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Soil Composition and Nutrient Dynamics of Some Phytoplankton's of River Jalangi, Nadia, WB

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Abstract

The river Jalangi was selected for the present studies not only to evaluate the increasing rate of pollution but also its effects on aquatic micro flora, because people incognito often use aquatic plants as vegetables, which are in turn the habitat of those microbes that may in turn cause severe human diseases. The river water contamination with hazardous waste and wastewater is becoming a common phenomenon. The water quality and human health are closely related. The domestic waste from each building along with the effluent of small scale industries is disposed off into the open drains and gutters which ultimately enter into the river. Thus, all these factors might have an effect on the soil composition and nutrient dynamics of phytoplankton. In our present study we tried our level best to sort out this fact by selecting the dominant phytoplankton of river Jalangi and their nutrient dynamics.

Keywords: Jalangi; Soil Composition; Nutrient Dynamics; Phytoplankton.

Introduction

The Jalangi, prime river of district Nadia is the main water source of the district along with its branch and ultimately merge into Bhagirathi at Nabadwip. The river contain plentiful algae, phytoplanktons and submerged aquatic herbs as, sufficient dissolved oxygen, carbondioxide and bicarbonate ions etc, present in the river water. This river is utilized variously by the people incognito. The pattern of algae, phytoplanktons and submerged aquatic herbs depends on majorly the bottom soil composition of a river. Moreover, it is a hard task to draw the interrelationship between the different biogeochemical cycles and that is why we shall treat only examples of the interrelationships between the cycles of phosphorus, nitrogen, carbon, sulphur. All of these are elements essential for the nutrition of plants. Algae phytoplanktons and submerged aquatic plants, the element carbon is derived from carbondioxide, carbonate ions, bicarbonate ions present in water. For algae phytoplanktons and submerged aquatic plants nitrogen is the most abundant element after carbon, oxygen and hydrogen. They derive the element from nitrate ion, nitrite ion, ammonium ions present in river water and bottom soil. Phosphorous occurs in river water as orthophosphate and in organic combinations. In fresh water sulphur is present as sulphate.

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Materials and Methods

Temporary slides were prepared for different algae like *Anabaena, Spirogyra* etc. with the help of lactophenol- cotton blue staining method. For aquatic macro flora morphological and chemical analysis was done. Elemental analysis (C, H, N and S) were done using Parkin Elmer CHN analyser machine at IACS, Jadavpur, Kolkata 700032. Analysis of Sodium, Potassium, Calcium, Total phosphorous, Total nitrogen , Boron, Iron and silica were done using standard methods using titrimetric methods, flame photometric methods, spectrophotometric methods etc. The analysis of the soil samples were carried out in the Department of Chemistry lab of Nabadwip Vidyasagar College. Some analysis were performed in outside laboratory (Scientific Research Laboratory, Santoshpur, Kolkata).

The Jalangi river bottom soil samples were collected from ten sampling sites, namely Taranipur, Chapra, Haranagar, Anandanagar Ghurni, Krishnanagar kadamtala ghat, PWD more (Rail Bridge), Char-sambhunagar, Hulorghat(Mayapur). Soil samples were collected from different depths of sampling sites, by expert swimmers. Flora specimen collections were a continuous process and were done using hiring boat service. The study period is chosen as pre-monsoon due to stedy-equlibria among bottom soil-river water-ecosystem though river ecosystem is a lotic ecosystem.

Results

Table 1: Pre-monsoon data of some elements from soil of Janalgi and their relative percentage in different plant groups

Plant groups	C%	H%	N%	S%
Spirogyra	20.86	2.97	1.51	1.26
Anabaena	12.21	4.71	1.27	0.77
Alternanthera	43.88	5.89	3.21	0.94
Cyperus	34.40	4.81	1.94	1.09
Jussia	34.72	4.92	2.55	0.92
Saggitaria	42.26	5.89	3.52	1.07

Table 2: Average Pre-monsson data from both water and soil of Jalangi of available N,P,K and B

Jalangi water	(mg/Liter)	Jalangi soil	(mg/Kg)
Available nitrogen	≤ 0.1	Available nitrogen	161.5
Available phosphorus	0.054	Available potassium	179.6
Available potassium	4.32	Available phosphorus	49.5
Available nitrate	0.45	Available boron	18.4

Table 3: Average Dry Bottom Soil Composition of River Jalangi (g/Kg)

Available Nitrogen (as N)	**0.1615**
Available Potassium (as K)	0.1796
Available Phosphorous (as P)	0.0495
Silica(as SiO2)	664
Iron (as Fe)	37.815
Calcium (as Ca)	4.1014
Sodium (as Na)	0.476
Boron (as B)	0.0184
Carbon (as C)	9.7
Hydrogen (as H)	0.9
Sulphur (as S)	1.1

Discussion

The most abundant component of bottom soil is silica, i.e., 66.4% of the soil contain silica. Iron, carbon and calcium are also present in significant amount.

In our study a number of observations are noticed. Firstly, the effects of Phosphorus and other elements on biogeochemical cycle and growth of phytoplanktons and secondly, their effects on the metabolisms is well marked. When phosphorus 'input' is high with respect to nitrogen, the rate of growth or production of phytoplankton populations often becomes limited by nitrogen. When this happens, nitrogen-fixing Cyanophyceae usually out compete other forms so that atmospheric nitrogen contributes to the nitrogen requirements of the plankton. It is reported that, when several whole-lake experiments in the experimental lakes area of Northwestern Ontario were designed to yield information about the interplay between phosphorus and nitrogen. For example, Lake 227 (area 5.0 ha, mean depth 4.4 m), was fertilized for 6 years with an N:P ratio of 14:1 by weight. Algal standing crops were dominated by the green alga, *Scenedesmus* (Schindler *et al.,* 1973), and no nitrogen fIxation was detectable (Flett *et al.,* 1980).

In our present study percentages of different elements utilized by a number of plant groups exhibit differences (Table 1). It clearly indicates that different plant groups are in different stages of their respective growth cycle. It also found that carbon percentage is quite high in two angiosperms as compared to the algal members and in dicots (*Alternanthera* and *Saggitaria)* the carbon percentage is more high than the rest monocot families. It might have happened due to variations in nutrient cycle. More over the availability of various elements in river Jalangi at pre monsoon stage also varies accordingly with its soil profile (Table 2 and Table 3).

This study presents a first attempt to quantify the biogeochemical transformations and fluxes of nutrients along the river Jalagi. The biogeochemical reaction-network is coupled to the hydrodynamic and transport processes of different nutrients, indicating the level of nutrient dynamics and also the biotic response thereof. In fact the residual transport field and in-situ turnover rates control the local nutrient availabilities and the emergence of distinct spatial patterns in ecosystem structure throughout the productive period.

On the other hand, nutrient enrichment by autochthonous recycling in fresh water ecosystems or through allochthonous input by feeder rivers have been considered a major stimulant for eutrophication and a threat to dwindling water resources. As a consequence of nutrient enrichment ecosystems experienced the events of toxic cyanobacterial bloom. Again a distinct effect of phosphorus on nitrogen cycle is also revealed. When phosphorus 'input' is high with respect to nitrogen, the rate of growth or production of phytoplankton populations often becomes limited by nitrogen. When this happens, nitrogen-fixing Cyanophyceae usually outcompete other forms so that atmospheric nitrogen contributes to the nitrogen requirements of the plankton. In a recent literature review of aquatic nitrogen flxation, Flett *et al.* (1980) found that fixation became important when the N:P ratio in nutrient loading fell below 10:1 by weight. While production and growth of nitrogen-fixing blue green algae are often lower than for other forms, their colonies are typically quite large, and therefore less susceptible to grazing or other mortality factors than smaller forms (Schindler and Comita, 1972). As a result, under steady-state conditions, the total algal standing crop is usually comparable to that which develops when the supply of ionic nitrogen is large. Thus, we think our present study will open a great scope regarding the study of correlation between soil composition and nutrient dynamics of some phytoplankton in the river Jalangi under a particular climate.

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