

Systematic Investigation of Algal Diversity of a Perennial Lake of Bamanwada Village, Chandrapur District, Maharashtra

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ABSTRACT

Inventory of biodiversity of each and every habitat is very essential to understand the species diversity and their exact distribution. A scientific investigation was carried out for a period of two consecutive years from 2020 to 2022 in order to enumerate the algal diversity of a perennial lake situated at Bamanwada village. During the study, a total of 64 taxa of phytoplanktons have been isolated from the lake. All the taxa isolated during the investigation have been properly identified and classified with the help of standard literature, and are presented here along with their microphotographs. Among the isolated taxa, two are the new reports for India, seven are new reports for the state and sixteen are reported first time from the district.

INTRODUCTION

Algae represent one of the most diversified and widely distributed groups within the plant kingdom. These photosynthetic organisms can thrive in diverse environments, ranging from oceans and fresh water to soil and even symbiotically in association with other organisms. Algae encompass a wide variety of forms, including single celled microalgae, macroscopic sea weeds, and colonial forms. Various systematic works have been conducted by researchers to determine the diversity and distribution of algae in various habitats globally. Various aquatic and terrestrial habitats of Maharashtra state and of the country have been explored by researchers to find out the algal diversity (Suxena and Venkateswarlu 1966, Kamat 1975, Pattanaik and Adhikary 2002, Dash et al. 2011, Ghosh and Keshri 2011, Mallick and Kesari 2011). The Botanical Survey of India has enlisted 7,411 species of algae belonging to 735 genera, which are categorized under 10 classes, 95 orders, and 252 families (Gupta 2012). Even after these efforts, several workers have reported new species and new distribution records of previously discovered species from various habitats. However, there are still various habitats yet to be explored, and a large number of algal taxa remain undiscovered.

Chandrapur is the most industrial district in the Maharashtra state and is also known as the "black gold city" of India. Geographically, the district is located near the border of Telangana state. The district is drained by three major rivers, Wineganga, Pine ganga, and Wardha river. Additionally, there are several large dams, ponds, and lakes present in the district. In Chandrapur district, the diversity of algae in rivers has been well studied (Kamat 1975, Reddy and Chaturvedi 2015, 2017,

2018, Reddy, 2020, 2021 & 2023), but most of the ponds and lakes have not been taxonomically enumerated properly. The present work is undertaken to determine the diversity of Phytoplanktons in a perennial lake located near Bamanwada village.

The lake is a small perennial water body covers 12 acres of land. It is located near Bamanwada village, which is 25 km away from the district center, situated between 19° 47.233' to 19° 47.371'N latitude and 79° 23.171' to 79° 23.051'E longitude. The lake is used for cultivating Singhada (*Trapa natans*) and also serves irrigation purposes. The lake exhibits a rich diversity of hydrophytes (Reddy 2020) and provides a suitable environment for several bird species (Chilke 2012).

Material and Methods:

The present study spanned two consecutive years, from 2020 to 2022. Samples were collected from four corners of the pond between 8:00 am to 10:00 am during February, May, August, and November months. From every site, fifty liters of surface water was collected with a bucket and poured in to a sample collection net made up of bolting silk and having pore size of 20 microns. The samples were preserved in 4% formaldehyde and then used for phytoplankton study.

Planktons were isolated and photographed with trinocular microscope equipped with an integrated digital camera (CosLab). Identification of the phytoplankton was carried out by referring to established reference books and relevant research publications (West & West 1904, 1905, 1908, 1912, Korshikov 1953, Desikachary 1959, Prescott 1962, Philipose 1967, John et. al. 2002, Ramos et. al. 2012). The identification of taxa was further validated by cross-referencing with the Algaebase database (Guiry 2022)

Systematic Study:

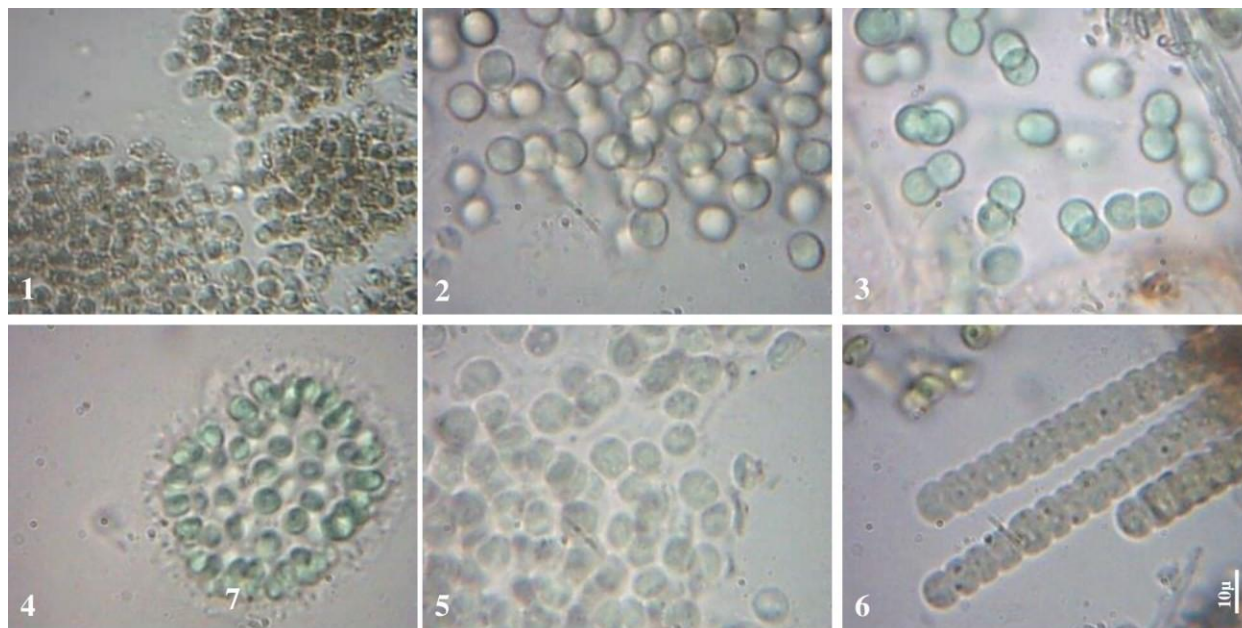
In the course of the present investigation, a total of 64 taxa, belonging to 40 genera, 18 families, and 8 classes, were successfully isolated and identified. Here, the details of

observed taxa along with their corresponding microphotographs have been presented (Table 1).

Sr. No.	Class	Order	Family	Taxa
1.	Cyanophyceae	Chroococcales	Chroococcaceae	<i>Microcystis aeruginosa</i> (Kützinger) Kützinger
2.	Cyanophyceae	Chroococcales	Chroococcaceae	<i>Microcystis robusta</i> (H.W.Clark) Nygaard
3.	Cyanophyceae	Chroococcales	Chroococcaceae	<i>Aphanocapsa roeseana</i> De Bary
4.	Cyanophyceae	Chroococcales	Chroococcaceae	<i>Coelosphaerium kuetzingianum</i> Nägeli
5.	Cyanophyceae	Pleurocapsales	Pleurocapsaceae	<i>Cyanosarcina spectabilis</i> (Geitler) Kováčik
6.	Cyanophyceae	Nostocales	Oscillatoriaceae	<i>Trichodesmium lacustre</i> Klebahn
7.	Chlorophyceae	Chlorococcales	Hydrodictyaceae	<i>Pediastrum biwae</i> Negoro
8.	Chlorophyceae	Chlorococcales	Hydrodictyaceae	<i>Stauridium tetras</i> (Ehrenberg) E.Hegewald
9.	Chlorophyceae	Chlorococcales	Hydrodictyaceae	<i>Tetraëdron enorme</i> var. <i>pentaedricum</i> Prescott
10.	Chlorophyceae	Chlorococcales	Hydrodictyaceae	<i>Tetraëdron gigas</i> f. <i>minus</i> Philipose
11.	Chlorophyceae	Chlorococcales	Hydrodictyaceae	<i>Tetraëdron minimum</i> (A.Braun) Hansgirg
12.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Chloroidium ellipsoideum</i> (Gerneck) Darienko & al.
13.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Oocystis borgei</i> J.W.Snow
14.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Nephrocytium agardhianum</i> Nägeli
15.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Nephrocytium lunatum</i> West
16.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Nephrocytium limneticum</i> (G.M.Smith) G.M.Smith
17.	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Oonephris obesa</i> (West & G.S.West) Fott
18.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Dictyosphaerium ehrenbergianum</i> Nägeli
19.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Dictyosphaerium reniforme</i> Bulnheim
20.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Dictyosphaerium indicum</i> M.O.P.Iyengar & Ramanathan
21.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Mucidosphaerium pulchellum</i> (H.C.Wood) C.Bock, Proschold & Krienitz
22.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Dimorphococcus lunatus</i> A.Braun
23.	Chlorophyceae	Chlorococcales	Dictyosphaeriaceae	<i>Westella botryoides</i> (West) De Wildeman
24.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Ankistrodesmus densus</i> Korshikov
25.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Ankistrodesmus falcatus</i> (Corda) Ralfs
26.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Ankistrodesmus fusiformis</i> Corda
27.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Ankistrodesmus spiralis</i> (W.B.Turner) Lemmermann
28.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Ankistrodesmus arcuatus</i> Korshikov
29.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Kirchneriella lunaris</i> (Kirchner) Möbius
30.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Pseudokirchneriella elongata</i> (G.M.Smith) Hindák
31.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Selenastrum bibraianum</i> Reinsch
32.	Chlorophyceae	Chlorococcales	Selenastraceae	<i>Messastrum gracile</i> (Reinsch) T.S.Garcia
33.	Chlorophyceae	Chlorococcales	Coelastraceae	<i>Coelastrum microporum</i> Nägeli
34.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Willea apiculata</i> (Lemmermann) D.M. John, M.J. Wynne & P.M. Tsarenko
35.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Willea rectangularis</i> (A.Braun) D.M. John, M.J. Wynne & P.M. Tsarenko
36.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Scenedesmus arcuatus</i> (Lemmermann) Lemmermann
37.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Scenedesmus arcuatus</i> var. <i>platydiscus</i> G.M. Smith
38.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Scenedesmus bijugatus</i>
39.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Verrucodesmus parvus</i> (G.M.Smith) E.Hegewald
40.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Rayssiella curvata</i> (Bohlin) Komárek
41.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Scenedesmus denticulatus</i> var. <i>australis</i> Playfair

42.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Desmodesmus hystrix</i> (Lagerheim) E.Hegewald
43.	Chlorophyceae	Chlorococcales	Scenedesmaceae	<i>Tetrallantos lagerheimii</i> Teiling
44.	Chlorophyceae	Volvocales	Volvocaceae	<i>Gonium pectorale</i> O.F.Müller
45.	Chlorophyceae	Volvocales	Palmellaceae	<i>Fusola viridis</i> J.W.Snow
46.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium obtusatum</i> (Schmidle) Schmidle
47.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium contractum</i> var. <i>ellipsoideum</i> (Elfving) West & G.S.West
48.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium ralfsii</i> Brébisson ex Ralfs
49.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium depressum</i> Bailey
50.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium meneghinii</i> Brébisson ex Ralfs
51.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium humile</i> var. <i>substriatum</i> (Nordstedt) Schmidle
52.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium neodepressum</i> var. <i>achondrum</i> (Boldt) G.J.P.Ramos & C.W.N.Moura syn.
53.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Cosmarium subcapitulum</i> West
54.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Euastrum bidentatum</i> Nägeli
55.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Sphaeroszma laeve</i> (Nordstedt) Thomasson
56.	Chlorophyceae	Conjugales	Desmidiaceae	<i>Teilingia excavata</i> (Ralfs ex Ralfs) Bourrelly
57.	Xanthophyceae	Heterochloridales	Heterocapsaceae	<i>Botryococcus braunii</i> Kützing
58.	Xanthophyceae	Heterococcales	Ophiocytaceae	<i>Ophiocytium elongatum</i> West & G.S.West
59.	Chrysophyceae	Chrysomonadales	Synuraceae	<i>Synura uvella</i> Ehrenberg
60.	Euglenophyceae	Euglenales	Euglenaceae	<i>Trachelomonas armata</i> (Ehrenberg) F.Stein
61.	Euglenophyceae	Euglenales	Euglenaceae	<i>Trachelomonas volvocina</i> (Ehrenberg) Ehrenberg
62.	Euglenophyceae	Euglenales	Euglenaceae	<i>Euglenaformis proxima</i> (P.A.Dangeard) M.S.Bennett & Triemer
63.	Cryptophyceae	Cryptomonadales	Cryptomonadaceae	<i>Cryptomonas ovata</i> Ehrenberg
64.	Bacillariophyceae	Cymbellales	Gomphonemataceae	<i>Gomphonema gracile</i> Ehrenberg

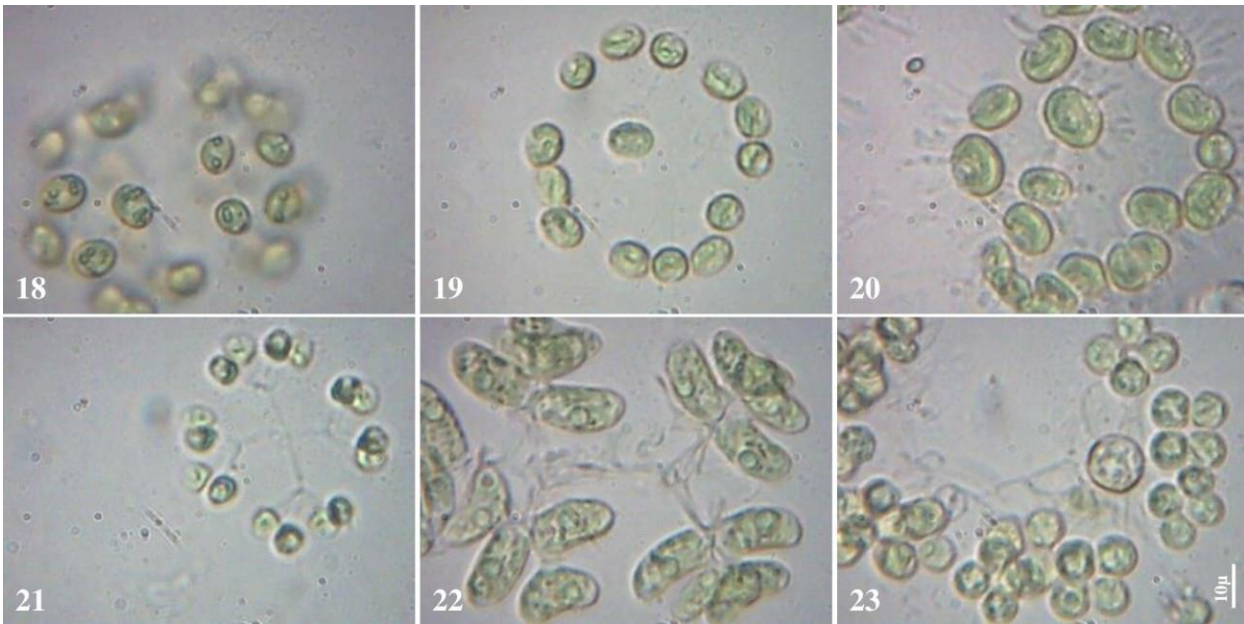
Table 1: Algae isolated from Bamanwada lake of Chandrapur district, Maharashtra



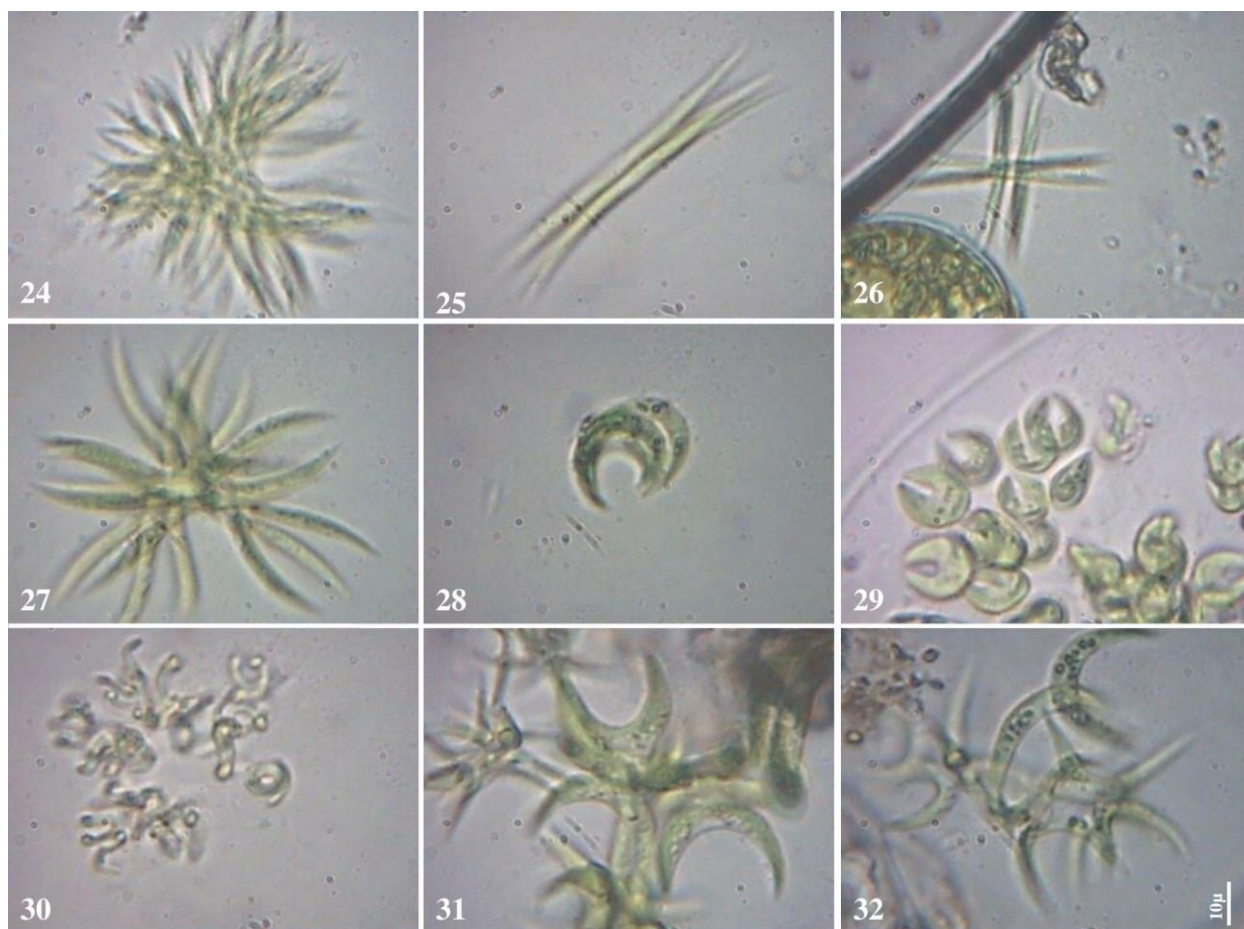
1. *Microcystis aeruginosa* , 2. *M. robusta* , 3. *Aphanocapsa roeseana* , 4. *Coelosphaerium kuetzingianum*, 5. *Cyanosarcina spectabilis*, 6. *Trichodesmium lacustre*.



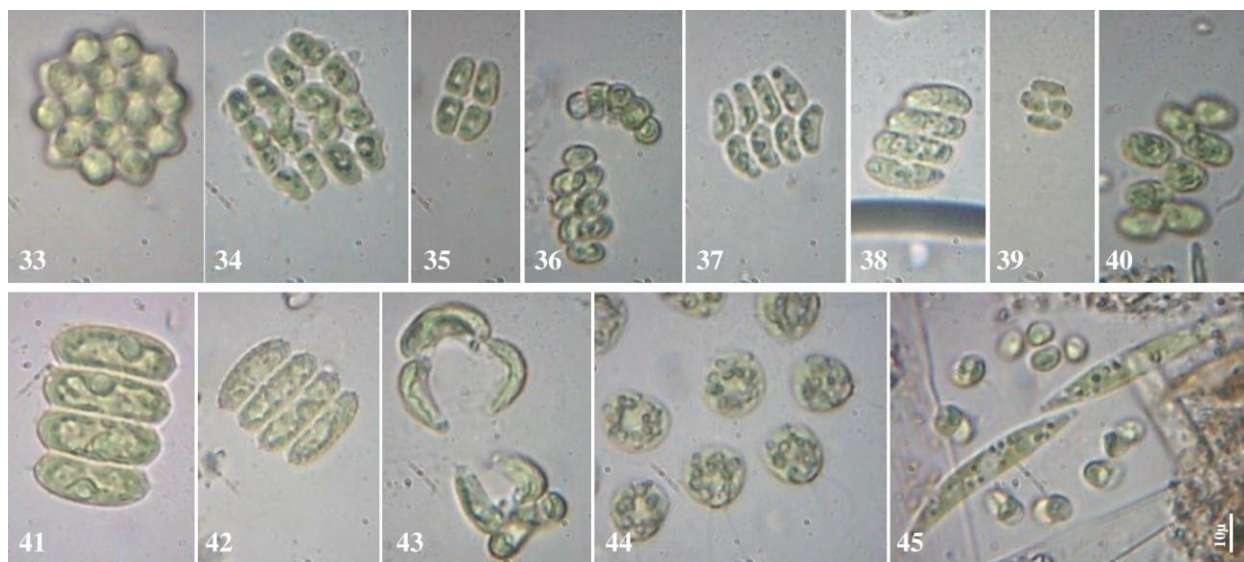
7. *Pediatrum biwae*, 8. *Stauridium tetras*, 9. *Tetraëdron enorme* var. *pentaedricum*, 10. *T. minimum*, 11. *T. gigas* f. *minus*, 12. *Chloridium ellipsoideum*, 13. *Oocystis borgei*, 14. *Nephrocytium agardhianum*, 15. *N. lunatum*, 16. *N. limneticum*, 17. *Oonephris obese*.



18. *Dictyosphaerium ehrenbergianum*, 19. *Dictyosphaerium reniforme*, 20. *D. indicum*, 21. *Mucidosphaerium pulchellum*, 22. *Dimorphococcus lunatus*, 23. *Westella botryoides*.



24. *Ankistrodesmus densus*, 25. *A. falcatus*, 26. *A. fusiformis*, 27. *A. spiralis*, 28. *A. arcuatus*, 29. *Kirchneriella lunaris*,
30. *Pseudokirchneriella elongata*, 31. *Selenastrum bibraianum*, 32. *Messastrum gracile*.



33. *Coelastrum microporum*, 34. *Willea apiculata*, 35. *W. rectangularis*, 36. *Scenedesmus arcuatus*, 37. *S. arcuatus* var. *platydiscus*,
38. *S. bijugatus*, 39. *Verrucodesmus parvus*, 40. *Rayssiella curvata*, 41. *S. denticulatus* var. *australis*, 42. *Desmodesmus hystrix*,
43. *Tetrallantos lagerheimii*, 44. *Gonium pectorale*, 45. *Fusola viridis*.



46. *Cosmarium obtusatum*, 47. *C. contractum* var. *ellipsoideum*, 48. *C. ralfsii*, 49. *C. depressum*, 50. *C. meneghinii*, 51. *C. humile* var. *substriatum*, 52. *C. neodepressum* var. *achondrum*, 53. *C. subcapitulum*, 54. *Euastrum bidentatum*, 55. *Sphaeroszma laeve*, 56. *Teilingia excavate*.



57. *Botryococcus braunii*, 58. *Ophiocytium elongatum*, 59. *Synura uvella*, 60. *Trachelomonas armata*, 61. *T. volvocina*,

62. *Euglenaformis proxima*, 63. *Cryptomonas ovata*, 64. *Gomphonema gracile*.

Result & Discussion:

The Bamanwada lake, according to the present investigation, boasts a remarkable diversity of algae with 64 taxa of 8 families, with Chlorophyceae being the dominant group with 50 taxa. Cyanophyceae follows close behind with 6 taxa, while Euglenophyceae, Xanthophyceae, Chrysophyceae, Cryptophyceae and Bacillariophyceae are represented by 3, 2, 1, 1 and 1 taxa respectively.

Kamat reported 391 taxa of Chlorophyceae, 96 taxa of Euglenophyceae, 2 taxa of Xanthophyceae, 11 taxa of Dinophyceae and 136 taxa of Cyanophyceae from Vidarbha region (Kamat 1975). Wadve reported 74 Cyanophyceae from paddy fields of Bhadrawati tahsil (Wadve 2014).

In addition to its abundant algae population, the Bamanwada lake is also habitat for 25 hydrophytes (Reddy 2020) and 46 species of birds (Chilke 2012), including migratory ones.

The present investigation also yielded several novel findings for the state and country. The taxa *Cosmarium subcapitulum* and *Rayssiella curvata* were recorded for the first time in India during this study, while *Oonephris obese*, *Desmodesmus hystrix*, *Cosmarium ralfsii*, *Cosmarium humile* var. *substriatum*, *Teilingia excavate*, *Synura uvella*, and *Cryptomonas ovata* were documented for the first time in Maharashtra.

In addition, *Aphanocapsa roeseana*, *Chloroidium ellipsoideum*, *Dimorphococcus lunatus*, *Pseudokirchneriella elongate*, *Messastrum gracile*, *Verrucodesmus parvus*, *Tetrallantos lagerheimii*, *Cosmarium obtusatum*, *Cosmarium contractum* var. *ellipsoideum*, *Cosmarium depressum*, *Cosmarium neodepressum* var. *achondrum*, *Euastrum bidentatum*, *Sphaerosoma leave*, *Botryococcus braunii*, *Trachelomonas armata* and *Trachelomonas volvocina* were observed for the first time in Chandrapur district.

The observed diversity of algal taxa in the Bamanwada lake is quite remarkable, with representatives from various taxonomic classes, orders, families, and genera. The presence of Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Euglenophyceae, Cryptophyceae, and Bacillariophyceae classes signifies the ecological richness of the lake. These diverse algal taxa contribute to the lake's overall ecological balance and may have important roles in nutrient cycling, primary production, and the overall health of the aquatic ecosystem.

CONCLUSION

This systematic study of algal diversity in the perennial lake of Bamanwada Village, Chandrapur District, Maharashtra, has revealed a diverse and complex algal community. The identification of 64 algal taxa spanning different classes, orders, families, and genera highlights the ecological significance of this aquatic ecosystem. These findings add valuable information to overall biodiversity of the lake.

Understanding the composition and distribution of algal species in the lake is crucial for assessing its ecological status and can serve as a baseline for future ecological research and conservation efforts. This study underscores the importance of constant monitoring and conservation measures to preserve the diversity and ecological integrity of this vital aquatic ecosystem. Future research could delve deeper into the ecological interactions, seasonal variations, and potential impacts of environmental factors on the algal community in this lake, further enhancing our comprehension of its ecological dynamics.

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