Composition, Density and Diversity of Phytoplankton in Rathicheruvu, BhadradriKothagudem, Telangana, India

Abstract

The current study deals with composition, density and diversity of phytoplankton during January 2023 to December 2023monthly in the Rathicheruvu, BhadradriKothagudem, Telangana, India. Samplings were collected from different locations of the study site during aone year research period. Several physico-chemical parameters were studied from two sampling stations such as water temperature, pH, DO, BOD, SO4, NO3, PO4 and Cl^-, of which pH, DO and BOD were shown to be the most significant in growth and development of phytoplanton. In the current study revealed a total number of 43 species of phytoplankton belonging to four major classes i.e. Chlorophyceae with 16 species, Bacillariophyceae with 14 species, Euglenophyceae with three species and Cyanophyceae with 10 species. The maximum population of phytoplankton diversity was observed during summer followed by monsoon with a total 1058 phytoplankton species during one year of study period. Finally the study showed that the study site has a well balanced phytoplankton community.

Key words: Phytoplankton community, Diversity indices, Aquatic ecosystem.

Introduction

The Rathicheruvu is a minor irrigated freshwater ecosystem situated at the lap of the hill Paloncha and surrounded by hill forest. The lake being studied is an important part of the water that is subjected to some degree of cultural eutrophication and is therefore considered to be more appropriate production studies in its restoration scheme.

The Rathicheruvu have played a significant role in the district's tribal and economic progress during the past three decades. Without the Rathicheruvu the villagers and tribal would have been thirsty, hungry, dark land and draughts. Reason to do research on this, the Lake occupies about 3.8% of the district's geographical area and a good place for tourists as it has a wide variety of flora and fauna and aquatic plants. The study area stores precious rainwater to irrigate farmlands, supply drinking water and save surrounding villages from floods and draughts. Two sampling stations from Rathicheruvuwere taken into consideration for the present study. Nowadays, Environmental change and global warming are a threat to mankind's security. The availability of various water systems and food chains are even more important.

Phytoplankton is one of the tiny and most abundant organisms living in lakes, which play a key role in aquatic ecosystems. In addition to being involved in photosynthesis, they form a food base for other living beings in aquatic ecosystems. Their absence and high growth is detrimental to water resources. There are many aspects to this that affect the growth and diversity of Phytoplanktons. The main reason for the change in species diversity and population abundance is the key changes in the surrounding environment. Less or no research studies on water quality and phytoplankton availability in Rathi Lake have been done. Hence, current research has fully studied the Phytoplanktons, water quality and resources of this lake.

Materials and Methods

The Topography of the study site is usually referred to for rolling with frequent mounds, hills are seen. The area is bounded by $17^{0}35^{'}30^{''}$ N and $80^{0}70'57''$E at Paloncha area,

BhadradriKothagudem, Telangana State. The Lake is very close to the hill station as it is very far from the transport and as well as pollution. That is why the aquatic plants and animals in this Lake look very healthy. The water from the study site is being used for drinking, and irrigation purposes. Water samples were collected on a monthly basis from the Lake for a period of one year January to December 2023 at Rathicheruvu. The Lake is around 100 years old water body associated with an ancient temple.

Collection of Samples

The water samples for phytoplankton analysis were collected separately in wide mouth reagent bottles with the help of plankton nets of 55 µm mesh size with some amount of Lake Water and immediately preserved in 4% formalin solution. The samples were collected from different locations of the study site, samplings were done in monthly interval in early morning hours and brought to the Laboratory and stored in Low temperature as followed by **Mittal and Sengar (1991).**

Isolation

Isolation of phytoplankton is made through a subsequent serial dilution process **(Vincent 1970).** For isolation of Unicellular and Filamentous Algae different dilutions were prepared. The individual phytoplankton colonies were picked up and transferred to the 4% formalin solution in flasks.

Seasonal Succession

Phytoplankton community in the study site showed major patterns of seasonal succession. Cyanophyceae (*Microcystis aeruginosa*) dominate in winter, Bacillariophyceae (*Synendra ulna*)

dominate in the whole summer. Overall algal development is the minimum amount during the rainy season.

Identification

The phytoplankton Identifications were made with the help of relevant standard available literatures and Monographs of **Desikachary (1959),Iyengar** and **Desikachary (1981),Anand (1988)**, **Misra (2008)** and **Dwivedi (2009)**. The count of phytoplankton was done by using the Sedwick Rafter plankton counting cell. Main important physico-chemical characteristics of water including water temperature, color, pH were analyzed onsite using mercury thermometer, visual, digital pH meter respectively. While dissolved oxygen and Total dissolved solids were analyzed onsite with water quality monitoring kit at the sampling sites. Rest of the parameters was analyzed according to standard methods (**APHA, AWWA, and WEF, 2005**).

Figure. 1. RathiCheruvu

Figure. 2. Map of Telangana State

Figure. 3. Map of BhadradriKothagudem District

Result and Discussion

All the collections from the study site recorded a pH value above 7.0. Dissolved oxygen is an important indicator of water quality which also determines the distribution and abundance of

phytoplankton population. In the present lake investigated the value of dissolved oxygen was found above 6.8 mg/l indicating the satisfactory range. Organic matter, total hardness, Calcium and Magnesium were indicating the satisfactory range (Table1).

Table – 1

Annual averages of physical – chemical parameters of RathiCheruvu.

S.No.	Physico – Chemical Parameters	Mg/l
1	Temperature (^{o}C)	29.19
2	pH	7.85
3	CO_3^{2-}	23.54
4	HCO_3^{-}	114.84
5	Cl^{-}	95.76
6	DO	8.49
7	BOD	9.25
8	TH	81.87
9	Ca^{2-}	42.25
10	Mg^{2+}	20.18
11	PO_4^{3-}	0.025
12	SiO_2	7.41

The study in water bodies of RathiCheruvu showed a rich diversity of phytoplanktons belonging to various classes. The list of phytoplankton collected from the study area is presented in Table.2. The total number of Phytoplankton consisted of 43 taxa belonging to Chlorophyceae (16 species), Bacillariophyceae (14 species), Euglenophyceae (three species) and Cyanophyceae (10 species) (Table 2 and 3).

Table – 2

Composition of Phytoplankton in RathiCheruvu.

Class	Organisms / ml	Percentage Composition
Chlorophyceae		
Ankistrodesmusfalcatus(Corda) Ralfs	28	9.03
*Chlorella vulagris*Bayerinck	61	19.67
Cladophoraglomerata(L.) Kutz	21	6.77
*Closteriumdianae*Ralfs	05	1.61
*C. elegans*Brebisson	05	1.61
*C. regulare*Brebisson	04	1.29
Monoraphidiumarcuatum(Korshikov)	11	3.54
Mougeotiascalaris Hass.	02	0.64
Netriumdigitus Ehrenberg ex Ralfs	05	1.61
Pediastrum tetras Ehrenberg ex Ralfs	101	32.58
Scenedesmusarmatus(Chod) G.M. Smith	06	1.93
*S. quadricauda*Brebisson	08	2.58
Spirogyra macrospora(C.B.Rao) Krieger	14	4.51
*S. singularis*Nordstedt	11	3.54
*Ulothrixlimnetica*Lemmermann	16	5.16
*Zygnemasubcylindricum*Krieger	12	3.8
Bacillariophyceae		
Achnanthes inflate(Kutz) Grun	15	2.77
*Cyclotellaglomerata*Bachm	18	3.33
*Cymbellacymbiformis*Ag	16	2.96
*C. turgidula*Grun	42	7.77
*Diatomatabulatum*Agardh	60	11.11
*Fragillariapinnata*Her	28	5.18
*Gomphonemalenceolatum*Ehr	45	8.33
*G. olivaceum*Kutz	32	5.92
*Melosiravarians*Her	54	1.0

*Naviculacryptocephala*Kuetz	46	8.5
*Nitzschiadubia*W. smith	14	2.5
*Pinnulariagibba*Her	28	5.1
P. major (Kutz) Rabenhorst	21	3.8
Synendra ulna (nitzsch) Ehr	121	22.40
Euglenophyceae		
Euglena acus Huebner	10	32.25
E. elastic Prescott	11	35.48
*Phacusnordstedtii*Lemmermann	10	32.25
Cyanophyceae		
*Anabaena circinalis*Rabenhorst ex Born.	15	8.47
*A. sphaerica*Born	14	7.90
Gloeocapsagigas W. & GS West	03	1.69
Gloeocystisampla(Kutz) Rabenhorst	08	4.51
*Lyngbyaceylanica*Wille	14	7.90
*Microcystis aeruginosa*Kutz	43	24.29
*M. flosaquae*Kutz	21	11.86
Oscillatorialimosa Ag	21	11.86
*O. princeps*Vaucher	24	13.55
*Phormidiuminundatum*Kutz	14	7.90

Table – 3

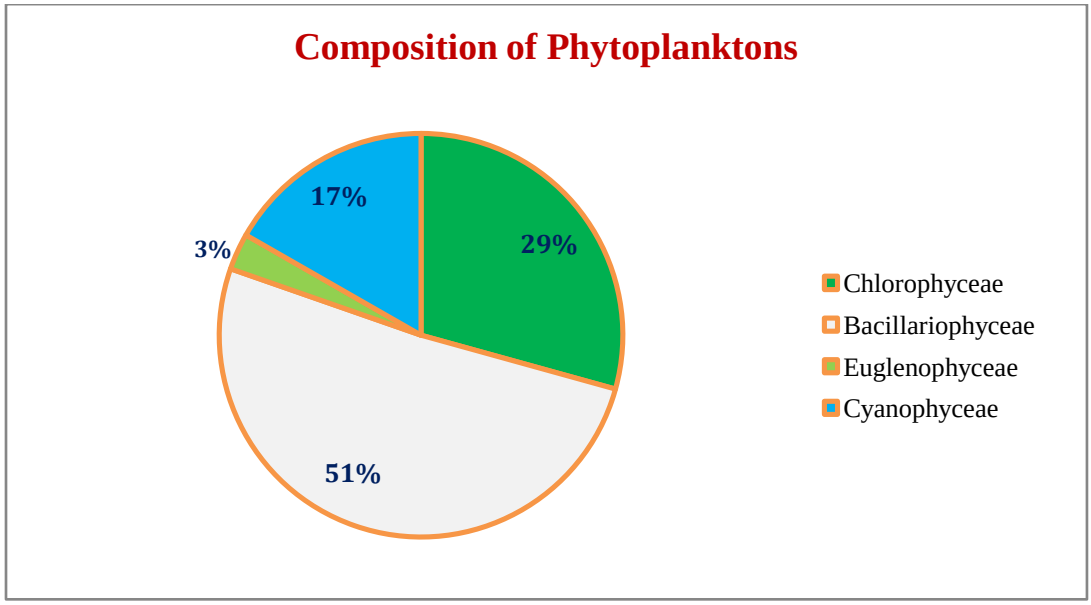
Phytoplankton species in RathiCheruvu.

Class	**Organisms / ml**	**Percentage Composition**
Chlorophyceae	310	29.30

Bacillariophyceae	540	51.03
Euglenophyceae	31	2.9
Cyanophyceae	177	16.72

Figure-4.

Composition of Phytoplankton



Phytoplankton shows the level of water quality as bio-indicators and also indicates diversity in the aquatic ecosystem **(Rajyalaxmi and Aruna 2019).** The distribution of phytoplankton exclusively depends upon the chemical parameters of the water, available nutrients and substrata (**RashmiPareek, 2011)**. Bacillariophyceae members are the most significant colonizers of the river stones (**Alakanada, 2011**). In the present investigation revealed that Diatoms dominated over the other group of phytoplanktons (Fig.-4).

Table – 4

Phytoplankton diversity Indices response to the Trophic state of the RathiCheruvu.

S.No.	Biodiversity indices	Diversity Value
1	Shannon's Diversity Index (H)	1.11
2	Shannon's Equitability Index (EH)	0.797
3	Simpson's Index (D)	0.37
4	Simpson's Evenness	0.66
4	Margalef Richness Index (d)	3.29

Table – 5

Correlation coefficient of phytoplankton in Rathicheruvu

Class	Chlorophyceae	Bacillariophyceae	Euglenophyceae	Cyanophyceae
Chlorophyceae	1			
Bacillariophyceae	0.002057	1		
Euglenophyceae	-0.06617	0.021825	1	
Cyanophyceae	-0.00619	0.572826	-0.48758	1

The development of integrated phytoplankton diversity indices is beneficial for environmental regulation in hydrological related aquatic lifestyle.

The phytoplankton diversity calculated and the indices were represented in Table.3. The Margalef diversity index (d) revealed the highest index value (3.29). Shannon's (1.11) and Simpson's index (0.37) followed the similar pattern. Correlation coefficient was calculated among the phytoplankton and represented in Table.5, insignificant correlation was observed.

Conclusion

Diversity indices provide significant information regarding uncommonness and commonness of phytoplankton in a community. Diversity indices are a significant tool to understand community structure. As a result the present study concludes that the diversity of phytoplankton not only

plays a major role in formation of the aquatic community and uniqueness in the study site it can also be a good indicator of environmental assessment. Anyhow the composition, density and diversity of phytoplankton in this polluted environment are at a very satisfactory level.

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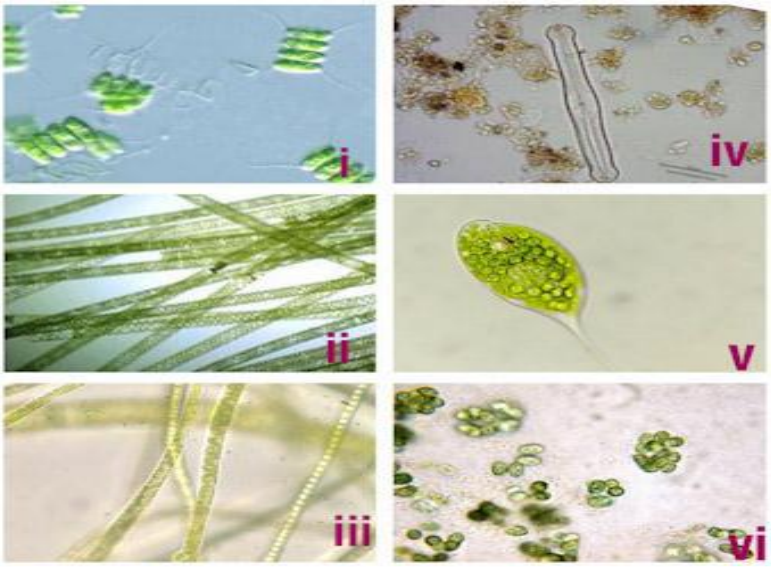
Plate-1. Microphotograph of Phytoplankton



i. Scenedesmusarmatus **(Chodt)**

ii. Spirogyra macrospora **(C.B.Rao) Krieger**

iii. Ulothrixlimnetica**Lemmermann**

iv. ***Pinnulariagibba*** **Ehrenberg**

v. ***Phacusnordstedtii*****Lemmermann**

vi. ***Microcystis aeruginosa*** **Otsuka**

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