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PHYTOPLANKTONIC COMMUNITY STATUS IN A FRESHWATER SHALLOW LAKE OF RANCHI

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A study on the phytoplankton community, from Karamtoli pond at Ranchi, Jharkhand was undertaken during September 2009 to August 2010. The community showed a clear dominance of Chlorophyceae followed by Cyanophyceae and Bacillariophyceae. They showed summer peak in month of March and April and winter peak in September-October. 4 Species of Cyanophyceae, 5 species of Bacillariophyceae and 25 species of Chlorophyceae were recorded during the investigation from the study area. *Scenedesmus* and *Closterium* were dominant in most samples. The richness has been attributed to nutrient rich polluted environment of the tank.

Keywords: Freshwater, Phytoplankton, 35 species.

Phytoplanktons consist of a diverse assemblage of nearly all major algal taxonomic groups. They are extremely diverse and many exhibit a very wide tolerance to environmental conditions. Many environmental factors interact to regulate spatial and seasonal growth and succession of phytoplankton population. Basically, the freshwater plankton contains green algae, blue green algae, yellow green algae and diatoms *etc.* Wetzel (2001).

Extensive studies on the phytoplanktons of Indian lakes in relation to their environmental conditions have been made by Hosmani (2002), Ramakrishnan 2003, Kumawat and Jawale 2004, Suseela and Dwivedi 2005, Guru and Sahu, 2006, Sayeeswari and Singara Charya 2006, Guru 2007a, Raja *et al,* 2008, Bandopadhyay *et al* 2010, Mukherji *et al,* 2010 *etc.* Algae have been used by many workers as Bio-indicators of pollution (Palmer 1969 Agarkar *et al,* 1994, Mishra *et al,* 2002, Bohra and Kumar 2004, Tyagi *et al,* 2007 Mishra and Ram 2007 Rajlakshmi and Sakila 2007 *etc.*). Little Information is available on the seasonality of Plankton production in majority of tropical lakes (Zafar 1986, Tripathi 1989, Satya Mohan 1991, Mohapatra and Mohanty 1992). In recent days Phytoplanktonic studies of shallow lakes in Ranchi District have also been investigated, by Khalkho and Das 2005, Guru and Sahu 2006; Guru 2007 a, b, c, d; and 2008 a,b.

The aim of the present investigation is to study the phytoplanktonic composition of a shallow pond namely Karamtoli tank. It is a rain fed perennial tank and is one of the oldest tanks of Ranchi city. This tank was selected because it sustains ample aquatic vegetation including phytoplankton throughout the year.

MATERIALAND MTEHODS

Phytoplankton samples were collected every month from September' 09 to August'10 with the help of plankton net made up of 55 bolting silk of 100 micron mesh size. The collected samples were preserved in 0.2% formalin and brought to the laboratory for species analysis. The various phytoplanktonic members were sorted out and identified under binocular microscope on the basis of diagnostic features. Characterization and identification of the phytoplankton taxa were carried out with the help of standard books and published articles (Smith 1950, Prescott 1962, Desikachari 1959,

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Randhawa 1959 Philipose 1967, *etc*).

OBSERVATIONS

During the present study, altogether 35 species belonging to 22 genera of planktonic algae have been identified. Out of 22 genera 14 belong to the Chlorophyceae, 5 genera belong to Bascillariophyceae and 3 genera to Cyanophyceae. The population is dominated by the Chlorococcalean flora. The details of their occurrence are given below.

List of various species of planktonic algae in Karamtoli tank

Name of the taxa	Name of the taxa
Chlorophyceae	
1. Chlamydomonas spp.	*20. Cosmarium spp.*
2. Sphaerella lacustris	*21. Cosmarium spp.*
3. Chlorococcum vitiosum	*22. Closterium intermedium*
4. C. humicola	*23. C. parvulum*
5. Nautococcus pyriformis	*24. C. acerosum*
6. Phyllobium spp.	*25. C. lunula*
7. Pediastrum borryanum	
8. P. tetras	**Bascillariophyceae**
9. Tetraedron minimum	*26.Synedra ulna*
10. Chlorella vulgaris	*27.Nitszschia palea*
11. Ankistrodesmus falcatus	*28. N. Ovalis*
12. A. convolutes	*29. Navicula capitata var. capitata*
13. Selenastum microporum	*30. Gomphonema sphaerophorum*
14. Crucigenia quadrata	*31.Pinularia*
15. Scenedesmus oblicus	**Cyanophyceae**
16. S. dimorphus	*32. Oscillatoria princeps*
17. S. bernardii	*33. O. limosa*
18. S. bijugatus	*34. Cylindrospermum Spp.*
19. S. bijugatus bicellularis	*35. Microcystis aeruginosa*

DISCUSSION

Co-existence of a number of phytoplankton species is a conspicuous feature of freshwaters though a few species commonly dominate a phytoplanktonic assemblage. Reservoirs, lakes and ponds are normally capable of supporting large mixed group of planktons at or near their surface, where light is present in sufficient intensity to carry on the process of photosynthesis. While photosynthesizing they oxygenate surroundings thereby increasing the level of oxygen in the environment. Secondly the algae are also responsible for the biological production of energy which they transfer to the organisms placed on higher trophic level (Reynold, 2006).

From the result it is evident that phytoplankton

population showed two peaks (bimodal) ie. 'Summer peak' occurring between March-April and 'winter peak' occurring between August-September. Of the two peaks the phytoplankton population was high in summer peak. The reason may be due to the high concentration of nutrients and pH of the water during this period influencing species richness. The table depicts that order Chlorococcales dominate the planktonic population in karamtoli tank as the investigators have identified 22 genera out of which Scenedesmus and Closterium were more abundant.

Habib (2002) while working on Riverine algae (Ramganga River) at Bareilly, noticed maximum algae during the summer months but the Chlorococcalean members dwindle on the onset of rainy season. He observed only one peak during June which is a summer month and concluded that the temperature of summer accelerates the growth of Chlorococcales but only up to a certain range. He also identified high concentration of dissolved oxygen as growth promoting factor for Chlorococcales in flowing water system. Earlier workers like Jana (1973) and Rao (1975) have also concluded that well oxygenated waters are a prerequisite for the growth of Chlorococcales. Guru (2008 b), while investigating on Phytoseston community in lentic water, observed two peaks of Chlorococcalean members. She also concluded that the difference in the periodicity and survival strategies of Chlorococcales in lentic and lotic environment is entirely different.

The present observation of two peaks of Chlorococcalean members in Karamtoli tank (lentic) is in contrast with the conditions prevailing in river system as Habib (2002) has recorded only one peak in Ramganga River. The investigator believes that the Chlorococcales of Karamtoli tank also have a narrow survival temperature spectrum. It appears that they get optimum conditions only during March-April and August-September when the temperature is not very high and water contains enough dissolved oxygen to sustain them. In winter, temperature becomes too low which is not conducive for their appearance though the oxygen content is quite sustainable.

The investigators presently report only 6 species of desmids, out of which 4 belongs to genus Closterium while 2 to Cosmarium. The thin population of desmids can be attributed to the environmental health of the water bodies. They are rich in nutrients as they receive not only detergents *etc.* but also mixed domestic sewage. The above conclusion is corroborated by the fact that high value of nitrogen, phosphate, chlorides *etc.* are toxic to desmids population (Tarar *et al.* 1998) besides organic substances especially those excreted by the blue green algae are inhibitory to desmids growth (Lefevre 1964). The presence of only six species in the freshwater body of Karamtoli tank clearly depicts dwindling or elimination of desmids from this region due to ever increasing aquatic pollution.

During the present survey 5 genera and six species of diatoms were recorded of which Nitschia palea and Synedra ulna was more pronounced. Blum (1957) has also pointed out that Nitschia palea is the most resistant and tolerant form of diatom and grows conspicuously in polluted waters which has been further supported by Palmer (1980). During inspection seasonal distribution of diatom has been registered maximum in March – April (Summer) and minimum in early winter (September - October) thus indicating two peaks. Jana (1973) has found two peaks in

summer (March – late April) and another the highest in September. Bohra and Kumar (2004) also observed similar trend in munsi pond and Nathu pond while working in the wetland of Jharkhand. It has also been suggested by most of the workers (George1966, Zafar 1986, Kamat 1981) that diatoms are associated with temperatures, high oxygen concentrations and low oxygenic matter although Rao (1977) states that low oxygen content may be beneficial to diatoms. Round (1965) stated that the uptake of Silica in diatoms is an aerobic process and hence diatom growth is restricted in oxygen-deficient waters. Sullivan (1976) also observed that under condition of stress, the species diversity and the numbers of diatom species are decreased.

Finally, the investigators concluded that the thin population of diatoms can also be attributed to the environmental condition of the experimental tank which is in a state of stress due to anthropogenic activities.

During the investigation the authors have noticed 4 species of blue green algae (Cyanobacteria) belonging to 3 genera *Oscillatoria, Cylindrospermum* and *Microcystis* of which Oscillatoria dominates. Cynobacteria is extremely diverse group of prokaryotic organism which make valuable contributions to soil fertility by fixing atmospheric nitrogen and play an important role in all types of water bodies whether they being heterogeneous or non-heterogeneous. They occur in diverse habitat due to their capability to adapt to extreme condition of temperature, pH, salinity and available nutrient (Adhikari 2005). They can change their position within their environment in many ways. Many Cyanobacteria also control in their position in the water column by adjusting the formation of gas vacuoles and regularly cellular ballast (Graham 2000). The chief physical factors contributing the prolific growth of the algae are high temperature, intensity of illumination, stagnation, large amount of phosphorous, ammoniacal nitrogen, organic matter and salts of calcium and magnesium (Khan 1970). After a close inspection the investigators have the opinion that the occurrence of this (*Oscillatoria*) alga is a sign of rather unsanitary condition of the water indicating presence of decomposed organic matter in the water.

Finally it can be said that the phytoplankton flora of the tank is influenced by various physico-chemical strata of the tank which depends upon the interaction among biological and physico-chemical factors. Due to eutrophication most of the algal flora which were sensitive to pollution did not grow in Karamtoli tank. However, some of the pollution tolerant forms were also reported to grow. The tanks and ponds are our natural resources which act as the best place for rearing, growing and developing fish proteins. They serve as the fish culture grounds. For such utmost care should be taken both at public and PPT level.

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