

Study of Phytoplankton Diversity in few water sources of Dooars area, WB through Foldscope- an Origami Paper Microscope

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Abstract: Phytoplankton is key producer of aquatic ecosystem and useful for determination of water quality. Water samples from four water sources of Dooars area, Alipurduar, West Bengal – Collegepara pond, Ramthakur temple pond, Samuktala nayunjali and Santali rain water were collected and preserved with 4% formalin. Phytoplankton diversity of the collected samples was studied microscopically. Algal taxa were identified on the basis of morphological characters and with the help of standard literature. Total 36 algal genera were obtained from four spots. Diatoms are dominating group among the different class of algae. Sample site 4 i.e. Santali rain water showed the highest algal diversity. The microscope used for the present study is an origami paper microscope invented by Dr. Manu Prakash and Jim Cybulsky, Dept of Bioengineering, Stanford University, USA. This paper microscope is ultra-affordable called Foldscope. Its magnification is 140X and resolution is 2 μ . The photographs were taken by camera of smart phone Samsung S9+ and photographs were magnified through digital zoom of the camera. This sort of study is first time in the said region which will inspire and engage students and researchers to preserve our natural resources explored with ultra-affordable frugal invention like foldscope.

Keywords: Biodiversity, Foldscope, Phytoplankton, Water bodies, Dooars.

I. INTRODUCTION

Microscope is basic tool of biology, providing an essential, visual connection between the familiar macro-world and the remarkable underlying micro-world. The invention of microscope and its developments help researchers to understand the microscopic world around us and also opened up a new way of research and study. However everything has its own advantages and disadvantages. The disadvantages of using a regular microscope are expensive, heavyweight, bulky, fragile, need to be operated by expert hand only and high maintenance, which makes the use of microscope very limited in underdeveloped and poor countries [12]. In 21st century a great revolution occur in the history of microscope. Dr. Manu Prakash and Jim Cybulski from Stanford University, realized the problem and came up with the idea of making affordable and easy microscopy, by using folded paper microscope named as “Foldscope”. It is a low cost origami-based microscope, and is sufficient to observe the microscopic world around us as magnifying power is up to 2000X. The present study has been carried out through 140X foldscope.

Phytoplankton are vital source of energy in aquatic environment and initial biological components from which the energy is transferred to higher organisms through food chain and establish coordination between abiotic and biotic factors in aquatic ecosystem [13]. The study of plankton is very useful for determination of productivity and quality of water bodies [10]. Biodiversity has recently become the focus of international debates. So our present scientific study is concentrated on phytoplankton diversity of water bodies prevailing in Alipurduar district of West Bengal. It is the 20th district in the state West Bengal covering a total area of 3383 Km² and geographically the district lies in between 26.4°N to 26.83°N and

89°E to 89.9°E. Plankton diversity of village pond of Trivandrum has also been investigated[8]. Monthly variation of plankton group of River Narmada[14], Fresh water algal diversity of Meghalaya [3] and algal diversity in Paddy Fields of Lalgotwa Area, Ranchi, Jharkhand [7] were studied [7]. Relation between biological diversity and abiotic properties of water was shown in the Kutt and Wetland ecosystem of Kerala [6]. Phytoplankton diversity of district Coochbehar[2] a nearby district of present study area was known. Green and blue-green algae from Murshidabad[9] and Malda district of West Bengal were also studied[5]. The present study is the first approach in Dooars region of Alipurduar District, West Bengal.

II. MATERIAL AND METHODS

Sampling Site description: The study has been conducted at four different water bodies of Alipurduar districts West Bengal. Locations of 4 sampling sites are indicated below and basic geographic information are given in Table 1.

Table 1: Details of the sample collection

Sampling site No.	Name of Sampling site	Geographic coordinates	Block/GP and Municipality	Date and time of sampling
1.	Alipurduar College pond	26°30'5N 89°32'15E	Alipurduar I Ward 3	2/08/2018 7:00 AM
2.	Ram Thakur temple pond	26°31'12N 89°32'21E	Alipurduar I GP++Vivekananda-I	12/08/2018 5.30 PM
3.	Samuktola nayanjuli	26°31'49N 89°40'21E	Alipurduar II GP-Samuktola	17/08/2018 9:05 AM
4.	Santali rain water	26°39'37N 89°22'41E	Kalchini GP-Satali	27/08/2018 9:30 AM

Site 1: Alipurduar College pond is of dimension 54 m. by 42 m. approximately with a depth of approximately 3 m. Quackgrass, several angiosperms are present on the banks. The pond is mostly covered by water hyacinth, duckweeds, water lettuce etc.

Site 2: Ram thakur pond is of dimensions 70 m. by 28 m. approximately having depth of approximately 5m. with a sloppy bank. Activities like fishing and washing clothes and utensils is done here. Presence of water strider is also observed. Growth of Ferns, *Colocasia esculanta* is observed on the banks.

Site 3: It is a nayanjuli with a breadth of approximately 45 m. and with depth of approximately 4m. Activities like fishing, washing clothes is generally done here. Presence of ferns, *Colocasia esculanta* is observed on the bank.

Site 4: It is a seasonal water source which create a small pond like appearance having dimensions of approximately 45 m. by 30 m with depth of approximately 2.5m. Bank is sloppy. Hydrophytes cover almost 20%. Abundance of plankton in the bank which makes it sloppy.

Sample Collection: Samples are collected by horizontal netting of surface water. The mesh size of plankton net is 25µm, the capacity of settling flask is 150 ml. Water is collected after 10 times netting of water. Span of towing is about 1 meter. Algal samples were also collected by scraping pebbles, rocks and submerged vegetation and preserved properly.

Preservation: Water is collected in two 50 ml Milton container, one container is preserved with 4% formalin and other is kept as it is for observation of live samples.

Microphotograph: The samples were analysed mainly with origami paper microscope i. e. Foldscope. Pictures of the plankton were taken under Foldscope with camera of Samsung S9+ smart phone. Foldscoptes, with the capability of 140X magnification and 2µm resolution are used for the present study. Algal taxa were determined according to morphological characteristics and using the key of Prescott (1954) [11].

The environmental parameters like water temperature, total dissolved solids and pH of the water has also been recorded.

III. RESULTS AND DISCUSSION

The water temperature recorded in different samples were mainly between 30°C to 34°C and pH range recorded was between 8 to 8.7. The total dissolved solids ranged between 74PPM – 210 PPM. All these parameters play a vital role in the occurrence and abundance of the phytoplankton in a water sample.

Table 2: Environmental parameters recorded in the study.

Parameters	Site 1	Site 2	Site 3	Site 4
pH		8	8.2	8.7
TDS (PPM)		91	210	74
Water temperature (°C)		32	30.4	29
Hydrophyte (%)	95%	>20%	15%	20%

Total number of 36 algal and Cyanobacterial genera were observed in four samples collected from 4 different sampling sites. Out of which eleven green algae, nine desmids, three blue green algae and thirteen diatoms were recorded in these four water sources. Occurrence of the individual taxa in individual site was evaluated. Biodiversity differed among the sampling sites. Sampling site 4 consists of highly diverse group of phytoplankton, it contains 23 algal taxa of which four Chlorophyceae, eight Bacillariophyceae, eight Zygnematophyceae, two Cyanophyceae and one Fragilariophyceae. Site 4 is followed by site-2 and sample -1 contains least number of phytoplankton. Diatoms are dominating group in case of sample 3 and 4, in case of sample 2 maximum number of diversity are found in Chlorophyceae, and diatoms are scanty in sample 1 where Chlorophyceae and Zygnematophyceae are rich in number. Maximum number of Chlorophyceae in samples collected from three different urban pond of Kolkata was observed[4]. In another study [8]it is also found that Chlorophyceae as a dominant group followed by Bacillariophyceae. Bacillariophyceae present as a dominant group followed by Chlorophyceae in wetlands of Jorhat district [1]similar to the present study.

Table 3: Phytoplankton diversity in different sampling sites

	Site 1	Site 2	Site 3	Site 4
Chlorophyceae				
<i>Pediastrum sp.</i>	-	+	+	-
<i>Eudorina sp.</i>	+	+	-	+
<i>Pandorina sp.</i>	-	+	-	+
<i>Scenedesmus sp.</i>	+	+	-	+
<i>Oedogonium sp.</i>	+	-	-	-
<i>Ankistrodesmus sp.</i>	+	-	-	+
<i>Sphaerocystis sp.</i>	-	+	-	-
<i>Volvox sp.</i>	-	+	-	-
<i>Pleodorina sp.</i>	-	+	-	-
Bacillariophyceae				
<i>Gomphonema sp.</i>	-	-	+	+

<i>Nitzschia sp.</i>	-	+	+	+
<i>Pinnularia sp.</i>	-	+	+	+
<i>Synedra sp.</i>	+	+	+	-
<i>Eunotia sp.</i>	-	+	-	+
<i>Cymbella sp.</i>	-	+	+	+
<i>Frustulia sp.</i>	-	-	+	+
<i>Navicula sp.</i>	-	-	+	-
<i>Pleurosigma sp.</i>	-	-	+	-
<i>Amphora sp.</i>	-	-	-	+
<i>Stauroneis sp.</i>	-	-	-	+
Zygnematophyceae				
<i>Closterium sp.</i>	-	+	+	+
<i>Cosmarium sp.</i>	+	+	+	+
<i>Micrasterias sp.</i>	+	-	-	-
<i>Staurodesmus sp.</i>	+	-	-	+
<i>Pleurotaenium sp.</i>	+	-	-	+
<i>Desmidium sp.</i>	-	-	-	+
<i>Euastrum sp.</i>	-	-	-	+
<i>Hyalotheca sp.</i>	-	-	-	+
<i>Sphaerososma sp.</i>	-	-	-	+
Cyanophyceae				
<i>Gloeocapsa sp.</i>	-	+	-	+
<i>Microcystis sp.</i>	-	+	-	-
<i>Oscillatoria sp.</i>	-	-	-	+
Fragilariophyceae				
<i>Fragilaria sp.</i>	-	+	+	+
<i>Asterionella sp.</i>	+	-	-	-
Trebouxiophyceae				
<i>Actinastrum sp.</i>	-	+	-	-
<i>Chlorella sp.</i>	-	+	-	-


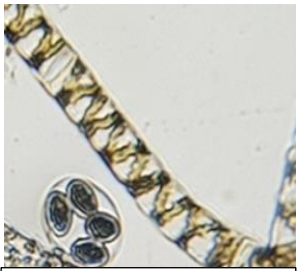
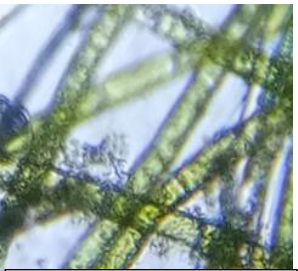

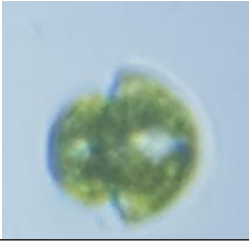
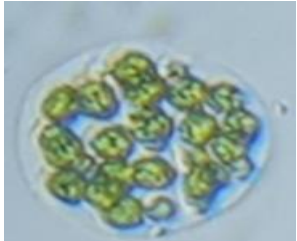
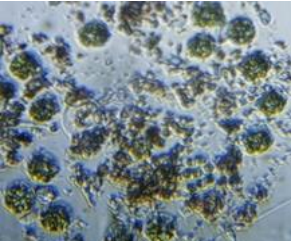

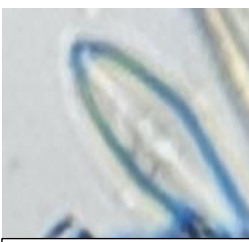



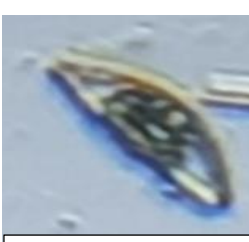




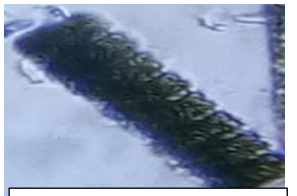

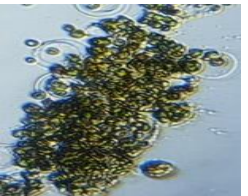
			
<i>Oedogonium sp.</i>	<i>Spirogyra sp.</i>	<i>Cladophora sp.</i>	<i>Volvox sp.</i>
			
<i>Cosmarium sp.</i>	<i>Sphaerocystis sp.</i>	<i>Pandorina sp.</i>	<i>Chlorella sp.</i>
			
<i>Gomphonema sp.</i>	<i>Navicula sp.</i>	<i>Stauroneis sp.</i>	<i>Pleurosigma sp.</i>
			
<i>Cymbella sp.</i>	<i>Nitzschia sp.</i>	<i>Synedra sp.</i>	<i>Actinastrum sp.</i>
			
<i>Desmidium sp.</i>	<i>Desmidium sp.</i>	<i>Oscillatoria sp.</i>	<i>Microcystis sp.</i>

Plate 1: Microphotograph of some algal taxa observed under foldscope during study period.

IV. CONCLUSION

This study of phytoplankton diversity in Dooars region of Alipurduar district is a pioneer work. It will give a basic information about the abundance of algal taxa in this region. It will also give a message to motivate the study of biodiversity with frugal invention like foldscope which will minimize the hindrance of junk expenditure of modern research.

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