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Research Article

TAXONOMICAL ANALYSIS OF THE PHYTOPLAKTON OF AKDARYA WATER RESERVOIR IN SPRING AND SUMMER TIMES

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Abstract

In the article, the authors present taxonomic analyzes of phytoplankton in the Akdarya reservoir in the middle reaches of the Zarafshan River basin. As a result of the study of the spring and summer seasons, Bacillariophyta and Xhanthophyta were identified, and their taxonomic analyzes were carried out.

Keywords: Taxanomy, Bacillariophyta, Xhanthophyta, Akdara reservoir, spring and summer.

INTRODUCTION

Importance of the topic

Phytoplankton is important as a primary producer in the trophic chain of the Akdarya Water Reservoir located in the middle stream of Zarafshan River. Phytoplankton directly or indirectly is consumed by representatives of hydrobionts (consumers) i.e. by micro-zooplanktons and macro-zooplanktons. Besides, phytoplankton is a source of oxygen for hytrobionts of this water reservoir. The trophic chain of consumers is completed by fish. Fish in its tern is an important product for human. Trophic chain is represented in the following scheme:

Scheme of Trophic Chain in Akdarya Water Reservoir

Phytoplankton → Zooplankton (Micro Zooplankton) → Zooplankton (Macro Zooplankton) → Fish → Human

Biological diversity of hydrobionts and their sustainable development in the water reservoir is connected with development of the food producers – phytoplankton of Akdarya Water Reservoir. At present time the seasonal change of phytoplankton, evaluation of its current state and measures for saving biodiversity of this water reservoir is one of the important goals.

Previous research conducted for study of phytoplankton of Akdarya Water Reservoir: Algae species content, their distribution, ecology and their importance in evaluation of ecological and sanitary conditions of the middle stream of Zarafshan River basin (its riverbed and tributaries such as Akdarya River, Karadaria River, Amankutansai River and Yettiuilisai River) generally were studied (Olimjonova and Toshpo'latov, 2012; Toshplatov and Olimzhonova, 2011, 2012, 2014,2015). However up to present time Akdarya Water Reservoir algae remained unstudied. Systematic lists of algae content for Zarafshan River basin's middle stream lacked the Akdarya Water Reservoir's algae list and algae taxonomic analysis.

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In a view of this gap the study of algae of this water reservoir has been determined as a priority goal for this research which was carried out from 2015-2016 (Alimjanova *et al.,* 2015).

MATERIALS AND METHODS

During 2015-2016 scientific expeditions were arranged for conducting season based researches of Akdarya Water Reservoir. Field research has been conducted and algological samples were collected in accordance with algological and hydro-biological research methods (Gollerbakh and Polyansky, 1951). Under laboratory conditions light microscope Carl Zeiss was used. Specimens were prepared (Gollerbakh and Polyansky, 1951; Sheshukova, 1949), algae content was defined with the use of fresh water algae identification directories of local and foreign authors (Dudusenko-Shchegoleva and Hollerbakh, 1962; Zabelina *et al.,* 1951). Research has been conducted within the framework of State Budget funded project 'Unique Objects". Collected algological samples are kept in 4% formalin while processed algae materials and prepared systematic lists are kept in the electronic database of Algological Collection 1B: "Collection of algae flora of water reservoirs and soils of the Republic of Uzbekistan". The results based on seasonal changes of phytoplankton and its taxonomical analysis have been divided into two parts. This article for the first time provides taxonomical analysis of Akdarya Water Reservoir's phytoplankton during spring and summer times.

Geographic location of Akdarya Water Reservoir: Akdarya Water Reservoir is located on 39^0995'N of northern latitude and 066^0382'E of eastern longitude 485 meters above the sea level in Ishtihan District of Samarkand Region of the Republic of Uzbekistan. Akdarya Water Reservoir receives waters from Akdarya tributary of the middle stream Zarafshan River. This water reservoir was constructed in 1989. The capacity of the water reservoir is 131.8 ml m^3 (O'zME, 2000).

Results of researches on hydro-physical and chemical content of the water of Akdarya Water Reservoir: During the spring season the air and water temperatures are15-20^0C and pH is 6.5-7.0, mineralization is 500 mg/l. During summer

time these indicators changed: air temperature was 38-40^{0}C, temperature of water – 29-30^{0}C, pH 8.0.

RESULTS

Spring and summer changes in the content of the phytoplankton species of Akdarya Water Reservoir: As a result of identifying the content of the phytoplankton species it has been found out that during the spring time only Bacillariophyta is spread in the water reservoir. Total number of phytoplankton species in spring time comprises 23 species and diversities. During summer time in June Bacillariophyta and Xanthophyta are spread in the water reservoir. Their total number comprises 25 species and diversities. Out of them 22 species are Bacillariophyta and 3 species – Xanthophyta. During summer time due to the air and water temperature increase (from 15-20^{0}C up to 29-30^{0}C) the number of species increased from 23 species to 25 species in comparison with spring time. During both seasons of the year in total 42 species and diversities of phytoplankton were spread in the water reservoir. Out of them there are 30 species, 10 variations and 2 forms. They are represented in the Table 1. Some species such as *Cyclotella ocellata* Pant., *Diatoma hiemale* (Lyngb.) Heib., *Surirella didyma* Kuetz that were found during spring time were not spread during summer time. On the contrary species that were spread during summer time such as *Achnanthes conspicua* A.Meyer., *Navicula perpusilla* Grun., *Cymbella reinhardtii Grun.and others* were not found during spring time. However some species such as *Synedra ulna* (Nitzsch.) Ehr., *Synedra ulna* var.*amphirhynchus* (Ehr.) Grun., *Synedra pulchella* (Ralfs) Kuetz., *Nitzschia distans* Greg., *Nitzschia vermicularis* (Kuetz.) Grun, *Nitzschia sigmoidea* (Ehr.) *W.Sm.* were found both during spring and summer times. The identified algae species in Akdarya Water Reservoir such as *Synedra ulna var.aequalis* (Kuetz.) Hust., *Navicula subtilissima f.baicalensis* Skv., *Cymbella helvetica Kuetz.* and others developed during spring time in small quantities and were rare. Such species as *Fragilaria intermedia* Grun., *Synedra pulchella* (Ralfs.)Kuetz., *Achnanthes conspicua* A.Meyer., *Navicula perpusilla* Grun. also developed in small quantities during summer time and were rare. The frequency of their occurrence is 1 to 3 units within eyesight (h). However there are algae species that develop in substantial numbers and are frequent in their occurrence. They comprise four species and they are dominant species and diversities. Among them in spring time following species were found: *Synedra ulna* (Nitzsch.) Ehr., *Navicula cryptocephala* var. *veneta* (Kuetz.) Grun., *Cymbella lacustris* (Ag.) Cl. f. *baicalensis* Skv.; in summer time - *Tribonema affine West*. The frequency of their occurrence is 5 unites within eyesight. During spring time *Navicula cryptocephala* var.*veneta* (Kuetz.) *Grun.* developed in mass quantity and it is distinguished with its prolific development among dominant algae species with the frequency of occurrence 7-9 unites within eyesight.

Taxanomic Anaysis of Phytoplanton of Akdarya Water Reservoir: 23 phytoplanktons of Bacillariophyta that were found during spring time in Akdarya Water Reservoir belong to 18 species, 3 varieties and 2 forms. From systematic point of view they belong to 2 classes (*Centrophyceae, Pennatophyceae*), 3 ordes (*Discoidales, Araphinales, Raphinales*), 5 families (*Coscinodiscaceae* Kuetz., *Fragilariaceae* (Kuetz.) D.T., *Naviculaceae* West., *Nitzschiaceae* Hass., *Surirellaceae* Turp.), and 10 Genuss (*Cyclotella* Kuetz., *Diatoma* D.C., *Fragilaria* Lyngb., *Synedra* Ehr., *Navicula* Bory, *Neidium* Ag., *Amphora* Ehr., *Cymbella* Ag., *Nitzschia* Hass., *Surirella* Turp.) During summer time two divisions of algae were found in Akdarya Water reservoir *Bacillaryophyta* and *Xanthophyta.* In summer the quantity of *Bacillaryophyta* comprises 22 species and diversities and out of them 14 are species and 8 – variations. From systematic location they belong to 1 class *Pennatophyceae,* 2 orders (*Araphinales, Raphinales*), 5 families (*Fragilariaceae* (Kuetz.) D.T., *Achnanthaceae* (Kuetz.) Grun., *Naviculaceae* West., *Nitzschiaceae* Hass., *Surirellaceae* (Kuetz.) Grun.), and 8 Genuss (*Fragilaria* Lyngb., *Synedra* Ehr., Achnanthes Bory, *Navicula* Bory, *Amphora* Ehr., *Cymbella* Ag., *Nitzschia* Hass., *Surirella* Turp.). In summer the Xanthophyta is represented by 3 species and in terms of systematic location they belong to 2 classes (*Heterotrichophyceae*, *Heterococcophyceae)*, 2 orders (*Tribonematales*, *Heterococcales),* 2 families (Tribonemataceae Pasch., Chlorotheciaceae Pasch.), and 2 Genuss (*Ophiocytium Naeg., Treibonema Pasch.).*

In total 42 phytoplankton species are identified during spring and summer times in Akdarya Water Reservoirs and they belong to 30 species, 10 variations and 2 forms which in terms of systematic location belong to 2 divisions (*Bacillariophyta, Xanthophyta*), 4 classes (*Centrophyceae, Pennatophyceae, Heterotrichophyceae, Heterococcophyceae*), 5 orders (*Discoidales, Araphinales, Raphinales, Tribonematales, Heterococcales),* 8 families *(Coscinodiscaceae* Kuetz., *Fragilariaceae(Kuetz.) D.T.*, *Achnanthaceae* (Kuetz.) Grun., *Naviculaceae* West., *Nitzschiaceae* Hass. *Surirellaceae* Turp., *Tribonemataceae Pasch., Chlorotheciaceae* Pasch.), and 13 Genuss (Cyclotella Kuetz., *Diatoma* D.C., *Fragilaria* Lyngb., *Synedra* Ehr., *Achnanthes* Bory, *Navicula* Bory, *Neidium* Ag., *Amphora* Ehr., *Cymbella* Ag., *Nitzschia* Hass., *Surirella* Turp., *Treibonema* Derb. et Sol., *Ophiocytium* Naeg.) (Table 2).

From the above mentioned the conclusions are as follows:

- In comparative analysis the taxonomic content of phytoplankton increases from 23 to 25 species and diversities during summer time in comparison with spring time. This is connected with air and water temperature increase in summer time (from 15-20^{0}C to 29-30^{0}C);
- General analysis shows that in spring and summer 42 species and diversities are identified that belong to 30 species, 10 variations and 2 forms;
- During summer the dominant species include 4 species and diversities: *Synedra ulna* (Nitzsch.) Ehr., *Navicula cryptocephala* var.*veneta* (Kuetz.) Grun., *Cymbella lacustris* (Ag.) Cl. f. *baicalensis* Skv. Also during summer *Tribonema affine* West. is observed in big numbers. Other phytoplanktons are observed in small quantities;
- Taxonomic analysis shows that identified phytoplankton in spring and summer time in Akdarya Water Reservoir belong to 2 divisions (*Bacillariophyta, Xanthophyta*), 4 classes (*Centrophyceae, Pennatophyceae, Heterotrichophyceae, Heterococco-phyceae*), 5 orders (*Discoidales, Araphinales, Raphinales, Tribonematales, Heterococcales), 8* families *(Coscinodiscaceae* Kuetz., *Fragilariaceae* (Kuetz.) D.T., *Achnanthaceae* (Kuetz.) Grun., *Naviculaceae* West., *Nitzschiaceae* Hass. *Surirellaceae* (Kuetz.) Grun., *Tribonemaceae Pasch., Chlorotheciaceae* Pasch.), and 13 Genuss (Cyclotella Kuetz., *Diatoma* D.C., *Fragilaria* Lyngb., *Synedra* Ehr., *Achnanthes* Bory, *Navicula* Bory, *Neidium* Ag., *Amphora* Ehr., *Cymbella* Ag., *Nitzschia* Hass., *Surirella* Turp., *Treibonema* Derb.et Sol., *Ophiocytium* Naeg.).

Table 1. Comparative Analysis of the Spring and Summer Taxonomic Content of the Phytoplankton of Akadarya Water Reservoir and the Frequency of Their Occurrence h (score), 2015-2016

Spring	h, score	Summer	h, score
Division *Bacillariophyta*		Division *Bacillariophyta*	
Class *Centrophyceae* Order *Discoidales* Familia *Coscinodiscaceae* Kuetz. Genus *Cyclotella* Kuetz.			
Cyclotella ocellata Pant.	1-3		
Class *Pennatophyceae* Order *Araphinales* Familia *Fragilariaceae* (Kuetz.) D.T. Genus *Diatoma* D.C.		Class *Pennatophyceae* Order *Araphinales* Familia *Fragilariaceae* (Kuetz.) D.T.	
Diatoma hiemale (Lyngb.) Heib.	1		
Genus. *Fragilaria* Lyngb.		Genus. *Fragilaria* Lyngb.	
Fragilaria capucina Desm.	1	*Fragilaria intermedia* Grun.	1
Genus *Synedra* Ehr.		Genus *Synedra* Ehr.	
Synedra ulna (Nitzsch.) Ehr.	5	*Synedra ulna* (Nitzsch.) Ehr.	1
Synedra ulna var.*aequalis* (Kuetz.) Hust.	1	*Synedra tabulata* (Ag.) Kuetz.	3
Synedra ulna var.*amphirhynchus* (Ehr.) Grun.	1	*Synedra ulna* var. *amphirhynchus* (Ehr.) Grun.	1
Synedra pulchella (Ralfs) Kuetz.	1	*Synedra pulchella* (Ralfs) Kuetz.	3
Sup-Order *Raphinales*		Order *Raphinales* Sup-Order Monoraphineae Familia Achnanthaceae (Kuetz.) Grun. Genus Achnanthes Bory	
		Achnanthes conspicua A.Mayer.	1
Order *Diraphineae* Familia *Naviculaceae* West. Genus *Navicula* Bory		Sub-Order *Diraphineae* Familia *Naviculaceae* West. Genus *Navicula* Bory	
Navicula cryptocephala var.*veneta* (Kuetz.) Grun.	5,7 9	*Navicula perpusilla* Grun.	1
Navicula subtilissima f.*baicalensis* Skv.	1		
Genus *Neidium* Ag.			
Neidium distincte-punctatum Hust.	1		
Genus *Amphora* Ehr.		Genus *Amphora* Ehr.	
Amphora commutata Grun.	1,3	*Amphora ovalis* var.*gracilis* Ehr.	3
Amphora lineolata Ehr.	1,3	*Amphora ovalis* var. *constricta* Skv.	1
		Amphora ovalis var. *libyca* Kuetz.	1
		Amphora ovalis var. *pediculus* Kuetz.	1
Genus *Cymbella* Ag.		Genus *Cymbella* Ag.	
Cymbella lacustris f. *baicalensis* Skv.	5	*Cymbella reinhardtii* Grun.	1
Cymbella parva (W.Sm.) Cl.	1,3		
Cymbella helvetica Kuetz.	1		
Cymbella tartuensis Mölder	1		
Sub-Order *Aulonoraphineae* Familia *Nitzschiaceae* Hass. Genus *Nitzschia* Hass.		Sub-Order *Aulonoraphineae* Familia *Nitzschiaceae* Hass. Genus *Nitzschia* Hass.	
		Nitzschia angularis W.Sm.	3
		Nitzschia acuta Hantzsch	3
Nitzschia distans Greg.	1,3	*Nitzschia distans* Greg. *Nizschia distans* var. *tumescens* Grun.	1 3
Nitzschia filiformis (W.Sm.) Hust.	1	*Nitzschia frustulum* var. *asiatica* Hust. *Nitzschia frustulum* var. *subsalina* Hust.	1 1
		Nitschia obtusa W.Sm.	3
Nitzschia vermicularis (Kuetz.) Grun	1,3	*Nitzschia vermicularis* (Kuetz.) Grun.	1
Nitzschia regula Hust.	1		
Nitzschia sigmoidea (Ehr.) W.Sm.	1	*Nitzschia sigmoidea* (Ehr.)W.Sm.	1,3
Familia *Surirellaceae* (Kuetz.) Grun. Genus *Surirella* Turp.		Familia *Surirellaceae* (Kuetz.) Grun. Genus *Surirella* Turp.	
Surirella linearis W.Sm.	1	*Surirella ovalis* Breb.	1
Surirella didyma Kuetz.	1		
Total – 23: species – 18. variations - 3, forms -2		Total - 22: species - 14 variations - 8	
Total during both seasons: 39; species – 27; variations – 10; forms – 2.			
		Division Xanthophyta	
		Class *Heterotrichophyceae*	
		Order Tribonematales Pasch.	
		Familia Tribonemataceae Pasch.	
		Genus Tribonema Derb. et Sol.	
		Tribonema affine West	5
		Tribonema spirotaenia Ettl	1
		Class *Heterococcophyceae*	
		Order *Heterococcales*	
		Familia *Chlorotheciaceae* Pasch.	
		Genus. *Ophiocytium* Naeg.	
		Ophiocytium gracillimum Borzi em.Pasch.	3
		Total - 3	
		Total number of algae during summer: 25, species – 17 variations - 8	
Total number of algae taxon during both seasons - 42: Species - 30; Variations – 10; Forms - 2			

Table 2. Systematic content of algae phytoplankton of Akdarya Water Reservoir

Titles					Number of species and inter species diversity			Total
Divisions	**Classes**	**Orders**	**Families**	**Genuss**	**Species**	**Variation**	**Forms**	
Bacilla-riophyta	*Centro-phyceae*	*Discoidales*	*Coscinodis-caceae* Kuetz.	*Cyclotella* Kuetz.	1			1
	Pennato-phyceae	*Araphinales*	*Fragilari-aceae* Lyngb.	*Diatoma* D.C.	1			1
				Fragilaria Lyngb.	2			2
				Synedra Ehr.	3	2		5
		Raphinales Sub-Order: *Monoraphineae*	*Achnanthaceae* (Kuetz.) Grun.	*Achnanthes* Bory	1			1
		Sub-Order: Diraphineae	*Naviculaceae* West.	*Navicula* Bory	1	2		3
				Neidium Ag.	1			1
				Amphora Ehr.	2	4		6
				Cymbella Ag.	4		1	5
		Sub-Order: Aulonora-phineae	*Nitzschiaceae* Hass.	*Nitzschia* Hass.	8	3		11
			Surirellaceae Turp.	*Surirella* Turp.	3			3
Total:1	2	3	6	11	27	10	2	39
Xantho-phyta	*Heterotri-chophyceae*	*Tribonematales*	*Tribonemata-ceae* Pasch.	*Treibone-ma* Pasch.	2			2
	Heterococco-phyceae-	*Heterococcales*	*Chlorotheci-aceae* Pasch.	Ophiocy-tium Naeg.	1			1
Total:1	*2*	*2*	*2*	*2*	3			3
Gross Total: 2	4	5	8	13	30	10	2	42

(spring and summer seasons, 2015-2016)

- The results of this research are provided for the first time and they can be used for creating general list of phytoplankton of the middle stream of Zrafshan River.

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