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Short Communication

# STUDY ON THE DIVERSITY AND TAXONOMY OF *HYELLA* BORNET & FLAHAULT 1886 AND *JOHANNESBAPTISTIA* DE TONI 1934 – TWO RAREST PSEUDO FILAMENTOUS CYANOBACTERIA FROM EASTERN INDIA

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**ABSTRACT**

*Hyella* &*Johannesbaptistia* are the genus belonging to Pseudo-filamentous Cyanobacteria which are not very common compared to other taxa of the same group of Cyanoprokaryotes. In this present investigation the authors could obtain two species viz. *H. maxima*, & *H. Fontana* under the genus *Hyella* and two other *viz. J. primaria* and *J. schizodichotoma* under the genus *Johannesbaptistia* from different locations of present Purba (East) Bardhaman and Paschim (West) Bardhaman district of West Bengal, India. According to the available literatures on the said group of organisms obtained by the author during the present investigation are first reports from this part of India. Related ecological investigations were also performed by the authors and present taxonomic status of the concerned taxa was reinforced. This investigation will add to the world data on the occurrence and taxonomic status of the concerned Cyanoprokaryotes.

**Keywords:** Hyella,Johannesbaptistia, Cyanobacteria, Pseudo-filamentous, First Report, West Bengal, India

## 1. INTRODUCTION

While investigating the Cyanobacterial flora of Burdwan (Presently known as Purba & Paschim Bardhaman) district of West Bengal, India; the author obtained two species viz. *H. maxima* [1] & *H. Fontana* [2] under thegenus *Hyella* [3] and two other *viz. J. primaria* [4] and *J. schizodichotoma* [5] under the genus *Johannesbaptistia* [6]. The district is mainly known for it's dominance in agriculture sector for production of different varieties of rice and on the other hand as Industrial zone of the district. The district possesses rich coal mines and is hub for Iron & Steel production.

The genus *Hyella* [3] belongs to the Class-Cyanophyceae [7]; Subclass-Oscillatoriophycidae; Order-Pleurocapsales and Family-Hyellaceae [7]. The genus *Johannesbaptistia* on the other hand belongs to Class-Cyanophyceae; Subclass-Oscillatoriophycidae; Order-Chroococcales and Family-Cyanotrichaceae [8].

According to the previous reports on *Hyella,* both fresh water as well as marine forms was reported by various workers time to time. Many species under *Hyella* & *Johannesbaptistia* were reported by many workers but many of them require proper taxonomic investigation to be flagged as validly accepted species.

Till date 29 (twenty nine) species were marked as validly accepted under *Hyella* and only 5 (five) species were marked as validly accepted under *Johannesbaptistia* [6]. All four taxa reported during this investigation were validly accepted species.

The locations from where samples were obtained are manifested with warm and humid condition. They were mainly obtained as free floating planktons on the surface of stagnant road side water bodies and rice fields.

The author did yearlong ecological study on the said taxa and tabulated the result as discussed in details in the ecology section of this report. The occurrence of the taxa discussed in this investigation was very infrequent and thus could be termed as rare. The literature study revealed that all three taxa obtained in this present investigation as first from this part of country.

The author also performed elaborate literature survey for proper identification of the obtained taxa. The author scripted artificial key and exact description of all taxa concerned. The significance of this investigation is not confined within taxonomic point of interest but as the area is heavily industrialized on one hand and agriculturally rich on the other it may have some social and environmental impact too.

The presence of watery sheath around the linearly arranged cells resulting in a pseudo-filament [7] of the concerned taxa could attribute to some scavenging

function for pollutants or may have $N_2$ fixation capabilities. As a result, all the taxa could have some role in biological $N_2$ fixation and in turn thus having potential to be explored as bio-fertilizer. Though detailed investigation required before reaching any conclusion.

## 2. MATERIAL & METHODS

The specimens were collected from different locations of the Burdwan district [presently named asPurba (East) & Paschim (West) Bardhaman] from different water bodies as phyto-planktons floating on surface water. Some materials were cultivated in culture 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.
For better understanding of life cycle pattern the author also obtained pure culture through repeated sub-culturing technique in modified BG-11[9] medium.

## 3. RESULTS & DISCUSSION

The authors described the obtained taxa according to observation as obtained during microscopic investigation and performed camera lucida drawing of the preserved samples. An artificial key was also prepared for proper taxonomic understanding. While describing the obtained taxa a detailed note was also scripted on its habitat and microclimatic condition.

### 3.1. HYELLA [3]

Many small spherical to sub-spherical colonies or mature cells in such a manner to form pseudoparenchymatous Thallus. The cells are spherical to sub-spherical in outline with granular content. The end of the pseudo-filaments are club-shaped. The sheath present around colony and individual cells are firm and mucilaginous. Generally obtained from soil condition with pH high in alkalinity.

**Taxonomic Position:** Cyanophyceae, Chroococcales, Hyellaceae.

**Artificial Key to the species:**

1. Cells 15 μm in diameter..... (1) *H. maxima*
2. Cells less than 15 μm in diameter .... (2) *H. fontana*

#### *3.1.1. Hyellamaxima [1]*

Thallus pseudo-filamentous in organization, constituted of mature cells and small colonies. The cells are spherical to sub-spherical in outline, 15μm-17μm in diameter, Sheath mucilaginous and thin, hyaline.

*Habitat*-Samples were collected from Panagarh area [Sample No. SC-120 & 123 (pH 6.5 & Temperature 27°C) dated 23/02/2018] in a road side water body in submerged condition; from Gopalmath area [Sample No. SC-134 (pH 6.5 & Temperature 35°C) dated 14/07/2017] in a drain within the market. Interestingly in both the cases the alkalinity was measured on higher side due to mixing of domestic waste on random basis.
*Earlier reports from India:* This is the first report of this taxon from this part of India.

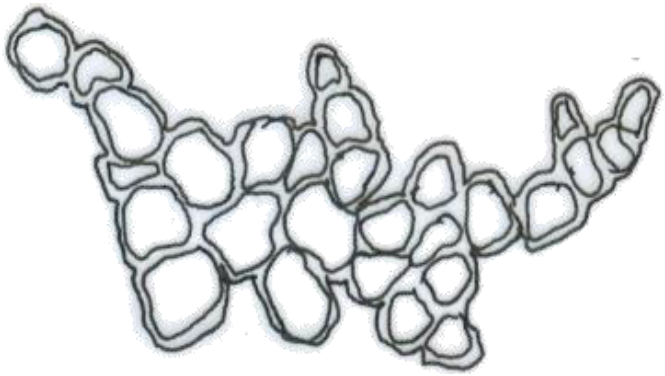

**Fig. 1: Cameri Lucida Drawing of *Hyella Maxima***

#### *3.1.2. Hyellafontana* [2]

Thallus made up of compactly arranged indefinitely shaped cells. Cells arranged within a common mucilaginous envelop resembling a pseudofilament. The cells are 12μm-13.5μm in diameter. Daughter colony also found within the same Thallus Fig.2.
*Habitat*-The samples were obtained from the soil surface of a rice field where pH found towards alkaline due to heavy use of urea like fertilizers in Galsi area [Sample N0. SC -102, 106 & 109 (pH 7.5 & Temperature 25°C) dated 23/02/2018].
*Earlier reports from India:* This is the first report of this taxon from this part of India.

**Fig. 2: Camera Lucida drawing of *Hyella fontana***

**3.2. JOHANNESBAPTISTIA** [6]

Pseudo-filamentous organization, unbranched or pseudodichotomously branched; consists of one row of ovoid to sub-spherical cells. Mucilaginous tube like, hyaline, watery sheath with rounded ends surrounding single row of cells.

**Taxonomic Position**: Cyanophyceae, Chroococcales, Synechococcaceae

**Artificial Key to the species:**

1. Diameter of individual cell is 3 µm .....(2) *J. schizodichotoma*

2. Diameter of individual cell is 3.3 µm .....(1) *J. primaria*

***3.2.1. Johannesbaptistiaprimaria***[4]

Solitary, pseudo-filamentous, un-branched organization. Single row of sub-spherical to ovoid cells. The tube like mucilaginous hyaline envelop surrounds the row of cells. Average diameter of individual filaments is 3.1µm-3.4µm (Fig. 3, 4).

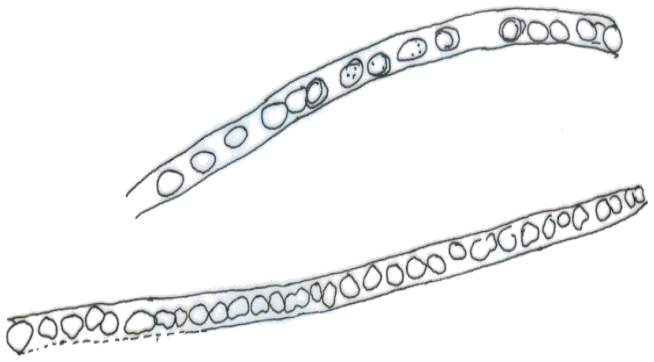

**Fig. 3 & 4: Camera Lucida drawing of Johannesbaptistia schizodichotoma**

*Habitat*- Samples were collected from Babur bag area within a drain in submerged condition [Sample No. SC-49 (pH 6.5 & Temperature 16°C) dated 12/12/2017]; from Kulti area in a roadside water body [Sample No. SC-155 & 157 (pH 6.5 & Temperature 35°C) dated 16/08/2003] and from Barakar region in a drain carrying domestic waste water [Sample No. SC -162 (pH 6.5 & Temperature 35°C) dated 16/08/2018].

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

***3.2.2. Johannesbaptistiaschizodichotoma*[5]**

The members shows pseudofilamentous and pseudodichotomous organization. Filaments having single row of ovoid sub-spherical cells. Mucilage surrounding the cells are tubular, watery and hyaline; diameter of individual filaments is 7.6µm -8.1µm. Cells are 5.5µm - 6µm long and 3µm-4µm in diameter (Fig.5).

*Habitat*-Samples were obtained from Babur Bag area [Sample No. SC-24 & 45 (pH 6.5 & Temperature 16°C) dated 12/12/2018] in temporary sewage canal near medical college carrying medical waste and from Sorai tikor area [Sample No. SC-56 (pH 7 & Temperature 15°C) dated 12/12/2018] in almost same habitat above.

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

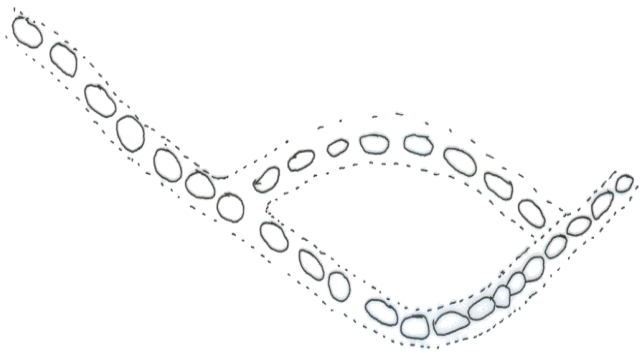

**Fig. 5: Camera Lucida drawing of *Johannesbaptistia schizodichotoma***

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