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Distributional Status of the Diversity of Phytoplankton Population in Fresh Water Lake

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ABSTRACT

Phytoplanktons are primitive, usually aquatic, photosynthetic and delightful organisms in their diversity and efficacy. Phytoplankton comprises a well-organized system for trapping the solar energy. These miniature amaze ball phykos alone contribute 90% of the total oxygen produced by the plant kingdom. They are prime manufacturers in water ecology and play a crucial role in converting sewage and waste water into beneficial biomass. Most of the Phytoplanktons grow in different water bodies such as ponds, pools, ditches, lakes, reservoirs, rivers and oceans. But some of them are common and widespread in habitat of the soil surface layer wherever moisture and sunlight are available. The main aim of the present study was to explore the phytoplankton from Singabhupalem Lake, study the diversity pattern and assess quality of the lake. In the present study a total number of 75 taxa of fifty-three genera, thirty families and fifteen orders of phytoplankton belonged to four classes such as Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae were recorded. The phytoplankton diversity study provided several new data with many of the phytoplankton taxa being recorded for the first time in study site, such as 32 taxa among the Chlorophyceae, 21 taxa of the Bacillariophyceae, 17 taxa of the Cyanophyceae and 5 taxa of the Euglenophyceae. The present observations revealed that Chlorophyceae species were dominant followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae.

Keywords : Phytoplankton Diversity, Distributional Status and Singabhupalem Lake

I. INTRODUCTION

Phytoplankton are largely autotrophic organisms relying upon photosynthesis to convert light into chemical energy which is then stored in organic compounds. Photosynthesis in addition to carbon and light, requires both macro (e.g. N and P) and micro nutrients (e.g. Fe and Zn) in the environment. The rate of biomass production of an aquatic ecosystem mainly depends upon diversity of Phytoplanktons. Algae are involved in water pollution in a number of significant ways. Pollution may bring about an environment of the algal nutrients in water and this may selectively stimulate the growth of a few types, producing massive surface growths or “blooms” that in turn reduce the water quality and effect its use. Certain algae are to flourish in water polluted with organic wastes and to play an important role in “self purification” of the water. The selective type of algae that exists in polluted water also is being used as indicators of collection of animal drinking the water or living in it. Since algae constitute part of a chain of aquatic life in the water whatever alters the number and kinds of algae affects all of the other organisms, including fish. Thus it requires a continuous monitoring and study of algae existing in waters of

various quality in order to determine what control, what changes or what uses be instituted for the benefit of man and for conservation of water and desirable aquatic life. The present lake was the important component of water system of Kothagudem area.

The term 'Water Quality' deals the physico-chemical and biological specification of water and directly or indirectly impacts the survival of aquatic species (Kohinoor, 2000). Natural environmental factors in aquatic ecosystem include various Physico-chemical characters of water such as colour, odor, pH, temperature, DO, BOD and COD which is necessary for growth and abundance of Phytoplanktons. Phytoplankton members also act as indicators of water purity and quality because of their susceptibility and effectual response to changes in their neighbouring environment (*Siddika*, 2012).

II. METHODS AND MATERIAL

Study area: Conventionally accessibility of nutrients and sedimentation were considered as the main driving force of algal communities' aquatic ecosystem. In the present work an attempt what made to document the phytoplankton diversity. For the proposed work, the major irrigation fresh water lake was selected and their physico chemical parameters and biological analysis was completed. Selected lake, Singabhupalem is situated at Kothagudem area, Bhadradri Kothagudem district and Telangana state. Lake is geographically located at latitude $17^{0}29^{1}6^{11}$ N and longitude $80^{0}33^{1}13^{11}$E. This is major fresh water lake which gets filled during rains. The lake was free from any shading and has sufficient sunlight throughout the day.

The size of the lake and their respective characteristics were shown in **Table-1**. Four stations were selected as shown in **Table -2**

Table 1: Morphometric characteristics of the Singabhupalem Lake

Dimensions (m)	280.0 X 320.0
Size (acres)	15 acres
Depth (m)	10m
Capacity (m^3)	38321.8

Table 2: List of Four Stations

Station	Location
Station-I	East
Station-II	North
Station-III	West
Station-IV	South

Analytical methods and Techniques : Physico-chemical and biological water quality was measured from the sample lake. Samples were taken from site once in a month between 6.00 a.m. to 9.00 a.m. for a period of 12 months from January to December 2017.

- ***On site analysis:*** On site analysis of temperature, pH, Color, Odor were carried out at the standard protocols, methods and techniques of American public health association
- (APHA). Color by visible and odor by sensible method. The pH of the water sample was analyzed by using classical method at site and a digital pH meter at laboratory. The volume of water sample was taken after a couple of minutes to achieve a stabilizing reading. PH of solution is taken as logarithm of hydrogen ions, value ranging from 0 to 7 is acidic, 7 to 14 is alkaline, and value 7 is neutral. Mainly lake water pH range from 4.8

to 8.5. pH was measured by using digital pH meter, temperature measured with mercury filled glass thermometer, transparency was measured with Secchi disk.

- *Laboratory analysis :* The chemical analyses were carried out by following the methods of APHA (1998) and CSIR (1974).

The present study was undertaken to elucidate phytoplankton diversity of selected lake in Kothagudem area with reference to water quality parameters. The main objective of this work is to study the distribution and diversity of Phytoplanktons in Singabhupalem Lake. For analysis of phytoplankton water samples were collected monthly wise (January to December 2017) from four stations (Station- I, II, III, & IV) of selected lake. Collected samples were mixed thoroughly and taken 5ml in plankton chamber contain few drops of Lugol's solution. Lugol's solutions was used to enhance sedimentation of the Phytoplanktons and were fixed immediately with 4% formaldehyde which was used as a fixative agent, fixed phytoplankton samples were allowed to settle for 24 hours kept in laboratory and the supernatant was collected carefully for analysis. Phytoplankton species observed under Olympus Binocular microscope and identified by using standard plankton determination keys.

III. RESULTS AND DISCUSSION

Water quality parameters colour, odor, pH, Temperature, DO, BOD and COD were measured and species were identified belonging to classes Chlorophyceae with 32 taxa, Bacillariophyceae with 21 taxa Cyanophyceae with 17 taxa and Euglenophyceae with 5 taxa **(Table -3).** Distribution of Phytoplankton in four stations of Singabhupalem Lake is focused in **Fig -1**.

The water temperature varied from 21^0 C to 38^0 C. the pH value varied from 7.0 to 8.5 in study period, the DO value ranged from 3.8 mg/l to 6.5mg/l, the biological oxygen demand varied from 5.8 to 13.6mg/l, while chemical oxygen demand values ranged from 0.1 to 1.1mg/l.

Table 3 : List of identified Phytoplankton species from four stations of Singabhupalem Lake during January - December 2017 (No. Of Species per ml).

Name of the Species	January – December 2017				
	Station - I	Station -II	Station- III	Station-IV	Total
Chlorophyceae					
Actinastrum gracillimum	60	32	14	56	**162**
Ankistrodesmus spiralis	11	35	12	-	**58**
Chara vulgaris	59	65	34	52	**210**
Characeum ambiguum	43	21	26	54	**144**
Chlamydomonas globosa	21	32	23	21	**97**
Chlorella ellipsoidea	28	24	-	-	**52**
C.vulgaris	112	67	65	32	**276**
Cladophora oligoclona	43	35	39	39	**156**

C. glomerata	34	43	44	48	**169**
Closterium decorum	65	54	56	65	**240**
C. dianae	67	45	34	12	**158**
Coleochaete orbicularis	36	35	41	34	**146**
Cosmarium portianum	45	43	45	30	**163**
C. depressum	43	-	-	-	**43**
C. exiguum	46	38	34	54	**172**
Eudorina elegans	26	24	22	15	**87**
Hydrodictyon reticulatum	32	43	34	24	**133**
Oedogonium gigantium	34	45	34	34	**147**
Padiastrum angulosum	24	32	35	43	**134**
P.duplex	28	38	34	16	**116**
P.simplex	37	36	54	21	**148**
Pandorina morum	32	26	15	11	**84**
P.cylindricum	15	17	27	32	**91**
scenedesmus acuteformis	42	58	98	-	**198**
S. denticulatus	56	98	56	-	**210**
S. quadricauda	-	-	32	-	**32**
Spirogyra crassa	83	94	56	54	**287**
S. parvispora	32	28	42	32	**134**
Tetraedron bifercatum	-	-	35	-	**35**
Ulothrix Mcylindricum	28	23	27	19	**97**
Volvox aureus	54	123	24	32	**233**
Zygnema pectinatum	43	28	58	43	**172**
Total	**1279**	**1282**	**1150**	**873**	**4584**
Bacillariophyceae					
Achnanthes inflata	-	32	35	-	**67**
Amphora coffoeformis	42	32	22	-	**96**
Cyclotella meneghiniana	32	33	43	25	**133**
Cymbella aspera	42	23	43	-	**108**
Eunotia camelus	-	-	-	32	**32**
Fragillaria crotonensis	32	54	21	23	**130**
Gamphonema constrictum	25	34	56	31	**146**
Melosera granulata	16	-	-	-	**16**
Navicula capitatoradiata	54	26	42	32	**154**
N. cincta	45	29	56	-	**130**
N. cryptocephala	22	25	19	11	**77**
N. lanceolata	32	23	12	24	**91**
Nitzschia denticula	32	35	38	-	**105**
N. palea	24	32	23	-	**79**

Pinnularia abaujensis	32	23	25	23	**103**
P. acrosphaeria	36	24	-	-	**60**
P. bravicostata	21	21	21	12	**75**
P. graciloides	17	24	16	-	**57**
Stauronensis anceps	24	21	16	-	**61**
Synendra acus	27	23	18	-	**68**
S. rumpens	14	18	21	-	**53**
Total	**569**	**532**	**527**	**213**	**1841**
Euglenophyceae					
Euglena pascheri	27	14	21	32	**94**
E. polymorpha	23	11	21	12	**67**
E. Sanguinea	-	18	-	23	**41**
Phacus orbicularis	15	24	27	42	**108**
Trachelomonas acanthostoma	23	17	19	22	**81**
Total	**88**	**84**	**88**	**131**	**391**
Cyanophyceae					
Anabaena iyengarii	23	21	14	-	**58**
Aphanocapsa grevillei	21	21	17	18	**77**
Chroococcus disperses	23	25	21	21	**90**
C. minor	23	23	20	12	**78**
Gloeocapsa atrata	23	25	15	-	**63**
Gloeotrichia ghosei	25	-	32	23	**80**
Hydrococcus rivularis	16	24	-	-	**40**
Lyngbya majuscula	23	-	13	15	**51**
Mycrocystis aeruginosa	21	25	24	-	**70**
Nostoc muscorum	22	21	15	9	**67**
Oscillatoria obtusa	32	23	25	21	**101**
Phormidium molle	19	21	17	18	**75**
Scytonema subtile	13	9	-	23	**45**
Spirulina gigantea	21	21	23	26	**91**
Stigonema turfaceum	23	27	32	34	**116**
Tolyphothrix distorta	26	32	23	26	**107**
Trichodesmium erythraeum	23	18	16	21	**78**
Total	**377**	**336**	**307**	**267**	**1287**

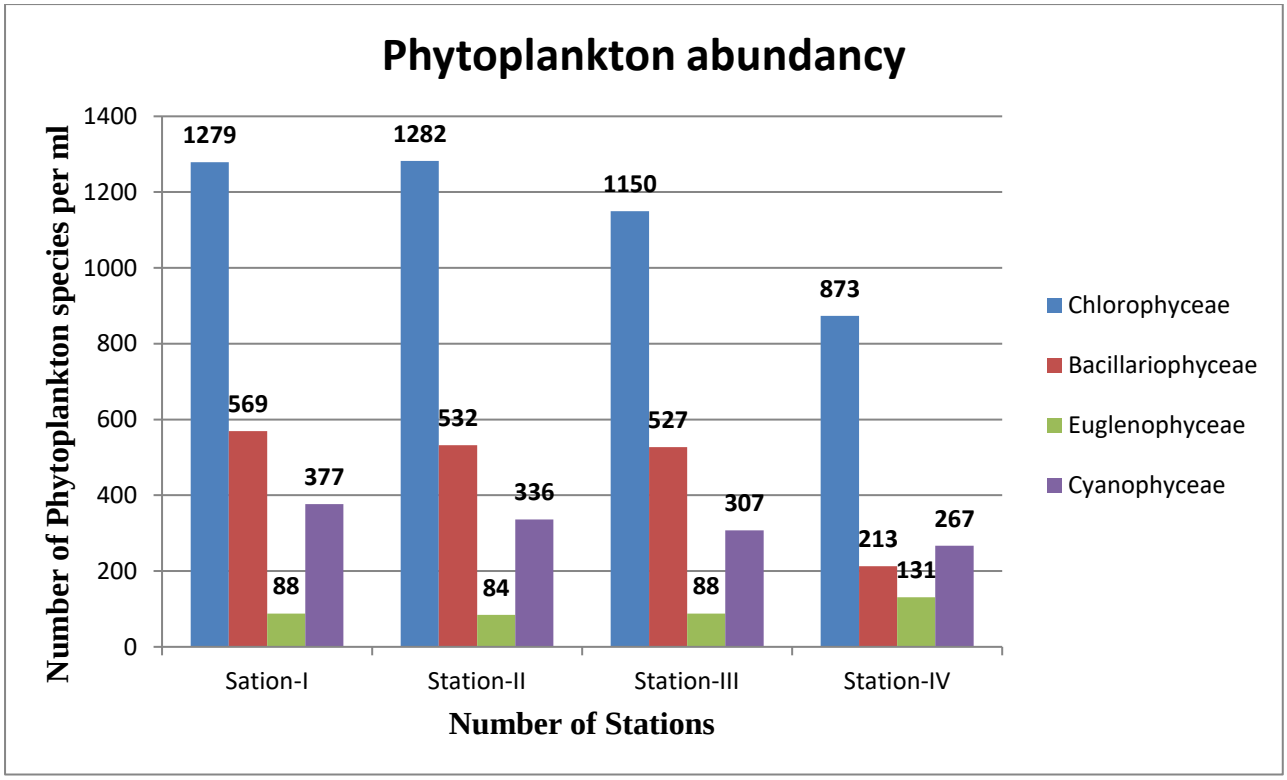


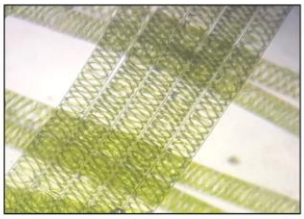
Figure 1. Distribution of Phytoplankton species in four stations of Singabhupalem Lake.

75 species of Phytoplankton belonging to 4 classes were identified from the four sites of lake during the study period. The largest class was Chlorophyceae represented 32 species, followed by Bacillariophyceae with 21 species, Cyanophyceae with 17 species and the least was Euglenophyceae contributing 5 species. Phytoplankton diversity richness was highest in Station-I and least in Station-IV. The Chlorophyceae members were most abundant, followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae in all stations. The study reveals that the highest number of Chlorophyceae was recorded in Station-II, Bacillariophyceae and Cyanophyceae in Station-I and Euglenophyceae in Station-IV (Fig-1).

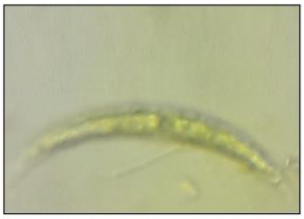
These Phytoplankton members show the levels of water quality in the aquatic environment as bio-indicators. And also indicate diversity and conservation of water. Observation of sample studies revealed that four groups of algae belongs to Chlorophyceae members were dominant followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. Similar observations were made by Earlier workers Ramesh and Aruna (2015), Shailaja and Aruna (2016) ,.Aruna et.al (2018) and Neha Srivastava (2018).

The present study, during January to December 2017 on phytoplankton diversity and water quality parameters data serves as a detailed report on the selected lake to establish objectives and approaches for purification and reclamation of Lake for future studies. Plate-1 & 2 shows some of the identified taxa of phytoplankton from Singabhupalem Lake.

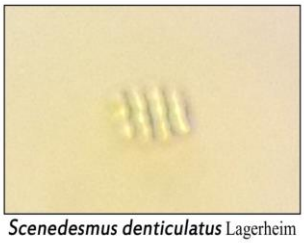
PLATE-1



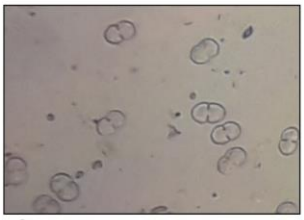
Spirogyra parvispora wood



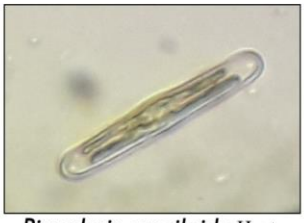
Closterium dianae Ralfs ex Ehren



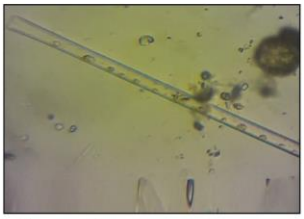
Scenedesmus denticulatus Lagerheim



Cosmarium exiguuna W.Archer



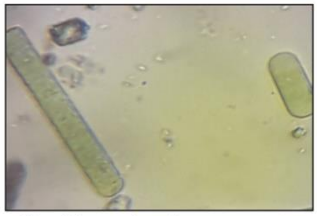
Pinnularia graciloids Hust



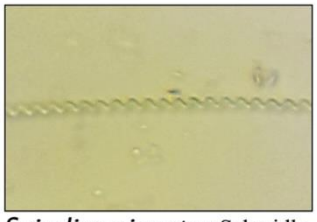
Synendra rumpens Kuetz

PLATE-2

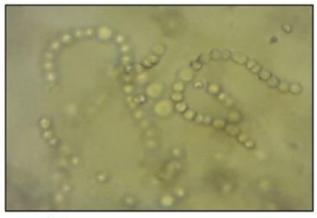
Navicula lanceolata Kuetz



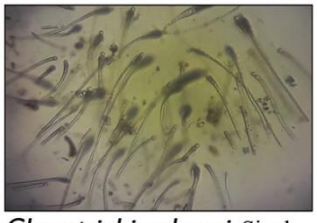
Oscillatoria obtusa Gardner



Spirulina gigantea Schmidle



Nostoc muscorun Ag



Gloeotrichia ghosei Singh

Euglena sanguinea Ehrenberg

IV. CONCLUSION

The physicochemical characteristic of aquatic ecosystem is significantly influenced by the human activities and for this reason it directly affects the flora and fauna, which reside in water bodies. The present study analyzed physico-chemical and biological parameters of the Singabhupalem Lake. The result suggested that the Lake water is of good quality and presence of all constituents were within permissible limits without any toxicants and any possibilities of mixing sewage, agricultural wastes and industrial effluents.

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