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SPECIES DIVERSITY OF CYANOBACTERIA IN CHAMBAL RIVER

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Blue green algae are also popularly known as Cyanobacteria with the prokaryotic structure and dominance of phycocyanin pigment that is responsible for bluish colour in them. They occupy a variety of habitats with a diverse range of organization. They are closely related to prokaryotic bacteria in evolution. Cyanobacteria are the only prokaryotes which have the ability to perform photosynthesis by evolving oxygen. Phytoplanktons are microscopic free floating plants which form the base of a food chain in aquatic ecosystem. These reproduce rapidly and are easily available. The aquatic ecosystems are dependent on these primary producers and are affected by the environmental conditions. To assess the changes in aquatic environment, they can be used for bioassessment of aquatic ecosystem. 8 genera of cyanobacteria were observed during the study period. *Oscillatoria* was found of more common occurrence in Chambal River.

Keywords: Chambal, Cyanobacteria, Prokaryotes, Phytoplanktons

Introduction

Cyanobacteria originated almost 3.5 billion years ago. They are also known as 'blue-green algae' because of the bluish green colour imparted by dominant phycocyanin pigment to them. But due to their close affinity to prokaryotic bacteria than to eukaryotic algae they are popularly known as cyanobacteria. They are the only oxygenic phototrophic prokaryotes which can perform oxygen evolving photosynthesis through photosynthetic pigments diffused in the entire cytoplasm. Cyanobacteria thrive well in variety of habitats from freshwater to marine, acidic to alkaline, hot water to soil, desert to snow[1].

These are the only algae that can fix atmospheric dinitrogen with the help of specialized thick walled cells called 'heterocysts' in some species. Besides being used as nutrient source, health supplement, animal feed, in cosmetics, wastewater treatment and for the production of secondary metabolites, these algae are of utmost importance as these are the first oxygenic photosynthetic organisms that have prepared the present day's aerobic environment to live in by releasing oxygen[2,3]. These are the most successful organisms that are still in existence and are exploiting every possible extreme of habitats for billions of years since their existence[4].

Diversity can be evaluated by calculating various indices, commonly known as diversity indices. The diversity indices are concerned with species diversity and take species occurrence into account[5]. Diversity of cyanobacteria in Chambal river in Rajasthan has been studied by some workers[6-9]. The present study was conducted with the aim to study the species diversity of cyanobacteria of a freshwater river using diversity index.

Materials & Methods

Study area:

The study is conducted in Kota city of Rajasthan. The city is located at 25°10'57.1" N latitude and 75°50'20.7" E longitude in south eastern part of Rajasthan[10]. Chambal river is the freshwater river of Rajasthan. It is the lifeline of the city. It originates from Janapao Hills of Vindhya range in south of Mhow town of Madhya Pradesh[11].

For the present investigation two sampling sites were selected on Chambal river. Station I (S-I) was selected at the entry point in upstream of Chambal river in the city near Akelgarh and Station II (S-II) was selected in the downstream of river behind the Chhoti Samadh temple in the middle of the city (Figure 1&2). The Kota Barrage is a dam that divides the flow of river into upstream and downstream.

Figure-1: Sample collection Site S-I (near Akelgarh)

Figure-2: Sample collection Site S-II (behind the Chhoti Samadh Temple)

For the study of species diversity of cyanobacteria the surface water samples were collected in polyethylene bottles from the selected sampling stations S-I and S-II during the summer season from March 2018 to June 2018 in the morning time. With the preparation of fresh mounts in laboratory the collected samples were studied within 48 hrs and also fixed and preserved using Lugol's solution for further detailed examination. The observation of microscopic Cyanobacteria was done using a trinocular research Metzer-M microscope (Model METZ-5000 DTM). Microphotography was done with an imported camera MD500 attached with microscope. Identification of species of cyanobacteria was done with the help of monograph and available relevant literature [12-14]. The enumeration of cyanobacteria was done using haemocytometer.

Sorensen's Index of Similarity (IS_S) was used as a diversity index to calculate the number of species common or similar between two communities compared[5]. This index was given by Sorensen in 1948.

The index was calculated as with the formula:

$$IS_S = \frac{2C}{A+B} X100$$

where

C = No. of species common to two releves/sites

A = Total number of species in releve/site A

B = Total number of species in releve/site B

Results and Discussion

Species diversity at the two stations were studied during the summer season in 2018. Total 7 genera of cyanobacteria were observed at S-I while only 5 genera were observed at S-II during the study (Table-1& 2). Bhatnagar and Bhardwaj (2013b)[6] reported 12 genera of cyanobacteria in Chambal River in their one year study during 2011-2012.

It was observed that species diversity differed at both the stations in upstream and downstream of Chambal River during the

study period. *Chroococcus* was observed dominant at Station I(S-I). The site at upstream of Chambal river was observed with higher diversity of cyanobacterial species. This richness of species is may be due to less human disturbance at Station I.

Oscillatoria was found dominant at both the stations during the summer season. *Anabaena*, *Aphanocapa* and *Spirulina* were not observed at S-II but were observed at S-I during the summer season. *Microcystis* showed dominance at station II (S-II). Occurrence and dominance of *Microcystis* is an indicator of organic pollution. As Station II is situated downstream of the Chambal river, it may be concluded that due to more anthropogenic activities and addition of sewage and waste at station II the water is rich in nutrients at downstream that favours the growth of *Microcystis* resulting in the formation of algal blooms (Figure 3).

Figure-3: Picture showing human interference at Station II

The value of Sorensen's Index of Similarity (IS_S) was calculated 0.5 between S-I and S-II which indicates that there is 50% similarity in the species of cyanobacteria present at two stations studied. It can be stated that there is a change in diversity of species from upstream to downstream of Chambal River.

It can be concluded that the species diversity of Chambal River differs from upstream which is minimally disturbed aquatic ecosystem to downstream tending to a change in the diversity of species of cyanobacteria due to human interference.

Table 1. Species diversity at two stations in summer season

Cyanobacteria	**S-I**	**S-II**
Anabaena sp.	+	-
Aphanocapsa sp.	+	-
Chroococcus sp.	++	+
Merismopedia sp.	+	+
Oscillatoria sp.	++	++
Planktothrix sp.	+	+
Spirulina sp.	+	-
Microcystis sp.	-	++
(++ dominant + present - absent)		

Table 2. Table showing Sorensen similarity index between two stations

Sorensen similarity index	**S-I & S-II**
	0.5

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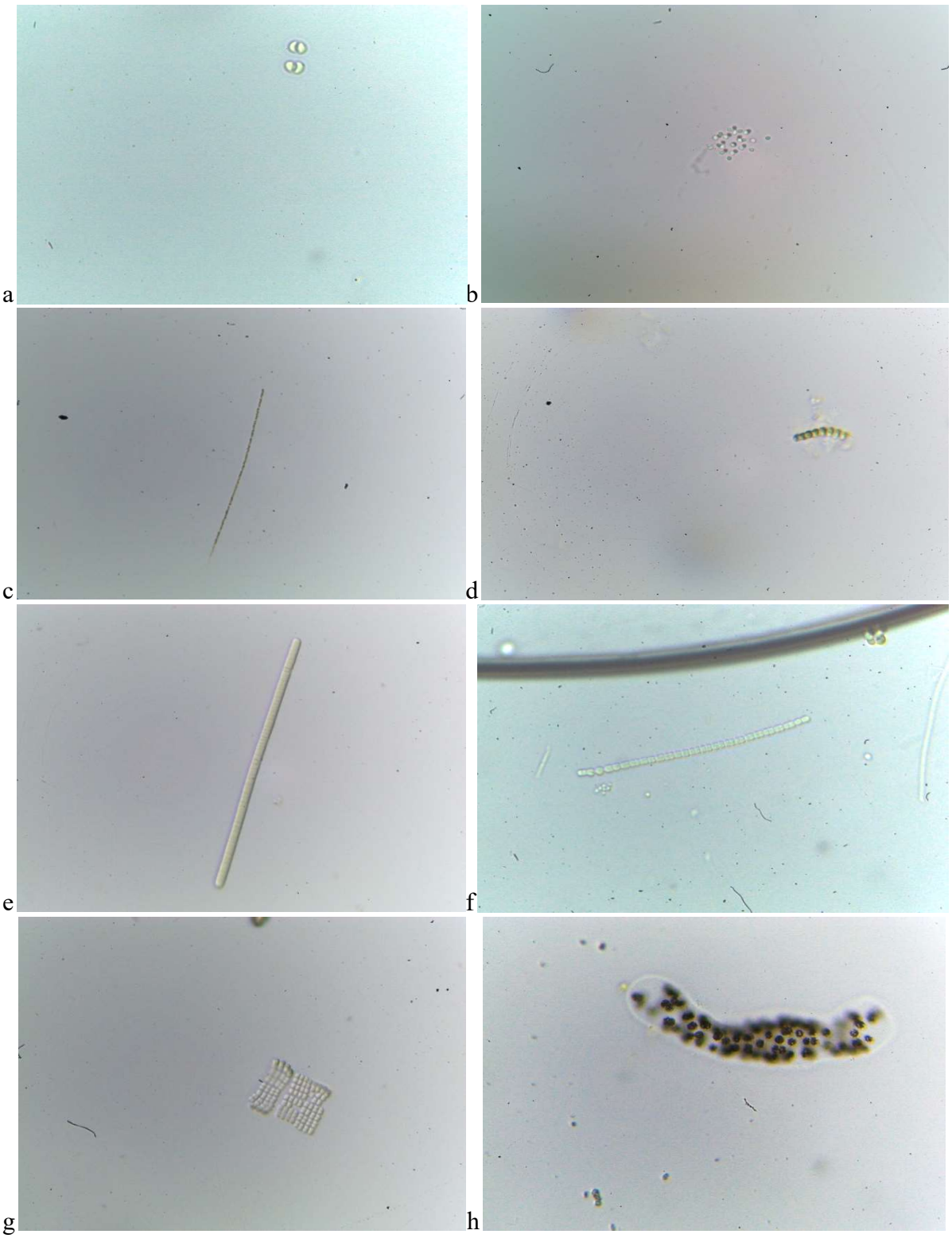

Plate1 a. *Chroococcus* sp. b. *Aphanocapsa* sp. c. *Planktothrix* sp. d. *Spirulina* sp. e. *Oscillatoria* sp. f. *Anabaena* sp. g. *Merismopedia* sp. h. *Microcystis* sp.

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