

Seasonal Dynamics of Phytoplankton Population of Ramadugu Lake in Nizamabad District Telangana, India

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ABSTRACT

Phytoplanktons are one of the smallest and the most plentiful organisms ranging from unicellular to multicellular forms. These organisms play a vital role in aquatic ecosystems. Algae being photoautotrophs take part in photosynthesis process, they form the food base for other organisms living in lakes, reservoirs, ponds, streams and oceans. Lakes are very important water resources which are used in daily life for several purposes. Majority of fresh water lakes showed distinct seasonal variation in phytoplankton abundance. The primary objective of this paper is to highlight the current status and to provide a quantitative record of the seasonal changes of phytoplankton and to examine their distribution and diversity in relation to environmental gradients of the Ramadugu lake which is located in Ramadugu village of Nizamabad district, Telangana. The present work was carried out to identify the fresh water algal flora and its diversity for a period of one year from January 2018 to December 2019 in different seasons. Water samples were collected seasonally over three seasons – March to June(summer), July to October(Monsoon) and November to February(winter) from selected four sampling stations of lake. The algal forms were identified by using various keys. Mainly four major algal groups were identified in Ramadugu lake throughout the study period. They are Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. Seasonal variations were observed in the presence and density of various algae. The density of diatoms are high in winter season indicates that lake water is unpolluted and good to support life. The lake water is used for irrigation and pisciculture but not suitable for drinking purpose.

Keywords : Phytoplankton, Photoautotrophs, Algal flora, Ramadugu lake, Seasonal variations.

I. INTRODUCTION

Water is the most precious and important natural heritage for all living beings. All biochemical reactions occur in water and it is essential for the maintenance of life. Water being valuable and limited vital resource needs to be protected, conserved and wisely used. Fresh water is an essential resource for life and it influences Earth's climate (Naiman et al.1995, [1]Palmer et al.1997)[2]. Fresh water is especially important in the cycling of elements and fresh water habitats respond to climatic changes due to wide range of human activities. Limnological studies include the study of lakes, reservoirs, ponds, rivers streams, wetlands and groundwater. Water is typically fresh (non-saline) and water bodies are of two main types-Running (Lotic) waters including rivers and streams whereas standing (Lentic) water bodies particularly ponds, lakes and wetlands. Considerable work has been done in India about systematic survey, distribution, periodicity and ecology of algae in different habitats(Pandey 1973) [3]Kumar et al. 1974,[4]. Phytoplankton communities respond very quickly to the changes in the environment because of their short life cycle and thus act as bio-indicators of pollution. Phytoplanktons are the prominent living entities of aquatic ecosystems and play a significant role as a tool in assessing the quality of the water. This is because of the high degree of sensitivity these organisms, exhibit to the altering environment (Kumar and Rai, 2005)[5]. Studies on seasonality of Indian fresh water planktons were initiated by Sewell. Seasonal variations of phytoplankton in natural lakes and reservoirs have been well documented (Katsiapi, et al., 2013;[6] Marshall, et al.,2013)[7]. Phytoplanktons are the microscopic algal communities and are the pioneers (producers) of any aquatic food chain as well as

oxygen emitters in various aquatic systems (Singh *et al.*, 2014)[8]. The planktonic algae include green algae, blue green algae, the diatoms, euglenoids and are important among aquatic flora. They are ecologically significant and forms as a basic unit of food chain of an aquatic ecosystem (Misra et al., 2001,[9]. Phytoplankton varies considerably with respect to different seasons and polluted conditions. Seasons were also important factors so there was something effecting the lakes beside temperature, it is light. Solar energy provides energy input to ponds and lakes (Bronmark.C and Hansson, 2005)[10]. The occurrence and abundance of phytoplankton majorly depends on the effect of light penetration, temperature and the availability of nutrients. Phytoplankton species were identified as effective and good biological indicators of water quality (Pawar et al., 2006)[11]. The healthy aquatic ecosystem is dependent on the physico-chemical and biological characteristics. Phytoplankton survey helps to find out the trophic status of the lake and organic pollution in the ecosystem (Ramchandra and Solanki, 2007)[12].

Therefore, in the present study investigations were conducted on fresh water phytoplankton and seasonal diversity of phytoplankton to explore the algae from different sites of Ramadugu project lake which is located in Ramadugu village of Nizamabad district. In order to study algal biodiversity algal samples were collected and identification was done with the help of standard literature to understand the distribution and diversity of microalgae.

II. MATERIAL AND METHODS

Study Area:

The main aim of present study is to explore the algae from different sites of Ramadugu lake of Nizamabad

district which lies between 18° 40' and 19° 00' North latitude and between 78° 10' and 79° 10' East longitude. Density is 321 km². The geographical area of the district is 7,956 sq. kms. The district is rich source of rivers, lakes, ponds and reservoirs. Ramadugu project is an existing medium irrigation project constructed across Pedda vagu, a tributary of Bheemgal River which ultimately joins into Godavari on the Sree Rama Sagar project. The project is located near Ramadugu village and Dharpally mandal of Nizamabad district to irrigate an ayacut of 5000 Acres. The project work was commissioned in the year 1964. The Government have accorded administrative approval for modernization of Ramadugu Project. It is located at a distance of 20 km from Nizamabad. This project is medium lake which gets filled during rains and is used for irrigation of Agricultural crops covering Dichpally, Dharpally, Jakranpally, Velpur and Bheemgal Mandal of Nizamabad District.

Mode of sample Collection:

During present study, surface and ground samples were collected periodically at monthly intervals from four sampling sites of Ramadugu lake throughout the three seasons of summer, Monsoon (Rainy) and winter during the study period. These areas are seasonal in nature, usually containing water in the months of June. During the monsoon, the density of microalgae in the lake water decreases due to the dilution of water by rain. Prior to sample collection, all the sampling bottles were thoroughly washed, sun-dried and rinsed with the same water to be collected in the lake. These samples were typically distributed and collected from random positions of lake. Algal samples were collected in two-liter plastic cans and transported to laboratory which is continued for a period of twelve months by using plankton net (mesh size 105 µm). The collection of water samples from sampling stations were made in the morning hours between 8:00 to 10:00 am. Benthic and planktonic algae were collected separately and simultaneously along with water samples every month. For benthic

algae small pebbles coated with brown or green scum were picked up with spatula from all the stations along with 100ml surface water. The sampling bottles were labelled with dates and collection sites. After returning to the laboratory the algal material was scraped and preserved.

Preservation:

All those collected algal samples were preserved in 4% formalin solution and deposited in Hydrobiology laboratory at Dept. of Botany Telangana University. The preserved water samples were kept undisturbed for 24 hours to allow sedimentation of algae. Then the samples were concentrated to 100ml and final volume of concentrated material was used for species identification.

Counting and Identification:

From the collected water samples and concentrated filtrates 1ml of sample was taken and analysis of phytoplankton was done by putting one drop of sample on the glass slide and observed under microscope. This analysis was repeatedly done for 10 times to determine the frequency of different species of algae present at each station by using Drop method of Pearsall et al., (1946)[13]. Identification of algae was done under binocular microscope. Identification was done according to the standard methods for the examination of water and waste water as prescribed by American Public Health Association, American Water Works Association, and Water Pollution Control Federation (APHA, AWWA, 2005) [14]. Phytoplanktons were examined and identified with the help standard literature, Monographs, Classified manuals and other related books like Fritsch (1935), [15] Prescott (1968) [16], Desikachary (1959) [17], and Vidyavati, (2007) [18].

III. RESULTS AND DISCUSSION

In the present investigation there are total 62 algal taxa belonging to four classes viz. Chlorophyceae,

Bacillariophyceae, Cyanophyceae and Euglenophyceae were identified. Seasonal variations was observed among different classes of algae throughout the study period and closely related to the change in physico-chemical conditions of the water. Thus, the change in water chemistry makes the water environment conducive for some species while for some others, it becomes nonconductive. It was observed that Chlorophyceae members observed in all seasons of study period as a stable community in the lake. The high frequencies were recorded in Winter and early summer season whereas minimum during Monsoon season. Chlorophyceae (Green algae), distinguished mainly on the basis of pigments. Temperature has been found to play an important role in periodicity of this group as emphasized by many workers (Venkateshwarlu, P. Manikya Reddy, 1985)[19], worked on the distribution of this group. The fall in phytoplankton density during monsoon season may be due to increase in water volume. (Mustafa & Zubair., 1997)[20] encountered minimum number of phytoplanktons in monsoon months. These observations go in agreement with these findings. From this class 32 genus were recorded during the study period from various sampling stations. The green algae were dominant members, (Table No-1) Bacillariophyceae (Diatoms) members occupied second rank and represented by 15 genera. The cell wall of diatoms is made with silica and consists of two valves, one of which overlaps the other like a soap box.

Diatoms maximum growth and development was observed during winter months and minimum during summer and rainy seasons and this is an agreement with the findings of earlier workers (Philipose, 1960., [21], mentioned that diatoms are usually abundant in alkaline water. silicates and oxygen are responsible for the growth of diatoms (Veerendra et al., 2006)[22] . The third dominant group is Cyanophyceae members represented by 12 genera. The abundance of these members depends on water temperature, organic matter and the least is recorded by Euglenophyceae with 2 algal species among four sampling stations of Ramadugu project influenced by temperature and organic matter. (Varma et al., 2001)[23] has reported phytoplankton density in different seasons in order of summer > winter > monsoon, which supports these findings. Observation of samples throughout the study period revealed that four groups of algae belong to Chlorophyceae followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. Similar observations were made by earlier workers Ramesh and Aruna (2015)[24], Shailaja and Aruna (2016)[25], Srinivas, M and Aruna, M (2018)[26], Rajyalakshmi and Aruna (2019)[27], K. Anuradha and Nirmala Babu Rao (2021)[28], Raju and Aruna (2022)[29]., Raju P, Aruna (2021)[30] and Neha Srivasthava (2018)[31]. Some of the dominated algal micrographs are Indicated Fig No-1 to Fig No-4.

Table -1 : Occurrence of dominant species of phytoplankton of Ramadugu project during 2018 – 2019

NAME OF THE ALGAL GROUP	NAME OF THE SPECIES IDENTIFIED
CHLOROPHYCEAE	<p><i>Ankistrodesmus falcatus</i>, <i>Actinastrum hantzschii</i>, <i>Bulbochaete longa</i>, <i>Chlamydomonas globose</i>, <i>Chara vulgaris</i>, <i>Chlorella vulgaris</i>, <i>Cladophora glomerata</i> <i>Cladophora crispata</i>, <i>Cosmarium sp.</i>, <i>Cylindrocapsa sp.</i> <i>Coelastrum reticulatum</i>, <i>Drapernaldiopsis indica</i>, <i>Eudorina elegans</i>, <i>Hydrodictyon reticulatum</i>, <i>Microspora indica</i>, <i>Staurastrum sp.</i> <i>Nitella tenuissima</i>, <i>Oedogonium indicum</i> <i>Pandorina morum</i>, <i>Pediastrum simplex</i>, <i>Pediastrum duplex</i>, <i>Pediastrum tetras</i>, <i>Protococcus sp.</i> <i>Scenedesmus quadricauda</i>, <i>Spirogyra longata</i>, <i>Spirogyra acanthospora</i>, <i>Stigeoclonium tenue</i>, <i>Ulothrix sp.</i> <i>Volvox aureus</i>, <i>Zygnema pectinatum</i></p>
BACILLARIOPHYCEAE	<p><i>Actinastrum spp</i>, <i>Amphora spp</i>, <i>Cymbella affinis</i>, <i>Cyclotella spp</i>, <i>Diatoma elongatum</i>, <i>Fragilaria biceps</i>, <i>Gomphonema acuminatum</i>, <i>Melosira spp</i>, <i>Navicula</i> <i>rectangularis</i>, <i>Navicula radiosa</i>, <i>Nitzschia acicularis</i>, <i>Pinnularia viridis</i>, <i>Pinnularia tabulate</i>, <i>Synedra spp</i>, <i>Tabellaria fenestrata</i>.</p>
CYANOPHYCEAE	<p><i>Anabaena viridis</i>, <i>Aphanotheca pallida</i>, <i>Chroochoccus</i> <i>minutus</i>, <i>Calothrix indica</i>, <i>Cylindrospermum spp</i>, <i>Gleocapsa atrata</i>, <i>Gloeotrichia natans</i>, <i>Lyngbya spp</i>, <i>Microcystis aeruginosa</i>, <i>Nostoc</i> <i>pruniforme</i>, <i>Scytonema spp</i>, <i>Spirulina spp</i>, <i>Oscillatoria</i> <i>tenuis</i>.</p>
EUGLENOPHYCEAE	<p><i>Euglena viridis</i>, <i>Phacus acuminatus</i>.</p>

Micrographs of some Chlorophyceae members




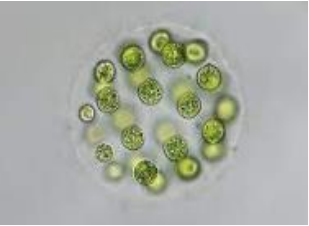

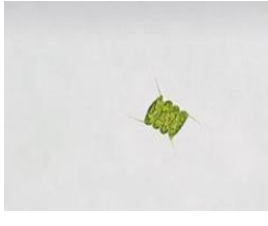
		
<i>Ankistrodesmus falcatus</i>	<i>Closterium ehrenbergii</i>	<i>Characium ambiguum</i>
		
<i>Eudorina elegans</i>	<i>Spirogyra longata</i>	<i>Scenedesmus bijunga</i>

Fig No-1; Indicating some of the dominant Chlorophyceae members

Micrographs of some Cyanophyceae members


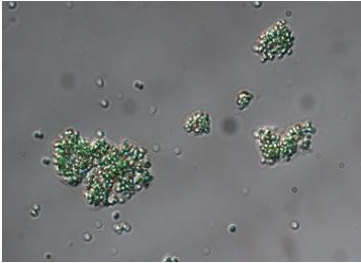

		
<i>Anabaena circinalis</i>	<i>Gloeocapsa atrata</i>	<i>Oscillatoria Tenuis</i>

Fig No-2; Indicating some of the dominant Cyanophyceae members

Micrographs of some Bacillariophyceae members

		
<i>Cymbella offinis</i>	<i>Synedra ulna</i>	<i>Gomphonema Lagenula</i>

Fig No-3; Indicating some of the dominant Bacillariophyceae members

Micrographs of some Euglenophyceae members

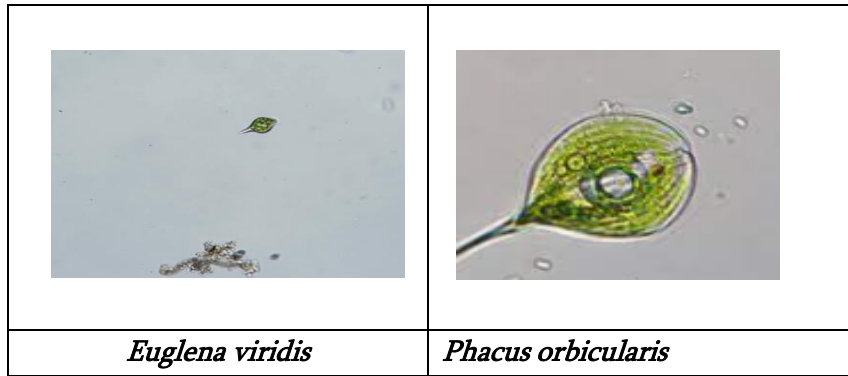


Fig No-4; Indicating some of the dominant Euglenophyceae members

IV. CONCLUSION

It would be obvious from present investigation algal biodiversity in selected fresh water lake showed seasonal changes throughout the study period and the genera recorded majorly belonged to Chlorophyceae and are dominant members followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. The increase and decrease in species diversity of Phytoplanktons during summer and monsoon seasons may be due to seasonal changes and water movement. The present study reveals that the Ramadugu lake water is clean, unpolluted and well aerated. There is no alarming deterioration in the quality of water. The investigation carried on these water bodies have shown a very significant distribution of algal flora. From the present study it may be concluded that Ramadugu lake investigated from Ramadugu village of Nizamabad district at present is free from pollution because the lake is distantly placed from human interference and development process is undertaken by irrigation department. Hence the water is clean and safe for pisciculture, domestic and agricultural purposes.

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V. REFERENCES

[1]. Naiman. R.J., Mognuson. J.J., Mcknight, D.M., and Stanford, J.A., (1995). The Fresh Water Island Press, Washington DC,

[2]. Palmer. M.A., Covich.A.P., Finlay. B.J., Gibert. J.,Hyder, K.D., Johnson, R.K., and Kairesalo, T. (1997). Biodiversity and ecosystem process in fresh water sediments. *Ambio*. 264(8).

[3]. Panday, S.N. (1993). Studies on distribution Periodicity and some ecological aspects of phytoplankton of Kanpur *Adv. Appl. Phycol.* II B:3-4.

[4]. Kumar, H.D., Bisaria, L.M., Bhandari, B.G., and Sharma, V., (1974). Ecological studies of algae isolated from effluent from a refinery, fertilizer factory and brewery, *Indian J., Environ. Health.* 16(3): 247-265.

[5]. Kumar, S. and Rai S.K, (2005). Contribution to the algal Flora (Chlorophyceae) of Namchi, Sikkim-Himalayas, *Our Nature*. 3; 50-55.

[6]. Katsiapi, M., Moustaka-Gouni, M., Vardaka, E. and Kormas, K.A., (2013). Different phytoplankton descriptors show asynchronous changes in a shallow urban lake (L. Kastoria, Greece) after sewage diversion. *Fundamental and Applied Limnology*, 182(3), pp.219-30.

[7]. Marshall HG (2013). Phytoplankton in Virginia lakes and reservoirs. *Virginia J Sci* 64:1-15.

[8]. Singh, L.D., Swamy, N.E., Swamy, B.K. and Rao, B.D., (2014). Freshwater algae of

- Laknavaram Lake from Warangal District, Telengana State, India. *J Algal Biomass Utln*, 5(4), pp.37-43.
- [9]. Misra SM., Pani s., Bajpai A., and Bajpai AK. (2001). Assessment of trophic status by using Moss, B., 1973. The influence of environmental factors on the distribution of fresh water algae. An experiment study The role of PH,CO₃ and the HCO₃ system. *J. Ecol.* 61: 157-177.
- [10]. Bronmark C,Hansson L-A(2017). *The Biology of Lakes and Ponds* second edition. Oxford University Press Oxford.
- [11]. Pawar, S.K., Pulle, J.S. and Shendge, K.M., (2006). The study on phytoplankton of Pethwadaj Dam, Taluka Kandhar, District Nanded, Maharashtra. *J. Aqua. Biol*, 21(1), pp.1-6.
- [12]. Ramachandra, T.V. and Solanki, M., (2007). Ecological assessment of lentic water bodies of Bangalore. *The Ministry of Science and Technology*, 25, p.96.
- [13]. Pearsall, W.H., Gardiner, A.C, Greenshields F. (1946). *Fresh water biology and water supply in Britain*. Sci. Pub.11 Fresh Water Biological Association., British Empire. 1-90.
- [14]. APHA, (2005). *Standard Methods for the examination of water and waste water*. AWWA, WPCF New York, 21st Edition.
- [15]. Fritsch, F.E.(1935). *The structure and reproduction of the algae*, Vol 1. Cambridge Univ. Press, London, 799 PP.
- [16]. Prescott, G.W. (1968). *The fresh water algae*. W.M.C.Brown Co., Publ. Dubuque,258 pp.
- [17]. Desikachary, T.V. (1959). *Cyanophyta*,ICAR, Monograph on Algae New Delhi,686.
- [18]. Vidyavati(2007). Biodiversity in Desmids. *Indian Hydrobiology*, 10(1): 27-33.
- [19]. M.R., and Venkateshwarlu. V. (1968). Desmids of Andhra Pradesh IV. From Dharmasagar Lakes, Warangal.J.,Osmania University (Science) Golden JubileenSpecial, 179-201.
- [20]. Mustafa, and Zubair Ahmed (1997). Environmental factors and planktonic communities of Baigul and Nanaksagar reservoirs, Nainital, *J. Bombay Nat. Hist Soc* 182: 13-21.
- [21]. Philipose, M.T., (1960). Freshwater phytoplankton of inland fisheries. In *Proceeding of the symposium on Algology* (Vol. 279, p. 291).
- [22]. Veerandra, D.N., Manjappa,S and Puttaiah, E.T.(2006). Diversity of plankton in Mani Reservoir,Hosanagar, Karnataka. *Indian Journal of Environment and Ecoplanning* (2):335-338
- [23]. Varma, M.C., Singh, S.K. and Thakur, P.K., (2001). Ecology of a perennial wetland: An overview of limnobiologic status. *Journal of Environment and Pollution*, 8(1), pp.53-59.
- [24]. Ramesh, B. and Aruna, M., (2015). Diversity of Fresh water algae in Trivenisangamam of Nizamabad District, Telangan state. India. *European journal of Botany, Plant sciences and Phytology*, 2(4), pp.31-37.
- [25]. Shailaja, A. and Aruna, M., (2016). Diversity of Phytoplankton in Agraharam Lake of Karimnagar District, Telangana State, India. *Life Sciences international research journal*, 3, pp.51-53.
- [26]. Srinivas, M. and Aruna, M., (2018). Diversity of Phytoplankton and Assessment of water in two lakes of Telangana state, India. *International Journal of Scientific Research in Science and Technology*, 4(10), pp.245-256.
- [27]. Rajyalaxmi, K. and Aruna, M., (2019). Distributional Status of the Diversity of Phytoplankton Population in Fresh Water Lake. *International Journal of Scientific Research in Science and Technology*, 6(1), pp.227-234.
- [28]. Anuradha, K. and Rao, N.B., (2021). Study of Physico-chemical parameters of Mominpet Lake in Vikarabad Dist., Telangana State., India. *Annals of the Romanian Society for Cell Biology*, pp.5717-5733.

- [29]. Raju Potharaju, M.Aruna, (2022). Phytoplankton Diversity of Shanigaram Lake, Siddipet District Telangana. International Journal of Creative Research Thoughts (IJCRT) 10(1), pp 291-297.
- [30]. Raju, P. and Aruna, M., (2021). Studies on some fresh water algae of Medchal lake in Telangana. International Journal of Research and Analytical Reviews (IJRAR) 8(3), pp 666-674.
- [31]. Srivastava, N., Suseela, M.R., Toppo, K. and Lawrence, R., (2018). Fresh water algal diversity of Central India. International Journal of Research and Development in Pharmacy & Life Science, 7(4), pp.3039-3049.

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