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Comparative Studies of Periphyton Diversity on Added Substrata in Fish Pond and Minor Reservoir

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Abstract : The present study deals with the comparative studies of periphyton diversity on added substrata, bamboo poles in two water bodies, a fish pond and a minor reservoir. The size of fish pond is 0.1 ha. and reservoir is 21.00 ha, but only a part (0.1 ha) of the reservoir is used for this study. The periphyton study was carried out after harvesting fish in both the water bodies, i.e., without fish. The bamboo poles were arranged at the rate of one pole/10m. The periphyton was analyzed after a month. Diversified periphyton communicates were found on bamboo poles. These belong to chlorphyceae, cyanophyceae basillariophyceae and euglenophyceae of algae and zooplankton in the fish pond whereas, bacterial and macro-invertebrates along with above group of organisms in the part of reservoir. In both the cases, periphyton was dominated by diatoms, followed by green algae and blue-greens. Diatoms most abundantly found in both water bodies. The periphyton was found more in fish pond when compared to the reservoir due to the application of manures in the pond during fish culture.

Key words : Periphyton diversity, Added substrata, Bamboo poles, Fish pond, Minor Reservoir, Algae, Zooplankton

Introduction

Periphyton is the micro floral community living attached to the substrate inside water (Wetzel, 1983). It is immensely important in aquatic system as it provides community structure and primary productivity that support a wide range of aquatic organisms. It is also important as it contributes carbon fixation and nutrient cycling, indicates the changes in aquatic environment and improves the water quality and food availability. It is easily grazed upon by small invertebrates, prawns and fishes and hence contributes considerably to the productivity of aquatic ecosystems. It harbours variety of organisms like algae, bacteria, fungi, protozoan, zooplankton and smaller invertebrates. These organisms function on a community, making them highly efficient in capturing and processing nutrients. Hence, present study was conducted to observe the diversity of periphyton communities on an added substrate, bamboo poles in two water bodies.

Materials and methods

The present work was conducted in an earthen fish pond at Hyderabad and a minor reservoir, which are found within 15 km radius during 2007. The size of fish pond and reservoir is 0.1 ha and 21 ha respectively. Only 0.1ha of water-spread area of the reservoir was used for this experiment to maintain uniform size of experimental water bodies. The fishes were harvested before commencement of this experiment. The water quality parameters were estimated in both the water bodies as per APHA (1998). The bamboo poles of 2 m lengths were arranged in both water bodies at the rate of 1 No / 10 m. After one month, the

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periphyton was collected from the poles. Periphyton communities identified as per Edmonson (1992) and categorized them into different groups.

Results

The water quality parameters of both the water bodies are depicted in Table 1. Most of the parameters are more in reservoir when compared to the pond.

Periphyton communities on bamboo poles in both fish pond and reservoir are depicted in Table 2. In fish pond, the algal communities represented by chlorophyceae (15 species), cyanophyceae (11 species), basillariophyceae (22 species) and euglenophyceae (2 species). The zooplankton represented by rotifers. Macro invertebrates and bacteria were absent in the pond.

In reservoir, algae represented by chlorophyceae (11 species), cyanophyceae (8 species), basillariophyceae (18 species) and euglenophyceae (4 species). Zooplankton represented by rotifers and macro-invertebrates. Macro-invertebrates represented by *Dugesia*, *Gammarus*, oligochaetes and chironomid larvae. Bacteria consist of *Micrococcus, Pseudomonas* and *Flavobacterium.*

In both water bodies algae was dominated. Among algae, diatoms were dominated, followed by green algae and blue green algae. Among the animal communities, rotifers were dominated. The zooplankton and macro-invertebrates were very few in number, when compared to phytoplankton.

In pond, the diatoms were most abundantly found and the most abundant genus was *Novicula*, where as *Chlorella* and *Oscillatoria* dominated among chlorophyceae and cyanophyceae respectively. *Brachionus* was dominated among zooplankton.

In reservoir diatoms were found most abundantly when compared to the pond ecosystem. *Diatoma, Chlorella*, *Anabaena* and *Difflugia* were dominated among the four groups of algae. *Brachionus, Gammarus* and *Micrococcus* were dominated among zooplankton, macro-invertebrates and bacteria respectively.

Discussion

The water quality parameters indicated that the fish pond is in mesotrophic and the reservoir is in early eutrophic in nature. Most of the parameters, especially the nutrients are high in reservoir.

Periphyton communities belong to algae, zooplanktons like rotifers and macro-invertebrates along with bacteria. They attach to substrates throughout or partially during their life cycles. Algae are most diverse and

Table 1: Water quality parameters in fish pond and reservoir

Parameter	Pond	Reservoir
pH	8.5±0.7	8.0±0.8
Dissolved Oxygen	6.2±0.7	5.6±0.5
Total alkalinity	86±7	67±6
Chlorides	42±2	128±11
Nitrates	1.0±0.05	12±0.05
Phosphates	0.04±0.001	0.1±0.02
Turbidity	32±4	24±4

The units are mg/1 except pH and turbidity (NTU.)

Table 2: Periphyton communities in fish pond and reservoir

Taxonomic group	Genera	
	Pond	**Reservoir**
Chlorophyceae	**8 Genera; 15 Species**	**6 Genera, 11 species**
	Chlorella, Oedagonium, Zygnema, Stigeoclonium, Ulothrix, Tetrospora, Scendosrmur, Pandurina	*Chlorella, Oedogonium, Zygnema, Ulothrix, Pandorina, Closterium*
Cyanophyceae	**5 Genera, 11 Species**	**4 Genera, 8 Species**
	Anabaena, Microcystis, Osciallatoria, Rivularia, Lyngbya	*Anabaena, Microcystis, Oscillatoria, Rivularia*
Basillariophyceae	**10 Genera, 22 Species**	**10 Genera, 18 Species**
	Novicula, Nitzschia, Synedra, Fragillaria, Gomphonema, Cocconeis, Diatoma, Cymbella, Microphora, Amphora	Novicula, Nitzschia, Synedra, Gomphonema, Cocconeis, Diatoma, Cymebella, Micrphora, Amphora, Acanthes
Euglenophyceae	2 Genera, 2 Species	**2 Genera 4 Species**
	Difflusia,Trachelomonos	*Difflusia, Trachelomonos Paranema*
Zooplankton	**1 Genus , 3 Species**	**2 Genera, 5 Species**
	Brachionus	*Ephiphanes, Brachionus*
Macro-Invertebrates	-	**5 Genera, 7 Species**
		Gammarus , *Dugesia* , Oligoihates, Chronomid larvae,
Bacteria	-	*Micrococcus* , Pseudomonas, Flevobacterium

cosmopolitan in nature and belong to about 26,000 species described in 24 classes (Bold and Wynne, 1985). In the present study, the diversity and abundance of periphyton communities varied from pond to minor reservoir. The periphyton communities were found more in pond when compared to reservoir. The bacterial communities absent in periphyton of pond along with macro-invertebrates. Vymazal and Richardson (1995) and Biggs and Smith (2002) reported that taxonomic diversity and abundance of periphyton depends on a range of factors such as habitat and substrate types. Their diversity and abundance also depends on light intensity (Maltais and Vincent, 1997), grazing pressure (Munoz *et al.*, 2000), seasonality (Goldborough and Robinson, 1985), nutrient availability (Van der Grinten *et al*, 2004) and physical disturbances (Blenkinsopp and Lock, 1994)

In the present study the diatoms comprised largest taxonomic group in both pond and reservoir. Goldborough and Robinson (1985), Sand-Jensen *et al* (1989) Verb and Vis(2000) and Biggs and Smith (2002) also reported that diatoms were dominant among periphyton communities on different substrates in different habitats. Van Dijk (1993) reported 50-90% of diatoms on artificial glass substrates in Lake Veluwe. He found that the abundance of cyanobacteria was relatively lower, contributing less than 5%.

Azim *et al* (2002) reported that, zooplankton and macro-invertebrates have also been recorded in the periphyton community,

especially in lentic environments when compared to phytoplankton, the above groups were found less, especially the later only with 3-4 genera. Thirteen genera of zooplankton belonging to crustacea and rotifera and some macro benthic invertebrates, especially chironomid larvae and oligochaetes, were identified from periphyton on bamboo substrates in aquaculture ponds (Azim *et al.*, 2002). In another study, periphytic macro-invertebrates were found to colonize on artificial ceramic tile substrates in two adjacent lakes with high and low fish densities, respectively (Benoit *et al*., 1998). In both lakes, Diptera, Amphipoda (*Gammarus lacustris*). Turbellaria (*Dugesia* sp.), Ephemeroptera and Mesogastropoda (*Limnea truncatual*) accounted for more than 90% of all individuals collected. Taniguchi *et al.* (2003) determined the diversity of periphytic invertebrates on two natural and two artificial plants in a second-order river. Natural plants *Ranunculus* (complex) and *Sparganium* (simple) harboured 54 and 45 taxa, respectively, with a numerical dominance by Diptera (61 and 82%, respectively) and Ephemeroptera (18 and 11%, respectively)

The periphyton growth was more on bamboo poles, due to its biodegradable nature. The communities were more in pond, when compared to the reservoir. This is due to the manuring in fish pond when fish were grown. The organic manure in the form of raw cattle dung (10t/ha/yr) and inorganic manures like urea (250kg/ha/yr), single superphasphate (250kg/ha/yr) and potassium murates (50 kg/ha/yr) were used for better growth and yield of fish. These nutrients usually responsible for better growth of periphyton in fish pond. Piska (1999), Piska (2000) and Piska (2001) reported that the plankton and fish production can be enhanced with application of organic and inorganic fertilizers in a fish pond.

Due to the better growth of periphyton, these water bodies can be used for the production of fish by utilizing bamboo poles as substrata for the growth of periphyton. By utilizing periphyton, the fish production can be enhanced.

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