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Diversity of Phytoplankton and Assessment of Water in Two Lakes of Telangana State, India

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ABSTRACT

Fresh water Algae are most diverse and ubiquitous organism on earth. Algae in fresh water have numerous environmental functions and are based upon the recycling of nutrients. Urbanization has led to the pollution of surface water bodies resulting in extinction of some species and some species have increased enormously making water unfit for drinking and reaction. The present study documents the of richness of two lakes, Komati Cheruvu and Erra Cheruvu in Siddipet district of Telangana State, India. Physico-chemical parameters of two lakes and their relation to the growth and distribution of planktonic population have been evaluated by standard procedure. The qualitative survey was carried out during the period, April 2015- March 2016. Algal members were collected from two lakes. The genera recorded majorly belonged to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. The species of *Spirogyra, Oscillatoiria* were most frequent among all the collected members of Erra cheruvu lake in Siddipet and *Pediastrum, Scenedesums* were most dominant in Komati cheruvu lake. Among Chlorophyceae *Pediastrum, Scenedesms, and among Cyanophyceae Oscillatoria, Rivularia, and from Bacillariophyceae Pinnularia, Navicula* were found to be abundant. Desmids were represented by a large number of *Cosmarium* and *Closterium.* Chrysophyceae and dinophyceae were completely absent

Keywords : Diversity, Phytoplankton, Lakes, Komati Cheruvu, Erra Cheruvu.

I. INTRODUCTION

Natural resources are the important wealth of our country, water is one of them. Water is a wonder of the nature. "No life without water" is a common saying depending upon the fact that water is one of the naturally occurring essential requirement of all life supporting activities (Simpi *et.al.,*2011). Water is an essential requirement for all forms of life needs, protection from pollution which otherwise cause a threat to human life. Environmental conditions such as salinity, oxygen, temperature and nutrients influence the composition distribution and growth of its biota (Swami *et al.,* 2000).

Phytoplankton constitutes the very basis of nutritional cycles of an aquatic ecosystem. They form a bulk of food for zooplankton, fishes and other aquatic organisms. Phytoplankton is one of the initial biological component from which the energy is transferred to higher organisms through food chain (Ananthan *et al.,* 2004. Tiwari *et al.,* 2006).

Phytoplankton represents the microscopic algal communities of water bodies and the pioneer of aquatic pond chain. The productivity of an aquatic system is directly related to diversity of phytoplankton. They are source of food for zooplankton, fishes and other aquatic organisms. According to Harikrishnan *et al.,*(1999), the maintenance of a healthy aquatic ecosystem depends

on the physico-chemical and the biological diversity of ecosystem. Physico-chemical parameters effect plankton distribution, occurrence and species diversity (Raymond, 1983). Diversity of phytoplankton responds rapidly to changes in the aquatic environment particularly in relation to silica and other nutrients (Chellappa et al., 2008). In India, diversity of phytoplankton in different freshwater bodies along with their physic-chemical characteristics were studied by earlier workers (Veereshakumar and Hosmani 2006, Tiwari and Shukla 2007, Senthilkumar and Das 2008).

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 extraordinary high proportion of the worlds'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). Water maintains an ecological balance between various groups of living organisms and their environment (Kumar at al., 2009). The main objectives of the study were to determine phytoplankton diversity and water quality in lakes and to study the effects of physic-chemical parameters on phytoplankton diversity.

Many workers have carried out hydrological studies on ecosystem. The significant contributions are of (Suganan 1995, Sabu and Abdul 1998, 1999 and Krishnamurthy 2002).

TOPOGRAPHY OF THE LAKES

Figure I : VIEW OF KOMATI CHERUVU & ERRA CHERUVU

I (a) - KOMATI CHERUVU

I (b) - ERRA CHERUVU

The study area:-

The present study was carried out in two fresh water lakes, from April-2015 to March 2016. Samples were collected monthly intervals. (Fig-1) Siddipet one of the 31 districts of Telangana region of T.S. lies between $18^0\ 05^1 30^{11}$ latitude, $78^0\ 50^1\ 45^{11}$ Longitude of Komati Cheruvu and Erra Cheruvu latitude was $18^0\ 7^1\ 30^{11}$, $78^0\ 50^1\ 30^{11}$ Longitude and The lake, Komati Cheruvu and Erra Cheruvu is focused in Fig-1(a) & Fig1(b) in Siddipet located at 18.00^0N,78.53^0E coordinates. Both are comparably large sized lakes with a water spread areas of 100 to 130 hectares. The lake is rub fed during monsoon period. The water of both lakes is mainly used for drinking purpose and also to cultivate paddy crops in and around the lake area.

Phytoplankton samples were collected from surface water at two stations samples of identified stations of both lakes at depth of more than one feet using polythene cans of two liter capacity, bottles and small vials at fresh water lakes: Komati Cheruvu and Erra Cheruvu of Siddipet region. Samples were obtained from subsurface layer and in some cases from a depth of 1 or 2 m using peristaltic pump and immediately preserved with 4% formalin for quantitative and Qualitative analysis. Additional samples were taken with a 15pm net, were collected as a complement for taxonomic identifications for the enumeration of phytoplankton, all the living specimen were observed under microscope for algal diversity and the microphotographs were taken with the help of Sony digital camera. The identification of phytoplankton up to the level of species was made with the help of literature cited [Deshikachary (1959), Presscott (1964), Anand (1998)]. Tropic status of the lake was assessed using Nygaard's indices. In these investigations P^H and temperature were maintained. The P^H was measured on the spot using P^H paper and later conformed in the laboratory using digital P^H meter. The chemical analysis was carried out following the methods suggested by Trivedy and Goel (1986) and Standard methods of APHA (2005).

II. RESULTS AND DISCUSSION

The results obtained related to analysis of water were represented in Table-II. Table-I focuses on richness of phytoplanktons observed among the algal groups Chlorophyceae showed the highest species richness. Some of these species were polymorphic (*Pinnularia microsturon and Nuvicula muticopsis*). Bacillariophyceae, Euglenaceae and Cyanophyceae. The phytoplankton population was stable during the months of April and May. The density slowly declined during June and pre monsoon period and the lowest value were recorded during the month of December 2015. In the present study, the maximum phytoplankton production coincided with the optimum water depth of 1 m. this is an agreement with the earlier findings of Sukumaran and Das (2001) in some fresh water reservoirs of Karnataka. In the present investigation it may be noted that the phytoplankton population of the lake appears closely related with the seasonal variations in hydrography. Though the lakes of siddipet were large, its phytoplankton composition, distribution, richness and diversity and their nutrients are almost similar to that of other major Indian reservoirs.

The data obtained on the diversity of algae in two fresh water lakes of Siddipet region is mainly based on the factors of both internal and external respectively. The water temperature plays an important role in controlling the occurrence and abundance of phytoplankton Nazneen, (1980), Verma and Mohanty (1995) have reported direct relationship between p^H 5 to 8.5 is ideal for phytoplankton growth and this found to be true in the present investigation.

Temperature is an important factor which regulates biological activates in the aquatic environment. In the present investigation maximum temperature was

during April and May and minimum in January and November. Water temperature influenced aquatic weeds and algal blooms (Zafer 1968) and surroundings air temperature (Guptha & Sharma 1993). All metabolic & physiological activities such as reproduction, seeding, movements and distribution of aquatic organism are greatly influenced by water temperature.

The pH is an important parameter which determines the suitability of water for various purposes. In the present investigation, pH concentration ranged from 7.01 to 7.81 maximum value in February with minimum in August. In many of the collections the pH value remained neutral. However the average values for two lakes in all seasons were taken into account and was found to be slightly alkaline. The present work is in coincidence earlier researchers with like Ambasht (1971) and Yogendra and Puttaiah (2008).

A maximum of 61 mg/L, 92 mg/L and minimum of 16 mg/L, 13 mg/L Carbonates were recorded in Komati Cheruvu and Erra cheruvu. Bicarbonate analysis showed fluctuated values during the present investigation. In Komati cheruvu maximum value was 92 mg/L, in Erra cheruvu maximum was 116 mg/L. and minimum 46 mg/Lin Komati cheruvu , and 42 mg/L value in Erra cheruvu were recorded. Tisser et al., (2008) reported change in carbonates and bicarbonates which also depend upon release of Co_2 through respiration of living organisms. Chloride is one of the most important parameter in assessing the quality of water. Munawar (1970) is of the opinion that higher concentration of chlorides indicates higher degree of organic pollution. In the present investigation, the concentration of chloride was 120.21 mg/L in minimum and Maximum 375.7 mg/L in Komati cheruvu and minimum of 152.11 mg/L and maximum 389.95 mg/L in Erra cheruvu.

The concentration of dissolved oxygen regulates the distribution of aquatic flora and fauna. The present investigation indicated that the concentration of dissolved oxygen fluctuated between 8.1 to 11.28 mg/L in Komati cheruvu and 8.1 to 10.5 mg/L in Erra cheruvu. Seasonally, the concentration of dissolved oxygen was more during rainy season and least during summer season. This observation is in conformity with the observations of Reddy et al. (1982), and Venkateshwarlu (1993). The highest amount of Total Hardness recorded during present investigation in Komati Cheruvu was maximum of 250 mg/L, minimum 222 mg/L and maximum 92 mg/L minimum 88 mg/L in Erra cheruvu, due to presence of high content of Calcium and Magnesium ions in addition to sulphate and nitrate in the sewage waste added during monsoon , and lowest hardness recorded in summer due to low temperature and high rate of vegetation in the lake. Angadi et.al., (2005).

Calcium is an important nutrient for aquatic organism and it is commonly present in all water bodies Ansari and Prakash (2000). The maximum 20.16 mg/L, minimum 8.82 mg/L in Komati cheruvu and maximum 20.58, minimum 4.2 in Erra cheruvu was recorded in present investigation. Calcium is present in water naturally, but the addition of sewage waste might also be responsible for the increase in amount of calcium Angadi et al., (2005) and UdhayaKumar et. *al,.*(2006). The decrease in amount of calcium may be due to its absorption by living organisms. Jhingran V.G (1975) suggested that calcium is one among the most abundant ions in fresh water and plays a pivotal role in shell construction, bone building and plant precipitation. The magnesium act similar to calcium in ion exchange reaction and influence the absorption of sodium equally Paliwal and Yadav (1976).Magnesium is found in various salt and minerals frequently in association with iron compound. Magnesium is vital micronutrient for both plant and animal. Magnesium is often associated with calcium in all kind of water; but its concentration remains generally lower than the calcium Venkatasubramani and Meenabal (2007). The maximum amount of magnesium was 51.19 mg/L,

minimum was 19.0 mg/L in Komati cheruvu and 55.41 mg/L, minimum 19.22 mg/L in Erra cheruvu was recorded during investigation period. Decrease in level of magnesium reduces the phytoplankton population. Govindan and Devika (1991), suggested that the considerable amount of magnesium influence water quality.

The maximum value of nitrate was recorded as 0.09 mg/L in Komati cheruvu lake and 0.9 mg/L in Erra cheruvu lake and minimum value in Komati cheruvu lake was 0.01 mg/L and in Erra cheruvu was 0.1 mg/L. The lowest amount of nitrates recorded during summer due to the utilization by plankton and aquatic plants for metabolic activities. The Sulphates were recorded in Komatic cheruvu as 49 mg/L and in Erra cheruvu 60 mg/L minimum value. The Maximum value in Komati cheruvu was 95 mg/L and 135 mg/L in Erra cheruvu. The phosphates volume in Komati cheruvu was maximum 0.81 mg/L and in Erra cheruvu 2.91 mg/L. Hastler, (1947) observed on algal growth stimulate by phosphorous and nitrates. The minimum value in Komati cheruvu was 0.11 and in Erra cheruvu was 2.12 mg/L. The highest amount was recorded during summer and lowest in winter season due to growth of macrophytes.

TABLE-I : FEW OF PHYTOPLANKTON SPECIES FOUND IN LAKES

CHLOROPHYCEAE	Pediastrum simplex Meyen Pediastrum duplex Meyen Pediastrum tetras (Her.) Ralfs Scenedesmus acutiformis Scenedesmus armatus (Chodat) Smith Scenedesmus perforates Scenedesmus dimorphus (Turp.) Kuetz. Scenedesmus quadricauda (Turp.) Breb. Csmarium granatum Cosmarium leave Ankistrodesmus falcatus (Corda) Ralfs Chlorella ellipsoidea Gerneck Closterium acerosum (Schrank) Her. Closterium purvulum Nageli Spirogyra varians Staurastrum hexaserum (Ehr.) Wittr. Chlorococcum humicola (Naeg.) Rabenh Chlorella pyrenoidosa Chick Tetrahedron trigonum (Naeg.) Hansg Eudorina elegans Her Microspora willeana Lagerheim Oocystis ecballocystiformis Iyenger Chlamydomonas globosa Snow.
CYANOPHYCEAE	Microcystis flos-aquae (wittr.) Itz & Rothe Aphanocapsa litroralis Hansgirg Aphanocapsa banarensis Bharadwaja Chroococcus disperses (V.Keissler) Lemm. Gloeocapsa magma (breb.) Kuetz Merismopedia elegans G.M. Smith. Merismopedia glauca

	(Ehr.) Naeg. Spirulaina major (Kutz) Gomont Spirulina princeps West. Et West Oscillatoria curviceps Ag.Ex Gomont Anabaena Spiroides Klebahn Anabaena circinalis Robenhorst ex Born et Flah Nostoc purniforme Ag.
BACILLARIOPHYCEAE	Nitzschia obtuse W. Smith Cyclotella memeghinima Kuetzing

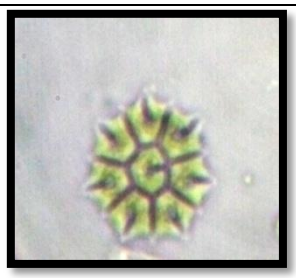
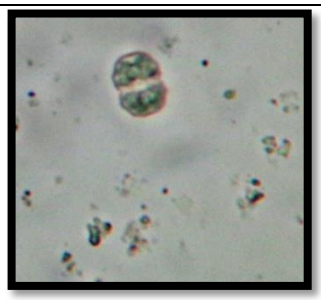
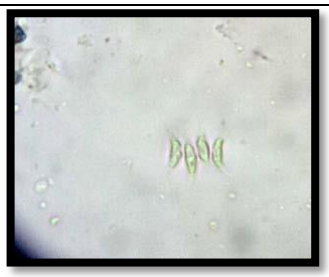
	Fragillaria Brevistriata Grun Fragillaria intermedia Grun Synedra Ulna Nitz Navicula cuspidate Kuetz. Navicula radiosa Kuetz. Gamphonema lanceolatum Her Cymbella naviculiformis Auersward
EUGLENOPHYCEAE	Euglena viridis Her Phacus acuminatus Stokes

Table-II : Physicochemical parameters with average values of two lakes of Siddipet. (April-2015 to March 2016)

S.NO.	Parameter	Station	Komati Cheruvu		Erra Cheruvu	
			Range	Average	Range	Average
1	Atmospheric temperature (^{O}C)	I	26-41	30.88	26-43	31.08
		II	28-41	31.58	26-43	31.33
2	Water temperature (^{O}C)	I	22-29	25.25	24-34	28.50
		II	22-29	25.17	24-34	28.25
3	pH	I	8.1-8.5	8.38	8.2-8.8	8.56
		II	8.0-8.8	8.53	8.2-8.6	8.44
4	Carbonate (mg/L)	I	28.42-58.02	47.49	18.56-58.22	40.98
		II	24.62-54.22	45.57	44.22-54.44	49.98
5	Bicarbonate (mg/L)	I	128.13-335.59	188.31	183.05-264.74	227.27
		II	140.34- 280.68	193.02	176.95-264.74	226.17
6	Chlorides (mg/L)	I	105.85-18.15	134.21	138.45-266.85	213.01
		II	102.32-177.51	128.80	152.12-191.56	173.19
7	Dissolved Oxygen (mg/L)	I	1.8-4.8	3.5	1.2-2.9	2.08
		II	1.8-3.4	2.92	2.2-4.8	3.55
8	Total Hardness (mg/L)	I	118-212	166.67	212-290	259.50
		II	128-222	176.83	120-264	209.00
9	Calcium	I	40.08-72.14	52.06	50.82-78.55	61.70

	(mg/L)	II	33.66-76.95	55.30	52.86-68.13	60.51
10	Magnesium (mg/L)	I	17.25-37.94	27.84	29.64-49.14	38.39
		II	20.22-42.33	29.65	21.26-38.46	32.33
11	Nitrates	I	0.01-0.09	0.06	0.2-0.8	0.51
		II	0.02-0.09	0.06	0.4-0.9	0.73
12	Sulphates	I	59-90	75.25	62-135	81.08
		II	49-95	74.75	60-78	67.92
13	Phosphates	I	0.11-0.19	0.16	2.12-2.82	2.42
		II	0.12-0.81	0.26	2.23-2.91	2.71

Fig-II: SHOWING FEW OF THE IDENTIFIED SPECIES OF PHYTOPLANKTON
PLATE-I CHLOROPHYCEAE

<table>
<tr>
<td> 
Staurastrum javanicum Nordst</td>
<td> 
Pediastrum simplex Meyen</td>
<td> 
Pediastrum biradiatum (Chod.) Pascher</td>
</tr>
<tr>
<td> 
Cosmarium angulosum Breb.</td>
<td> 
Tetraedon muticum (A.Braun) Hansging</td>
<td> 
Scenedesmus quadricauda (Turp.) Breb.</td>
</tr>
<tr>
<td> 
Scenedesmus dimorphus (Turp.) Kuetz.</td>
<td> 
Zygnema pectinatum Rao</td>
<td> 
Ankistrodesmus falcatus (Corda) Ralfs.</td>
</tr>
</table>

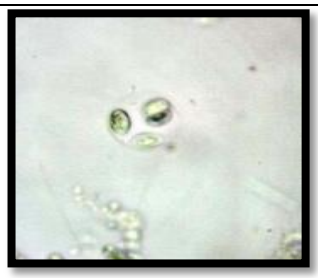
 *Chlorella pyrenoidosa Chick*	 *Oocystis gigas* Archer	 *Closterium acerosum* (Sch.) Ehrenb.

PLATE-II BACILLARIOPHYCEAE

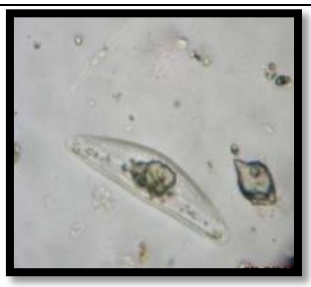
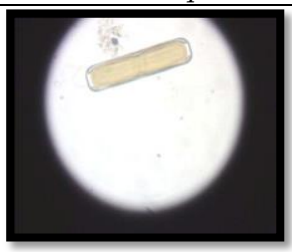
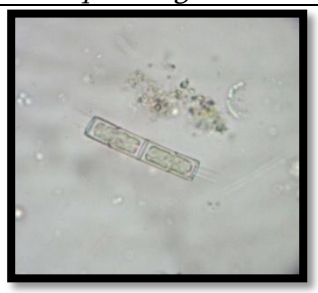
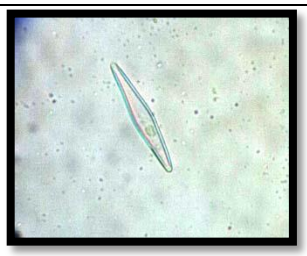
 *Pinnularia stauroptera* Grun.	 *Cymbella affinis* Kutz.	 *Cyclotella meneghiniana, Kuetz*
 *Pinnularia braunii (Nitz)* Her.	 *Fragilaria brevistriata* Grun.	 *Gamphonema angustatum* Kutz
 *Closteriopsis longissima* Lemm.	 *Mastogloia smithii* Thwaites	 *Navicula rhynchocephala*
 *Melosira granulate* (Her.) Ralfs	 *Fragillaria vaucheriae* Kutz.	 *Navicula twoutiensis* Cholonky

PLATE-III CYANOPHYCEAE

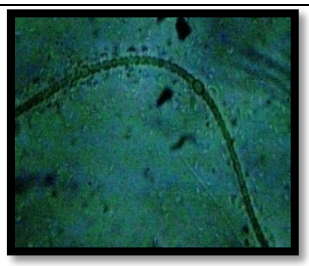
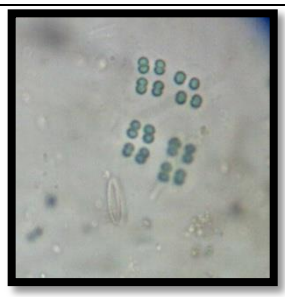
 *Anabaena circinalis* Robenhorst ex Born et Flah.	 *Microcystis aeruginosa* (Kuetz)	 *Chroococcus minutes* (Kirchn)
 *Spirulina major* Kuetz. Ex Gomont	 *Nostoc pruniforme* Ag.	 *Gleocpsa nigrescens* Naeg.
 *Oscillatoria curviceps* Ag. Ex Gomont	 *Oscillatoria agardhii gomont*	 *Merismopedia tenuissima* Lemm.

PLATE-IV EUGLENOPHYCEAE

 *Phacus acuminatus* Stokes	 *Euglena viridis* Her

III. CONCLUSION

Algae in fresh waters have numerous environmental functions and are based upon the recycling of nutrients. Urbanization has led to the pollution of surface water bodies resulting in decline/extinction of some species. The present study reveals the importance of physic-chemical parameters and their

effect on algal biodiversity in selected fresh water lakes of Siddipet region. The genera recorded majorly belonged to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae (Fig-II). The species of *Spirogyra, Oscillatoiria* were most frequent among all the collected members of Erra cheruvu lake in Siddipet and *Pediastrum, Scenedesums* were most dominant in Komati cheruvu lake. Among Chlorophyceae *Pediastrum, Scenedesms, and among Cyanophyceae Oscillatoria, Rivularia, and from Bacillariophyceae Pinnularia, Navicula* were found to be abundant. Desmids were represented by a large number of *Cosmarium* and *Closterium.* Chrysophyceae and dinophyceae were completely absent.

IV. ACKNOWLEDGMENT

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