IDENTIFICATION OF ALGAE FROM FRESH WATER SAMPLE COLLECTED FROM MUMBAI REGIONS

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Abstract: The aim of exploring the freshwater algal diversity in the Mumbai region, a study for 3 months was carried out. The predominant taxa found were *Bacillariophyta* and *Gyrista*.. Diversity indices were used to quantify biodiversity. The findings highlight the genera of algal species and their potential application in the ecosystem.

Keywords: - Algae, Freshwater, Diversity, Diversity index

INTRODUCTION

Mumbai, a bustling metropolis on the western coast of India, is not only known for its vibrant culture and economic significance but also for its rich biodiversity. The city's extensive network of lakes, ponds, and wetlands provides a suitable habitat for a diverse array of freshwater algae. The study of algae is referred to as Phycology or Algology. Algae are photosynthetic, polyphyletic organisms that include diverse microscopic and macroscopic forms. They are found in various aquatic environments, including freshwater, marine, and terrestrial ecosystems. They are primary producers in aquatic food webs, oxygen producers through photosynthesis, and bioindicators. Also, algae help regulate atmospheric carbon dioxide levels and play a role in nutrient cycling in the ecosystem. The term 'Algae' embraces the group of algae belonging to the phylum Bacillariophyta, Cyanophyta, Charophyta, and Euglenophyta. The photosynthetic efficiency of algae is much greater than that of other higher plants. Algae can be unicellular or multicellular. In multicell, they can be colonial or coenocytic, and they can be uninucleate or multinucleate. (Belcher & Swale, n.d.). Freshwater algae include a very diverse range of shapes, sizes, morphologies, and arrangements when viewed through a microscope. Among freshwater forms, three basic morphologies are seen most consist of uniseriate (single axis), branched filaments (members of the Ectocarpales), which develop to form either spreading or cushion-like tufts, others consist of prostate filaments, which produce an upright series of densely packed, vertical filaments, forming a crustose morphology and Sphacelaria cells are arranged in multiseriate (multiaxial), branched filaments, and also form spreading cushions on submerged substrate. The morphologies of all freshwater Phaeophyta species are based upon a relatively simple filamentous structure and do not form parenchymatous (tissue-like) thalli, characteristic of more complex brown seaweeds. At high latitudes, blue-green algae are particularly adapted to low temperatures. Algae often dominate the planktonic environment by forming dense mats (Bellinger & Sigee, n.d.). The diversity index is a measure of the species diversity within a community that consists of a recurring population of multiple different species. The richness and evenness of the diversity can be measured by indices such as the Simpson Diversity Index and Shannon Diversity Index (Handa & Jadhav, 2016). Algae can be valuable indicators of environmental quality.

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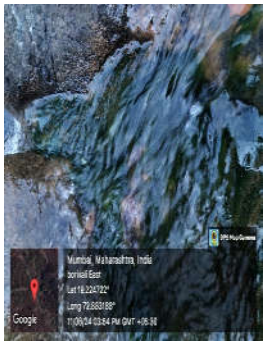
Methods and Materials

The sample is collected from the freshwater resources located in various places in Mumbai. The locations selected were Kanheri caves, Sanjay Gandhi National Park, Powai Lake, Lokhandwala Lake, and Kamte Talao.

Collection of Samples

The study was conducted for 3 months from July 2024 to September 2024. For the sampling process, random sampling methods were preferred for sample collection materials such as forceps, scalpel, gloves, transparent plastic jar,4% formalin for sample preservation, compound microscope.



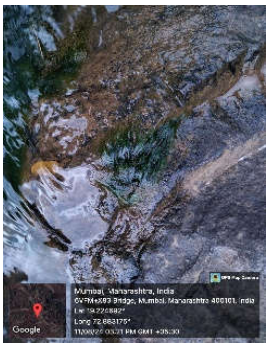


Fig. 1.1 Powai Lake, fig1.2 Kanheri caves Fig. 1.3 Sanjay Gandhi National Park

fig1.4 Kamte talao **fig1.5 Nallasopara lakeside** **fig1.6 Lokhandwala lake**

Figure 1.1 Location of sampling site

Enrichment

For the preservation of the algal sample, 4% formalin was used. Formalin was made using.

Ethyl Alcohol 10ml

Glacial Acetic acid 0.8ml

Cupric sulphate 0.1g

4% Formalin 0.4ml

Samples were incubated at room temperature using light for photosynthesis and growth.

Observation

The algal sample was observed under 10x magnification lenses using a compound microscope. The classification of algae was done on the basis of reference books and research papers. The grid of 100 squares, arranged in a 10x10 pattern, was prepared for observation.

Microscopic observation of the field was performed.

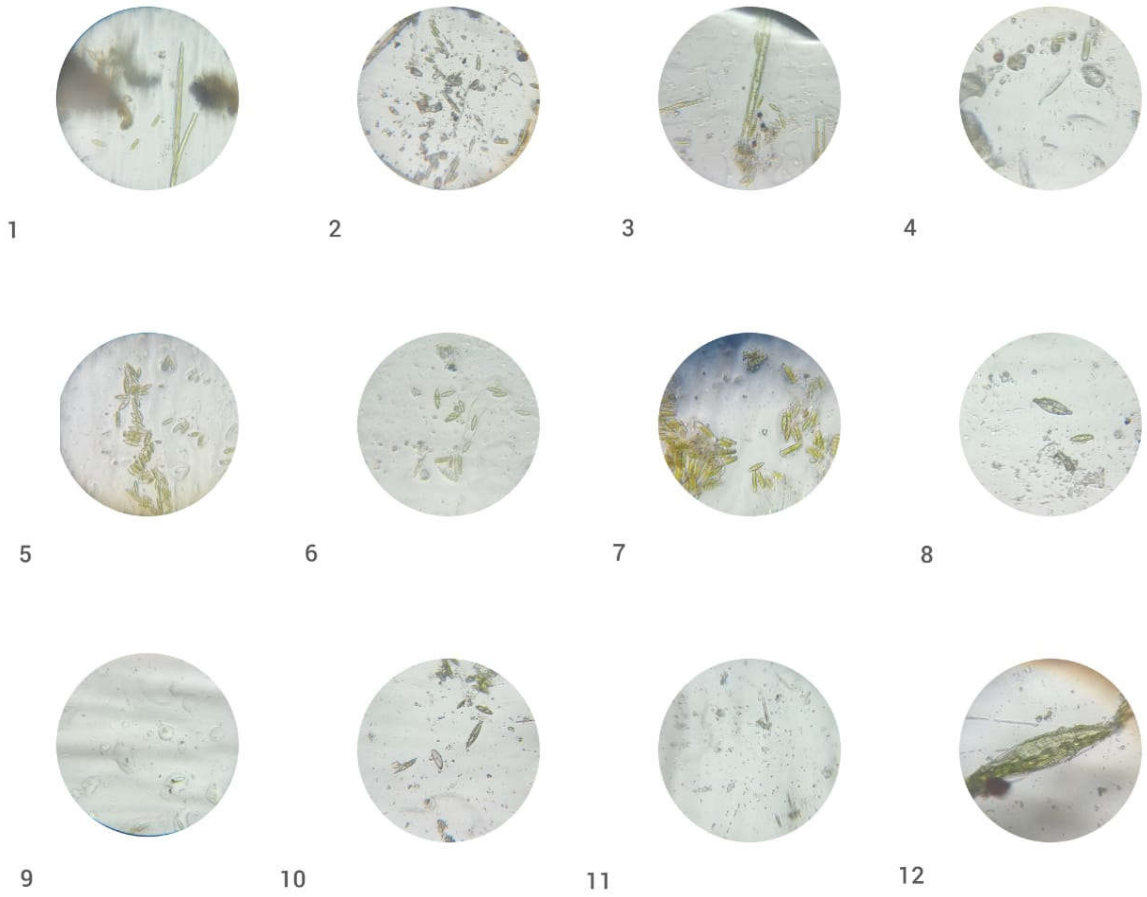


Fig1.2. Microscopic observation of collected freshwater samples.

1.Stauroneis pusilla, 2.Cymatopleura solea, 3.Phaeodactylum tricornutum, 4.Synedra ulna, 5.Craticula cuspidata, 6.Oscillatoria tenuis, 7.Euglena viridis, 8.Caloneis amphisbaena, 9.Diatoma vulgaris, 10.Microcoleus lacustris, 11.Lyngbya lutea, 12.Lyngbya dendrobia , 13.Phormidium tenue,

14.Pleurotaenium trabecula, 15.Closterium navicula,16.Netrium digitus, 17.Navicula nunivakiana, 18.Navicula tripunctata, 19.Navicula schroeteri, 20.Navicula rostellata, 21.Fragilaria pinnata, 22.Mastogloia calcarea, 23.Ankistrodesmus bernardii, 24..Ankistrodesmus fusiformis, 25.Chlorella, 26..Pinnularia viridis, 27.Nitzschia agnita, 28.Nitzschia reversa, 29.Nitzschia littorea, 30.Nitzschia gracilis, 31.Navicula pupula 32.Pinnularia jaculata.

Occurrence pattern

A total of 100 fields were screened for each sample. Each observation was noted down, and the types of algae were analysed. The frequency of occurrence of a particular division in observed fields was analysed. The Simpson's Index (D) was calculated to obtain the mean value, whereas to check the abundance of population in particular families and algae divisions, the Weiner diversity Index (H) was used.

Diversity indices

A. Simpson's Diversity Index

The diversity of the algae, based on the relative abundance of species, was measured. Simpson's Diversity Index was used for comparison and analysis. The value of *D* ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.
The formula to calculate Simpson's index is: $\boldsymbol{D = 1- \Sigma n_i(n_i-1) / N(N-1)}$ (Handa & Jadhav, 2016).
Where:
Ni: CFU that belong to species *i*
N: Total CFU

B. Shannon Wiener Diversity Index
Shannon's diversity index (H) is also used to characterize species diversity in a community. Shannon's index accounts for both abundance and evenness of the species present.
The formula to calculate Shannon Wiener Diversity Index: $H=- \sum[(pi)\times log(pi)]$
where:
H: Shannon diversity index;
pi: proportion of single individuals of the i-th species in a whole community;
∑: sum symbol; and
Log: usually the natural logarithm, but the base of the logarithm is arbitrary (10 and 2-based logarithms are also used) (Handa & Jadhav, 2016).

Results & Discussion

The study reveals a rich and diverse community of algae in the **Kamte Talao**, supported by high values of Simpson Diversity Index (D=0.9) and Shannon Diversity Index (H=2.765). **Sanjay Gandhi National Park**, supported by the values of Simpson Diversity Index (D=0.9) and Shannon Diversity Index (H=2.446), **Kanheri Caves** supported by values of Simpson Diversity Index (D = 0.4) and Shannon Diversity Index (H= 2.789), **Powai Lake** supported by values of Simpson Diversity Index (D= 0.5) and Shannon Diversity Index (H = 2.244), **Lokhandwala Lake** supported by values of Simpson Diversity Index (D= 0.6) and Shannon Diversity Index (H'= 0.3646), **Nallasopara Lake** supported by values of Simpson Diversity Index (D= 0.9) and Shannon's Diversity Index (H'= 2.446)These findings underscore the ecological significance of preserving this habitat to sustain biodiversity and ecosystem health.

Diversity indexes

Table 1.1 Diversity Indexes of Samples

Name of the location	Simpson's diversity index	Shannon's diversity index
Kanheri caves	0.4	2.789
Sanjay Gandhi National Park	0.9	2.446
Powai lake	0.5	2.244
Kamte talao	0.9	2.765
Nallasopara lake	0.9	2.446
Lokhandwala lake	0.6	0.3646

Bar Graph

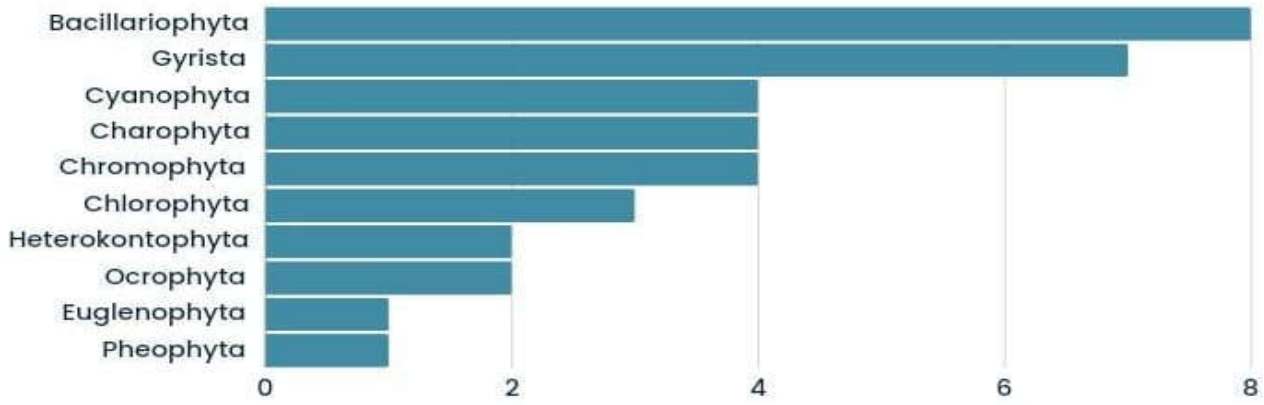


Figure 1.3 Graph of observation according to Phylum

Pie chart

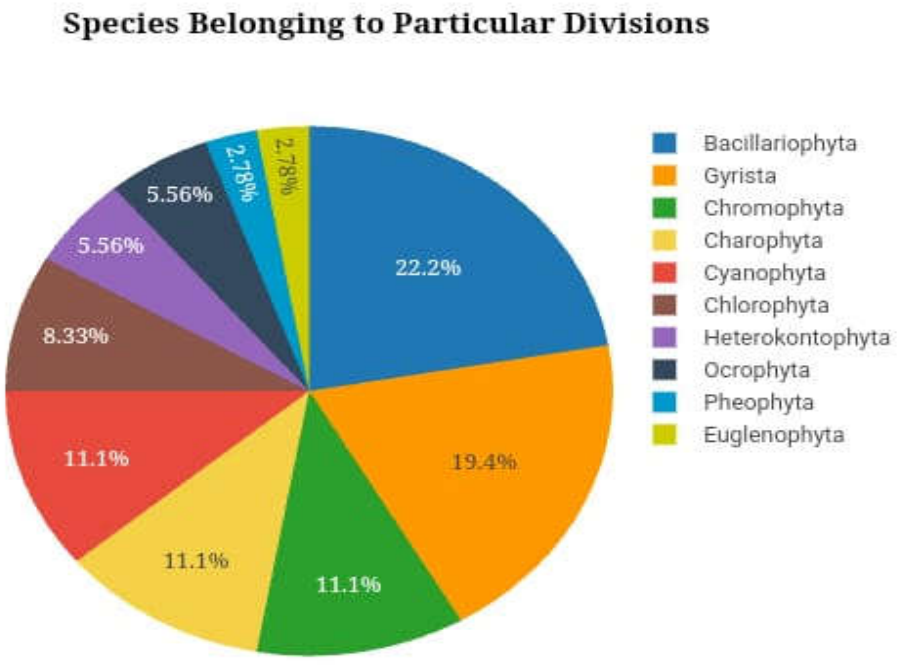


Figure 1.4 Pie Chart on the observation according to the particular division

Conclusion

The study conducted on the algae diversity from freshwater samples collected in various regions of Mumbai has revealed significant findings. The diversity indices calculated for the different sites underscore the ecological richness of these habitats. The high Simpson Diversity Index (D = 0.9) and Shannon Diversity Index (H' = 2.765) at Kamte Talao and similarly high values at Sanjay Gandhi National Park (D = 0.9, H' = 2.446) suggest these locations host a diverse and well-balanced algal community.

The species found, which were rare to be found in freshwater resources of Mumbai, were *Ankistrodesmus bernardii*, *Craticula cuspidata, Nitzschia agnita, Nitzschia reversa, Nitzschia littorea, Nitzschia gracilis, Navicula pupula, Navicula nunivakiana, Navicula schroeteri, and Navicula rostellata.* The predominant taxa identified, including *Bacillariophyta* and *Gyrista*, highlight the complex ecological roles these algae play in their environments.

The data underscores the importance of these water bodies as reservoirs of biodiversity and their potential role in supporting ecosystem functions such as nutrient cycling and serving as bioindicators of water quality. The presence of diverse algal species, including pollution indicators, underscores the need for ongoing monitoring and conservation efforts to preserve these ecologically significant habitats in Mumbai.

Acknowledgement

We are also profoundly thankful to the Department of Biotechnology (DBT), Govt. of India for supporting the project under the Star College Scheme, Principal, PTVA's Sathaye College(Autonomous) for providing the necessary resources and support, which made this research possible. This work would not have been completed without their continuous assistance and cooperation.

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