

Fresh Water Cyanophycean Algae From Durg and Rajnandgaon District (C.G.), India

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Abstract: Cyanobacteria are of great economic value. The morpho-taxonomic survey of fresh water algae of Durg and Rajnandgaon (C.G.) has revealed that large numbers of blue-green algae are present in the water bodies. Around 12 large and moderate size water bodies of the area are screened throughout the year 2013-14. In the present paper 24 taxa of class cyanophyceae including 13 genera have been described. These taxa belongs to orders Chroococcales (7 taxa) and Nostocales (17 taxa). Durga chowk pond, RJN was found to have maximum number of taxa (14) followed by Budha Sagar pond, RJN (11) and Lyngbya ceylanica was found most common among all other representatives.

Keywords: cyanobacteria, diversity, morpho-taxonomic, single-cells, filamentous.

1. Introduction

Cyanobacteria, formerly called "Blue-Green Alga" are relatively simple, primitive life forms of earth, closely related to bacteria. They are morphologically diverse group of unique photosynthetic organisms of great importance because of their very long existence for well over 3.5 billion years and cosmopolitan distribution in terrestrial, freshwater and marine habitat [1], [2].

Tropical conditions such as those in India provide favorable environment for the luxuriant growth of these organisms in the natural ecosystems. Diversity studies for exploiting their innate potential have been done by many in various habitats. Recently many workers have worked on algal diversity of Central, Eastern and South-Western Uttar Pradesh [3] and from various parts of Northern India have also recorded [4]. High temperature is observed favorable for the growth of cyanophycean taxa [5]. Algal flora of Banjara and Nadini lakes have been studied and reported that the lakes were eutrophic and dominated by Cyanophycean and Bacillariophycean members [6]. Cyanobacterial biodiversity in relation to certain physico-chemical parameters of pond water have been observed from Thanjavur, Tamilnadu, India [7]. Some observations were reported on the distributional pattern of Cyanobacteria in different habitats of Durg Dist. in Chhattisgarh [8], [9].

Durg and Rajnandgaon are second major districts of Chhattisgarh after Raipur. The area receives tropical climate and many large and moderate size water bodied scattered over the land surface. Very little work on particular Cyanophycean algae has been reported so far from this area. The present report is a preliminary work done during isolation and characterization of indigenous Cyanobacterial members so as to exploit them for commercial purpose.

2. Materials and Methods

Algal collections have been done with the help of planktonic mesh net and forceps during July 2013 to June 2014 from different fresh water ponds of Durg-Rajnandgaon (C.G.). Algae growing in the marginal soil of ponds and submerged in water and free floating on the surface of water were

collected in clean polythene bags. A small amount of sample was preserved in 4% formalin and remaining was used for transfer to culture media. Algal forms are stained with methylene blue and mounted in glycerin. Taxonomic consideration of algal species has done on the basis of morphological types, cell dimensions, trichomes / filaments shape, sheath thickness, size and position of akinetes / heterocysts. Algal taxa are identified and systematized according to [1], [10] and [11]. The specimens are preserved at the Microbiology Lab., Govt. V.Y.T.P.G. College, Durg (C.G.).

3. Result and Discussion

All together 24 species belonging to 13 genera were recorded from 12 study sites (Table-1, 2 Plate-1, 2). Out of that 7 single celled forms and 16 filamentous forms were observed. Durga Chowk pond and Budha Sagar pond were recorded most diversified ponds of RJN area which consist 15 and 11 species of Cyanobacteria respectively. Vikas Nagar pond and Indira Sarovar pond were recorded least diversified ponds of RJN area. Both the ponds consists only 1 species of Cyanobacteria viz. *Gomphospheria naegelianum* and *Nostoc sponaegiaeforme* respectively. Risali villege pond was recorded the most diversified pond of Durg area with 9 species of Cyanobacteria, while Deepak Nagar pond was recorded as least diversified pond of Durg area which consist of only 2 species of Cyanobacteria viz. *Lyngbya ceylanica* and *Oscillatoria principes*.

Camptylonema indicum, *Calothrix sp.*, *Synchococcus aeruginosus*, *Microchaete uberrima* and *Microcoleus lacustris* were recorded as single isolates from Durga Chowk pond (RJN), Budha sagar pond (RJN) and Purai villege pond (Durg) respectively. Members of order Nostocales were found dominating (17 taxa) while the family Oscillatoriaceae is the most common (21 species) among all.

From this data it can be assumed that nitrogen fixing strains like *Nostoc*, *Anabaena* and other members of Oscillatoriaceae are abundant in these low-land areas. Thus reported Cyanophycean flora along with their natural habitat, may have local application in rice and paddy fields

as a biofertilizer. Studies on their further characterization is under progress.

Tables and Plates

Table 1 (a): Diversity of Cyanobacteria in fresh water pond of Rajnandgaon Dist.

S.No.	Name of the isolates	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6	Total
Single cell forms								
1.	<i>Synechococcus aeruginosus</i>	-	-	-	-	+	-	01
2.	<i>Microcystis aeruginosa</i>	-	-	+	+	+	+	04
3.	<i>M. viridis</i>	-	-	+	+	+	+	04
4.	<i>Aphanocapsa Montana</i>	-	-	-	+	-	-	01
5.	<i>Gomphospheria naegelianum</i>	+	-	-	-	+	+	03
Filamentous forms								
6.	<i>Lyngbya ceylanica</i>	-	-	+	-	+	-	02
7.	<i>L. hieronymusii</i>	-	-	+	-	+	-	02
8.	<i>L. holdenii</i>	-	-	+	-	+	-	02
9.	<i>Oscillatoria tenuis</i>	-	-	+	-	+	+	03
10.	<i>O. limosa</i>	-	-	+	-	+	-	02
11.	<i>O. obscura</i>	-	-	+	-	-	-	01
12.	<i>O. proboscidea</i>	-	-	+	-	-	-	01
13.	<i>O. subbrevis</i>	-	-	+	-	+	-	02
14.	<i>O. principes Aand B</i>	-	-	+	-	-	-	02
15.	<i>O. sancta</i>	-	-	+	-	-	-	01
16.	<i>Nostoc spongiaeforme</i>	-	+	+	-	-	-	02
17.	<i>Camptylonema indicum</i>	-	-	+	-	-	-	01
18.	<i>Calothrix sp.</i>	-	-	-	-	+	-	01
Total no. of sp.		01	01	15	03	11	04	18

Table 1 (b): Diversity of Cyanobacteria in fresh water pond of Durg Dist.

S. No.	Name of the isolates	Pond 7	Pond 8	Pond 9	Pond 10	Pond 11	Pond 12	Total
Single cell forms								
1.	<i>Aphanothwce sp. A and B</i>	-	-	+	-	+	-	04
2.	<i>Aphanocapsa Montana</i>	-	-	+	-	+	+	03
Filamentous forms								
3.	<i>Lyngbya ceylanica</i>	+	-	-	+	+	-	03
4.	<i>L. hieronymusii</i>	-	-	-	-	+	-	01
5.	<i>L. holdenii</i>	+	-	-	-	-	-	01
6.	<i>Oscillatoria tenuis</i>	-	-	-	-	-	+	
7.	<i>O. limosa</i>	-	-	-	-	-	+	
8.	<i>O. obscura</i>	-	+	-	-	-	+	02
9.	<i>O. proboscidea</i>	-	+	+	-	-	+	03
10.	<i>O. subbrevis</i>	-	-	-	-	-	+	
11.	<i>O. principes Aand B</i>	-	-	-	+	-	+	04
12.	<i>O. sancta</i>	-	-	-	-	+	+	01
13.	<i>Microchaete uberrima</i>	-	+	-	-	-	-	01
14.	<i>Anabaena naviculoides</i>	+	-	-	-	-	+	02
15.	<i>Microcoleus lacustris</i>	-	+	-	-	-	-	01
Total no. of sp.		03	04	04	04	06	09	15

+ : present; - : not recorded. Pond 1: Vikash nagar pond, RJN; Pond 2: Indira sarovar pond, RJN; Pond 3: Durga chowk pond, RJN; Pond 4: Rani sagar pond, RJN; Pond 5: Budha sagar pond, RJN; Pond 6: Moti talab, RJN; Pond 7: Shiv nath river RJN-Durg; Pond 8: Purai villege pond, Durg; Pond 9: Rishama villege pond, Durg; Pond 10: Deepak nagar pond, Durg; Pond 11: Rowabandha pond, Durg; Pond 12: Risali villege pond, Durg.

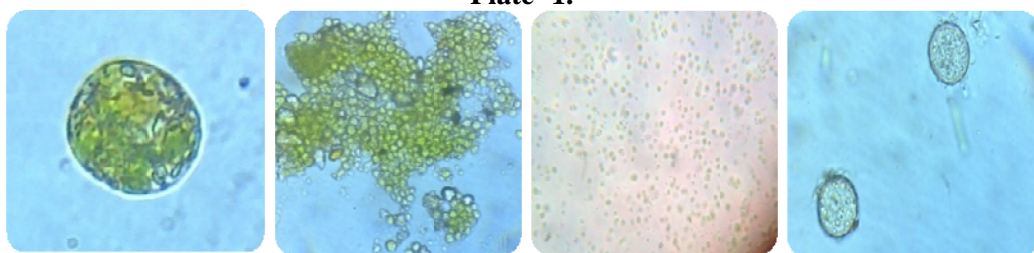
Table 2: Morpho-Taxonomic characteristics of the isolates

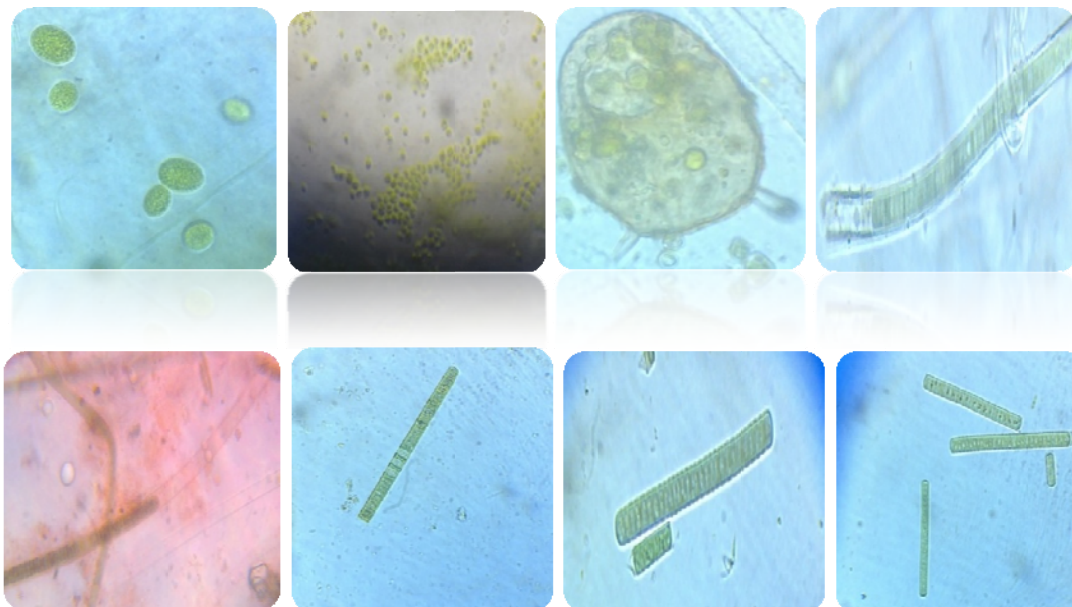
S.No.	Name of the isolates	Characteristics features
1.	<i>Synechococcus aeruginosus</i>	Cells cylindrical, 5-16µm broad, up to 30µm long, single or 2-4 together, pale blue-green.
2.	<i>Microcystis aeruginosa</i>	Colonies irregular in shape, cell 7-8µm in diameter, spherical generally with gas vacuole, mucilage sheath of colonies indistinct.
3.	<i>Microcystis viridis</i>	Cells in group of 2-4, blue green without sheath, 12-15µm in diameter, with sheath 50-52µm in diameter, sheath yellow-brown, distinct lamellated.
4.	<i>Aphanothece sp. A and B</i>	In nature, it grew as yellow-brown gelatinous expanses of several centimeters. In culture, a structured gelatinous blue-green floating thallus was formed which gradually turned yellow-green and then brown.
5.	<i>Aphanocapsa Montana</i>	Thallus of no definite shape, gelatinous, yellow-green or blue-green, olive coloured, light violet or colourless, cells 2.5-4µm diam., spherical, single or in pairs, mucilage colourless, diffluent.
6.	<i>Gomphospheria naegelianum</i>	Colonies spherical or ellipsoidal, often constricted, up to 30-40µm diam., with hyaline mucilage, cells ellipsoidal, spherical or ovoid, 1.5-2.5µm board, 2-4µm with distinct or gelatinized envelopes, loosely arranged, olive-green or yellowish, mucilage stalks of cells narrow or thin, irregular proceeding from the centre of the colony.
7.	<i>Lyngbya ceylanica</i>	Filament 15µm broad, slightly bent, sheath thin colourless, trichome blue-green, trichome constricted at the cross wall, not attenuated at the end. 12µm broad. Cell rectangular, ½ to 1/3 as long as broad, end cell rounded without calyptas.
8.	<i>Lyngbya hieronymusii</i>	Filament single, free floating, straight or slightly bent 37µm broad, sheath firm, homogenous, colourless, not coloured by violet chlor-Zinc iodide, trichome 32µm broad, cells 6-7µm long, not constricted at joints end cell broadly rounded.
9.	<i>Lyngbya holdenii</i>	Filaments attached to other algae by their middle, ends free, about 12-14µm broad, sheath thin,

		delicate, trichome pale green, distinctly constricted at the cross wall, 6-7µm broad, cell sub quadrate 3-4µm long, end cell rounded.
10.	<i>Oscillatoria tenuis</i>	Thallus thin blue green or olive green, slimy, trichome straight, fragile, slightly constricted at the cross wall, 12µm broad, blue-green, bent at the end, not attenuated, not capitates, cell up to 1/3 as long as broad, 2.8-3.2µm long, granulation at septa not clear, end cell more or less hemispherical.
11.	<i>Oscillatoria limosa</i>	Trichome more or less straight, blue-green or olive green, not constricted at the cross wall, 22µm broad, cell 7µm long, cross wall frequently granulated, end walls flatly rounded with slightly thickened membrane.
12.	<i>Oscillatoria obscura</i>	Thallus blue-green, unconstricted at the cross wall, slightly attenuated at the apex, granulated cells 1.6-2.0µm long.
13.	<i>Oscillatoria proboscidea</i>	Trichomes blue-green, curved, not constricted at the cross walls, cells flatly rounded, capitates with thick membrane, cells 2.5-3.5µm long.
14.	<i>Oscillatoria subbrevis</i>	Trichome straight, not attenuated at the apices, non constricted at the cross walls, 7-8µm broad, cells 1-1.4µm long, end cell rounded, without calyptras.
15.	<i>Oscillatoria princeps A and B</i>	Thallus blue-green, trichome straight, rigid, sp. a is constricted at the cross walls bt sp. b was not, not granulated, 25-30µm broad, cell 3-4µm long, apex slightly convex, end cells capitata with distinct undulations, calyptra absent.
16.	<i>Oscillatoria sancta</i>	Thallus blue-green, trichomes straight, not attenuated, end cell thickened, calyptras present, cells broad, constricted at the joints, cells 3.0-6.0µm long, 10.0-15.0µm broad.
17.	<i>Microchaete uberrima</i>	Filaments elongated, cylindrical, decumbent at their base stellately arranged 16µm broad, sheath firm, brown-green trichomes 12µm broad, not attenuated, cell generally subquadrate, spores and heterocyst are not seen.
18.	<i>Anabaena naviculoides</i>	Thallus thin, gelatinous, blue-green, trichome elongate, more or

		less coiled, moniliform, apices acuminate, cells 3.5-5µm broad, as long as or shorter than broad (developing akinetes), apical cell obtuse conical, or acute, sometimes retuse, heterocysts rare, intercalary, single, barrel-shaped, 5-6µm broad, as long as or slightly longer than broad, spores in long series, irregularly disposed, ellipsoidal, ends acute and protracted, exospores thin, hyaline, more or less 11-12.5µm long, 6-7µm broad.
19.	<i>Nostoc spongiaeforme</i>	Plant mass thin, spreading blue-green, trichomes loosely entangled, sometime individually enveloped by yellowish brown mucilage, 3-3.5µm broad, cells barrel-shaped, 2-3.5µm long, end-cell conical with a rounded apex, heterocysts barrel-shaped or cylindrical with rounded or flat ends, broader than the trichomes, 4.8-6.4µm broad and 5.8-6µm long, spores in long chains, cylindrical with rounded ends, sometimes ellipsoidal, rarely spherical, 4-4.8µm broad and 4.8-10µm long, with a smooth hyaline outer wall.
20.	<i>Camptylonema indicum</i>	Plant mass brownish, filament crescent shaped in the middle portion, 9.8µm broad, in the basal portion 12.5µm broad, sheath lamellate, heterocysts and hermocyst not seen.
21.	<i>Calothrix sp.</i>	Young trichome, broad, at base narrow towards apex, basal cell hemispherical, other cells barrel shaped constricted at middle, a loght strip visible through out the trichomes, both side of trichome are dark coloured, cell 8.7µm broad, 9µm long basal cell, 9.2µm broad.
22.	<i>Microcoleus lacustris</i>	Thallus blackish blue-green, filaments contorted, seldom brached, sheath colourless, slimy, not coloured violet by chlor-zinc-iodide, sometimes gelatinizing, many trichomes in each, trichomes distinctly constricted at the cross-walls, 4-5µm broad, cells cylindrical, 1-3 times long as well as broad, 6-12µ long, bright blue-green, end cell more or less rounded, conical, not capitates.

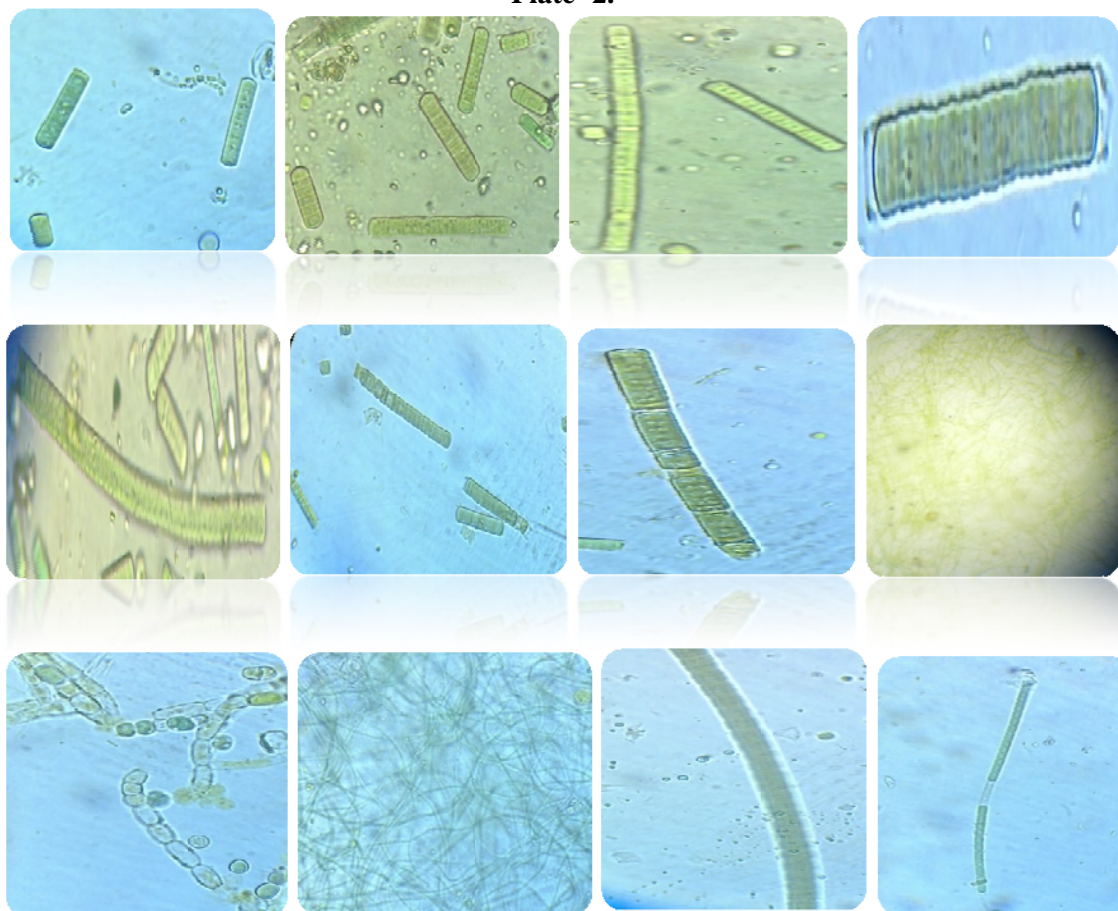
Plate- 1.





1. *Synechococcus aeruginosus* (fig. 1), 2. *Microcystis aeruginosa* (fig. 2), 3. *M. viridis* (fig. 3), 4. *Aphanothece* sp. A and B (fig. 4, 5), 5. *Aphanocapsa Montana* (fig. 6), 6. *Gomphospehria naegelianum* (fig. 7), 7. *Lyngbya ceylanica* (fig. 8), 8. *L. hieronymusii* (fig. 9), 9. *L. holdenii* (fig. 10), 10. *Oscillatoria tenuis* (fig. 11), 11. *O. limosa* (fig. 12).

Plate- 2.



12. *O. obscura* (fig. 1), 13. *O. proboscidea* (fig. 2), 14. *O. subbrevis* (fig. 3), 15. *O. princeps* A and B (fig. 4, 5), 16. *O. sancta* (fig. 6), 17. *Microchaete uberrima* (fig. 7), 18. *Anabaena naviculoides* (fig. 8), 19. *Nostoc spongiaeforme* (fig. 9), 20. *Camptylonema indicum* (fig. 10), 21. *Calothrix spp.* (fig. 11), 22. *Microcoleus lacustris* (fig. 12).

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Author Profile

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