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DIVERSITY OF CYANOPHYCEAE FROM THE NATAWAD DAM OF NANDURBAR DISTRICT, MAHARASHTRA, INDIA

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Abstract

The present investigation was carried out at the Natawad dam in the Nandurbar District of Maharashtra, India. Blue Green algae are cosmopolitan in distribution. Throughout the investigation, a total of 24 BGA species of 10 genera were identified. The reported BGA species are a) Gloeocapsa punctate b) Chroococcus pallidus c) Chroococcus minutus d) Chroococcus minor e) Microcystis aeruginosa f) Merismopedia marssonii g) Lyngbya aestuarii h) Lyngbya majuscule i) Lyngbya lutea j) Oscillatoria laete-virens var. minimus k) Oscillatoria martini l) Oscillatoria princeps m) Oscillatoria subbrevis n) Oscillatoria perornata o) Oscillatoria terebriformis p) Oscillatoria tenuis q) Oscillatoria chalybae r) Oscillatoria pseudogeminata s) Spirulina major t) Geitlerinema amphibium u) Geitlerinema calcuttensis v) Phormidium uncinatum w) Phormidium willei x) Pseudanabaena catenata etc. During the study of filamentous genera, Oscillatoria was the dominant genus observed.

Key words:* - *Blue green Algae, Cyanobacteria, Algae.

Introduction

The Blue-Green Algae are prokaryotes, which set them apart from other groups in this flora, and are unicellular or filamentous; sometimes form structures that may be seen with the naked eye but commonly need a microscope for identification (Srinivas, M., & Aruna, M. 2016). Cyanobacteria are found in a wide range of aquatic and terrestrial ecosystems, including conditions hot springs, deserts, and Polar Regions (Mohr, K. I., Brinkmann, N., & Friedl, T. 2011), nearly every exposed rock surface on the planet (Budel, B. 2011), On damp rocks, on cement walls, in marine water, streams and lakes etc. (Valvi, A. B., & Gautam, P. K. 2017). Blue-green Algae are the oldest known photosynthetic organism’s component of biological soil crusts (Büdel, *et al*. 2016). The development of oxygenic photosynthesis altered every face of our planet's appearance. It is believed that the anoxygenic progenitors of cyanobacteria were the first species to develop oxygenic photosynthesis (De Clerck, O., Bogaert, K. A., & Leliaert, F. 2012). Cyanobacteria's agricultural significance in rice production is directly tied to their ability to fix nitrogen and have other beneficial effects on plants and soil (Rajasekaran, A., & Raja, U. 2021). Because of their innate ability to fix carbon Dioxide and Nitrogen through the nitrogenase and rubisco enzymes, respectively, cyanobacteria play a key role in the global cycle of nutrients (Saha, *et al.* 2007). They are symbiotic with fungi and plants and colonization in seas, lakes, rivers, hot springs, and soils. Cyanobacteria must be highly variable in order to adapt to a variety of environmental variables (Sinha, R. P., & Hader, D. P. 1996).

Materials and Methods

Study Area

The present work was carried out from the Natawad Dam in the Nandurbar district. The Natawad dam is located at the 21°23'37°N 74° 05'52" E. The samples were collected during the period 2022.

Method of Sampling

The algal samples were collected from different sites of the Natawad dam. The sampling sites were carefully selected to get the maximum number of algal forms growing in the varied habitats. The algal samples were collected with the help of different tools like forceps, needles, spatulas, Scalpel and the microalgae was suspended in the water body collected by the plankton net and sometimes directly along with water. The collected samples were taken to the laboratory and preserved in 4% formalin for further microscopic morphological investigation (Gautam, P. K., Valvi, A. B. & Nayka, J. 2022). Temporary sides were prepared during the present work and observed at a different magnification of a microscope (4X, 10X, 40X & 100X). The photomicrographs were taken with the help of the Amscope MU1000 microscope digital camera. The algal material was identified with the help of standard monographs and the latest literature on algae.

Result and Discussion

1. *Gloeocapsa punctate* Nageli **[pl. 1, Fig. a.]**

Desikachary, T. V., 1959, pl. 23, Fig. 2. p. 115.

Thallus gelatinous, pale blue-green; cells without sheath 0.8 to 1.7 μ diameter., with sheath 3.5 to 4.5 μ wide, blue-green coloured; sheath thick, colourless, not-lamellated or barely lamellated; cells 2-16 in clusters or colonies, about 25 μ diameters.

2. *Chroococcus pallidus* Nageli **[pl. 1, Fig. b.]**

Desikachary, T. V., 1959, pl. 24 Fig. 4 and pl. 26 Figs. 4, 13., p. 108.

Cells globular or oblong, solitary or in clumps of 2-4, light blue-green, with a sheath 14.7 μ without sheath 8.6 μ diameter; colonies 10 to 13x 15 to 16.6 μ; sheath un-lamellated, colourless.

3. *Chroococcus minutus* (Kutz) Nag **[pl. 1, Fig. c.]**

Desikachary, T. V., 1959, pl. 26 Fig. 5, p.106. .

Thallus gelatinous, yellow or colourless; cells solitary or 2-4, sometimes up to 8 in elliptic-oblong oblong colonies, without sheath 4.6 μ; with sheath 5.4 μ broad, blue-green or yellow; sheath colourless, not lamellated.

4. *Chroococcus minor* (Kutz.) Nag **[pl. 1, Fig. d.]**

Desikachary, T. V., 1959, pl. 24, Fig. 1, p. 105.

Thallus olive green or dirty blue-green, slimy-gelatinous; cells globular, 2.0 to 3.0 μ in diameter; mostly solitary or in a pairs, sometimes 4 or 8; sheath 3-4 very thin, colourless, hardly visible.

5. *Microcystis aeruginosa* Kutz. **[pl. 1, Fig. e.]**

Desikachary, T. V., 1959, pl. 17, Figs. 1, 2, 6 and pl. 18, Fig. 10, p. 105.

Colonies are spherical or slightly longer than broad when young, solid, when old becomes clathrate, with distinct hyaline colonial mucilage; cells are 2.0 to 2.20 μ in diameter, typically with gas-vacuoles.

6. *Merismopedia marssonii* Lemmermann **[pl. 1, Fig. f.]**

Desikachary, T. V., 1959, pl. 29, Fig. 15 p. 154.

Spherical to sub-spherical cells, 1.3 μ broad, colony with16-128 cells, rectangular, gas vacuoles present.

7. *Lyngbya aestuarit* Liebm. ex Gomont **[pl. 1, Fig. g.]**

T.V. Desikacharya 1959, pl. 52, Fig. 8, p. 305.

Filaments solitary or developing a brown or dull blue-green thallus, many times with false branches, nearly linear or coiled, sheath thin at first, later thick, yellow-brown, lamellated, only occasionally brownish on the inside and colourless on the outside, not coloured violet by chlor-zinc-iodide; cells 20.3 μ, ordinarily 10-16 μ broad, 0.33 to 0.16 times as long as broad, 3.6 to 5.0 μ long, often granulated without constriction at the cross wall, end cells are slightly attenuated, flat with thickened membrane.

8. *Lyngbya majuscula* Harvey ex Gomont **[pl. 1, Fig. h.]**

Desikachary, T. V., 1959, pl. 48, Fig.7, pl. 49, Fig. 12, pl. 52, Fig. 10, p. 313.

Thallus enlarged, up to 3 cm long, pale blue-green to brown or yellowish brown; filaments extremely long, curved or rarely only slightly coiled; trichome blue-green, brownish green, or grey violet; not constricted at the cross-walls, not attenuated at the ends, 16-60 (or up to 80) broad, generally 17.7 μ broad; cells extremely short, 2 to 4 μ long, cross-walls not granulated; end cells rotund without calyptra.

9. *Lyngbya lutea* (Ag.) Gom. **[pl. 1, Fig. i.]**

Desikachary, T. V., 1959, pl. 52, Fig. 9.

Thallus slightly gelatinous, leathery, yellowish brown to olive-green, often dark violet when dry; filaments coiled and densely intertwined; sheath colourless, smooth at first thin, but later up to 3 μ thick and lamellated, violet coloured by chlor-zinc-iodide; trichome un-constricted at the cross-walls, not attenuated at the endpoints, 4.7 μ broad, olive-green, cross-walls granulated; Cells quadrate to 1/3 the length of the width, 1.5 to 2.2 μ long; terminal cells with rounded calyptra.

10. *Oscillatoria laete-virens* (Crouan) Gomont var. *minimus* Biswas **[pl. 1, Fig. j.]**

Desikachary, T. V., 1959, pl. 39, Figs. 2, 3; p.213.

Trichomes are 2.5 μ in diameter, slightly fragile, slightly constricted at the cross-walls, and slightly tapering at the apex. The apical cell is acute, somewhat pointed, not capitate, and has no calyptra. Cells are 1.5 to 2 μ in length; the cross-walls are granulated, with three granules on either side, and the cell contents are uniformly granular and blue-green.

11. *Oscillatoria prolifica* (Grev.) Gomont **[pl. 1, Fig. k.]**

Desikachary, T. V., 1959, pl. 38, Figs.6, p. 216.

Trichomes may be straight or curved, un-constricted at the cross-walls, gradually attenuated at the ends, 2.3 μ broad, rarely single, mostly forming irregular groups or clusters of purple-red cells; cells can be nearly quadrate or longer, rarely shorter than broad, 4-6 μ long, septa sometimes granulated, gas-vacuoles are present, end cells capitate, with calyptra.

12. *Oscillatoria princeps* Voucher ex Gomont **[pl. 1, Fig. l.]**

Desikachary, T. V., 1959, pl. 37, Figs. 1, 10, 11, 13, 14; p. 210

Trichomes are blue-green, somewhat brownish, violet, or reddish, mostly forming a thallus, predominately straight, cross walls not constricted, 16.5 to 21.5 μ broad, commonly 25 to 50, blue-green to dirty green, mildly or briefly attenuated at the apices, and bent; cells are 1/11 to 1/4 as long as broad, 3 to 3.5 μ long, and end-cells are flattened, slightly capitated.

13. *Oscillatoria subbrevis* Schmidle **[pl. 1, Fig. m.]**

Desikachary, T. V., 1959, pl. 37, Fig. 2 & pl. 40, Fig. 1, p.207.

Trichomes solitary, 8.6 μ broad, almost straight, not attenuated at the apex. Cells are 1-2 μ long, and the cross walls are not granulated; end-cell spherical without calyptra.

14. *Oscillatoria perornata* Skuja **[pl. 1, Fig. n.]**

Desikachary, T. V., 1959, pl. 41, Figs. 8, 9, 14; p. 205.

Trichomes are erect and flexuous, with apices that are briefly attenuated, bent, or curved and that are well constricted at the cross-walls, 13 μ broad, Cells are typically 1/2-1/5 as long as broad, and 2.5 to 6.5 μ long. Their contents are pallide tenerumgue aeruginius, finely granular, and their septa are more or less granulated, end cells humilis depressed hemispherical, and calyptra is absent.

15. *Oscillatoria terebriformis* Ag. ex Gomont **[pl. 1, Fig. o.]**

Desikachary, T. V., 1959, pl. 38, Fig. 16, p.217

The thallus is dull blue; the trichomes are un-constricted at the cross walls, screw-like manner, and somewhat attenuated; 4.4 μ broad, 1.2 to 1.9 μ long; the end cells are rounded rather than capitate; and the without calyptra.

16. *Oscillatoria tenuis* Ag. ex Gomont **[pl. 1, Fig. p.]**

Desikachary, T. V., 1959, pl. 42, Fig. 15, p. 222.

Thallus thin, olive green or blue-green, slimy; trichome straight, fragile, mildly constricted at the cross-walls, 6.6 μ broad, blue-green, occasionally bent at the ends; cells up to as long as broad, 1.8 to 3.1 μ long, at the septa largely granulated; end cell more or less hemispherical with the thickened outer membrane.

17. *Oscillatoria chalybea* (Mertens) Gomont **[pl. 1, Fig. q.]**

Desikachary, T. V., 1959, pl. 38, Fig. 3, p. 219.

Thallus deep blue-green; trichome linear or lightly or inconsistently spirally coiled, mildly constricted at the cross-walls, apex attenuated, and quite bent, 8.2 μ broad, blue-green; cells 1/2 to 1/3 times as long as broad, very seldom as long as broad, 1.6 to 4.3 μ long, septa not ungranulated, end cell obtuse, not capitate, calyptra absent.

18. *Oscillatoria pseudogeminata* G. Schmid **[pl. 1, Fig. r.]**

Desikachary, T. V., 1959, pl. 38, Fig. 3, p. 219; Kamat, N. D; 1963, p. 93.

Thallus light or dirty blue-green, trichomes coiled, light blue-green, apex not attenuated, 1.3 to 1.6 μ broad; cells range from 1.6 to 3.3 μ long, un-constricted at the cross-walls, cross-walls thick, not granulated, end cell rounded, without calyptra.

19. *Spirulina major* Kutz. Ex Gomont **[pl. 1, Fig. s.]**

Desikachary, T. V., 1959, pl. 36, Fig.13, p. 196.

Trichome 1.3 μ broad, consistently spirally coiled, blue-green 2.4 μ broad and 2.2 μ distant.

20. *Geitlerinema amphibium* Anagnostidis **[pl. 1, Fig. t.]**

Anagnostidis, K; 1989, Fig.3 (a), p. 36.

Thallus dark blue green; trichome linear and somewhat parallelly arranged; not constricted at the cross walls, 0.8 μ broad, cells longer than broad, 3.1 μ long, with or without granules at the cross walls, calyptra absent.

21. *Geitlerinema calcuttens* Anagnostidis **[pl. 1, Fig. u.]**

Anagnostidis, K; 1989, Fig.3 (g); p. 36.

Thallus Brown colour; trichome linear and somewhat parallelly arranged; un-constricted at the cross walls, 2.1 μ broad, cells longer than width, 1.3 to 2.5 μ long, cross wall with 3 granules, cell at the apex pointed, conical, not capitate.

22. *Phormidim uncinatum* (Ag) Gomont **[pl. 1, Fig. v.]**

Desikachary, T. V., 1959, pl. 43, Figs. 1, 2 & pl. 45 Figs. 9, 10; p. 276.

Stratum greatly extended, dark green to brownish black, adherent, thin, solid, or floating attached at the base, thick, ripped; filaments linear or slightly curved; sheath mucilaginous, prominent or diffluent in an amorphous mucilage, not coloured blue by chlor-zinc-iodide; trichomes are blue-green, cross walls not constricted, 5 μ broad, with ends that are briefly attenuated, capitate, curved, or short spirally coiled. Cells are half to one-third as long as broad, seldomly sub-quadrate, 1.6 to 2 μ long, and have cross-walls that are frequently granulated. The end cell has a conical or rounded calyptra.

23. *Phormidim willei* (N.L.Gardner) Anagnostidis & Komárek **[pl. 1, Fig. w.]**

Basioym- *Oscillatoria willei* N.L.Gardner

Desikachary, T. V., 1959, pl. 38, Figs. 44 & pl. 40, Fig. 5, p. 217.

Trichomes have a light blue-green to grey-blue-green colour, twisted at the ends or screw-like, 2.4 μ broad, not constricted at the cross-walls, apex not attenuated, and not capitate. Cells are 0.8 to 1 μ to twice as long as broad, at the cross-walls not granulated and cells rounded without a thickened membrane.

24. *Pseudanabaena catenata* Lauterb. **[pl. 1, Fig. x.]**

Desikachary, T. V., 1959, pl. 43, p. 419.

Cells blue green coloured, cylindrical, at both ends truncated, sometimes slightly brownish, 1.6 μ broad 1 to 1.5 μ long.

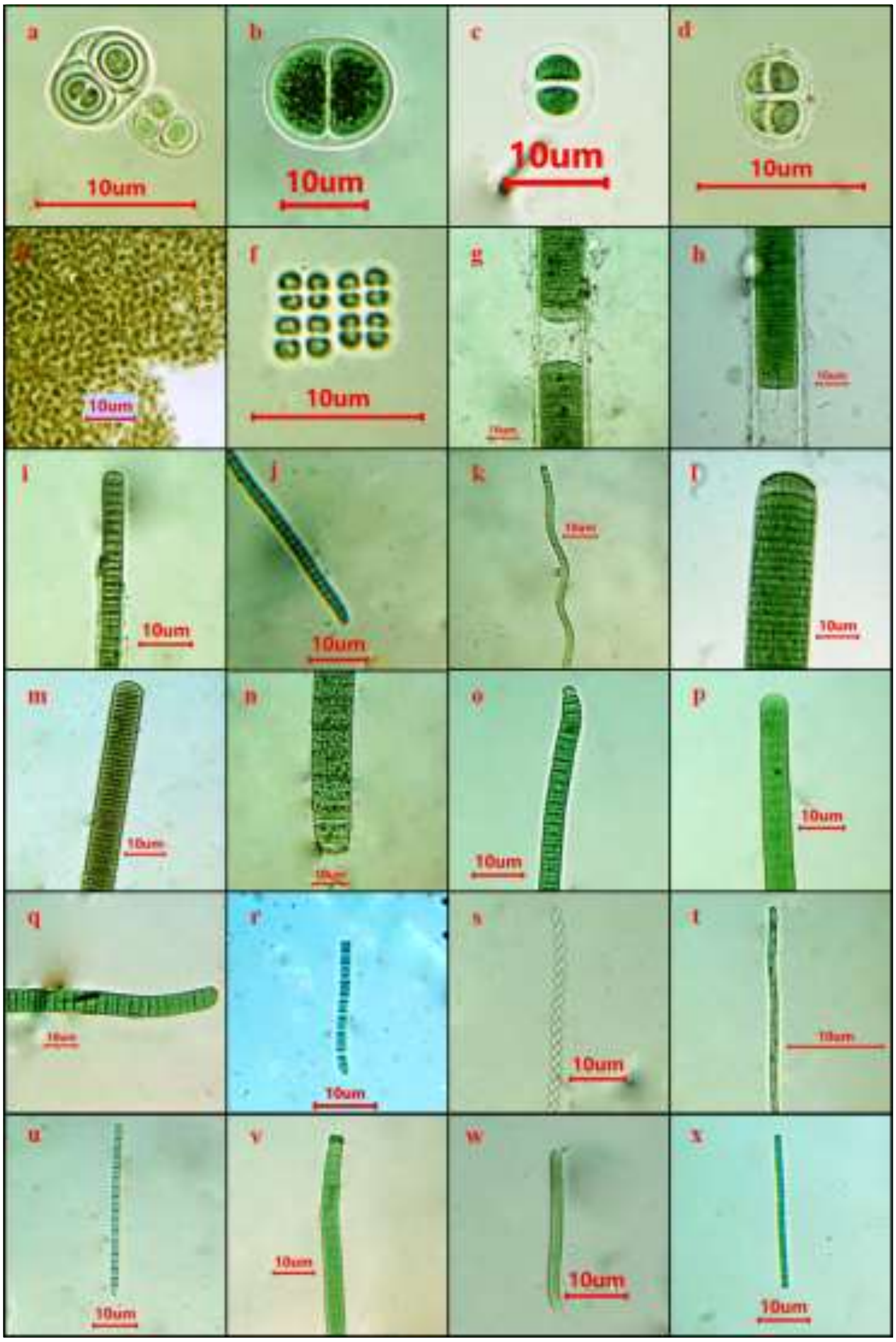

Plate: (1) a) *Gloeocapsa punctate* b) *Chroococcus pallidus c) Chroococcus minutus d) Chroococcus minor e) Microcystis aeruginosa f)* Merismopedia marssonii *g) Lyngbya aestuarii h) Lyngbya majuscule i) Lyngbya lutea j) Oscillatoria laete-virens var. minimus k) Oscillatoria martini l) Oscillatoria princeps m) Oscillatoria subbrevis n) Oscillatoria perornata o) Oscillatoria terebriformis p) Oscillatoria tenuis q) Oscillatoria chalybae r) Oscillatoria pseudogeminata s) Spirulina major t) Geitlerinema amphibium u) Geitlerinema calcuttensis v) Phormidium uncinatum w) Phormidium willei x) Pseudanabaena catenata*

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