AN UPDATED CHECKLIST OF ALGAE FROM HIMACHAL PRADESH, INDIA

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Abstract

This checklist of algae has been compiled by critical reviewing all available literature and provides a consolidated, up-to-date account of the diversity of algae in Himachal Pradesh state of India. According to the compiled data the algal flora of the state is represented by a total of 629 algal species of 158 genera belonging to 53 families of 31 orders of the 8 algal classes. The maximum number reported species are belongs to class Cyanophyceae (320 species) followed by Chlorophyceae (139 species), Bacillariophyceae (117 species), Euglenophyceae (25 species), Xanthophyceae (6 species), Dinophyceae (3 species), Coscinodisophyceae (3 species) and Chrysophyceae (2 species) from different habitats of the state. This checklist with taxonomically updated/accepted name of genera/species of algal species reported so far will be helpful for future floristic studies from the region.

Keywords: Algae, checklist, diversity, flora, Himachal Pradesh

Running Title: Algae of Himachal Pradesh

INTRODUCTION

Algae represent ubiquitous group of oxygen-evolving photosynthetic autotrophs including both prokaryotic and eukaryotic cell structure and single cell to complex multi-cellular body organizations (Paul *et al.* 2017; Agarwal 2018). As a primary producer, the members of this group are important components of aquatic based food chains (Parmar *et al.* 2016; Kumar *et al.* 2020). Algae play an important role in maintaining water-column oxygen dynamics through respiration and photosynthesis processes, which is responsible for nutrient cycling to stabilize substrata in aquatic ecosystem (Effendi *et al.* 2016). The community structure of algae is influenced by various factors such as nutrient concentration, type of substratum, water quality and light regime that directly affect the development and growth of algae (Breuer *et al.* 2017; Burrows *et al.* 2021). Algae can act as an indicator of degree of alterations in water quality resulted from anthropogenic stress because of having specific ecological requirements (Omar 2010; Dell *et al.* 2017). Many algal indicators are increasingly been used in bio-monitoring and conservation of water bodies around the world (Wu *et al.* 2017; Komal *et al.* 2021). Therefore, availability of information on the distribution and diversity of algae is very important as they represent an ecologically important group of organisms.

Himachal Pradesh is one of the Northern hilly state of India located between latitude 30˚22′ to 33˚13′ North and longitude 75˚45′ to 79˚04′ East with geographical area of 55,673 km^2 (Fig. 1). The state has three distinct regions on the basis of altitudes including the Shivaliks, with altitudes up to 1,500 m, Middle Himalayan regions between 1,500 m to 3,000 m and the Himadris, higher than 3,000 m. The average annual rainfall is about 1,800 mm and the temperature varies from sub zero to 35°C. The state is surrounded by Jammu and Kashmir on the north, Punjab on the west and south-west, Haryana and Uttar Pradesh on the south, Uttarakhand on the south-east and by the Tibet Autonomous Region on the east (Arora

et al. 2012; Balasubramanian 2017). About one third of the state is permanently under snow, glaciers and cold deserts, where tree growth is minimal due to extreme environmental conditions (Mahar *et al.* 2011). The major rivers are Sutlej, Beas, Ravi, Chenab and Yamuna (Mahar *et al.* 2011). It has a deeply explored topography, complex geological structure and a rich temperate flora in the sub-tropical latitudes. The diverse habitat of this Western Himalayan state supports rich floral and faunal diversity, nearly 18,440 species of plants with 25 to 30 per cent of endemics and 27,298 species of mammals, birds, reptiles, amphibians and fishes are reported from this region (Samant *et al.* 1998; Nowak 1999; Myers *et al.* 2000; Dar & Sundarapandian 2016).

Algal diversity of Himachal Pradesh from various diverse habitats including lakes, freshwater streams, paddy field, cold and hot water springs etc. have been explored by various workers (Vashista 1968; Shukla *et al.* 1970; Misra *et al.* 2006; Bhusan *et al.* 2018; Dwivedi *et al.* 2008; Arora *et al.* 2011; Gupta 2012 a,b; Gupta & Das 2012; Thakur *et al.* 2013; Mongra 2014; Singh *et al.* 2014; Jindal *et al.* 2014; Bhushan & Kumar 2018). Despite these efforts, the knowledge about the algal diversity of the state is still inconsistent. Therefore, there is a need for an updated checklist of algae to provide a consolidated, up-to-date account of the diversity of algae in of Himachal Pradesh. Although, Gupta (2012a,b) published checklists of cyanoprokaryota, chlorophyceae, xanthophyceae, chrysophyceae and xanthophyceae and diatoms from India, which include 371 taxa reported from Himachal Pradesh. The present work with addition 258 more algal taxa is helpful in increasing the number of known algae from state to 629 taxa. Since, algae represent tremendously diverse group of aquatic organisms, which need to be exploit for their diverse ecological and economical benefits by collecting and culturing at large scale.

The objective of present work was to review all the available information and to prepare a list having currently acceptable name of algal species reported so far from

Himachal Pradesh state of India. Checklist preparation is the most basic taxonomic work on a group of organisms arranged in systematic or alphabetical order. The checklist prepared during present work is in a systematic order by reviewing the available literature up to July, 2022. This is the first complete checklist of algae from Himachal Pradesh covering all currently accepted species names and their synonyms. This updated checklist will provide baseline information for future floristic, ecological, biogeographic distributional studies on algae from the region.

MATERIALS AND METHODS

The current checklist has been prepared by consulting the available literature from 1907 to 2022. The list has been prepared from collected data, which includes, 1) the species name listed as it is appeared in the original publications, 2) the species current, valid and accepted names. The study area includes the whole current geographical area of the Himachal Pradesh. The species have been taxonomically arranged by adopting the classification system proposed by Komárek (2014) Fritsch (1945) and Bellinger & Sigee (2010). The taxonomic identity including the authority and current accepted name has been verified from an online database AlgaeBase (Guiry & Guiry 2020).

RESULTS AND DISCUSSION

As per the current literature survey, Algal diversity in Himachal Pradesh state of India is represented by 629 algal species of 158 genera belonging to 53 families of 31 orders of the 8 algal classes (Table1). From the collected data it is observed that in terms of the number of species, class Cyanophyceae dominate with (329 species, 54 genera) followed by Chlorophyceae (143 species, 50 genera), Bacillariophyceae (118 species, 38 genera), Euglenophyceae (25 species, 5 genera), Xanthophyceae (6 species, 5 genera), Dinopyceae (3 species, 3 genera), Coscinodisophyceae (3 species, 2 genera) and Chrysophyceae (2 species, 1 genera) (Table 2).

The present checklist is helpful in adding 258 algal taxa to the list of 371 previously known taxa of algae from Himachal Pradesh. The large area including extreme varied habitats of the state is still remained unexplored for algal diversity. Thus, there is need to explore every possible habitat which further leads to increase our knowledge in algal diversity and document all the algal species. In future, checklist prepared during this work will play an important role as a base line data for floristic studies from the state.

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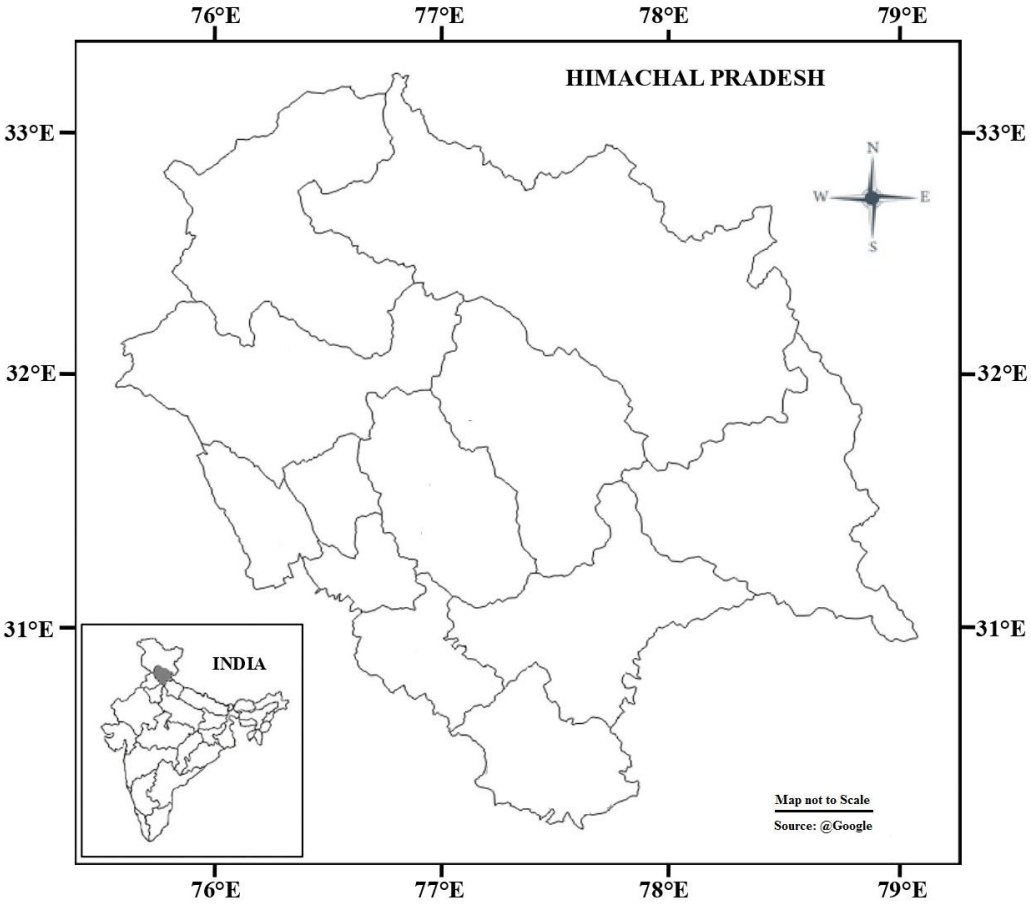

Fig. 1 Location map of Himachal Pradesh state of India

Table-1 Number of orders, families, genera and species of algae reported from Himachal Pradesh, India

Class	**Order**	**Family**	**Genera**	**Species**
Cyanophyceae	7	19	54	329
Chlorophyceae	10	17	50	143
Xanthophyceae	3	3	5	6
Chrysophyceae	1	1	1	2
Coscinodisophyceae	1	2	2	3
Bacillariophyceae	7	9	38	118
Dinophyceae	1	1	3	3
Euglenophyceae	1	1	5	25
Total	**31**	**53**	**158**	**629**

266 Table-2 List of algal species reported from Himachal Pradesh, India.

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S. No.	Currently Accepted Name	References
	Class: Cyanophyceae **Order: Synechococcales** **Family: Synechococcaceae**	
1	*Romeria minima* (Lemmermann) Komárek **Synechococcus minimus* (Lemmermann) Komárek	3,19
2	*Synechococcus bigranulatus* Skuja **Synechococcus elongatus var. amphigranulatus* J.J.Copeland	16,25
3	*Synechococcus vulcanus* J.J.Copeland	3,19
4	*Synechococcus vulcanus var. bacillarioides* J.J.Copeland	3,19
5	*Coelosphaerium kutzingianum* Nägeli	26,25,23,7
6	*Limnococcus limneticus* (Lemmermann) Komárková, Jezberová, O.Komárek & Zapomelová **Chroococcus limneticus* Lemmermann	26,25,23,11,29,18
7	*Chroococcus minor* (Kutzing) Nägeli	16,25,5,13,19
8	*Chroococcus minutus* (Kutzing) Nägeli	16,25,5,13,19
9	*Synechococcus elongatus* (Nägeli) Nägeli **Synechococcus lividus* J.J.Copeland	11,3,19,29,18
10	*Eucapsis alpine* F.E.Clements & H.L.Schantz	11,29,18
11	*Synechocystis minuscula* Woronichin	11,29,18
12	*Microcystis smithii* Komárek & Anagnostidis **Aphanocapsa pulchra* (Kutzing)	26,25,23
13	*Microcystis litoralis* (Hansgirg) Aboal, nom. illeg.	26,25,23
14	*Aphanocapsa biformis* A.Braun	4,17
15	*Komvophoron schmidlei* (Jaag) Anagnostidis & Komárek **Pseudanabaena schmidlei* Jaag	26,25,23
16	*Cyanobium parvum* Komárek, J.Kopecký & Cepák	26,25,23
17	*Leptolyngbya Antarctica* Anagnostidis & Komárek	26,25,23
18	*Leptolyngbya benthonica* Anagnostidis	26,25,23
19	*Planktolyngbya limnetica* (Lemmermann) Komárková-Legnerová & Cronberg	11,29,18
20	*Leptolyngbya foveolarum* Anagnostidis & Komárek	26,25,23
21	*Leptolyngbya frigida* Anagnostidis & Komárek	26,25,23
22	*Drouetiella lurida* (Gomont) Mai, J.R.Johansen & Pietrasiak **Leptolyngbya lurida* Anagnostidis & Komárek	26,25,23,3,19
23	*Leptolyngbya valderiana* Anagnostidis & Komárek	26,25,23,11,16,25,29,18
24	*Limnothrix redekei* (Goor) Meffert	26,25,23
25	*Stenomitos frigidus* (F.E.Fritsch) Miscoe & J.R.Johansen **Pseudanabaena frigida* Anagnostidis	26,25,23
26	*Merismopedia tranquilla* (Ehrenberg) Trevisan **Merismopedia punctata* Meyen, nom. illeg.	26,25,23
27	*Merismopedia elegans* A.Braun ex Kutzing	26,25,23
28	*Aphanocapsa incerta* (Lemmermann) G.Cronberg & Komárek **Microcystis incerta* (Lemmermann) Lemmermann	26,25,23
29	*Aphanocapsa grevillei* (Berkeley) Rabenhorst	26,25,23,5,13,19

30	*Aphanocapsa thermalis* Brugger	5,13,19
31	*Synechocystis aquatilis* Sauvageau	26,25,23
32	*Coelosphaerium dubium* Grunow	26,25,23,16,25,5,13,19
33	*Coelosphaerium kuetzingianum* Nägeli	16,25,5,13,19
34	*Coelosphaerium aerugineum* Grunow	26,25,23
35	*Leptolyngbya carnea* (Kutzing ex Lemmermann) Anagnostidis & Komárek	26,25,23
36	*Leptolyngbya thermarum* (Woronichin) Anagnostidis & Komárek	26,25,23
37	*Leptolyngbya orientalis* (G.S.West) Anagnostidis & Komárek	26,25,23
38	*Leptolyngbya amphibian* (Gomont ex Gomont) Anagnostidis & Komárek	26,25,23,11,29,18
39	*Pseudanabaena limnetica* (Lemmermann) Komárek	26,25,23
40	*Leptolyngbya gelatinosa* (Woronichin) Anagnostidis & Komárek	20,29
41	*Leptolyngbya thermobia* Anagnostidis	20,29
42	*Nodosilinea epilithica* Perkerson et Casamatta	20,29,3,19,7,8,27
43	*Leptolyngbya cebennensis* (Gomont)	20,29,3,19
44	*Aphanocapsa koordersi* Storm	20,29,9
45	*Merismopedia minima* Beck	20,29,9,18
46	*Anathece clathrata* (West & G.S.West) Komárek, Kastovsky & Jezberova	3,19, 20,29,7,8,27
47	*Synechococcus elongates* (Nägeli) Nägeli	3,19
	Family: Merismopediaceae	
48	*Stichosiphon sansibaricus* (Hieronymus) F.E.Drouet & W.A.Daily	26,25,23,4, 17
49	*Merismopedia glauca* (Ehrenberg) Kutzing	16,25
50	*Aphanocapsa grevillei* (Berkeley) Rabenhorst	3,19
51	*Synechocystis thermalis* J.J Copeland	16,25
52	*Aphanocapsa thermalis* Brugger	3,19
53	*Synechocystis pevalekii* Ercegovic	3,19
54	*Eucapsis himalayensis* (Kutzing) Rabenhorst	3,19
55	*Pseudanabaena catenata* Lauterborn	3,19
56	*Dermocarpa olivacea* var. *amphibian* Rao, CB	3,19,16,25
	Family:Coelosphaeriaceae	
57	*Spirulina subsalsa* Oerst. Ex Gomont	3,19,9
	Order: Spirulinales	
58	*Spirulina gomontii* Guwinski	11,29,18
59	*Spirulina meneghiniana* Zanardini ex Gomont	11,3,19,29,18
60	*Arthrospira amphibian* (Schmidle) Anagnostidis **Spirulina amphibian* Schmidle	3,19,11,3,19,29,18
61	*Spirulina major* Kutzing ex Gomont	3,19,11,29,18
62	*Spirulina major* (Kutzing ex Gomont)	3,19
	Order:Chroococcales	
63	*Microcystis aeruginosa* (Meneghini) Elenkin	11,29,18
64	*Aphanothece castagnei* (Kutzing) Rabenhorst	11,29,18
65	*Microcystis pulverea* (H.C.Wood) Forti	11,29,18
66	*Chroococcus varius* A.Braun	3,19,11,3,19,5

		,13,19,29,18
67	*Gloeocapsa atrata* Kutzing	3,19
68	*Gloeocapsa coracina* Kutzing	11,29,18
69	*Chroococcus minor* (Kutzing) Nägeli	5,13,19
70	*Microcystis flos-aquae* (Wittrock) Kirchner	3,19
71	*Chroococcus minutes* (Kutzing)	1
72	*Chroococcus yellowstonensis* J.J.Copeland	1
73	*Gleocapsa calcarea* Tilden	3,19
74	*Gloeocapsa rupestris* Kutzing	3,19
75	*Gloeocapsa conglomerata* Kutzing	4,17
76	*Gleocapsa punctata* Nägeli	4,17
77	*Microcystis lamelliformis* Holsinger	4,17
78	*Chroococcus tenax* (Kirchner) Hieronymus	4,17,9
79	*Aphanocapsa pulchra* (Kutzing)	4,17,11,3,19,26,25,23,29,18
80	*Gloeocapsopsis pleurocapsoides* Komárek & Anagnostidis ex Komárek	4,17
81	*Chroococcus amphibi* (Kutzing) Nägeli	4,17,3,19,16,25
82	*Chroococcus turgidus* (Kutzing) Nägeli	4,17,16,25
83	*Entophysalis amphibian* Kutzing	16,25
84	*Chroococcus yellowstonensis* J.J.Copeland	4,17
85	*Leptolyngbya amphibia* (Lemmermann) Anagnostidis & Komárek **Phormidium africanum* Lemmermann	26,25,23
86	*Leptolyngbya tenuis* (Gomont) Anagnostidis & Komárek **Phormidium tenue* Gomont	4,17
87	*Aphanothece nageli* W.West & G.S.West	4,17
88	*Aphanothece pallida* (Kutzing) Rabenhorst	4,17,16,25,4,17
89	*Gomphosphaeria natans* Komárek & Hindák	4,17,16,25
90	*Gomphosphaeria aponina* Kutzing	4,17
91	*Kamptonema cortianum* (Meneghini ex Gomont) Strunecký, Komárek & J.Smarda	5,13,19
92	*Jaaginema filiforme* (J.Copeland) Anagnostidis	5,13,19
93	*Microcystis viridis* (A.Braun) Lemmermann	5,13,19,7,28
94	*Microcystis pulverea* (H.C.Wood) Forti	5,13,19,7,28
95	*Microcystis flosaquae* (Wittrock) Kirchner	5,13,19,7,28
96	*Microcystis marginata* (Meneghini) Kutzing	5,13,19,7,28
97	*Microcystis robusta* (H.W.Clark) Nygaard	5,13,19,7,28
98	*Microcystis wesenbergii* (Komárek) Komárek ex Komárek	5,13,19
99	*Chlorogloea simplex* M.Watanabe & Komárek	5,13,19,6,25,7,28
100	*Gloeocapsa gelatinosa* Kutzing	5,13,19,9
101	*Gloeocapsopsis thermalis* (Novácek) Komárek & Anagnostidis ex Komárek	5,13,19
102	*Gloeocapsa gelatinosa* (Meneghini) Kutzing	5,13,19,7,11,28,29,18
103	*Microcystis protocystis* Crow	5,13,19,9

104	*Microcystis amphiba* Bharadwaja	5,13,19,7,28
105	*Microcystis orissica* West, W.	11,3,19,29,18, 9
106	*Aphanothece elabens* (Brebisson ex Meneghini) Elenkin **Microcystis elabens* (Breb.) Kutz	6,25,8,9
107	*Chroococcus micrococcus* (Kutz) Rabenh.	6,25,9
108	*Chroococcus rufescens* (Kutzing) Nägeli **Chroococcus minimus* (Kutzing)	6,25
109	*Gloeocapsa gelatinosa* Kutz	6,25
110	*Gloeocapsa livida* (Carm.) Kutz	7,3,19,28,9
	Family: Aphanothecaceae	
111	*Aphanothece nidulans* P.Richter	3,19
112	*Aphanothece stagnina* (Sprengel) A.Braun	7,28,9
	Family: Chroococcaceae	
113	*Chroococcus amphibia* (Kutzing) Nägeli	7,28
114	*Chroococcus schizodermatics* West	16,25
115	*Chroococcus endophyticus* J.J.Copeland	16,25
116	*Oscillatoria cortiana* Meneghini ex Gomont	7,28
117	*Cyanosarcina burmensis* (Skuja) Kovácik	7,26,25,23,28
118	*Gloeocapsopsis thermalis* (Novácek) Komárek & Anagnostidis ex Komárek	7,28
	Family: Entophysalidaceae	
119	*Entophysalis granulosa* Kutzing	7,26,25,23,28
	Family:Coleofasciculaceae	
120	*Anagnostidinema acutissimum* (Kufferath) Strunecký,Bohunická, J.R.Johansen & J.Komárek **Geitlerinema acutissimum* (Kufferath) Anagnostidis	7,28
121	*Coleofasciculus chthonoplastes* (Thuret ex Gomont) M.Siegesmund, J.R.Johansen & T.Friedl **Microcoleus chthonoplastes* Thuret ex Gomont	7,28
122	*Anagnostidinema acutissimum* (Kufferath) Strunecký, Bohunická, J.R.Johansen & J.Komárek **Geitlerinema acutissimum* (Kufferath) Anagnostidis	7,28
123	*Geitlerinema sulphureum* (Strzeszewski) Anagnostidis	7,28
	Family: Microcoleaceae	
124	*Microcoleus autumnalis* (Gomont) Strunecky, Komárek & J.R.Johansen **Phormidium autumnale* Gomont	7,26,25,23
125	*Microcoleus lacustris* Farlow ex Gomont	7,28
126	*Planktothrix agardhii* Anagnostidis & Komárek	7,11,28,29,18
127	*Planktothrix clathrata* Anagnostidis & Komárek	7,28
128	*Arthrospira jenneri* Stizenberger ex Gomont	7,28
129	*Arthrospira khannae* Drouet & Strickland	7,28
130	*Microcoleus amoenus* (Gomont) Strunecky, Komárek & J.R.Johansen **Oscillatoria amoena* Gomont	11,29,18
131	*Arthrospira platensis* Desikachary	4,17
132	*Spirulina argentina* Frenguelli **Arthrospira argentina* Guarrera & Kuhnemann	4,17
133	*Limnospira fusiformis* (Voronichin) Nowicka-Krawczyk,	4,17

	Muhlsteinová & Hauer **Arthrospira fusiformis* (Voronichin) Komárek & J.W.G.Lund	
134	*Planktothrix isothrix* (Skuja) Komárek & Komárková	4,17
135	*Microcoleus acremanii* Gomont ex Gomont	4,17
136	*Microcoleus vaginatus* Gomont ex Gomont	4,17
	Family: Oscillatoriaceae	
137	*Jaaginema pseudogeminatum* (G.Schmid) Anagnostidis & Komárek **Oscillatoria pseudogeminata* G.Schmid	4,17
138	*Geitlerinema calcuttense* (Biswas) Anagnostidis **Oscillatoria calcuttensis* Biswas	4,17
139	*Phormidium chalybeum* (Mertens ex Gomont) Anagnostidis & Komárek **Oscillatoria chalybea* Mertens ex Gomont	4,17
140	*Oscillatoria chilkensis* Biswas	4,17,26,25,23
141	*Kamptonema chlorinum* (Kutzing ex Gomont) Strunecký, Komárek & J.Smarda **Oscillatoria chlorina* Kutzing ex Gomont	4,17
142	*Oscillatoria curviceps* C.Agardh ex Gomont	4,17
143	*Oscillatoria corallinae* Gomont ex Gomont	16,25
144	*Kamptonema formosum* (Bory ex Gomont) Strunecký, Komárek & J.Smarda **Oscillatoria formosa* Bory ex Gomont	26,25,23
145	*Kamptonema laetevirens* (H.M.Crouan & P.L.Crouan ex Gomont) Strunecký, Komárek & J.Smarda **Oscillatoria laetevirens* P.Crouan & H.Crouan ex Gomont	16,25
146	*Oscillatoria limosa* C.Agardh ex Gomont	11,29,18
147	*Kamptonema okenii* (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda **Oscillatoria okenii* C.Agardh ex Gomont	7,28
148	*Oscillatoria princeps* Vaucher ex Gomont	7,4,17,28
149	*Jaaginema pseudogeminatum* (G.Schmid) Anagnostidis & Komárek **Oscillatoria pseudogeminata* G.Schmid	3,19
150	*Oscillatoria subbrevis* Schmidle	7,4,17,28
151	*Leptolyngbya fritschii* Anagnostidis **Plectonema notatum var. africanum* F.E.Fritsch & M.F.Rich	7,28
152	*Lyngbya truncicola* Ghose	3,19
153	*Potamolinea aerugineocaerulea* (Gomont) M.D.Martins & L.H.Z.Branco **Lyngbya aerugineocaerulea* Gomont	3,19,16,25
154	*Leptolyngbya fragilis* (Gomont) Anagnostidis & Komárek **Phormidium fragile* Gomont	3,19
155	*Oscillatoria sancta* Gomont	7,28
156	*Lyngbya martensiana* (Meneghini ex Gomont	3,19
157	*Phormidium allorgei* (Fremy) Anagnostidis & Komárek **Lyngbya allorgei* Fremy	7,4,17,28
158	*Limnoraphis birgei* (G.M.Smith) J.Komárek, E.Zapomelová, J.Smarda, J.Kopecký, E.Rejmánková, J.Woodhouse, B.A.Neilan & J.Komárková * *Lyngbya birgei* G.M.Smith	7,28

159	*Lyngbya martensiana Menegh* Meneghini ex Gomont	7,11,28,29,18
160	*Leibleinia epiphytica* (Hieronymus) Compère	7,11,3,19,28,29,18
161	*Phormidium kuetzingianum* (Kirchner ex Hansgirg) Anagnostidis & Komárek	7,28
162	*Heteroleibleinia kuetzingii* (Schmidle) Compère **Lyngbya kuetzigii* Schmidle	7,11,28,29,18
163	*Lyngbya major Menengh* Meneghini ex Gomont	3,19
164	*Phormidium nigrum* (Vaucher ex Gomont) Anagnostidis & Komárek **Lyngbya nigra* Hangirg	7,4,17,26,25,23,28
165	*Phormidium puteale* (Montagne ex Gomont) Anagnostidis & Komárek **Lyngbya putealis Mont* Montagne ex Gomont	7,28
166	*Oscillatoria perornata* Skuja	7,28
167	*Oscillatoria princeps* Vaucher ex Gomont	7,28
168	*Phormidium terebriforme* (C.Agardh ex Gomont) Anagnostidis & Komárek **Oscillatoria terebriformis* C.Agardh ex Gomont	7,28
169	*Phormidium chalybeum* Gomont	7,28
170	*Oscillatoria limosa* C.Agardh ex Gomont	7,16,25,5,13,19,28
171	*Phormidium willei* (N.L.Gardner) Anagnostidis & Komárek	16,25
172	*Oscillatoria tenuis* Gomont	7,16,25,5,13,19,28
173	*Oscillatoria amphibia* Lauterborn	7,16,25,28
174	*Phormidium subfuscum* Kutzing ex Gomont	7,16,25,28
175	*Lyngbya lutea* Gomont ex Gomont	7,3,19,28
176	*Oscillatoria stigonema* Gomont	16,25
177	*Potamolinea aerugineocaerulea* Gomont **Lyngbya aerugineocaerulea* Gomont	7,28
178	*Lynqbya diqueti* Gomont	7,28
179	*Lyngbya calcicola* (C.Agardh) Hansgirg	7,28
180	*Lynqbya niqra* Gomont	7,28
181	*Oscillatoria brevis* Schröter	7,28
182	*Oscillatoria laetevirens* Hofman-Bang ex Forti	7,3,19,28
183	*Oscillatoria proboscidea* Gomont	7,28
184	*Oscillatoria proboscidea* var. *westii* Forti	3,19
185	*Oscillatoria tenuis* Gomont	3,19
186	*Limnoraphis hieronymusii* (Lemmermann) J.Komárek, E.Zapomelová, J.Smarda, J.Kopecký, E.Rejmánková, J.Woodhouse, B.A.Neilan & J.Komárková **Lyngbya hieronymusi* Lemmermann	3,19
187	*Phormidium limnetica* (Vaucher ex Gomont) Anagnostidis & Komárek	3,19
188	*Kamptonema chlorinum* (Kutzing ex Gomont) Strunecký, Komárek & J.Smarda **Phormidium chlorinum* (Kutzing ex Gomont) Umezaki & Watanabe	3,19
189	*Kamptonema animale* (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda **Phormidium animale* (Vaucher ex Gomont) Anagnostidis &	7,28

	Komárek	
190	*Phormidium ambigum* Thuret ex Gomont	7,28
191	*Phormidium nigrum* (Vaucher ex Gomont) Anagnostidis & Komárek	7,28
192	*Phormidium desikacharyiense* Vasishta	7,28
193	*Phormidium jenkelianum* G.Schmid	7,28
194	*Phormidesmis molle* (Gomont) Turicchia, Ventura, Komárková & Komárek **Phormidium molle* Gomont	7,28
195	*Phormidium molle* f. *tenuior* West & West	7,28
196	*Leptolyngbya valderiana* (Gomont) Anagnostidis & Komárek **Phormidium valderianum* Gomont	8
197	*Phormidium chalybeum* (Mertens ex Gomont)	8,27
198	*Oscillatoria obscura* Bruhl et Biswas	3,19,9
199	*Oscillatoria chilkensis* Biswas	8,27
200	*Phormidium irriguum* (Kutzing ex Gomont) Anagnostidis & Komárek **Oscillatoria irrigua* (Kutz) Gomont	8,27
201	*Oscillatoria agardhii* Gomont	8,11,16,25,27, 29,18
202	*Phormidium corium* Gomont	8,27
203	*Phormidium baculum* (Gomont ex Gomont) Anagnostidis **Lyngbya baculum* Gomont	8,27
	Family:Stigonemataceae	
204	*Stigonema ocellatum* Fremy	8,27
	Family: Hapalosiphonaceae	
205	*Hapalosiphon pumilus* Kirchner ex Bornet & Flahault **Hapalosiphon fontinalis* Kirchner ex Bornet & Flahault	11,29,18
206	*Halosiphon intricatus* West & G.S.West	11,29,18
207	*Fischerella epiphytica* S.L.Ghose	11,29,18
208	*Fischerella thermalis* Gomont	8,27
209	*Mastigocladus laminosus* Cohn ex Kirchner	3,19
	Family: Gloeotrichiaceae	
210	*Gloeotrichia echinulata* Gonzalves & Kamat	3,19
211	*Gloeotrichia intermedia* (Lemmermann) Geitler	8,27
	Family: Pseudanabaenaceae	
212	*Pseudanabaena thermalis* Anagnostidis	11,29,18
213	*Leptolyngbya copelandii* Anagnostidis	3,19
	Family: Leptolyngbyaceae	
214	*Planktolyngbya contorta* (Lemmermann) Anagnostidis & Komárek	3,19
215	*Leptolyngbya margaretheana* (G.Schmid) Anagnostidis & Komárek	3,19
216	*Leptolyngbya boryana* (Gomont) Anagnostidis & Komárek	11,3,19,29,18
	Family: Entophysalidaceae	
217	*Chlorogloea simplex* M.Watanabe & Komárek	11,29,18
218	*Entophysalis amphibian* Kutzing	8,27
	Order: Pleurocapsales	
219	*Cyanosarcina spectabilis* (Geitler) Kovácik **Myxosarcina spectabilis* Geitler	8,27
	Family: Hydrococcaceae	8,27
220	*Hydrococcus rivularis* Kutzing	8,27
	Order: Chroococcidiopsidales	

221	*Chroococcidiopsis cubana* Komárek et Hindák	9,18
	Order: Oscillatoriales	
222	*Oscillatoria tenuis* Vaucher ex Gomont	9,18
223	*Geitlerinema splendidum* (Greville ex Gomont) Anagnostidis	9,18
224	*Oscillatoria curviceps* C.Agardh ex Gomont	9,18
225	*Kamptonema jasorvense* (Vouk) Strunecký, Komárek & J.Smarda **Oscillatoria jasorvensis* Vouk	9,18
226	*Kamptonema laetevirens* (H.M.Crouan & P.L.Crouan ex Gomont) Strunecký, Komárek & J.Smarda **Oscillatoria laetevirens* P.Crouan & H.Crouan ex Gomont	9,18
227	*Jaaginema angustissimum* (West & G.S.West) Anagnostidis & Komárek **Oscillatoria angustissima* West & G.S.West	9,18
228	*Anagnostidinema amphibium* (C.Agardh ex Gomont) Strunecký, Bohunická, J.R.Johansen & J.Komárek **Oscillatoria amphibian* C.Agardh ex Gomont	3,19
229	*Phormidium minnesotense* (Tilden) Drouet **Oscillatoria minnesotensis* Tilden	16,25,5,13,19
230	*Anagnostidinema exile* (Skuja) Strunecky *et al.* **Geitlerinema exile* (Skuja) Anagnostidis	9,18,4,17
231	*Oscillatoria curviceps* C.Agardh ex Gomont	9,18
232	*Lyngbya semiplena* Hansgirg	9,18,18
233	*Phormidium minima* Thuret ex Gomont	9,18,9
234	*Kamptonema animale* (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda **Phormidium animale* (Vaucher ex Gomont) Anagnostidis & Komárek	9,18
235	*Phormidium ambigum* Thuret ex Gomont	9,18
236	*Phormidium nigrum* (Vaucher ex Gomont) Anagnostidis & Komárek	12,15
237	*Oscillatoria obscura* Bruhl et Biswas	12,15
238	*Oscillatoria sancta* (Kutz). Gomont.	12,15,26,25,23,9
239	*Oscillatoria chilkensis* Biswas	12,15,9
240	*Phormidium irriguum* (Kutzing ex Gomont) Anagnostidis & Komárek **Oscillatoria irrigua* (Kutz) Gomont	12,15,9
241	*Oscillatoria agardhii* Gomont	12,15,9
242	*Phormidium corium* Gomont	12,15,9
243	*Phormidium baculum* (Gomont ex Gomont) Anagnostidis **Lyngbya baculum* Gomont	12,15,9
	Order: Nostocales	
244	*Nostoc carneum* C.Agardh ex Bornet & Flahault **Nostoc spongiaforme* C.Agardh ex Bornet & Flahault	12,15
245	*Calothrix marchica* Lemmermann	12,15
246	*Calothrix parietina* Thuret ex Bornet & Flahault	12,15
247	*Anabaenopsis circularis* (G.S.West) Woloszynska & V.V.Miller	12,15
248	*Dolichospermum macrosporum* (Klebhan) Wacklin, L.Hoffmann & Komárek **Anabaena macrospora* Klebahn	12,15
249	*Trichormus fertilissimus* (C.B.Rao) Komárek & Anagnostidis	4,17,17

	**Anabaena fertilissima* C.B.Rao	
250	*Anabaena laxa* A.Braun	12,15
251	*Dolichospermum helicoideum* (C.Bernard) Wacklin, L.Hoffmann & Komárek **Anabaena helicoidea* C.Bernard	12,15
252	*Anabaena torulosa* Lagerheim ex Bornet & Flahault	12,15
253	*Cylindrospermum stagnale* Bornet & Flahault	12,15
254	*Nostoc carneum* C.Agardh ex Bornet & Flahault	12,15
255	*Desmonostoc muscorum* C.Agardh ex Bornet & Flahault **Nostoc muscorum* C.Agardh ex Bornet & Flahault	12,15
256	*Nostoc passerifiianum* C.Agardh ex Bornet & Flahault	12,15
257	*Dolichospermum circinale* (Rabenhorst ex Bornet & Flahault) P.Wacklin, L.Hoffmann & J.Komárek **Anabaena circinalis* Rabenhorst ex Bornet & Flahault	12,15
258	*Nodularia spumigena* Mertens ex Bornet & Flahault	12,15
259	*Fortiea bossei* (Fremy) Desikachary	12,15
260	*Calothrix braunii* Bornet & Flahault	12,15
261	*Calothrix brevissima* G.S.West	12,15
262	*Nostoc linckia* Bornet & Flahault	12,15
263	*Nostoc punctiforme* (Hariot) Elenkin	12,15
264	*Nostoc carneum* C.Agardh ex Bornet & Flahault **Nostoc spongiaeforme* C.Agardh ex Bornet & Flahault	12,15
265	*Nodularia sphaerocarpa* Bornet & Flahault	12,15
266	*Aulosira prolific* Bharadwaja	12,15
267	*Aulosira fertilissima* S.L.Ghose	12,15
268	*Calothrix castelli* Bornet & Flahault	12,15
269	*Cylindrospermum majus* A.M.Bendre & M.S.Agarkar	26,25,23
270	*Cylindrospermum musicola* A.M.Bendre & M.S.Agarkar	1,7
271	*Anabaena iyengarii* Bharadwaja	26,25,23
272	*Anabaenopsis arnoldii* Aptekar	26,25,23
273	*Nostoc commune* Elenkin	26,25,23,9
274	*Desmonostoc muscorum* (C.Agardh ex Bornet & Flahault) Hrouzek & Ventura **Nostoc muscorum* C.Agardh ex Bornet & Flahault	26,25,23
275	*Trichormus variabilis* Komárek & Anagnostidis	26,25,23
276	*Scytonema leptobasis* S.L.Ghose	26,25,23
277	*Scytonema ocellatum* Ghose	26,25,23
278	*Scytonema simplex* Vasishta	26,25,23
279	*Tolypothrix distorta* C.-C.Jao	26,25,23
280	*Calothrix castellii* Bornet & Flahault	26,25,23
281	*Rivularia minuta* C.B.Rao	26,25,23
282	*Gloeotrichia echinulata* Gonzalves & Kamat	26,25,23
283	*Gloeotrichia intermedia* (Lemmermann) Geitler	26,25,23
284	*Hapalosiphon pumilus* Kirchner ex Bornet & Flahault	26,25,23
285	*Fischerella epiphytica* S.L.Ghose	26,25,23
286	*Stigonema ocellatum* Fremy	26,25,23
287	*Nostochopsis lobatus* Hansgirg	26,25,23
288	*Chlorogloeopsis fritschii* (A.K.Mitra) A.K.Mitra & D.C.Pandey	26,25,23

289	*Fischerella thermalis* Gomont	4,17
290	*Mastigocladus laminosus* Cohn ex Kirchner	3,19
291	*Tolypothrix fragilis* (Gardner) Geitler	26,25,23,11,29,18
292	*Nostoc edaphicum* (Roth) Bornet ex Bornet et Flahault	26,25,23
293	*Nostoc linckia* (Roth) Bornet ex Bornet et Flahault	11,29,18
	Family: Tolypothrichaceae	
294	*Tolypothrix distorta* C.-C.Jao	11,29,18
295	*Tolypothrix fragilis* (Gardner) Geitler	11,29,18
	Family: Chlorogloeopsidaceae	
296	*Chlorogloeopsis fritschii* (A.K.Mitra) A.K.Mitra & D.C.Pandey	20,29
	Family: Aphanizomenonaceae	
297	*Anabaenopsis circularis* (G.S.West) Woloszynska & V.V.Miller	20,29,3,19,7,8,27
298	*Dolichospermum macrosporum* (Klebhan) Wacklin, L.Hoffmann & Komárek **Anabaena macrospora* Klebahn	20,29,3,19
299	*Trichormus fertilissimus* (C.B.Rao) Komárek & Anagnostidis **Anabaena fertilissima* C.B.Rao	20,29
300	*Anabaena laxa* A.Braun	20,29,9,18
301	*Dolichospermum helicoideum* (C.Bernard) Wacklin, L.Hoffmann & Komárek **Anabaena helicoidea* C.Bernard	2,8,27
302	*Anabaena torulosa* Lagerheim ex Bornet & Flahault	20,29,9,18
303	*Nodularia spumigena* Mertens ex Bornet & Flahault	3,19
304	*Nodularia sphaerocarpa* Bornet & Flahault	3,19, 20,29,7,8,27,28
305	*Anabaenopsis arnoldii* Aptekar	3,19
	Family: Nostocaceae	
306	*Nostoc carneum* C.Agardh ex Bornet & Flahault **Nostoc spongiaforme* C.Agardh ex Bornet & Flahault	3,19,8,27
307	*Johanseninema constrictum* (Szafer) Hasler, Dvorák & Poulícková **Anabaena constricta* (Szafer) Geitler	3,19
308	*Nostoc paludosum* Kutzing ex Bornet & Flahault	3,19
309	*Cylindrospermum stagnale* Bornet & Flahault	12,15
310	*Desmonostoc muscorum* C.Agardh ex Bornet & Flahault **Nostoc muscorum* C.Agardh ex Bornet & Flahault	3,19,12,15,12,15
311	*Nostoc oryzae* (F.E.Fritsch) J.Komárek & K.Anagnostidis **Anabaena oryzae* F.E.Fritsch	12,15
312	*Anabaena perturbata* H.Hill	12,15
313	*Anabaena sphaerica* Bornet & Flahault	3,19
314	*Anabaena echinospora* Skuja	3,19
315	*Nostoc passerifiianum* Bornet & Flahault **Nostoc passerifiianum* Bornet & Flahault	3,19
316	*Dolichospermum circinale* (Rabenhorst ex Bornet & Flahault) P.Wacklin, L.Hoffmann & J.Komárek	12,15

	**Anabaena circinalis* Rabenhorst ex Bornet & Flahault	
317	*Nostoc linckia* Bornet & Flahault	12,15
318	*Nostoc punctiforme* (Hariot) Elenkin	12,15
319	*Nostoc carneum* C.Agardh ex Bornet & Flahault **Nostoc spongiaeforme* C.Agardh ex Bornet & Flahault	12,15
320	*Aulosira prolific* Bharadwaja	3,19,12,15
321	*Cylindrospermum majus* A.M.Bendre & M.S.Agarkar	12,15
322	*Cylindrospermum musicola* A.M.Bendre & M.S.Agarkar	3,19
323	*Anabaena iyengarii* Bharadwaja	3,19,12,15,12, 15
324	*Nostoc commune* Elenkin	12,15
325	*Desmonostoc muscorum* (C.Agardh ex Bornet & Flahault) Hrouzek & Ventura **Nostoc muscorum* C.Agardh ex Bornet & Flahault	3,19
326	*Trichormus variabilis* Komárek & Anagnostidis	3,19,8
327	*Rivularia minuta* C.B.Rao	3,19,8
328	*Nostoc edaphicum* (Roth) Bornet ex Bornet et Flahault	3,19,12,15,12, 15
	Class: Chlorophyceae **Order:Volvocales** **Sub Order:Chlamydomonadineae** **Famliy:Chlamydomonadaceae**	
329	*Chlamydomonas reinhardi* P.A.Dangeard	12,15
330	*Carteria pseudoglobosa* Korshikov	3,19,12,15
331	*Chlamydomonas globosa* J.W.Snow	12,15
	Order:Chlorococcales **Family:Chlorococcaceae**	
332	*Chlorella vulgaris* Clemençon & Fott	3,19
333	*Cystococcus humicola* Nägeli **Chlorococcum humicola* (Nägeli) Rabenhorst	12,15
334	*Auxenochlorella pyrenoidosa* (H.Chick) Molinari & Calvo-Perez **Chlorella pyrenoidosa* H.Chick	3,19,12,15
335	*Lepocyclis fusiformis* (H.J.Carter) Lemmermann	12,15
336	*Micractinium pusillum* Fresenius	3,19
	Family: Oocystaceae	
337	*Neglectella solitaria* (Wittrock) Stenclová & Kastovsky **Oocystis solitaria* Wittrock	3,19
338	*Oocystis elliptica* West	12,15
339	*Trochiscia zachariasii* Lemmermann **Trochiscia zachariasii* Lemmermann	12,15
340	*Oocystis noval-semliae* Wille	12,15
	Family: Chlorellaceae	
341	*Dictyosphaerium ehrenbergianum* Nägeli	12,15
	Family: Selenastraceae	
342	*Ankistrodesmus falcatus* (Corda) Ralfs	12,15
343	*Selenastrum bibraianum* Reinsch **Ankistrodesmus bibrainus* (Reinsch) Korshikov	12,15
344	*Pandorina morum* (O.F.Muller) Bory	12,15
345	*Ankistrodesmus spiralis* (W.B.Turner) Lemmermann	12,15

346	*Messastrum gracile* (Reinsch) T.S.Garcia **Ankistrodesmus gracilis* (Reinsch) Korshikov	12,15
347	*Kirchneriella lunaris* (Kirchner) Möbius	12,15
348	*Messastrum gracile* (Reinsch) T.S.Garcia **Selenastrum gracile* Reinsch	12,15
349	*Pyrobotyrs gracilis* Reinsch	12,15
	Family: Hydrodictyaceae	
350	*Conferva reticulate* Linnaeus **Hydrodictyon reticulatum* (Linnaeus) Bory	12,15
351	*Tetraëdron gracile* (Reinsch) Hansgirg	12,15
352	*Stauridium tetras* var. *tetraodon* (Corda) J.D.Hall & Karol **Pediastrum tetras* var. *tetraodon* (Corda) Hansgirg	12,15
353	*Monactinus simplex* (Meyen) Corda **Pediastrum simplex* (Meyen) Corda	12,15
354	*Pediastrum tetras* (Ehrenberg) Ralfs **Pediastrum tetras var. excisum* (A.Braun) Hansgirg	12,15
355	*Stauridium tetras var. tetraodon* (Corda) J.D.Hall & Karol **Pediastrum tetras var. tetraodon* (Corda) Hansgirg	12,15
356	*Pediastrum tetras* (Ehrenberg) Ralfs	12,15
357	*Parapediastrum biradiatum* (Meyen) E.Hegewald	12,15
358	*Pediastrum duplex* Meyen	12,15
359	*Pediastrum ovatum* (Ehrenberg) A.Braun	12,15
360	*Sorastrum spinulosum* Nägeli	12,15
361	*Tetraedron minimum* (A.Braun) Hansgirg	12,15
362	*Volvox glabator* Linnaeus	12,15
	Order:Ulotrichales **Family: Ulotrichaceae**	
363	*Klebsormidium subtile* (Kutzing) Mikhailyuk, Glaser, Holzinger & Karsten **Ulothrix subtilissima* Rabenhorst	3,19
364	*Ulothrix tenerrima* (Kutzing) Kutzing **Ulothrix variabilis* Kutzing	12,15
365	*Ulothrix zonata* (F.Weber & Mohr) Kutzing	12,15
	Family: Microsporaceae	
366	*Microspora floccose* (Vaucher) Thuret	12,15
367	*Microspora willeana* Lagerheim	12,15
368	*Microspora indica* Randhawa	12,15
	Family: Sphaeropleaceae	
369	*Sphaeroplea annulina* (Roth) C.Agardh	12,15
	Order: Cladophorales **Family: Cladophoraceae**	
370	*Cladophora glomerata* (Linnaeus) Kutzing	12,15
371	*Cladophora glomerata* (Linnaeus) Kutzing	12,15
372	*Pithophora roettleri* (Roth) Wittrock **Pithophora mooreana* Collins	12,15
373	*Pseudorhizoclonium africanum* (Kutzing) Boedeker **Rhizoclonium hookeri* Kutzing	12,15
	Order: Chaetophorales **Family: Chaetophoraceae**	

374	*Stigeoclonium tenue* Kutzing	12,15
375	*Chaetophora flagellifera* Kutzing	12,15
	Order: Oedogoniales **Family: Oedogoniaceae**	
376	*Oedogonium crispum* Wittrock ex Hirn	12,15
377	*Oedogonium terrestre* Randhawa	12,15
378	*Oedogonium figuratum* Tiffany	12,15
379	*Oedogonium tapeinosporum* Wittrock ex Hirn	12,15
380	*Oedogonium nanum* Wittrock ex Hirn	12,15
	Order: Conjugales **Sub Order: Euconjugatae** **Family: Mesotoniaceae**	
381	*Cylindrocystis brebissonii* (Ralfs) De Bary	12,15
	Family: Zygnemataceae	
382	*Spirogyra cylindrical* Czurda	12,15
383	*Spirogyra weberi* var. *grevilleana* (Hassal) O.Kirchner **Spirogyra grevilleana* (Hassall) Kutzing	12,15
384	*Zygnema mirabile* Hassall **Spirogyra mirabilis* (Hassall) Kutzing	12,15
385	*Spirogyra schmidtii* West & G.S.West	12,15
386	*Spirogyra sinensis* L.-C.Li	12,15
387	*Spirogyra tumida* C.-C.Jao	12,15
388	*Zygnema cruciatum* (Vaucher) C.Agardh **Zygnema insigne* (Hassall) Kutzing	12,15
389	*Zygnemopsis mysorensis* M.O.P.Iyengar	12,15
390	*Mougeotia thylespora* Skuja	4,17
391	*Zygogonium ericetorum* Kutzing	4,17
	Order: Desmiodioideae **Family: Desmidiaceae**	
392	*Cosmarium subtumidium* Nordstedt	4,17,12,15,10
393	*Micrasterias zeylanica* F.E.Fritsch	10
394	*Cosmarium awadhense* B.N.Prasad & R.K.Mehrotra	10
395	*Cosmarium botrytis* Meneghini ex Ralfs	10
396	*Cosmarium granatum* Brebisson ex Ralfs	10
397	*Cosmarium lundelli* var. *corruptum* (W.B.Turner) West & G.S.West	10
398	*Cosmarium moniliforme* var. *lamneticum* West & G.S.West	10
399	*Cosmarium norimbergense* var. *depressum* (West & G.S.West) Willi Krieger & Gerloff	10
400	*Cosmarium pyramidatum* Brebisson ex Ralfs	10
401	*Cosmarium radiosum* Wolle	10
402	*Cosmarium subcrenatum* Hantzsch	10
403	*Cosmarium supraspeciosum* Wolle	10
404	*Cosmarium turpinii* Brebisson	10
405	*Cosmarium abbreviatum* var. *germanicum* (Raciborski) Willi Krieger & Gerloff	10
406	*Cosmarium punctulatum* var. *rotundatum* Klebs	10
407	*Cosmarium quadrum* P.Lundell	10
408	*Cosmarium regnellii* Wille	10
409	*Cosmarium regnesii* Reinsch	10

410	*Cosmarium succisum* var. *hyalinum* Skvortsov	10
411	*Euastrum crassangulatum* Borgesen	10
412	*Euastrum subvalidum* Ehrenberg ex Ralfs	10
413	*Euastrum platycerum* Reinsch	10
414	*Euastrum spinulosum* Delponte	10
415	*Euastrum verrucossum* Ehrenberg ex Ralfs	10
416	*Pleurotaenium ehrenbergii* (Ralfs) De Bary	10
417	*Teilingia granulata* (J.Roy & Bisset) Bourrelly **Sphaerozosma granulatum* J.Roy & Bisset	10
418	*Staurastrum coarctatum* var. *subcurtum* Nordstedt	10
419	*Staurodesmus dickiei* (Ralfs) S.Lillieroth	10
420	*Staurastrum avicula* var. *lunatum* (Ralfs) Coesel & Meesters **Staurastrum lunatum* Ralfs	10
421	*Pseudostaurastrum enorme* (Ralfs) Chodat **Staurastrum muticum* (A.Braun) Bourrelly	10
422	*Staurastrum pachyrhynchum* Nordstedt	10
423	*Stauratrum perundulatum* West & West	12,15
424	*Staurastum pseudotetracerum* (Nordstedt) West & G.S.West	12,15,14,17
425	*Staurastrum punctulatum* Brebisson	12,15
426	*Pleurotaenium ehrenbergi* (Ralfs) De Bary	12,15
427	*Staurastrum unguiferum* W.B.Turner	4,17
428	*Lepocynclis fusiformis* (H.J.Carter) Lemmermann	4,17
429	*Closterium acerosum* De Notaris	12,15
430	*Closterium acerosum* var. *elongatum* West	12,15
431	*Cosmarium calcareum* Wittrock	12,15
432	*Cosmarium contractum* var. *pachydermum* A.M.Scott & Prescott	12,15
433	*Cosmarium cucumis* Corda ex Ralfs	12,15
434	*Cosmarium depressum* var. *apertum* (W.B.Turner) M.Hirano	12,15
435	*Cosmarium circulare* var. *messikommeri* Krieger & Gerloff	12,15
436	*Cosmarium dubium* O.Borge	12,15
437	*Cosmarium furcatospermum* var. *maius* Prescott	12,15
438	*Closterium acerosum* var. *angolense* West & G.S.West	12,15
439	*Cosmarium granatum* Brebisson ex Ralfs **Cosmarium granatum* Brebisson ex Ralfs	5,13,19
440	*Cosmarium lundellii* var. *subellipticum* B.N.Prasad & R.K.Mehrotra	5,13,19
441	*Cosmarium quadrum* var. *sublatum* (Nordstedt) Krieger **Cosmarium margaritatum* var. *sublatum* (Nordstedt) Krieger	12,15
442	*Cosmarium nitidulum* De Notaris	12,15
443	*Cosmarium nymannianum* Grunow	14,17,12,15
444	*Closterium acerosum* f. *rectum* A.M.Scott & Prescott	14,17
445	*Closterium acutum* var. *linea* (Perty) West & G.S.West	12,15,22
446	*Cosmarium obsoletum* (Hantzsch) Reinsch	22
447	*Cosmarium pachydermum* P.Lundell	22
448	*Cosmarium granatum* var. *rotundatum* Willi Krieger	4,17
449	*Cosmarium pseudopyramidatum* var. *oculatum* Willi Krieger	4,17,14,17,12, 15,7
450	*Cosmarium pyramidatum* Brebisson ex Ralfs	4,17
451	*Cosmarium quadrum* P.Lundell	4,17

452	*Cosmarium radiosum* Wolle	4,17
453	*Cosmarium reniforme* var. *elevatum* West & G.S.West	7
454	*Cosmarium subalatum* West & G.S.West	12,15
455	*Cosmarium scabrum* W.B.Turner	12,15
456	*Cosmarium sexnotatum* Gutwinski	7
457	*Cosmarium speciosum* P.Lundell	12,15,7
458	*Cosmarium subprotumidum* var. *gregoryi* West & G.S.West	4,17,7
459	*Pleurotaenium trabecula* Nägeli	4,17
460	*Closterium dianae* Ehrenberg ex Ralfs	6,25,7,14,17
461	*Closterium leibleinii* Kutzing ex Ralfs	6,25
462	*Closterium rectimarginatum* var. *majus* N.D.Kamat	6,25
463	*Clostrium venus* Kutzing ex Ralfs	6,25,7,7
464	*Closterium dianae* var. *pseudodianae* (J.Roy) Willi Krieger	7
465	*Closterium tumidium* L.N.Johnson	7
	Order: Siphonales **Family: Protosiphonaceae**	
466	*Ditchotomisiphon tuberosus* (A.Braun ex Kutzing) A.Ernst	7
	Family: Vaucheriaceae	
467	*Vaucheria bursata* (O.F.Muller) C.Agardh	7
	Order: Charales **Family: Characeae**	
468	*Chara corallina* Klein ex C.L.Willdenow	7,8
469	*Chara braunii* C.C.Gmelin	7
470	*Chara wallichi* A.Braun	7,14,17
471	*Nitella acuminata* A.Braun ex Wallman	7
	Class: Xanthophyceae **Order: Heterochloridales** **Family: Heterochloridaceae**	
472	*Stipitococcus urceolatus* West & G.S.West	14,17
	Order: Heterotrichales **Family: Tribonemaceae**	
473	*Xanthonema exile* (Klebs) P.C.Silva **Bumilleria exilis* Klebs	14,17,6,25
474	*Tribonema bombycinum* (C.Agardh) Derbes & Solier	7
475	*Heterodendron squarrosum* Pascher	20,29
	Order: Heterosiphonales **Family: Botrydiaceae**	
476	*Botrydium tuberosum* M.O.P.Iyengar	20,29
477	*Botrydium divisum* M.O.P.Iyengar	14,17
	Class: Chrysophyceae **Order:Chrysomonadales** **Family:Chromulinaceae**	
478	*Chrysophaerella coronacircumspina* Wujek & Kristiansen	7
479	*Chrysophaerella septisina* (K.H.Nicholls) J.Kristiansen & D.Tong	7,6,25,14,17
	Class: Coscinodisophyceae **Order:Melosirales** **Family:Melosiraceae**	
480	*Melosira Varians* C.Agardh	12,15

481	*Melosira granulata* (Ehrenberg) Ralfs **Aulacoseira granulate* (Ehrenberg) Simonsen	12,15
	Family: Stephanodiscaceae	
482	*Cyclotella meneghiniana* Kutzing	2
	Class: Bacillariophyceae **Order:Eunotiales** **Family:Eunotiaceae**	
483	*Eunotia diadema* Ehrenberg **Eunotia serra* var. *diadema* (Ehrenberg) R.M.Patrick	7
484	*Eunotia valida* Hustedt	7
485	*Leplochlamys ampullaceal* (Ehrenberg) Rabenhorst	7
486	*Cymbella affinis* (Krammer) W.Silva	7
487	*Cymbella cymbiformis* Longa Cleve	7
488	*Cymbella reinhardti* Grunow	7
489	*Cymbella rupicola* Grunow	12,15
490	*Cymbella tumidula* Grunow	12,15
491	*Cymbella cistula* (Ehrenberg) O.Kirchner	12,15
492	*Cymbella curvata* Rabenhorst	12,15
493	*Cymbella tumescens* A.Cleve	14,17
494	*Epithemia turgida* (Ehrenberg) Kutzin **Cymbella turgid* (Ehrenberg) Hassall	5,13,19,12,15
495	*Cymbella tumida* (Brebisson) Van Heurck	5,13,19,7,14,17
496	*Encyonema subalpinum* D.G.Mann	4,17
497	*Gyrosigma acuminatum* (Kutzing) Rabenhorst	4,17
498	*Gyrosigma scalproides* (Rabenhorst) Cleve	4,17
499	*Cocconeis placentula* Ehrenberg	4,17
500	*Cymbella ventricosa* Kutzing	4,17
501	*Cymbopleura amphicephala* (Nageli ex Kutzing) Krammer	4,17
502	*Cymbopleura cuspidate* (Kutzing) Krammer	5,13,19
503	*Cymbopleura inaequalis* (Ehrenberg) Krammer	5,13,19
504	*Cymbopleura reinhardtii* (Grunow) Krammer	6,25
505	*Diatoma vulgare* Grunow	5,13,19,7
506	*Fragilaria capucina* Desmazières	5,13,19,7
507	*Gomphonema gracile* Ehrenberg	5,13,19
508	*Gyrosigma acuminatum* (Kutzing) Rabenhorst	5,13,19
509	*Aulacoseira granulata* (Ehrenberg) Simonsen **Melosira granulate* (Ehrenberg) Grunow	5,13,19,7
510	*Craticula cuspidata* (Kutzing) D.G.Mann **Navicula cuspidate* (Kutzing) Hustedt	5,13,19,7,9,18
511	*Navicula laterostrata* Hustedt	5,13,19
512	*Navicula cryptocephala* Kutzing	5,13,19,6,25,7
513	*Navicula laterostrata* Hustedt	5,13,19,7
514	*Navicula phyllepta* Kutzing	20,29
515	*Navicula radiosa* Kutzing	5,13,19,7,14,17,12,15,2,6,25
516	*Navicula veneta* Kutzing **Navicula cryptocephala* var. *veneta* (Kutzing) Rabenhorst	5,13,19
517	*Diadesmis confervacea* Kutzing	5,13,19

	**Navicula confervacea* (Kutzing) Grunow	
518	*Sellaphora bacillum* (Ehrenberg) D.G.Mann **Navicula bacillum* Ehrenberg	5,13,19
519	*Pinnularia brebissonii* (Kutzing) Rabenhorst **Navicula brebissonii* Kutzing	5,13,19
520	*Pinnularia interrupta* W.Smith	5,13,19,7
521	*Pinnularia tabellaria* Ehrenberg **Pinnularia luculenta* (A.W.F.Schmidt) Cleve	6,25,8
522	*Navicula radiosa* Kutzing	6,25,14,17
523	*Navicula viridula* Grunow	6,25,7,12,15
524	*Pinnularia gibba* (Ehrenberg) Ehrenberg	6,25
525	*Pinnularia burkei* R.M.Patrick	6,25
526	*Pinnularia viridis* (Nitzsch) Ehrenberg	6,25,7
527	*Caloneis alpestris* (Grunow) Cleve	22
528	*Cocconema affine* (Kutzing) West & G.S.West	22
529	*Navicula andium* Frenguelli	22
530	*Pinnularia interrupta* W.Smith	22
531	*Pinnularia interrupta* (Ehrenberg) O.Muller	22
532	*Surirella robusta* Ehrenberg	22
533	*Synedra affinis* Kutzing	22
534	*Actinastrum hantzchii* Lagerheim	14,17
	Family: Gomphonemataceae	
535	*Gomphoneis elegans* (Grunow) Cleve	12,15
536	*Gomphonema acuminatum* Ehrenberg	14,17
537	*Gomphonema angustatum* (Kutzing) Rabenhorst	12,15
538	*Gomphonema ghosei* Abdul-Majeed	11
539	*Gomphonema gracile* Ehrenberg	12,15
540	*Gomphonella olivacea* (Hornemann) Rabenhorst **Gomphonema olivaceum* (Kutzing) Grunow	22,9
541	*Gomphonema parvulum* A.Mayer	14,17,12,15,22
542	*Gomphoneis clevei* (Fricke) Gil	22
543	*Gomphonema constrictum (Ehr.)* var. *capitatum (Ehr.) Grunow* f. *turgidum* H.P.Gandhi	12,15
544	*Gomphonema coronatum* Ehrenberg **Gomphonema acuminatum* var. *coronatum* (Ehrenberg) Rabenhorst	12,15
545	*Gomphonema constrictum (Ehr.)* var. *capitatum (Ehr.)* H.P.Gandhi	22
546	*Gomphonema gracile Ehr.* var. *dichotomum* H.P.Gandhi	22
547	*Gomphonema lacus-rankala* H.P.Gandhi	22,20,29
548	*Brebissonia lanceolata* (C.Agardh) R.K.Mahoney & Reimer **Gomphonema lanceolatum* (Grunow) A.Cleve	22
549	*Gomphonema acuminatum* var. *montanum* Schumann **Gomphonema montanum* (J.Schumann) Grunow	22
550	*Gomphonema constrictum* Ehrenberg	12,15
551	*Gomphonema sphaeroporum* Ehrenberg	22
552	*Gomphonema subcapitatum* (Grunow) E.Reichardt & Levkov	14,17
553	*Gomphonema subtile* Ehrenberg	22
554	*Gomphonema tenellum* W.Smith	7
555	*Gomphonema towutense* Hustedt	7

556	*Didymosphenia geminate* Skvortzow & K.I.Meyer	7
557	*Pleurosigma chandolensis* H.P.Gandhi	5,13,19
558	*Gyrosigma scalproides* (Thwaites) Cleve	12,15
559	*Navicula viridula* Grunow	6,25
560	*Pinnularia acrosphaeria* var. *parva* Krammer **Navicula acrosphaeria* A.W.F.Schmidt	7
561	*Ulnaria danica* (Kutzing) Compère & Bukhtiyarova **Synedra ulna* (Kutzing) Hustedt	7
562	*Gyrosigma kuetzingii* (Grunow) Cleve	7
563	*Navicula accomodata* Hustedt	7
564	*Navicula exigua* W.Gregory, nom. illeg.	7
565	*Nitzschia palea* Grunow	12,15
566	*Nitzschia acicularis* W.Smith	12,15
567	*Navicula cryptocephala* (Kutzing) Hustedt	12,15
568	*Gomphonema parvulum* A.Mayer	12,15
569	*Craticula cuspidata* (Kutzing) D.G.Mann **Navicula cuspidate* Foged	12,15
570	*Cocconeis placentula* Ehrenberg	12,15
571	*Fragilaria capucina* Desmazières	12,15
572	*Gomphonema gracile* Ehrenberg	12,15
	Order:Acanthales **Family:Achnanthaceae**	
573	*Achnanthes crenulata* Grunow	12,15
574	*Achnanthes inflate* (Kutzing) Grunow	12,15
575	*Planothidium lanceolatum* (Brebisson ex Kutzing) Lange-Bertalot **Achnanthes lanceolata* (Brebisson ex Kutzing) Grunow	12,15
576	*Achnanthidium exile* (Kutzing) Heiberg	12,15
577	*Planothidium hauckianum* (Grunow) Bukhtiyarova	12,15
578	*Achnanthidium nodosum* (Cleve) Tseplik & Chudaev **Rossithidium nodosum* (Cleve) Aboal	12,15
	Order: Bacillariales **Family:Bacillariaceae**	
579	*Fragilariopsis doliolus* (Wallich) Medlin & P.A.Sims	12,15
580	*Nitzschia acicularis* (Kutzing) W.Smith	12,15
581	*Nitzschia frustulum* Hustedt	12,15
582	*Nitzschia irresoluta* Hustedt	11
583	*Nitzschia palea* (Kutzing) W.Smith	12,15
	Order:Rhopalodiales **Family: Rhopalodiaceae**	
584	*Epithemia gibba* (Ehrenberg) Kutzing **Rhopalodia gibba* (Ehrenberg) O.Muller	14,17,12,15,22
585	*Rhopalodia gibba* var. *ventricosa* (Kutzing) H.Peragallo & M.Peragallo	22
586	*Epithemia sorex* Kutzing	12,15
	Order: Rhabdonematales **Family: Cocconeidaceae**	
587	*Cocconeis pediculus* Ehrenberg	22
588	*Cocconeis placentula* Ehrenberg	22
589	*Cocconeis lineata* Ehrenberg	22,20,29

	**Cocconeis placentula* var. *lineata* (Ehrenberg) Van Heurck	
	Order: Naviculales **Family:Amphipleuraceae**	
590	*Halamphora veneta* (Kutzing) Levkov	22
	Family:Stauroneidaceae	
591	*Stauroneis anceps* Ehrenberg	22
	Order: Surirellales **Family:Surirellaceae**	
592	*Cymatopleura elliptica* (Brebisson) W.Smith	22
593	*Surirella librile* (Ehrenberg) Ehrenberg **Cymatopleura solea* (Brebisson) W.Smith	7
594	*Surirella apiculata* W.Smith	7
595	*Iconella biseriata* (Brebisson) Ruck & Nakov	7
596	*Iconella celebesiana* (Hustedt) D.Kapustin & Kulikovskiy	5,13,19
597	*Surirella ovalis* Brebisson	12,15
598	*Surirella patella* Kutzing	6,25
599	*Surirella robusta* Ehrenberg	7
600	*Surirella robusta* Ehrenberg **Surirella saxonica* Auerswald ex Rabenhorst	7
	Class:Dinophyceae **Order:Dinophysiales** **Family:Ceratiaceae**	
601	*Ceratium hirundinella* (O.F.Muller) Dujardin	7
602	*Lepocynclis ovum* (Ehrenberg) Lemmermann **Euglena ovum* Ehrenberg	12,15
	Family:Peridiniaceae	
603	*Peridinium inconspicuum* Lemmermann	12,15
	Class:Euglenophyceae **Order:Euglenida** **Family:Euglenidae**	
604	*Euglena gracilis* G.A.Klebs	12,15
605	*Euglena proxima* P.A.Dangeard	12,15
606	*Euglena acus* (O.F.Muller) Ehrenberg	12,15
607	*Euglena tuba* H.J.Carter	12,15
608	*Phacus pleuronectes* (Ehrenberg) Dujardin	12,15
609	*Strombomonas verrucosa* (E.Daday) Deflandre	12,15
610	*Trachelomonas armata* (Ehrenberg) F.Stein	12,15
611	*Trachelomonas hispida* (Perty) F.Stein	12,15
612	*Phacus caudatus* Hubner	12,15
613	*Phacus curvicauda* Svirenko	12,15
614	*Phacus orbicularis* Hubner	12,15
615	*Phacus orbicularis* var. *caudate* Skvortsov	12,15
616	*Phacus pleuronectes* (O.F.Muller) Nitzsch ex Dujardin	12,15
617	*Phacus polytrophos* Pochmann	12,15
618	*Monomorphina pyrum* (Ehrenberg) Mereschkowsky	12,15
619	*Phacus quinquemarginatus* T.L.Jahn & Shawhan	7
620	*Phacus triqueter* (Ehrenberg) Dujardin	7
621	*Phacus unguis* Pochmann	7
622	*Trachelomonas armata* (Ehrenberg) F.Stein	7

623	*Trachelomonas bulla* F.Stein	7
624	*Trachelomonas dybowski* Drezepolski	12,15
625	*Trachelomonas hispida* (Perty) F.Stein	12,15
626	*Trachelomonas oblonga* var. *pulcherrima* (Playfair) T.G.Popova **Trachelomonas pulcherrima* Playfair	12,15
627	*Strombomonas scabra* (Playfair) Tell & Conforti **Trachelomonas scabra* Playfair	12,15
628	*Trachelomonas subverrucosa* Deflandre	12,15
629	*Trachelomonas volvocina* (Ehrenberg) Ehrenberg	12,15

**Previously accepted name*

1. Fritch 1907; 2. Carter 1926; 3. Vashista 1968; 4. Shukla *et al.* 1970; 5. Novarino 1991; 6. Srivastava & Gupta 2004; 7. Misra *et al.* 2006; 8. Dwivedi *et al.* 2008; 9. Bhushan *et al.* 2018; 10. Shukla *et al.* 2008; 11. Suseela & Topoo 2009; 12. Arora *et al*. 2011; 13. Gupta 2012a; 14. Gupta 2012b; 15. Gupta & Das 2012; 16. Mongra 2012, Singh *et al.* 2018; 17. Kumar *et al.* 2012; 18. Thakur *et al.* 2013; 19. Jindal & Thakur 2013; 20. Singh & Sharma 2014; Jindal *et al.* 2014; 21. Mongra 2014: 22. Dwivedi & Misra 2014: 23. Singh *et al.* 2014; 24. Singh *et al.* 2014; 25. Jindal *et al.* 2014; 26. Dwivedi & Misra 2015; Singh *et al.* 2014; 27. Singh *et al.* 2018; 28. Bhushan & Kumar 2018; 29. Singh *et al* 2018.