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Research Article

NEW REPORT OF *ANABAENA* BORY FROM HOOGHLY DISTRICT IN WEST BENGAL, INDIA

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ABSTRACT
In the present paper, three heterocystous species of the genus *Anabaena* Bory viz. *Anabaena sphaerica* Born. et Flah., *Anabaena variabilis* Kütz. ex Born. et Flah., *Anabaena anomala* Fritsch of Nostocaceae under the order Nostocales of Cyanophyta had been morpho-taxonomically described first time from Hooghly district in West Bengal, India. These algae had been collected from swampy land, ditches and river of West Bengal. The above mentioned all three taxa were new reports from the said district.

Keywords: *Cyanophyta, Anabaena Bory, Nostocaceae, Hooghly District, West Bengal*

INTRODUCTION
Hooghly district (20°30'32"-23°1'20"N and 87°30'20"-80°30' 15"E) is a central district of the state West Bengal of India and is pre-dominantly occupied a land of the lower Gangetic alluvial soil (Halder and Sinha, 2013a,b).

The average rainfall is 110.0 mm. and average temperature in summer 30.5°C and in winter 18°C. The members of Nostocaceae are trichomatous, mucilaginous, odorous, bluish-green, with or without sheath, heterocystous or non-heterocystous, unbranched.

Tropical hot, dry and humid conditions help their luxuriant growth in various aquatic ecosystems. Previously some attempts had been made for the identification of the members of nostocales from West Bengal, India.

In this respect, the work of Martens (1871), Prain (1905), Brühl and Biswas (1922), Biswas (1925, 1926), Banerjee (1936, 1938), Gupta (1965, 1975), Laloraya and Mitra (1974), Sinha and Mukherjee (1975a, b), Mukhopadhyay and Chatterjee (1981), Pal and Santra (1982, 1985), Maity and Santra (1985), Gupta and Sen (1987a, 1987b), Sen and Gupta (1993), Santra (1990), Santra *et al*.,(1988), Sen and Naskar (2003), Sen (2005,06) and Roy and Keshri (2014) may be mentioned.

The aim of the present study was the documentation of algal species to prepare algal data bases of this district as well as state in future.
The study would also provide baseline information regarding algal flora in respect of ecological conditions.

MATERIALS AND METHODS
Algal samples were collected in plastic and glass containers from different places viz. downstream of the river Dwarkeshwar at Arambag (22°.88'N, 87°.78'E), ditches at Diara (22°.79'N, 88°.28'E) and Swampy land at Seoraphuli (22°.77'N, 88°.32'E) of the Hooghly district, West Bengal (Figure 1). Detail study was made by examining specimens under Olympus microscope (Model-CH20i) for determination of species. Samples were preserved in 4% formalin solution. Identification of different taxa was accomplished with the help of authentic literatures viz. Desikachary (1959), Prescott (1962) Prasad and Srivastava (1992). Each currently accepted name has been provided with its author(s) name. All physico-chemical parameters in ecological notes are expressed in mg/l. except pH and temperature. The pH and temperature of the water bodies were determined at the site immediately after collection with the help of portable pH meter (Model No. PP9046 Philips, India) and Zeal's (UK) mercury thermometers. The other limnological parameters of waters were determined following the standard method (APHA, 2005).

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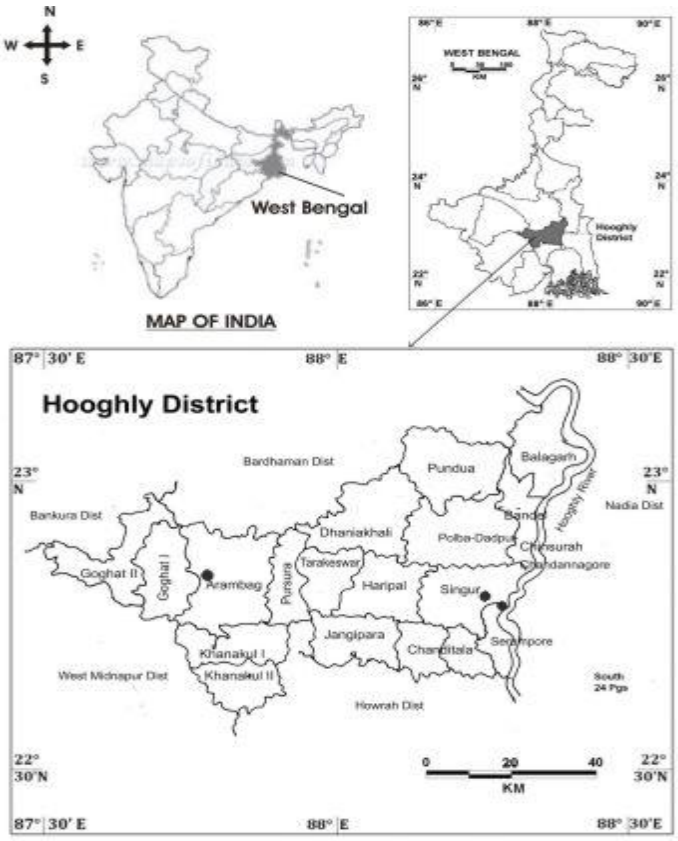

Map of Hooghly district, W.B

Fig. 1

● indicated study sites of Hooghly district in West Bengal, India

RESULTS AND DISCUSSION

A total of three algal species of the genus *Anabaena* Bory viz. *Anabaena sphaerica* Born. et Flah., *Anabaena variabilis* Kütz. ex Born. et Flah., *Anabaena anomala* Fritsch belonging to the family Nostocaceae under the order nostocales of cyanophyta were recorded for the first time from different aquatic ecosystems in Hooghly district of West Bengal, India. Each currently accepted name has been provided with its author(s) name. All parameters in ecological notes are expressed in mg/l except pH and temperature.

Morpho-Taxonomic Description

Key to the Species

1(a)Trichomes somewhat arranged in parallel; cells moniliform and with few pseudo-vacules; end cell conical---------- *Anabaena sphaerica*

(b) Trichomes otherwise ----------2

2(a) Heterocysts oval, 7.5- 8.5 µm long and 4.5-6.0 µm broad---------- *A. variabilis*

(b) Heterocyst spherical, 3.4-5.4 µm broad and 7.0-7.3 µm long ---------- *A. anomala*

Order: Nostocales

Family: Nostocaceae

Genus: *Anabaena* Bory

1. *Anabaena sphaerica* Born. et Flah. in Revision des Nostocacées hétérocystées 228, 1888; Forti in De Toni, Sylloge Algarum, 5: 440, 1907; Frémy, Myxo. d' Afr. équat. franc., 361, figure 295, 1929; Geitler, Kryptogamenflora, 878, 1932; Desikachary, Cyanophyta 393, 1959. (Plate 1, Figure A)

Description: Thallus floccose, blue green, trichomes moniliform, straight, arranged in parallel; cells spherical or short barrel shaped 5.5 to 6.0 µm broad; sheath mucilaginous, not visible; cell content

homogenous, few gas vacuoles present in each cell; cell wall smooth, thick; heterocysts intercalary, spherical, 6.0 to 7.0 µm broad; end cell colonial with rounded apices.
Habitat: In the downstream of the river Dwarkeshwar at Arambag.
Collection No: 712
Date: 31.10.10
Ecological Notes: Blue-green**,** grows on bottom sandy mud as tubular form or finger like projections as submerged conditions. Dwarkeshwar river, water temperature: 30ºC; pH: 7.3; NO_3-NO: 0.17; PO_4: 0.20; DO: 7.0; BOD: 3.8; COD: 100.0; TDS: 162.4.
Significance: Primary producer in water bodies; biological agent of nitrogen fixation.
2. *Anabaena variabilis* Küetz. ex Born. et Flah. in Phyc. gene. 210.1843; Bornet & Flahault Revision des Nostocacées hétérocystées 226, 1888; Forti in De Toni, Sylloge Algarum, 5 :437, 1907; Frémy, Myxo. d' Afr. équat. franc., 360, figure 294, 1929; Geitler, Kryptogamenflora, 876, figure 558,1932; Desikachary, Cyanophyta 410, plate 71, figure 5, 1959. (Plate 1, Figure B)
Description: Thallus blue green, free floating, mucilaginous, soft; trichomes loosely entangled, straight or irregularly curved; cells barrel shaped or sub-globose, as long as broad or shorter than broad; constricted at the cross wall; 5.4 to 6.5 µm long, 4.5 to 6.0 µm broad; cell content homogenous, without gas vacuoles in cells; end cells conical with rounded apices; heterocysts intercalary, oval; 7.5 to 8.5 µm long and 4.5 to 6.0 µm broad.
Habitat: Ditches at Diara.
Collection No: 1234
Date: 29.08.12
Ecological Notes: Blue-green**,** mucilaginous, free floating. Diara, water temperature: 31ºC; pH: 7.6; NO_3-NO: 0.20; PO_4:0.32; DO: 5.8; BOD: 4.2; COD: 120.0; SO_4: 7.0.
Significance: Primary producer in aquatic bodies and biological agent of nitrogen fixation.
3. *Anabaena anomala* Fritsch (Plate 1, Figure C)
(Desikachary, Cyanophyta 398, Plate 73, figure 2, 1959)
Trichomes loosely arranged, thin, mucilaginous, bluish green, irregular, more or less contorted; cells moniliform, apical cell sub conical and apex obtuse; cells 2.6 to 3.6 µm broad and 5.0 to 5.5 µm long, 1½ times as long as broad, barrel shaped; heterocyst single, intercalary, spherical, 3.4 to 5.4 µm broad and 7.0 to 7.3 µm in length.
Habitat: Swampy land at Seoraphuli.
Collection No: 694
Date: 15.09.10
Ecological Notes: Bluish green, odorous, mucilaginous, loosely entangled algal mass growing during rainy season in association with the aquatic plants in swampy land at Seoraphuli, water temperature: 30ºC; pH: 7.5; NO_3-NO: 0.25; PO_4:0.36; DO: 6.4; BOD: 4.0; COD: 120.0; SO_4: 8.0.
Significance: Primary producer in aquatic ecosystems and biological agent of nitrogen fixation.

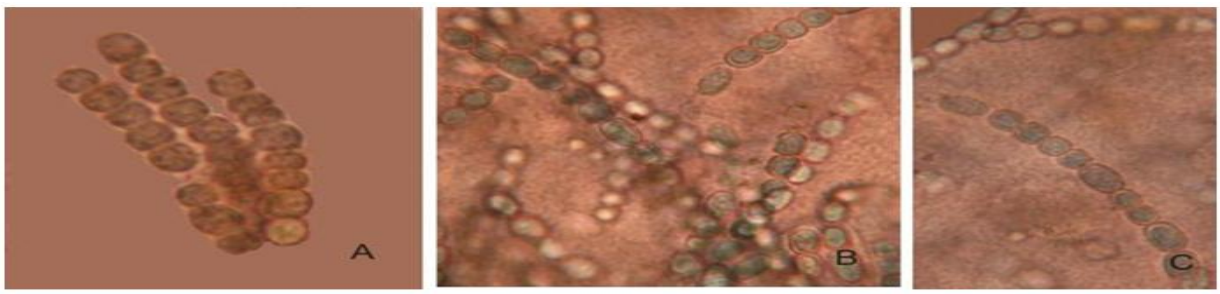

Plate 1: Figures A. *Anabaena sphaerica* Born. et Flah., B. *Anabaena variabilis* Kütz. ex Born. et Flah. and C. *Anabaena anomala* Fritsch

Above, a total of three algal species of the genus *Anabaena* Bory had been taxonomically described. The present study would be helpful for the documentation of algal species and to prepare algal data bases of this district as well as state in future. The study would also provide baseline information regarding morpho- taxonomic features of algal flora in respect of ecological conditions.

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