



Taxonomy and ecology of *Coleochaete irregularis* Pringsheim and *Coleochaete orbicularis* Pringsheim, West Bengal, India

Nilu Halder *

Department of Botany, Raja Peary Mohan College, Uttarpara-712258, Hooghly, West Bengal, India

*Corresponding author e mail: niluhalder1@gmail.com

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Abstract

The present communication was dealt with the taxonomy and ecology of two Chaetophoralean epiphytic species belonging to the genus *Coleochaete* Bréb. of class Chlorophyceae. The species are viz. *Coleochaete irregularis* Pringsheim and *Coleochaete orbicularis* Pringsheim. Among them, *C. irregularis* Pringsheim showed irregularly branched and loosely arranged filaments of different sizes which were not radiating from a common centre while the other species formed a disc-shaped structure and exhibited multicellular erect filaments which were adjoined laterally and radiating from a common centre. Moreover, *Coleochaete irregularis* Pringsheim and *C. orbicularis* Pringsheim is the third time reports from West Bengal, India. Ecological study revealed that the species preferred to grow in shallow water bodies like wetlands with alkaline water (pH: 7.0-7.2) where submerged plants supported their habitats and temperature < 22°C as well as unpolluted water favoured their growth.

Introduction

The members of the order Coleochaetales are heterotrichous and structurally complex freshwater green algae and attached to the surfaces of aquatic angiospermic plants as epiphytes in stagnant and, slow moving water bodies. Prostrate system is well developed in most of the species under this order. Characteristic sheathed setae are found on the cells due to extension of the cell wall or extrusion of cytoplasm content. Asexual reproduction takes place by formation of zoospores while sexual reproduction by oogamy. After fertilization, a sterile jacket is formed around the zygote for its protection.

During the taxonomic investigation side by side, some of the physico-chemical characteristics of waters such as temperature pH, DO, BOD, COD, NO₃-N, PO₄³⁻, total alkalinity and SO₄²⁻ of the studied aquatic ecosystems had been analyzed to find out their impact on algal growth and occurrence.

The genus *Coleochaete* Bréb. includes *Ca* 16 species of filamentous epiphytic freshwater algae that have recently attracted much attention due to their presumed sister position to the land plants (Graham, 1993; Szymańska, 2003). Review of phycological literatures showed that a few works had been carried out on the taxonomy of these two species from West Bengal (Saxena, 1962; Kargupta and Sarma, 1991; Keshri, 2010) and India (Sinha and Noor, 1962; Bhardwaja, 1963; Kamat, 1963, 1968, 1974, 1975; Sinha and Das, 1963; Pandey, 1965; Patel, 1968; Alfred, 1978; Meena, 2015). *Coleochaete irregularis* Pringsheim was first reported by Kargupta and Sarma in 1991 whereas *Coleochaete orbicularis* Pringsheim was first recorded by Saxena (1962) from West Bengal, India.

Materials and Methods

Algal samples were collected in plastic and glass containers from fresh water habitats at Madhusudanpur (23.01°N; 88.40°E) and Behula (23.18°N; 88.42°E) of Hooghly district (20°30'32"-23°1'20"N; 87°30'20"-80°30'15"E). Detailed taxonomic studies were made by examining the algal specimens under Olympus microscope (Model-CH20i) for description of these species. The algal samples were preserved in 4% formalin. Identification of these taxa accomplished with the help of authentic literatures (Printz, 1964; Starmach, 1972; Delwiche *et al.*, 2002; Bicudo and Bicudo, 2014). The pH and temperature of the waters were measured at the sites immediately after collections with the help of portable pH meter (Model No. PP9046 Philips, India) and Zeal's mercury thermometers (UK). The other limnological parameters such as dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrate-nitrogen (NO₃-N), phosphate (PO₄³⁻), total alkalinity and sulphate (SO₄²⁻) of

waters were estimated by UV-VIS Spectrophotometry (CECIL CE- 7200) following the standard method (APHA, 2005). All the physico-chemical parameters in ecological notes are expressed in mg/l except pH and temperature.

Results and Discussion

A total number of two algal species namely *Coleochaete irregularis* Pringsheim and *Coleochaete orbicularis* Pringsheim under the genus *Coleochaete* Bréb. of the family Coleochaetaceae belonging to the order Chaetophorales of the class Chlorophyceae were recorded for the first time from Hooghly district in West Bengal, India. Each currently accepted name has been provided with its author (s) name. They were described below:

Key to the species

1a. Filaments not radiating from a common centre of disc-shaped thallus-----

Coleochaete irregularis

1b. Filaments radiating from a common centre of disc-shaped thallus and adjoined laterally-----

C. orbicularis

Morpho-taxonomic description

Order: Chaetophorales

Family: Coleochaetaceae

Genus: *Coleochaete* Brébisson

1. *Coleochaete irregularis* Pringsheim in Jahrb. Wiss. Bot. 2: 35, pl.1, fig. 6, pl. 6, figs. 3-9, 1860

Printz in Hydrobiol. 24: 358, pl. 112, fig. 2, 1964 (PL.1, Figs.1A-B)

Sarmach, Flora Slodkowodna Polski. Chlorophyta III. 534, fig. 546, 1972

Delwiche, Karol, Cimino and Sytsma in J. Phycol. 38: 396, fig.2.F, 2002

Description: Thallus epiphytic and attached to the substrate rigidly; mucilaginous, light green with irregularly branched filaments; roughly circular in appearance and margin usually irregular; prostrate and erect systems not differentiated; thallus up to 0.5 mm diameter; vegetative filaments branched with irregular sizes and not radiating from common centre; they are loosely arranged and pseudo-parenchymatous; branching typically occurs in 2nd sub-apical cell and gives rise to a filaments growing at right angles to the parent filament; crowding among the filaments forces the thallus into a roughly circular outline; a distinct layer of mucilage is found around the filaments but this is often inconspicuous; cells rectangular to polygonal; 10.0 -16.5 μ m broad and 12.0-25.0 μ m long; apical cell of the filament with rounded tip; setae are inserted laterally, arising from one side of the vegetative cell; chloroplast single, parietal with one to two pyrenoids; cells contain distinctive granules perhaps of lipid droplets; antheridia are flask-shaped; oogonia spherical and form at the terminal cell of filament; spermocarp globes, corticated; 50.0-58.0 μ m in diameter; oospore brown; zoospores on germination give rise to young filaments of several cells.

Habitat: Swampy land at Behula, Hooghly, West Bengal.

Collection No: Vaucher specimen No. NH 318; **Dated:** 01.12.2006

2. *Coleochaete orbicularis* Pringsheim in Jahrb. Wiss. Bot. 2: 35, pl. 1, fig. 5, pl. 3, figs. 6-7, pl. 6, figs. 1-2, 1860 (PL.1, Fig.1C)

Delwiche, Karol, Cimino and Sytsma in J. Phycol. 38: 396, fig.2.A, 2002

Bicudo and Bicudo in Hoehnea 41(3): 420, figs. 28-30, 2014

Description: Thallus epiphytic, microscopic, monoecious, mucilaginous, discoid in shape and pseudo-parenchymatous; up to 1mm in diameter; prostrate system well developed; filaments radiating from a common centre, compactly adjoined laterally; cells box-like or rectangular; 5.5-14.0 μ m broad and 9.4-35.0 μ m long; thin walled; setae rare; chloroplast single dorsal or parietal, typically with a pyrenoid; antheridia quadrangular or spherical; two to four chambered; proximal of oogonia; oogonia ovoid; spermocarp globose, 35.0-58.0 μ m in diameter and outer surface corticated; oospore bright yellow; zygote divides meiotically and resulted formation of 8-16 (32) zoospores which on germination produce vegetative thalli.

Habitat: Marshy land at Madhusudanpur, Hooghly.

Collection No: Vaucher specimen No. NH 349; **Dated:** 10.12.2006

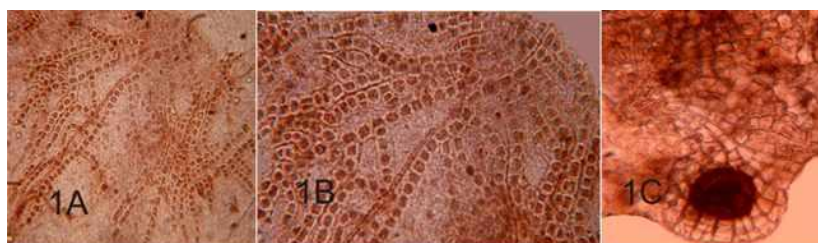


Plate 1. Figs. 1A-C: 1A, *Coleochaete irregularis* Pringsheim thallus; 1B, Magnified image of *C. irregularis* filaments 1C, *C. orbicularis* Pringsheim

The limnological parameters of the studied aquatic ecosystems of two sites were measured and given in **Table 1**. The pH of water was found to be alkaline. It was also observed that different limnological parameters favoured the growth of these algal species in the aquatic ecosystems and the water parameters were found within the permissible limits mentioned by WHO (2011). It was also noticed that DO values were quite higher (DO: 9.4-10.2) in the studied ecosystems which is a good indication of unpolluted water.

Table 1: Physico-chemical characteristics of waters in two study sites during collections of algal specimens (Mean \pm SE)

Name of algal species	Collection sites	Limnological parameters								
		Temp. (°C)	pH	DO (mg/l)	BOD (mg/l)	COD (mg/l)	NO ₃ -N(mg/l)	PO ₄ ³⁻ (mg/l)	Total alkalinity (mg/l)	SO ₄ ²⁻ (mg/l)
<i>Coleochaete irregularis</i>	Behula	20°C \pm 0.04	7.2 \pm 0.05	9.4 \pm 0.1	3.8 \pm 0.2	100.0 \pm 0.5	0.12 \pm 0.1	0.20 \pm 0.1	146.0 \pm 0.2	6.8 \pm 0.2
<i>Coleochaete orbicularis</i>	Madhusudanpur	20°C \pm 0.05	7.0 \pm 0.04	10.2 \pm 0.1	3.4 \pm 0.1	90.0 \pm 0.4	0.10 \pm 0.1	0.18 \pm 0.2	138.0 \pm 0.2	6.2 \pm 0.1

Morpho-taxonomic studies give recognition of a particular species among the living entities and one can be distinguished easily from other species. All the above said species showed very complex thallus organization. This study had given taxonomic and ecological information of those two species of *Coleochaete* Bréb. from West Bengal.

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