Bulgarian Journal of Agricultural Science, 16 (No 3) 2010, 311-316
Agricultural Academy

EUGLENOPHYCEAE IN VARNA AND BELOSLAV LAKES DURING 2008

D. PETROVA and D. GERDZHIKOV
Institute of Fishing Resources, BG - 9000 Varna, Bulgaria

Abstract

PETROVA, D., and D. GERDZHIKOV, 2010. *Euglenophyceae* in Varna and Beloslav Lakes during 2008. . *Bulg. J. Agric. Sci*., 16: 311-316

The representatives of class *Euglenophyceae* inhabit mainly freshwater basins but some species occur also in marine and brackish waters. Along the Bulgarian coast, in Varna – Beloslav Lake system large-scale development and blooms of *Euglenophyceae* have not been observed since a lot of years. This paper discusses their quantitative and qualitative distribution in 2008.

*Key words: Euglenophyceae***,** distribution, number, biomass, Varna Lake, Beloslav Lake

Introduction

The representatives of class *Euglenophyceae* inhabit freshwater basins as well as marine waters. It is established that macro-algae of this class develop widely in waters with high concentration of organic matter and basins subjected to anthropogenic eutrophication (Lee, 1999). Over 10% of the species are used as indicators of water saprobility (Kiriakov, 1987). Mass development and blooms of *Euglenophyceae* representatives have been observed in Varna and Beleoslav Lakes since many years. *Eutreptia viridis* occurred as an abundant species developing in blooming concentrations during 80^{ies} as a consequence of the Black Sea eutrophication (Moncheva, 1987). It is presumed that the species participates in the organic substance mineralization which explains its development to blooming as a species accompanying other phytoplankton species blooms (Moncheva, 1989). In 1983-1984 *Euglenophyceae* abundance rapidly increased. Their availability during the greater part of the year was maximal, only in spring peridines dominated and diatoms were in obvious depression (Velikova and Petrova, 1999). After 1991 diatoms and peridines were the leading groups in phytocene and *Euglenophyceae* reached blooming concentrations only in May – June (rarely in winter) (Velikova and Petrova, 1999).

Materials and Methods

In 2008, in the lake system 26 samples from 15 stations were collected by the R/V "Prof. A. Valkanov" during the following months: March (Varna and Beloslav Lakes), October (Varna Lake) and December (Varna and Beloslav Lakes). The sampling was conducted by using Nansen bottles (1.5 L) in surface and bottom layers (Figure 1).

In May and June two control samples from the surface water layer were added (in May: st. canal lake-sea and in June: st. A-22). The samples were fixed in 4% formalin solution on board the ship. After being concentrated through precipitation the samples were

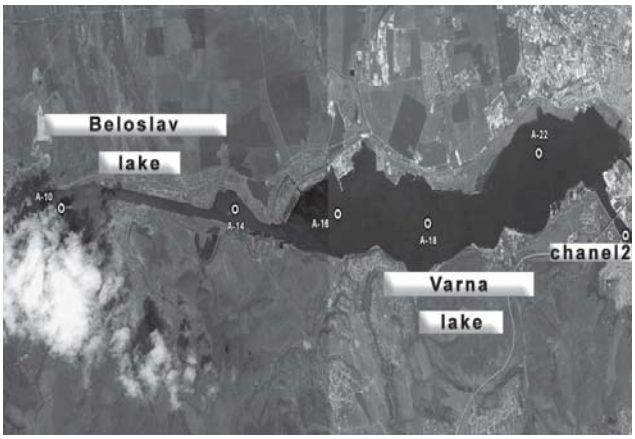

Fig. 1. Map of station (A-10,A-14-Beloslav lake; A-16, A-18, A-22,Chanel 2 –Varna lake), (picture from Google Earth)

kept in glass jars and analyzed by light microscope NIKON E400 in Sedgewick Rafter Counting Cell with volumes of 0.05 ml and 1.00 ml. Cell biomass was calculated by using a geometric method (Edler, 1979) and Phytomar software.

Results and Discussion

Green, euglenic and blue-green microalgae are characteristic of the lakes (Velikova and Petrova, 1999). Their availability is due to the brackish features of the lake ecosystem and its hypereutrophication. Total of 85 phytoplankton species were observed during the present study. Out of them the following species exhibited the highest diversity: *Bacillariophyceae* (45%), *Dinophyceae* (27%), *Cryptophyceae* (5%), *Chrysophyceae* (4%), *Craspedophyceae* (1%), *Chlorophyta* (13%), *Euglenophyceae* (6%), *Prasinophyceae*, *Chlorophyceae* (7%) and *Cyanophyta* (6%).

In comparative multi-annual view, the registered biomasses and numbers of the phytoplankton community in 2008 were not high (Velikova and Petrova, 1999; Petrova et al., 1999; Petrova, 2008). In March 2008, for Beloslav Lake the mean values of number and biomass were 12.86 mln cells l^{-1} and 4.14 $g.m^{-3}$ respectively; for Varna Lake they were 10.45 mln cells l^{-1} and 3.47 $g.m^{-3}$. In May, the control surface sample

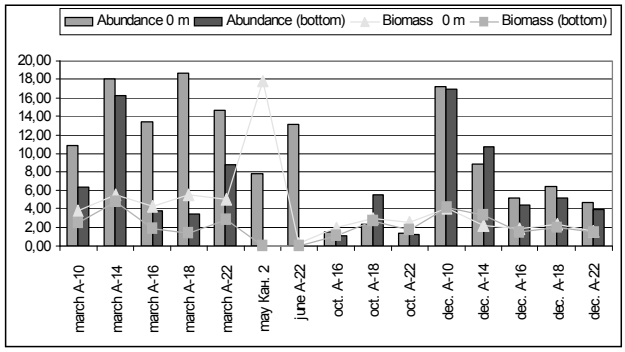

Fig. 2. Abundance, mln.cells.l^{-1} and biomass, $g.m^{-3}$ of phytoplankton

from st. canal 2, lake-sea, contained 7.77 mln cells l^{-1} and 17.78$g.m^{-3}$ (the highest biomass for 2008). In June, the number and biomass in the control surface sample were 13.17 mln cells l^{-1} and 0.29 $g.m^{-3}$ respectively; small-sized picoplankton cells bloomed (~2μm). In October, in Varna Lake the mean number and biomass were $2.15.10^6$ cells.l^{-1} and 2.15 $g.m^{-3}$ respectively. In December, on the average for Beleoslav Lake, the number and biomass were $13.43.10^6$ cells.l^{-1} and 3.42 $g.m^{-3}$ and for Varna Lake - $4.95.10^6$ cells.l^{-1} and 1.77 $g.m^{-3}$ (Figure 2).

Other indicators of the lake system as Shannon-Weaver index and water transparency demonstrated poor quality of the water environment. Shannon-Weaver index was low with values alerting for the ecosystem's instability. In March, it was 0.75 on an average in Varna Lake, 0.55 in Beloslav Lake, and 1.06 in the control sample taken in May. In June, unusually low value of 0.06 was registered. In October it was 2.17 on an average (the highest during the year). In December the index was again low, on the average of 0.26 for Beloslav Lake and 0.51 for Varna Lake.

Water transparency had also poor indicators. The mean values in March were 1.25 m for Varna Lake and 1.20 m for Beloslav Lake. In June it was 1.64m. In October, for Varna Lake it was 2.13m on an average. In December, the mean transparency values were 1.4 m in Beloslav Lake and 2.4 m in Varna Lake (Figure 3).

During the time of research, blooms of the chryptophyte *Chroomonas sp.* (17.5 $x10^6$ cells.l^{-1})

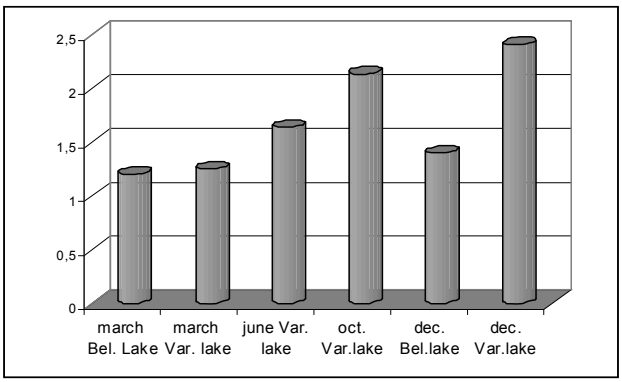

Fig. 3. Average transparency (m) in lake system, by months

and diatom *Sk.costatum* (1.4 x10^6 cells.l^{-1}) were observed in March. In May there were blooms of the diatom *Dactyliosolen fragilissimus* (6.13 x10^6 cells.l^{-1} and 16.85 g.m^{-3}) and *Cryptophyceae* (up to 1.23x10^6cells.l^{-1}). In June, unidentified picoplankton cells (~2μ) with number of 13.09 x10^6 cells.l^{-1} and low biomass 0.19 g.m^{-3} were bloming. *Cryptophyceae* vegetated in October with a number of 4.81 x10^6 cells.l^{-1} and biomass 1.29 g.m^{-3}. In December, diatom *Sk. costatum* dominated with a blooming maximum of 16.95 x10^6 cells.l^{-1} and 3.33 g.m^{-3} (st..A-10) in Beloslav Lake while in Varna Lake the maximal number of 5.87 x10^6 cells.l^{-1} was registered.

The groups of *Cryptophyceae* and *Bacillariophyceae* were dominating in the phytocene structure. Chryptophytes reached maximum of 96.41% on the surface and 95.94% on the bottom in March, and diatoms – up to 99.30% on the surface and 99.35% on the bottom in December (Figure 4).

Diatoms prevailed in biomass up to 97.75% on the surface and to 98.05% on the bottom in December. Chryptophytes reached 84.84% on the surface and 86.88% on the bottom in March. Biomass percentage content of peridines reached to 83.24% on the surface and 66.65% on the bottom in October (Figure 5).

Blooms of peridines were observed during the research period. Their widespread development and dominance in biomass during winter-spring months were connected with the worsening of the ecological state of the marine ecosystems. The peridine *Sc. trochoidea* exhibited the highest number 0.258 x10^6 cells.l^{-1} and biomass 0.816 g.m^{-3} (October, st. A-22, on the surface.), a value far lower than the blooming concentrations. The higher percentage content of *Dinophyceae* in October was in consequence of its development (Figure 5).

We consider as a positive fact for the ecosystem the lack of blooms and widespread developmemnt of *Euglenophyceae*. The representatives of euglenic algae are a common member of the phytoplankton community in the lake system where the species *Eutreptiella sp.* and *Eutreptia lanowii* take the greatest part (Figure 6).

Three representatives of the *Euglenophyceae* group were identified: *Eutreptiella - Eutreptiella sp.*; *Eutreptia – Eutreptia lanowii, Eutreptia viridis* and *Euglena – Euglena sp.* The highest number and biomass exhibited *Eutreptiella sp.* (0.163 x10^6 cells.l^{-1} and 0.17 g.m^{-3}, Oct. st. A-18, bottom), followed by

A **B**

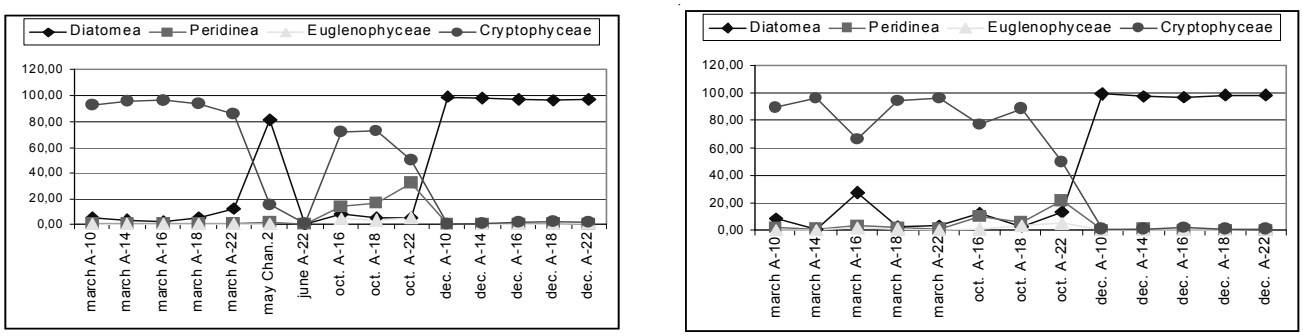

Fig. 4. Phytoplankton abundance percentage content in surface (A) and bottom (B)

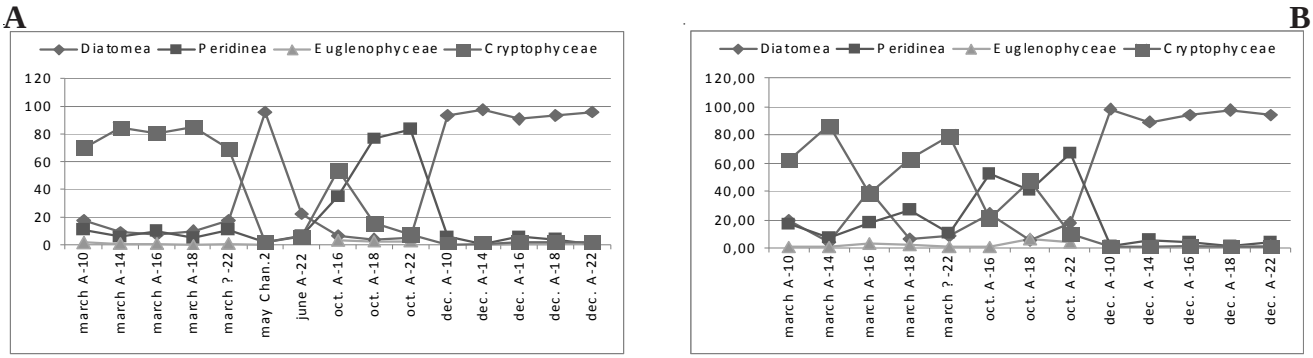

Fig. 5. Phytoplankton biomass persantage content on the surface (A) and on the bottom (B)

Eutreptia lanowii (0.063x10^6 cells.l^{-1}, Oct. st. A-16 0 m.), *Eutreptia viridis* (0.044 x10^6 cells.l^{-1}, March st. A-10 0 m) and *Eutreptia sp.* (0.016x10^6 cells.l^{-1}, March st. A-10, bottom). The lowest number compared to all other species of the group was observed in *Euglena sp.* in March and October with a maximum of 0.003x10^6 cells.l^{-1} (Oct. st. A-18 0 m).

In previous years the same species had been often observed in blooming concentrations. The number of *Eutreptia viridis* registered in winter and autumn in Varna Lake was 11.1 x10^6 cells.l^{-1} in 1999 and 1.5 x10^6 cells.l^{-1} in 1992. Its maximal number (169 x10^6 cells.l^{-1}) in Varna Lake during the last two decades was observed in the spring of 1991 (Velikova and Petrova, 1999; Petrova et al., 1999).

Eutreptia lanowii had developed with higher concentrations (91.4x10^6 cells.l^{-1}, spring and 3.7x10^6 cells.l^{-1}, winter) in Beloslav Lake during 1995. In Varna Lake during the winter of 1995 its number was 9.6 x10^6 cells.l^{-1}.

Eutreptiella sp. vegetated in Varna Lake with abundance of 3.77 x10^6 cells.l^{-1} in the spring and 1.28 x10^6 cells.l^{-1} in the winter of 1999 (Velikova and Petrova, 1999; Petrova et al., 1999)**.**

Euglenophyceae percentage content in the phytocene was low. Higher values were observed in the bottom water layer but they did not exceed 5.33% in number and 6.36% in biomass, October, Varna Lake (Figures 6 and 7). The highest percentage content of *Euglenophyceae* in the phytoplankton community was also observed in October (Table 1).

In horizontal direction, a difference between the development of the *Euglenophyceae* in Varna and Beloslav Lakes was observed only in December when their numbers and biomasses smoothly grew up from the uttermost western station in Beloslav Lake towards the uttermost eastern one in Varna Lake (Figures 7 and 8).

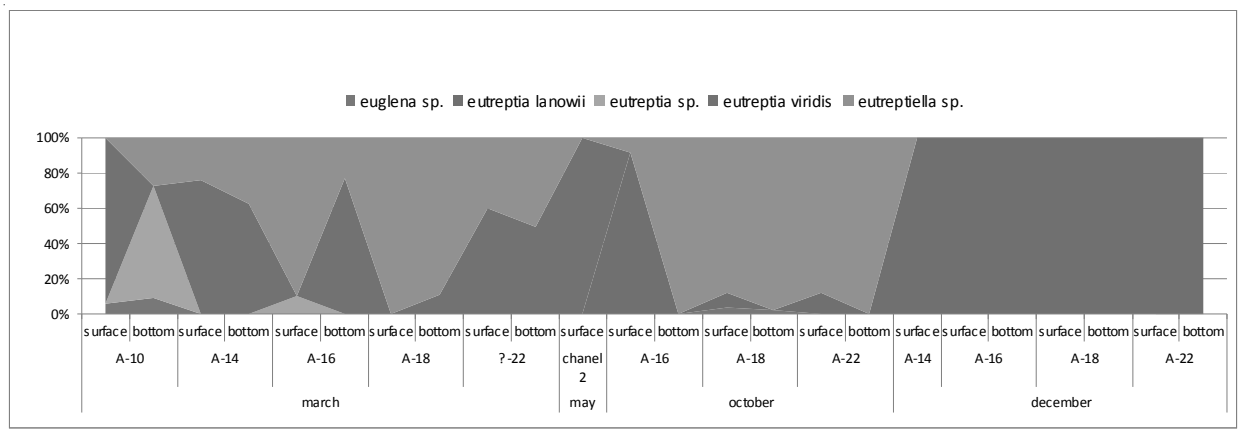

Fig. 6. Dynamics in the percentage content of the *Euglenophyceae* representatives

Table 1

Monthly mean values of density, biomass and percentage proportions of *Euglenophyceae* representatives' content in the phytocene

Month average	Abundance, mln cells m^{-3}	Biomass, $mg.m^{-3}$	Abundance, %	Biomass, %
March	35.57	37.36	0.44	1.22
May	3.6	3.77	0.05	0.02
October	74.33	78.05	3.67	3.41
December	14.39	15.06	0.28	0.84

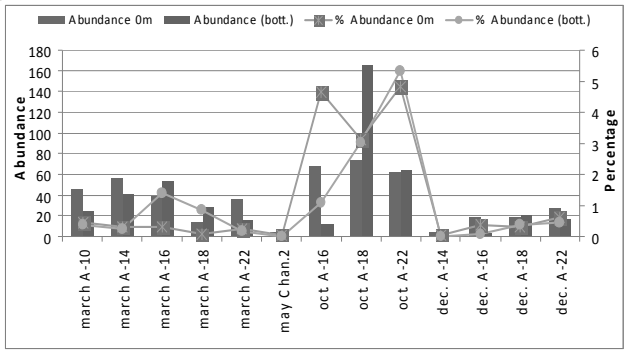

Fig. 7. *Euglenophyceae* distribution according to Abundance, mln.cells.m^{-3} and abundance percentage content in the phytocene of the studied surface – bottom layers

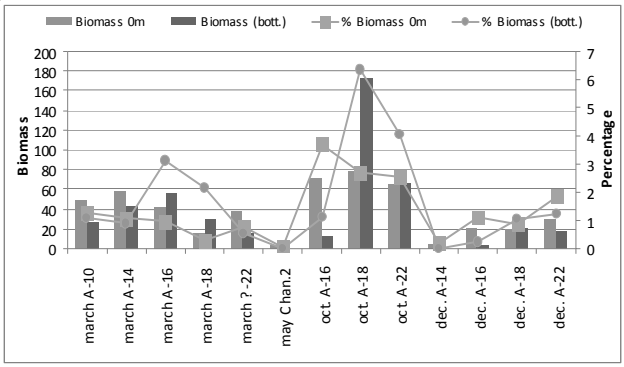

Fig. 8. *Euglenophyceae* distribution according to biomass ($g.m^{-3}$) and biomass percentage content in the phytocene of the studied surface – bottom layers

The registered low concentrations and biomasses of *Euglenophyceae*, most probably, are due to the reduction of the industrial production, low organic content in the lake waters and consequent improvement of the ecological conditions. This conclusion is supported also by studies on the benthos communities in the lakes (Petrova and Stoikov, 2008). Compared to previous years, the maximal phytoplankton numbers and biomasses registered in 2008 were far lower. However, blooms were observed in the entire lake waters which led to changes in color and low water transparency.

Conclusions

- *Euglenophyceae* algae are a typical phytoplankton representative in the lake ecosystem with the greatest availability of *Eutreptiella sp.* and *Eutreptia lanowii*.

- In 2008 *Euglenophyceae* percentage content in the phytocene was low and did not exceed 5.33% in number and 6.36% in biomass.

- Blooms of *Euglenophyceae* were not registered during the period of research. The number and biomass of *Eutreptiella sp.* were maximal, 0.163 $x10^6$ $cells.l^{-1}$ and 0.17 $g.m^{-3}$, respectively. A comparison with previous years shows strong decrease in their number in the lake ecosystem.

- *Cryptophyceae, Bacillariophyceae* and *Dynophyceae* were dominating groups in the phytoplankton of the lake ecosystem.

- The only blooms observed in the lakes belonged to small-sized *Cryptophyceae* (*Chroomonas sp.*, 17.5 $x10^6$ $cells.l^{-1}$), diatoms *Sk.costatum* (16.95 $x10^6$ $cells.l^{-1}$) and *Dactyliosolen fragilissimus* (6.13 $x10^6$ $cells.l^{-1}$ and 16.85 $g.m^{-3}$).

- In spite of the registered lower quantitative values of *Euglenophyceae* allowing assuming a conclu-

sion for a relative improvement in the trophic status, the low values of water transparency and Shannon index describe a bad state of the lake ecosystem.

References

Edler, L., 1979. Recommendations for marine biological studies in the Baltic Sea phytoplankton and chlorophyll. *Baltic Marine Biologists*, pp. 5-38.

Kiriakov, I., 1987. Opportunities for the use of euglenophyceae for the water quality in biological monitoring, *First National Conference on Biological Monitoring*, 22-24 October, Plovdiv, pp. 154-157 (Bg).

Lee, R. E., 1999. Phycology. *Cambridge University Press*. 3 rd Edition.

Moncheva, S., 1987. Blooms and succession of the phytoplankton in the eutrophication conditions Blooms and succession of phytoplankton in a eutrophic. *First National Conference on Biological Monitoring,* 22-24 October, Plovdiv, pp. 133-138 (Bg).

Moncheva, S., 1989. Blooms "of the phytoplankton in relation twith some abiotic environmental factors. *Scientific and Practical Conference - Status of Research, Rational Utilization And Protection Of Natural Resources In The Varna Region*, 30 October, Varna, pp. 134-145 (Bg).

Petrova, D., V. Velikova and D. Gerdzhikov, 1999. Recent state of phytoplankton in Varna lakes (1998-2003). In: *Proceedings of SU-Varna*, **2**'2003-1'2004, pp. 91-96 (Bg).

Petrova, D., 2008. Major Bloom Producing Phytoplankton Species in the Lakes along the Bulgarian Black Sea Coast. *Bulg. J. Agric. Sci.*; **14**: 201-208.

Petrova, E. and S. Stoikov, 2008. Anthropogenic impact on the biota of the Varna lake ecosystem, *Proceedings of the SU-Varna*, **2:** 107-110 (Bg).

Velikova, V. and D. Petrova, 1999. Recent state of phytoplankton in Beloslav and Varna lakes in 1991-1997. In: *Proceedings of IFA-Varna*,XXV, pp.103-124 (Bg).