



Diversity of the genus *Microcystis* Kutzing ex Lemmermann from Andhra Pradesh, India

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Abstract

The genus *Microcystis* Kuetzing ex Lemmermann has been screened from various collections made from various fresh water bodies present in different districts of Andhra Pradesh, India. Upon careful observations, we are able to identify seven species of *Microcystis* based on their surface morphological features. Of seven species identified, *Microcystis aeruginosa* Kuetz., *M.flos-aquae* (Wittr.)Kirchner and *M.wesenbergii* Komarek are very common from samples collected from the freshwater bodies throughout the state of Andhra Pradesh. The rest, *M.botrys* Teil., *M.novacekii* (Kom.)Comp., *M. smithii* Kom &Anag and *M.panniformis* Kom.et.al., are rare and new distributional records to the state of Andhra Pradesh. Detailed morphological description and key to the taxa and microphotographs were provided.

Keywords: *Microcystis*; Diversity; Fresh Water Algae

I. Introduction

Microcystis belongs to the family Microcystaceae, Order Chroococcales of Cyanobacteria. The species of *Microcystis* are planktonic, often forming blooms. Tandon et.al.,(2016) reported Seventeen species of *Microcystis* from India of which *M.aeruginosa* kuetz., *M.flos-aquae* have been reported by several authors and are very common in the state of Andhra Pradesh. Distribution of *M.elegans* from lake Kolleru by Bhanuprasad et.al., (2014) may probably *M.elabens* (Breb.)Kutz., which is a taxonomic synonym of *Aphanothece elebens*. Venkateswarlu, (1976) reported *M.viridis*, from erstwhile Andhra Pradesh state, has not come across in the present study. It is evident from the literature that, documentation of Cyanobacteria from the state of Andhra Pradesh is very limited and scare. Seven species, viz., *Microcystis aeruginosa* Kuetz., *M.flos-aquae* (Wittr.)Kirchner *M.wesenbergii* Komarek, *M.botrys* Teil.,*M.novacekii* (Kom.)Comp.,*M.smithii* Kom.&Anag and *M.panniformis* Kom et al., were reported in the present study. *M.botrys* Teil., *M.novacekii* (Kom.)Comp., *M.smithii* Kom.&Anag. *M.panniformis* Kom.et.al., are rare and new distributional records to the state of Andhra Pradesh, India

II. Materials and Methods

Cyanobacterial samples were collected from various freshwater habitats of Ananthapuramu, Chittoor, Kakinada surroundings of East Godavari, YSR Kadapa and Visakhapatnam Districts of Andhra Pradesh State since 2013 and preserved in 4% formaldehyde. These samples were stored at Department of Botany, S.S.B.N.Degree College (Autonomous), Ananthapuramu until further examined. Samples were analyzed for the Genus *Microcystis*. The algal samples, stained with Anilin blue were observed under readily calibrated Olympus CHi20 binocular bright field microscope .The shape, size of colony and cells, nature of mucilage, extent of mucilage, aerotopes were recorded and microphotographs were taken with the help of Olympus E-PL3 camera. Further these were identified with the help of standard literature Crow. (1923), Komarek and Komarkova, (2002), Jiri KOMAREK a, Jaroslava KOMARKOVA-LEGNEROVA, 2002and Monograph of Desikahary TV 1959 and Floras(J.Komarek K.Anagnostidis 2008)

III. Results

Upon careful observations by microscope, we are able to identify seven species of *Microcystis* based on their surface morphological features. The identified seven species are 1. *Microcystis aeruginosa* (Kuetz.), 2. *M.flos-aquae* (Wittr.),

3. *M.wesenbergii* (Komarek), 4. *M.botrys* (Teil.), 5. *M.novacekii* (Kom.)Comp., 6. *M. smithii* (Kom &Anag), 7. *M.panniformis* (Kom.). Results were represented in (figure.1).

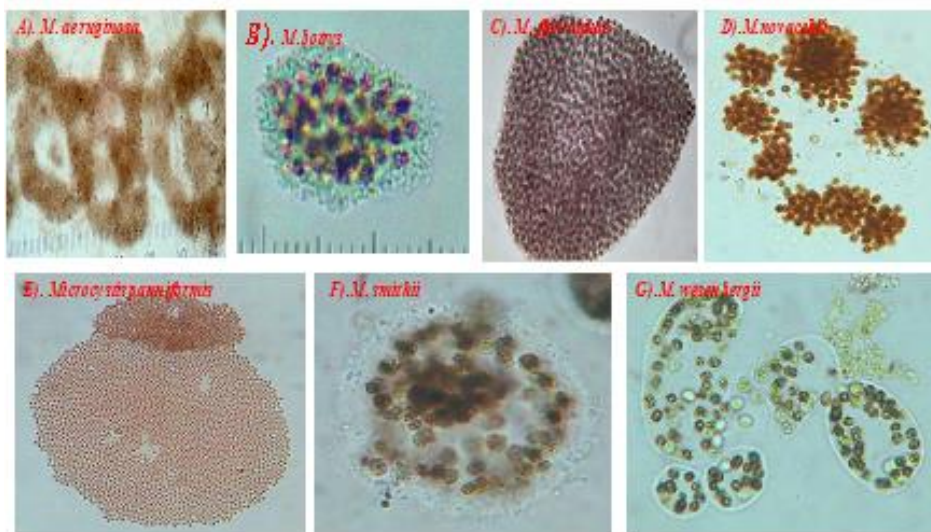


Fig 1 (A to G) Diversity of the genus *Microcystis* Kutzing

KEY

- | | | |
|--------------------------------------------------------------------------------------------------|---------|--------------------------------|
| 1. Colony with distinct larger holes | ----- | <i>Microcystis aeruginosa</i> |
| 1. Colony without distinct holes | ----- 2 | |
| 2. Mucilaginous margin indistinct | ----- 3 | |
| 2. Mucilaginous margin distinct | ----- 4 | |
| 3. Colonies flat, cells in single layer, 2.5 to 3.25 μm in diameter | -- | <i>Microcystis panniformis</i> |
| 3. Colonies otherwise, cells 3.5 to 5 μm in diameter | -- | <i>Microcystis flos-aquae</i> |
| 4. Mucilaginous margin refractive, colony lobate | -- | <i>Microcystis wesenbergii</i> |
| 4. Mucilaginous margin not refractive | --5 | |
| 5. Cells densely aggregated in the centre, few solitary cells dispersed in enveloping mucilage – | | <i>Microcystis novacekii</i> |
| 5. Cells otherwise | --6 | |
| 6. Cells densely arranged, Mucilage has tubular structures --- | | <i>Microcystis botrys</i> |
| 6. Cells sparsely arranged, Mucilage plain | ----- | <i>Microcystis smithii</i> |

1. *Microcystis aeruginosa* (Kütz.) Kütz., Tab. Phycol.1:6. 1846. (fig.1A)

Basionym: *Micraloa aeruginosa* Kütz., Linnaea 8:371.1833. Gupta.P, Algae of India, Vol.1:A checklist of Cyanoprokaryota P.13, 2012. Desikachary, Cyanophyta, p.93.1959.

Colonies mucilaginous, microscopic, elongated or spherical, lobate, with distinct holes. Mucilage colourless, diffuse, slightly overlap cell agglomerations. Cells spherical, loosely or moderately packed, 5 μm in diameter, with numerous conspicuous aerotopes.

Distribution: Common in all states in India and in all districts of Andhra Pradesh

Collection number: ATP-GT 42, 18-10-14; CHTR-CG 10, 02-11-15; KAK 18, dt.28-12-14; VIZ-KK 28 dt.18-01-17

2. *Microcystis botrys*, Teiling, Bot. Notiser 1942:65. 1942. (fig.1B)

Colonies mucilaginous, microscopic, ovoid, without holes. Mucilage thick, 5 μm wide, distinct, colourless, mucilage is filled with tubular projections from colony whose ends are spherical. Cells spherical, with aerotopes, 5 μm in diameter, loosely packed in the colony.

Distribution: India: Uttar Pradesh; Andhra Pradesh: Ananthapuramu District

Collection number and date: ATP-SST 31 dt.04-02-15

Note: Standard literature confirms the colony shape as spherical, but our specimen is ovate to elliptical.

3. *Microcystis flos-aquae* (Wittrock) Kirchner ex Forti 1907: Syll. Myxophyc., P.86 (fig.1C)

Gupta, P., Algae of India, Vol.1: A checklist of Cyanoprokaryota P.13, 2012. Desikachary, Cyanophyta, p.94.1959.
Colony microscopic, spherical or obovoid in outline, with compactly arranged cells, without holes. Mucilage diffuse, indistinct, not overlapping the cell agglomerations. Cells 4-5µm in diameter, spherical, with aerotopes.
Distribution: Common in all states in India and in all districts of Andhra Pradesh
Collection number and date: Collection number: ATP-GT 42, 18-10-14; CHTR-CG 10, 02-11-15; KAK 18, dt.28-12-14; VIZ-KK 28 dt.18-01-17

4. *Microcystis novacekii* (Komárek) Compere. 1974. Cah. O.R.S.T.O.M., Hydrobiol.8(3-4) (fig.1D)

Colony microscopic, mucilaginous, irregularly elongated or spherical, without holes. Mucilage colourless, diffuse, wide, extended beyond cell agglomerations. Cells compactly arranged at center, solitary cells are scattered in the mucilage, 5µm in diameter, with aerotopes.
Distribution: India : Uttar Pradesh; Andhra Pradesh: East Godavari
Collection number and date: KAK 10, dt.28-12-14

5. *Microcystis panniformis* (Komárek et al.,) Cryptogamie, Algol. 23:165. 2002. (fig.1E)

Colony microscopic, irregularly flat or spherically flat, with cells evenly and densely arranged, without holes. Mucilage diffuse, indistinct, do not overlap cell agglomerations. Cells spherical, 2.5-3.75 µm in diameter, with aerotopes
Distribution: India : Uttar Pradesh; Andhra Pradesh: East Godavari
Collection number and date: KAK 18, dt.28-12-14

6. *Microcystis smithii* (Komárek & Anagnostidis Preslia, Praha) 67:21, 1995. (fig.1F)

Colony microscopic, Spherical, without holes, 50µm in diameter with freely and sparsely distributed cells. Mucilage colourless, firm, distinctly delimited, wide. Cells spherical, 5µm in diameter, with aerotopes.
Distribution: India : Uttar Pradesh; Andhra Pradesh: East Godavari
Collection number and date: KAK 18, dt.28-12-14

Note: our specimen from palasamudram shows 1-3 aerotopes as was mentioned by Komárek(2002). Other specimens show 5-7 aerotopes.

7. *Microcystis wesenbergii* (Komárek) Komárek in Kondratieva, Cvetenie vody, p.13. 1968. (fig.1g).

Basionym: *Diplocystis wesenbergii* Komárek in Komárek & Ettl, Algol. Stud., p.68. 1958.

Colony microscopic, spherical in the beginning with cells arranged in concentric rings, later lobate, elongate, with sub colonies, sometimes clathrate. Mucilage colourless, firm, refractive, distinctly delimited. Cells 5-6.5 µm in diameter, spherical with many aerotopes.

Distribution: India : Uttar Pradesh; Andhra Pradesh: Visakhapatnam, East Godavari and Ananthapuramu Districts

Collection number and date: ATP-SST 42, 18-10-14; KAK 18, dt.28-12-14 ; VIZ-KK 22 dt.18-01-17

Note: It is observed from the collections of Kakinada, that, the colonies are spherical at first with cells arranged concentrically and regularly. Small spherical sub colonies cut off from periphery or cleavage of mucilage occur from the center in a linear fashion or V shaped incisions and lead to separation of colony into small, variously shaped sub colonies.

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