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PHYTOPLANKTON IN LOWER MANAIR DAM AND KAKATIYA CANAL, KARIMNAGAR, ANDHRA PRADESH

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ABSTRACT

Qualitative survey of phytoplankton was done during a period of two years from July 1999 to June 2001 associated with Lower Manair Dam and Kakatiya Canal, Karimnagar. About 53 species were recorded during the study of which 47 species were recorded in Lower Manair Dam and 36 species in Kakatiya Canal. Number of species were more in static water than the running water. Majority of the phytoplankton belong to class Chlorophyceae followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. Species of Euglenophyceae were comparatively less in number.

INTRODUCTION

Phytoplankton are ecologically significant as they trap radiant energy of sunlight and convert it to chemical energy, i.e., organic materials. Many herbivores, mostly zooplankton, graze upon the phytoplankton thus, passing the stored energy to its subsequent trophic levels. The role of phytoplankton in energy budgets of aquatic systems and their importance in establishing their states is well known. The phytoplankton float passively and spread uniformly and extend down to various depths, where light is available for photosynthesis. Studies on phytoplankton of Indian lentic systems in relation to their environmental conditions have been made by Ganapathi (1941), Pandey et al. (2000). However, the literature pertaining to the comparative study of phytoplankton of lentic and lotic waters are rather scanty (Saha & Pandit 1990, Singh & Ahmad 1990). Mohan (1980) compared the values of organic carbon and planktonic biomass with that of dominant algal associations in two lakes of Hyderabad. Rana & Palria (1988) have surveyed the River Ayad which receives high amounts of domestic and industrial wastes and calculated the percentage of algae, where 50% belongs to blue greens, 33% to green algae, 10% to diatoms, and the remaining Euglenophyceae members. Padhi (1995) in his studies on the water chemistry and algal communities on the three fresh water ponds in and around Berhampur suggested revival method using the algal communities as biological indicators. He recorded wide variation in pH, dissolved oxygen, BOD, COD phosphate and nitrates. Pandey et al. (2000) investigated the nutrient status and cyanobacterial diversity of tropical freshwater reservoir of Udaisagar and clearly indicated elimination of sensitive cyanobacterial species from the substations receiving urban industrial effluents. This has a great ecological implications, since cyanobacteria not only contribute to global carbon dioxide sink due to being primary producers but also many add sizeable amount of fixed nitrogen to the ecosystems. Pulle & Khan (2003) analysed the qualitative and quantitative concepts of phytoplankton and recorded 43 species of which 18 were Chlorophyceae, 10 Bacillariophyceae, 10 Cyanophyceae and 5 Euglenophyceae. Angadi et al. (2005) studied physico-chemical and biological status of aquatic bodies and recorded 39 species of algae from four classes. In view of these diversified reports on phytoplankton, the present study was aimed to investigate the existence, distribution and functions of phytoplankton in two neighbouring water bodies on the same geological substratum i.e., lentic (Lower Manair Dam, LMD) and lotic (Kakatiya Canal, KC) systems.

MATERIALS AND METHODS

The phytoplankton were enumerated by taking one litre of sample from Lower Manair Dam and Kakatiya Canal during 1999-2001 and filtered. Then the filtrate was washed into a beaker with 100 mL distilled water and fixed in Lugol solution (KI + I). From this, one mL of sample was drawn quickly with a wide mouthed pipette and plankton numbers were counted. The average of three samples were taken into consideration. The algal species were identified with the help of standard monographs and books.

RESULTS AND DISCUSSION

From the data recorded at study sites during 1999 to 2001 certain interesting observations were made and clear-cut bimodal phytoplankton blooms were appeared in the months of April (summer peak) and in December (winter peak) (Table 1). Among the Bacillariophyceae members the algal blooms were reported in the months of January and May. The genera *Nitzschia* and *Navicula* were always appeared in greater densities in all the study sites. The moderate incidence of *Stauronies, Synedra, Cymbella, Ankistrodesmus, Gomphonema* and *Fragilaria* was noticed. The genera *Asterionella, Melosira, Pinnularia* and *Cyamotopleura* occurred in poor densities. The occurrence of these Bacillariophyceae was high in all the study sites of LMD. Among the Cyanophycean genera *Lyngbya, Agmenellum, Microcystis* and *Scytonema* were present with higher incidence. *Anabaena, Volvox, Phormidium, Spirulina, Schizothrix, Cylindrospermum* and *Merismopedia* were moderate in their incidence. *Nostoc, Nodularia, Oscillatoria* and *Chroococcus* were very poor in their occurrence in the two years of the study. It was interesting to note that the number of Cyanophyceae was less during the initial stages of this study but later there was an increase in Cyanophycean densities indicating an increase in pollution loads. The Chlorophycean members were dominant compared to others, indicating the oligotrophic status of the aquatic bodies. Among the Chlorophycean members *Spirogyra, Chlorella, Enteromorpha* and *Scenedesmus* were abundantly present with high incidence in majority of the months, while genera like *Tetraedron, Mougeotia* and *Pandorina* appeared in poor densities. The genera *Zygnema, Scenedesmus, Hydrodictyon, Ankistrodesmus* and *Chlamydomonas* were present in almost all the months of the study. *Oedogonium* also appeared only in few months.

Based on the data collected from four sites of LMD and Kakatiya Canal, it was observed that the algal species do not follow any predictable rule for their fluctuations. As expected the abundance of phytoplankton was high in lentic systems over running water. In both the aquatic bodies, phytoplankton population showed two peaks i.e., summer peak (April) and winter peak (December). Similar to the present observation, Jana (1973) and Shastry (1992) also noted the same tendencies in aquatic systems studied by them. Based on the nature of the algal species four individual groups viz., Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae were made and their role in establishing the status of these aquatic systems were studied. Among the groups Chlorophyceae members were dominant and collected in all seasons of the year in both lentic and lotic waters. The second dominant algal flora observed in the present study was Bacillariophyceae. The Chlorophyceae and Bacillariophyceae are the indicators of the healthiness of the system and are also responsible for addition of high amounts of oxygen to the waters. Similarly Brajesh & Pandey (2001) noted the existence of Chlorophyceae and indicated the cleanliness of water and further they observed that the dominance of desmids indicates the sensitivity to pollution. The data also clearly indicated that the Odum's algal index was minimum due to the dominance of Chlorophyceae members, though the

Table 1: Phytoplankton in Lower Manair Dam (LMD) and Kakatiya canal (KC).

	LMD	KC
Chlorophyceae :		
Actinastrum	+	–
Ankistrodesmus	+	+
Chlamydomonas	+	+
Chlorococcum	+	–
Chlorella	+	–
Chaetophora	–	+
Closterium	+	+
Cosmarium	+	–
Coelastrum	+	+
Enteromorpha	+	–
Euastrum	+	–
Gonium	+	–
Hydrodictyon	+	–
Mougeotia	+	+
Oedogonium	+	+
Pediastrum	+	+
Pandorina	–	+
Scenedesmus	+	+
Spirogyra	+	+
Staurastrum	+	+
Tetraedron	+	–
Zygnema	–	+
Bacillariophyceae :		
Agmenellum	+	+
Asterionella	+	+
Cocconeis	+	–
Cyamatopleura	+	–
Cymbella	+	+
Fragilaria	+	+
Gomphonema	+	–
Gyrosigma	+	–
Mastogloia	+	+
Melosira	+	+
Nitzschia	+	+
Navicula	+	+
Pinnularia	+	+
Synedra	–	+
Stauronies	+	+
Cyanophyceae :		
Aphenocapsa	+	+
Anabaena	–	+
Cylindrospermum	+	+
Chroococcus	+	+
Gomphosphaeria	+	+
Lyngbya	–	+
Microcystis	+	+
Merismopedia	+	–
Oscillatoria	+	+
Phormidium	+	–

Table cont....

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Schizothrix	+	–
Sytonema	+	+
Spirulina	+	+
Nostoc	+	+
Euglenophyceae :		
Euglena	+	+
Phacus	+	–

Cyanophyceae members (*Scytonema, Lyngbya, Microcystis*), indicators of bad quality of water, were appeared in few seasons but their abundance was very less and distribution was poor.

Nygaard (1949) has proposed five indices for biological monitoring of aquatic habitats based on the individual populations of Myxophyceae, Chlorophyceae, Bacillariophyceae, Euglenophyceae and the mixture of all these populations together. Many workers (Jeegi Bai 1995, Sharma et al. 1999, Govindaswamy et al. 2000) determined the oligotrophic and eutrophic status of aquatic bodies based on the formula developed by Nygaard. The present data revealed that the two aquatic systems were in oligotrophic status but the LMD is at its threshold to convert into a eutrophic body if proper management practices were not undertaken. The Chlorophycean and Bacillariophycean indices were at their highest levels and the Myxophycean and Euglenophycean indices were meagre. This is an indication of the healthiness of these systems.

Palmer (1969) reviewed a composite rating of algae, tolerating organic pollution and developed an index to establish the status of the aquatic bodies. He recorded certain algal 'genera index' and certain members for each genera to calculate the score of an aquatic body. A score of 20 or more per a sample was considered as the indication of organic pollution and the present data calculated in various seasons clearly indicated that the index is at its low level to recognise these habitats are pollution free. The site-IV in Lower Manair Dam is at its threshold and the index values were near to 20, indicated the switching of oligotrophic to eutrophic status of aquatic bodies in Hyderabad based on the values of Nygaard's algal index. Rawat (1987) estimated values of Nygaard's algal indices as per the phytoplankton diversity as their variations in Sequential Comparison Index (SCI). The seasonality and variation in physico-chemical characteristics in stagnant and flowing waters could not show any impact on the levels of SCI.

The role of phytoplankton in managing bioenergetics of the lake and their role as bioindicators and their secretions of enzyme in purification of polluted aquatic habitats has known for a long time (Munawar 1978). Shastree (1992) identified two main advantages of the phytoplankton study. They are: (1) fish monitoring and surveillance programme, and (2) sensitivity towards foreign material and indication of contaminant stress. Bott (1983) observed that the abundance of small algae would have far reaching impact on decomposition, production, biomass relationship and community rates of energy or material flow. Venkateshwarlu (1986) observed that the low temperature allows nitrate to accumulate in water, which stimulate the abundant growth of diatoms in winter and the following rise in temperature accelerate breakdown of nitrates leading to their depletion in water during their studies on Kashmir Himalayan lakes visualised distinct, unimodal, seasonal pattern and rapid responses of phytoplankton to the changed environmental conditions. Shashtree et al. (1992) in their studies on dynamics of phytoplanktonic fluctuations in Ravindra Sarovar observed that fluctuations in water level with consequent changes in the transparency and the light penetrability of water affected the phytoplankton growth. Jeegi Bai (1995) in her extensive study on nature and phytoplankton paradox observed the contradictory behaviour of phytoplankton in their natural habitats and in artificial environment. Arivazhagam & Kamalaveni (1997) studied the seasonal variation in physico-chemical parameters and plankton analysis of Kurichi pond and suggested management practices for the revival of the pond. Ganguly et al. (1999) visualised the role of plankton as indicators of water quality and also biomonitoring agents to understand the reclamation and revival processes of aquatic bodies. Manna et al. (2000) studied the phytoplankton as an index of water quality in respect of industrial pollution. Kaur et al. (2000) systematically assessed the role of small ponds and tanks in the recharging of the water in villages and suggested some modern methods of watershed management in Punjab State. Prakash (2001) reported that the plankton population and density were maximum in the month of June and recorded 21 species of phytoplankton and 16 species of zooplankton. He used the species as indicators for the levels of pollution in phytoplankton diversity and their subsequent use as monitoring organisms clearly indicate that these two systems are still healthy and favourable for proliferation of flora and fauna. Ganeshan et al. (2004) noticed the plankton density was uniform and the community structure of the water body varied from season to season. Sunitha et al. (2005) reviewed the ecological status of river ecosystems and used the phytoplankton as indicators to establish the quality status. Susheela & Kiran (2006) enumerated 68 algal taxa belonging 45 to Cyanophyceae, 14 to Chlorophyceae and 8 to Bacillariophyceae from Gangtok, Sikkim.

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REFERENCES

Angadi, S. B., Shidda Mallaiah, N. and Patil, P. C. 2005. Limnological studies of Papanash pond, Bidar, Karnataka. J. Environ. Bio., 26: 213-216.

Arivazhagan, P. and Kamalaveni, K. 1997. Seasonal variation in physico-chemical parameters and Plankton analysis of Kurichi Pond. Env. Eco., 15: 272-274.

Brajesh, K. D. and Pandey, A.K. 2001. Bioindicators in aquatic environment. Env. and People, 3: 24-25.

Ganapthi, S.V. 1941. Studies on the chemistry and biology of ponds in the Madras City: Seasonal changes in the physical and chemical conditions of a garden pond containing aquatic vegetation. J. Madras Univ., 13: 55-59.

Ganesan, Jaya Balan M. and Jagatheesan, K. 2004. Environmental status and seasonal variation in the water qualities studies of Pilavakkal reservoir at Western Ghats, India. Plant Arch., 4: 195-200.

Ganguly, T., Kumar, B., Sen, A.K. and Bhunia, A.B. 1999. Assessment of water quality of Damodar river through comparative analysis of bioindicators and physico-chemical determinants. J. Env. Poll., 6: 189-196.

Govindaswamy, C., Kannan, L. and Jayapoul, A. 2000. Seasonal variation in physico-chemical properties and primary production in the coastal water biotopes of Coromandal coast, India. J. Env. Biol., 21: 1-8.

Hosmani, S.P. and Bharathi, S.G. 1980. Limnological studies in ponds and lakes of Dharwar: Comparative phytoplankton ecology of water bodies. Phykos, 19: 27-43.

Jana, B.B. 1973. Aquatic environment. Hydrobiologia, 5: 127-143.

Jeegi Bai, N. 1995. A phytoplankton paradox. Algal ecology: An overview. International Book Distributor, Dehradun, India.

Kaur, H., Batt, K. S., Mander, G. and Jerath, N. 2000. Physico-chemical status of Kanjili wetland (Punjab, India). J. Env. Pollu., 7: 39-42.

Manna, M.K., Basherjee, S. and Bhowmik, M.L. 2000. Plankton as index of alter quality with reference to sewage pollution. Asian. J. Microbiol. Biotech. and Env. Sci., 2: 45-149.

Mohan, K.S. 1980. Limnology of the Osman Sagar and Mir Alam lakes. Ph.D. Thesis, Osmania Univ., Hyderabd, India.

Munawar, M. 1978. Limnological studies on freshwater ponds of Hyderabad, India. II. The biocoenose. Distribution of unicellular and colonial phytoplankton in polluted and unpolluted environments. Hydrobiologia, 36: 105-128.

Nandan, S.N. and Aher, N.H. 2002. Limnological study of algae of the River Mausam in Maharashtra. Indian J. Env. And Ecoplan., 6: 605-608.

Nygaard, G. 1949. Hydrobiological studies on some Danish ponds and lakes. II. The quotient hypothesis and some new of little known phytoplankton organisms. Dat. Kurgl. Danske. Vial. Sel. Biol. SKr., 7: 1-293.

Padhi, M. 1995. Algal environment of polluted and unpolluted freshwater ponds. Kargupta, A.N. and E.N. Siddiqui (eds). Algal Ecology: An overview. International Book Distributor, Dehradun, India.

Palmer, C.M. 1969. A composite rating of algae tolerating organic pollution. J. Phycol., 5: 78-88.

Pandey, J., Usha, P., Tyagi, H.R. and Rai, N. 1998. Algal flora and physico-chemical environment of Fatehsagar lake. Phykos, 37: 29-40.

Pandey, J., Usha, P. and Tyagi, H.R. 2000. Nutrient status and cyanobacterial diversity of a tropical freshwater lake. J. Env. Biol., 21: 133-138.

Prakash Sadguru 2001. Seasonal dynamics of plankton in a freshwater body at Balrampur. Geobios, 28: 29-32.

Pulle, J. S., Khan, A. M. 2003. Phytoplanktonic study of Isapur dam water. Eco. Env. Conser., 9: 403-406.

Rana, B.C. and Parlia, S. 1988. Phycological and physico-chemical evaluation of the River Ayadi, Udaipur. Phykos, 27: 211-217.

Saha, L.C. and Pandit, B. 1990. Dynamics of primary productivity between lentic and lotic systems in relation to abiotic factors. J. Indian Bot. Soc., 69: 213-217.

Sharma, A., Jarousha, K.H. and Srivastava, P. 1999. Chlorococcales from Jal Mahal lake Jaipur - their relevance to composition of water. J. Env. Poll., 6: 231-235.

Shastree, K.N. 1992. Dynamics of phytoplanktonic fluctuations in a lentic water body. Aquatic environment, 6: 59-85.

Singh, A.K. and Singh, D.K. 1999. Comparative study on the phytoplanktonic primary production of River Ganga and pond of Patna (Bihar), India. J. Env. Biol., 20: 263-270.

Singh, A.K. and Ahmed, S.H. 1990. A comparative study of the phytoplankton of the River Ganga and pond of Patna (Bihar) India. J. Indian Bot. Soc., 69: 153-158.

Susheela M. R. and Kiran Toppo 2006. Enumeration of freshwater algal flora of Gangtok, Sikkim, India. Geobios, 33: 225-232.

Sunitha Solanki, Rana, K.S. and Singh, Arun Kumar 2005. Ecological status of Khari nadi at Agra, UP. J. Zoo., 25: 101-103.

Tanushree Dhua and Patra, A. K. 2006. Lunar rhythm in the planktonic biomass of Nicco park lake, Bhubaneshwar. Environ. Biol., 27: 739-744.

Venkateshwarlu, V. 1986. Ecological studies on rivers of Andhra Pradesh with special reference to water quality and pollution. Proc. Indian Acad. Sci. (Plant Sci.), 96: 495-508.