The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 20(1): S1: 42-47, 2025 www.thebioscan.com

A PRELIMINARY STUDY ON BHADALWADI LAKE ALGAL BIODIVERSITY

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DOI: https://doi.org/10.63001/tbs.2025.v20.i01.S1.pp42-47

KEYWORDS
Algal diversity, Bhadalwadi lake, Spirulina sp., Chroococcus sp.

Received on:

12-01-2025

Accepted on:

07-02-2025

Published on:

15-03-2025

ABSTRACT

Bhadalwadi Lake in Indapur Tehsil, Pune district, Maharashtra, has been chosen to be the site of a study on the algal diversity in freshwater habitat. During the 24 months from June 2022 to May 2024, the investigation was conducted. In present investigation, Algae belonging to 29 genera were found to have 36 species. 36 species represent the four classes of algae. Chlorophyceae and Cyanophycean members were found dominant followed by Bacillariophyceae. One member of the Euglenophyceae, *Euglena proxima* Dangeard, is the most abundant during the summer. Chlorophyceae members mostly found in rainy and winter season whereas Cyanophycean and Bacillariophyceae found in summer season mainly. There were many different types of algae present in Bhadalwadi Lake, both in terms of number and quality. The species of *Oedogonium, Hydrodictyon, Ankistrodesmus, Spirogyra, Zygnema, Navicula Nitzschia, Chroococcus, Merismopedia, Spirulina, Phormidium, Nostoc and Scytonema* were dominant in Bhadalwadi Lake. *Stigeoclonium, Trebauxia, Characium, Pediastrum, Ankistrodesmus, Amphora, Gyrosigma, Arthrospora, Lyngbya, Plectonema* present not as much of dominant species. *Spirulina* shows maximum species diversity i.e. 8.33%, followed by *Oedogonium, Navicula, Chroococcus* & *Lyngbya* 5.55%. The preliminary investigation shows Bhadalwadi Lake is rich with the members of Chlorophyceae and Cyanophyceae.

INTRODUCTION

Algae are a significant class of plants. They live naturally in bodies of water. The presence of algae is common in freshwater environments, including lakes, ponds, and rivers. The aquatic ecosystem's primary autotrophic component is algae. Most prevalent and plentiful photosynthetic organisms in both aquatic and terrestrial ecosystem. This group is diverse within the plant kingdom, consisting of a large and varied collection of autotrophs. Since water is a vital life-supporting environment, each kind of water body anchorages its own communities. Freshwater environments serve as habitat where algae flourish abundantly and exist in various forms (Talekar and Baglane, 2020). To truly value life in all its forms and preserve it for future generations, knowledge of species diversity is necessary (Pandey, 1995). For this reason, research on biodiversity is strongly recommended in developing countries (Briji, 2005; Tessy & Sreekumar, 2017). Taxonomy is generally regarded as an antiquated science that is unable to address the current biodiversity issue (De Clerck et al., 2013). However, systematics and taxonomy are crucial for the advancement of biodiversity studies in the future (Koen & Segers, 2005). One of the most significant sources of water i.e. lakes are mostly utilized for irrigation in agricultural techniques, drinking water, and fishing. The diversity of algae in lakes is essential to their preservation. Algal variety and abundance are balanced in a healthy lake. These groups are at the top of the aquatic ecosystem and exhibit a great deal of structural variety (Jadhav and Mali,2022).

In the Indapur tehsil area of the Pune district of Maharashtra, Bhadalwadi Lake is one of the most important water bodies. Bhadalwadi Lake is Constructed during British period situated river Bhīma it is 64 miles east of Pune. It was created 1876-77 as a relief work during famine. It was designed to irrigate the lands of the nearby villages Dalej and Palasdev it is earthen 2,2725 feet long (Gantaloo and Dongare, 2014).

Ashtekar, 1980 studied the fresh water algae of Aurangabad district and recorded 617 algal taxa. Pashan Lakes algal flora was noted by Pingle (2005). Jadhav (2011) covered Algal biodiversity of Gharni reservoir in Latur district. Jain (2002) studied algae from Sonvad dam and Devhane dam and reported 306 taxa. Magar (2008) reported 364 algal taxa which mainly belongs to Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae from Girna reservoir of Nasik District. Andhale (2008) reported 215 algal species from Jayakwadi reservoir of Paithan Tahsil in Aurangabad District. Rathod et al. (2021) studied algal biodiversity in Panvel Region of Konkan, Maharashtra. From, review of literature, it reveals that Bhadalwadi Lake has not been studied yet in algal diversity point of view. It is necessary to find out the correct taxonomic identification of algal species is essential to understand the distribution of each single taxon. Algal growth accumulations at or close to the water's surface are referred to as blooms or mats. In Bhadalwadi Lake the algal blooms of *volvox, Hydrodictyon, Spirogyra, Zygnema Spirulina, Nostoc* observed in large quantities and season wise variation in the algal species. This is the key point which pay our attention to focus on Bhadalwadi Lake algal biodiversity in order to study the unexplored algae. The aim and objectives of study to find out class wise distribution and identification of algal taxa from Bhadalwadi lake. It is necessary to assess the biodiversity and its abundance of the algal groups as a preliminary stage of phycological exploration of research. The current study of biodiversity

creates new avenues for understanding the various types of algae in their natural habitats.

MATERIALS AND METHODS

A. **Study area -** In order to study the algal biodiversity of Bhadalwadi Lake Indapur, Dist. Pune, Maharashtra five sites of the lake have been selected. It lies between the latitudes - 18°14' 23"N to 74°47'15"E (figure 1). The gross storage capacity of the said lake is 4.56 MCM.

Figure 1: Map of Bhadalwadi Lake

B. **Collection of algal samples:**
In accordance with standard procedures (APHA, 2005), filamentous algae are picked by hand, and other algal blooms attached to the rocks are collected with a scalpel and forceps. The floating and submerging microscopic algal samples were collected in an acid-washed, sterile plastic container using a standard plankton net that was 30 cm in diameter and 1 meter long. The samples were then stored in various bottles. For further taxonomic research, the collected samples were stored in 4% formalin. Samples are being collected monthly during each season from June 2022 to May 2024 for the current study.

C. **Observation and identification of algal samples:**
Both preserved and fresh algal types were closely examined and standard texts, keys, and monographs given by Prescott (1951), Cox (1996), Prasad and Misra (1992), Philipose (1967), Rath and Adhikary (2005) and the keys of Desikachary (1959) were used to thoroughly examine the morphological features of the algae.

The species diversity % was calculated by using the formula –

$$\text{Species diversity \%} = \frac{\text{Total no.of particular species recorded in that area}}{\text{Total no.of species recorded from that area}} \times 100$$

RESULTS

A total of 36 species belonging to 29 genera were found and documented during the present study (Table-1, Fig-3), 15 of these species were found in 13 genera of the Chlorophyceae, 15 species from 11 genera of the Cyanophyceae, and 5 species were in 4 genera of the Bacillariophyceae (Table-2). Chlorophyceae group was dominant followed by Cyanophyceae and Bacillariophyceae. One genus-species belongs to Euglenophyceae. Chlorophyceae members mostly found in rainy and winter season whereas Cyanophycean and Bacillariophyceae found in summer season mainly. *Spirogyra subsalsa* and *Zygnema mucigenum* found abundantly in Bhadalwadi lake. This shows an agreement with earlier reports (Ashtekar 1980, Jain 2002, Magar 2008, Jadhav 2011). From class wise percentage contribution reveals that Chlorophyceae had the largest contribution (44.82%), followed by Cyanophyceae (37.93%), Bacillariophyceae (13.79%), and Euglenophyceae (3.44%). Unicellular, colonial and filamentous algal forms were recorded throughout the period of investigation.

Algal taxonomic species diversity percentage (Fig.-2) shows that the genus *Spirulina* has the highest species diversity (8.33%), followed by *Ulothrix, Oedogonium, Navicula, Chroococcus* and *Lyngbya* (5.55%), while the remaining 23 genera have the lowest species diversity (2.77%).

In Bhadalwadi lake *Stigeoclonium, Trebauxia, Characium, Pediastrum, Ankistrodesmus, Amphora, Gyrosigma, Arthrospora, Lyngbya, Plectonema* shows their presence in less quantity as compared to the dominant species.

Table1: Total number of algal genera and species recorded from Bhadalwadi lake.

Sr. No.	Class	Genera	% Genera	Species
1.	Chlorophyceae	13	44.82	15
2.	Bacillariophyceae	04	13.79	05
3.	Euglenophyceae	01	3.44	01
4.	Cyanophyceae	11	37.93	15
	Total	**29**	**99.96**	**36**

Table2: Algal biodiversity of Bhadalwadi lake.

Sr. No.	Class	Name of Species
1.	Chlorophyceae	1. *Volvox tertius* A. Meyer 2. *Tetrospora lacustris* Lemmermann 3. *Ulothrix aequalis* Kuetcing

		4. *Ulothrix subtilissma* Rabenhorst 5. *Stigeoclonium lubricum* (Dillw.) Kuetzing 6. *Oedogonium magnusii* Wittrock 7. *Oedogonium spurium* Hirn 8. *Trebouxia humicola* (Treboux) West et Fritsch. 9. *Characium ambiguum* Hermann ex. Rabenhorst 10. *Pediastrum duplex* Meyen v. reticulatum Lag 11. *Hydrodictyon reticulatum* (L.) Lagerheim 12. *Ankistrodesmus falcatus* (Corda) Ralfs 13. *Tetraedron hastatum var.palatinum* (Schmidle) Lemmermann 14. *Spirogyra subsalsa* Kuetzing 15. *Zygnema mucigenum* Randhawa
2.	Bacillariophyceae	1. *Amphora costata* W. Smith 2. *Gyrosigma baikalensis* skv. 3. *Navicula cuspidata* Kuetz. V. *ambigua* (Ehr.) Cleve 4. *Navicula avenacea* Breb. 5. *Nitzschia palea* (Kuetz) W. Smith
3.	Euglenophyceae	1. *Euglena proxima* Dangeard
4.	Cyanophyceae	1. *Microcystis aeruginosa* Kuetzing 2. *Chroococcus turgidus* (Kuetzing) Naegeli 3. *Chroococcus limneticus* Lemmermann 4. *Merismopedia elegans* A.Br. 5. *Spirulina laxissima* West G.S. 6. *Spirulina platensis* (Nordst.) Gomont 7. *Spirulina princeps* W. et. G. S. West. 8. *Oscillatoria subtilissima* Kutz. 9. *Phormidium usterii* Schmidle 10. *Lyngbya majuscula* Harvey ex Gomont 11. *Lyngbya baculum* Gomont 12. *Arthrospira jenneri* Stizenb. ex. Gomont 13. *Nostoc punctiforme* (Kutz) Hariot 14. *Scytonema bohneri* Schmidle 15. *Plectonema gracillimum* (Zopt) Hansgirg

Fig. 2 - Species diversity percentage of algal taxa in Bhadalwadi lake area.

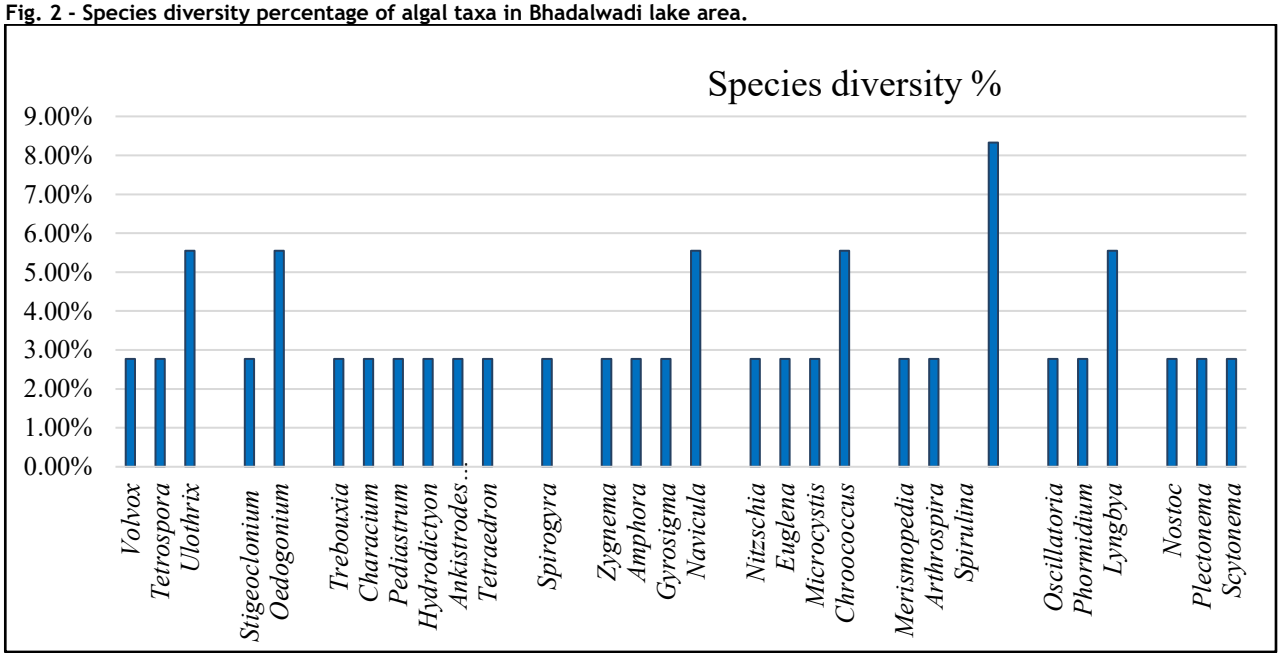
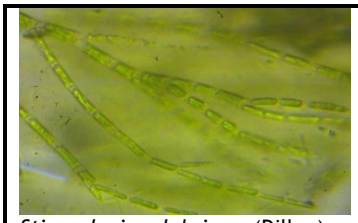


Fig.3 - Algal diversity of Bhadalwadi Lake

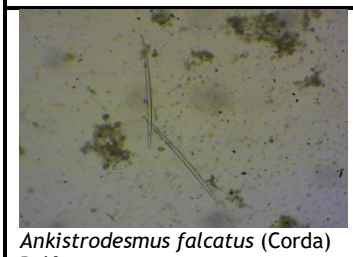


Stigeoclonium lubricum (Dillw.) Kuetzing

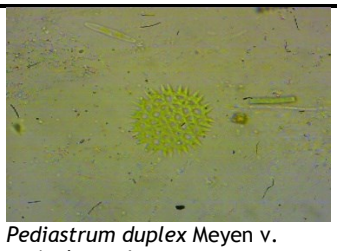
Oedogonium magnusii Wittrock

Oedogonium spurium Hirn

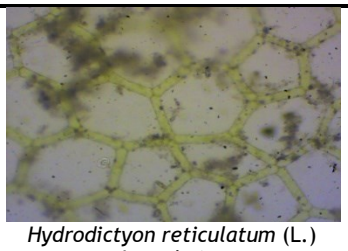
Tetraedron hastatum var. palatinum (Schmidle) Lemmermann



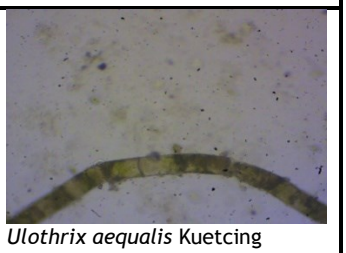
Ankistrodesmus falcatus (Corda) Ralfs



Pediastrum duplex Meyen v. *reticulatum* Lag



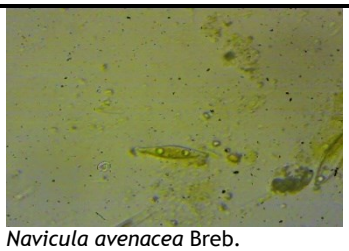
Hydrodictyon reticulatum (L.) Lagerheim



Ulothrix aequalis Kuetcing

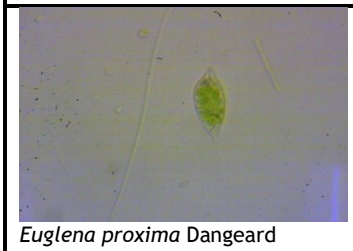
Amphora costata W. Smith

Gyrosigma baikalensis skv



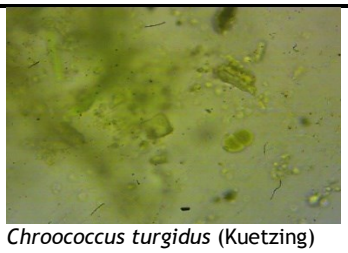
Navicula avenacea Breb.

Nitzschia palea (Kuetz) W. Smith

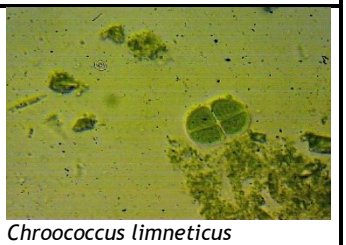


Euglena proxima Dangeard

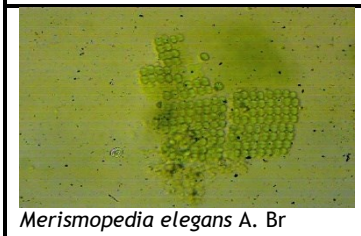
Microcystis aeruginosa Kuetzing



Chroococcus turgidus (Kuetzing) Naegeli



Chroococcus limneticus Lemmermann

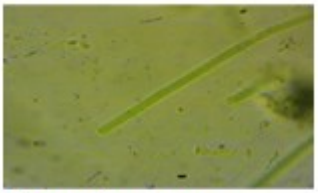


Merismopedia elegans A. Br

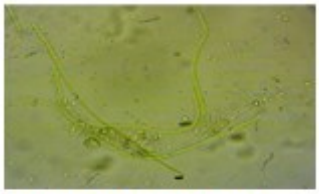
Spirulina laxissima West G. S.

Spirulina platensis (Nordst.) Gomont

Spirulina princeps W. et. G. S. West.



Phormidium usterii Schmidle



Plectonema gracillimum (Zopt) Hansgirg

DISCUSSION

In aquatic systems, phytoplankton serves as a crucial primary producer. Algae are a diverse group of aquatic plants. These groupings are the most prominent in the aquatic ecosystem and exhibit a great deal of structural variety. The wide range of algal species found in Bhadalwadi Lake environments, as well as the species diversity within genera, measures of diversity are more useful overall. An attempt has been made to investigate the many groups of algae found in Bhadalwadi Lake. Similar investigation done by Kartha & Rao (1992), Pandey (1993), Veereshkumar & Hosmani (2006), Tiwari & Shukla (2007), and

Senthilkumar & Das (2008). All they examined the algal diversity of freshwaters in India.

In aquatic environments, the variety of species and composition of plankton provide a trustworthy indicator for biomonitoring the pollution load (Venkateshwarlu, 1981). In present study also Euglenophyceae member recorded when the water gets polluted because of Bilt graphics paper products Ltd. *Euglena proxima* found in maximum amount in summer season.

According to the preliminary investigation on the diversity of algae in the Kannam River, Kannur, Kerala, where 40 algal species were found from four classes such as Chlorophyceae, Bacillariophyceae, Cyanophyceae and Eugleninae. Among 4 classes, Chlorophyceae and Cyanophycea being the most prevalent (Girish et al. 2018). In the present study also similar results found, 36 species belong to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. There are 61 species of algae found in the Pennar River in Kottayam, with Chlorophyceae representing the most prominent (Joseph & Claramma, 2010). Vijayan et al., (2014) stated that 37 of the 87 algae species found in Gundur Lake were Cyanophyta. Jose & Xavier (2022) studied of algal diversity from fresh water bodies of Chimmony Wildlife Sanctuary, Kerala where the Chlorophyceae was the dominant class it represents 33 taxa under 22 genera. In Bhadalwadi lake also Chlorophyceae (Genus-13 & species-15) and Cyanophyceae (Genus-11 & species-15) algal member was more dominated than other classes. Our observations are similar to work done by earlier researchers.

A comparable kind of variation was noted in Bhadalwadi Lake. The species of *Spirogyra, Zygnema, Oedogonium, Hydrodictyon, Ankistrodesmus, Navicula, Nitzschia, Chroococcus, Merismopedia, Spirulina, Phormidium, Nostoc and Scytonema* were dominant. Similar kind of observations was made by Subramian et al., (2023), Jadhav (2011) and Pingle (2005).

Algal member are primary producers of aquatic ecosystem and are used for biomonitoring the water body Stoermer, (1977). The presence of algal members like *Oscillotoria*, *Navicula* shows organic richness of water body (Palmer, 1969). The preliminary analysis of selected Bhadalwadi Lake site shows rich algal diversity showing presence of both pollution and good health indicating algal genera which is matter of interest for further investigation in future.

CONCLUSION

In Bhadalwadi Lake different algal forms were found throughout the period of investigation. During the study period 29 genera and 36 species were recorded. Chlorophyceae represents 13 genera & 15 species followed by Cyanophyceae 11 genera & 15 species. In Bacillariophyceae 4 genera & 5 species recorded. Plentiful *Euglena proxima* (Euglenophyceae) observed during summer. Hence it is concluded that, in Bhadalwadi Lake algal members were found in diverse form in terms of quantity. The good population of mainly thirteen dominant genera viz. *Spirogyra, Zygnema, Oedogonium Hydrodictyon Ankistrodesmus Navicula Nitzschia, Chroococcus, Merismopedia, Spirulina, Phormidium, Nostoc and Scytonema* species observed in the Bhadalwadi Lake. It is remarkable that the class Chlorophyceae and Cyanophyceae is the most abundant in selected water body. Preliminary observation showed that, variety of freshwater phytoplankton was found in the Bhadalwadi Lake. Lake provides valuable water resources for a variety of uses. Because biological diversity is essential to an ecosystem's quality, studying biodiversity is extremely important that's why it is necessary to explore further Bhadalwadi Lake for algal biodiversity.

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