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Diversity of Phytoplankton inAyyanakere Lake, Chikmagalur District, Karnataka

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ABSTRACT

In the present study, phytoplankton belonging to 40 species under 27 genera was recorded from Ayyanakere lake, Chikmagalur, Karnataka during the period from April 2008 to March 2009. Results revealed that, Zygnemophyceae was found to be the dominant group of phytoplankton (25.0 %) followed by Chlorophyceae and Bacillariophyceae with 22.5 % and 20.0 % respectively and Euglenophyceae with 15%. Ayyanakere lake is found to be rich in phytoplankton diversity and hence productive. Physico-chemical factors were found to be the important factors influencing the growth of phytoplankton. The lake is said to be moderately oligotrophic.
Keywords : Diversity, Phytoplankton , Physico-chemical parameters, Ayyanakere lake.

I. INTRODUCTION

Phytoplankton is a functional aquatic community based upon which the aquatic food web is culminating (Reynolds, 1984). Studies on physicochemical factors and phytoplankton standing crop of its habitat are essential for the proper management of water resources and for the prediction of the potential changes in the aquatic ecosystem (Kobbia, 1982; Descy, 1987). Sheehan (1984) reported that phytoplankton populations are mostly structured by the physical and chemical variables of their environment. These factors have also been reported to be responsible for the heterogeneity in phytoplankton composition and biomass (El-Ayouty*et al*., 1994, 1999; Ahmad *et al*., 2001; Ibrahim *et al*., 2003).

The present study has been carried out to know the diversity and distribution ofphytoplankton in Ayyanakere Lake of Karnataka. This study is relevant since the present water body forms the source of water for irrigation, drinking and fisheries.

II. METHODS AND MATERIAL

Study Area

Ayyanakere is an Anicut lake (Figure 1) constructed by Rukumanda Raya, chief of Sakharayapatna and renovated later in 1156 A.D. during the Hoysalas period. The large lake situated at the eastern base of Dattapeetha (Baba Budan) range, 18 kms northeast of Chikmagalur town provides irrigation facilities to more than 1574 hectares of registered land on a hillock adjacent to the lake.

Figure 1: A View of Ayyanakere lake

Ayyanakere area possess evergreen to deciduous forest type. It is one of the most coffee and tea growing regions in India. The climate of the region is cool and dominated by many hillocks. The water body is completely surrounded by the small to larger hillocks with perennial streams.

Figure 2 shows location of the study area. The geographical location of this lake is 13°41'42" north latitude and 75°04'46" eastern longitude. This lake constructed to the upper Veda river. The water from this lake along with some other small tributaries forms river Veda and joins the river Avathi at Yagatipura to form Vedavathi. The Vedavathi joins to Krishna river which ultimately joins Bay of Bengal.

Figure 2: Location of the Ayyanakere Lake

Many hillocks surrounded to the lake which forms the natural reservoirs. It is a shallow lake has an area of 15 sq. kms. The catchment area of 116.59 sq. kms water spread area 118.54 ha. The bund forms from the natural hills and stones with length of 450 m and height 4.80 m. The maximum depth of the lake is 30 m and an average depth is 20 m.

Water Quality Parameters

The sampling was carried out during morning between 8.00 AM to 9.00 AM. For physico-chemical analysis samples were collected weekly during April 2008 to March 2009. Water samples were collected in 2 litre capacity plastic cans. The water and air temperature were recorded at the sampling site itself by mercury thermometer. Dissolved oxygen was fixed on the spot itself in BOD bottles. The parameters like free CO_2, alkalinity, total hardness, total dissolved solids, Calcium, magnesium, phosphates and chlorides were estimated as per the standard methods (APHA ,1995; Trivedy and Goel, 1986).

Phytoplankton Diversity

For the estimation of phytoplankton, the water samples were transferred to cleaned 500 ml polyethylene bottles. Then, 5 ml of lugols iodine solution and 10-15 ml of 4% formaldehyde were added to it for fixation and preservation of planktonic cells. Plankton were enumerated using SedgewickRaftar cell (Welch, 1948) and expressed as numbers per litre. Qualitative identification of phytoplankton organisms was done with the help of monographs and they are identified upto species level (Edmondson,1959; Prasad and Mehrotra,1977; Needham & Needham,1978; Bharathi and Hegde, 1982; Digamber and Vidyavathi, 1985; Adoni et al. 1985; Hegde and Bharathi, 1985 and Coesel, 1996).

III. RESULT AND DISCUSSION

Water Quality

Seasonal variations in the physico-chemical parameters of water of the present lake is summarized in Table 1. Seasonal analysis of water temperature showed that it was highest in summer and relatively lower in monsoon and winter (Table 1). pH is considered as important chemical parameter in waterbody since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes. The maximum pH was recorded in pre-monsoon it may due to leaching of soil followed by the decomposition of plankton (Swarnalatha and NarasingaRao, 1993) and minimum in monsoon. The present study shows the acceptable range of pH for fish culture.

Maximum CO_2 recorded during post-monsoon and low during monsoon season (Table 1). It has been found that CO_2 content is inversely proportional to the oxygen content due to photosynthesis and respiratory activities (Deshmukh*et al*., 1964; Wetzel, 2001).

The present investigation showed that maximum dissolved oxygen recorded during monsoon because of increased phytoplankton high primary productivity and low metabolic activity of organisms, DO is high due to photosynthetic activity, minimum in pre-monsoon. These observations are in agreement with earlier work of Kumar and Singh (2000), Munwar (1970), Honneshappa (2008) and Rajashekar and Vijaykumar (2008). The present study also reveals that the total DO is suitable for fish growth.

The seasonal variation of calcium concentration is maximum in monsoon,but less in pre-monsoon. Similar observation was recorded by Kamran Tasaduque*et al.* (2003). The seasonal variation of magnesium concentration is maximum value in post-monsoon and slightly less in monsoon. The minimum value recorded during pre-monsoon. This is in conformity with the findings of JanardhanaRao (1982), Zutshi and Khan (1988), Shardendu and Ambasht (1991) which have concluded that normally natural water contains magnesium concentration lower than the concentration of calcium.

Regarding TDS seasonal analysis states that low in pre-monsoon and maximum value was recorded in post-monsoon (Table 1). The higher values may be due to lower water level and perhaps various kinds of ions present in the waterbody. Similar, observations were found by Rajashekar*et al.* (2003) in the river Umshyripi as Shillong Meghalaya. In the present study also reveals that the total dissolved solids is suitable for fish growth.

The seasonal values of chloride was recorded maximum in post-monsoon and low in pre-monsoon (Table 1). This in close agreement with that of the observation made by Patil*et al.* (1986), Swarnalatha and NarasingaRao (1993) and Sinha (1995). The reduced concentration of chloride content recorded during monsoon season when compared to pre-monsoon season and may be due to dilution, caused by rain water. Similar opinion has been given by Orborne*et al.* (1980) and Lowe (1980).

Highest total alkalinity recorded during post-monsoon and lowest in the monsoon (Table 1). The present study the total hardness is 92, 96 and 108 mg/l during the period of pre-monsoon, monsoon and post-monsoon respectively. Highest total hardness recorded during post-monsoon and lowest in the pre-monsoon (Table 1). Values for the total hardness in the present investigation falls in the range of moderately hard category (Mitra, 1982; Birsal*et al.*, 1985).

The phosphate level minimum during monsoon and maximum in post-monsoon period (Table 1). Many researchers such as Venkateshwarlu (1969a), Sampath Kumar (1977) and NirmalKumari (1984) have observed an increase in phosphate concentration in such water bodies they may receive domestic waste. This was contributed by the surface runoff draining the agricultural fields and mixing with the influent water of the pond.

Phytoplankton diversity

Phytoplankton population in the Ayyanakere was summarized in Table 2. The percentage composition of phytoplankton was shown in Table 3 and Fig. 3. The 5 classes of phytoplankton were Bacillariophyceae, Chlorophyceae, Zygnemophyceae, Cyanophyceae and Euglenophyceae formed 20%, 22.5%, 25 %, 17.5% and 15% respectively.

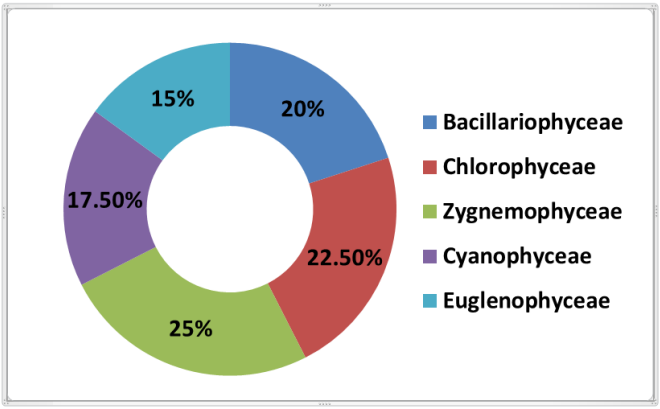

Figure 3. Percentage of the phytoplankton diversity of different classes

Among these, Zygnemophyceae dominated the other groups in the lake. Phytoplankton diversity was found in the order of Zygnemophyceae>Chlorophyceae>Bacillariophyceae>Cyanophyceae>Euglenophyceae. The Zygnemophyceae, formed the dominant group of phytoplankton community and its numerical abundance was relatively high in all three seasons. Water temperature plays an important role in controlling the occurrence and abundance of phytoplankton (Nazneen, 1980). The pH

has got its effects on phytoplankton population abundance (Nandan and Patel, 1992). Observed that high pH values promote the growth of algae and results in blooms.

Table 1. Seasonal variations in Physico-chemical parameters of water of Ayyanakere lake during 2008-09

Parameters	**Pre-monsoon**	**Monsoon**	**Post-monsoon**
Air temp.	32	27	22
Water temp.	29.5	25	21
pH	7.5	7	7.2
DO	6.4	12.2	9.75
Free CO_2	6.83	5.06	7.05
Total hardness	92	96	108
Calcium	16.03	19.63	18.83
Magnesium	12.67	13.20	15.10
TDS	100.31	127.13	134.70
Chlorides	24	23.90	28.4
Total alkalinity	63.18	50.65	66.25
Phosphates	0.45	0.28	0.59

All the parameters are in mg/l except air and water temperature (°C), pH

Among phytoplankton community, diatoms play a very important role ecologically as they comprise of major components of producers in wetland ecosystem (Zalewski et al., 1997; Murulidhar and Yogananda Murthy, 2015). Diatoms are ubiquitous, unicellular microorganisms form the basic bulk of planktonic population in freshwaters characterized by siliceous cell wall (Round et al., 1990). Blue-greens exhibited heavy growth in polluted water bodies and dominated over Chlorophyceae and Bacillariophyceae (Paramasivam and Srinivasan, 1981; Murulidhar and Yogananda Murthy, 2015). Desmids are sensitive organisms, act as indicators of water pollution. Abundance of desmids clearly indicates the unpolluted condition of the wetland (Sabir et al., 2007; Murulidhar and Yogananda Murthy, 2015). AsheshTiwari and Chauhan (2006) reported that, in Kithamlake, Agra, euglenoids density was maximum during summer followed by rainy and minimum during winter months. Euglenoids occur in greater number in polluted water bodies. Tripathi and Pandey (1995) have recorded maximum euglenoids during monsoon and low during post-monsoon. In the present study, Zygnemophyceae is dominant followed by Chlorophyceae.

Table 2. Distribution of phytoplankton in Ayyanakere lake

CHLOROPHYCEAE - Chlorococcales		**CYANOPHYCEAE - Blue-greens**
1	*Coelastrum microporum*	*1. Anabena spiroides*
2	*Pediastrum simplex*	*2. Merismopedia glauca*
3	*Scenedesmus platydiscus*	*3. Arthrospira platensis*
4	*Scenedesmus quadricauda*	*4. Oscillatoria subrevis*
5	*Tetraedon trigonum*	*5. Phormidium fragile*
6	*Tetraedon minimum*	*6. Microcystis aeruginosa*
7	*Korshikoviella limnetica*	*7. Oscillatoria auguina*
8	*Ankistrodesmus falcatus*	
9	*Micractinium pussillum*	
ZYGNEMOPHYCEAE - Desmids		**BACILLARIOPHYCEAE-Diatoms**
1	*Micrasterias inciser*	*1. Synedra ulna*

2	*Cosmarium tumidum*	*2. Pinnularia major*
3	*Closterium lunula*	*3. Navicula hustedtii*
4	*Cosmarium constactum*	*4. N. palea*
5	*Closterium accutum*	*5. N. radiosa*
6	*Euastrum rublobatum*	*6. N. rhomboides*
7	*Cosmarium constactum*	*7. Epithemia turgida*
8	*C. pseudoconnatum*	*8. Melosira granulata*
9	*C. retusiformii*	**EUGLENOPHYCEAE - Euglenoids**
10	*Desmidium baileyii*	*1. Euglena acus*
		2. E. elatica
		3. E. polymorpha
		4. E. minuta
		5. Phacus tortus
		6. Trachelomonas robusta

Table 3. Percentage composition of Phytoplankton during the study period

Class	Nos.	Percentage (%)
Bacillariophyceae	8	20.0
Chlorophyceae	9	22.5
Zygnemophyceae	10	25.0
Cyanophyceae	7	17.5
Euglenophyceae	6	15.0

IV. CONCLUSION

Plankton are important food sources of fishes specially the commercially culturing fish species. The present study shows the rich inphyto plankton diversity they are chlorococcales, diatoms, desmids, euglenoids and blue-greens .The commercially culturing fishes are almost plankton feeders. So the lake is suitable for fish culture. Based on the present investigations the water is soft water, it is dominating phytoplankton diversity.

Ayyanakere lake harboured 40 species belonging to 27 genera is rich in phytoplankton diversity and hence productive. Based on the data on physico-chemical parameters in relation to phytoplankton distribution and abundance forms a useful tool for further ecological assessment and monitoring of water bodies. They are the risk of pollution by human anthropogenic and agricultural activities. It is suggested that continuous assessing of water body and make a plan to protect it from pollution.

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