

## POLYMORPH TAXA OF THE ALGAL FLORA OF FERGANA VALLEY'S WATER RESERVOIRS

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Results of research on taxonomical composition of Andijan, Eskiye and Karkidon reservoirs algal flora, situated in the territory of Fergana Valley of Uzbekistan are presented. Detailed data are given regarding polymorph taxa, composing a base of algal flora. Species amount of polymorph classes and families were analyzed comparatively.

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**Key words:** Algal flora; water reservoirs; taxonomic units; polymorph

آرایه‌های پلی مورف از فلور جلبکی دریاچه‌های ذخیره آب در دره فرگانا در ازبکستان

خیلیولا ارکینجونونا ارگاشوا: انستیتوی ذخایر ژنتیک گیاهی و جانوری آکادمی علوم ازبکستان

نتایج تحقیق بر روی ذخایر ژنتیکی فلور جلبکی مجموعه دریاچه‌های ذخیره آب در آندیجان، اسکیر و کارکیدون قلمرو دره فرگانان در ازبکستان گزارش می‌گردد. داده‌های دقیق در رابطه با آرایه‌های پلی مورف که پایه فلور جلبکی را نشان می‌دهند آرایه می‌گردد. میزان گونه‌ها در کلاس‌ها و خانواده‌های پلی مورف با یکدیگر آنالیز و مقایسه می‌گردند.

### INTRODUCTION

A taxonomic structure of algal flora of Uzbekistan' water reservoirs were studied by a number of algologists (Muzafarov 1965; Ergashev 1974; 1979; Temirov 1995). Today a part of researches, connected to development of theoretical and practical issues of algology in Uzbekistan is being carried out in reservoirs. Especially, considerable attention is currently being focused on investigation of algal flora of reservoirs in Fergana valley. Researches, which were carried out from 2006 to 2015, devoted to identification and wide-ranging analysis of species structure of such reservoirs algal flora as Andijan (Andijan region, Khonobod district), Eskiye (Namangan region, Yangikurgan district) and Karkidon (Fergana region, Quva district), (fig. 1). Definition of modern taxonomic structure of water reservoirs algal flora of this region and their wide-ranging analysis are of great importance in composition of a list of Uzbekistan's algal flora. Obtained data, especially, definition of taxonomic units of algal flora, besides, formation of inventory of local biodiversity objects will serve as a base of monitoring studies.

### MATERIALS AND METHODS

Generally recognized methods of algology were used during studies, focused on definition of taxonomic structure of these reservoirs (Kiselyov, 1956). Species included in the algal flora were identified using classical (Kiselev, 1954; Dedusenko-Shchegolev & al. 1959; Muzafarov, 1965; Muzafarov & al. 1987, 1988) and the modern (Khalilov & al. 2012, 2014) determinants of algae. For taxonomic, seasonal and quantitative investigation of algal flora, algal samples were collected from 17 observation points which were set in five places of reservoirs.

Seasonal algal samples collection in water reservoirs carried out from 2006 to 2013 in Andijan and from 2011 to 2015 in Karkidon and Eskiye.

At the sample collecting period water temperature was measured by thermometer, water transparency by Secchi disk, pH by pH instrument (pH 262 and pH 340) and planktons were gathered by plankton net GAZ №76. Collected examples were fixed with 4% of formalin.

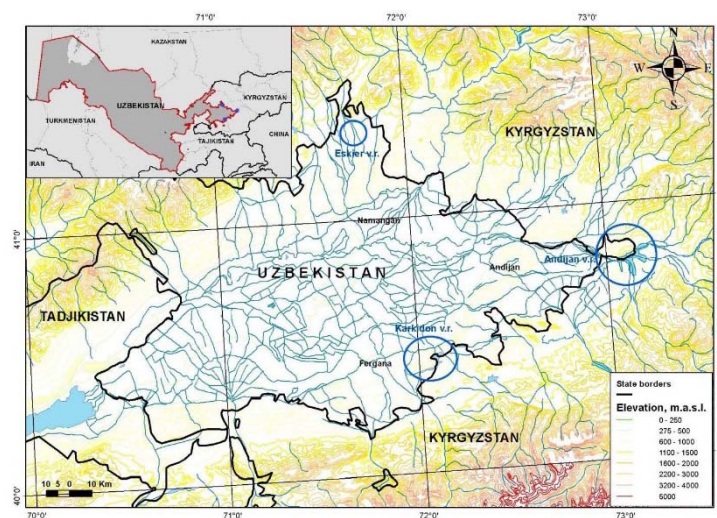


Fig. 1. Map of the research areas.

Totally 560 samples of algae were collected from the water reservoirs, 360 of collected samples were used for identifying of planktons, 150 samples for benthos and 100 samples for periphytons. Permanent slides of collected diatom were made by methods of Sheshukova V. S (1949).

## RESULTS AND DISCUSSION

During investigations which were carried out in 2011-2015, taxonomic units of algal flora of water reservoirs such as Andijan, Eskiye and Karkidon were studied for the first time. As a result 418 species and subspecies were identified in Andijan, 267 species in Eskiye and 186 species in Karkidon water reservoirs. (table 1).

In Andijan water reservoir the temperature of the water in spring is 11-13-18 °C, transparency 0.4-1.1 meters to 2 meters, pH 7.5-8.5, mineralization 580-1300 mg / liters. The temperature in summer is 20-25-31 °C, transparency 1-2 meters to 2-2.5 meters, pH 7.4-8.2, mineralization 860-1580 mg / liters. The temperature in autumn is 24-22-16 °C, transparency 0.8-1.3 meters to 2 meters, pH 7.3-8.2, mineralization 890-1280 mg / liters. The temperature of the water in

winter is +6, +5, +4 °C, transparency 1.5-2.5 meters, pH 6.5-7, mineralization 560 -1010 mg / liters.

In Eskiye water reservoir, the temperature of the water in spring is 12-14-22 °C, transparency 0.5-1 meters to 1.6 meters, pH 7.3-8.2, mineralization 650-1300 mg / liters. The temperature in summer is 20-25-32 °C, transparency 0.8-1.5 meters to 2-2.3 meters, pH 7.1 - 8.3, mineralization 880-1600 mg / liters. The temperature in autumn is 26-16-14 °C, transparency 0.8-1 meters to 1.5 meters, pH 7.6-8.5, mineralization 780-1300 mg / liters and in winter it is +6, +5, +4 °C, transparency 1.5 to 2 meters, pH 6.8-7.3, mineralization 620 -1200 mg / liters.

In Karkidon water reservoir, the temperature of the water in spring is 11-14-22 °C, transparency 0.5-1 to 1, 3 meters, pH 7.5 -8.4, mineralization 750-1500 mg / liters. The temperature in summer is 19-26-32 °C, transparency 0.4-1.2 to 1.6 meters, pH 7.1-8.3, mineralization 910-1760 mg / liters. The temperature in autumn is 26-17-13 °C, transparency 0.6 - 0.8 to 1.2 meters, pH 7.9-8.7, mineralization 810-1600 mg / liters. In winter the temperature is +6 +5 +4 °C, transparency 1.3 to 1.7 meters, pH 7.1-7.5, mineralization 660 -1300 mg / liters.

Table 1. Taxonomic analysis of Fergana Valley water reservoir's algal flora.

Divisions	Classes			Orders			Families			Genera			Species		
	Andijan	Eskier	Karkidon	Andijan	Eskier	Karkidon	Andijan	Eskier	Karkidon	Andijan	Eskier	Karkidon	Andijan	Eskier	Karkidon
Cyanophyta	2	2	22	4	3	3	16	10	7	28	14	10	107	60	44
Euglenophyta	1	1	1	1	1	1	2	2	2	5	4	4	23	26	10
Chrysophyta	2	1	1	2	2	1	2	3	1	2	3	1	5	10	4
Xanthophyta	-	1	-	-	1	-	-	1	-	-	1	-	-	4	-
Bacillariophyta	2	2	2	4	4	3	8	8	6	29	24	19	115	76	52
Dinophyta	1	1	1	1	1	1	1	1	1	3	3	3	17	18	6
Chlorophyta	4	2	2	8	3	3	21	13	13	49	26	28	151	73	70
Total:	12	10	9	20	15	12	50	38	30	116	75	65	418	267	186

In algal flora of Andijan reservoir 5 out of 12 families covering 339 species (81.10%) are polymorphic families. Of these families Pennatophyceae (99 species, 23.68%), Chlorococcophyceae (98 species, 23.44%) and Hormogoniophyceae (90 species, 21.53%) bringing together 287 species, compose 68.66% of the total algal flora (2 table). The number of species of other families varies from 1 to 21.

In algal flora of Eskier reservoir 4 out of 10 families covering 182 species (68.61%) are polymorphic families. Of these families Pennatophyceae (60 species,

22.47%), Chlorococcophyceae (59 species, 22.09%) and Hormogoniophyceae (37 species, 13.85%) bringing together 156 species, compose 58.42% of the total algal flora (table 2). The number of species of other families varies from 1 to 18.

In algal flora of Karkidon reservoir 3 (that three families are polymorphic) out of 9 families covering 138 species (74.19%) are polymorphic families. Of these Chlorococcophyceae (61 species, 32.79%), Pennatophyceae (42 species, 22.58%) and Hormogoniophyceae (35 species, 18.81%) (table 2). Species of other families varies from 1 to 16 species.

Table 2. Polymorph classes of algal flora composition.

Classes	Andijan reservoir		Eskier reservoir		Karkidon reservoir	
	Species number	Of total algal flora %	Species number	Of total algal flora %	Species number	Of total algal flora %
Pennatophyceae	99	23.68	60	22.47	42	22.58
Chlorococcophyceae	98	23.44	59	22.09	61	32.79
Hormogoniophyceae	90	21.53	37	13.85	35	18.81
Conjugatophyceae	29	6.93	-	-	-	-
Euglenophyceae	23	5.50	26	9.73	-	-
Total: 5	339	81.10	182	68.16	138	74.19

A number of Pennatophyceae species in the algal flora of Fergana reservoirs compared with a number of

species of Syrdarya basin reservoirs' algal flora (fig. 2). It has been found that species of Pennatophyceae class are dominant algal group in all studied water reservoirs. Analyzed data of reservoirs belong to Syrdarya River Basin and geographically close areas, showed too similarity. But, as can be seen from the figure there is a significant difference in percentages of algal flora of two reservoirs (upper and lower). Charvak reservoir water is very clear. Chatkal, Pskem Kuksu and rivers, which are located at altitude of 1800 m above sea level

with mineralization of 239, 5-768 mg / l without sewage. Some of representatives of this class are common in mountainous regions. Therefore, percentage of species in this reservoir is high. Chardara reservoir is located at an altitude of 600-700 meters above sea level, transparency and purity of Syrdarya is low, mineralization is 880-1500 mg / l, and saturated with the sewage. Therefore, the percentage indicator of species of these reservoirs is relatively low.

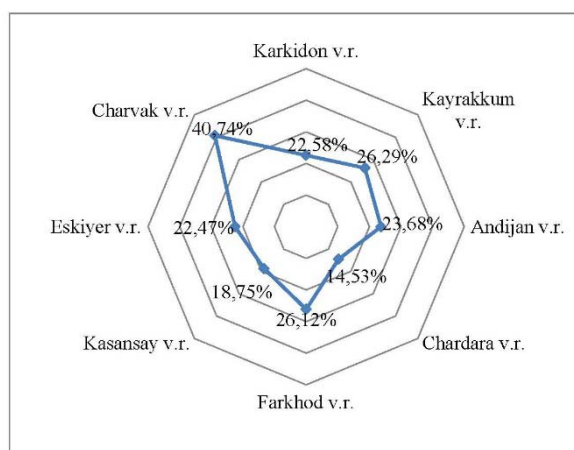


Fig 2. Comparative analysis of species amount of Pennatophyceae class.

In algal flora of Andijan reservoir 10 out of 20 orders combining 369 species (88.27%) are polymorphic orders. Of these Chlorococcales (91 types 21, 77%), Raphinales (88 species of 21.05%) and Oscillatoriales (63 species, 15.07%) orders covering 242 species make more than half of the total algal flora of the area (table 3).

In Algal flora of Eskier reservoir 6 out of 20 orders consist of 192 species (71 91%) are polymorphic orders. Of these, Chlorococcales (57 species, 21.34%), Raphinales (45 species, 16.85%) and Euglenales (26 species, 9.7%) orders covering 128 species and constitute 47.94% of total algal flora of this area (table 3).

In algal flora of Karkidon reservoir 4 out of 12 orders consisting 121 species (65.05%) are polymorphic orders. The predominant orders are Chlorococcales (59 species 31.72%), Raphinales (27 species 14.51%), Oscillatoriales (21 species, 11.29%) and Nostocales (14 species, 7.52%) (table 3).

In algal flora of Andijan reservoir 16 out of 49 families covering 289 species (69.13%) are polymorphic families. Of these families

Oscillatoriaceae (57 species, 13.63%), Naviculaceae (48 species, 11.48%) and Euglenaceae (23 species, 5.50%) bringing together 128 species compose 30.62% of total algal flora (table 4).

In algal flora of Eskier reservoir 12 out of 38 families covering 190 species (71.16%) were polymorphic families. Of these Naviculaceae family (25 species, 9.36%), Oscillatoriaceae (23 species, 8.61%), and Euglenaceae (22 species, 8.23%) bringing together 70 species compose 26.21% of total algal flora (table 4).

In algal flora of Karkidon reservoir 9 out of 30 families covering 118 species (63.44%) are polymorphic families. Of these Naviculaceae (25 species, 12.36%), by Oscillatoriaceae (21 species, 11.29%), and Oocystaceae (18 species, 9.67%) families bringing together 62 species compose 33.33% of total algal flora (table 4).

A number of Oscillatoriaceae class' species in algal flora of Fergana Valley reservoirs compared with a number of species in algal flora of some reservoirs of Uzbekistan (fig 3).

Table 3. Polymorph orders of algal flora composition.

Orders	Andijan reservoir		Eskier reservoir		Karkidon reservoir	
	Species number	Of total algal flora %	Species number	Of total algal flora %	Species number	Of total algal flora %
Chlorococcales	91	21.77	57	21.34	59	31.72
Raphinales	88	21.05	45	16.85	27	14.51
Oscillatoriales	63	15.07	23	8.6	21	11.29
Nostocales	25	5.98	-	-	14	7.52
Euglenales	23	5.50	26	9.7	-	-
Peridinales	17	4.06	18	6.7	-	-
Ulothrichales	16	3.82	-	-	-	-
Chroococcales	16	3.82	23	8.6	-	-
Discoidales	15	3.58	-	-	-	-
Araphinales	15	3.58	-	-	-	-
Total:	369	88.27	192	71.91	121	65.05

Table 4. Polymorph families in algal flora composition.

Families	Andijan reservoir		Eskier reservoir		Karkidon reservoir	
	Species number	Of total algal flora %	Species number	Of total algal flora %	Species number	Of total algal flora %
Oscillatoriaceae	57	13.63	23	8.61	21	11.29
Naviculaceae	48	11.48	25	9.36	23	12.36
Euglenaceae	23	5.50	22	8.23	8	4.30
Desmidiaceae	20	4.78	-	-	-	-
Peridiniaceae	17	4.06	18	6.74	-	-
Cosinodiscaceae	15	3.59	15	5.61	-	-
Oocystaceae	15	3.59	16	5.99	17	9.13
Hydrodictyaceae	15	3.59	14	5.24	-	-
Cosinodiscaceae	-	-	15	5.61	10	5.37
Fragilariaceae	-	-	14	5.24	11	5.91
Scenedesmaceae	12	2.87	-	-	9	4.83
Ankistrodesmaceae	12	2.87	10	3.74	8	4.30
Ulothrichaceae	11	2.63	-	-	-	-
Anabaenaceae	-	-	9	3.37	11	5.91
Nitzshiaceae	10	2.39	-	-	-	-
Micractiniaceae	9	2.15	-	-	-	-
Zygnemataceae	9	2.15	-	-	-	-
Chlorococcaceae	8	1.91	-	-	-	-
Achnanthaceae	8	1.91	9	3.37	-	-
Total:	289	69.13	190	71.16	118	63.44

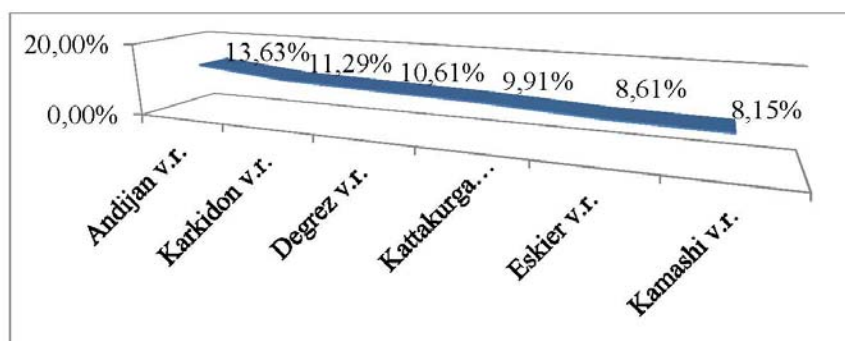


Fig 3. Comparative analysis of species number of Oscillatoriaceae family.

The percentages of Oscillatoriaceae species of studied reservoir is no significant difference (1-5%). Thus, species of this family are widespread in other reservoirs. In addition, species of this family differ according to large number of scientific data, written for the algal flora of Uzbekistan and Central Asia [1, 2, 4]. This state indicates favorable environmental conditions for representatives of this class in the reservoirs of Uzbekistan.

In algal flora of Andijan reservoir 22 out of 116 genera covering 189 species (45.21%) are polymorphic genera. Of these *Oscillatoria* (21 species, 5.02%), *Phormidium* (13 species, 3.11%), and *Lyngbya* (22 species, 8.23%) genera bringing together 47 species,

compose 11.24% of total algal flora (table 5).

In algal flora of Eskier reservoir 14 of 75 genera covering 105 species (39.32%) are polymorphic genera. Of these *Oscillatoria* Vauch. (16 species - 5, 99%), *Euglena* Ehr. (9 species, 3.37%) and *Phacus* Duj. (9 species, 3.37%) genera bringing together 34 species compose 12.73% of total algal flora (table 5).

In algal flora of Karkidon reservoir 7 out of 66 genera covering 62 species (33.33%) are polymorphic genera. Of these *Oscillatoria* Vauch. (15 species, 8, 06%), *Anabaena* Bory. (11 species, 5.91%) and *Ankistrodesmus* Corda (8 species, 4.30) genera combining, 34 species make 18.27% of total algal flora (table 5).

Table 5. Polymorph genera in algal flora composition.

Genera	Andijan reservoir		Eskier reservoir		Karkidon reservoir	
	Species number	Of total algal flora %	Species number	Of total algal flora %	Species number	Of total algal flora %
<i>Oscillatoria</i>	21	5.02	16	5.99	15	8.06
<i>Phormidium</i>	13	3.11	-	-	-	-
<i>Lyngbya</i>	13	3.11	-	-	-	-
<i>Navicula</i>	11	2.63	7	2.62	8	4.30
<i>Surirella</i>	9	2.15	-	-	-	-
<i>Nitzschia</i>	9	2.15	6	2, 24	-	-
<i>Euglena</i>	8	1.91	9	3, 37	-	-
<i>Glenodinium</i>	8	1.91	6	2, 24	-	-
<i>Spirulina</i>	8	1.91	-	-	-	-
<i>Cymbella</i>	8	1.91	-	-	-	-
<i>Tetraedron</i>	8	1.91	-	-	-	-
<i>Scenedesmus</i>	8	1.91	6	2.24	7	3.76
<i>Staurodesmus</i>	7	1, 67	-	-	-	-
<i>Oocystis</i>	7	1.67	6	2.24	6	3.22
<i>Pediastrum</i>	7	1.67	-	-	7	3.76
<i>Ankistrodesmus</i>	7	1.67	8	2.99	8	4.30
<i>Phacus</i>	7	1.67	9	3.37	-	-
<i>Anabaena</i>	-	-	8	2.99	11	5.91
<i>Cosmarium</i>	6	1.43	-	-	-	-
<i>Melosira</i>	6	1.43	6	2.24	-	-
<i>Cyclotella</i>	6	1.43	-	-	-	-
<i>Achnanthes</i>	6	1.43	6	2.24	-	-
<i>Gomphonema</i>	6	1.43	-	-	-	-
<i>Peridinium</i>	-	-	6	2.24	-	-
<i>Ceratium</i>	-	-	6	2.24	-	-
Total:	189	45.21	105	39.32	62	33.33

## CONCLUSION

The above mentioned polymorphic classes, orders, families, and groups form the bulk of the algal flora of Fergana Valley' reservoirs, Oscillatoriaceae (57 species), Naviculaceae (48 species), Euglenaceae (23 species) and Oocystaceae (18 species) are leading

families. Rich species composition of *Oscillatoria* (21 species), *Phormidium* (13), *Lyngbya* (13) and *Anabaena* (11) genera shows that reservoirs of Fergana Valley is a special algological region in Uzbekistan. Moreover, it indicates presence of favorable environmental conditions for algal flora of the region.

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