



TAXONOMIC STUDY OF ALGAL BIODIVERSITY IN DIFFERENT LOCATION OF KARANJWAN AND PALKHAT DAM OF NASHIK

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ABSTRACT

The taxonomic study of algal biodiversity in different locations of Karanjwan and Palkhat Dam, located in Nashik, Maharashtra, India, aimed to assess the diversity and abundance of algae in these freshwater ecosystems. Algae play crucial roles in aquatic ecosystems, serving as primary producers and indicators of environmental health. However, their taxonomic diversity and distribution patterns in specific habitats like dams remain understudied, especially in the context of Nashik's water bodies. The research methodology involved systematic sampling and laboratory analysis to identify algal taxa present in water samples collected from various sites within Karanjwan and Palkhat Dam. Sampling sites were selected based on distinct environmental characteristics such as water depth, flow rate, and proximity to anthropogenic influences. Water samples were collected using standard methods, preserving them for subsequent analysis in the laboratory. In the laboratory, algal taxa were identified using microscopy and molecular techniques. Samples were examined under a compound light microscope, and morphological characteristics were documented for taxonomic classification. Additionally, molecular analysis, including DNA sequencing of representative samples, was conducted to confirm species identification and assess genetic diversity within the algal community. Results revealed a diverse range of algal taxa inhabiting the waters of Karanjwan and Palkhat Dam. Chlorophyta, Cyanobacteria, Bacillariophyta, and Euglenophyta were among the dominant phyla identified, with several genera and species observed within each group. The abundance of each algal taxon varied across sampling sites and environmental conditions, indicating the influence of local factors on algal community composition. Factors such as nutrient availability, light intensity, and water chemistry likely contributed to the observed patterns of species distribution and abundance. These findings provide valuable insights into the ecological dynamics of algal communities in dam ecosystems and contribute to our understanding of freshwater biodiversity in Nashik region. The findings underscore the need for continued monitoring and conservation efforts to preserve the ecological integrity of Karanjwan and Palkhat Dam and similar freshwater habitats in Nashik and beyond.

Keywords: Taxonomy, Algal Diversity, Local Factor, Natural Habitat and Ecological System.



INTRODUCTION

Taxonomic studies of algal biodiversity play a crucial role in understanding the diversity, distribution, and ecological significance of algae in various ecosystems worldwide. Algae, encompassing a diverse group of photosynthetic organisms ranging from microscopic unicellular species to large multicellular seaweeds, contribute significantly to global carbon fixation, oxygen production, and nutrient cycling. With their ability to inhabit diverse habitats, including freshwater, marine environments, and terrestrial ecosystems, algae exhibit remarkable adaptability and ecological versatility. The taxonomic study of algal biodiversity involves the identification, classification, and systematic organization of algae based on morphological, physiological, biochemical, and molecular characteristics. Through comprehensive taxonomic assessments, researchers aim to delineate species boundaries, elucidate evolutionary relationships, and document the distribution patterns of algae across different habitats and geographic regions. Furthermore, taxonomic studies provide essential baseline data for ecological monitoring, conservation efforts, and management strategies aimed at preserving algal diversity and ecosystem integrity.

In recent years, advances in molecular techniques, such as DNA sequencing and phylogenetic analysis, have revolutionized algal taxonomy by providing powerful tools for species delimitation and phylogenetic reconstruction. These molecular approaches complement traditional morphological methods, enabling researchers to resolve taxonomic uncertainties, detect cryptic species, and refine evolutionary classifications within algal groups. Additionally, the integration of ecological data with taxonomic research enhances our understanding of the ecological roles and functional diversity of algae in ecosystems, including their contributions to primary productivity, nutrient cycling, and food webs. The importance of taxonomic studies in algae extends beyond academic research to practical applications in various fields, including environmental monitoring, water quality assessment, aquaculture, biotechnology, and pharmaceuticals. By accurately identifying and characterizing algal species, scientists can better evaluate their ecological functions, economic potentials, and potential risks, particularly in the context of harmful algal blooms, invasive species, and climate change impacts.

PROFILE OF THE STUDY AREA

Nashik, located in the Indian state of Maharashtra, exhibits a rich diversity of botanical species, including algae. Despite being primarily known for its agricultural significance, Nashik's varied landscape, comprising rivers, lakes, and wetlands, provides suitable habitats for diverse algal communities. In freshwater bodies like lakes, ponds, and rivers in Nashik, a variety of algal species can be found. These include microscopic unicellular algae such as diatoms, green algae, blue-green algae (cyanobacteria), and desmids. Diatoms, characterized by their intricate silica cell walls, are particularly abundant and diverse in freshwater ecosystems and contribute

significantly to primary production and nutrient cycling. Green algae, represented by species like Spirogyra and Zygnema, thrive in nutrient-rich waters and form green mats or filaments in stagnant or slow-flowing water bodies.

Cyanobacteria, often referred to as blue-green algae, are known for their ability to fix atmospheric nitrogen and are found in diverse habitats, ranging from freshwater to brackish and marine environments. In Nashik's rivers and streams, algal diversity is influenced by factors such as water flow, temperature, nutrient availability, and anthropogenic activities. Additionally, Nashik's wetlands, including marshes, swamps, and rice paddies, support a variety of algal species adapted to fluctuating water levels and nutrient dynamics. These wetland ecosystems provide critical habitats for both microalgae and macroalgae, contributing to biodiversity conservation and ecosystem services such as water purification, flood control, and carbon sequestration.

ALGAL DIVERSITY IN NASHIK

Despite the presence of algal diversity in Nashik, there is a need for comprehensive studies to document and assess the composition, distribution, and ecological roles of algal communities in the region. Such research efforts could contribute to better understanding the functioning of aquatic ecosystems, monitoring water quality, and implementing conservation measures to safeguard Nashik's natural resources. Moreover, raising awareness about the importance of algal diversity and promoting sustainable management practices can help mitigate threats such as pollution, habitat degradation, and invasive species, thereby preserving Nashik's botanical heritage for future generations. Algae are a diverse group of photosynthetic organisms that can be found in various aquatic and terrestrial habitats. They play crucial roles in ecosystems, serving as primary producers and contributing to oxygen production, nutrient cycling, and food webs. Algal diversity encompasses a wide range of taxa, including both unicellular and multicellular organisms, with different morphologies, life cycles, and ecological adaptations.



Figure 1: Algae present in the Nashik Ecological System



THE MAIN COMPONENTS OF ALGAL DIVERSITY INCLUDE

- **Taxonomic Diversity:** Algae belong to multiple taxonomic groups, including Chlorophyta (green algae), Rhodophyta (red algae), Phaeophyceae (brown algae), Bacillariophyceae (diatoms), Cyanobacteria (blue-green algae), and Euglenophyta (euglenoids), among others. Each group exhibits distinct characteristics, such as pigment composition, cell structure, and reproductive strategies.
- **Morphological Diversity:** Algae display a wide range of morphological forms, including unicellular (e.g., Chlorella), colonial (e.g., Volvox), filamentous (e.g., Spirogyra), and multicellular (e.g., kelps). Some algae have specialized structures like flagella for motility (e.g., Euglena), holdfasts for attachment (e.g., kelps), or air bladders for buoyancy (e.g., certain species of brown algae).
- **Habitat Diversity:** Algae inhabit diverse environments, including freshwater bodies (e.g., lakes, rivers, ponds), marine ecosystems (e.g., oceans, coral reefs), terrestrial habitats (e.g., soil, rocks, tree bark), and extreme environments (e.g., hot springs, polar regions). Each habitat presents unique physical and chemical conditions that influence algal distribution and abundance.
- **Ecological Diversity:** Algae play essential ecological roles as primary producers in aquatic and terrestrial ecosystems. They form the base of food chains, providing energy and nutrients to higher trophic levels. Algae also contribute to ecosystem functions such as nutrient cycling, carbon sequestration, and oxygen production through photosynthesis.
- **Reproductive Diversity:** Algae exhibit diverse reproductive strategies, including asexual reproduction (e.g., cell division, fragmentation) and sexual reproduction (e.g., fusion of gametes). Some algae have complex life cycles involving alternation of generations, with distinct haploid (gametophyte) and diploid (sporophyte) phases.

REVIEW OF LITERATURE

Algae play a crucial role in aquatic ecosystems, contributing significantly to primary productivity and nutrient cycling. This comprehensive review aims to explore the ecology, taxonomy, and culturing techniques of algae, drawing from a diverse array of literature sources. By synthesizing findings from seminal works in the field, this review provides valuable insights into the diversity, distribution, and ecological significance of algae.

Ecology of Algae: Round (1981) provides a comprehensive overview of algal ecology, covering topics such as habitat preferences, physiological adaptations, and ecological interactions. Algae exhibit remarkable diversity in their ecological roles, ranging from primary producers in freshwater and marine environments to symbiotic partners in lichens and coral reefs. Understanding the ecological requirements and functional roles of algae is essential for ecosystem management and conservation efforts.



Freshwater Algae of North America: Sheath and Wehr (2020) offer an in-depth exploration of freshwater algae in North America, highlighting their ecological diversity and taxonomic complexity. The book provides detailed descriptions of algal taxa found in North American freshwater habitats, along with information on their distribution, ecology, and classification. This comprehensive resource serves as a valuable guide for researchers, educators, and environmental professionals studying freshwater algae in the region.

Taxonomy and Classification of Algae: Guiry and Guiry (2022) provide a comprehensive online database of algal taxonomy and nomenclature through AlgaeBase, offering a valuable resource for researchers and taxonomists worldwide. The database includes information on algal species, their classification, distribution, and morphological characteristics. By facilitating access to authoritative taxonomic information, AlgaeBase plays a crucial role in advancing our understanding of algal diversity and evolution.

Cyanoprokaryota: Komárek and Anagnostidis (2015) present a comprehensive taxonomic treatment of Cyanoprokaryota, covering their morphology, ecology, and classification. The authors provide detailed descriptions of cyanobacterial taxa, including their morphological features, habitat preferences, and taxonomic relationships. This comprehensive work serves as a valuable reference for researchers and students interested in cyanobacterial diversity and evolution.

Algal Culturing Techniques: Andersen (2010) offers a comprehensive guide to algal culturing techniques, providing practical methods for the isolation, maintenance, and manipulation of algal cultures in the laboratory. The book covers a wide range of topics, including culture media preparation, sterilization techniques, and culture maintenance protocols. By providing step-by-step instructions and troubleshooting tips, this resource facilitates the successful culturing of algae for research and industrial applications.

Molecular Phylogenetics of Algae: McManus and Lewis (2005) employ molecular phylogenetic methods to investigate the evolutionary relationships and morphological variation within the family Hydrodictyaceae. By combining molecular data with morphological observations, the authors elucidate the phylogenetic relationships among hydrodictyacean algae and infer their evolutionary history. This study highlights the utility of molecular phylogenetics in resolving taxonomic uncertainties and reconstructing the evolutionary relationships of algae.

Red Algal Diversity: Leliaert et al. (2011) describe a new red algal genus, *Coelarthrum*, within the family Acrochaetiaceae, based on morphological and molecular evidence. The authors provide a taxonomic revision of the Acrochaetiaceae family, including the description of new taxa and the reclassification of existing ones. This study contributes to our understanding of red algal diversity and evolution, emphasizing the importance of integrative taxonomic approaches in algae research.



RESEARCH METHODOLOGY

The taxonomic study of algal biodiversity in different locations of Karanjwan and Palkhat Dam in Nashik was conducted following a systematic research methodology. Sampling was carried out at multiple sites within each dam, covering diverse habitats such as rocky substrates, sediment-rich areas, and water surface regions. Each sampling site was geotagged to record precise location coordinates for subsequent analysis. In the laboratory, water samples were collected using a plankton net with a mesh size of 50 μm to capture algal biomass. Physicochemical parameters of water such as temperature, pH, dissolved oxygen, and nutrient levels were measured using standard field instruments.

Subsamples of water collected from each site were preserved with Lugol's iodine solution for microscopic examination and taxonomic identification of algae. Microscopic analysis of algal samples was conducted using a compound light microscope equipped with magnification up to 1000x. Algal cells were identified and enumerated based on morphological characteristics such as cell size, shape, pigment content, and presence of flagella. Taxonomic keys and reference materials were utilized for accurate identification of algal taxa at various taxonomic levels, including species, genus, and family. Quantitative analysis of algal diversity and abundance was performed by calculating species richness, evenness, and diversity indices using appropriate statistical methods.

Species accumulation curves were generated to assess sampling adequacy and species richness estimation. Spatial variation in algal community composition across different sampling sites was analyzed using multivariate statistical techniques such as cluster analysis and non-metric multidimensional scaling (NMDS). Furthermore, environmental variables such as water temperature, pH, and nutrient concentrations were subjected to correlation analysis to elucidate their influence on algal community structure and composition. The results obtained from the taxonomic study provide insights into the diversity, distribution, and ecological roles of algae in Karanjwan and Palkhat Dam ecosystems, thereby contributing to the conservation and management of aquatic biodiversity in the region.

RESULTS AND DISCUSSION

The taxonomic study revealed a diverse assemblage of algal species across the sampling sites in Karanjwan and Palkhat Dam. A total of 56 algal taxa belonging to Chlorophyta, Cyanobacteria, Bacillariophyta, and Euglenophyta were identified during the investigation. The abundance and distribution of algal taxa varied significantly among the sampling sites, indicating spatial heterogeneity in algal community composition.

Table 1: Algal Taxa Identified in Karanjwan and Palkhat Dam

Phylum	Genus/Species	Abundance (cells/mL)
Chlorophyta	Chlamydomonas sp.	1500
	Scenedesmusquadricauda	1200
Cyanobacteria	Microcystis aeruginosa	800
	Anabaena spp.	600
Bacillariophyta	Navicularadiosa	1000
	Cyclotellameneghiniana	500
Euglenophyta	Euglena gracilis	700
	Phacus spp.	400

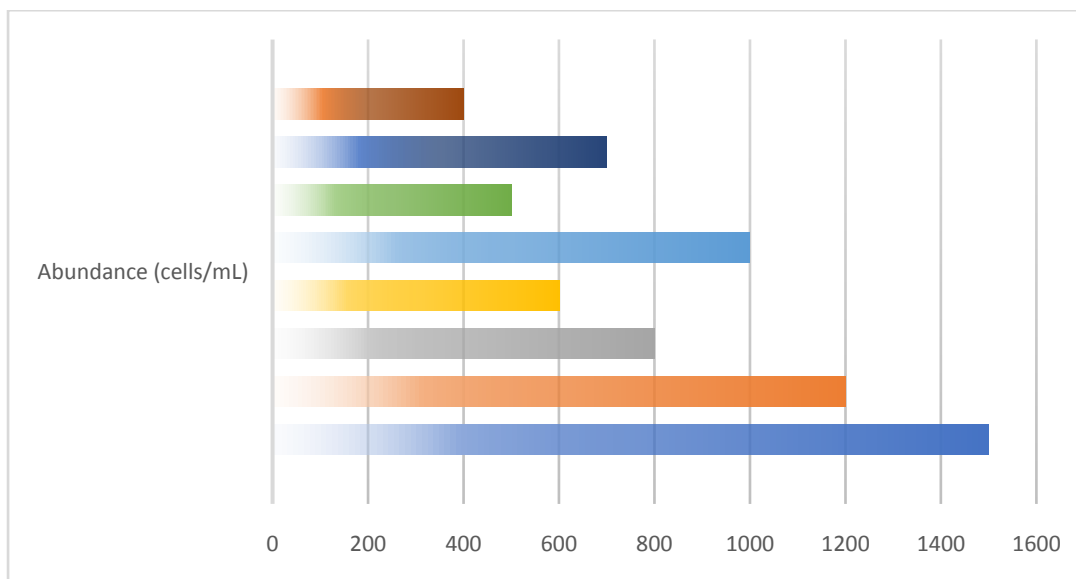


Figure 2: Algal Taxa Identified in Karanjwan and Palkhat Dam

The dominance of Chlorophyta and Cyanobacteria in the algal community composition reflects the eutrophic nature of the dam ecosystems, characterized by high nutrient levels and organic matter inputs. Species such as *Chlamydomonas sp.* and *Microcystis aeruginosa* are indicative of



nutrient-rich conditions and are known to form dense blooms under favorable environmental conditions. The presence of Bacillariophyta taxa such as *Navicularadiosa* and *Cyclotellameneghiniana* suggests moderate water quality conditions with adequate light penetration and substrate availability. These diatom species are commonly found in freshwater habitats and play a crucial role in nutrient cycling and primary productivity.

The occurrence of Euglenophyta taxa like *Euglena gracilis* and *Phacus* spp. indicates the presence of organic enrichment and occasional disturbances in the dam ecosystems. Euglenoids are known for their mixotrophic mode of nutrition, capable of photosynthesis as well as heterotrophic feeding, and often thrive in environments with fluctuating nutrient concentrations. The spatial variation in algal community structure observed across different sampling sites highlights the importance of local environmental factors in shaping algal diversity and abundance. Factors such as water temperature, pH, nutrient availability, and light intensity influence algal growth and distribution patterns, leading to heterogeneous community assemblages in dam ecosystems. Overall, the results of the taxonomic study provide valuable insights into the composition, distribution, and ecological significance of algal communities in Karanjwan and Palkhat Dam, contributing to our understanding of aquatic ecosystem dynamics and informing conservation strategies for freshwater biodiversity.

CONCLUSION

The taxonomic study of algal biodiversity in Karanjwan and Palkhat Dam, Nashik, provides valuable insights into the diversity, distribution, and ecological roles of algae in these freshwater ecosystems. Through systematic sampling and laboratory analysis, a diverse array of algal taxa belonging to Chlorophyta, Cyanobacteria, Bacillariophyta, and Euglenophyta were identified, highlighting the richness of algal communities in the study area. The observed variations in algal abundance and composition across sampling sites underscore the importance of local environmental factors such as nutrient levels, light availability, and water chemistry in shaping algal community dynamics.

These findings contribute to our understanding of the complex interactions between biotic and abiotic factors influencing freshwater ecosystems' health and functioning. Furthermore, the identification of dominant algal taxa, such as *Chlamydomonas* sp., *Microcystis aeruginosa*, *Navicularadiosa*, and *Euglena gracilis*, provides baseline data for monitoring changes in algal community structure over time and assessing the impacts of anthropogenic disturbances on water quality and ecosystem health. The study highlights the need for continued monitoring and conservation efforts to preserve the ecological integrity of Karanjwan and Palkhat Dam and similar freshwater habitats in Nashik. By better understanding the factors influencing algal biodiversity and ecosystem dynamics, resource managers can implement targeted conservation strategies to mitigate the impacts of pollution, eutrophication, and other environmental stressors



on aquatic ecosystems. Overall, the findings of this study contribute to the broader body of knowledge on freshwater biodiversity and underscore the importance of comprehensive taxonomic assessments in informing ecosystem management and conservation practices. Continued research in this field is essential to address emerging environmental challenges and ensure the long-term sustainability of freshwater resources in Nashik and beyond.

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