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Cyanobacterial diversity in Johila Reservoir, Amarkantak (M.P.), India

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ABSTRACT

Cyanobacteria are blue-green algae included in the division Cyanophycophyta and class Cyanophycophyceae. Since they are Prokaryotic in nature and structure hence called cyanobacteria. Though cyanobacteria are known as a potential nuisance in freshwater bodies and a risk bio-factor for human health, however, they play a crucial role in the fixation of atmospheric nitrogen and sustainable agriculture. In the present study, the diversity of the Cyanobacterial population in Johila reservoir, which is interiorly located in Amarkantak, and no study on its prevalence has been done so far. Six species of cyanobacteria belonging to these orders have been observed in the Johila reservoir and its outlets: *Oscillatoria princeps*; *Anabaenatorulosa*; *Cylindrospermum musicola*; *Merismopedia glauca*; *Oscillatoria chlorina*; *Oscillatoria terebriformes*. The nature, structure and, prevalence, status of each Cyanobacteria has been discussed in this paper.

Key words : Johila Reservoir, Cyanobacteria, Nostocales, Chlorococcales

Introduction

Cyanobacteria are not actual bacteria; instead, these are microalgae belonging to the class myxophyceae or cynophyceae. Since they contain the prime Character of bacteria, i.e., prokaryotic cells, and at the name of class Cynophycophyceae, such groups of algae are called cyanobacteria.

Cyanobacteria play a crucial role in nitrogen fixation and primary productivity and transforming the energy at the higher trophic level. Since Johila reservoir is interiorly located, covering an area of about 216 acres and on the diversity of cyanobacteria in this reservoir, hence present study has been undertaken.

In the propagation of aqua farming, the natural conditions of freshwater bodies are supposed to be helpful. The overall picture of any freshwater aquatic ecosystem is primarily determined by the interaction of its Physico-chemical and biological

properties. Since cyanobacteria are blue-green algae, they fix the radiant energy.

The accurate picture of the primary productivity of any freshwater aqua system may be judged by the abundance of the cyanobacteria and phytoplankton bio-mass Blue-green algae, which belong to the division Cynophycophyta and Class-Cynophycophyceae are well-known nitrogen fixer in the natural aquatic eco-systems.

Sporadic studies have been made on the diversity of Cyno-bacteria (Blue-green algae); hence present study has been undertaken to analyze the status of cyanobacteria in the Johila reservoir and its outlets from May 2021-June 2022.

Materials and Methods

For qualitative analysis of blue-green algae (Cyanobacteria) of division Cynophycophyta and class Cynophycophyceae, observations were made

from May 2021 to June – 2022 at four sampling sites, namely A, B, C, and D.

Site 1: (A) This sampling site is an emerging point of the Johila river near the village Bhundakona (North direction).

Site 2: (B) This sampling site is fixed near villages Bhawariya and Umargohan (East direction).

Site 3: (C) This sampling site is fixed near the village Lalpur (South direction).

Site 4: (D) This sampling site is fixed near the village Podki and Harratola (West direction).

Collections of cyanobacteria were done with the help of a planktonic mesh net.

Cyanobacteria samples were prepared using stain with iodine and mounted with glycerine; their characterization has been illustrated with their salient features.

Results and Discussion

The flowing Cyanobacterial members of division cynophycophyta and class cynophycophyceae with their respective orders in Johila Reservoir of Amarkantak, interiorly located covering an area of about 216 acres) has been described ahead.

It belongs to the order Nostocales; In this species, trichomes are aggregated loosely, giving the appearance of a floating mass. It is almost straight or slightly covered at the apex. It is not constricted at the cross walls; granules are distributed irregularly throughout the cell. The cells somewhere reveal margins. The cell wall of this procaryotic algae is thick and smooth. Its prevalence is high at the outlet of the lake and less at the site(A). This sampling site is an emerging point of the Johila river near the village Bhundakona (North direction).

It belongs to the order Nostocales of class



Fig. 1. *Oscillatoria princeps* (Voucher Ex. Gomnt)

cynophycophyceae. It is a solitary integrated into a thin brownish-green mucilaginous constriction. It is free-floating and slightly bent cyanobacteria, with cell diameter ranging from 4.0-4.5 μm and a length

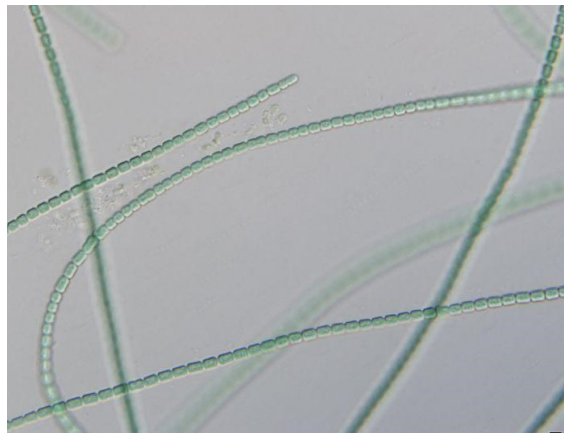


Fig. 2. *Anabaena torulosa* (Carm.)

of about 5.1-8.4 μm . Looks barrel shape and is slightly constricted at the center; cells do not contain granules and gas vacuoles. The heterocyst is intercalary, bipolar, and ovoid or globular.

The wall of the epispore is thick, smooth slightly brown in color. Its prevalence was high at the site - B, near village Bhawariya and Umargohan, and less at the outlet.

It belongs to the order Nostocales of class cynophycophyceae. It is filamentous cyanobacteria, and the filaments are entangled in mucilaginous covering. The trichomes' diameter is about 4.1-5.9 μm .

Cells are constricted at the cross wall. The cells are cylindrical and somewhat quadrate, having 4.2-8.4 μm , in length.

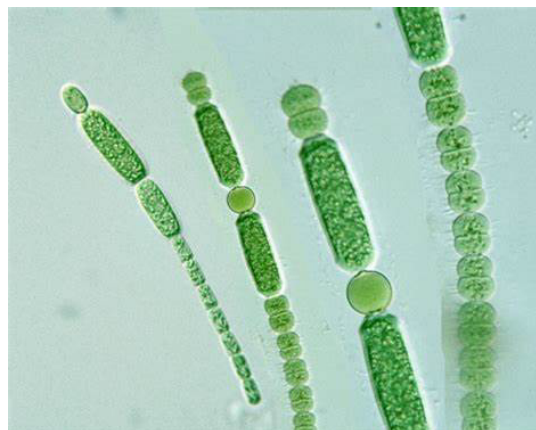


Fig. 3. *Cylandro spermum muscicola* (Kuetz. Ex. Born. Flah)

Granules and gas vacuoles are absent in the cell, and the green pigments are homogeneously scattered. Its prevalence is high at site D and outlet and less at sites A, B, and C (near village Bhundakona, village Bhawariya, and Umargohan, Podki, and Harrantola), respectively.



Fig. 4. *Merismopedia glauca* (Ehr.)

Cell content in this cyanobacterium is homogenous, and the agranular colony appears light blue-green. Each cell is roughly rectangular, having crenate margins cells, and is usually present in multiples of four. The diameter is about 2.0-3.0 μm , Cell wall is smooth and thick and contains cytoplasm and gas vacuoles. Its prevalence is high at sites B and C, lesser at sites A & D, and reservoir outlets.

The shape of the cells of this cyanobacterium is variable, representing quadrate frequently; however, some are broad and short. Each cell is about 3.4-5.0 μm long. The content of the cell is yellowish or greenish and homogenous. It is granular and vacuolar. The cell wall is smooth and thick; its prevalence is high at sites A and low at sites B, C, and D.

Morphology is straight, and trichomes are thin. It gives a light blue-green color. Cell diameter is 3.1 - 5.3 μm . Cells are longer and broad cell content is blue-green, homogenous, and non-granular, having

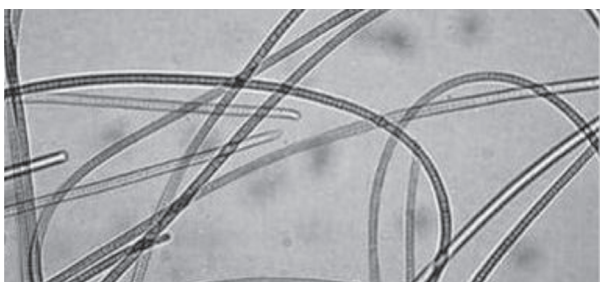


Fig. 5. *Oscillatoria chlorina* (Kuetz Ex. Gomant)

no gas vacuoles; and calyptra in the cyanobacteria. The cell wall is smooth and thick. Its prevalence is high at the site -B and less at sites A, C, and D.

Several workers have conducted various hydrobiological studies, namely Shukla *et al.*, (2008); Shukla *et al.*, 2011a & 2011b; however, sporadic studies have been made on cyanobacteria. Therefore, qualitative analysis of cyanobacteria in Johila reservoir, Amarkantak, has been completed and may be helpful for further studies, especially in the productive potential of this lake and other freshwater bodies of India in general.

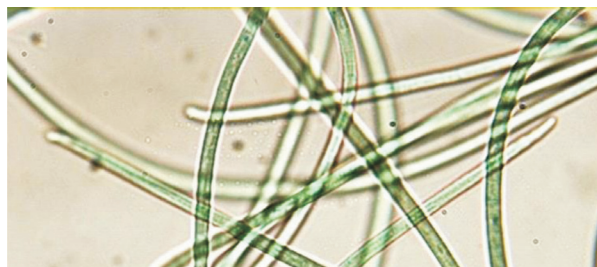


Fig. 6. *Oscillatoria terebriformis* (Ag.Ex. Gomont)

Cyanobacteria (also called blue-green algae) are an ancient group of photosynthesis microbes in the division Cyanophycophyta and class Cyanophycophyceae. These occur in most inland waters and significantly affect the water quality and functioning of the aquatic ecosystem. They include about 150 genera and 2000 species having a wide range of shapes and sizes. These bacteria obtain energy via photosynthesis. These are regarded as a diverse group of photos auto-trophic prokaryotes, commonly called blue-green algae. Johila reservoir is the interior of the district head-quarter, Anuppur, and having no industrialization in this area, it is unpolluted and undisturbed, representing a sustainable lentic ecosystem. Cyanobacteria are potential wonders since they produce toxins that may cause certain health disorders, including allergies, gastroenteritis, and human liver dysfunction. However, they are regarded as indicators of the productive potential of the lentic and lotic bodies because cyanobacteria bring nitrogen fixation. For a long time, microbes have been known to contribute to seeking fertility and sustainable green energy production (Koller *et al.*, 2012). It has also been proposed that cyanobacteria may be the vital bio-agent in the ecological restoration of degraded lands; they are also helpful for wastewater treatment and can degrade various toxic compounds, including pesti-

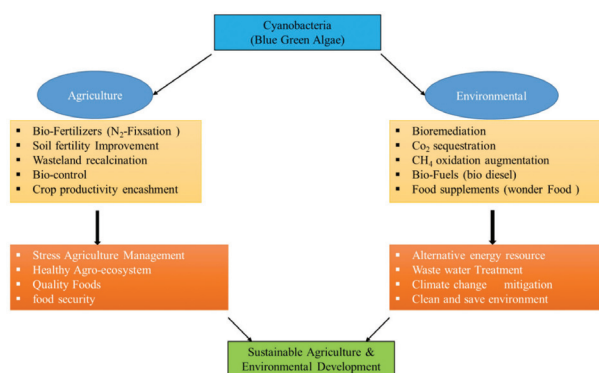


Fig. 7. A Model representing the potential role of cyanobacteria in sustainable agriculture and environment

cides (Cohen, 2006). A conceptual model for the role of cyanobacteria in sustainable agriculture and environmental management has been proposed below:

It highlights the role of cyanobacteria in bio production, agriculture and environmental sustainability, and ecological restoration. Various works on the part of cyanobacteria have been done, notably by Anjana *et al.*, (2007); Atsumi *et al.*, 2009; Dutta *et al.*, (2005); Kaushik, 2012; Lee *et al.*, (2004); however, the taxonomic study of the cyanobacteria in aquatic eco-systems is scarce. Therefore, the present study has been undertaken, and in aquatic bodies of M.P., an attempt has yet to be made to identify cyanobacteria.

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