Basic Qualitative And Quantitative Characteristics Of Phytoplankton In Some Water Bodies Of The Bukhara Region

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The aim was to study the main qualitative and quantitative characteristics of phytoplankton in the studied areas of surface water bodies of the Bukhara region. It was found that in the studied water bodies (Tudakul lakes and Kuyumazar reservoir), *Bacillariophyta* (34 species), *Chlorophyta* (20 species), *Cyanophyta*(15 species), less often *Dinophyta*(5 species), *Englenophyta* (1 species) were found. The highest total phytoplankton abundance in water samples from both reservoirs was *Cyanophyta*, and the highest phytoplankton biomass was recorded in *Bacillariophyta* and *Chlorophyta*. At the same time, *Englenophyta* and *Dinophyta* were not found in the waters of the Kuyumazarreservoir. In the phytoplankton samples from Lake Tudakul, planktonic freshwater-brackish-water forms b-mesosaprobic predominated; brackish-water b- and b- and α-mesosaprobic species of algae prevailed.

The role of aquatic organisms in the life of various water bodies is enormous. They take part in the circulation of matter and energy, in the accumulation of bottom sediments, and are also of great medical and social importance due to the use of numerous surface water bodies for household, drinking and cultural and domestic purposes [1, 3]. For this reason, the determination of phytoplankton is mandatory according to UzSS 950-2011 “Drinking water. Hygiene requirements and quality control “(Interstate Standard) and UzSS 951-2011” Sources of centralized drinking water supply.Hygienic, technical requirements and selection rules” (Interstate Standard) [12, 13]

The most important part of aquatic ecosystems is the aquatic biota, represented by a mosaic of interconnected biocenoses that occupy all possible biotopes in watercourses and reservoirs: they inhabit the water column (plankton), the thickness and surface of the soil (benthos), overgrow the surface of solid rocky substrates washed by water or settling on the surface of macrophytes and in the turf of water moss (periphyton). Their species composition and structure are entirely determined by the climatic and landscape conditions prevailing in the river corridors and coastal zones of lakes [2]. Consequently, biocenoses can be considered as information systems that characterize the state of not only specific water bodies, but also the surrounding natural complexes on the territory of which they are located [8].

Byuniting into communities, the residence time of living beings (bacteria, zoobenthos) in the water may be lengthened, and therefore it was advisable to study hydrobiological parameters together with microbiological indicators [3].

In conditions of low water under the influence of intensive anthropogenic impact in Uzbekistan, the rational use of water resources in the national economy is important. In this regard, constant monitoring, assessment of the variability of the microbial and chemical composition of water in water bodies is of great importance [6].

Changes in the chemical, mineral composition of water affect the microbial composition of water in reservoirs. Pathogenic microorganisms transmitted by water, adapting to these conditions, change their biological properties [7].

Due to the vital activity of aquatic organisms, the chemical composition of water is formed, thereby determining its quality. The microflora of reservoirs performs the function of a primary oxidant or reductant of pollutants entering the reservoir [4].

Phytoplankton are microscopic plant organisms that freely soar in the water column and carry out photosynthesis, and are one of the important elements of aquatic ecosystems involved in the formation of water quality and the productivity of a reservoir [9,10,11].

As is known, the study of phytoplankton occupies an important place in biomonitoring, since algae assimilate solar energy, accumulating it in the form of organic compounds during photosynthesis, while releasing oxygen necessary for respiration of algae themselves and other inhabitants of the reservoir [5]. The organic matter synthesized by them serves as a source of energy for heterotrophic organisms - bacteria, animals. Therefore, the properties of the phytoplankton link of an ecosystem determine its state.

The abundance, biomass, taxonomic composition, and physiological activity of phytoplankton make it possible to draw conclusions about the well-being of the water body or its critical state [8].

The purpose of this research was to study and assess the main qualitative and quantitative characteristics of phytoplankton in the studied areas of surface water bodies of the Bukhara region.

1. MATERIALS AND METHODS

The composition, abundance, and distribution of phytoplankton over surface (open) water bodies of the studied region (Bukhara region of the Republic of Uzbekistan) are due to unequal hydrological, hydro chemical conditions and anthropogenic impact.

We have investigated the surface water bodies of the Bukhara region - Lake Tudakul and the Kuyumazar reservoir, which are used for household, drinking, cultural, household and irrigation purposes. The studies were carried out in the spring and summer of 2020. Were examined 16 samples taken from different places of these reservoirs.

In biological research, the most reliable and acceptable method for sampling phytoplankton from surface water is the bathometric method. Samples taken with a bathometer were used both for quantitative accounting and for the qualitative characterization of the sample taken.

In the researches carried out, phytoplankton samples were taken with a one-liter Ruttner bathometer: samples were poured 250 ml into 500 ml dishes, mixed (i.e., integral samples were taken).

For high-quality collection of phytoplankton, we used silk gas plankton net No. 76. For “soft” fixation of phytoplankton samples, Lugol's solution (until slightly yellow) was used, followed by the addition of 40% formalin (10 ml of 40% formalin for 0.5 l of the sample). It should be taken into account that high concentrations of the specified fixative cause deformation of algae and a change in the color of their pigment [8].

Phytoplankton samples were collected according to generally accepted algological methods [5, 8]; identification keys were used to identify the species composition of microalgae [10, 11].

The sample taken in a polyethylene bottle was fixed with 40% formalin and Lugol's solution, supplied with a label (sample number, date, water body, by whom it was taken, in the presence of whom the sample was taken). Standard horizons for water sampling were: 0 (surface); 0.5; 1.0; 2.5; 5 m.

The sedimentary method was used for phytoplankton samples. Then, according to the methods, the precipitate was brought to 100 ml.

In office conditions, the sedimentation method (sedimentation) was used to concentrate samples, because Planktonic cells settle at a speed of 1 cm in 3 hours [9], then the samples were settled in a dark place for 5-10 days, and then the filtrate was slowly sucked off with a siphon through a double layer of plankton net from silk gas No. 76 (this helps to preserve the fine structures of algae).

The compaction of the taken sample was carried out in 2 stages: from 0.5 L (500 ml) to 0.1 L (100 ml). Then, after secondary settling (no more than 5 days), the solution was sucked off again. Poor samples (winter-spring) were brought to a volume of 10 ml (usually up to 20 ml), very rich (summer ones during the “blooming” blue-green period) - up to 50 ml, sometimes even up to 100 ml, in this case the secondary settling of the sample is not produced).

The quantitative processing of the material was carried out according to the generally accepted algological method in a Goryaev chamber with a volume of (0.001 mm3) or in a Fuchs-Rosenthal chamber with a volume of (3.2 mm3). Further research was carried out in the laboratory using a MEIJI light microscope.

The data obtained by counting phytoplankton were used to calculate their abundance, for which the conversion formula was used:

N = n x v1 / v2 x W, where,

N is the number of cells in 1 cm3 of water;

n is the number of cells in a 1 mm3 chamber;

v1 - Volume of sample concentrate (cm3);

v2 - Chamber volume (cm3);

W - Volume of the sampled (cm3).

The biomass of the studied phytoplankton was determined by a generally accepted calculation method [3, 8].

In the course of research, the following qualitative and quantitative characteristics of phytoplankton were determined: species composition of phytoplankton; the number of species in each main group; taxonomic composition of phytoplankton; number and biomass of species and main groups of phytoplankton - number of cells x103.

2. THE RESULTS OF THE RESEARCHES AND THEIR DISCUSSION

During the reconnaissance trip, samples of phytoplankton were taken, in which 75 species, varieties and forms of algae were found: diatoms (Bacillariophyta) - 34 species; green (Chlorophyta) - 20 species; blue-green (Cyanophyta) - 15 species; dinophytes (Dinophyta) - 5 species; Euglenophyta (Euglenophyta) - 1 species.

The taxonomic structure of phytoplankton in water bodies of the Bukhara region is presented in table. 1.

Table 1 Taxonomic structure of phytoplankton in the studied areas of water bodies in Bukhara region

Algae taxon	LakeTudakul	Kuyumazarreservoir
Bacillariophyta (diatoms)	13	21

Chlorophyta(green)	14	6
Cyanophyta (blue-green)	9	6
Dinophyta (dinophytic)	5	-
Euglenophyta (euglena)	1	-
Total number of species	42	33

The dominant complex of phytoplankton communities in the studied areas of Lake Tudakul and the Kuyumazar reservoir was mainly represented by producers. Among them, diatoms, green and blue-green algae reach the greatest development and diversity, as well as dinophytic and euglenic algae with a low abundance (1-5 species).

Diatoms *(Bacillariophyta)* and green *(Chlorophyta)* algae in the samples from Lake Tudakul were found more often than others: 13 (31.0%) and 14 (33.3%) species, respectively.

Blue-green algae *(Cyanophyta)* in phytoplankton samples of the studied areas of this reservoir are poorly represented, only 9 species, which amounted to 21.43% of the total number of species. The widespread planktonic colonial and filamentous forms of algae of the genera *Merismopedia, Microcystis, Gloeocapsa, Gomposphaeria* and species of the *Oscillatoriacea* family prevailed.

The most indicative quantitative development of blue-green algae *(Cyanophyta)* was noted in a sample from Lake Tudakul. The number of blue-greens here in the sample was 6500.00x103 cells / l, and the biomass was 58.694 mg / l. The least development of blue-green algae was noted in a sample from the Kuyumazar reservoir: the number was 706.250x103 cells / l with a biomass of 11.150 mg / l (Table 2).

In terms of taxonomic diversity, diatoms *(Bacillariophyta)* occupied a dominant position in phytoplankton samples (34 species, 45.33%) of the studied open water bodies.

In June phytoplankton samples from Lake Tudakul, planktonic freshwater-brackish-water forms b-mesosaprobic species of the genera *Melosira, Cyclotella, Fragilaria, Synedra* prevailed. The phytoplankton sample from the Kuyumazar Reservoir was dominated by brackish water (mesohalobes) b- and b-α-mesosaprobic forms of algae from the genera *Cocconeis, Achnanthes, Gyrosigma, Amphiprora, Navicula, Bacillaria, Nitzschia.*

With a single occurrence, diatoms *(Bacillariophyta)*, due to the large cell size, made up a large biomass. The number of diatoms in the samples was 162,500x103 cells / l and 193,750x103 cells / l, and the biomass, respectively, was 61.344 mg / l and 187,800 mg / l.

Table2 Quantitative development of phytoplankton in the studied areas of water bodies in Bukhara region (number of cells x103 / biomass mg / l)

Taxon	Lake Tudakul	Kuyumazarreservoir
Cyanophyta (blue-green)	6500,00 / 58,694	706,250 / 11,150
Bacillariophyta (diatoms)	162,500 / 61,344	193,750 / 187,800
Euglenophyta (euglena)	12,500 / 11,150	0
Dinophyta (dinophytic)	150,625 / 211,125	0
Chlorophyta (green)	756,250 / 188,400	87,500 / 31,500
Total number of cells x103 cells / l / biomass, mg / l	7621,875 / 530,713	987,500 / 230,450

Note: in the numerator is the total number of phytoplankton (cells / l), in the denominator is the biomass of phytoplankton (mg / l).

Green algae *(Chlorophyta)* in the samples of the investigated water bodies are represented moderately - 20 species or 26.67%, forms and varieties, which are mainly represented by widespread b-mesosaprobic species from the genera*Ankistrodesmus, Oocystis, Chlorella, Chlamidomonas, Scenedesmus, Cosmarium,* etc. The number of green algae in phytoplankton samples was 756.250x103 cells / l and 87.500x103 cells / l, and the biomass was 188.400 mg / l and 31.500 mg / l, respectively.

In phytoplankton samples from Lake Tudakul, there was a good development of dinophytic algae - Dinophyta (5 species), which are mainly represented by the genera*Glenodinium, Peridinium,* and *Eugleic algae - Thahelomonas*with a single occurrence. The number of dinophytic algae was 150.625x103 cells / l, and the biomass was 211.125 mg / l. At the same time, dinophytic and eugleic algae were not found in water samples from the Kuyumazar reservoir.

The species composition of the studied species of algae in the phytoplankton community of the investigated areas of the water bodies of the Bukhara region is presented in Table. 3.

Table 3 Species composition of phytoplankton found in the studied water bodies of the Bukhara region

Taxons	S	Lake Tudakul	Kuyumazarreser voir
Microalgae		1	7
Cyanophyta			
Merismopediaglauca (Ehr.) Nag.	b	C	+
*Microcystisaeruginosa*Woron.	b-a	D	-
*M.pulvereaf.planctonica (*G.M.Smith.)	b-a	D	-
*Gloeocapsaalpina*Nag. end.Brend.	b	+	-
Gl.minima(Kütz.) Hollerb.	b	+	-
Gl.turgida(Kütz.) Hollerb.	b	+	-
*Gomphosphaerislacustris*Chod.	b	+	-
Oscillatoria limosa Ag.	b-a	-	C
Osc.planctonica Wolosz.	b-o	C	-
Phormidium uncinatum (Ag.) Gom.	b	-	C
LyngbyaKuetzingii (Kütz.) Schmidle	b	C	C
Bacillariophita			
*Melosiravarians*Ag.	b	+	-
*Cyclotellacaspia*Grun.	b-a	+	+
*C.meneghiniana*Kütz	b-a	+	-
*Fragilariacrotonensis*Kitt.	o-b	-	+
*Synedraacus*Kütz.	o-b	+	+
S. minuscula Grun.	b	+	+
S.pulchella(Ralfs) Kütz.	b	+	-
S.tabulata (Ag.) Kütz.	b	+	-
S.ulna(Nitzsch.) Ehr.	b	+	-
*Achnanthesaffinis*Grun.	o	-	+
*Ach.minutissima*Kütz.	o-b	-	+
Rhoicospheniacurvata(Kütz.) Grun.	b	+	-
Diploneis Smithii v.pumilla (Grun.) Hust.	b-a	+	-
Navicula spp.	b	-	+
*N.bacillum*Ehr.	b-a	-	+
*N.cryptocephalav.intermedia*Grun.	b	-	+

N.cryptocephalav.veneta(Kütz.) Grun.	a-b	+	+
N.cincta (Ehr.) Kütz.	b-a	-	+
N.pygmaea Kütz.	a-b	-	+
N.rhynchocephala Kütz.	a-b	-	+
Pinnulariaviridis(Nitzsch.) Ehr.	b	-	+
Gyrosigmascalproides(Rabenh.) Cl.	b	-	+
Ampiprora paludosa W.Sm.	b	-	+
Amp.paludosa v.subsalina Cl.	b	-	+
Gomphonemaolivaceum (Lyng.) Kütz.	b	+	-
*Bacillariaparadoxa*Gmelin.	a	-	+
Nitzschia capitelata Hust.	b	+	-
N.intermedia Hantzsch	b	-	+
N.palea (Kütz.) Grun.	a	-	+
N.vermicularis (Kütz.) Grun.	b	-	+
Chryptohyta			
Chryptomonas spp.	b	-	-
Euglenophyta			
Thrachelomonas spp.	b	+	-
Dinophyta			
Gimnodinium spp.	b	+	-
Glenodimiumborgei (Lemm.) Schiller	b	C	-
Peridinium cinctum (O.F.M.)Ehr.	b	C	-
P.caudatum (O.F.M.)Ehr.	b	+	-
P.bicepsf.tabulatum (O.F.M.)Ehr.	b	C	-
Chlorophyta			
Ankistrodesmus angustus(Bern)	b	+	-
*Oocystis marssonii*Lemm.	b	C	-
Oocystis spp.	b	C	-
O.natans Wille.	b	C	+
*Chlorella vulrgaris*Beyer.	b	C	+
Chlamidomonas spp.	b	+	-
*Chlorococcumhumicola*Meneg.	b	+	-
*Cosmariumformulosum*Hofm.	b	-	+
*C.granatum*Rensch.	b	-	+
Chodatellacitriformis	b	C	-
Golenkiniaradiata	b	+	-
Scenedesmusacuminatus (Lagerh.) Chod.	b	+	-
Sc.bijugatus(Turp.) Kuetz.	b	+	-
Sc.quadricauda(Turp.) Breb.	b	+	+
*Sc.obliguus*Kütz.	b	+	-
Gonatozigonbrebissonii de Bary	b	+	-
Algae spp.	b	-	+
Mucotaspp.	a	-	+
Consumens			
Uronemanigricans	b-a	-	+
*Chilodonellauncinata*Ehr.	a-b	+	+
Lecanespp.	b	+	+
Colurellauncinata	b-a	+	-

Rotariarotatoria (Pallas)	a-b	-	+
Nematoda gen. spp. 1	a-b	-	+

Conditional designations: S - saprobity of organisms; + - single occurrence (1-9 cells); C - subdominants (10-40 cells); D - dominants (over 40 cells); vdr - reservoir.

It should also be noted that representatives of rotifers *(genera Rotaria, Colurella, Lecane, Chilodonella)* and fungi *(Mucota spp.)* were found in phytoplankton samples from water bodies.

The obtained hydrobiological information from the investigated water bodies of the Bukhara region indicates that anthropogenic factors, especially pollution, cause changes in the composition, structure and ecological state of aquatic biocenoses of various depths, expressed in the change of dominant complexes of organisms, simplification of the ecological structure, the appearance of high saprobic species.

Analysis of the ecological characteristics found in the phytoplankton of algae indicates that, under the conditions of modern water salinity in the studied water bodies, the species composition of summer phytoplankton was mainly freshwater-brackish water b-, b- and α-mesosaprobic, brackish-water forms of algae.

3. CONCLUSIONS

1. It has been established that in the studied water bodies (Tudakul lakes and Kuyumazar reservoir) the following types of algae are more often found: Bacillariophyta (34 species); Chlorophyta (20 species); Cyanophyta (15 species); less often - Dinophyta (5 species); Englenophyta (1 species).

2. It was revealed that the highest total phytoplankton abundance in water samples from both reservoirs was Cyanophyta (6500.00x103 cells / l and 706.250x103 cells / l, respectively), and the highest phytoplankton biomass was noted in Bacillariophyta (187.800 mg / l) and Chlorophyta (188.400 mg / l). At the same time, Englenophyta and Dinophyta were not found in water samples from the Kuyumazar reservoir.

3. It was proved that in the phytoplankton samples from Lake Tudakul, planktonic freshwater-brackish-water forms b-mesosaprobic predominated; brackish-water b- and b- and α-mesosaprobic species of algae prevailed.

4. The increased number of phytoplankton was created mainly by representatives of colonial and filamentous blue-green algae of the Oscilatoriaceae family, and widespread diatoms Synedra, Fragilaria, Navicula, Nitzschia and green desmidia, protococcal algae.

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