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# Floristic Composition and Periodical Analysis of Cyanobacteria of Some Freshwater Aquatic Bodies of Bikaner (Rajasthan), India

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**Abstract:**
Studies pertaining to the systematic enumeration, floristic composition and periodical analysis of the Cyanobacteria of two freshwater aquatic bodies (Kalyan Sagar Pond and Kodamdesar Pond) of Bikaner. The work was carried out for the period of one year from July 2012 to June 2013. A total 14 species of 9 genera of Cyanobacteria were observed in the year round study. Summer season support the maximum number and density of Cyanobacteria in both Kalyan Sagar and Kodamdesar Pond.
**Keywords:** *Cyanobacteria; Kodamdesar Pond; Kalyan Sagar Pond*

## Introduction

Bikaner district is located between 27°11' and 29°03' N latitude and 71°54' and 74°12' E longitude and lies in the north-western part of Rajasthan. This region is covered by shifting and stabilized sand dunes of various types, magnitude and orientation like longitudinal, barkhan, transverse etc. Kodamdesar pond, situated at Kodamdesar village is about 24 km from Bikaner city and Kalyan Sagar Pond is situated about 7 km east of Bikaner city. It is manmade and rain fed pond and retain water whole the year and in case of low rainfall during the year it become dry for few months.

Cyanobacteria are the largest known oxygenic organisms, which by their photosynthetic activity probably made a fundamental contribution to the development of the present oxygenic environment. Study of blue greens in different part of India has been carried out by various workers (Singh, 1961; Gonzalves and Joshi, 1946; Gonzalves and Kamat, 1958, 1960; Kamat, 1961; Desikachary, 1970; Bendre and Agarkar, 1965; Khare *et al*., 2010; Roy *et al.,* 2012; Deka *et. al.,* 2012; Bhushan and Kumar, 2013; Jain; 2015; Kesarwani *et. al.,* 2015; Kashturi *et al*., 2016; Tandon *et al.,* 2016).

## Material and Methods

Samples were collected from different sites of the Kodamdesar and Kalyan Sagar Pond, randomly during July 2012 to June 2013. After the collection, the algal material was studying in a living state and the samples were not allowed to be exposed to strong light. Several fundamental characteristics were used for taxonomic interest. These are shape, size, number, arrangement, type appendages etc. of cells. The systematic enumeration of Cyanobacterial species were done with the help of standard work of Cyanophyta (Desikachary 1959); Structure and Reproduction of Algae (Fritch 1935); Fresh Water Algae of the United State (Smith 1950) and Algae of Western Great Area (Prescott 1962).

## Results

**Systematic Enumeration and Description of Cyanobacteria**
**Order : Chroococcales**
**Family : Microcystaceae**
**Genus : *Microcystis*** Kutzing ex. Lemmermann
*Microcystic flos-aquae* ( Wittr.) Kirchner
Colonies roughly spherical, ellipsoidal, or somewhat elongate of often squarish in optical section, net clathrate, with indistinct colonial mulilage, cells spherical, with gas-vacuoles, nannocytes present, Cell 3-7 µ diameter .

*Microcystis aeruginosa* Kutz.
Colonies when young round or slightly longer than broad, solid, when old becoming clathrate, with distinct hyaline colonial mucilage, cells spherical, generally with gas-vacuoles, cell 3-7 µ diameter.

**Family : Chroococcaceae**
**Genus : *Merismopedia*** Meyen
*Merismopedia elegans* A. Br.
Colonies small or big, 16-4000 celled, cells spherical or oblong, more or less closely arranged, light blue, Cell : 3.5-7 µ broad and 4.8-6 µ long.

*Merismopedia glauca* (Ehrenb.) Nag.
Colonies mostly small with 16-64 cells, rarely more, 45-150 µ diameter, cells oval to spherical, closely arranged, pale blue-green, Cell : 3-6 µ broad and 3.3-4.5 µ long.

**Order : Nostocales**
**Family : Nostocaceae**
**Genus : *Anabaena*** Bory
*Anabaena doliolum* Bharadwaja
Thallus mucilaginous, pale blue-green, trichome single, free-swimming, straight, curved or slightly tapering at the ends, with conical apical cell, cells barrel shaped, as long as broad or little longer than broad, heterocysts barrel-shaped, spores ellipsoidal, adjoining the heterocysts, Cell 3.6-4.2 µ broad, Heterocyst 5.2-6.3 µ broad and 6.3-9.4 µ long, Spore 4.2-6.2 µ broad and 6.3-11.5 µ long.

**Genus : *Anabaenopsis (*** Wolosz.) Miller Sensu Strict.
*Anabaenopsis circularis* ( West) Wolosz. et Miller )
Trichome free swimming , very short, mostly spirally coiled, with 1-1.5 spirals, very seldom straight, cells spherical or somewhat longer than broad, heterocyst spherical, spore not known, Cell : 4.5-6 µ broad and 5-8 µ long.

**Genus : *Raphidiopsis*** Fritsch et Rich.
*Raphidiopsis mediterranea* Skuja
Trichome free-floating, mostly straight, often curved, or weakly sigmoid of 6-12 cells, attenuated at both ends, unconstricted at cross-walls, generally with gas vacuoles, spore ellipsoid with rounded ends, epispores brown, thick and smooth, Cell 1.9-3 µ broad and 40-110 µ long.

**Family : Oscillatoriaceae**
**Genus : *Arthrospira*** Stizenberger
*Arthrospira jenneri* Stizenb. ex Gomont
Tricomes blue-green, unconstricted at the cross-walls or very little constricted, not attenuated at the ends, more or less regularly spirally coiled, spirals 9-15 µ broad, distance between two spirals 21-31 µ, cells nearly as long as broad, or somewhat shorter than broad, end cells broadly rounded, Cell 5-8 µ broad and 4-5 µ long.

*Arthrospira massartii* Kuffareth
Tricomes loosely coiled, spirals 26-28 µ broad, distance between spirals 50 µ, cells grayish blue-green, end cells rounded conical, cross-walls not granulated, no gas-vacuoles, Cell 5-6 µ broad and 2-4 µ long.

**Genus : *Lyngbya*** Ag.
*Lyngbya contorta* Lemm.
Filament single, free floating regularly spirally coiled, with a delicate, nearly circular coils, sheath narrow, coloureless, not constricted at the cross-walls, granulated with a single granule or without them, end cell rounded, not attenuated, Cell 1-2 µ broad and 3-5 µ long

*Lyngbya martensiana* Menegh. ex Gomont
Thallus caespitose, blue-green,when dried violet, filaments long, more or less flexible, sheath colourless, thick, trichome not constricted at the cross - walls, cross wall sometimes granulated, apices not attenuated, end cell rotund, calyptra absent, Cell 6-10 µ broad and 1.7-3.3 µ long.

**Genus : *Oscillatoria*** Vaucher
*Oscillatoria subbrevis* Schmidle
Trichome single, 5-6 µ broad, nearly straight, not attenuated at the apices, cell not granulated at the cross-walls, end cell rounded, calyptra absent, Cell : 4.9-6.8 µ broad and 1.5-2.5 µ long.

*Oscillatoria perornata* Skuja
Trichomes erect and flexuous, apices briefly attenuated and bent or curved, well constricted at the cross-walls, single, content pallide tenerumgue aeruginius, finely granular, septa more or less granulated, end cell humilis depressed hemispherical, calyptra absent, Cell 13-15 µ broad and 2.5-6.5 µ long.

**Genus : *Spirulina*** Turpin em. Gardner
*Spirulina major* Kutz. ex Gomont
Tricome 1.2-1.9 µ broad, regularly spirally coiled, blue-green, spirals 2.5-4 µ broad and 2.7-5 µ distant, apex not attenuated, terminal cell rounded without calyptras, Cell 1.2-1.9 µ broad, Spiral 2.7-5 µ long.

**Table – 1. Occurrence (months), Peak month and Maximum Density of Cyanobacteria in Kalyan Sagar Pond and Kodamdesar Pond of Bikaner, during 2012 – 2013.**

| Name of the species | Kalyan Sagar Pond | Kodamdesar Pond |
|---|---|---|
| **Cyanobacteria** | | |
| **Order : Chroococcales** | | |
| **Family: Chroococcaceae** | | |
| *Microcystis flos aquae* (Wittr.)Kirchner | 7 (May) 15 | - |
| *Microcystis aeruginosa* Kutz | 11 (Jun.) 20 | 12 (May) 25 |
| *Merismopedia elegans* A. Br. | - | 9 (Jun.) 16 |
| *Merismopedia glauca* (Ehrenb.) Nag. | 6(Jun.) 5 | 7 (Apr) 10 |
| **Order : Nostocales** | | |
| **Family: Oscillatoriaceae** | | |
| *Anabaena doliolum* Bharadwaja | 2 (May) 6 | 6 (May) 8 |
| *Anabaenopsis circularis* (West) Wolosz. et Miller | - | 7 (Apr) 10 |
| *Raphidiopsis mediterranea* Skuja | 6 (Mar., Apr., Jun.)10 | - |
| *Arthrospira jenneri* Stizenb. ex Gomont | 9 (May) 9 | 12 (May) 8 |
| *Arthrospira massartii* Kuffareth | - | 10 (Jun.) 8 |
| *Lyngbya contorta Lemm.* | 9 (May, Jun.) 9 | 11 (May) 12 |
| *Lyngbya martensiana Menegh ex Gomont* | 11 (May) 10 | - |
| *Oscillatoria subbrevis* Schmidle | 12 (Apr., May) 12 | 12 (May) 28 |
| *Oscillatoria perornata* Skuja | - | 7 (Jun., Jul.) 8 |
| *Spirulina major* Kutz. ex Gomont | - | 12 (Dec.) 12 |

- not observed

**Floristic Composition and Periodical Analysis**

Cyanophyceae or Cyanobacterial group was observed to be represented by 9 species belonging to 7 genera in Kalyan Sagar Pond. Out of them, 3 species belongs to Chroococcales and 6 to Nostocales. Chroococcales This group was observed to be dominant during the period of April to June with the concentration and maximum display was observed during the summer season followed by the rainy and winter season. This group exhibited maximum density in the month of May and June. In respect of season, the density of blue green was observed to be maximum during summer season decreasingly followed during rainy and winter season. The density among the orders of this group was that of 130 Ind. $ml^{-1}$ (Chroococcales) and 249 Ind. $ml^{-1}$ (Nostocales). Chroococcales had their maximum concentration during June and Nostocales during May. The maximum density among the species of different order of Cyanophyceae was that of *Microcystis aeruginosa* (Chroococcales) and *Lyngbya martensiana* (Nostocales).

In Kodamdesar Pond, Cyanophyceae was represented by 11 species belonging to 8 genera. Out of them, 3 species belongs to Chroococcales and 8 to Nostocales (Table-1). Cyanophyceae was observed to

be dominant during the period of April to June in the number of species and algal concentration and maximum display of this group was reported during the summer season followed by the rainy and winter season. The maximum density (120 Ind. $ml^{-1}$) of blue greens was observed during May and minimum (18 Ind. $ml^{-1}$) during February. The density among the orders of this group was that of 226 Ind. $ml^{-1}$ (Chroococcales) and 464 Ind. $ml^{-1}$ (Nostocales). Chroococcales and Nostocales had their maximum concentration during May. The maximum density among the species of different order of Cyanophyceae was that of *Microcystis aeruginosa* (Chroococcales) and *Oscillatoria subbrevis* (Nostocales).

**Discussion**

In the present study, total 14 Cyanobacterial species of 9 genera were taxonomically enumerated. Out of total 14 species, 9 species were observed in Kalyan Sagar and 11 species in Kodamdesar Pond. Cyanobacteria were observed dominantly during the summer season followed by rainy and winter in both Kalyan Sagar and Kodamdesar Pond in respect of number of species and concentration. A peak of maximum concentration of Cyanophyceae was observed during the month of May in both the pond. Nostocales order exhibited the better performance in comparison to Chroococcales with number and concentration in both the Pond.

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