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Short Communication

Appraisal of phytoplankton and macrophytic composition in Tungabhadra river ecosystem, Harihar, Karnataka

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ABSTRACT:

Aquatic pollution is harmful both to human and river ecosystem health. Phytoplankton, the most important producers in the food chain of the natural water body, plays a determining role in biological productivity and water quality of the aquatic system. It also acts as a sensitive biomonitor of aquatic ecosystem. Phytoplankton can play a significant role in the control of environmental quality. Macrophytes represented a significant biotype of the aquatic ecosystem and trophic level of the food chain from aquatic to the terrestrial life. Aquatic macrophytes are of utmost ecological and economic importance and they contribute significantly to the productivity of an aquatic ecosystem. This research deals with a preliminary survey on seasonal changes that occur in phytoplankton and it's macrophytic composition from December 2013 to July 2014. It was observed that total of 37 phytoplankton species were collected using plankton net from lotic ecosystem, which includes, Chlorophyceae being represented by 14 species, Bacillariophyceae by 9 species, Cyanophyceae by 8 species, Euglenophyceae by 6 species and a collection of 8 macrophytic species were recorded from different stations out of which *Ceratophyllum* was the sole species present at all the stations. The algae plays a prominent role as pollution indicator owing to their high range of tolerance capacity against the polluted water discharged from city municipality domestic sewage and industrial activities.

Keywords:

Phytoplankton, Macrophytes, Tungabhadra river, *Ceratophyllum*

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INTRODUCTION

Aquatic ecosystems are dynamic systems, with several biotic and abiotic variables that change with respect to space and time due to different processes. The realizations of the causal changes in time of these complex systems are very restricted. The water gets fertilized and become nutritionally very rich due to addition of organic and inorganic materials through excessive run off from the catchment. This areas and lead to the establishment of macrophytic population (Mishra, 1968). Aquatic macrophytes are bioindicators of pollution as they respond to water quality changes (Tripathi and Shukla, 1991).

Macrophytes are important biotypes of the aquatic ecosystem and the tropical stage of the aquatic to terrestrial life. Aquatic macrophytes are of the greatest ecological and economic significance and make a major contribution to productivity utilizing the mineral in the bottom sediments. The amount of biological material present at a particular time in a unit area (standing crop biomass) is used in estimating productivity. Most of the aquatic macrophytes become a nuisance when grown profusely and they are termed as weeds. The phytoplanktons are primary producers that constitute the base of food chain in an aquatic ecosystem. Various phytoplankton groups prefer to exist in various kinds of water.

Many aquatic macrophytes, when grown profusely, become a pest and are called weeds. But pollution may not be attributed to any unique category. There may be some species in each category that avoid pollutants, while others may be very sensitive. Pearsall (1930, 1932) also attempted to classify the Chlorophyceae containing water is distinct from diatoms and Myxophyceae members. The phytoplankton plays a determining role in biological productivity and water quality of the aquatic ecosystem.

MATERIALS AND METHODS

The study area

For this analysis, three ecologically diverse ecosystems were selected.

- Station S1: The habitat sites are situated upstream before the river enters town.
- Station S2: This station is situated on the Tungabhadra river main stream in a spot close to the Sulekere Stream confluence point.
- Station S3: This is downstream of the effluent discharge from Harihar polyfibers (near Harlapura).

Sampling

Subsurface water samples were collected at regular monthly intervals for a period of six months extending from December 2013 to July 2014. In the field at the collection sites, the water temperature, pH value and fixation of O_2 were reported for subsequent study. Water samples were collected in polythene bottles with a capacity of one litre for chemical analysis. For the distribution of macrophyte studies, quadrates of 50 X 50 size were laid in triplicate of monthly intervals at each site (Sorenson, 1948). Aliquots of water samples were preserved by Lugol’s solution for subsequent counting and identification. All forms of phytoplanktons were counted. Physico-chemical analysis of water and phytoplankton identification was carried out following the standard methods (APHA, 1985).

RESULTS AND DISCUSSION

In the present investigation, thirty seven species of phytoplanktons and eight species of macrophytes have been observed. In all the samples, Chlorophyceae were the dominating group among phytoplanktons. Chlorophyceae were represented by 14 species, Bacillariophyceae by 9 species, Cyanophyceae by 8 species and Euglenophyceae were represented by 6

Table 1. List of different groups of phytoplankton species from three stations (A, B, and C) of Tungabhadra river

S. No	Station A	Station B	Station C
	Chlorophyceae	**Chlorophyceae**	**Chlorophyceae**
1	*Ankistrodesmus* sp	*Ankistrodesmus* sp	*Chlorella*
2	*Cosmarium*	*Chlorella*	*Pediastrum ovatum*
3	*Kirchneriella* sp	*Closterium* sp	*Pandorina* sp
4	*Pediastrum duplex*	*Cosmarium*	*Scenedesmus* sp
5	*Pediastrum simplex*	*Kirchneriella* sp	*Spirogyra*
6	*Pandorina* sp	*Pediastrum duplex*	*Ulothrix* sp
7	*Scenedesmus* sp	*Pediastrum simplex*	-
8	*Spirogyra*	*Pandorina* sp	-
9	-	*Scenedesmus* sp	-
10	-	*Ulothrix* sp	-
	Bacillariophyceae	**Bacillariophyceae**	**Bacillariophyceae**
11	*Diatoma* sp	*Cymbella*	*Cyclotella*
12	*Fragilaria*	*Diatoma* sp	*Nitzschia*
13	*Melosires*	*Melosires*	*Navicula*
14	*Nitzschia*	*Nitzschia*	*Synedra*
15	*Pinnularia*	*Navicula*	-
16	*Navicula*	-	-
	Cyanophyceae	**Cyanophyceae**	**Cyanophyceae**
17	*Phormidium*	*Anabaena*	*Phormidium*
18	*Lyngbya*	*Phormidium*	*Anabaena spiroides*
19	*Microcystis*	*Lyngbya*	*Lyngbya*
20	*Oscillatoria*	-	*Nostoc* sp
	Euglenophyceae	**Euglenophyceae**	**Euglenophyceae**
21	*Euglena minuta*	*Euglena minuta*	*Euglena minuta*
22	*Euglena spirogyra*	*Phacus* sp	*Euglena proxima*
23	*Trachelomonas* sp	*Trachelomonas* sp	*Euglena spirogyra*
24	-	-	*Trachelomonas ovata*

species (Table 1) and 8 species of macrophytes (Table 2).

Out of these, *Ankistrodesmus* sp, *Spirogyra* sp, *Pediastrum duplex*, *Diatom* sp, *Oscillatoria* sp, *Euglena minuta* and *Trachelomonas* were collected at station A; *Chlorella* sp, *Kirchneriella* sp, *Pandorina* sp, *Cymbella* sp, *Nitzschia*, *Anabaena* sp, *Phosmisium* sp and *Phacus* sp at station B and *Chlorella*, *Spirogyra, Ulothrix* sp, *Cyclotella*, *Navicula, Synedra, Phormidium, Nostoc* sp and *Euglena proxima* at station C. Similar studies conducted by Kar *et al*. (1987) reported that, high phytoplankton population with dominance of Bacillariophyceae in down stream and Cyanophyceae group are observed with dominance in the up streams of the Ib river (Kar *et al*., 1987).

The physico chemical characteristics of lotic water ecosystem showed that the station C was found to be highly polluted because of the influx content of industrial effluent and other domestic wastes. Station B also received sewage with less pollution load when compared to station C (Table 3). McCombie (1953), suggested that the seasonal phytoplankton cycle in temperate zones may be influenced by temperature.

Similarly, Hutchinson (1967), stated that temperature had an influence on planktonic flora quality

Table 2. List of macrophytes from three stations (A, B and C) of Tungabhadra river

S. No	Station A	Station B	Station C
1	*Azolla pinnata*	*Eichornia*	*Ceratophyllum*
2	*Eichornia*	*Lemna minor*	*Eichornia*
3	*Najas graminea*	*Najas graminea*	*Najas graminea*
4	*Salvinia*	*Pontederia*	*Pontederia*
5	*Typha*	*Salvinia*	*Typha*
6	*Ceratophyllum*	*Typha*	-
7	-	*Ceratophyllum*	-

and quantity. In the present study, temperature range from 27.8^{O} C–30.0^{O} C does not appear to be a significant factor in determining the phytoplankton abundance. The phytoplanktons were comparatively minimum. Similar findings were also reported by Chacko and Krishnamurthy (1954).

The pH of water varied from 7.44 to 8.94 during the present study. Chari (1980) observed that high pH value was related to heavy bloom of phytoplanktons. The present investigation is in agreement with other researchers. Robert *et al*. (1994) suggested that pH 5.0 to 8.5 is ideal for phytoplankton growth. Puttaiah and Somashekar (1986) are of the opinion that dissolved oxygen at a higher concentration favours the abundance of Cyanophyceae blooms. During the present study, lowest average value (6.90 mg/L) in station C is due to the addition of industrial effluent and other domestic waste that discharges into the water body. Highest average value (8.00 mg/L) is observed in station A. The population of Cyanophyceae is very low, indicating that water with lower concentration of dissolved oxygen does not favor its abundance of Cyanophyceae. A similar observation has been made by Chatterjee, (1992).

Table 3. Water quality parameters at three stations (A, B and C) of Tungabhadra river

S. No	Parameters	Units	A	B	C
1	Temperature	° C	27.80	29.20	30.00
2	pH		8.94	7.72	7.44
3	Dissolved oxygen	mg/L	8.00	7.00	6.90
4	Phosphate	mg/L	1.97	2.18	3.13
5	Nitrate	mg/L	3.02	3.76	4.76
6	Ammonia (nitrogen)	mg/L	2.12	1.01	1.68
7	Total hardness	mg/L	38.00	74.00	92.00
8	Total alkalinity	mg/L	41.00	68.00	85.00

The dominance of Chlorophyceae in the present study is due to the alkaline, pH, higher phosphate and ammonia-nitrogen contents of the river. According to Chatterjee (1992), the higher amount of ammonia-nitrogen favour the growth of Chlorophyceae members. In the present study ammonia-nitrogen content ranges from 1.68 mg/L to 2.12 mg/L. Philipose (1967) considered that certain Chlorococcales thrives well in water that are rich in nitrates and phosphate ranging from 3.02 mg/L 4.76 mg/L and 1.97 mg/L to 3.13 mg/L respectively. Zafar (1964 a and b) attributed the higher percentages of Chlorococcales to high values of dissolved oxygen.

CONCLUSION

The discussion is based on the distribution of phytoplankton in lotic ecosystems. The physico-chemical characteristics of lotic ecosystem showed that the station B is highly polluted. Further, it was observed that, Chlorophyceae members were abundant in surface water, where Bacillariophyceae members occupied the second place during the six months of analysis. However, it was interesting to note that the Cyanophyceae members occupied the third place and Euglenophyceae members the last place. Totally 8 species of macrophytes are identified.

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