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Microalgal Diversity of Podaturpet Lake, Tamil Nadu, India

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Abstract
The present study assessed the microalgal diversity of Podaturpet Lake, Tamil Nadu, revealing a moderately rich and taxonomically diverse freshwater algal community. A total of 21 microalgal species were identified, representing three kingdoms (Bacteria, Plantae, and Chromista), four phyla, six classes, and fourteen families. Among these, Bacillariophyta (diatoms) emerged as the dominant group with 13 species, indicating their major contribution to the lake's microalgal composition and suggesting favorable ecological conditions with adequate nutrient availability. Other recorded groups included Cyanobacteriophyta (2 species), Charophyta (4 species), and Chlorophyta (2 species), reflecting the coexistence of both prokaryotic and eukaryotic microalgae. At the class level, Bacillariophyceae was predominant, followed by Zygnematophyceae, while other classes contributed fewer species. Naviculales was the most species-rich order, and the genus *Navicula* showed the highest representation. The dominance of diatoms, particularly *Navicula*, highlights their ecological significance in primary productivity and nutrient cycling. Overall, the study indicates that Podaturpet Lake provides a favorable and balanced habitat supporting diverse microalgal assemblages, which can serve as important indicators of freshwater ecosystem health.

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Keywords: Microalgal diversity, Podaturpet Lake, Bacillariophyta, Freshwater ecosystem, Diatoms, *Navicula*

1. Introduction

Freshwater lakes are large inland water bodies and they are created by depressions in the earth's surface. The plants and animals first appeared on the land as a result of aquatic life adapting to changing environments (Hudson, 2016). The earth's surface is covered with 71% water and within that only 3% is Freshwater. Lakes contribute more than 98% of freshwater on Earth, which constitutes only 0.01% of the total water on the planet (Hairston and Fussmann, 2002). Lakes have historically played a crucial role in the ecological, cultural, and economic landscapes of Tamil Nadu. Tamil Nadu, being a predominantly agrarian state with semi-arid climatic conditions, heavily depends on surface water bodies like lakes for irrigation and domestic use (Wetzel, 2001) [12]. Algae are simple photosynthetic aquatic organisms representing both prokaryotes and eukaryotes (Gupta, 1980) [3]. Microscopic algae, known as microalgae, are incredibly diverse and can be found in oceans, lakes, rivers, and even terrestrial environments such as soil, tree bark, and rocks. These are some important facets of microalgal ecology. The majority of microalgae were classified into four primary phyla like Cyanobacteria, Chlorophyta, Charophyta and Heterokontophyta (Shaikh *et al.*, 2022).

Microalgae normally inhabit the water column and sediment in marine and freshwater environments (Pereira and Pardal, 2024) [9]. Research over the past century has focused on algal structure, reproduction, and distribution (Smith, 1920; Fritsch, 1935; Prescott, 1951; Desikachary, 1959; Randhawa, 1959; Pal *et al.*,, 1962; Ramanathan, 1964; Philipose, 1967), with taxa described mainly at the generic level and diagnostic keys used for species identification, including major South Indian rice-field blue-green algae. Algae occur widely in aquatic and terrestrial ecosystems across India. Algal biodiversity in fresh water and related physico-chemical factors were studied by Veereshakumar and Hosmani (2006), which dealt substantially for the organic

production of waters ways. Several investigators have examined phytoplankton distribution and abundance in freshwater ecosystems such as lakes, reservoirs, and stagnant waters. The aim of the present study was to evaluate the Microalgal diversity in Podaturpet Lake, Podaturpet, Tamil Nadu.

2. Materials and Methods

2.1. Study Area

The samples were collected from the Podaturpet Lake, Podaturpet, Tamil Nadu- 631208. It is located at Lat. 13.27626º and Long. 79.475139º. Podaturpet Lake is a freshwater lake located in Podaturpet, under Pallipet Taluk in Thiruvallur District, Tamil Nadu (Fig. 1). It spans approximately [insert area, e.g., 150 acres] with an average depth ranging between 10 and 15 feet. The lake water is used for numerous purposes. Water samples were collected from various points within the lake and its immediate surroundings, focusing on areas with potential contamination.



Fig 1: Study area – Podaturpet Lake using GPS Map camera

2.2. Sample Collection

Water samples were collected from the surface of two different randomly chosen spots from Podaturpet Lake. The collection was done using a 0.2 mm phytoplankton mesh net. The collection was done from December 2025 to January 2026 around early morning. The samples were collected in sterilized bottles. The sample collected was segregated into two parts. Out of which one part was used for capturing microphotographs and another was used for isolation.

2.3. Identification of Microalgae

The observation was based on the size, shape, and color of the cells, as well as the nature of the filaments and branching patterns. Morphotaxonomic identification was carried out using various monographs and relevant literature, including works by Geitler (1925), Venkataraman G (1939), Randhawa (1959), Desikachary (1959), Prescott (1962), Ramanathan (1964), Philipose (1967), and Krishnamurthy & Baluswami (2000). The identification was further confirmed using AlgaeBase (Guiry and Guiry, 2023), an online resource cataloging the world's algae.

3. Results

The present study investigated the microalgal diversity of Podaturpet Lake, Tamil Nadu, and revealed a considerable diversity of freshwater microalgae. A total of 21 microalgal species were recorded (Table 1), representing three kingdoms (Bacteria, Plantae, and Chromista), four phyla, six classes, fourteen families, and several taxonomic orders and genera (Fig. 2 & 3).

Table 1: Overall species list

S.No.	Species	Order	Family
	Kingdom:Bacteria		
	Phylum:Cyanobacteriophyta		
	Class:Cyanophyceae		
1	*Aphanothece microscopica* Nägeli 1849	Chrococcales	Microcystaceae
2	*Merismopedia tenuissima* Lemmermann 1898	Chrococcales	Microcystaceae
	Kingdom:Plantae		
	Phylum:Charophyta		
	Class:Zygnematophyceae		
3	*Cylindrocystis brebissonii* (Ralfs) De Bary 1858	Zygnematales	zygnemataceae
4	*Mougeotia* sp. C.Agardh, 1824, nom. cons.	Zygnematales	zygnemataceae
5	*Spirogyra porticalis* (O.F.Müller) Dumortier 1822	spirogyrales	spirogyraceae
6	*Spirogyra* sp. Link, 1820, nom. cons.	spirogyrales	spirogyraceae
	Phylum:Chlorophyta		
	Class:Chlorophyceae		

7	*Tetraëdron gracile* (Reinsch) Hansgirg 1889	Sphaeropleales	Hydrodictyaceae
8	*Tetraëdron minimum* (A.Braun) Hansgirg 1889	Sphaeropleales	Hydrodictyaceae
	Kingdom:Chromista		
	Phylum:Bacillariophyta		
	Class:Bacillariophyceae		
9	*Cymbella excisa* Kützing 1844	Cymbellales	Gomphonemataceae
10	*Gomphonema* sp. Ehrenberg, 1832, nom. et typ. cons.	Cymbellales	Gomphonemataceae
11	*Lemnicola hungarica* (Grunow) Round & Basson 1997	Cocconeidales	Achnanthidiaceae
12	*Mastogloia* sp. Thwaites ex W.Smith, 1856	Mastogloiales	Mastogloiaceae
13	*Navicula oblonga* (Kützing) Kützing 1844	Naviculales	Naviculaceae
14	*Navicula rostellata* Kützing 1844	Naviculales	Naviculaceae
15	*Navicula* sp. Bory, 1822	Naviculales	Naviculaceae
16	*Nitzschia* sp. Hassall, 1845, nom. cons.	Bacillariales	Bacillariaceae
17	*Pinnularia* sp. Ehrenberg, 1843, nom. et typ. Cons	Sellaphorales	Pinnulariaceae
	Class : Fragilariophyceae		
18	*Ulnaria ulna* (Nitzsch) Compère 2001	Fragilariales	Fragilariaceae
19	*Staurosira construens* Ehrenberg 1843	Staurosirales	Staurosiraceae
	Class : Thalassiosirophyceae		
20	*Cyclotella distinguenda* Hustedt 1928	Thalassisiorales	Thalassiosiraceae
21	*Stephanocyclus meneghinianus* (Kützing) Kulikovskiy, Genkal & Kociolek 2022	Stephanodiscales	Stephanodiscaceae

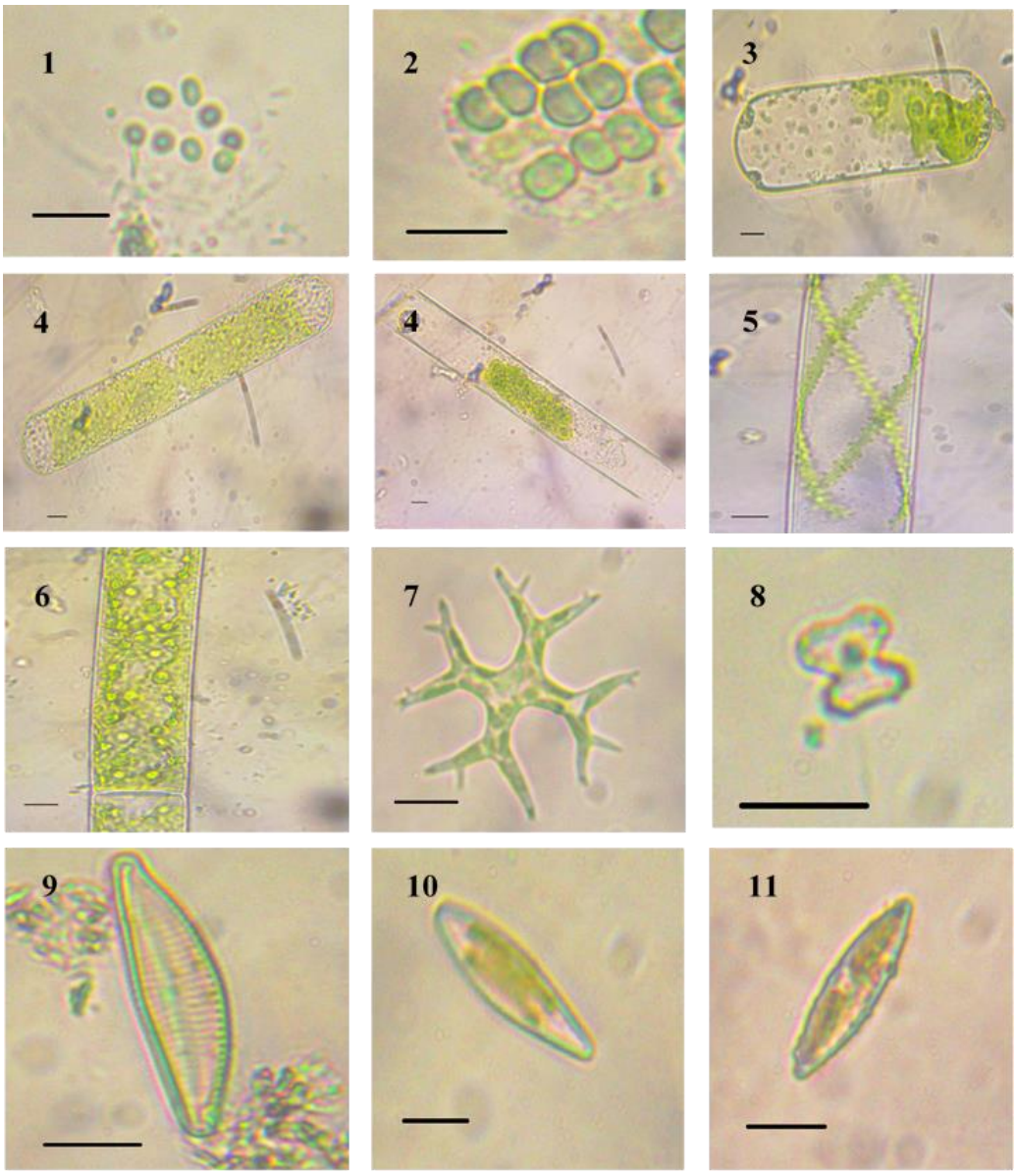


Fig 2: 1. Aphanothece microscopica 2. Merismopedia tenuissima 3. Cylindrocystis brebissonii 4. Mougeotia sp. 5. Spirogyra porticali 6. Spirogyra sp. 7. Tetraëdron gracile 8. Tetraëdron minimum 9. Cymbella excisa 10. Gomphonema sp. 11. Lemnicola hungarica

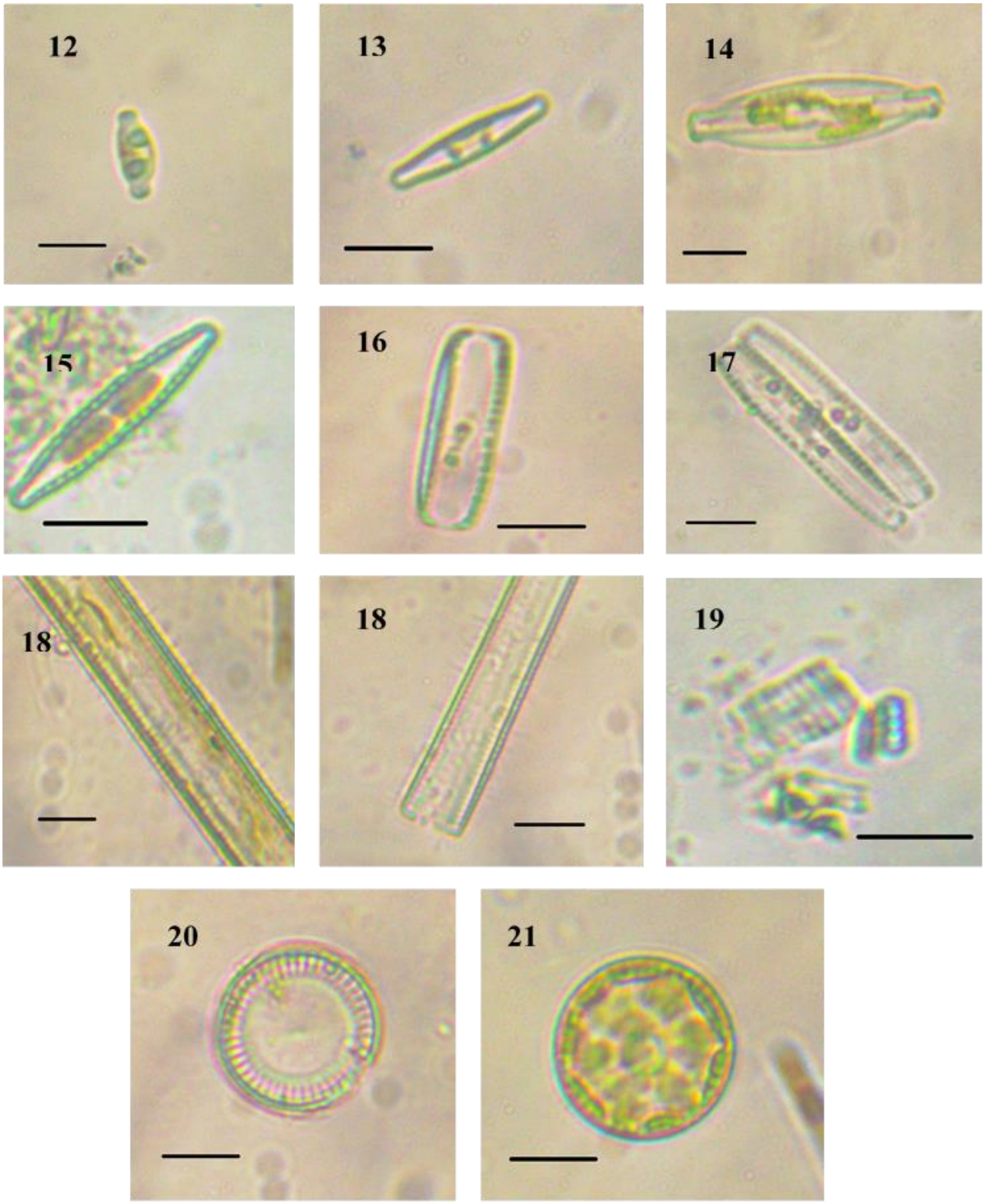


Fig 3: 12. Mastogloia sp 13. Navicula oblonga 14. Navicula rostellata 15. Navicula sp. 16. Nitzschia sp. 17. Pinnularia sp. 18. Ulnaria ulna 19. Staurosira construens 20. Cyclotella distinguenda 21. Stephanocyclus meneghinianus.

Among the identified taxa, phylum Bacillariophyta (diatoms) was the most dominant group with 13 species, indicating that diatoms form the major component of the microalgal community in the lake. Diatoms are commonly abundant in freshwater ecosystems and their dominance often reflects good nutrient availability and favorable ecological conditions. The other phyla recorded include Cyanobacteriophyta (2 species), Charophyta (4 species), and Chlorophyta (2 species), showing that both prokaryotic and eukaryotic microalgae coexist in the lake environment.

At the class level, Bacillariophyceae was the most dominant class with nine species, followed by Zygnematophyceae with Four species, while Chlorophyceae, Cyanophyceae, Fragilariophyceae, and Thalassiosirophyceae contributed fewer species (Fig. 4). The dominance of Bacillariophyceae indicates that siliceous diatoms play a significant role in the primary productivity and nutrient cycling of the lake ecosystem. In the taxonomic orders, Naviculales recorded the highest species richness with three species, followed by Cymbellales with two species, whereas the remaining orders were represented by only one species each.

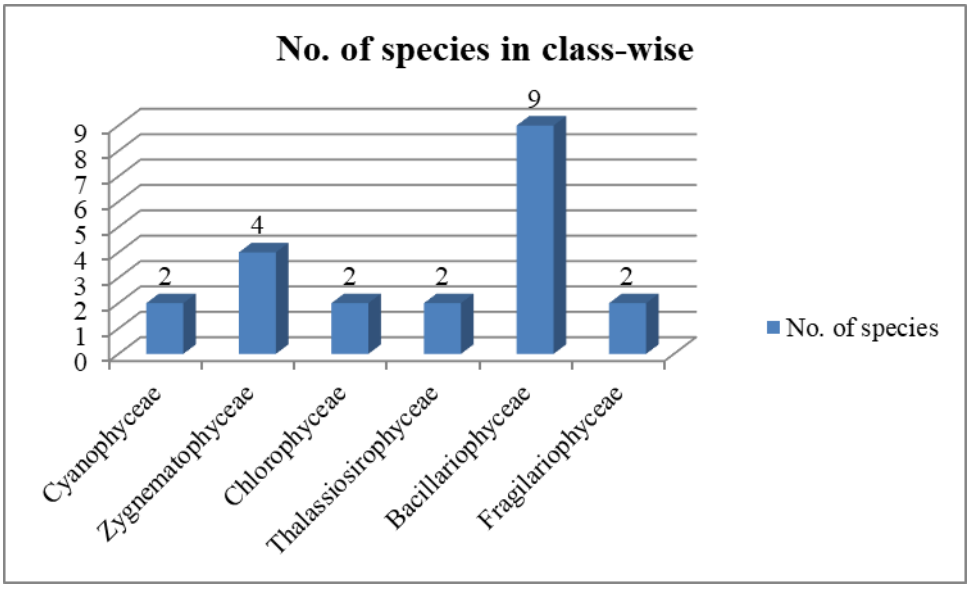


Fig 4: No. of species in class-wise distribution

At the genus level, *Navicula* was the most dominant genus with three species (*Navicula oblonga*, *Navicula rostellata*, and *Navicula* sp.). Other genera such as *Tetraëdron* (*Tetraëdron gracile* and *Tetraëdron minimum*) and *Spirogyra* (*Spirogyra porticalis* and *Spirogyra* sp.) were represented by two species each, while the remaining genera were represented by a single species. The predominance of *Navicula* species, which are commonly used as indicators of freshwater environmental conditions, suggests that the lake possesses favorable ecological conditions for benthic and planktonic diatoms. The results demonstrate that Podaturpet Lake supports a moderately rich and taxonomically diverse microalgal community, with diatoms forming the dominant group. The presence of cyanobacteria, green algae, and charophytes along with diatoms indicates balanced ecological conditions and a productive freshwater habitat.

4. Discussion

Microalgae are important primary producers in freshwater ecosystems and their diversity often reflects the ecological condition of the water body. In the present investigation of Podaturpet Lake, a total of 21 microalgal species belonging to Cyanobacteriophyta, Charophyta, Chlorophyta, and Bacillariophyta were recorded. Among these groups, Bacillariophyceae (diatoms) formed the dominant component of the algal community. Similar observations have been reported in several freshwater ecosystems where diatoms represent a major proportion of phytoplankton diversity.

A study conducted in Basaka Lake, Metehara, Ethiopia by Nega reported 13 genera of Chlorophyceae, six genera of Bacillariophyceae including *Navicula* and *Nitzschia*, and five genera of Cyanophyceae. In the present study also, the genera *Navicula* and *Nitzschia* under Bacillariophyceae were identified, indicating that these diatom genera are widely distributed in freshwater ecosystems (Nega, 2021) [8].

The diversity of benthic diatoms and phytoplankton has also been widely documented in freshwater habitats. Bolgovics *et al.*, (2019) [1] investigated benthic diatom and phytoplankton diversity and highlighted the ecological importance of diatoms in aquatic ecosystems (Bolgovics *et al.*, 2019) [1]. Cyanobacterial diversity in freshwater ecosystems has been reported by Makandar and Bhatnagar, who documented 13 cyanobacterial taxa including *Spirogyra*, *Merismopedia*, and *Microcystis*. In the present study, the genera *Spirogyra* and *Merismopedia* were also recorded, suggesting that these taxa are common components of freshwater algal communities and can tolerate a wide range of environmental conditions (Makandar and Bhatnagar, 2010) [7].

Similarly, Lone (2010) reported the presence of several phytoplankton genera such as *Merismopedia*, *Cyclotella*, *Cymbella*, and *Navicula* in Dal Lake. Interestingly, the same genera were also identified in the present study, indicating similarities in phytoplankton composition between different freshwater lakes and suggesting that these genera are widely distributed in lentic ecosystems (Lone, 2010).

Ganai and Parveen, (2014) [2] reported 64 phytoplankton species from Wular Lake, Kashmir, including members of Bacillariophyceae (*Nitzschia*, *Navicula*, *Cymbella*), Chlorophyceae (*Spirogyra*), and Cyanophyceae (*Merismopedia*). The presence of these same taxonomic groups in the present study further supports the widespread occurrence of these genera in freshwater habitats and highlights their ecological adaptability.

Seasonal variation in phytoplankton diversity has also been reported in several studies. Raghavendra *et al.*, (2015) [10] observed that phytoplankton diversity increased during summer and decreased during the monsoon season, with Chlorophyceae being the dominant group. In contrast, the present study recorded Bacillariophyceae as the dominant group. This difference may be attributed to variations in environmental conditions such as nutrient availability, eutrophication, temperature, and lake stratification patterns, which can significantly influence phytoplankton composition and abundance (Raghavendra *et al.*, 2015) [10]. These findings reveal that the present study is consistent with earlier reports on freshwater algal diversity, demonstrating that genera such as *Navicula*, *Nitzschia*, *Cymbella*, *Spirogyra*, and *Merismopedia* are common and widely distributed in freshwater lakes.

5. Conclusion

The present study confirms that Podaturpet Lake supports a moderately diverse microalgal community with a clear

dominance of diatoms. The high representation of Bacillariophyta, particularly Navicula, indicates favorable ecological conditions and active nutrient cycling. The coexistence of cyanobacteria, green algae, and charophytes reflects a balanced and productive freshwater ecosystem. The observed taxonomic diversity highlights the ecological stability and biological richness of the lake. Overall, the microalgal composition can serve as a reliable indicator for monitoring water quality and ecosystem health.

Conflict of Interest

The authors report no conflicts of interest in this work.

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Author Contribution

Vidhya. N - Data collection, Vasanthapriya. M - Analysis and Drafting the paper; Gokulabalaji. S - Analysis the paper, Sankaran. B - Supervision, Review and Editing.

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