutrophic according to the phytoplankton biomass and Pchelina Dam Lake is classified as eutrophic and hipereutrophic according to the same indicator. The present study established that average phytoplankton biomass was 0.333 $mg.l^{-1}$, which is an indication of oligotrophic condition of the dam. That statement differs from the data from some large dams in the country reported by (Beshkova and Saiz, 2006; Belkinova et al., 2007) like Yasna Polyana dam, whose trophic status was determined as oligo-mesotrophic by (Beshkova and Saiz, 2006) and Kardzhali Dam, where the average biomass is 1.62 $mg.l^{-1}$, which classifies the dam as oligo mesotrophic on this parameter (Belkinova et al., 2007).

Conclusions

In the course of the study of phytoplankton diversity of the Bistrica Dam Lake 77 taxa of planktonic algae in 6 divisions were identified: Cyanoprokaryota (8), Chlorophyta (34), Euglenophyta (6), Streptophyta (2), Pyrrhophyta (3), Ochrophyta (24) including class Synurophyceae (3) and class Bacillariophyceae (21) taxa. The highest percentage in species diversity had green algae Chlorophyta (44.15%), diatoms Bacillariophyceae (27.27%), and the representatives of Cyanoprokaryota (10.38%) had secondary importance as their number was insignificant. Dominant and subdominat species and seasonal dynamics of the phytoplankton community of Bystrica Dam Lake have been identified. There were no significant differences in the taxonomic structure of the phytoplankton within the observed stations, except for station 5 located at the karst spring where quantitative indicators in the dynamics of phytoplankton are logically more than 20 times lower than the ones recorded at the stations located in the dam aquatic area. Trophic status of the Bistrica Dam Lake was defined based on the average levels of phytoplankton biomass. Average biomass of the phytoplankton throughout the period of the study was (0.333 $mg.l^{-1}$), which is an indication of oligotrophic nature of the Bistrica Dam Lake (Kovachev and Uzunov, 2002). The research presented can serve as a basis for further in-depth studies of phytoplankton communities as well as the abiotic environmental factors that affect the dynamics of their development.

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