

Alpha-biodiversity of nondiatom algae in the Pamir aquatic habitats, Tajikistan

Abstract

We represented in first the alpha-biodiversity list of nondiatom algae in Pamir aquatic habitats that contain 780 species (863 with infraspecific taxa) from nine taxonomic Divisions as a result of our study of 21 aquatic objects in 2000-2015 and compilation of data from references published in previous period of 1930-2000. Cyanobacteria were most species rich, whereas *Charophyta* and *Chlorophyta* were followed. Floristically only Cyanobacteria with some *Charophyta* or *Chlorophyta* species were contain more than 50% of alpha-diversity in each studied aquatic object. Comparative floristics distinguished three floristic cores that related to hydrologically uniform habitats – lakes, rivers, and mineral springs. Comparison of revealed algal species richness in Pamir with the surrounding mountain algal floras let us to identify prevailing of Cyanobacteria species as peculiarity of the Pamir algal flora. Cyanobacteria were dominated the altitude communities, which are highest, than in surrounding studied floras: 2,100-4,700m a.s.l. Other taxonomic Divisions were or indifferent to altitude (*Chlorophyta*) or preferred low altitude habitats about 2,100-2,500m a.s.l. As a result of present study of nondiatom algae alpha-biodiversity and our investigation of diatoms in Pamir aquatic objects the total list of the Pamir algal flora now is represented by 1,235 species (1,415 with infraspecific taxa). Therefore, studied algal flora of Pamir, the alpha-biodiversity list of which is given here in first time, is comparable now with surrounding floras of highmountain areas and total list of taxa can be assessed as representative and full enough.

Keywords: nondiatom algae, diversity, algal flora, pamir, Tajikistan

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Introduction

Floristic composition of algae in freshwater habitats is represented by alpha-biodiversity when we have some list of algal species.¹ In ecology, alpha diversity is the mean species diversity in sites or habitats at a local scale. R. H. Whittaker introduced the term together with the terms beta diversity and gamma diversity for terrestrial plants communities.² This term can be applied to the freshwater algal communities in local scale like a small river basin or local territory such as Pamir aquatic habitats. Because algal samples are usually combined to one pool of species for local territory water bodies, we use this term as the same as species richness, the list of algal species without abundance in the samples. Freshwater algae are widely used in ecological assessment of water quality. It is very important to know about algal diversity in inland waters because most algal species can be used as environmental indicators.³⁻⁵ Pamir biodiversity is important to study because highmountain areas not only are the water sources but also formed the climatic properties of the region.⁶

Diversity of algae in Tajikistan and in Pamir especial has been studied sporadically during the last century. The uppermost part of Tajikistan territory is Pamir where. This highmountain area is very rich in thermal and mineral waters. In these waters, for many centuries, a special community of algae with a specific species composition and degree of species resistance to peculiarly extreme environmental conditions was formed and developed. Therefore, Pamir is one of high altitude area in Eurasia with close relations to Hindu Kush, Altay, and Himalayas. Its territory has diverse aquatic habitats from clear freshwater large rivers, streams, lakes, to mineral and thermal springs which are occupied by diverse algal communities. Our own study of diatoms in thermal and mineral springs was enriched by the regional diversity^{5,7,8} but we assume that the diversity

study of this group of algae in Pamir is still far from complete. Thus, the aim of our work was to compile full nondiatom taxa list of different habitats in Pamir from own and referenced data, and analyse their species richness, systematic structure data and environmental preferences.

Material and methods

Sampling and chemical analysis

The material for this analysis is represented by our own data from 150 samples collected during few field trips in summer period of 2000-2015 from various aquatic habitats located at an altitude from 2,100m to 4,500m a.s.l.⁵ Algological samples were collected by scratching and scooping, placed in 15ml plastic tubes, and partly fixed with 3% neutral formaldehyde solution, as well as partly not fixed and transported to the laboratory in the ice box. The structure elements of the algal cells were observed with Nikon stereomicroscope under magnifications 740x–1850x from two repetitions of each sample and were photographed with a DC in the Institute of Botany, Plant Physiology and Genetics, Dushanbe, Republic of Tajikistan, and species were defined with help of international handbooks.

Taxonomic data compilation

Total species list was compiled from our study as well as from referenced lists in publication about algal diversity in Pamir aquatic habitats for the lakes Karakul, Sassykkul, Zorkul, Yashilkul, Bulunkul, Turumtaikul, Sarez and others,⁹⁻²¹ thermal springs,^{11,12,14,22-34} rivers Gunt, Panj, and Shohdara,^{29,35-41} algal flora of Pamir aquatic habitats,^{27,42-44} and soil algae.^{45,46} Species identification of algae was performed using determinant handbooks for relevant divisions.⁴⁷⁻⁵¹ All collected taxonomic data was adapted to the modern system with

help of algaebase.org. Taxonomic list was analyzed in the Microsoft Access 2013 Program.

Statistical calculation

Statistical programs were used for analysis and plots construction: 1) GRAPHS program⁵² were used for constructions of the comparative floristic similarity dendrograms, and dendrites on-intersection by the Ward method with the Euclidean distance; 2) Statistica 12.0, with the method of weighted least squares distance to construct 3D surfaces. Statistically constructed 3D surfaces in three parameters include the integration of its relationship and have prognostic properties. Pearson Correlation Coefficients were performed in wessa.net program.

Description of studied site

Pamir is high-mountain part of Central Asia including the catchment area of the most water-bearing river of the region - the Amu Darya as well as the large regional rivers Panj and Gunt. It is also the arena where synoptic processes are developed that determine the distinctive features of the climate and influence the formation of river floz.⁶ The Pamir is rich in water resources, including reserves of glaciers, snow cover, rivers, lakes, underground waters, as well as mineral waters, consisting of various cold, warm and hot springs. Algal species richness and occurrence up to now are studied not enough in mountain habitats because their usually placed in hard-to-reach areas. Figure 1 is represented points of algal samples collections during 2000-2015 period (Table 1).

Table 1 Studied aquatic habitats in summer 2000-2015 with its river basins, Altitude, and approximated catchment area

No on the map	Name and type of aquatic object	River basin	Altitude, m	Catchment area, km ²
1	lake Karakul	undrained	3914	4210
2	lake Shorkul	undrained	3782	566
3	lake Rangkul	undrained	3784	1980
4	river Murgab	Murgab	3200-4200	6500
5	lake Zorkul	Pamir	4125	1080
6	lake Sassykkul	Alichur (undrained)	3825	-
7	lake Tuzkul	Alichur (undrained)	3798	-
8	lake Bulunkul	Gunt	3757	535
9	lake Yashilkul	Gunt	3734	5280
10	spring Sassykbulak	Gunt	3800	-
11	lake Turumtaikul	Gunt	4213	52
12	spring Jelandy	Gunt	3600	-
13	river Gunt	Gunt	2100-4500	6720
14	reservoir Tang	Gunt	2540	147
15	artificial waterbodies Khorog	Gunt	2150	-
16	river Shokhdara	Shokhdara	2100-4200	4180
17	spring Garm-Chashma	Panj	2800	-
18	spring Sist	Panj	2360	-
19	spring Barshor	Panj	2400	-
20	spring Avdzh	Panj	2410	-
21	lake Sarez	Bartang	3239	16500



Figure 1 Studied aquatic objects in Pamir Mountains. (1) lake Karakul. (2) lake Shorkul. (3) lake Rangkul. (4) river Murgab. (5) lake Zorkul. (6) lake Sassykkul. (7) lake Tuzkul. (8) lake Bulunkul. (9) lake Yashilkul. (10) spring Sasykbulak. (11) Turumtaikul. (12) spring Jelandy. (13) river Gunt. (14) reservoir Tang. (15) artificial reservoirs Khorog. (16) river Shokhdara (17) spring Garm-Chashma. (18) spring Sist. (19) spring Barshor. (20) spring Avdzh. (21) lake Sarez.

Table 2 Diversity of nondiatom algae in the Pamir high mountain habitats.

No	Taxa	Sp	Ssp
1	<i>Anabaena berezowskii</i> Usacev 1928		
2	<i>Anabaena contorta</i> Bachmann 1921		
3	<i>Anabaena cylindrica</i> Lemmermann 1896		
4	<i>Anabaena groenlandica</i> Bachmann 1921		
5	<i>Anabaena heterospora</i> Nygaard 1949		
6	<i>Anabaena laxa</i> A.Braun in Bornet & Falhault 1886		
7	<i>Anabaena oscillarioides</i> Bory ex Bornet & Flahault 1886		
8	<i>Anabaena oscillarioides</i> var. <i>terrestris</i> f. <i>minor</i> B.M.Bristol 1919		
9	<i>Anabaena oscillarioides</i> f. <i>torulosa</i> Playfair		
10	<i>Anabaena oscillarioides</i> var. <i>nova-zelandiae</i> Lemmermann		
11	<i>Anabaena tenericaulis</i> f. <i>longispora</i> (Nygaard) Kossinskaja		
12	<i>Anabaena thermalis</i> f. <i>propinqua</i> (Setchell & Gardner) Pohribniak		
13	<i>Anabaena torulosa</i> var. <i>cylindracea</i> (Playfair) Geitler 1932		
14	<i>Anabaena variabilis</i> f. <i>crassa</i> Woronichin		
15	<i>Anabaena variabilis</i> f. <i>tenuis</i> Popova		
16	<i>Anabaena verrucosa</i> J.B.Petersen 1923		
17	<i>Anagnostidinema acutissimum</i> (Kufferath) Strunecký, Bohunická, J.R.Johansen&J.Komárek 2017		
18	<i>Anagnostidinema amphibium</i> (C.Agardh ex Gomont) Strunecký, Bohunická, J.R.Johansen & J.Komárek 2017		
19	<i>Anagnostidinema deflexum</i> (West & G.S.West) Strunecky et al. 2017		

Results and discussion

The data compilation for the algal floristic analysis from our samples collected in the field excursions and from the referenced data has allowed us to identify 780 species (863 with infraspecific taxa) of nondiatom algae (Table 2). Nondiatom species number in the floras of surrounding mountain areas is usually contain about half of the total species richness whereas in the lowland floras the *Chlorophyta* species are prevail.⁵³ So, nondiatoms are contain 692 taxa from 1,190 in South-Tajik Depression,⁵⁴ 565 taxa from 1,063 in mountain Georgia,⁵⁵ 327 taxa from 644 in the Aragvi River basin,⁵⁶ 89 from 149 taxa in Hindu Cush,⁵⁷ 931 taxa from 1,621 in Israel,⁵⁸ 888 taxa from 1,559 in Iran,⁵³ and 1,139 from 2,100 in Turkey.⁵⁹ It let us to assume that full list of freshwater diversity in Pamir can reach more than 1,000 taxa and we continuing our study in this direction. Therefore, our present study with our and published data about nondiatom algae diversity⁷ let us to summarize a total alpha-diversity floristic list of the Pamir habitats as 1,235 taxa of species level and 1,415 taxa of infraspecific level.

The study of the taxonomic alpha-diversity of the flora is an important part of the floristic analysis, which makes it possible to identify the most diversified taxa of the floristic spectrum, showing the direction of the algal flora development of the region as a whole. We are collected data about alpha-biodiversity of aquatic habitats in close placed highmountain areas of Central Asia.^{53–59} It help us to compare revealed Pamir algal diversity with other highmountain areas in surround.

Table Continued

No	Taxa	Sp	Ssp
20	<i>Anagnostidinema lemmermannii</i> (Woloszynska) Strunecky et al. 2017		
21	<i>Anagnostidinema tenue</i> (Anisimova) Strunecky et al. 2017		
22	<i>Anathececlathrata</i> (W.West & G.S.West) Komárek, Kastovsky&Jezberová 2011		
23	<i>Aphanizomenon flosaquae</i> Ralfs ex Bornet & Flahault 1886		
24	<i>Aphanocapsa grevillei</i> (Berkeley) Rabenhorst 1865		
25	<i>Aphanocapsa planctonica</i> (G.M.Smith) Komárek & Anagnostidis 1995		
26	<i>Aphanothece castagnei</i> (Kützing) Rabenhorst 1865		
27	<i>Aphanothece microscopica</i> Nägeli 1849		
28	<i>Aphanothece naegeli</i> Wartmann in Rabenhorst 1865		
29	<i>Aphanothece salina</i> Elenkin & Danilov 1915		
30	<i>Aphanothece saxicola</i> Nägeli 1849		
31	<i>Arthrospira gomontiana</i> Setchell 1895		
32	<i>Arthrospira jenniferi</i> Stizenberger ex Gomont 1892		
33	<i>Aulosira laxa</i> O.Kirchner ex Bornet & Flahault 1886		
34	<i>Blennothrix brebissonii</i> (Kützing) Gomont) Anagnostidis & Komárek 1988		
35	<i>Borzia trilocularis</i> Cohn ex Gomont 1892		
36	<i>Calothrix braunii</i> Bornet & Flahault 1886		
37	<i>Calothrix brevissima</i> G.S.West 1907		
38	<i>Calothrix elenkinii</i> Kossinskaja 1924		
39	<i>Calothrix elenkinii</i> Kossinskajaf. edaphicaMelnik 1924		
40	<i>Calothrix fusca</i> Bornet & Flahault 1886		
41	<i>Calothrix fusca</i> f. michailovskoi (Elenk.) V.Poljansk.		
42	<i>Calothrix fusca</i> f. parva (Ercegovic) Poljansky		
43	<i>Calothrix gypsophila</i> (Kützing) Thuret 1875		
44	<i>Calothrix gypsophila</i> f. orsiniana (Kützing) V.Poljanskij		
45	<i>Calothrix kossinskajae</i> Elenkin 1927		
46	<i>Calothrix montana</i> (Tild.) V.Poljansk.		
47	<i>Calothrix parietina</i> f. brevis Erceg.		
48	<i>Calothrix parietina</i> f. major V.Poljanskij		
49	<i>Calothrix parietina</i> Thuret ex Bornet & Flahault 1886		
50	<i>Chamaesiphon aggregatus</i> (Janczewski) Geitler 1925		
51	<i>Chamaesiphon confervicola</i> A.Braun in Rabenhorst 1864		
52	<i>Chamaesiphon fuscus</i> (Rostafinski) Hansgirg 1888		
53	<i>Chamaesiphon incrustans</i> Grunow in Rabenhorst 1865		
54	<i>Chamaesiphon minutus</i> (Rostafinski) Lemmermann 1907		
55	<i>Chlorogloea microcystoides</i> Geitler 1925		
56	<i>Chroococcus dispersus</i> (Keissler) Lemmermann 1904		
57	<i>Chroococcus minimus</i> (Keissler) Lemmermann 1904		
58	<i>Chroococcus minor</i> (Kützing) Nägeli 1849		
59	<i>Chroococcus turgidus</i> (Kützing) Nägeli 1849		
60	<i>Coelosphaerium kuetzingianum</i> Nägeli 1849		

Table Continued

No	Taxa	Sp	Ssp
61	<i>Cyanobacterium cedrorum</i> (Sauvageau) Komárek, Kopecky & Cepák 1999		
62	<i>Cyanobacterium minervae</i> (J.J. Copeland) Komárek, Kopecky & Cepák 1999		
63	<i>Cyanothece aeruginosa</i> (Nägeli) Komárek 1976		
64	<i>Cyanothece majus</i> (Schröter) Komárek 1976		
65	<i>Cylindrospermum catenatum</i> Ralfs ex Bornet & Flahault 1886		
66	<i>Cylindrospermum caucasicum</i> Woronichin [Woronichin] 1923		
67	<i>Cylindrospermum licheniforme</i> Kützing ex Bornet & Flahault 1886		
68	<i>Cylindrospermum majus</i> Kützing ex Bornet & Flahault 1888		
69	<i>Cylindrospermum michailovskoense</i> Elenkin 1911		
70	<i>Cylindrospermum muscicola</i> Kützing ex Bornet & Flahault 1886		
71	<i>Cylindrospermum punctatum</i> Woronichin [Woronichin] 1923		
72	<i>Dactylococcopsis elenkinii</i> Roll 1928		
73	<i>Dactylococcopsis fascicularis</i> Lemmermann 1898		
74	<i>Dactylococcopsis raphidioides</i> Hansgirg 1888		
75	<i>Dolichospermum affine</i> (Lemmermann) Wacklin, L.Hoffmann & Komárek 2009		
76	<i>Dolichospermum flosa quae</i> (Brébissonex Bornet & Flahault) P.Wacklin, L.Hoffmann & J.Komárek 2009		
77	<i>Dolichospermum solitarium</i> (Klebahn) Wacklin, L.Hoffmann & Komárek 2009		
78	<i>Dolichospermum spiroides</i> (Klebhan) Wacklin, L.Hoffmann & Komárek 2009		
79	<i>Dolichospermum tenericaule</i> (Nygaard) E.Zapomelová, O.Skácelová, P.Pumann, R.Kopp & E.Janecek 2012		
80	<i>Eucapsis alpina</i> F.E.Clements & H.L.Schantz 1909		
81	<i>Fischerella ambigua</i> (Kützing ex Bornet & Flahault) Gomont 1895		
82	<i>Fischerella letestui</i> Frémy 1930		
83	<i>Fischerella major</i> Gomont in Bech & Zahlbruchner 1898		
84	<i>Geitlerinema attenuatum</i> (Woronichin) Anagnostidis 2001		
85	<i>Geitlerinema splendidum</i> (Greville ex Gomont) Anagnostidis 1989		
86	<i>Gloeocapsa alpina</i> Nägeli in Rabenhorst 1865		
87	<i>Gloeocapsa arenaria</i> (Hassall) Rabenhorst 1865		
88	<i>Gloeocapsa atrata</i> Kützing 1843		
89	<i>Gloeocapsa calcarea</i> Tilden 1898		
90	<i>Gloeocapsa cohaerens</i> (Brébisson) Hollerbach in Elenkin 1937		
91	<i>Gloeocapsa compacta</i> Kützing 1847		
92	<i>Gloeocapsa dermochroa</i> Nägeli ex Kützing 1849		
93	<i>Gloeocapsa kuetzingiana</i> Nägeli ex Kützing 1849		
94	<i>Gloeocapsa lithophila</i> (Ercegovic) Hollerbach		
95	<i>Gloeocapsa minor</i> f. glomerata Frémy		
96	<i>Gloeocapsa minuta</i> (Kützing) Hollerbach in Elenkin 1937		
97	<i>Gloeocapsa rupestris</i> Kützing 1847		
98	<i>Gloeocapsa tenax</i> (Kirchner) Hollerbach		
99	<i>Gloeocapsa turgida</i> f. mipitanensis (Wolosz.) Hollerbach		
100	<i>Gloeocapsa turgida</i> f. subnuda (Hansg.) Hollerbach		
101	<i>Gloeocapsa violacea</i> Kützing 1847		

Table Continued

No	Taxa	Sp	Ssp
102	<i>Gloeocapsopsis magma</i> (Brébisson) Komárek & Anagnostidis ex Komárek 1993		
103	<i>Gloeothece confluens</i> Nägeli 1849		
104	<i>Gloeothece lunata</i> West & G.S.West 1894		
105	<i>Gloeothece rupestris</i> (Lyngbye) Bornet in Wittrock & Nordstedt 1880		
106	<i>Gomphosphaeria aponina</i> Kützing 1836		
107	<i>Gomphosphaeria aponina</i> var. <i>limnetica</i> Virieux 1916		
108	<i>Gomphosphaeria fusca</i> Skuja 1948		
109	<i>Gomphosphaeria naegeliana</i> (Unger) Lemmermann 1907		
110	<i>Gomphosphaeria rosea</i> (J.W.Snow) Lemmermann 1907		
111	<i>Heteroleibleinia kossinskajae</i> (Elenkin) Anagnostidis & Komárek 1988		
112	<i>Heteroleibleinia kuetzingii</i> (Schmidle) Compère 1985		
113	<i>Heteroleibleinia ucrainica</i> (Schirshoff) Anagnostidis & Komárek 1988		
114	<i>Homoeothrix schizotrichoides</i> Muzafarov 1952		
115	<i>Hydrocoleum homeotrichum</i> Kützing ex Gomont 1892		
116	<i>Hydrocoleum homoeotrichum</i> f. <i>minor</i> (Woronich.) Elenk.		
117	<i>Hydrocoleum muscicola</i> Hansgirg ex Forti 1907		
118	<i>Hydrocoleum terrestre</i> Novichkova 1960		
119	<i>Hydrocoleum violaceum</i> G.Martens ex Geitler 1932		
120	<i>Isocystis salina</i> Iwanoff [Ivanova] in Berg & Ignatov 1901		
121	<i>Jaaginema geminatum</i> (Schwabe ex Gomont) Anagnostidis & Komárek 1988		
122	<i>Jaaginema gracile</i> (Böcher) Anagnostidis & Komárek 1988		
123	<i>Jaaginema pseudogeminatum</i> (G.Schmid) Anagnostidis & Komárek 1988		
124	<i>Jaaginema quadripunctulatum</i> (Brühl & Biswas) Anagnostidis & Komárek 1988		
125	<i>Jaaginema subtilissimum</i> (Kützing ex Forti) Anagnostidis & Komárek 1988		
126	<i>Johanseninema constrictum</i> (Szafer) Hasler, Dvorák & Poulícková 2014		
127	<i>Kamptonema animale</i> (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda 2014		
128	<i>Kamptonemachlorinum</i> (Kützing ex Gomont) Strunecký, Komárek & J.Smarda 2014		
129	<i>Kamptonemacortianum</i> (Meneghin ex Gomont) Strunecký, Komárek & J.Smarda 2014		
130	<i>Kamptonema formosum</i> (Bory ex Gomont) Strunecký, Komárek & J.Smarda 2014		
131	<i>Kamptonemajasorvense</i> (Vouk) Strunecký, Komárek & J.Smarda 2014		
132	<i>Kamptonema laetevirens</i> (H.M.Crouan & P.L.Crouan ex Gomont) Strunecký, Komárek & J.Smarda 2014		
133	<i>Kamptonema okenii</i> (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda 2014		
134	<i>Leptochaete rivularis</i> Hansgirg 1892		
135	<i>Leptolyngbya amplivaginata</i> (Goor) Anagnostidis & Komárek 1988		
136	<i>Leptolyngbya angustissima</i> (West & G.S.West) Anagnostidis & Komárek 1988		
137	<i>Leptolyngbya boryana</i> (Gomont) Anagnostidis & Komárek 1988		
138	<i>Leptolyngbya ferruginea</i> (G.S.West) Anagnostidis & Komárek 1988		
139	<i>Leptolyngbya foveolara</i> (Gomont) Anagnostidis & Komárek 1988		
140	<i>Leptolyngbya fragilis</i> (Gomont) Anagnostidis & Komárek 1988		
141	<i>Leptolyngbya halophila</i> (Hansgirg ex Gomont) Anagnostidis & Komárek 1988		
142	<i>Leptolyngbya laminosa</i> (Gomont ex Gomont) Anagnostidis & Komárek 1988		

Table Continued

No	Taxa	Sp	Ssp
143	<i>Leptolyngbya lurida</i> (Gomont) Anagnostidis & Komárek 1988		
144	<i>Leptolyngbya nostocorum</i> (Bornet ex Gomont) Anagnostidis & Komárek 1988		
145	<i>Leptolyngbya notata</i> (Schmidle) Anagnostidis & Komárek 1988		
146	<i>Leptolyngbya ramosa</i> (J.B.Petersen) Anagnostidis & Komárek 1988		
147	<i>Leptolyngbya scottii</i> (F.E.Fritsch) Anagnostidis & Komárek 1988		
148	<i>Leptolyngbya thermophila</i> (Elenkin) Anagnostidis 2001		
149	<i>Leptolyngbya valderiana</i> (Gomont) Anagnostidis & Komárek 1988		
150	<i>Leptolyngbya voronichiniana</i> Anagnostidis & Komárek 1988		
151	<i>Leptolyngbya weedii</i> (Tilden) Anagnostidis 2001		
152	<i>Leptolyngbya voronichinii</i> (Anissimova) Anagnostidis & Komárek 1988		
153	<i>Limnococcus limneticus</i> (Lemmermann) Komárková, Jezberová, O.Komárek & Zapomelová 2010		
154	<i>Limnoraphis birgei</i> (G.M.Smith) J.Komárek, E.Zapomelová, J.Smarda, J.Kopecky, E.Rejmánková, J.Woodhouse, B.A.Neilan & J.Komárková 2013		
155	<i>Limnothrix rosea</i> Meffert 1988		
156	<i>Lyngbya aestuarii</i> Liebman ex Gomont 1892		
157	<i>Lyngbya diguetii</i> Gomont in Hariot 1895		
158	<i>Lyngbya joanniana</i> (Kützing ex Gomont) Hansgirg 1892		
159	<i>Lyngbya kuetzingii</i> f. <i>woronichinii</i> Elenkin 1949		
160	<i>Lyngbya lutea</i> Gomont ex Gomont 1892		
161	<i>Lyngbya martensiana</i> Meneghini ex Gomont 1892		
162	<i>Lyngbya molischii</i> Vouk 1916		
163	<i>Lyngbya nordgaardii</i> Wille f. <i>schirschoviana</i> Elenkin 1949		
164	<i>Lyngbya nordgaardii</i> Wille 1919		
165	<i>Lyngbya semiplena</i> J.Agardh ex Gomont 1892		
166	<i>Merismopedia arctica</i> (Kosinskaja) Komárek & Anagnostidis 1995		
167	<i>Merismopedia elegans</i> A.Braun ex Kützing 1849		
168	<i>Merismopedia glauca</i> (Ehrenberg) Kützing 1845		
169	<i>Merismopedia marssonii</i> Lemmermann 1900		
170	<i>Merismopedia punctata</i> Meyen 1839		
171	<i>Merismopedia smithii</i> De Toni 1939		
172	<i>Merismopedia tenuissima</i> Lemmermann 1898		
173	<i>Merismopedia trolleri</i> Bachmann 1920		
174	<i>Microchaete tenera</i> f. <i>minor</i> Hollerbach 1935		
175	<i>Microchaete tenera</i> Thuret ex Bornet & Flahault 1886		
176	<i>Microcoleus amoenus</i> (Gomont) Strunecky, Komárek & J.R.Johansen in Strunecky et al. 2013		
177	<i>Microcoleus attenuatus</i> (Fritsch) Strunecky, Komárek & J.R.Johansen in Strunecky et al. 2013		
178	<i>Microcoleus autumnalis</i> (Gomont) Strunecky, Komárek & J.R.Johansen in Strunecky et al. 2013		
179	<i>Microcoleus beggiatoiformis</i> (Gomont) Strunecky, Komárek & J.R.Johansen in Strunecky et al. 2013		
180	<i>Microcoleus caucasicus</i> (Elenkin & Kosinskaja) Strunecky, Komárek & J.R.Johansen in Strunecky et al. 2013		

Table Continued

No	Taxa	Sp	Ssp
181	<i>Microcoleus chthonoplastes</i> Thuret ex Gomont 1892		
182	<i>Microcoleus fonticola</i> (KirchnerexHansgirg) Strunecky, Komárek&J.R.JohanseninStruneckyetal. 2013		
183	<i>Microcoleus lacustris</i> Farlow ex Gomont 1892		
184	<i>Microcoleus paludosus</i> Gomont 1892		
185	<i>Microcoleus steenstrupii</i> J.B.Petersen 1923		
186	<i>Microcoleus subtorulosus</i> Gomont ex Gomont 1892		
187	<i>Microcoleus tenerrimus</i> Gomont 1892		
188	<i>Microcoleus vaginatus</i> f. <i>monticola</i> (Gomont) Elenkin		
189	<i>Microcoleus vaginatus</i> f. <i>polytrichoides</i> (F.E.Fritsch) Hollerbach		
190	<i>Microcoleus vaginatus</i> Gomont ex Gomont 1892		
191	<i>Microcoleus vaginatus</i> var. <i>vaucheri</i> Gomont 1892		
192	<i>Microcystis aeruginosa</i> (Kützing) Kützing 1846		
193	<i>Microcystis flosaquae</i> (Wittrock) Kirchner 1898		
194	<i>Microcystis hansgirgiana</i> Elenkin 1938		
195	<i>Microcystis ichthyoblabe</i> (G.Kunze) Kützing 1843		
196	<i>Microcystis muscicola</i> (Meneghini) Elenkin 1938		
197	<i>Microcystis novacekii</i> (Komárek) Compère 1974		
198	<i>Microcystis parietina</i> (Nägeli) Elenkin 1938		
199	<i>Microcystis pulverea</i> (H.C.Wood) Forti 1907		
200	<i>Microcystis salina</i> (Woronichin) Elenkin 1938		
201	<i>Microcystis viridis</i> (A.Braun) Lemmermann 1903		
202	<i>Nodularia harveyana</i> Thuret ex Bornet & Flahault 1886		
203	<i>Nostoc caeruleum</i> Lyngbye ex Bornet & Flahault 188		
204	<i>Nostoc commune</i> f. <i>sphaericum</i> (Vaucher) Elenkin 1938		
205	<i>Nostoc commune</i> Vaucher ex Bornet & Flahault 1888		
206	<i>Nostoc edaphicum</i> Kondrateva 1962		
207	<i>Nostoc gelatinosum</i> Schousboe ex Bornet & Flahault 1886		
208	<i>Nostoc linckia</i> Bornet ex Bornet & Flahault 1886		
209	<i>Nostoc microscopicum</i> Carmichael ex Bornet & Flahault 1886		
210	<i>Nostoc paludosum</i> f. <i>longius</i> Kossinska [Kossinskaya] 1932		
211	<i>Nostoc paludosum</i> Kützing ex Bornet & Flahault 1886		
212	<i>Nostoc pruniforme</i> C.Agardh ex Bornet & Flahault 1886		
213	<i>Nostoc punctiforme</i> f. <i>populorum</i> (Geitler) Hollerbach 1936		
214	<i>Nostoc punctiforme</i> Hariot 1891		
215	<i>Nostoc verrucosum</i> Vaucher ex Bornet & Flahault 1886		
216	<i>Nostoc zetterstedtii</i> Areschoug ex Bornet & Flahault 1886		
217	<i>Oncobyrsa rivularis</i> (Kützing) Meneghini 1842		
218	<i>Oscillatoria acuíformis</i> Skuja 1948		
219	<i>Oscillatoria angusta</i> Koppe 1924		
220	<i>Oscillatoria brevis</i> Kützing ex Gomont 1892		

Table Continued

No	Taxa	Sp	Ssp
221	<i>Oscillatoria chalybea</i> f. <i>conoidea</i> Poljansky 1941		
222	<i>Oscillatoria deflexa</i> West & G.S. West 1911		
223	<i>Oscillatoria deflexoides</i> Elenkin & Kossinskaja 1949		
224	<i>Oscillatoria guttulata</i> Goor 1918		
225	<i>Oscillatoria homoeotrichoides</i> Kützing		
226	<i>Oscillatoria irrigua</i> Kützing ex Gomont 1892		
227	<i>Oscillatoria janus</i> Skuja 1955		
228	<i>Oscillatoria jenensis</i> G. Schmid 1921		
229	<i>Oscillatoria limosa</i> C. Agardh ex Gomont 1892		
230	<i>Oscillatoria limosa</i> f. <i>disperso-granulata</i> (Schkorbatov) Elenkin 1949		
231	<i>Oscillatoria lloydiana</i> Gomont 1899		
232	<i>Oscillatoria major</i> Vaucher ex Forti 1907		
233	<i>Oscillatoria margaritifera</i> Kützing ex Gomont 1892		
234	<i>Oscillatoria mucicola</i> Woronichin [Woronichin] 1949		
235	<i>Oscillatoria nitida</i> Schkorbatov [Škorbatov] 1923		
236	<i>Oscillatoria okenii</i> var. <i>gracilis</i> (Kützing) Kützing ex Forti 1907		
237	<i>Oscillatoria ornata</i> Kützing ex Gomont 1892		
238	<i>Oscillatoria perfilievii</i> Anissimova 1949		
239	<i>Oscillatoria planctonica</i> Woloszynska 1912		
240	<i>Oscillatoria princeps</i> Vaucher ex Gomont 1892		
241	<i>Oscillatoria proboscidea</i> Gomont 1892		
242	<i>Oscillatoria proboscidea</i> var. <i>westii</i> Forti 1907		
243	<i>Oscillatoria pseudominima</i> Skuja 1956		
244	<i>Oscillatoria quadripunctulata</i> f. <i>crassa</i> (Anissimova) Elenkin ex Starmach 1966		
245	<i>Oscillatoria redekei</i> Goor 1918		
246	<i>Oscillatoria rupicola</i> (Hansgirg) Hansgirg ex Forti 1907		
247	<i>Oscillatoria sancta</i> f. <i>tenuis</i> (Woronichin) Elenkin 1949		
248	<i>Oscillatoria sancta</i> Kützing ex Gomont 1892		
249	<i>Oscillatoria simplicissima</i> Gomont 1892		
250	<i>Oscillatoria spirulinoidea</i> Woronichin 1932		
251	<i>Oscillatoria tenuis</i> C. Agardh ex Gomont 1892		
252	<i>Oscillatoria tenuis</i> f. <i>asiatica</i> (Wille) Elenkin 1949		
253	<i>Oscillatoria tenuis</i> f. <i>nigra</i> (Schkorbatov) Elenkin 1949		
254	<i>Oscillatoria terebriformis</i> f. <i>amphigranulata</i> Elenkin & Kossinskaja 1949		
255	<i>Oscillatoria terebriformis</i> f. <i>tenuis</i> (Woronichin) Poljansky 1953		
256	<i>Oscillatoria trichoides</i> Szafer 1910		
257	<i>Oscillatoria utermoehlii</i> var. <i>epilimnica</i> (Skuja) J. de Toni 1946		
258	<i>Oxynemaa cuminatum</i> (Gomont) Chatchawan, Komárek, Strunecky, Smarda & Peerapornpisal 2012		
259	<i>Phormidesmis molle</i> (Gomont) Turicchia, Ventura, Komárková & Komárek 2009		
260	<i>Phormidiumaerugineo-caeruleum</i> (Gomont) Anagnostidis & Komárek 1988		

Table Continued

No	Taxa	Sp	Ssp
261	<i>Phormidium ambiguum</i> f. <i>novae-semlicae</i> (Schirschov) Elenkin		
262	<i>Phormidium ambiguum</i> Gomont 1892		
263	<i>Phormidium articulatum</i> (N.L.Gardner) Anagnostidis & Komárek 1988		
264	<i>Phormidium bohneri</i> Schmidle 1902		
265	<i>Phormidium boryanum</i> (Bory ex Gomont) Anagnostidis & Komárek 1988		
266	<i>Phormidium chalybeum</i> (Mertens ex Gomont) Anagnostidis & Komárek 1988		
267	<i>Phormidium corium</i> Gomont ex Gomont 1892		
268	<i>Phormidium coutinhoi</i> J. Sampaio 1941		
269	<i>Phormidium crustaceum</i> Woronichin 1932		
270	<i>Phormidium dimorphum</i> Lemmermann 1908		
271	<i>Phormidium favosum</i> Gomont 1892		
272	<i>Phormidium frigidum</i> F.E. Fritsch 1912		
273	<i>Phormidium granulatum</i> (N.L.Gardner) Anagnostidis 2001		
274	<i>Phormidium grunowianum</i> (Gomont) Anagnostidis & Komárek 1988		
275	<i>Phormidium henningsii</i> Lemmermann 1907		
276	<i>Phormidium incrustatum</i> Gomont ex Gomont 1892		
277	<i>Phormidium interruptum</i> Kützing ex Forti 1907		
278	<i>Phormidium inundatum</i> Kützing ex Gomont 1892		
279	<i>Phormidium jadinianum</i> Gomont 1893		
280	<i>Phormidium jenkelianum</i> G.Schmid 1914		
281	<i>Phormidium lividum</i> (Hansgirg) Forti 1907		
282	<i>Phormidium lucidum</i> f. <i>tenuius</i> Melnikova		
283	<i>Phormidium lucidum</i> Kützing ex Gomont 1892		
284	<i>Phormidium nigrum</i> (Vaucher ex Gomont) Anagnostidis & Komárek 1988		
285	<i>Phormidium papyraceum</i> Gomont ex Gomont 1892		
286	<i>Phormidium paulsenianum</i> f. <i>takyricum</i> Novitschkova		
287	<i>Phormidium paulsenianum</i> J.B.Petersen 1930		
288	<i>Phormidium pavlovskoënsë</i> Elenkin 1949		
289	<i>Phormidium retzii</i> f. <i>tenuë</i> Rabenhorst		
290	<i>Phormidium retzii</i> Kützing ex Gomont 1892		
291	<i>Phormidium schroeteri</i> (Hansgirg) Anagnostidis 2001		
292	<i>Phormidium setchellianum</i> Gomont 1892		
293	<i>Phormidium solitare</i> (Kützing ex Gomont) Anagnostidis & Komárek 1988		
294	<i>Phormidium subfuscum</i> Kützing ex Gomont 1892		
295	<i>Phormidium subfuscum</i> var. <i>inaequale</i> Nägeli ex Forti 1907		
296	<i>Phormidium tambi</i> (Woronichin) Anagnostidis & Komárek 1988		
297	<i>Phormidium tenue</i> Gomont 1892		
298	<i>Phormidium terebriforme</i> (C.Agardh ex Gomont) Anagnostidis & Komárek 1988		
299	<i>Phormidium tergestinum</i> (Rabenhorst ex Gomont) Anagnostidis & Komárek 1988		
300	<i>Phormidium tinctorium</i> Kützing ex Gomont 1892		
301	<i>Phormidium truncicola</i> S.L.Ghose 1924		

Table Continued

No	Taxa	Sp	Ssp
302	<i>Phormidium uncinatum</i> Gomont ex Gomont 1892		
303	<i>Phormidium valderianum</i> f. majus Hollerbach		
304	<i>Phormidium valderianum</i> var. tenue Woronichin 1923		
305	<i>Phormidium viride</i> (Vaucher ex Gomont) Lemmermann 1907		
306	<i>Planktolyngbya holsatica</i> (Lemmermann) Anagnostidis & Komárek 1988		
307	<i>Planktolyngbya limnetica</i> (Lemmermann) Komárková-Legnerová & Cronberg 1992		
308	<i>Planktothricoides raciborskii</i> (Woloszynska) Suda & Watanabe 2002		
309	<i>Planktothrix agardhii</i> (Gomont) Anagnostidis & Komárek 1988		
310	<i>Planktothrix clathrata</i> (Skuja) Anagnostidis & Komárek 1988		
311	<i>Planktothrix mougeotii</i> Anagnostidis & Komárek 1988		
312	<i>Planktothrix planctonica</i> (Elenkin) Anagnostidis & Komárek 1988		
313	<i>Planktothrix rubescens</i> (De Candolle ex Gomont) Anagnostidis & Komárek 1988		
314	<i>Plectonema gracillimum</i> Hansgirg 1893		
315	<i>Plectonema indicum</i> S.C. Dixit 1936		
316	<i>Plectonema puteale</i> (Kirchner) Hansgirg 1885		
317	<i>Plectonema radiosum</i> Gomont 1892		
318	<i>Plectonema rhenanum</i> Schmidle 1897		
319	<i>Plectonema schmidlei</i> Limanowska 1912		
320	<i>Plectonema tauricum</i> Woronichin 1932		
321	<i>Plectonema tomasinianum</i> Bornet ex Gomont 1893		
322	<i>Plectonema tomasinianum</i> var. gracile Hansgirg 1891		
323	<i>Pseudanabaena batrachospermorum</i> (Skuja) Anagnostidis & Komárek 1988		
324	<i>Pseudanabaena biceps</i> Böcher 1946		
325	<i>Pseudanabaena catenata</i> Lauterborn 1915		
326	<i>Pseudanabaena crassa</i> Uherkovich 1979		
327	<i>Pseudanabaena edaphica</i> Mel'nikova 1953		
328	<i>Pseudanabaena galeata</i> Böcher 1949		
329	<i>Pseudanabaena limnetica</i> (Lemmermann) Komárek 1974		
330	<i>Pseudanabaena mucicola</i> (Naumann & Huber-Pestalozzi) Schwabe 1964		
331	<i>Pseudanabaena papillaterminata</i> (Kiselev) Kukk 1959		
332	<i>Pseudanabaena tenuis</i> Koppe 1924		
333	<i>Pseudophormidium edaphicum</i> (Elenkin) Anagnostidis & Komárek 1988		
334	<i>Pseudophormidium hollerbachianum</i> (Elenkin) Anagnostidis 2001		
335	<i>Pseudophormidium phormidioides</i> (Hansgirg ex Forti) Anagnostidis & Komárek 1988		
336	<i>Rivularia haematites</i> C. Agardh ex Bornet & Flahault 1886		
337	<i>Schizothrix arenaria</i> Gomont 1892		
338	<i>Schizothrix coriacea</i> Gomont 1892		
339	<i>Schizothrix delicatissima</i> West & G.S. West 1897		
340	<i>Schizothrix friesii</i> Gomont 1892		
341	<i>Schizothrix lamyi</i> Gomont ex Gomont 1892		
342	<i>Schizothrix lardacea</i> Gomont 1892		

Table Continued

No	Taxa	Sp	Ssp
343	<i>Schizothrix lenormandiana</i> Gomont 1892		
344	<i>Schizothrix lutea</i> Frémy 1930		
345	<i>Schizothrix mexicana</i> Gomont 1892		
346	<i>Schizothrix rivulariarum</i> Woronichin 1932		
347	<i>Schizothrix tenuis</i> Woronichin 1923		
348	<i>Scytonema alatum</i> Borzi ex Bornet & Flahault 1886		
349	<i>Scytonema coactile</i> Montagne ex Bornet & Flahault 1886		
350	<i>Scytonema hofmannii</i> C.Agardh ex Bornet & Flahault 1886		
351	<i>Scytonema myochrous</i> C.Agardh ex Bornet & Flahault 1886		
352	<i>Scytonema ocellatum</i> Lyngbye ex Bornet & Flahault 1886		
353	<i>Scytonema wolleanum</i> Forti 1907		
354	<i>Snowella lacustris</i> (Chodat) Komárek & Hindák 1988		
355	<i>Spirulina labyrinthiformis</i> Gomont 1892		
356	<i>Spirulina major</i> Kützing ex Gomont 1892		
357	<i>Spirulina subtilissima</i> Kützing ex Gomont 1892		
358	<i>Spirulina tenuissima</i> Kützing 1836		
359	<i>Stigonema minutum</i> Hassall ex Bornet & Flahault 1887		
360	<i>Stigonema mirabile</i> Beck-Mannagetta 1929		
361	<i>Symploca lacustris</i> Kützing ex Gomont 1892		
362	<i>Symploca thermalis</i> Gomont 1892		
363	<i>Symploca willei</i> N.L.Gardner 1927		
364	<i>Symplocastrum friesii</i> (Gomont) Kirchner 1898		
365	<i>Synechococcus elongatus</i> (Nägeli) Nägeli 1849		
366	<i>Synechococcus gaarderi</i> Ålvik 1934		
367	<i>Synechocystis aquatilis</i> Sauvageau 1892		
368	<i>Synechocystis crassa</i> Woronichin 1929		
369	<i>Synechocystis minima</i> Woronichin 1927		
370	<i>Synechocystis parvula</i> Perfiliev [Perfiljev] 1923		
371	<i>Synechocystis pevalekii</i> Ercegovic 1925		
372	<i>Synechocystis salina</i> Wislouch 1924		
373	<i>Synechocystis sallensis</i> Skuja 1930		
374	<i>Synechocystis septentrionalis</i> Skuja 1956		
375	<i>Tolypothrix distorta</i> Kützing ex Bornet & Flahault 1886		
376	<i>Tolypothrix limbata</i> Thuret ex Bornet & Flahault 1886		
377	<i>Tolypothrix saviczii</i> Kossinskaja 1928		
378	<i>Tolypothrix tenuis</i> f. aegagropila (Kutz.) Kossinsk		
379	<i>Tolypothrix tenuis</i> f. terrestris J.B.Petersen 1923		
380	<i>Tolypothrix tenuis</i> Kützing ex Bornet & Flahault 1886		
381	<i>Trichocoleus sociatus</i> (West & G.S.West) Anagnostidis 2001		
382	<i>Trichodesmium lacustre</i> Klebahn 1895		
383	<i>Trichormus thermalis</i> (V.Youk) Komárek & Anagnostidis 1989		
384	<i>Trichormus variabilis</i> (Kützing ex Bornet & Flahault) Komárek & Anagnostidis 1989		

Table Continued

No	Taxa	Sp	Ssp
385	<i>Woronichinia compacta</i> (Lemmermann) Komárek & Hindák 1988		
386	<i>Xenococcus keneri</i> Hansgirg 1887		
	Ochrophyta		
387	<i>Acanthochloris scherffellii</i> Pascher 1938		
388	<i>Botrydiopsis arhiza</i> Borzi 1895		
389	<i>Botrydiopsis eriensis</i> J.W.Snow 1903		
390	<i>Botrydiopsis minor</i> Schmidle ex Chodat 1913		
391	<i>Botrydium granulatum</i> (Linnaeus) Greville 1830		
392	<i>Bumilleria exilis</i> Klebs 1896		
393	<i>Bumilleriopsis brevis</i> (Gerneck) Printz 1914		
394	<i>Bumilleriopsis peterseniana</i> Vischer & Pascher in Vischer 1936		
395	<i>Bumilleriopsis simplex</i> Pascher 1939		
396	<i>Bumilleriopsis terricola</i> Matvienko 1951		
397	<i>Characiopsis minima</i> Pascher 1938		
398	<i>Characiopsis minuta</i> (A.Braun) Borzi 1895		
399	<i>Chloridella simplex</i> Pascher 1937		
400	<i>Chlorocloster raphidioides</i> Pascher 1937		
401	<i>Chlorocloster simplex</i> Pascher 1938		
402	<i>Chloropedia plana</i> Pascher 1930		
403	<i>Dinobryon divergens</i> O.E.Imhof 1887		
404	<i>Dinobryon sertularia</i> Ehrenberg 1834		
405	<i>Ellipsoidion anulatum</i> Pascher 1938		
406	<i>Ellipsoidion oocystoides</i> Pascher 1938		
407	<i>Ellipsoidion regulare</i> Pascher 1938		
408	<i>Ellipsoidion solitarium</i> (Geitler) Pascher 1938		
409	<i>Goniochloris parvula</i> Pascher 1938		
410	<i>Heterococcus chodatii</i> Vischer 1936		
411	<i>Heteropedia polychloris</i> Pascher 1939		
412	<i>Heteropedia simplex</i> (Pascher) Pascher 1939		
413	<i>Heterothrix bristoliana</i> Pascher 1939		
414	<i>Heterothrix monochloron</i> f. <i>terrestris</i> (Ettl) Hollerbach		
415	<i>Heterothrix pascheri</i> Ettl 1956		
416	<i>Heterothrix stichococcoides</i> Pascher 1939		
417	<i>Heterothrix ulotrichoides</i> Pascher 1932		
418	<i>Hydrurus foetidus</i> (Villars) Trevisan 1848		
419	<i>Microglena media</i> (Klebs) Nakada 2014		
420	<i>Microglena monadina</i> Ehrenberg 1832		
421	<i>Monallantus brevicylindrus</i> Pascher 1938		
422	<i>Monallantus gracilis</i> Pascher 1937		
423	<i>Monodus chodatii</i> Pascher 1925		
424	<i>Nephrodiella lunaris</i> Pascher 1937		
425	<i>Nephrodiella phaseolus</i> Pascher 1938		

Table Continued

No	Taxa	Sp	Ssp
426	<i>Nephrodiella semilunaris</i> Pascher 1937		
427	<i>Ophiocytium capitatum</i> Wolle 1887		
428	<i>Ophiocytium cochleare</i> (Eichwald) A.Braun 1855		
429	<i>Ophiocytium majus</i> Nägeli 1849		
430	<i>Pleurochloris commutata</i> Pascher 1925		
431	<i>Pleurochloris imitans</i> Pascher 1937		
432	<i>Pleurochloris magna</i> J.B.Petersen 1932		
433	<i>Pleurochloris pyrenoidosa</i> Pascher 1938		
434	<i>Polyedriella aculeata</i> Pascher 1938		
435	<i>Polyedriella helvetica</i> Vischer & Pascher in Pascher 1938		
436	<i>Tribonema aequale</i> Pascher 1925		
437	<i>Tribonema affine</i> (Kützing) G.S.West 1904		
438	<i>Tribonema ambiguum</i> Skuja 1948		
439	<i>Tribonema elegans</i> Pascher 1925		
440	<i>Tribonema intermixtum</i> Pascher 1939		
441	<i>Tribonema minus</i> (Wille) Hazen 1902		
442	<i>Tribonema monochloron</i> Pascher & Geitler in Pascher 1925		
443	<i>Tribonema subtilissimum</i> Pascher 1939		
444	<i>Tribonema ulotrichoides</i> Pascher 1939		
445	<i>Tribonema viride</i> Pascher 1925		
446	<i>Tribonema vulgare</i> Pascher 1925		
447	<i>Vaucheria geminata</i> (Vaucher) De Candolle in Lamarck & De Candolle 1805		
448	<i>Xanthonema exile</i> (Klebs) P.C.Silva 1979		
449	<i>Xanthonema monochloron</i> (Ettl) P.C.Silva 1979		
	Eubacteria		
450	<i>Achroonema inaequale</i> Skuja		
	Euglenozoa		
451	<i>Anisonema acinus</i> Dujardin 1841		
452	<i>Anisonema platysomum</i> Skuja 1939		
453	<i>Dinematomonas griseola</i> (Perty) P.C.Silva 1960		
454	<i>Entosiphon ovatus</i> Stokes 1885		
455	<i>Entosiphon sulcatus</i> (Dujardin) Stein 1878		
456	<i>Euglena brevis</i> Christ		
457	<i>Euglena deses</i> Ehrenberg 1834		
458	<i>Euglena geniculata</i> Dujardin 1841		
459	<i>Euglena gracilis</i> G.A.Klebs 1883		
460	<i>Euglenalimnophilavar. swirenkoi</i> (Arnoldi) T.G.Popova 1955		
461	<i>Euglena sanguinea</i> Ehrenberg 1832		
462	<i>Euglena viridis</i> (O.F.Müller) Ehrenberg 1830		
463	<i>Euglenariacaudata</i> (E.F.W.Hübner) Karnowska-Ishikawa, Linton&KwiatowskiinLintonetal. 2010		
464	<i>Heteronema acus</i> (Ehrenberg) F.Stein 1878		

Table Continued

No	Taxa	Sp	Ssp
465	<i>Heteronema leptosomum</i> Skuja 1939		
466	<i>Heteronema medusae</i> Skvortzov 1958		
467	<i>Heteronema nebulosum</i> (Dujardin) G.A.Klebs 1892		
468	<i>Lepocinclis acus</i> (O.F.Müller) B.Marin & Melkonian in Marin et al. 2003		
469	<i>Lepocinclis acus</i> var. <i>hyalina</i> (Klebs) D.A.Kapustin 2011		
470	<i>Lepocinclis acus</i> var. <i>longissima</i> (Deflandre) D.A.Kapustin 2011		
471	<i>Lepocinclis acus</i> var. <i>minor</i> (Hansgirg) D.A.Kapustin 2011		
472	<i>Lepocinclis autumnalis</i> Chu 1936		
473	<i>Lepocinclis cylindrica</i> (Korsikov) W.Conrad 1934		
474	<i>Lepocinclis fusiformis</i> (H.J.Carter) Lemmermann 1901		
475	<i>Lepocinclis oxyuris</i> (Schmarda) B.Marin & Melkonian in B.Marin et al. 2003		
476	<i>Lepocinclis spirogyroides</i> B.Marin & Melkonian in Marin et al. 2003		
477	<i>Menoidium pellucidum</i> Perty 1852		
478	<i>Menoidium pellucidum</i> var. <i>cultellus</i> (Pringsheim) T.G.Popova 1955		
479	<i>Menoidium tortuosum</i> (Stokes) Lemmermann 1913		
480	<i>Monomorphina pyrum</i> (Ehrenberg) Mereschkowsky 1877		
481	<i>Notosolenus apocamptus</i> (A.C. Stokes) A.C. Stokes 1884		
482	<i>Notosolenus orbicularis</i> (A.C. Stokes) A.C. Stokes 1884		
483	<i>Peranema curvicauda</i> Skuja 1948		
484	<i>Peranema inflexum</i> Skuja 1939		
485	<i>Peranema trichophorum</i> (Ehrenberg) F.Stein 1859		
486	<i>Petalomonas mediocanellata</i> F.Stein 1878		
487	<i>Petalomonas mediocanellata</i> var. <i>disomata</i> (Stokes) Lemmermann 1910		
488	<i>Phacus acuminatus</i> Stokes 1885		
489	<i>Phacus acuminatus</i> var. <i>acuticauda</i> (Y.V.Roll) Huber-Pestalozzi 1955		
490	<i>Phacus acuminatus</i> var. <i>globulus</i> Dedusenko-Stregoleva		
491	<i>Phacus alatus</i> G.A.Klebs 1883		
492	<i>Phacus caudata</i> var. <i>tenuis</i> Svirenko 1916		
493	<i>Phacus caudatus</i> Hübner 1886		
494	<i>Phacus hamatus</i> Pochmann 1942		
495	<i>Phacus limnophilus</i> (Lemmermann) E.W.Linton & A.Karnkowska-Ishikawa in Linton et al. 2010		
496	<i>Phacus longicauda</i> (Ehrenberg) Dujardin 1841		
497	<i>Phacus megalopsis</i> Pochmann 1942		
498	<i>Phacus mirabilis</i> Pochmann 1942		
499	<i>Phacus orbicularis</i> K.Hübner 1886		
500	<i>Phacus parvula</i> G.A.Klebs 1883		
501	<i>Phacus pleuronectes</i> (O.F.Müller) Nitzsch ex Dujardin 1841		
502	<i>Phacus pleuronectes</i> var. <i>hyalina</i> Klebs		
503	<i>Phacus raciborskii</i> Drezepolski 1925		
504	<i>Phacus splendens</i> Pochmann 1942		

Table Continued

No	Taxa	Sp	Ssp
505	<i>Phacus swirenkoi</i> Skvortzov 1928		
506	<i>Rhabdomonas incurva</i> Fresenius 1858		
507	<i>Scytomonas pusilla</i> Stein 1878		
508	<i>Sphenomonas teres</i> (F.Stein) G.A.Klebs 1892		
509	<i>Strombomonas acuminata</i> (Schmarda) Deflandre 1930		
510	<i>Strombomonas schauinslandii</i> (Lemmermann) Deflandre 1930		
511	<i>Trachelomonas allia</i> Drezepolski 1925		
512	<i>Trachelomonas armata</i> (Ehrenberg) F.Stein 1878		
513	<i>Trachelomonas armata</i> var. <i>steinii</i> Lemmermann 1905		
514	<i>Trachelomonas asymmetrica</i> Kisselev 1931		
515	<i>Trachelomonas cervicula</i> A.C.Stokes 1890		
516	<i>Trachelomonas curta</i> A.M.Cunha 1913		
517	<i>Trachelomonas curta</i> f. <i>punctata</i> (Skvortzov) T.G.Popova 1955		
518	<i>Trachelomonas hispida</i> (Perty) F.Stein 1878		
519	<i>Trachelomonas hispida</i> var. <i>coronata</i> Lemmermann 1913		
520	<i>Trachelomonas hispida</i> var. <i>punctata</i> Lemmermann 1905		
521	<i>Trachelomonas intermedia</i> P.A.Dangeard 1902		
522	<i>Trachelomonas lacustris</i> Drezepolski 1925		
523	<i>Trachelomonas legatowii</i> (Skvortzov) Deflandre 1927		
524	<i>Trachelomonas macropunctata</i> (Skvortzov) Deflandre 1927		
525	<i>Trachelomonas nigra</i> Svirenko 1914		
526	<i>Trachelomonas oblonga</i> Lemmermann 1899		
527	<i>Trachelomonas oblonga</i> var. <i>pulcherrima</i> (Playfair) T.G.Popova 1955		
528	<i>Trachelomonas verrucosa</i> A.C.Stokes 1887		
529	<i>Trachelomonas volvocina</i> (Ehrenberg) Ehrenberg 1834		
530	<i>Urceolus cyclostomus</i> (F.Stein) Mereschkowski 1879		
531	<i>Urceolus gobii</i> Skvortzov 1924		
532	<i>Urceolus pascheri</i> Skvortzov 1925		
	Miozoa		
533	<i>Apocalathium aciculiferum</i> (Lemmermann) Craveiro, Daugbjerg, Moestrup & Calado 2016		
534	<i>Ceratium hirundinella</i> (O.F.Müller) Dujardin 1841		
535	<i>Glenodinium berlinense</i> (Lemmermann) Lindemann 1925		
536	<i>Glenodinium berlinense</i> var. <i>apiculatum</i> Lenm.		
537	<i>Gymnodinium paradoxum</i> A.J.Schilling 1891		
538	<i>Peridinium aciculiferum</i> f. <i>inermis</i> J.Woloszynska		
539	<i>Peridinium cinctum</i> (O.F.Müller) Ehrenberg 1832		
	Cryptophyta		
540	<i>Cryptomonas ovata</i> Ehrenberg 1832		
541	<i>Cryptomonas pyrenoidifera</i> Geitler 1922		
	Chlorophyta		
542	<i>Actinastrum hantzschii</i> Lagerheim 1882		

Table Continued

No	Taxa	Sp	Ssp
543	<i>Actinastrum hantzschii</i> var. <i>subtile</i> J.Woloszynska 1911		
544	<i>Actinochloris sphaerica</i> Korshikov 1953		
545	<i>Ankistrodesmus densus</i> Korshikov 1953		
546	<i>Ankistrodesmus fusiformis</i> Corda 1838		
547	<i>Aphanochaete repens</i> A.Braun 1850		
548	<i>Asterococcus superbus</i> (Cienkowski) Scherffel 1908		
549	<i>Botryococcus braunii</i> Kützing 1849		
550	<i>Botryosphaerella sudetica</i> (Lemmermann) P.C. Silva 1970		
551	<i>Bracteacoccus aerius</i> H.W.Bischoff & Bold 1963		
552	<i>Bracteacoccus anomalus</i> (E.J. James) R.C. Starr 1955		
553	<i>Bulbochaete mirabilis</i> Wittrock ex Hirn 1900		
554	<i>Carteria minima</i> (Dangeard) Franzé		
555	<i>Chaetopeltis orbicularis</i> Berthold 1878		
556	<i>Chaetophora attenuata</i> Hazen 1902		
557	<i>Chaetophora pisiformis</i> (Roth) C.Agardh 1812		
558	<i>Characium acuminatum</i> A.Braun in Kützing 1849		
559	<i>Characium braunii</i> Brügger 1863		
560	<i>Characium ovatum</i> Reinhard 1869		
561	<i>Characium ovatum</i> var. <i>minus</i> Hollerb 1936		
562	<i>Chlamydomonas acuta</i> Korshikov in Pascher 1927		
563	<i>Chlamydomonas akimovii</i> Vaulina, Dorogostajskaja, Noviczikova & Sdobnikova 1959		
564	<i>Chlamydomonas debaryana</i> Goroschankin [Gorozhankin] 1891		
565	<i>Chlamydomonas debaryana</i> var. <i>atactogama</i> (Korshikov) Gerloff 1940		
566	<i>Chlamydomonas elliptica</i> Korshikov in Pascher 1927		
567	<i>Chlamydomonas globosa</i> J.W.Snow 1903		
568	<i>Chlamydomonas gloeogama</i> f. <i>humicola</i> Hollerbach 1936		
569	<i>Chlamydomonas gloeogama</i> Korshikov in Pascher 1927		
570	<i>Chlamydomonas intermedia</i> Chodat 1894		
571	<i>Chlamydomonas oblongella</i> J.W.G.Lund 1947		
572	<i>Chlamydomonas perpusilla</i> Gerloff 1940		
573	<i>Chlamydomonas peterfii</i> Gerloff 1940		
574	<i>Chlamydomonas platystigma</i> Pascher 1927		
575	<i>Chlamydomonas polychloris</i> Korshikov 1938		
576	<i>Chlamydomonas reinhardtii</i> P.A. Dangeard 1888		
577	<i>Chlamydomonas tetras</i> J.W.G. Lund 1947		
578	<i>Chlamydomonadsieboldii</i> (A.Braun) Tsarenko 2000		
579	<i>Chlorella ellipsoidea</i> var. <i>minor</i> L.Moewus		
580	<i>Chlorella vulgaris</i> Beyerinck [Beijerinck] 1890		
581	<i>Chlorhormidium dissectum</i> (F.Gay) Farooqui 1969		
582	<i>Chlorhormidium subtile</i> (Kützing) Starmach 1972		
583	<i>Chlorococcum botryoides</i> Rabenhorst		

Table Continued

No	Taxa	Sp	Ssp
584	<i>Chlorococcum dissectum</i> Korshikov 1953		
585	<i>Chlorococcum humicola</i> (Nägeli) Rabenhorst 1868		
586	<i>Chlorococcum infusioenum</i> (Schrank) Meneghini 1842		
587	<i>Chloroidiumellipsoideum</i> (Gerneck) Darienko, Gustavs, Mudimu, Menendez, Schumann, Karsten, Friedl & Proschold 2010		
588	<i>Chlorolobion braunii</i> (Nägeli) Komárek 1979		
589	<i>Chloromonas paradoxa</i> Korshikov 1926		
590	<i>Chloroplana terricola</i> Hollerbach 1936		
591	<i>Chlorosarcina stigmatica</i> T.R.Deason 1959		
592	<i>Chlorosarcinopsis gelatinosa</i> Chantanachat & Bold 1962		
593	<i>Chlorotetraedron incus</i> (Teiling) Komárek & Kovácik 1985		
594	<i>Cladophora fracta</i> (O.F.Müller ex Vahl) Kützing 1843		
595	<i>Cladophora glomerata</i> (Linnaeus) Kützing 1843		
596	<i>Cladophora glomerata</i> var. <i>crassior</i> (C.Agardh) Hoek 1963		
597	<i>Coccomyxa confluens</i> (Kützing) Fott 1974		
598	<i>Coccomyxa solorinae</i> Chodat 1909		
599	<i>Coelastrum microporum</i> Nägeli in A.Braun 1855		
600	<i>Coelastrum sphaericum</i> Nägeli 1849		
601	<i>Cosmarium asphaerosporum</i> Wittrock in Wittrock, Nordstedt & Lagerheim 1879		
602	<i>Ctenocladus circinnatus</i> Borzi 1883		
603	<i>Cylindrocapsa conferta</i> West 1892		
604	<i>Desmococcus vulgaris</i> F.Brand in F.Brand & Stockmayer 1925		
605	<i>Desmodesmus denticulatus</i> (Lagerheim) S.S.An, T.Friedl & E.Hegewald 1999		
606	<i>Desmodesmus denticulatus</i> var. <i>linearis</i> (Hansgirg) Hegewald 2000		
607	<i>Desmodesmus microspina</i> (Chodat) Tsarenko 2000		
608	<i>Dictyococcus irregularis</i> J.B.Petersen 1932		
609	<i>Dictyosphaerium pulchellum</i> H.C.Wood 1873		
610	<i>Draparnaldia glomerata</i> (Vaucher) C.Agardh 1812		
611	<i>Enallax costatus</i> (Schmidle) Pascher 1943		
612	<i>Eremosphaera gigas</i> (W.Archer) Fott & Kalina 1962		
613	<i>Eudorina elegans</i> Ehrenberg 1832		
614	<i>Fernandinella alpina</i> Chodat 1922		
615	<i>Glochiococcus aciculiferus</i> (Lagerheim) P.C.Silva 1996		
616	<i>Gloeococcus schroeteri</i> (Chodat) Lemmermann 1915		
617	<i>Gongrosira lacustris</i> Brand 1907		
618	<i>Gongrosira terricola</i> Bristol 1920		
619	<i>Gonium pectorale</i> O.F.Müller 1773		
620	<i>Gregiochloris lacustris</i> (Chodat) Marvan, Komárek & Comas 1984		
621	<i>Hariotina reticulata</i> P.A. Dangeard 1889		
622	<i>Hindakiatetrachotoma</i> (Printz) C.Bock, Pröschold&Krienitz 2010		
623	<i>Hydrodictyon reticulatum</i> (Linnaeus) Bory 1824		

Table Continued

No	Taxa	Sp	Ssp
624	<i>Hypnomonas chlorococcoides</i> Korshikov 1926		
625	<i>Hypnomonas ellipsoidea</i> Korshikov 1953		
626	<i>Keratococcus bicaudatus</i> (A.Braun ex Rabenhorst) J.B.Petersen 1928		
627	<i>Kirchneriella obesa</i> (West) West & G.S.West 1894		
628	<i>Korshikoviella limnetica</i> (Lemmermann) P.C.Silva 1959		
629	<i>Lagerheimia wratislawiensis</i> Schröder 1897		
630	<i>Macrochloris dissecta</i> Korshikov 1926		
631	<i>Microspora lauterbornii</i> Schmidle 1895		
632	<i>Microspora pachyderma</i> (Wille) Lagerheim 1887		
633	<i>Microspora tumidula</i> Hazen 1902		
634	<i>Monomastix opisthostigma</i> Scherffel 1912		
635	<i>Monoraphidium arcuatum</i> (Korshikov) Hindák 1970		
636	<i>Monoraphidium griffithii</i> (Berkeley) Komárková-Legnerová 1969		
637	<i>Muriella magna</i> F.E.Fritsch & R.P.John 1942		
638	<i>Myrmecia irregularis</i> (J.B.Petersen) Ettl & Gärtner 1995		
639	<i>Neochloris gelatinosa</i> Herndon 1958		
640	<i>Neochloris oleoabundans</i> S.Chantanachat & Bold 1962		
641	<i>Neochloris terrestris</i> W.Herndon 1958		
642	<i>Neochlorosarcina minor</i> (Gerneck) V.M.Andreyeva 1998		
643	<i>Nephrocytium agardhianum</i> Nägeli 1849		
644	<i>Oedogonium crispum</i> Wittrock ex Hirn 1900		
645	<i>Oedogonium fragile</i> Wittrock ex Hirn 1900		
646	<i>Oedogonium gracillimum</i> Wittrock & P.Lundell ex Hirn 1900		
647	<i>Oedogonium intermedium</i> Wittrock ex Hirn 1900		
648	<i>Oedogonium richterianum</i> Lemmermann ex Hirn 1900		
649	<i>Oedogonium rufescens</i> Wittrock ex Hirn 1900		
650	<i>Oedogonium sociale</i> Wittrock ex Hirn 1900		
651	<i>Oedogonium suecicum</i> Wittrock ex Hirn 1900		
652	<i>Oedogonium upsaliense</i> Wittrock ex Hirn 1900		
653	<i>Oedogonium varians</i> Wittrock & Lundell ex Hirn 1900		
654	<i>Oocystis borgei</i> J.W.Snow 1903		
655	<i>Oocystis elliptica</i> West 1892		
656	<i>Oocystis gigas</i> var. <i>borgei</i> Lemmermann 1904		
657	<i>Oocystis lacustris</i> Chodat 1897		
658	<i>Oocystis novae-semlicae</i> Wille 1879		
659	<i>Oocystis pusilla</i> Hansgirg 1890		
660	<i>Oocystis solitaria</i> Wittrock in Wittrock & Nordstedt 1879		
661	<i>Palmella miniata</i> Leiblein 1830		
662	<i>Palmellopsis gelatinosa</i> Korshikov 1953		
663	<i>Pandorina morum</i> (O.F.Müller) Bory in J.V.Lamouroux, Bory & Deslongs-champs 1827		
664	<i>Pediastrum angulosum</i> Ehrenberg ex Meneghini 1840		

Table Continued

No	Taxa	Sp	Ssp
665	<i>Pediastrum boryanum</i> f. <i>granulatum</i> (Raciborski) Parra Barrientos		
666	<i>Pediastrum boryanum</i> var. <i>brevicorne</i> A. Braun 1855		
667	<i>Pediastrum boryanum</i> var. <i>cornutum</i> (Raciborski) Sulek in Fott 1969		
668	<i>Pediastrum duplex</i> Meyen 1829		
669	<i>Pediastrum integrum</i> Nägeli 1849		
670	<i>Pediastrum tetras</i> var. <i>tetradon</i> (Corda) Hansgirg 1888		
671	<i>Phacotus lenticularis</i> (Ehrenberg) Deising 1866		
672	<i>Planktosphaeria botryoides</i> W. Herndon 1958		
673	<i>Prasiola fluviatilis</i> (Sommerfelt) □□ Areschoug ex Lagerstedt 1869		
674	<i>Protosiphon botryoides</i> (Kützing) Klebs 1896		
675	<i>Pseudocharacium acuminatum</i> Korshikov 1953		
676	<i>Pseudocharacium obtusum</i> (A. Braun) Petry-Hesse 1968		
677	<i>Pseudodidymocystis lineata</i> (Korshikov) Hindák 1990		
678	<i>Pseudopediastrum boryanum</i> (Turpin) E. Hegewald in Buchheim et al. 2005		
679	<i>Pseudopediastrum boryanum</i> var. <i>longicorne</i> (Reinsch) Tsarenko 2011		
680	<i>Pseudopediastrum kawraiskyi</i> (Schmidle) E. Hegewald 2005		
681	<i>Radiosphaera minuta</i> Herndon 1958		
682	<i>Rhizoclonium hieroglyphicum</i> (C. Agardh) Kützing 1845		
683	<i>Scenedesmus acuminatus</i> (Lagerheim) Chodat 1902		
684	<i>Scenedesmus apiculatus</i> Corda 1838		
685	<i>Scenedesmus apiculatus</i> var. <i>irregularis</i> Dedusenko-Shchegoleva 1949		
686	<i>Scenedesmus arcuatus</i> (Lemmermann) Lemmermann 1899		
687	<i>Scenedesmus caudato-acuteolatus</i> Chodat 1926		
688	<i>Scenedesmus magnus</i> Meyen 1829		
689	<i>Scenedesmus obliquus</i> (Turpin) Kützing 1833		
690	<i>Scenedesmus obliquus</i> var. <i>alternans</i> Khristyuk 1926		
691	<i>Scenedesmus obtusus</i> Meyen 1829		
692	<i>Scenedesmus quadricauda</i> Chodat 1926		
693	<i>Scenedesmus subspicatus</i> Chodat 1926		
694	<i>Schizochlamydeella delicatula</i> (West) Korshikov 1953		
695	<i>Scotiellopsis levicostata</i> (Hollerbach) Puncová & Kalina 1981		
696	<i>Scotiellopsis musci</i> □□□□		
697	<i>Sorastrum spinulosum</i> Nägeli 1849		
698	<i>Sphaerellopsis gelatinosa</i> (Korshikov) Gerloff 1940		
699	<i>Sphaerocystis schroeteri</i> Chodat 1897		
700	<i>Stauridium tetras</i> (Ehrenberg) E. Hegewald in Buchheim et al. 2005		
701	<i>Stichococcus bacillaris</i> Nägeli 1849		
702	<i>Stichococcus minor</i> Nägeli 1849		
703	<i>Stichococcus variabilis</i> West & G.S. West 1896		
704	<i>Stigeoclonium amoenum</i> Kützing 1845		
705	<i>Stigeoclonium attenuatum</i> (Hazen) Collins 1909		

Table Continued

No	Taxa	Sp	Ssp
706	<i>Stigeoclonium lubricum</i> (Dillwyn) Kützing 1845		
707	<i>Stigeoclonium tenue</i> (C.Agardh) Kützing 1843		
708	<i>Stigeoclonium thermale</i> A.Braun in Kützing 1849		
709	<i>Tetradasmus lagerheimii</i> M.J.Wynne & Guiry 2016		
710	<i>Tetradasmus obliquus</i> (Turpin) M.J.Wynne 2016		
711	<i>Tetraëdron minimum</i> (A.Braun) Hansgirg 1888		
712	<i>Tetraëdron minutissimum</i> Korshikov 1953		
713	<i>Tetraëdron triangulare</i> Korshikov 1953		
714	<i>Tetrasporacylindrica</i> (Wahlenberg) C.Agardh 1824		
715	<i>Tetrastrum triacanthum</i> Korshikov 1939		
716	<i>Topaczevskiella nautococcoides</i> Massjuk 1985		
717	<i>Trochiscia granulata</i> (Reinsch) Hansgirg 1888		
718	<i>Ulothrix aequalis</i> Kützing 1845		
719	<i>Ulothrix flacca</i> (Dillwyn) Thuret in Le Jolis 1863		
720	<i>Ulothrix implexa</i> (Kützing) Kützing 1849		
721	<i>Ulothrix moniliformis</i> (Kützing) Kützing 1849		
722	<i>Ulothrix oscillatorina</i> Kützing 1845		
723	<i>Ulothrix pamirica</i> (Wille) Printz 1927		
724	<i>Ulothrix tenerrima</i> (Kützing) Kützing 1843		
725	<i>Ulothrix tenuissima</i> Kützing 1833		
726	<i>Ulothrixzonata</i> (F.Weber & Mohr) Kützing 1833		
727	<i>Ulotrichopsis cylindrica</i> L.Wichmann 1937		
728	<i>Ulva flexuosa</i> Wulfen 1803		
729	<i>Ulva intestinalis</i> Linnaeus 1753		
730	<i>Ulva prolifera</i> O.F.Müller 1778		
731	<i>Uronema confervicola</i> Lagerheim 1887		
732	<i>Uronema confervicola</i> var. <i>uncinatum</i> Popova 1929		
733	<i>Volvox aureus</i> Ehrenberg 1832		
734	<i>Willea irregularis</i> (Wille) Schmidle 1900		
Charophyta			
735	<i>Actinotaenium curtum</i> (Brébisson ex Ralfs) Teiling 1978		
736	<i>Actinotaenium didymocarpum</i> (P.Lundell) Coesel & Delfos 1986		
737	<i>Chara aspera</i> C.L.Willdenow 1809		
738	<i>Chara globularis</i> Thuiller 1799		
739	<i>Chara vulgaris</i> Linnaeus 1753		
740	<i>Closterium acerosum</i> Ehrenberg ex Ralfs 1848		
741	<i>Closterium acerosum</i> var. <i>elongatum</i> Brébisson 1856		
742	<i>Closterium acerosum</i> var. <i>minus</i> Hantzsch in Rabenhorst 1861		
743	<i>Closterium cornu</i> Ehrenberg ex Ralfs 1848		
744	<i>Closterium lanceolatum</i> Kützing ex Ralfs 1848		
745	<i>Closterium leibleinii</i> Kützing ex Ralfs 1848		

Table Continued

No	Taxa	Sp	Ssp
746	<i>Closterium lunula</i> Ehrenberg & Hemprich ex Ralfs 1848		
747	<i>Closterium manschuricum</i> Skvortzov		
748	<i>Closterium moniliferum</i> Ehrenberg ex Ralfs 1848		
749	<i>Closterium parvulum</i> Nägeli 1849		
750	<i>Closterium peracerosum</i> F.Gay 1884		
751	<i>Closterium pritchardianum</i> W.Archer 1862		
752	<i>Closterium rostratum</i> Ehrenberg ex Ralfs 1848		
753	<i>Closterium submoniliferum</i> var. malinvernianum (De Notaris) Coesel in Coesel & Meesters 2007		
754	<i>Closterium tumidulum</i> F.Gay 1884		
755	<i>Closterium turgidum</i> Ehrenberg ex Ralfs 1848		
756	<i>Closterium venus</i> Kützing ex Ralfs 1848		
757	<i>Coleochaete orbicularis</i> Pringsheim 1860		
758	<i>Cosmarium abbreviatum</i> Raciborski 1885		
759	<i>Cosmarium annulatum</i> (Nägeli) De Bary 1858		
760	<i>Cosmarium annulatum</i> var. elegans Nordstedt 1873		
761	<i>Cosmarium bioculatum</i> Brébisson ex Ralfs 1848		
762	<i>Cosmarium bipunctatum</i> Børgesen 1891		
763	<i>Cosmarium bireme</i> Nordstedt 1870		
764	<i>Cosmarium biretum</i> Brébisson ex Ralfs 1848		
765	<i>Cosmarium biretum</i> var. trigibberum Nordstedt 1875		
766	<i>Cosmarium blyttii</i> Wille 1880		
767	<i>Cosmarium botrytis</i> Meneghini ex Ralfs 1848		
768	<i>Cosmarium botrytis</i> var. hyacinthii (Gutwinski) Petlovany in Petlovany & Tsarenko 2015		
769	<i>Cosmarium botrytis</i> var. mediolaeva West 1892		
770	<i>Cosmarium calcareum</i> Wittrock 1872		
771	<i>Cosmarium capitulum</i> J.Roy & Bisset 1886		
772	<i>Cosmarium conspersum</i> Ralfs 1848		
773	<i>Cosmarium contractum</i> O.Kirchner 1878		
774	<i>Cosmarium crenatum</i> Ralfs ex Ralfs 1848		
775	<i>Cosmarium crenulatum</i> Nägeli 1849		
776	<i>Cosmarium cymatopleurum</i> Nordstedt 1872		
777	<i>Cosmarium etchachanense</i> J.Roy & Bisset 1894		
778	<i>Cosmarium exiguum</i> W.Archer 1864		
779	<i>Cosmarium formosulum</i> Hoff in Nordstedt 1888		
780	<i>Cosmarium granatum</i> Brébisson ex Ralfs 1848		
781	<i>Cosmarium humile</i> Nordstedt ex De Toni 1889		
782	<i>Cosmarium humile</i> var. glabrum Gutwinski 1892		
783	<i>Cosmarium humile</i> var. substriatum (Nordstedt) Schmidle 1895		
784	<i>Cosmarium impressulum</i> Elfving 1881		
785	<i>Cosmarium inclusum</i> Borge 1930		
786	<i>Cosmarium jenisejense</i> Boldt 1885		

Table Continued

No	Taxa	Sp	Ssp
787	<i>Cosmarium laeve</i> Rabenhorst 1868		
788	<i>Cosmarium laeve</i> var. <i>septentrionale</i> Wille 1879		
789	<i>Cosmarium latifrons</i> P.Lundell 1871		
790	<i>Cosmarium logiense</i> Bisset 1884		
791	<i>Cosmarium margaritifera</i> Meneghini ex Ralfs 1848		
792	<i>Cosmarium meneghinii</i> Brébisson ex Ralfs 1848		
793	<i>Cosmarium moniliforme</i> Ralfs 1848		
794	<i>Cosmarium moniliforme</i> var. <i>limneticum</i> West & G.S.West 1908		
795	<i>Cosmarium obtusatum</i> (Schmidle) Schmidle 1898		
796	<i>Cosmarium ochthodes</i> Nordstedt 1875		
797	<i>Cosmarium phaseolus</i> Brébisson ex Ralfs 1848		
798	<i>Cosmarium prominulum</i> Raciborski 1885		
799	<i>Cosmarium pseudarctoum</i> Nordstedt 1879		
800	<i>Cosmarium punctulatum</i> Brébisson 1856		
801	<i>Cosmarium pygmaeum</i> W.Archer 1864		
802	<i>Cosmarium quadratum</i> Ralfs ex Ralfs 1848		
803	<i>Cosmarium quadratum</i> var. <i>willei</i> (Schmidle) Willi Krieger & Gerloff 1969		
804	<i>Cosmarium rectangulare</i> Grunow in Rabenhorst 1868		
805	<i>Cosmarium reniforme</i> (Ralfs) W.Archer 1874		
806	<i>Cosmarium sexangulare</i> P.Lundell 1871		
807	<i>Cosmarium subcrenatum</i> Hantzsch in Rabenhorst 1868		
808	<i>Cosmarium subprotumidum</i> Nordstedt in Nordstedt & Wittrock 1876		
809	<i>Cosmarium subtumidum</i> Nordstedt in Wittrock, Nordstedt & Lagerheim 1878		
810	<i>Cosmarium tetraophthalmum</i> Brébisson ex Ralfs 184		
811	<i>Cosmarium tinctum</i> Ralfs 1848		
812	<i>Cosmarium tyrolicum</i> (Nordstedt) Krieger & Gerloff 1962		
813	<i>Cosmarium umbilicatum</i> Lütkenmüller 1893		
814	<i>Cosmarium undulatum</i> Corda ex Ralfs 1848		
815	<i>Cosmarium varsoviense</i> Raciborski 1889		
816	<i>Cosmarium venustum</i> (Brébisson) W.Archer in Pritchard 1861		
817	<i>Cosmarium venustum</i> var. <i>induratum</i> Nordstedt 1887		
818	<i>Cosmarium vexatum</i> West 1892		
819	<i>Cosmoastrum coarctatum</i> (Brébisson) Palamar-Mordvintseva 1982		
820	<i>Cosmoastrum muticum</i> (Brébisson) Palamar-Mordvintseva ex Petlovany in Petlovany & Tsarenko 2015		
821	<i>Cylindriastrum merianii</i> (Reinsch) Palamar-Mordvintseva 1982		
822	<i>Cylindrocystis brebissonii</i> (Ralfs) De Bary 1858		
823	<i>Euastrum bidentatum</i> Nägeli 1849		
824	<i>Klebsormidium flaccidum</i> (Kützing) P.C.Silva, K.R.Mattox & W.H.Blackwell 1972		
825	<i>Klebsormidium nitens</i> (Kützing) Lokhorst 1996		
826	<i>Klebsormidium subtile</i> (Kützing) Mikhailyuk, Glaser, Holzinger & Karsten 2015		
827	<i>Mougeotia parvula</i> Hassall 1843		

Table Continued

No	Taxa	Sp	Ssp
828	<i>Penium margaritaceum</i> Brébisson in Ralfs 1848		
829	<i>Penium spirostriolatum</i> J.Barker 1869		
830	<i>Pleurotaenium clavatum</i> (Kützing) de Bary 1858		
831	<i>Pleurotaenium trabecula</i> Nägeli 1849		
832	<i>Spirogyra affinis</i> (Hassall) Petit 1880		
833	<i>Spirogyra elongata</i> (Vaucher) Dumortier 1822		
834	<i>Spirogyra laxa</i> Kützing 1849		
835	<i>Spirogyra maxima</i> (Hassall) Wittrock in Wittrock & Nordstedt 1882		
836	<i>Spirogyra mirabilis</i> (Hassall) Kützing 1849		
837	<i>Spirogyra tenuissima</i> (Hassall) Kützing 1849		
838	<i>Staurastrum avicula</i> var. <i>lunatum</i> (Ralfs) Coesel & Meesters 2013		
839	<i>Staurastrum bacillare</i> Brébisson ex Ralfs 1848		
840	<i>Staurastrum bacillare</i> var. <i>obesum</i> P.Lundell 1871		
841	<i>Staurastrum bieneanum</i> Rabenhorst 1862		
842	<i>Staurastrum gracile</i> Ralfs ex Ralfs 1848		
843	<i>Staurastrum gracile</i> var. <i>subtenuissimum</i> Woronichin		
844	<i>Staurastrum hexacerum</i> Wittrock 1872		
845	<i>Staurastrum hibernicum</i> West 1892		
846	<i>Staurastrum lanceolatum</i> W.Archer 1862		
847	<i>Staurastrum lunatum</i> var. <i>planctonicum</i> West & G.S.West 1903		
848	<i>Staurastrum orbiculare</i> Meneghini ex Ralfs 1848		
849	<i>Staurastrum paradoxum</i> Meyen ex Ralfs 1848		
850	<i>Staurastrum pileolatum</i> Brébisson in Ralfs 1848		
851	<i>Staurastrum punctulatum</i> Brébisson in Ralfs 1848		
852	<i>Staurastrum ralfsii</i> var. <i>depressum</i> (J.Roy & Bisset) Coesel & Meesters 2013		
853	<i>Staurastrum tetracerum</i> Ralfs ex Ralfs 1848		
854	<i>Staurodesmus cuspidatus</i> (Brébisson) Teiling 1967		
855	<i>Staurodesmus dejectus</i> (Brébisson) Teiling 1954		
856	<i>Zygnema insigne</i> (Hassall) Kützing 1849		
857	<i>Zygnema pectinatum</i> (Vaucher) C.Agardh in Liljeblad 1816		
858	<i>Zygnema vaginatum</i> Klebs 1886		
Rhodophyta			
859	<i>Amphiroa malectractata</i> var. <i>constricta</i> (Heiden) Simonsen 2000		
860	<i>Audouinella chalybea</i> (Roth) Bory 1823		
861	<i>Bangia atropurpurea</i> (Mertens ex Roth) C.Agardh 1824		
862	<i>Batrachospermum moniliforme</i> Roth 1800		
863	<i>Chroodactylon ramosum</i> (Thwaites) Hansgirg 1885		
Total taxa		780	863

Sp, species; Ssp, subspecies

Alpha-biodiversity of nondiatom algae is fluctuated in studied habitats from 150 taxa in the Karakul Lake to 13 taxa in the mineral springs Sist and Barshor. Table 3 show that Cyanobacteria species richness was prevail in all studied objects. More of them, floristic analysis of the taxonomical structure demonstrated prevailing of

Cyanobacteria in floristic cores of communities in mostly of studied habitats. The *Charophyta* species are included in the floristic cores (more than 50% of taxa) in the rivers Gunt and Shokhdara, and *Chlorophyta* species are enriched core in the reservoir Tang together with Cyanobacteria.

Table 3 Taxonomic spectrum of algal species in studied aquatic habitats of Pamir with altitude of sampling points. The names of aquatic objects are as in Table I. Numbers of taxa that represent of more than 50% of alpha-diversity (biodiversity core) in studied habitat are marked by boldred

No of object	1	6	8	9	10	11	12	13	14	15	16	17	18	19	20
Altitude, m	3914	3825	3757	3734	3800	4213	3600	3300	2540	2150	3150	2800	2360	2400	2410
Cyanobacteria	78	67	76	80	17	68	45	41	27	32	32	29	13	13	45
Chlorophyta	44	45	45	44	0	39	3	15	26	23	15	1	0	0	9
Charophyta	21	22	14	15	0	21	5	33	24	27	33	0	0	0	2
Euglenozoa	6	6	5	5	0	4	0	3	8	17	4	0	0	0	0
Ochrophyta	1	0	0	0	0	0	1	5	3	0	5	1	0	0	3
Miozoa	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0
Rhodophyta	0	0	0	0	0	1	0	3	0	0	3	0	0	0	0
Eubacteria	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Total taxa	150	140	141	145	17	133	54	101	89	99	93	31	13	13	59
50% of taxa	75	70	71	73	9	67	27	51	45	50	47	16	7	7	30

Species richness-altitude relationships were revealed when we constructed histogram for taxonomic structure in the altitude gradient (Figure 2). Can be seen that species richness is fluctuated as a whole with individual peculiarities for each aquatic object, but increased with altitude (Figure 2) mostly with Cyanobacteria and *Chlorophyta* increasing (Figure 2).

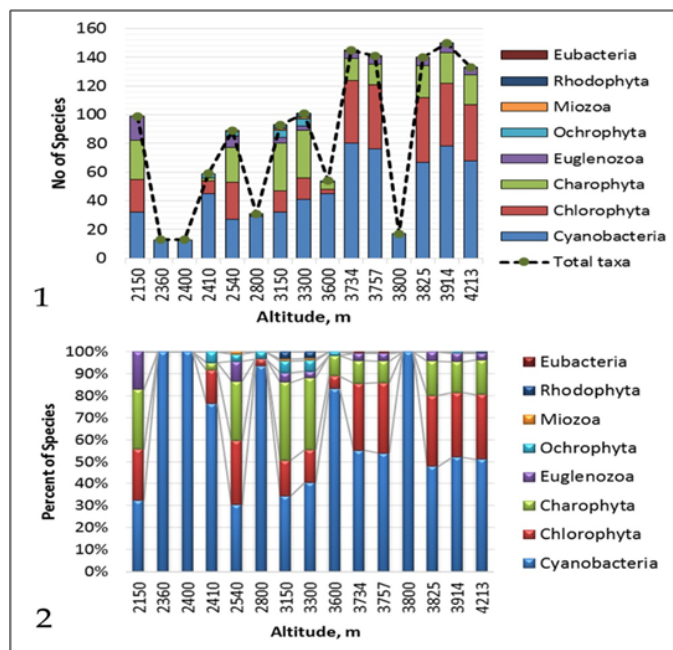


Figure 2 (1) Distribution of algal species richness over habitat altitude. (2) Percent of taxonomic division in communities.

The next step for analysis of the alpha-diversity peculiarity was revealing the species distribution with comparative floristics. Figure 3 show three clusters that cut off on the similarity level 50%. The rose cluster included highmountain lakes; second green cluster unites rivers habitats and artificial reservoirs in the river valley. Third blue cluster combined the mineral spring's communities. Here we can see relationships of algal taxonomic content with hydrology of studied objects. Dendrite of species overlapping in studied communities shows three floristic cores with same colors as in Figure 4. Our calculation helps us to reveal the core community for each cluster. So, the Sassykkul Lake community was center of similarity for cluster one – the lakes. The river Gunt community was core for the riverine cluster two. The cluster three of mineral springs demonstrates highly individual communities with low overlappind. But even in this case we can see the Garm-Chashma spring community as core for third cluster.

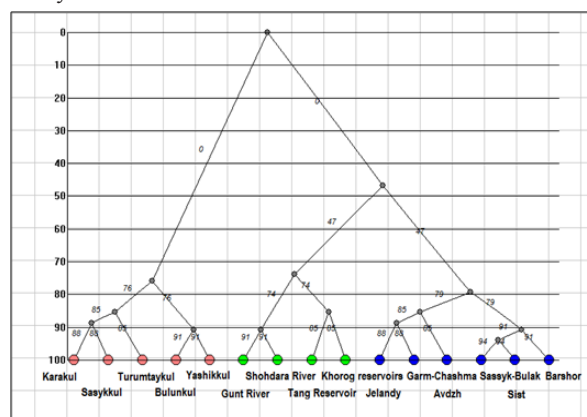


Figure 3 Demdrogram of species similarity in studied communities of the Pamir aquatic habitats by Euclidean Distace. Floristic clusters are highlighted on the similarity level of 50%.

We constructed surface plots for distribution of species richness in major taxonomic Division over total species richness and habitat altitude. Figure 5 shows that Cyanobacteria (Figure 5-1) are fluctuated but as a while have a trend to increasing in species richness in high altitude richest communities. The *Chlorophyta* species richness is demonstrated indifference to altitude (Figure 5-2) but they increased by species number with total species richness increasing in community. *Charophyta* (Figure 5-3) and Euglenozoa (Figure 5-4) diversity show similar fluctuation with low altitude habitats preference.

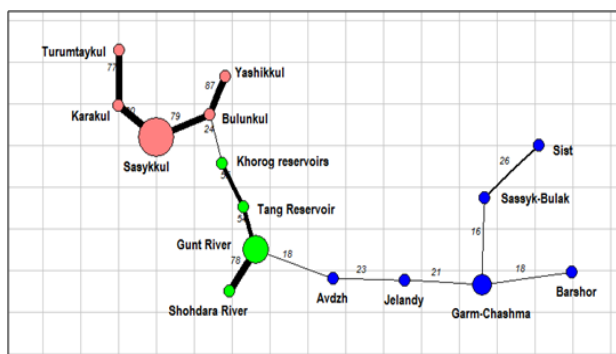


Figure 4 Dendrite of species overlapping in studied communities of the Pamir aquatic habitats by the Vae'd's method. Floristic clusters are highlighted with core object as large round, percent of overlapping are stay in the connection lines. The lines thickness is correlated with percent of overlapping.

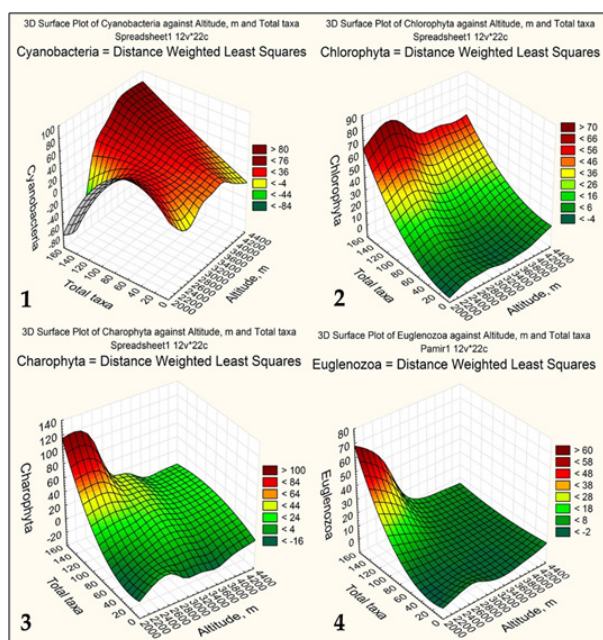


Figure 5 Distance weight least squares surface plots of the (1) Cyanobacteria, (2) Chlorophyta, (3) Charophyta, (4) Euglenozoa and total species richness and habitat altitude.

Conclusion

The Pamir mountain aquatic habitats are unique, low studied localities of algae we list of which here presented in the first time as a result of references data of 1930-2000 compilation with the species list from our study in 2000-2015. So, studied communities of 21 aquatic habitats are including 780 species (863 with infraspecific

taxa) that related to nine taxonomic Divisions. The systematical structure analysis of alpha-biodiversity of nondiatom algae in Pamir revealed Cyanobacteria as most richest. The followed Division were *Charophyta* and *Chlorophyta*, but floristically only Cyanobacteria with some *Charophyta* or *Chlorophyta* species was contain more than 50% of alpha-diversity in each studied aquatic object. Comparative floristic results let us to distinguish three floristic cores that combine algal communities from hydrologically similar habitats – lakes, rivers, and mineral springs. Comparison of revealed algal species richness in Pamir with the surrounding mountain algal floras let us to assume that prevailing of Cyanobacteria species can be marked as peculiarities of the Pamir algal flora. One of the cause of this Cyanobacteria domination can be the altitude of habitats that was in range much more than surrounding studied floras: 2,100-4,700m a.s.l. Cyanobacteria show preferences of high altitude habitats in this environment only whereas other Division were or indifferent to altitude (*Chlorophyta*) or prefers low altitude about 2,100-2,500m a.s.l. We are summarised alpha-biodiversity of studied diatoms in Pamir habitats with presented here nondiatom algae and total list of the Pamir flora now are represents by 1,235 species (1,415 with infraspecific taxa). Therefore, studied algal flora of Pamir the alpha-biodiversity list of which is represents here in first time, is comparable now with surrounding floras of highmountain areas and total list of taxa can be assessed as representative and full enough.

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Conflict of interest

Authors declare there is no conflict of interest in publishing the article.

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