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A Comprehensive Report On The Occurrence Of Nine Species Of Gloeocapsa – A Coccoidal Cyanobacteria From Burdwan District Of West Bengal, India

Dr. Sudip Chatterjee[1]*
Assistant Professor (S-III) & H.O.D.
[1]Department of Botany; Syamsundar College; Shyamsundar; Purba Bardhaman
*scsscbwn@gmail.com; Mob. No. – 9475482265

ABSTRACT

Gloeocapsa is a Coccoidal Cyanobacteria (Desikachary 1959) with thick mucilaginous sheath. The heath sometime forms yellowish hue and thus this organism termed as glow cap. Thus study on the said group was conducted at the East (Purba) & West (Paschim) Burdwan district in West Bengal. Large portion of the area is agriculture land and due to the ability of *Gloeocapsa* to fix calcium and nitrogen it was perfect organism to perform the investigation on occurrence as that may illuminate the chemical composition of the soil. During the investigation total nine species were obtained under the said genus out of which one species – *G. chroococcoides* found to be first report from India.

KEY WORDS

Gloeocapsa, Coccoid, Cyanobacteria, Taxonomy, Ecology, Diversity, First Report

INTRODUCTION

Gloeocapsa is a Coccoidal Cyanobacteria (Desikachary 1959) with thick mucilaginous sheath. The name of the taxa obtained from Greek words which means gelatinous case. The cells secrets mucilage around each cell generally at the time of division. That's why sheath around individual cells within a common sheath forming a mucilaginous colony could be obtained, the appearance thus become lamellated. The heath sometime forms yellowish hue and thus this organism termed as glow cap.

Taxonomically an enigma persists amongst scientists of the concerned area regarding the positioning of the taxa either with bacteria or as blue-green algae (Komárek *et al* 1988, 1998*)*. This organism prefers to grow as fresh water form or as a halophyte. Sometime obtained growing on moist soil surface. In the present investigation the author collected samples from different

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locations of the East (Purba) & West (Paschim) Burdwan districts, taxonomically described each taxa, performed camera lucida drawing of the samples under microscope and identified each one with the help of available literatures.

During the present investigation the author successfully identified nine (9) species of the genus *Gloeocapsa*. Out of those nine species one species is the first report from India, no previous reports on the same from India could be obtained from available literatures. The other significance of the study is the elaborate description and distribution of each taxon which is expected and searched by each worker for further study.

The *Gloeocapsa* due to occurrence of heavy sheath around is a potent biological tool for Nitrogen fixation and Calcium fixation (Gallon 1978). The obtained result would thus be very helpful to understand the natural composition of soil in the said area of study. Sometime the water quality may deteriorate by the presence of this alga in high concentration due to bioaccumulation of pollutants of diverse nature within the sheath by the organism. But it is also cannot be ruled out that this group contribute as a phytoplankton that in turn is become extremely beneficial for the growth of fish and other insects of water.

MATERIAL & METHODS

The specimens were collected from different locations of the East (Purba) & West (Paschim) Burdwan districts. The specimens were collected from different water bodies as phyto-planktons floating on surface water and from moist soil surfaces. Some materials were cultivated in culture using modified BG-11 (Stainer 1979) medium and others were preserved in 5% formalin. The specimens were observed under light microscope (Olympus GB model). Camera Lucida drawings were made from collected samples of different locations as to confirmatively establish the status of obtained taxa. Microphotography was done using Zeiss Microscope. The pH of water at the site of collection was measured using "Merck pH paper". The temperature at the time of collection was noted using submerged thermometer. The collection was performed from different and distant localities to confirm the presence in a conclusive manner and the specimens were numbered accordingly with place and date of collection. The association study was also performed for clear understanding of ecological niche of the concerned taxa.

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RESULT & DISCUSSION

Description of the Genus - GLOEOCAPSA Kützing 1843

Cells spherical to sub-spherical, mostly two to eight within a colony. Many small colonies from a mucilaginous thallus like structure that either remain attached to the substratum or free floating. Sheath present, hyaline or sometimes colored, lamellated or not lamellated. Individual cells are with or without sheath.

Taxonomic Treatment: Cyanophyceae, Chroococcales, Microcystaceae.

Artificial Key to the obtained species:

1. Sheath around individual cell is homogenous……..……2
1. Sheath around individual cell is lamellated…….……6
    2. Cells less than 7 µm…….……..…3
    2. Cells more than 7 µm……4
        3. Cells 3.5 µm in diameter……(9) *G. violascea*
        3. Cells 6 µm in diameter……(3) *G. crepidinum*
        4. Cells more than 10 µm in diameter……(8) *G. rupestris*
        4. Cells less than 10 µm in diameter……..5.
            5. Cells 8.4 µm in diameter……..(6) *G. nigrescens*
            5. Cells 9 µm in diameter……..…(5) *G. gelatinosa*
    6. Cells less than 5 µm in diameter……7.
    6. Cells more than 5 µm in diameter…….8.
        7. Cells 4 µm in diameter……..….(1) *G. atrata*
        7. Cells 4.5 µm in diameter……...(7) *G. polydermatica*
        8. Cells 5.5 µm in diameter…….(2) *G. chroococcidiopsis*
        8. Cells 6 µm in diameter……..(4) *G. decorticans*

1. ***Gloeocapsa atrata* Kützing 1845**

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The thallus is made up of small mucilaginous colony. Two to four cells assemble to gether to to form a colony with hyaline sheath. Cells without sheath are 3 μm – 4.5 μm in diameter. Sheath multilayered, diameter of each cell with sheath is 5.5 μm – 9.5 μm.

Habitat – Collected from baburbag area [Sample No. SC – 40, 45 (pH 6.5 & Temperature 16^{o}C) dated 12/12/2002] on the surface of water of a non-cemented drain carrying domestic polluted water; from Gangpur area [Sample No. SC – 67 (pH 7.5 & Temperature 18^{o}C) dated 12/12/2002] in an irrigation canal near a rice field.

Earlier reports from India: North India (Turner 1892); Benaras (Bharadwaja 1935); Bombay (Dixit 1936); Calcutta (Banerji 1936); Rajpur (Thomas and Gonzalves 1965f); Uttar Pradesh (Tiwari 1972); Cochin (Joseph and Sarma 2004).

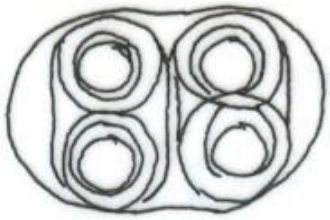

Fig. 1:- Camera Lucida Drawing of *Gloeocapsa atratra*

2. ***Gloeocapsa chroococcides*** **Novaček 1934**

Very small microscopic colony made up of many spherical to sub-spherical cells. Cells light blue-green in colour with multilayered sheath. Diameter of each cell without sheath 4 μm – 5.6 μm and with sheath 6 μm - 8 μm.

Habitat – Samples were obtained from Kalna area [Sample No. SC – 98 (pH 7 & Temperature 18^{o}C) dated 28/12/2002] as floating algal mass in a road side water body from Galsi area [Sample No. SC – 103, 106 (pH 7.5 & Temperature 15^{o}C) dated 23/02/2003] as floating mass on the waters of a rice field.

Earlier reports from India: This is the first report of this taxon from this part of India.

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Taxonomic note: This taxon is presently known as *Gloeocapsopsis chroococcoides* (Nováček) J. Komárek 1993 (Guiry and Guiry 2012).

Fig. 2

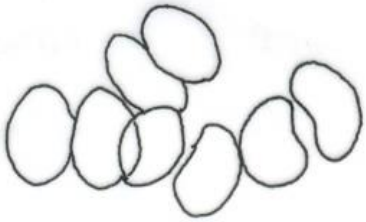

Fig. 2 & Fig. 3:- Camera Lucida Drawing of *Gloeocapsa chroococcoides*

3. ***Gloeocapsa crepidinum*** **(Thuret) Thuret 1876**

Thallus microscopic with very watery hyaline sheath. The colony is made up of very small number of cells, generally 4 – 8. Cells are 5 μm - 6 μm in diameter and sheath around individual cells is very thick or stratified.

Habitat – The samples were obtained from Sheyarabazar area [Sample No. SC – 214, 215 (pH 7 & Temperature 30^{o}C) dated 04/03/2005] from amongst the aquatic and semi-aquatic plants of road side water bodies as gelatinous mass.

Earlier reports from India: Poona (Schmidle 1900); Nainital (Singh 1974); Karnataka (Bongale and Bharati 1980); Lucknow (Prasad and Mehrotra 1980); West Bengal (Mukhopadhyay and Chatterjee 1981); Cochin (Joseph and Sarma 2004).

Taxonomic note: This taxon is presently known as *Gloeocapsopsis crepidinum* (Thuret) Geitler ex Komárek 1993 (Guiry and Guiry 2012).

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Fig. 4:- Camera Lucida drawing of *Gloeocapsa crepidinum*

4. ***Gloeocapsa decorticans*** **(A. Braun) Richter 1925**

Colony made up of two – four cells and many such colony aggregated together to form small thallus. Cells without sheath 6 μm - 8 μm in diameter and with sheath 12 μm - 14 μm in diameter. Sheath stratified, hyaline.

Habitat – Collected from Baburbag area [Sample No. SC – 17, 27& 34 (pH 6.5 & Temperature 15^{o}C) dated 12/12/2002] growing as attached algal film on the surface of the temporary drain used for domestic purpose.

Earlier reports from India: Uttar Pradesh (Mitra 1951; Pandey 1965; Pal 1975; Chadha and Pandey 1983a,b); West Bengal (Gupta 1975); Punjab (Pandhol and Grover 1976); Karnataka (Bongale and Bharati 1980; Somashekar 1983).

Fig. 5:- Camera Lucida drawing of *Gloeocapsa decorticans*

5. ***Gloeocapsa gelatinosa*** **(Meneghini) Kützing 1843**

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Small microscopic colony with very less number of cells. The colony is oval in outline with 8 μm - 9 μm in diameter and 9 μm - 10 μm in length, cells 1.5 μm - 2 μm in diameter with individual hyaline watery thin sheath.

Habitat – Sample was obtained from Talit area [Sample No. SC – 194 (pH 7 & Temperature 32^{o}C) dated 19/06/2004] in a sewage canal of temporary nature as mucilaginous mass and form Bajepratap Pur area [Sample No. SC – 195 (pH 7 & Temperature 33^{o}C) dated 19/06/2004] as floating algal mass on the water of a drain heavily polluted by domestic waste water.

Earlier reports from India: Calcutta (Banerji 1936); Tuwa (Thomas and Gonzalves 1965d).

Fig. 6:- Camera Lucida drawing of *Gloeocapsa gelatinosa*

6. ***Gloeocapsa nigrescens*** **Nägeli *In* Rabenhorst 1857**

Thallus dark blue-green in colour with watery sheath. Cells within the colony are 8 μm – 8.4 μm in diameter without sheath and 11 μm - 12 μm in diameter with sheath. Cells spherical in outline with not lamellated sheath.

Habitat – Collected from Baburbag area [Sample No. SC – 34 (pH 6.5 & Temperature 15^{o}C) dated 12/12/2002] in a drain heavily polluted by medical waste from nearby medical college; from Memari area [Samaple No. SC – 83 (pH 7 & Temperature 16^{o}C) dated 25/12/2002] in a rice field as free floating algal mass and from Satgachia area in a road side water body in sub-merged condition [Sample No. SC – 95 (pH 7 & Temperature 16^{o}C) dated 25/12/2002].

Earlier reports from India: Punjab (Sarma and Kanta 1978).

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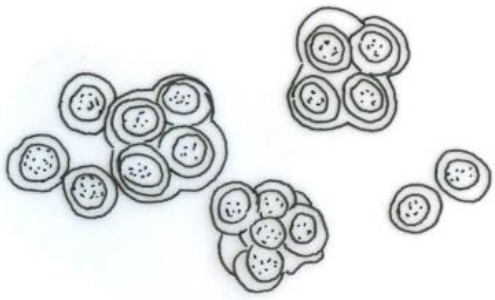

Fig. 7:- Camera Lucida drawing of *Gloeocapsa nigrescens*

7. ***Gloeocapsa polydermatica*** **Kützing 1846**

Many small mucilaginous colony assemble together to form mucilaginous Thallus. Cells spherical to sub-spherical in outline and 3.5 μm – 4.5 μm in diameter. Shrath around individual cells not very prominent but the sheath is very thick, distinctly lamellated and dark in colour.

Habitat – The samples were collected from the Baburbag area [Sample No. SC – 23, 25 and 29 (pH 6.5 & Temperature 15^{o}C) dated 12/12/2002] as growing on the surface of the moist wall surface of a temporary drain in the area use for domestic purpose.

Earlier reports from India: Ghaziabad (Pal 1975); Meerut (Bendre and Kumar 1975); West Bengal (Sinha and Mukherjee 1975b); Karnataka (Bongale and Bharati 1980; Somashekar 1984b).

Taxonomic note: This taxon is presently known as *Gloeocystis polydermatica* (Kützing) Hindák 1978 (Guiry and Guiry 2012).

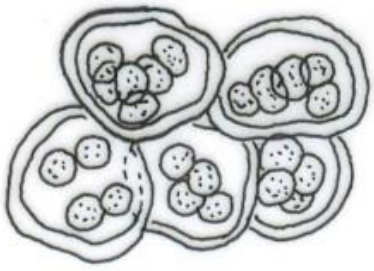

Fig. 8:- Camera Lucida drawing of *Gloeocapsa polydermatica*

8. ***Gloeocapsa rupestris*** **Kützing 1845**

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The Thallus is yellowish green in colour, made up of numerous small colonies. Colony 60 μm - 75 μm in diameter with relatively thick sheath. Cells are without sheath 7 μm - 9 μm in diameter and with sheath 9 μm – 10.5 μm in diameter.

Habitat – The samples were collected from the Korzona area [Sample No. SC – 189 and 190 (pH 7 & Temperature 32^{o}C) dated 07/03/2004] as growing within some sub-merged aquatic plants as mucilaginous algal mass.

Earlier reports from India: West Bengal (Prain 1905; Banerji 1936; Pal and Santra 1982; Maity and Santra 1985; Santra *et al* 1988); Uttar Pradesh (Tiwari 1972); Coimbatore (Laloraya and Mitra 1974); Uttar Pradesh (Pal 1975; Pandey 1982); Punjab (Sarma and Kanta 1978); Karnataka (Bongale and Bharati 1980); Maharastra (Bhoge and Ragothaman 1986); Cochin (Joseph and Sarma 2004).

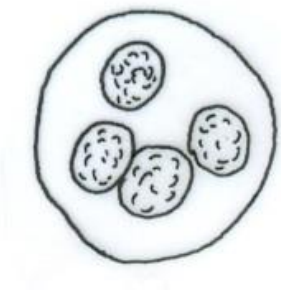

Fig. 9:- Camera Lucida drawing of *Gloeocapsa rupestris*

9. ***Gloeocapsa violascea*** **(Corda) Rabenhorst 1865**

Colony small in size with two to four cells and 75 μm - 100 μm in diameter. Sheath thick and lamellated. Cells without sheath 3 μm - 4 μm in diameter and with sheath 10 μm - 15 μm in diameter.

Habitat – Samples were collected from the Police Line area of Burdwan town itself [Sample No. SC – 08 and 10 (pH 6.5 & Temperature 25^{o}C) dated 28/11/2002] in a pond used for routine domestic activities and from Baburbag area [Sample No. SC – 18 (pH 6.5 & Temperature 15^{o}C) dated 12/12/2002] as attached on the surface of the drain carrying medical waste.

Earlier reports from India: Bombay (Schmidle 1900).

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Fig. 10:- Camera Lucida drawing of *Gloeocapsa violascea*

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