Phytoplankton diversity and Physico-chemical features of Achankovil river, India

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ABSTRACT

The present study focuses on the phytoplankton diversity and physico-chemical parameters of Achankovil River during the post monsoon season. Water samples were collected during the morning and the phytoplankton were collected by plankton net Number-20 silk bolting cloth having a mesh size of 20 µm. A total forty three phytoplankton genera were recorded from the study area. They belonging to the four major classes, Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. Physico-chemical parameters such as temperature, pH, dissolved oxygen, carbon dioxide, alkalinity and amount of calcium, hardness of water, content of nitrate and silicate and productivity also were analyzed. Phytoplankton diversity and physico-chemical parameters showed significant variations in different study sites.

Introduction

Phytoplankton are microscopic single celled photosynthetic organisms are live and suspended in water. They are found in marine and freshwater and are the essential components of aquatic ecosystem. They remarkably show variation in size and shape. Phytoplankton is considered as the key species of aquatic food web and act as a role primary producer. Through photosynthesis, phytoplankton consume carbon dioxide on a scale equivalent to forests and other land plants. Phytoplankton plays a prime role in the transfer of carbon dioxide from the atmosphere to the ocean. It generate half of the atmospheric oxygen as like that of land plants. Phytoplankton also form the base of virtually every aquatic food web. Phytoplankton plays a significant role in global ecology and ecosystem functioning. They are primary producers and contribute to about half of the primary production on the planet and global nutrient cycles of the earth by making up the main producers in any given water body (Biddanda and Benner, 1997).

The structure and abundance of the phytoplankton populations are mainly controlled by inorganic nutrients such as nitrogen, phosphorus and silica and mainly available nitrogen as nitrate, nitrite and ammonia, phosphorus as soluble orthophosphate (USEPA, 2000). The variations and distribution of phytoplankton in freshwater depend on its physiochemical features (Cetin and Sen, 2004). Phytoplankton is usually used as an ecological health and stress effects of chemical contaminants on aquatic ecosystems (Yu *et al.*, 2014). Impacted changes in the water quality are reflected in the biotic community structure which includes the phytoplankton, with the most vulnerable death, while the most sensitive species act as indicators of pollu-

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tion. To keep the aquatic habitat favorable for existence of living organisms and physical and chemical factors must be monitored regularly. Activity of living organisms is influenced by the seasonal and diurnal changes of these parameters (Akinyeye, 2011). The current investigation studied the diversity of phytoplankton population and physico-chemical parameters of Achankovil River during the post monsoon season.

Materials and Methods

Achankovil river, originates from the Achankovil forest division, which comes under Kollam and Pathanamthitta districts of Kerala state, India. Achankovil river drains the southern part of the forest division. The river has a length of around 128 km. It finally join Pamba river at Veeyapuram. The convenience of sampling, the study site Achankovil river was divided into three regions such as upstream, midstream and downstream.

The upstream region consist of Achankovil, Konni and Aruvappulam, midstream includes Thumpamon, Pandalam and Vettiyar and downstream comprises Mavelikkara, Veeyapuram top and down regions. Water samples were collected during the post monsoon season i.e., October 2019 to January 2020. Samples were collected during the early morning time before the outbreak of sunlight. Phytoplankton was collected by plankton net Num-

ber-20 silk bolting cloth having a mesh of 20µm in size. The samples were collected and stored in a plastic containers and preserved using 4% formalin and Lugol's iodine for better settlement. Microscopic observations were conducted by Magnus (MX 2li clinical) light compound microscope and phytoplankton identified with the help of Fresh water algal identification key established by Desikachary (1959), Prescott (1982) and Philipose (1967). Physico- chemical characteristics such as temperature, pH, dissolved oxygen, carbon dioxide, alkalinity, amount of calcium, hardness of water, content of nitrate and silicate and productivity were analyzed according to standard procedures (APHA, 2001).

Results and Discussion

The observations of the study revealed the presence of phytoplankton diversity during the post monsoon season. A total of forty three genera were recorded, it is represented by four major families such as Chlorophyceae have highest number followed by Bacillariophyceae Cyanophyceae, and Euglenophyceae with least number. The Chlorophyceae was recorded as the dominant group in the river with eighteen in number and Euglenophyceae with three (Table 1).

The abundance of phytoplankton diversity has significant correlation with physico-chemical parameters of the water. The growth of phytoplankton was directly or indirectly dependent on the physico-chemical parameters. Presence of *Navicula*, *Cymbella*, *Nitzchia* and *Oscillatoria* are the indicators of water pollution. Phytoplankton communities in general
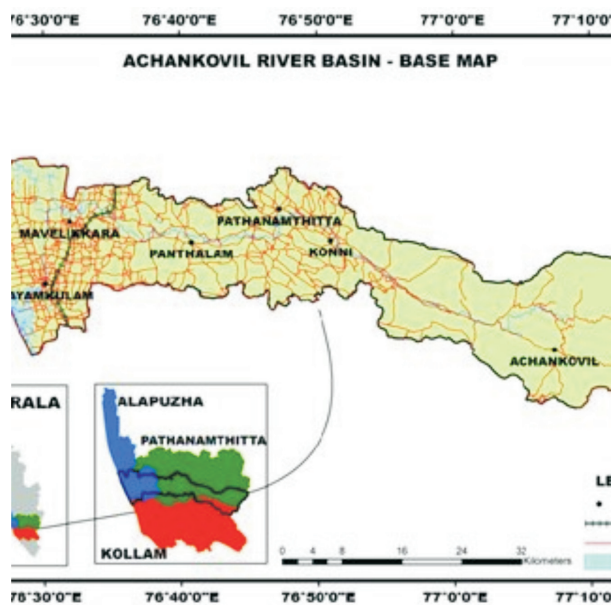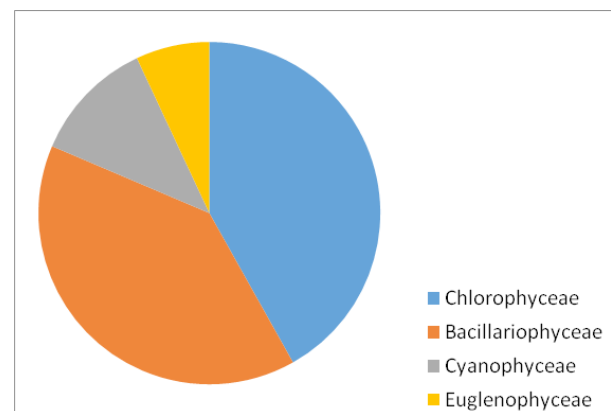

Fig. 1. Map of sampling location

Fig. 2. Showing the graphical presentation of phytoplaktonic diversity

can be used as indicators of pollution for assessing the water quality (Usman, 2016). The occurrence of *Ocillatoria* in the present study also indicates pollutants of biological origin (Altaf and Saltanat, 2014). It is evident from the results that the river is progressing from the oligotrophic to the mesotrophic state (Sharma and Vijayta, 2018). Water temperature was found maximum at downstream (27 ^{0}C). The

amount of hydrogen ion concentration is an important parameter and has a significant role in the biological process of all aquatic organisms (Weleh, 1952). In the present report pH ranges from 6.79 to 7.03. The availability of dissolved oxygen is one of the major and vital factors for survival of the aquatic organisms (Sharma *et al.,* 2017). Dissolved oxygen was found maximum at upstream. The nu-
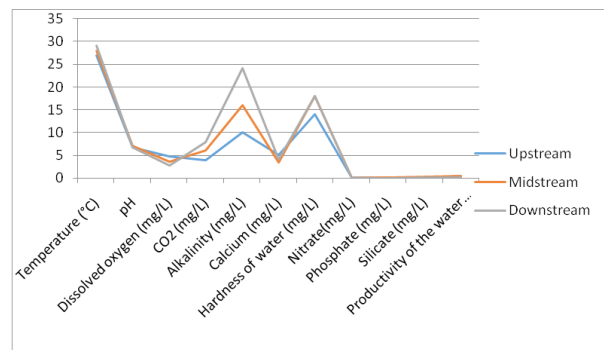
Table 1. Phytoplankton diversity in Achankovil River during post monsoon season

Phytoplakton	Class	Upstream	Midstream	Downstream
Chlorella	Chlorophyceae	+	+	+
Coelastrum		-	+	+
Cosmarium		+	+	+
Micrasterias		+	-	+
Scenedesmus		+	+	+
Kirchneriella		-	+	+
Onychonema		-	-	+
Spondylosium		-	-	+
Pediastrum		+	+	+
Euastrum		+	-	+
Closterium		+	-	+
Staurodesmus		+	+	+
Xanthidium		+	-	+
Cloteriopsis		+	+	+
Microspora		+	-	-
Oedogonium		-	+	-
Spirogyra		+	+	-
Volvox		-	-	+
Pinnularia	Bacillariophyceae	+	+	+
Aulacoseira		+	-	+
Gomphonema		+	+	+
Melosira		-	+	+
Navicula		+	+	+
Surirella		+	+	+
Cyclotella		+	-	+
Amphora		+	-	-
Diadesmis		-	-	+
Synedra		+	+	+
Tabellaria		+	+	+
Cocconeis		+	+	-
Cymbella		+	+	+
Fragilaria		+	-	+
Gyrosigma		+	-	+
Stephanodiscus		+	-	-
Nitzschia		+	+	+
Lyngbya	Cyanophyceae	+	+	-
Anabaena		-	+	+
Spirulina		+	+	-
Oscillatoria		-	+	+
Merismopedia		+	-	-
Trachelomonas	Euglenophyceae	-	-	+
Phacus		-	+	+
Euglena		+	+	+

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Table 2. Physico-chemical qualities of the water samples

Parameters	Upstream	Midstream	Downstream
Temperature (°C)	27	28	29
pH	6.8	7.03	6.79
Dissolved oxygen (mg/l)	4.8	3.6	2.8
CO_2 (mg/l)	4	6	8
Alkalinity (mg/l)	10	16	24
Calcium (mg/l)	5.04	3.36	4.20
Hardness of water (mg/l)	14	18	18
Nitrate (mg/l)	0.113	0.083	0.153
Phosphate (mg/l)	0.126	0.084	0.027
Silicate (mg/l)	0.182	0.198	0.257
Productivity of the water (mg/C/l/hr)	0.525	0.45	0.225

trients like nitrate, phosphate and silicate showed remarkable variations in different regions. Results of physico-chemical parameters were tabulated in the Table 2.

Fig. 3. Showing the graphical presentation of physico-chemical parameters

Conclusion

The diversity of phytoplankton and physico-chemical parameters of Achankovil river during the post monsoon shows a compactable relationship. The phytoplankton communities can be used as indicators for assessing the water quality. The occurrence of chlorophyceae is relatively greater than other classes. Physico-chemical parameters are varying with different sites of the river.

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