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Periphytic Community on Glass Slide Substrata in a Freshwater Lake in relation to Some Abiotic Factors

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The influence of temperature, transparency, *p*H, carbon dioxide, dissolved oxygen, alkalinity, dissolved organic matter, specific conductivity, phosphate-phosphorus and nitrate-nitrogen on the abundance of periphytic community was studied during March 1984 to February 1986. The abundance of periphyton showed significant correlations with transparency ($P<0.05$) and specific conductivity ($P<0.05$). ANOVA showed that the regressions were significant ($P<0.01$).

Key Words: Periphytic community, Abiotic factors, Correlation coefficient

Introduction

The growth of periphytic community basically depends on two indispensable requirements. (i) suitable substrata for initial as well as subsequent colonisation of the periphytic members, and (ii) optimum physico-chemical conditions of water conducive to growth. In case the above two requirements are fulfilled the sustenance of periphytic growth is probably a function of grazing. In a particular study site the grazing may be taken as a common factor in all the samples. In such cases the density and diversity of periphytic species will be regulated largely by the abiotic factors. If a uniform substratum is used the difference in the growth of periphyton due to different types of substrata may also be eliminated. Various workers (Phinney & McIntire 1965, Shortreed & Stockner 1983, Reuter et al. 1983, 1986 and Fairchild et al. 1985) have studied the effect of different physico-chemical factors on growth of periphyton. In India Vass et al. (1978) also examined the effect of some abiotic parameters on the abundance of periphyton but their results were not subjected to statistical analysis.

The present paper communicates the effects of some abiotic factors on the abundance of periphytic community grown on glass slide substrata.

Study Area

The present investigation has been conducted in a lake, which is popularly known as Rabindra Sarovar, situated at Ballygunge area, Calcutta (Latitude 22°30′10″N and Longitude 88°22′30″E). The depth of study site varies from 2.5m to 2.75m.

Materials and Methods

Glass slides (2.5 cm × 7.5 cm) were used as artificial substrata. These when immersed were held in a vertical position with reference to water surface (Sladeckova 1960). The slides were fastened by nylon twine and hung with the horizontal arm of a wooden stand at subsurface, middle, and bottom layer of water body. The samplings were done at an interval of one week. The samples from three layers were pooled to a monthly mean.

Water samples were collected from subsurface, middle and bottom layer of the water body. The physico-chemical parameters such as water temperature, transparency, *p*H, carbon dioxide, dissolved oxygen, conductivity, carbonate alkalinity, bicarbonate alkalinity, total alkalinity, dissolved organic matter, nitrate-nitrogen and phosphate-phosphorus were estimated following APHA (1975). In order to get a clear idea of the physico-chemical characteristics of the waterbody, all the data of subsurface, middle and bottom layers were pooled together into a monthly mean. The results were evaluated by means of simple correlation coefficient and stepwise multiple regression analysis.

Table 1 *List of periphytic organisms*

Protozoans			Rotifera	Algae
**Lacrymaria*	*Carchesium*	*Thuricola*	***Brachionus*	*Stigeoclonium*
***Peranema*	*Zoothamnium*	**Caulicola*	*Limnias*	*Oedogonium*
Stentor	*Cothurnia*	**Podophrya*	*Ptygura*	*Spirogyra*
Scyphidia	*Pyxicola*	*Tokophrya*	*Sinantherina*	***Oscillatoria*
Epistylis	*Systylis*	**Acineta*	*Lacinularia*	Diatoms
Vorticella	*Vaginicola*	*Squalorophrya*	*Collolheca*	
			Rotaria	

*These organisms were recorded in a very poor density
**These organisms, also recorded in a very poor density, are freeliving but found in association with the sessile forms

Table 2 *Stepwise multiple regression analysis of total periphyton with the physico-chemical parameters of a lake* (Sample size = 24; Independent Variables = 12; Dependent variable = Total periphyton;Value of intercept = 2465.66721)

Variables	Regression coefficient	± SE	*F*	β-coefficient
Water temperature	−51.66159	39.36261	1.72253	−0.25830
Transparency	48.31573	23.01568	4.40686	0.37498**
Specific conductivity	− 5.02330	1.82830	7.54891	−0.46332**

Multiple correlation coefficient = 0.77442

Coefficient of multiple determination = 0.59972

ANALYSIS OF VARIANCE TABLE

Source of variation	Degrees freedom	Sum of squares	*F*	Conf. Level
Regression	3	8.1437E + 06	9.9883	99.969***
Residual	20	5.4355E + 06		
Total	23	1.3579E + 07		

***$P<0.01$, **$P<0.05$

Results and Discussion

The periphytic community is represented by sessile protozoans, sessile rotifers, filamentous algae and diatoms (table 1). Numerically diatoms are dominant over other groups.

It is evident from simple correlation coefficient that abundance of total periphytic community shows signigicant and negative correlations with water temperature ($P<0.1$) and specific conductivity ($P<0.1$). The stepwise multiple regression analysis shows that the abundance of total periphytic community has significant correlations with transparency ($P<0.05$) and specific conductivity ($P<0.05$). ANOVA shows that the regressions were significant ($P<0.01$) (table 2).

Sand-Jensen (1983) opined that it is difficult to determine when and how physico-chemical factors regulate the growth of periphytic algae. He further stated that many physico-chemical parameters affect growth and it is not possible to pinpoint a single regulating factor. Stockner and Shortreed (1976) hypothesized that "phosphorus was the primary factor limiting periphyton growth rates" and the same workers in 1978

demonstrated that addition of phosphorus either alone or with nitrogen increased the biomass of periphyton while nitrogen alone did not show any improvement. Some workers (Shortreed et al. 1984) pointed out that *p*H was the most improtant parameter, which controlled the periphytic species composition on artificial substrata, as other parameters which may affect species composition were either relatively uniform or had their effects minimized due to use of artificial substrata. But contrary to the above views it is evident from the present investigation that both transparency and specific conductivity have significantly influenced the abundance of periphytic community on glass slide substrata and the impact of other factors including *p*H and phosphorus were not found to be significant.

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References

APHA 1975 *Standard Methods for the Examination of Water and Wastewater* 14th edn (Washington: American Public Health Association. Inc.)

Fairchild G W, Lowe RL and Richardson W B 1985 Algal periphyton growth on nutrient-diffusing substrates and *in situ* bioassay; *Ecology* **66** 465–472

Phinney H K and McIntire C D 1965 Effects of temperature on metabolism of periphyton communities developed in laboratory streams; *Limnol. Oceanogr.* **10** 341–344

Reuter J E, Loeb S L and Goldman C R 1983 Nitrogen fixation in periphyton of oligotrophic Lake Tahoe; in *Periphyton of Freshwater Ecosystems* pp 101–109 ed. R G Wetzel (The Hague: Dr W Junk Publishers)

——, —— and —— 1986 Inorganic nitrogen uptake by epilithic periphyton in a N-deficient lake; *Limnol. Oceanogr.* **31** 149–160

Sand-Jensen K 1983 Physical and chemical parameters regulating growth of periphytic communities; in *Periphyton of reshwater Ecosystems* pp 63–71 ed. R G Wetzel (The Hague: Dr W. Junk Publishers)

Stockner J G and Shortreed K R S 1976 Autotrophic production in Carnation Creek, a coastal rainforest stream on Vancouver Island, British Columbia; *J. Fish. Res. Bd. Can.* **33** 1553–1563

—— and —— 1978 Enhancement of autotrophic production by nutrient addition in a coastal rainforest stream on Vancouver Island; *J. Fish. Res. Bd. Can.* **35** 28–34

Shortreed K S and Stockner J G 1983 Periphyton biomass and species composition in a coastal rainforest stream in British Columbia; Effects of environmental changes caused by logging; *Can. J. Fish. Aquat. Sci.* **40** 1887–1895

——, Costella A C and Stockner J G 1984 Periphyton biomass and species compostion in 21 British Columbia lakes: seasonal abundance and response to whole-lake nutrient additions; *Can. J. Bot.* **62** 1022–1031

Vass K K, Bhanot K K and Ghosh A N 1978 Studies on periphyton production in two ponds of brackishwater farm at Kakdwip, West Bengal; *J. Inland Fish. Soc. India* **10** 32–38