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Systematic enumeration and ecological study of some members of Charales from the reservoirs of Ajodhya hills and forest area of Baghmundi (Purulia district, West Bengal)

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Abstract

The present paper was deals with morpho-taxonomic descriptions of 4-members of Charales (green algae) such as *Chara aspera* Willdenow, *Chara fibrosa* Ag. Ex Bruz, *Nitella hyaline* (*DC.*) Ag. And *Nitella myriotrichavar. acuminate D.* Subramanian. All species were collected from freshwater aquatic ecosystem of Ajodhya hills and forest area, Purulia, West Bengal. These members are ecologically important in their ecosystems as they help control nutrient cycles, food sources of aquatic animals, improve water clarity and serve as bioindicators.

Keywords: Morpho-taxonomic, Freshwater, Aquatic, Bioindicator

Introduction

Charales is an order of green algae and also known as "Stonewort's". Their plant bodies are grass-green, branched, differentiated into nodes and internodes; bear two types of branches– branches of limited and unlimited growths. They are very common in temporary and permanent aquatic ecosystems like ponds, lakes, man-made reservoirs, canals, swampy lands, water logged rice fields and rivers. Both the male (globule) and female (nucule) sex organs are complicated and well protected by a sterile jacket. The zygotes of Charales are very resistant to dry and cold conditions that might be due to development of sporopollen in layer surrounding the zygotes.

From cytological point of view, presence of Golgi bodies and network of microtubules, the formation of phragmoplasts and cell plates during late cytokinesis are the key characters of Charophytes (Bennici 2008). Few species of *Chara* L. are bioindicator of water quality (Gudrun et al. 1996). Ecologically, Charophytes are distinct because they release some chemical substances which causing a strong and characteristic smell and, Blindow 2003).

Present collection area includes five water bodies namely Upper dam, Lowerdam, Marblelake, Kestobazar lake, and Murguma dam which have been selected for the present study. Upper and Lower dam are mainly used for hydro-electric power project, Marble lake adds to aesthetic beauty of the tourist, the lake was created by cutting stones when constructing the upper and lower dam. Kestobazar lake is an impoundment used by local people for various purposes and Murguma dam is being used for irrigation and drinking purposes. These serene water bodies make the place an attractive tourist spot. All the dams are source of fish fauna. The details of 5 water bodies are given below-

Sl No.	Site	Latitude	Longitude	Altitude	*Area of water bodies	*Water Depth
1	Site- I (Upper Dam)	23.201709^{0}N	86.095766^0 E	(494-516) mMSL	82900 square meters	22 Meters
2	Site- II (Lower Dam)	23.193147^{0}N	86.087350^{0}E	(300-337) mMSL	1266000 square meters	37 Meters
3	Site-III (Marble Lake)	23.212718^{0}N	86.086895^{0}E	465 mMSL	300 square meters	21 Meters
4	Site-IV (Kesto bazar Lake)	23.186611^{0}N	86.087334^{0}E	350mMSL	500 square meters	6 Meters
5	Site- V (Murguma Dam)	23.315680^{0}N	86.049350^{0}E	(339.4-347.14) mMSL	Approx. 2000 square meters.	22 Meters

*Data source: Purulia Pumped Storage Project, Irrigation Div. (Saharjore Project) , Purulia, W.B

In Bengal, some earlier reports were available on taxonomy of Charophytes by the investigations of Griffith (1849), Agarkar & Kundu (1937), Kundu (1929, 1934–1935, 1937, 1941, 1959), Chaterjee (1975, 1979), Pal & Santra (1987), Mandal & Ray (2004), Mondal, Pal and Keshri (2021). As far as the karyotype is concerned, the work of cyto-taxonomy on Charophytes by Chaterjee (1976, 1979), Ray & Chaterjee (1987, 1994), Mukhopadhyay (1995) enriched our knowledge of this interesting plant group. As, there was no comprehensive report of Charophytes from this district the present study was undertaken. The main objective of the present work was to explore the occurrences and diversities of Charophytes from this region.

Materials and Methods

Five water bodies were selected for the collection of samples of Charales along with other algal flora for three consecutive years. Monthly collection of samples from surface water were made and five collection sites were chosen for each water body namely Site-I, Site-II, Site-III, Site-IV, and Site-V.

The samples were brought to laboratory and examined under Levenhuk Biological Microscope (Magnification 40x to1200x) and photographic analysis of objectives were performed with Microscope Digital Camera (Model No. SCMOS00350KPA, TOUPCAM) for morpho-

taxonomical studies. Both fresh and preserved (4% formalin) samples were studied and micro measurement was taken.Identifications of the taxa were done through authentic literatures (Imahori 1954, Pal et al. 1962, Wood & Imahori 1964–65, Pal & Santra 1987, Subramainian 2002 etc.)

Results and Discussion

A total number of five algal taxa belonging tothe family Characeae under the order Charales of the class Chlorophyceae were described morpho-taxonomically for the first time from Ajodhya hills and forest area of Purulia district of West Bengal, India.

1. *Chara aspera* Willdenow

(Gontcharov et al.,2021, p.6-8.fig.5A-K)
(Pl.I, Figure-A,B,C)

Plants are green, dioecious, up to40cmtall, without incrustations. Axes moderately slender, 350–450 µm in diameter. Cortex triplostichous, isostichoustotylacanthous. Spine-cellssolitary, papilliform. Stipulodesdiplostephanous (in 2 tiers), 2 sets per branchlet, acuminate, uppers somewhat longer than lowers . Internodes corticated, 1–3 times longer than the branchlets. Branchlets 6–9 in a whorl, straight and spreading, 1.2–1.8 cm long; each branchlet consisting of 5–6 corticated segments; end segment 1–2-celled, naked. Bract-cells usually 5, well developed, unilateral, shorter to longer than oogonium. Bracteoles 2, somewhat longer than the bract-cells and exceeding the mature oogonium. Gametangia on separate plants and the female thalli only observed. Oogonia solitary at the 2–3 lowest branchlet nodes, 690–750µmlong.

Date of Collection: 03.09.2022

Place of Collection: Site-I, V

Collection No.: P. D- 290

2. *Chara fibrosa* Ag. Ex Bruz.; Em (*C.flqaccida* A. Br.) R.D.W

(Subramanian 2002, p.88.pl.32.f.1-4)
(Plate. I, Figure. D, E)

Monoecious plant, stem 364-392 µm thick, corticated, primary series prominent . Spine cells short. Whorls of 8-9 thick branchlets. Gametangia produced at the lower three nodes. Oogonia 574-600 µm long,410µm broad; Antheridia 410µm in diameter.

Date of Collection: 04.09.2022

Place of Collection: Site-I, III

Collection No.: P. D- 294

3. *Nitella hyalina*(DC.) Ag.

(Subramanian 2002, p.64.pl.18.f.1-4)
(Plate. I, Figure-.F,G)

Monoecious, soft stem, 570µm thick, 5cm height, internodes shorter than branchlets, 2 celled dactyls. Gametangia conjointed, male female at same node. Oogonium brown ,475 µm in length and 425µm in breadth.Antheridium orange ,498 µm in diameter

Date of Collection: 04.09.2022

Place of Collection: Site-I, III

Collection No.: P. D- 295

4.Nitella. myriotricha var. acuminate D. Subramanian

(Subramanian 2002, p.58.pl.14.f.1-4)
(Plate.I, Figure-H)

Monoecious 10 cm height, bright green, mucilaginous. Internodes slightly longer than branchlets. Sex organ in the longer branchlets, no sex organ in shorter branchlets Antheridium larger and greenish yellow 500µm in diameter. Oogonium large sized, 300µm long, 285µm broad.

Date of Collection: 04.09.2022

Place of Collection: Site-I, III

Collection No.: P. D- 296

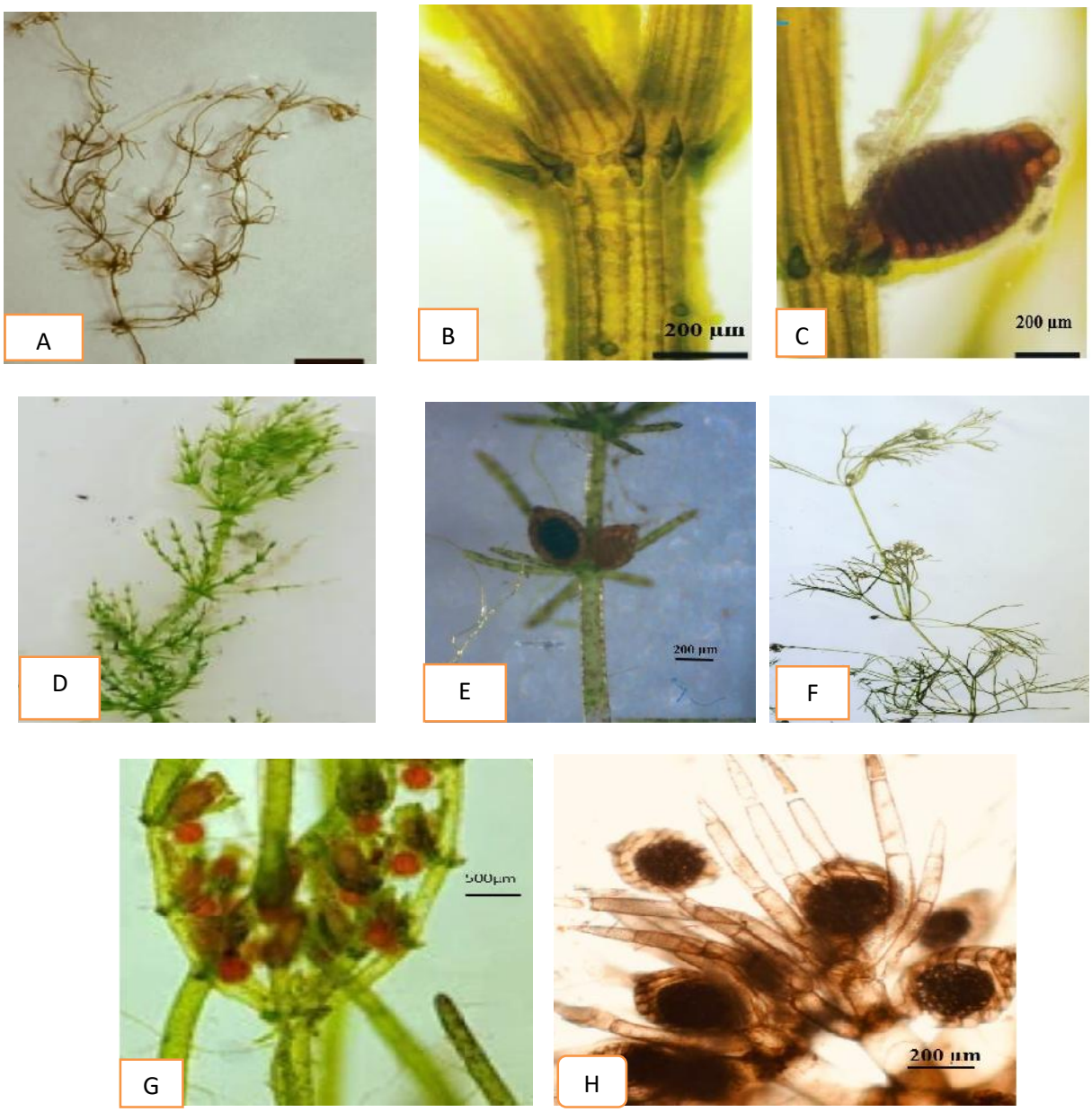

PLATE-I,-Figure-A: ***Chara aspara*** (whole plant), Figure-B: ***C. aspera*** (branch), Figure-C: ***C. aspera*** (reproductive part), Figure-D:***C. fibrosa*** (whole plant). Figure-E: ***C. fibrosa*** (reproductive part), Figure-F:***Nitella hyalina*** (whole plant), Figure-G: ***Nitella hyalina*** reproductive part), Figure-G: ***Nitella myriotricha*** (with reproductive part)

Above taxa occur in all depths in fresh waters. Although most species of the order Charales inhabit oligotrophic (nutrient-poor) waters, some species can tolerate eutrophic (nutrient-rich) conditions of high productivity (Penning et al. 2008). However, since most Charales are not found in nutrient-rich waters, they are among the first submerged macroalgae to disappear during the eutrophication process. The habit of the plants are often Sharply affected by ecological conditions. Intense light produces stunted and compact shoots, while reduce light permits elongated and diffused plants (Subramanian, 2002). Charophytes are ecologically important. They can establish dense biomass in both deep and shallow lakes and ponds, depending on water

clarity. They also have functions in water purification and fish farming (Schneider et al. 2015). These beds are important breeding areas for fish because they offer protection from predators and currents (Lake et al. 2002). Charales beds are good bioindicators of ecosystem status because they are sensitive to environmental changes. For example, Chara play an important role in carbon and nutrient cycles, especially nitrogen and phosphorus, because they improve water clarity and maintain oligotrophic conditions in ecosystems. Charales can absorb nutrients from the water into the plant biomass, improve sedimentation, and reduce sediment suspension, which helps control nutrient cycles (Vermaat et al. 2000). Although Charales meadows are considered advantageous for an ecosystem, they are sometimes seen as a nuisance. They can obstruct canals and reservoirs if growth is not properly controlled. Charales beds are good bioindicators of ecosystem status because they are sensitive to environmental changes. For example, *Chara* play an important role in carbon and nutrient cycles, especially nitrogen and phosphorus, because they improve water clarity and maintain oligotrophic conditions in ecosystems. Charales can absorb nutrients from the water into the plant biomass, improve sedimentation, and reduce sediment suspension, which helps control nutrient cycles (Vermaat et al. 2000). Charales are very important as they enhanced of water quality, storage of carbon and nutrients, fish farming, food for aquatic animals and farm livestock, fertilizers, and much more.

Therefore, a better understanding of the ecology of this group of algae is important for the conservation and restoration of aquatic ecosystems.

This study provides an overview ecology of Charales, habitat, status and outlined of species identification.

Conclusion

Four number of taxa of Charales (green algae) such as *Chara aspera* Willdenow, *Chara fibrosa* Ag. Ex Bruz, *Nitella hyaline* (*DC*.) Ag. and *Nitella myriotrichavar. acuminate D.* Subramania were identified by relevant literatures. All species were found in freshwater reservoirs of Ajodhya hills and forest area, Purulia, West Bengal. These algal taxa are biologically important as they help control nutrient cycles, food sources of aquatic animals, improve water clarity and serve as bioindicators. All species are being reported for the first time from Ajodhya hills and forest area of Baghmundi, Purulia, West Bengal. This study contributes to the knowledge of the biodiversity of this region providing support for future ecological studies and biomonitoring.

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Conflict of interests

No conflict of interest.

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