The Distribution of Phytoplankton Population in Fresh Water Reservoir of Mallanna Sagar, Telangana State.

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ABSTRACT
The present study was carried out to investigate the phytoplankton diversity of Mallannasagar Reservoir, Siddipet District, Telangana, from June 2024 to May 2025. Water and algal samples were collected monthly from four selected sampling stations to assess algal diversity and evaluate the ecological status of the reservoir. Phytoplankton samples were collected using a

20 µm plankton net, while epilithic and periphytic algae were collected from submerged substrates. Physico-chemical parameters of water were analyzed following standard laboratory procedures, and algal identification was performed using standard taxonomic literature under a binocular microscope.

Among the phytoplankton genera of epipelagic waters, 104 were recorded and some belonged to one of four major algal groups: Chlorophyceae (41 generas), Bacillariophyceae (36 generas), Cyanophyceae(21generas) and Euglenophyceae (6 genera). The four groups were identified among the postmolt samples, with Chlorophyceae being dominant; followed by Bacillariophyceae and then Cyanophyceae. A predominance of green algae and diatoms points to reasonably good water quality (low phytoplankton chlorophyll concentrations) along with supportive ecological conditions, while cyanobacteria indicate moderate nutrient enrichment within the reservoir.

The study demonstrates that phytoplankton diversity is an effective biological indicator for assessing reservoir health. Overall, the findings reveal that Mallannasagar Reservoir possesses good ecological potential, supports rich algal biodiversity, and maintains water quality suitable

for sustaining aquatic life. These baseline data will be valuable for future monitoring, conservation, and management of the reservoir ecosystem.

Keywords: Microalgae, Phytoplankton, Freshwater, Mallannasagar, Reservoir, Siddipet

INTRODUCTION

Mallannasagar Reservoir, the largest man-made reservoir in the Kaleshwaram Project, is situated in the Kondapaka and Toguta mandals of Siddipet District, Telangana State. Fed by the waters of the Godavari River, the reservoir provides a suitable habitat for diverse aquatic organisms. To assess its algal diversity, a study was conducted from June 2024 to May 2025. Regular observations and sample analyses during this period revealed the presence of a wide range of algal species. Algae are the organic compounds producer in water. Fresh water algal groups have been categorized primarily based totally on their habitat as planktons, benthos and algae connected to hydrophytes, stones, mud, sand, reservoir rocks and lakes (Mallikarjuna et al., n.d.). It has an important position in aquatic food chain (Ramesh & Aruna, 2015).

Phytoplankton are in large part autotrophic organisms depending upon photosynthesis to transform mild into chemical strength that is then stored in organic compounds (K. & M., 2019). Algae indicate the pollution levels in water bodies. These are the bio indicator; it helps in determine the quality. The phytoplankton in a reservoir is an important biological indicator of the water quality (Ariyadej et al., n.d.). phytoplankton are important primary producers on the basis of the food chain in water and some species are harmful to human and other vertebrates by releasing toxic substances in to the water (Khanna et al., n.d.). Phytoplankton constitutes the very foundation of dietary cycles of an aquatic ecosystem (Dhanam et al., n.d.). A captivating thing about fresh water lakes is that they provide variety of chemical substances which influence the growth of phytoplankton of diverse range (Srinivas, 2020). They form a bulk of food for zooplankton, fishes and other aquatic organisms. (Aruna et al., 2018).
The present investigation was undertaken to study the distribution and abundance of micro algal population at Mallanna sagar reservoir of Siddipet district, Telangana state.

Material and Method.

Study Site

Mallannasagar is the largest artificial reservoir. Mallannasagar Reservoir is located at Toguta -Kondapaka Mandal of Siddipet District, Telangana State. The reservoir has a 50TMC garage capacity, of which 30 TMC is water for Hyderabad's consuming purposes. The other 16 TMCs will be provided for the industrial needs of them. The main aim of the present study is to explore the algae from different sites of Mallannasagar reservoir in the length from June – 2024 to May - 2025. During this period total four sampling sites taken for algal collection, Station – I located at Surge Pool. Station- II is located in the middle of the reservoir, Station – III is located at the east side of the reservoir and the IV Station is placed in the center of the reservoir.

Figure 1 MallannaSagar_Reservoir_satellite_imagery

Water samples were collected from four stations of the Mallannasagar Reservoir using sterilized 1-L plastic bottles. At each sampling station, two 1-L bottles were collected: one was used for physicochemical analysis, while the other was used for algal identification. For that purpose, these bottles shifted to laboratory and stored with Lugol's iodine and 4% of formaldehyde.

Algal specimens, particularly phytoplankton, were harvested using a standard plankton net with a 20-micron mesh and epilithic and periphytic algae were collected by scrubbing submerged substrates such as rocks, aquatic plants, and sediments using sterile tools(A. Rajani et al., 1987). Temperature and pH taken at the time of sample collection. All collected algal samples were observed and identified using a binocular microscope fitted with a digital camera for further taxonomic analysis.

Physico-chemical analysis:

Collected water samples from the selected stations and tested for the Physicochemical analysis of pH with HANNA digital meter, Temperature was tested with the ^{O} Celsius thermometer and remaining parameters, Alkalinity, Total Hardness, Calcium hardness, magnesium hardness, chlorides, dissolved oxygen, BOD, COD, were estimated in the Laboratory by using Indian Standard Procedures (Titration method)(Karnataka et al., 2011).

Phosphates, Sulphates, Nitrates, Nitrites and Silicates were estimated with Double beam UV spectrophotometer as per the standard protocol of APHA 2005. The bodily and chemical residences of clean water our bodies are characterized with the aid of using the climatic, geochemical, geomorphologic and pollutants conditions(V. Rajani, 2023)

Morphological analysis

Identification done with the help of algal monographs, standard literature and other related research books like Fritsch (1935) Smith (1950), Prescott (1951), A.B. Gore, Desikachary, Venkatraman (1951) and Philiphose (1967). Identified algae photographs were taken with 5.1 mega pixel industrial digital camera attached to the binocular microscope 40X.

Result and Discussion

The phytoplankton study of water samples revealed the presence of four major algal groups with varying abundance across all sampling sites. These algal communities serve as important bio-indicators of water quality and pollution levels in the reservoir ecosystem (Ramesh & Aruna, 2015). The density and diversity of phytoplankton are strongly influenced by the physicochemical characteristics of water, and their diversity reflects the complexity of the aquatic community structure (Sameera & Aruna, 2019). Algae play a significant role in the natural self-purification process of water bodies by reducing organic contamination (Meena et al., n.d.).

The present study recorded abundant growth of algae belonging to the classes Chlorophyceae, Bacillariophyceae, and Cyanophyceae, while members of Euglenophyceae have been relatively much less abundant. The majority of the identified algal genera belonged to Chlorophyceae, followed by Bacillariophyceae and Cyanophyceae, whereas Euglenophyceae contributed the least to the phytoplankton composition. Observations from the amassed samples found out that Chlorophyceae contributors have been dominant, observed through Bacillariophyceae, Cyanophyceae, and Euglenophyceae.

The dominance of green algae and diatoms generally indicates relatively clean and oligotrophic water conditions, whereas the occurrence and bloom formation of blue-green algae (Cyanophyceae) suggest eutrophic conditions and possible nutrient enrichment in the water body (Srivastava et al., n.d.). Similar findings were reported by earlier researchers including Ramesh and Aruna (2015), Shailaja and Aruna (2016), Aruna et al. (2018), Neha Srivastava (2018), and K. & M. (2019). Human activities have a significant impact on reservoir ecosystems and directly influence the distribution and abundance of aquatic flora and fauna.

The occurrence of common and dominant Chlorophyceae phytoplankton species in the Mallannasagar Reservoir is presented in Table No. 1. The dominant phytoplankton species were identified and recorded throughout the study

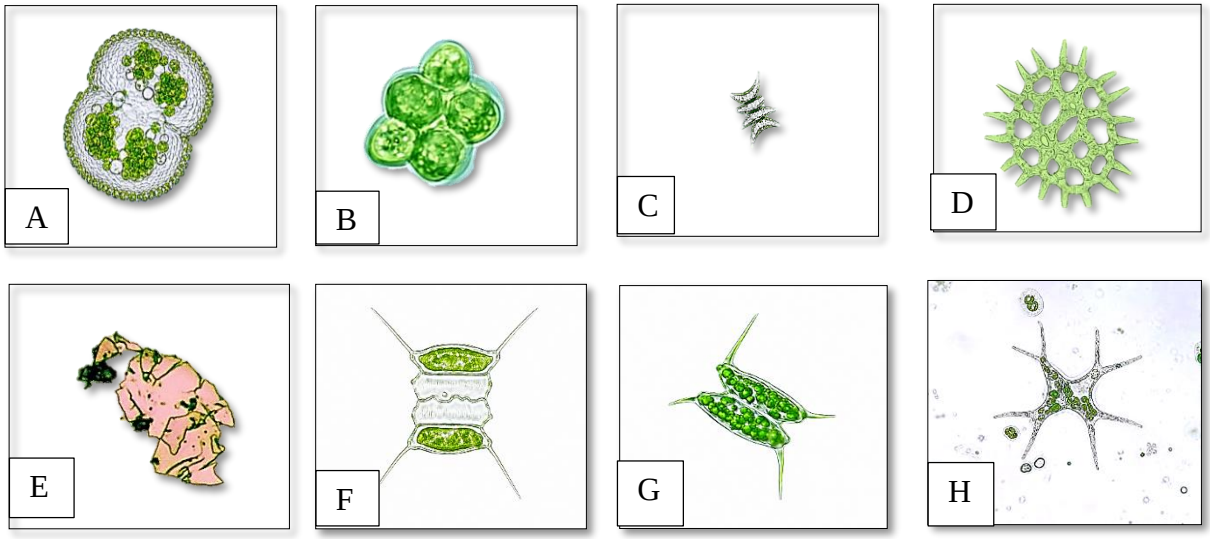
period. Bacillariophyceae constituted the second most dominant phytoplankton group in the reservoir and are presented in Table No.2. Cyanophyceae represented the next dominant group and are shown in Table No.3. The remaining less phytoplankton groups are presented in Table No.4.

Table No – I

Occurrence of common dominant species Chlorophyceae of phytoplankton of Mallannasagar reservoir.

Class	Name of the Genera	Class	Name of the Genera
Chlorophyceae	1. *Ankistrodesmus spiralis (W.B.Turner) Lemmermann* 2. *2.Closterium acutum Brébisson* 3. *Closterium moniliferum (Bory) Ehrenberg ex Ralfs* 4. *Coelastrum astroideum De Notaris* 5. *Coelastrum microporum Nägeli* 6. *Cosmarium corda* 7. *Cosmarium cyclecum* 8. *Cosmarium geminatum Lundell* 9. *Cosmarium laeve Rabenhorst* 10. *Cosmarium portianum Archer* 11. *Cosmarium subtumidum Nordstedt* 12. *Oedogonium grande Kützing* 13. *Eudorina elegans Ehrenberg* 14. *Gonatozygon kinahanii (Archer) Rabenhorst* 15. *Oedogonium capilliforme Kützing Pediastrum angulosum (Ehrenberg) Meneghini* 16. *Pediastrum boryanum (Turpin) Meneghini* 17. Pediastrum duplex var. gracillium 18. *Pediastrum simplex Meyen* 19. *Pediastrum tetras (Ehrenberg) Ralfs* 20. *Pandorina morum* (O.F.Müller) Bory,	**Chlorophyceae**	21. *Pandorina morum* (O.F.Müller) Bory, 22. *Scenedesmus acuminatus (Lagerheim) Chodat* 23. *Scenedesmus acutiformis Schröder* 24. *Scenedesmus armatus (Chodat) Chodat* 25. *Scenedesmus bijugatus (Turpin) Kützing* 26. *Scenedesmus dimorphus (Turpin) Kützing* 27. *Scenedesmus maximus (West & G.S.West) Smith* 28. *Scenedesmus obliquus (Turpin) Kützing* 29. *Scenedesmus quadricauda (Turpin) Brébisson* 30. *Spirogyra formosa (Hassall) Kützing* 31. Staurastrum Meyen 32. Staurastrum gracile Ralfs ex Ralfs, 33. *Staurastrum javanicum Nordstedt* 34. *Staurastrum tetracerum Ralfs ex Ralfs* 35. *Staurodesmus dejectus (Brébisson ex Ralfs) Teiling* 36. . *Staurastrum crenulatum (Nägeli) Delponte* 37. *Tetraedron tumidulum (Reinsch) Hansgirg* 38. *Ulva lactuca* 39. *Ulothrix zonata (Weber & Mohr) Kützing* 40. *Volvox tertius Printz* 41. *Zygnema gangeticum Randhawa*

Plate No. – 1



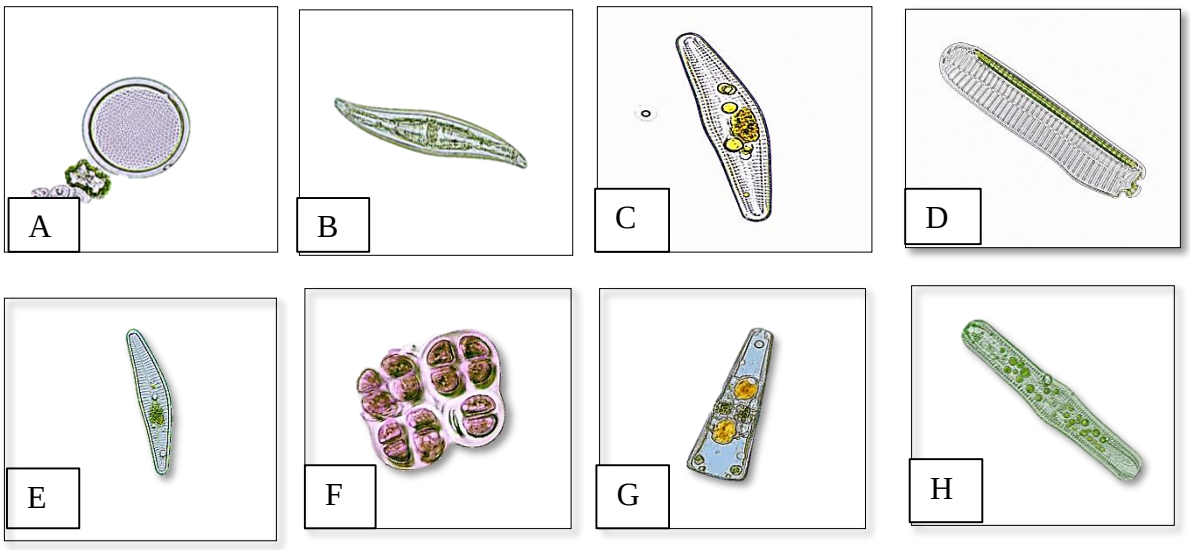
A). Cosmarium dispersum Johnson B). Pandorina morum C). Scenedesmus dimorphus D). Pediastrum duplex var. gracillium E). Ulva lactuca F). Staurastrum Meyen G). Staurastrum gracile Ralfs ex Ralfs,H). Tetraëdron gracile (Reinsch) Hansgirg.

Table No – 2

Occurrence of common the second dominant Bacillariophyceae species of phytoplankton of Resevoir

Class	Name of the Genera	Class	Name of the Genera
Bacillariophyceae	1. *Achnanthidium minutissimum* (Kützing) Czarnecki 2. *Amphora ovalis* (Kützing) Kützing 3. *Anomoeoneis sphaerophora* (Kützing) Pfitzer 4. *Cocconeis pediculus* Ehrenberg 5. *Cyclotella bodanica* Eulenstein ex Grunow 6. *Cyclotella meneghiniana* Kützing 7. *Cymbella affinis* Kützing 8. *Cymbella aspera* (Ehrenberg) Cleve 9. *Gomphonema acceptatum* Lange-Bertalot & Reichardt 10. *Gomphonema constrictum* Ehrenberg 11. *Gomphonema parvulum* (Kützing) Kützing 12. *Gyrosigma acuminatum* (Kützing) Rabenhorst 13. Gleocapsa_punctata 14. *Melosira granulata* (Ehrenberg) Ralfs 15. *Navicula cryptocephala* Kützing	**Bacillariophyceae**	16. *Navicula cuspidata* (Kützing) Kützing 17. *Navicula pupula* Kützing 18. *Navicula rhynchocephala* Kützing 19. *Navicula viridula* (Kützing) Ehrenberg 20. *Neidium iridis* (Ehrenberg) Cleve 21. *Nitzschia acicularis* (Kützing) W. Smith 22. *Nitzschia closterium* (Ehrenberg) W. Smith 23. *Nitzschia denticula* Grunow 24. *Nitzschia sigmoidea* (Nitzsch) W. Smith 25. *Nitzschia longissima* (Brébisson) Ralfs 26. *Nitzschia recta* Hantzsch ex Rabenhorst 27. Pinnulariaviridis (Nitzsch) Ehrenberg 28. *Pinnularia gibba* Ehrenberg 29. *Pinnularia opulenta* (A.W.F. Schmidt) Cleve 30. *Pinnularia socialis* Ehrenberg 31. *Rhoicosphenia abbreviata* (C. Agardh) Lange-Bertalot 32. *Surirella robusta* Ehrenberg 33. *Synedra tabulata* (C. Agardh) Kützing 34. *Synedra ulna* (Nitzsch) Ehrenberg 35. *Trachyneis aspera* (Ehrenberg) Cleve 36. *Trigonium arcticum* Brightwell

Plate No.2



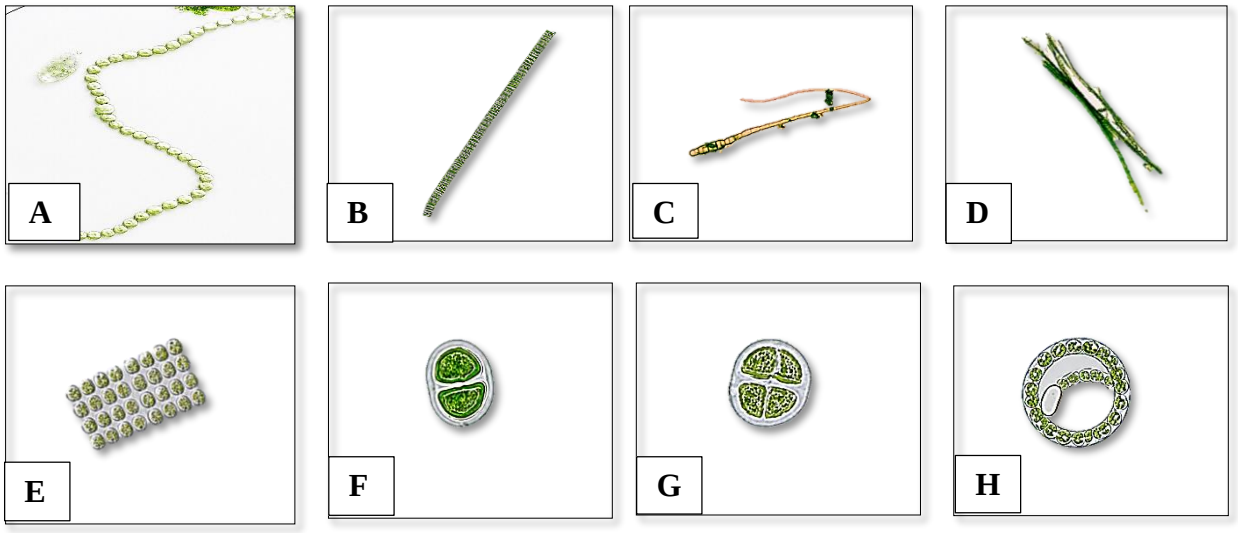
A). Cyclotella meneghiniana KützingB). Gyrosigma acuminatum (Kützing) Rabenhorst C). Navicula cryptocephala Kützing, D). Gomphonema C. Agardh,E). Cymbella lanceolata F). Gleocapsa_punctata_ G). Rhoicosphenia abreviata, H). Pinnularia viridis (Nitzsch) Ehrenberg

Table No.3

Occurrence of common the Cyanophyceae species of phytoplankton of the reservoir.

Class	Name of the Genera
Cyanophyceae	1. Anabaena circinalis 2. Aphanizomenon 3. *Aphanocapsa* Nägeli 4. *Aphanocapsa biformis* A. Braun 5. *Calothrix fusca* (Kützing) Bornet & Flahault 6. *Chroococcus minutus* (Kützing) Nägeli 7. *Chroococcus minor* (Kützing) Nägeli 8. *Chroococcus turgidus* (Kützing) Nägeli 9. *Merismopedia glauca* (Ehrenberg) Kützing 10. *Merismopedia punctata* Meyen 11. *Microcystis aeruginosa* (Kützing) Kützing 12. *Nostoc commune* Vaucher ex Bornet & Flahault 13. *Oscillatoria animalis* C. Agardh ex Gomont 14. Oscillatoria Vaucher ex Gomont 15. *Oscillatoria chalybea* (Mertens ex Gomont) Anagnostidis 16. *Oscillatoria curviceps* C. Agardh ex Gomont 17. *Oscillatoria formosa* Bory ex Gomont 18. *Oscillatoria ornata* Kützing ex Gomont 19. *Oscillatoria rubescens* DC. ex Gomont 20. *Rivularia atra* Roth ex Bornet & Flahault 21. *Spirulina major* Kützing ex Gomont

Plate No.3

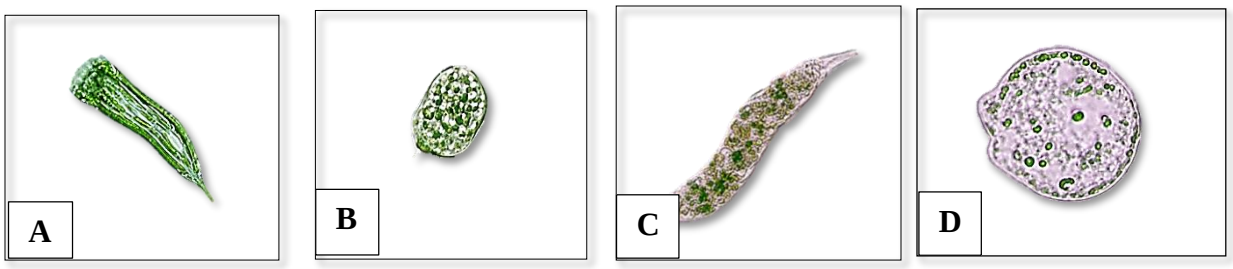


A). Nostoc commune B). Oscillatoria Vaucher ex Gomont C). Rivularia atra D). Aphanizomenon E). Merismopedia glauca F). Chroococcus minutus (Kützing) Nägeli G). Chroococcus turgidus (Kützing) Nägeli H). Anabaena circinalis

Table No.4

Class	Name of the Genera
Euglenophyceae	*1. Euglena minuta Prescott* *2. Euglena viridis Ehrenberg* *3. Lepocinclis tripteris (Dujardin) Marin & Melkonian* *4. Phacus curvicauda Svirenko* *5. Trachelomonas volvocina Ehrenberg* 6. *Phacus gigas*

Plate No.4

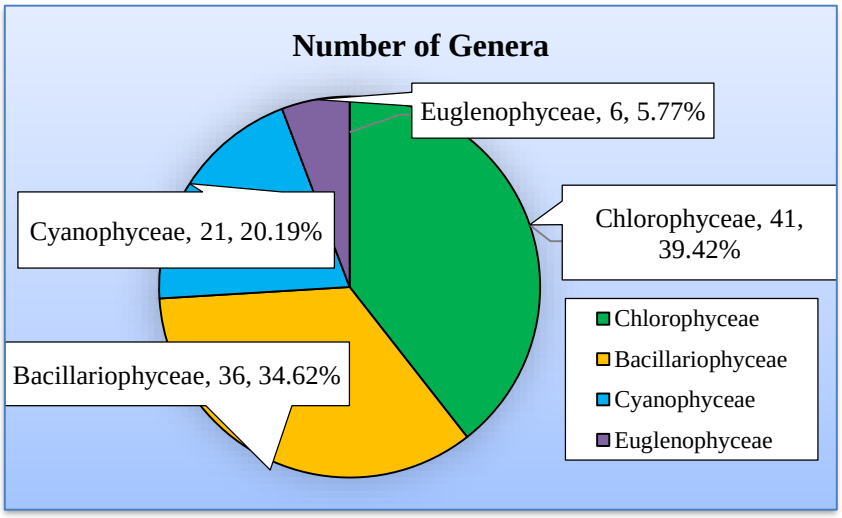


A). Euglena gracilis B). Trachelomonas volvocina Ehrenberg C). Euglena Ehrenberg, D). Phacus gigas

Table No. - 5

Class	Number of Genera
Chlorophyceae	**41**
Bacillariophyceae	**36**
Cyanophyceae	**21**
Euglenophyceae	**6**
Total	**104**

Figure No. 1



The graphical representation above shows that Mallanna sagar reservoir water contained 39.42% (highest) of Chlorophyceae in the sample (Table No.5, Figure No.1) and was the dominant group in the reservoir, followed by 34.62% of Bacillariophyceae members (Table No.5, Figure No.1) , 20.19% of Cyanophyceae members (Table No.5, Figure No.1) , and least Euglenophyceae members with 5.77% (Table No.5, Figure No.1) .

Conclusion:

The current study of the Mallannasagar Reservoir shows that the four major groups of phytoplankton Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae are found in the reservoir. The abundance of Chlorophyceae in the study stations indicates good water quality and favorable conditions in the reservoir water. The second highest number of taxa was in Bacillariophyceae, which contributed considerably to the phytoplankton diversity.

The presence of the Cyanophyceae indicates the presence of nutrients in the reservoir and moderate eutrophication of the waters at the time, while the Euglenophyceae, represented by only a few species, were less abundant at that time.

Further, phytoplankton diversity could be used as a surrogate index and the ecological status of the reservoir was determined to be good, with a diverse aquatic biota indicated by dominance of green algae and diatoms over other algae taxa. In conclusion, the study reports overall good ecological potential, biological productivity and water quality of the Mallannasagar Reservoir to support aquatic biota.

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