



Studies on algal diversity in Lower Manair Dam, Karimnagar, Telangana, India

L. Srinivas, Y. Seeta* and P. Manikya Reddy

Department of Botany, Osmania University, Hyderabad-500007, Telangana State, India. *Department of Environmental Science, Osmania University, Hyderabad-500007, Telangana State, India.

Abstract

Lakes are the important water resources and used for several purposes. The water quality of all fresh water environments is assessed by the physico-chemical and biological parameters. The present investigation is focused on the water quality and diversity of algae. In the present study, four groups of algae viz., Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae were identified. In the dam Bacillariophyceae was dominant among all other classes having maximum diversity followed by Chlorophyceae, Cyanophyceae and Euglenophyceae. The maximum growth of diatoms was recorded during winter, minimum values were attained during summer and rainy season. The dam water is extensively used for drinking and irrigational purposes.

Key words: Physico-chemical parameters, Manair dam, Phytoplankton and Diversity

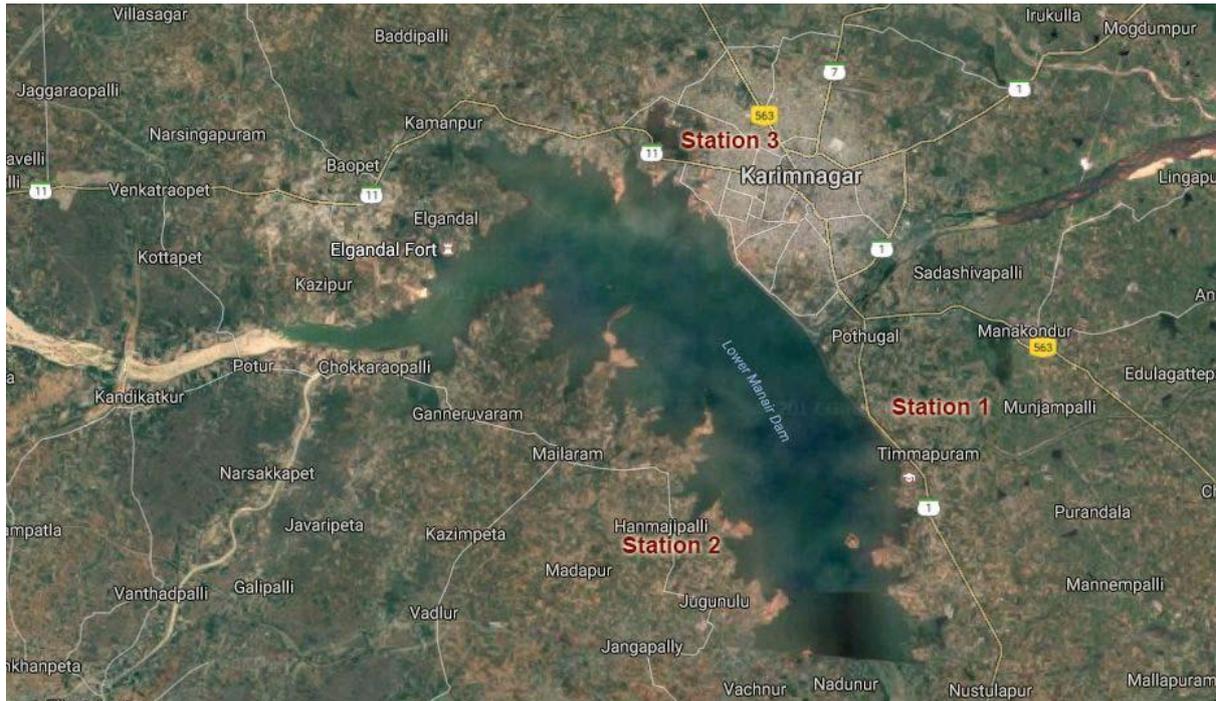
Introduction

In limnological studies, to determine the water quality in lake, pond, stream and river and to identify of algae that composed to primary productivity and to obtain this continuity are very important. Diversity of phytoplankton is an indication of purity and the use of community structure to assess pollution is conditioned by four assumptions: the natural community will evolve towards greater species complexity which eventually stabilizes; this process increases the functional complexity of the system; complex communities are more stable than simple communities, and pollution stress simplifies a complex community by eliminating the more sensitive species (Akbay *et al.*, 1999).

The physical and chemical characteristics of water bodies affect the species composition, abundance, productivity and physiological conditions of aquatic organisms. These stressed systems support an extraordinarily high proportion of the world's biodiversity. The phytoplankton in a reservoir is an important indicator of the water quality. Phytoplanktons are recognized worldwide as bioindicators in the aquatic environment (Yakubu *et al.*, 2000). Phytoplankton is one of the most essential characteristics of the aquatic ecosystem for maintaining its stability and a means of coping with any environmental change (Jayaraman *et al.*, 2003 and Tiwari *et al.*, 2004). Water maintains an ecological balance between various groups of living organisms and their environment (Kumar *et al.*, 2009). The main objectives of the study were to determine phytoplankton diversity and water quality in Manair dam and to study the effects of physico-chemical parameters on phytoplankton diversity.

Materials and Methods

Lower Manair Dam situated at Karimnagar District, Telangana state. The Lower Manair Dam is constructed across the Manair River at 18°24' N latitude and 79° 20' E longitude in Karimnagar District. Three sampling stations were selected for the collection of water and algal samples. The collected samples were brought to the laboratory for the analysis of various physico-chemical parameters. For phytoplankton one litre of surface water samples were collected from three different stations of the dam and samples were kept in the sedimentation column after adding 2-3 ml of 4% formaldehyde solution. The samples were concentrated to 100 mL. Finally, the concentrated material was used for frequency measurements and identification of species. For determining the frequency of different species of algae at each station, the drop method of Pearsall *et al.*, (1946) was followed.



LOCATION MAP – LOWER MANAIR DAM

Results and Discussion

The data collected on major water quality parameters is presented in table: 1. The range of pH is 8.0 to 8.8 at all the three stations. The pH values are indicating alkaline nature of water. The average values of carbonates are 31.38 mg/L, 25.31 mg/L and 33.74 mg/L at station I, station-II and station-III respectively. The bicarbonates concentration fluctuated between 224.26- 296.26 mg/L at all the stations. The dissolved oxygen was found higher in winter season and lower in summer season. Organic matter reached maximum concentration during summer at all the stations of the lake. The total hardness of Manair dam ranged between 69.33 to 193.67 mg/L.

In the present investigation the values of sulphate were fluctuated between 20.0 mg/L to 65.0 mg/L. The average values of silica were 3.34 mg/L at station-I, 3.52 mg/L at station-II and 3.54 mg/L at station-III respectively. The phosphates concentration fluctuated between 0.02- 0.09 mg/L at all the stations. The average values of nitrates were 2.30 mg/L at station-I, 1.75 mg/L at station-II and 1.79 mg/L at station-III. The concentration of total dissolved 261.70 mg/L at station-I, 307.50 mg/L at station-II and 340.70 mg/L at station-III respectively.

Seasonal variations among different classes of algae were found to be 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. Such an interrelationship between physico-chemical parameters and phytoplankton has been reported by Sharma (2009) and Priya Gopinath and Ajit Kumar (2014). In Lower Manair Dam Bacillariophyceae were dominated during the entire study period. Chlorophyceae members occupied second position, Cyanophyceae and Euglenophyceae occupied third and fourth positions (Figure-1).

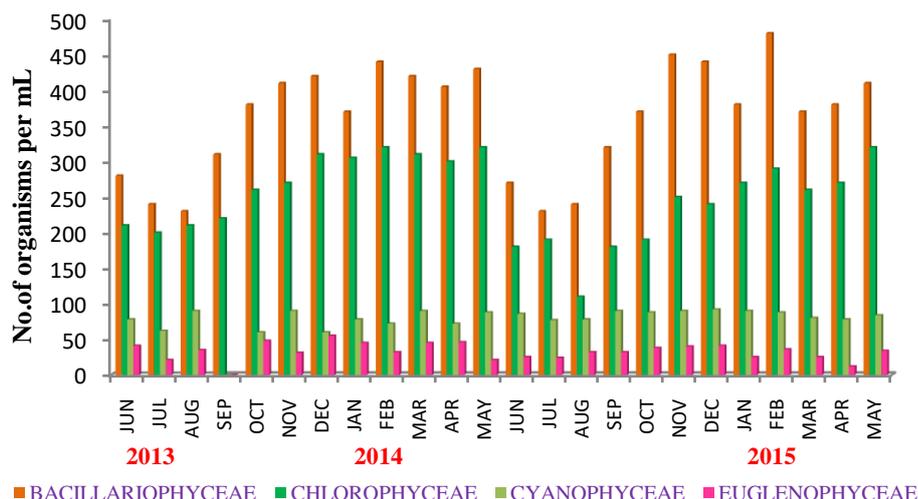


Figure-1. Diversity and Distribution of Phytoplankton

Linear Multiple Regression Analysis (MRA) is a statistical approach has been carried out in evaluating the relative importance of various physico-chemical variables on the growth and development of algal communities with SPSS software. Phytoplankton group is considered as dependent variable and physico-chemical parameters as predictors.

The diatoms constitute an important component of the fresh water or marine plankton, the environmental factor such as physico-chemical and biological factors influence the abundance and species richness of diatoms, which is reflected in their seasonal variations. The diatoms showed rich species diversity and distribution at all the stations and they were present throughout the period of investigation.

According to Pearsall (1946) and Tiwari *et al.*, (2006) the temperature is the most important factor which affects the growth of diatoms. pH, calcium and silica exhibited positive influence on the growth of diatoms phosphates and organic matter has exerted a negative influence on the growth of diatoms. The lake with higher silica concentration has denser diatom population and harboured greater number of diatom species (Mustapha, 2008 and Jena *et al.*, 2006). Calcium is found to be one of the most important factors influencing the distribution of diatoms in water bodies (Hosmani and Shankar, 2010). 58 species of diatoms, 32 species of green algae and 14 species of Cyanophyceae were recorded. The diatoms consists of *Synedra tabulata*, *Achnanthes microcephala*, *Gomphonema montanum*, *Coconeis placentula*, *Amphora ovalis*, *Cymbella affinis*, *C. turgida*, *C. delicatula*, *C. cymbiformis*, *Mastogloea smithii*, *Pinnularia biceps*, *Rhopalodia gibba*, *Nitzschia denticula*, *Navicula cryptocephala* and *Navicula rhynchocephala*.

In the present study Chlorophyceae occupied second position in order of dominance in the lake at all the stations. Seasonal variations in members of Chlorophyceae showed maxima in summer months (June) and minima in winter (January, February) at all the study stations. High Chlorophycean count registered during summer months may be due to low DO and bicarbonate level prevailing during these periods, which favors its quick growth (Misra *et al.*, 2001). The green algae were present throughout the period of investigation.

Dissolved oxygen, phosphate, nitrate and pH are the most significant parameters for the growth and diversity of Chlorophyceae in the present investigation. Chlorophyceae represented in greater numbers during summer months. This is in conformity with Manikya Reddy and Venkateswarlu (1992) and Pawar *et al.*, (2006). Temperature, pH, biochemical oxygen demand and phosphates were showed negative influence on the growth of Chlorophyceae. The positive influence of chlorides, DO and negative influence of phosphates on algal growth also observed by Misra *et al.*, (2001) and Pulla Reddy (2004). Chlorophyceae are represented by the species of *Pediastrum boryanum*, *Oocystis crassa*, *Golonkinia radiata*, *Coelastrum cambricum*, *Oocystis elliptica*, *Tetraedron regulare*, *Scenedesmus acutiformis*, *S. armatus* and *Selenastrum gracile*.

Cyanophycean members are the most abundant in habitats, which are rich in organic matter having lower oxygen concentration. Silica, organic matter and bicarbonates have showed positive influence on the growth of Cyanophyceae. The positive influence of chlorides, DO and negative influence of phosphates on algal growth also observed by Misra *et al.*, (2001) and Pulla Reddy (2004). In the present investigation the blue-greens constituted the low number of phytoplankton; this group is mainly represented by the species of *Merismopedia*

glauca, *Gomphosphaeria aponina*, *Anabaena unispora*, *Oscillatoria princeps*, *O. Margarifera* and *Chroococcus turgidus*.

Euglenophyceae contribute minor fraction of the phytoplankton of the Manair Dam. Euglenophyceae members tolerate low oxygen tensions and phosphorous is the most rapidly and commonly limiting nutrients (Sharma, 2009). Higher concentration of chlorides, total dissolved solids and lower concentration of phosphates favour the growth of Euglenophyceae. In the present study all the stations *Euglena* and *Phacus* species were present.

Conclusions

In the Lower Manair Dam four groups of phytoplankton were recorded. Among the four groups Diatoms were dominant and showed rich diversity followed by Chlorophyceae. Among the biological parameters the algal data has been used as an important tool in lake study. The maximum growth of diatoms were recorded during winter, minimum values were attained during summer and rainy season. *Mastogloia smithii*, *Amphora ovalis*, *Rhopalodia gibba*, *Gomphonema montanum*, *Navicula cryptocephala*, *Synedra ulna*, *Cymbella tumida*, *Cymbella aspera*, *C. affinis*, *C. cymbiformis* were dominant. The presence of all these species indicates the clean and unpolluted nature of the lake, as they are very sensitive to pollution. Both physico-chemical and biological data analyzed in the Manair Dam indicates that the lake is at present free from pollution and the quality of water is good. Hence, it can be safely used for different purpose such as drinking, domestic and agriculture purposes.

Acknowledgements

The authors wish to thank Head, Department of Botany for providing research facilities and one of the authors is thankful to Department of Science and Technology, Government of India for providing the research fellowship.

References

- Akbay, N., Anul, N., Yerti, S., Soyupak, S. and Yurteri, C. 1999. Seasonal distribution of large phytoplankton in Keban dam reservoir. Plank. Res., 21(4): 771-787.
- Hosmani, Shankar, P., 2010. Phytoplankton diversity in Lake of Mysore district, Karnataka state, India. The Ecoscan, 4, 53-57.
- Jayaraman, P.R., Ganga Devi, T. and Vasudevan Nayar, T. 2003. Water quality studies on Karamana River, Thiruvananthapuram district, South Kerala. Ind. Pollut. Res. 22: 89-100.
- Jena, M., Ratha, S.K., and Adhikari, S.P., 2006. Diatoms (Bacillariophyceae) from Orissa state and neighbouring regions, India, 377-392.
- Kumar, A. Sharma, L.L. and Aery, N.C., 2009. Physico-chemical characteristics and diatom diversity of Jawahar Sagar Lake, Bundi – A Wet land of Rajasthan. Sarovar Saurabh Vol. 5(1): 8-14.
- Manikya Reddy, P. and Venkateswarlu, V., 1992. The impact of paper mill effluents on the algal flora of the river Tungabhadra. J. Indian. Bot. Soc. 71: 109- 114.
- Misra, P.K., R.K. Mehrotra, Jai Prakash and A.K. Shrivastava, 2001. Fresh water green algae from Basti district, Uttar Pradesh, Geophytology, 31(1&2):1-7.
- Mustapha, M. K., 2008. Assessment of the water quality of Oyum reservoir of Nigeria using selected physico-chemical parameters. Turkish Journal of Fisheries and Aquatic Science, 8; 309-319.
- 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: 1-6.
- Pearsall, W.H., 1946. Fresh water biology and water supply in Britain. Sci. Pub. II, Fresh Water Biol. Asso., British Empire. 1 - 90.

Priya Gopinath, T. and Ajit Kumar, K.G., 2014. A Study On The Physico-Chemical Parameters And Diversity Of Phytoplankton In Vellayani Lake, Thiruvananthapuram, Kerala, India. Journal of Aquatic Biology and Fisheries Vol. 2 pp. 489 to 492
Pulla Reddy, P., 2004. Limnological studies on Ramanpad Lake with reference to water quality. Ph.D. Thesis, Osmania University, Hyderabad.

Sharma, B.K., 2009. Composition, abundance and ecology of phytoplankton communities of Loktak Lake, Manipur, India. J. Threat. Taxa, 1 (8): 401- 410.

Tiwari, S., Dixit, S. and Gupta, S.K. 2004. An evaluation of various physico-chemical parameters in surface waters of Shahpura Lake, Bhopal. Pollut. Res. 23: 829-832.

Yakubu, A.F., Sikoki F.D., Abowei J.F.N., and Hart S.A. 2000. A comparative study of phytoplankton communities of some rivers, creeks and burrow pits in the Niger delta area. J. Applied sci. Environ Manage. 4: 41-46.

Table -1 Average Values of Physico-Chemical Parameters

(All values are expressed in mg/L except pH and Temp (°C))

Parameters	Station - I	Station - II	Station - III
pH	8.43	8.26	8.42
CO ₃ ²⁻	31.38	25.31	33.74
HCO ₃ ⁻	255.80	259.72	246.31
Cl ⁻	135.57	133.70	136.87
DO	8.78	9.41	9.93
OM	1.30	1.58	1.22
TH	158.70	208.13	172.44
Ca ²⁺	54.86	44.48	42.86
Mg ²⁺	25.32	39.86	31.41
SO ₄ ²⁻	36.47	34.69	34.30
PO ₄ ³⁻	0.05	0.06	0.069
SiO ₂	3.34	3.52	3.54
NO ₃ ⁻	2.30	1.75	1.79
TDS	261.70	307.50	340.70