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A CHECKLIST OF MICROALGAE IN THE FRESHWATER LAKES OF SOUTHERN BANGALORE (KAR) AND HOSUR (T.N) BORDER, INDIA

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ABSTRACT
A checklist of freshwater microalgae from the Southern Bangalore-Hosur border region was compiled. The studies included 4 major lakes and 2 smaller ponds of the area and conducted seasonally in sessions for a period of 2 years, from May 2017 to May 2019. The investigations resulted in the documentation of a large variety of algal communities and the discovery of the presence of one new species, *Pseudokirchneriella subcapitata,* which has never been recorded or documented in the past from India. A total of 119 species of algae were recorded. The maximum species were identified under class Cyanophyceae (47 taxa) followed by Bacillariophyceae (42 taxa), Chlorophyceae (23 taxa), Euglenophyceae (6 taxa), and Xanthophyceae (1 taxa).

INTRODUCTION

Algae, defined by Lee (2008), as "Thallophytes that have chlorophyll and lack a sterile covering of cells around reproductive cells". They are ubiquitous, ranging from microscopic to gigantic kelps inhabiting all of the earth's water bodies, soil, rocks, and trees, and produce large amounts of organic matter by photosynthesis. Algae can grow in extreme environments also, such as hot springs, snow, rocks, and deserts (Seckbach, 2007). They are highly diversified groups with enormous economic implications, including being primary producers, pollution indicators, bio-fertilizers, and biofuel (Sayeshwara *et al.,* 2011). The productivity of an aquatic community directly depends on the amount of algae that are present in the system (Guy, 1992). Aquatic ecosystems are known to harbor a large variety of algal communities in order to maintain their productivity and surroundings (Negi and Rajput, 2011).

India has been known to have 7284 species (15.33% of Indian flora) belonging to 738 genera in 206 families. The State of Karnataka has a total of 1761 taxa belonging to 109 families of the classes Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Euglenophyceae, Dinophyceae, Bacillariophyceae, Phaeophyceae, and Rhodophyceae. Of these, 100 taxa are endemic to Karnataka, and 46 taxa are endemic to India (Gupta and Das, BSI, 2018).

A constant count on the algal population can always be considered as a key to assess the pollution levels of water bodies (Mathivanan and Jayakumar, 1995). As a result of coming up of both small-scale as well as large-scale manufacturing units and industries in the study area, there has been a rise in ecological disturbances as well as profound changes in physicochemical and biological changes in catchment areas. This has resulted in disturbances in the freshwater environment. The current study has been done to investigate the diversity of algae present in the lakes and document them.

MATERIALS AND METHODS

The study area considered was the 4 major lakes namely- Zuzuwadi and Ballur— belonging to the Hosur town of Tamil Nadu and Giddenahalli and Mayasandra, along with 2 smaller ponds belonging to Attibele town in South Bangalore. Attibele and Hosur lie hand in hand, and the lakes are located within an area of approximately 20 kms, which marks the border of Karnataka with Tamil Nadu. Algal samples were collected using a plankton net of 100μ pulled along the circumference of the lakes twice a day once a month for a period of 2 years. The collected sample was immediately fixed in lugol's iodine and taken to the laboratory for further studies. Observation of the algal species was done using a microscope and identified using identification keys (Allen Pentacost, 1984).

RESULTS AND DISCUSSION

An average of 17 genera with 47 species of Cyanophyceae were recorded. The remaining records included 3 genera with

10 species of Desmidae, 5 genera with 11 species of Chlorococcales, 3 genera with 6 species of Euglenophyta, 1 genus and 6 species of centric diatoms, 9 genera with 38 species of pennate diatoms, and 1 species of Xanthophyceae. A total of 119 species and 38 genera. Of these, the chlorophyte alga *Pseudokirchneriella subcapitata* was first identified and reported in freshwater lakes in India (Padmakumar, V. and Tharavathy N C, 2020). Previously, no documentation on the presence of this algae species has been noted.

Algal documentation has been comparatively scattered due to limited algologists working at university and college levels. Despite this, the recorded Bacillariophyceae, Chlorophyceae, and Cyanophyceae were adorably large. Among chlorophytes, it can be noted that desmids are dominant (Iyengar, 1981). The least indulgence of researchers subsequently on the diversity of algae has been one of the major aspects of this study.

Allen (1995) reported that algal communities in streams are dominated by diatoms during spring, blue-green algae in summer, and green algae in late summer. He also stated that the instability of the physical and chemical characteristics of running waters makes rivers unique to biological communities in various habitats.

Negi *et al*. (2007) reported a total of 38 genera of phytoplankton from three different streams of the Nainital region, where Bacillariophyceae was the dominant group, with 21 genera followed by other classes. Mathivanan *et al*. (2007) studied the plankton population of the Cauvery River and reported that the river housed large communities of phytoplankton and zooplankton populations.

Senthilkumar and Shivakumar (2008) studied the phytoplankton diversity of Tamil Nadu and collected 160 species of phytoplankton belonging to different taxonomic groups in which Bacillariophyceae emerged as the most dominant group, with a total of 74 species followed by chlorophyceae (43 species), cyanophyceae (38 species), and euglenophyceae (5 species), respectively.

Negi and Negi (2010) reported the zooplankton diversity of the Hinval freshwater stream of the Garhwal region (Uttarakhand) and reported a total of 16 genera.

Large amounts of environmental stressors on the freshwater ecosystem can be surely an aspect of the reduction or increase in algal diversity depending on their adaptations to the ecosystem.

The checklist provided below has been apparently one of its kind in this region and establishes the presence of *Pseudokirchneriella subcapitata*. It can be noted that Seasonal variations in physicochemical parameters had a significant effect on the quantitative results of the algae (Kar *et al.*, 2010).

Checklist

The list of algae identified from Station1, 2, 3, and 4 during the 2 years study has been documented in a checklist as given below:

Checklist

S. No.	Species name	Stn 1	Stn2	Stn 3	Stn 4
1.	*Anabaena circinalis*	+	+	+	+
2.	*Anabaena oryzae*	+	-	+	+
3.	*Aphanocapsabanaresensis*	+	-	-	+
4.	*Aphanocapsaelachista*	+	+	+	+
5.	*Aphanocapsa Montana*	-	+	-	+
6.	*Aphanocapsamuscicola*	-	-	+	-
7.	*Aphanocapsarivularis*	+	+	+	+
8.	*Aphanocapsalitoralis*	-	+	+	+
9.	*Aphanothecemicroscopia*	+	+	-	+
10.	*Aphanothececlathrata*	-	+	+	+
11.	*AphanotheceSaxicola*	+	+	+	+
12.	*Aphanothecestagnina*	+	-	+	+
13.	*Aphanothececastagnei*	-	+	-	-
14.	*Chroococcusmacrococcus*	+	+	+	+
15.	*Chroococcusminutus*	+	+	+	+
16.	*Chroococcusmontanus*	+	-	-	-
17.	*Chroococcus pallidus*	+	-	-	+
18.	*Oscillatoria chlorine*	+	+	+	+
19.	*Oscillatorialimosa*	+	+	-	+
20.	*Oscillatoriaprinceps*	+	+	+	+
21.	*Oscillatoria tenuis*	+	+	-	-
22.	*Oscillatoria putrid*	-	-	+	+
23.	*Chlorogloeafritschii*	+	+	+	+
24.	*Dermocarpaclavata*	+	+	-	+
25.	*Dermocarpaparva*	+	+	+	+
26.	*Eudorinaelegans*	+	+	+	+
27.	*Gloeocapsa magma*	+	-	+	-
28.	*Hapalosiphonflagelliformis*	+	+	+	+
29.	*Hydrococcusrivularis*	+	+	+	+
30.	*Lyngbyabirgei*	+	-	+	+
31.	*Lyngbyaceylanica*	+	-	+	-
32.	*Lyngbyamartensiana*	+	+	-	-
33.	*Lyngbyamesotricha*	-	+	-	+
34.	*Lyngbyaallorgei*	+	-	+	+
35.	*Merismopediaelegans*	-	+	+	+
36.	*Merismopediamarssonii*	+	+	+	+
37.	*Merismopediapunctata*	+	+	-	+
38.	*Merismopediaglauca*	+	+	+	-
39.	*Microcystiselabis*	+	+	+	+
40.	*Microcystisflosaquae*	+	+	+	-
41.	*Microcystislamelliformis*	+	-	+	+
42.	*Microcystispseudofilamentosa*	+	+	+	+
43.	*Microcystisviridis*	+	+	+	+
44.	*Microcystisrobusta*	+	+	+	+
45.	*Nostocmuscorum*	+	+	+	+
46.	*Myxosarcinaburmensis*	+	-	+	-
47.	*Xenococcuskerneri*	+	+	-	+
48.	*Ankistrodesmusfulcatus*	+	+	+	+
49.	*Cosmariumsubalatum*	+	-	-	-
50.	*Chlorella vulgaris*	+	+	+	+
51.	*Chlorella pyrenoidosa*	+	+	+	+
52.	*Desmidium sp.*	+	+	-	+
53.	*Pseudokirchneriellasubcapitata*		+	+	+ +
54.	*Pediastrum tetras*	+	-	+	-
55.	*Pediastrum duplex*	+	+	+	+
56.	*Pandorinamorum*	+	+	+	+
57.	*Scenedesmussubspicatus*	+	+	+	+
58.	*Scenedesmusquadricola*	+	-	+	-
59.	*Scenedesmusobliquas*	+	+	-	-
60.	*Scenedesmusdimorphus*	+	-	-	+
61.	*Scenedesmusacuminatus*	+	+	-	-

Checklist cont.....

S. No.	Species name	Stn 1	Stn2	Stn 3	Stn 4
62.	*Stigeoclonium tenue*	+	+	+	+
63.	*Staurastrumophiura*	+	-	+	+
64.	*Staurastrumpinnatum*	+	+	+	-
65.	*Staurastrumrosei*	+	-	-	-
66.	*Staurastrumsmithii*	+	+	-	-
67.	*Staurastrumsubsaltans*	+	-	+	-
68.	*Staurastrumlaeve*	+	+	+	+
69.	*Staurastrumavicula*	-	+	-	-
70.	*Zygnemafanicum*	-	-	+	-
71.	*Euglena gracilis*	+	+	+	+
72.	*Euglena viridis*	+	+	+	+
73.	*Euglena oxyuris*	+	-	+	+
74.	*Euglena acus*	+	-	-	+
75.	*Trachelomonasvolvocina*	+	+	+	+
76.	*Lepocinchlis ovum*	-	+	+	-
77.	*Acnanthesandicola*	+	-	+	+
78.	*Acnanthesexigua*	+	+	-	+
79.	*Acnanthes inflate*	+	+	-	+
80.	*Acnanthes lanceolate*	+	+	+	+
81.	*Acnanthessubsalsa*	-	-	+	-
82.	*Anomoeoneisstyriaca*	-	+	-	-
83.	*Cyclotella antique*	+	+	+	-
84.	*Cyclotellacatenata*	-	+	+	-
85.	*Cyclotellameneghiniana*	+	+	+	+
86.	*Cyclotellastelligera*	-	+	+	-
87.	*Cymbellaamphicephala*	+	+	+	+
88.	*Cymbellabengalensis*	+	+	+	+
89.	*Cymbella turgid*	+	-	+	-
90.	*Diploneiselliptica*	+	+	+	+
91.	*Diploneisovalis*	+	+	+	+
92.	*Diploneispuella*	+	+	+	+
93.	*Diploneissubovalis*	+	+	+	+
94.	*Fragilaria intermedia*	-	-	+	-
95.	*Fragilariaconstruens*	+	+	+	+
96.	*Gomphonemaintricatum*	-	+	-	+
97.	*Gomphonemalanceolatum*	+	-	+	-
98.	*Gomphonemalongiceps*	+	+	+	+
99.	*Gomphonemamontanum*	+	+	+	+
100.	*Hantzschiaamphioxys*	+	-	+	-
101.	*Hantzschialinearis*	+	+	+	-
102.	*Naviculadisjuncta*	+	+	+	+
103.	*Navicula cuspidate*	+	+	+	+
104.	*Naviculapupula*	+	-	+	-
105.	*Navicula sp.*	+	+	+	+
106.	*Naviculaviridula*	+	-	+	+
107.	*Nitzschiapalea*	+	+	+	+
108.	*Nitzschia intermedia*	+	+	+	+
109.	*Pinnulariabrevicostata*	+	-	+	-
110.	*Pinnulariadivergens*	+	+	+	+
111.	*Pinnularia major*	+	+	+	+
112.	*PinnulariaScythica*	+	-	+	-
113.	*Surirellalinearis*	+	+	+	+
114.	*Surirellatenuissima*	+	+	+	+
115.	*Synedraacus*	+	+	+	+
116.	*Synedra ulna*	+	+	+	+
117.	*Synedra miniscule*	+	-	+	-
118.	*Synedra tabulate*	+	+	+	+
119.	*Botryococcusbraunii*	+	-	-	+

S. No. 1- 47: Cyanophyceae, 48-70: Chlorophyceae, 71-76: Euglenophyceae, 77-118: Bacillariophyceae, 119: Xanthophyceae.

Station 1: Zuzuvadi lake, Station 2: Ballur lake, Station 3: Giddenahalli lake, Station 4: Mayasandra lake.

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