

Abundance of Family Rivulariaceae of Cyanobacteria from Rice Fields of North Odisha, India

Harisankar Dey* and A. K. Bastia

Department of Botany, North Orissa University, Baripada-757003, Odisha, India. *E-mail:- harisankardey@gmail.com;

Contact No. +91-9853437475

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Abstract

The rice fields are agronomically managed wet land ecosystem, well known for the rich diversity of cyanobacteria. Rivulariaceae, a group of heterocystous, unbranched or false branched filamentous cyanobacteria rarely found in the rice fields' soil ecologies of Odisha. In the present investigation, a taxonomical survey of the family Rivulariaceae was carried out in the rice fields of North Odisha, India. Altogether 10 taxa belonging to 3 genera were encountered. The genus *Calothrix* was the most dominant cyanobacteria belongs to the family Rivulariaceae with 5 species i.e. *Calothrix braunii*, *Calothrix clavatoidea*, *Calothrix gardneri*, *Calothrix javanica* and *Calothrix marchica*. *Gloeotrichia* was the second dominant genera with 4 species i.e. *Gloeotrichia ghosei*, *Gloeotrichia indica*, *Gloeotrichia longicauda* and *Gloeotrichia raciborskii*. The genus *Rivularia* was represented only one species in our study

Introduction

Cyanobacteria are a diverse group of Gram-negative photosynthetic prokaryotes that are distributed in all possible biotopes of the world and have played a significant role in Earth history as primary producers and the ultimate source of atmospheric oxygen. The rice fields are agronomically managed wet land ecosystem, well known for the rich diversity of cyanobacteria. Rivulariaceae, a group of heterocystous, unbranched or false branched filamentous cyanobacteria rarely found in the rice fields' soil ecologies of Odisha.

The distribution of Rivulariaceae and their role in maintaining soil fertility has variously been studied throughout the World (Sahu *et al.*, 1996; Tiwari *et al.*, 2000; Singh *et al.*, 2001; Nayak *et al.*, 2001; Kaushik and Prasanna, 2002; Mishra and Pabbi, 2004; Choudhury and Kennedy, 2005; Song *et al.*, 2005; Rai, 2006; Nayak and Prasanna, 2007; Digambar Rao *et al.*, 2008; Begum *et al.*, 2008; Saadatnia and Riahi, 2009; Prasanna *et al.*, 2009). Unfortunately so far, no work has been done on distribution of family Rivulariaceae in the rice-fields' soil of this part of the state. The present study aims to enumerate the abundance of family Rivulariaceae in rice fields' soil of north Odisha, which is a typical and undisturbed habitat of the state.

Materials and Methods

The study was conducted in the rice fields of North Odisha, specially in Mayurbhanj district situated between 21°16' – 23°34' North latitude and 85°40' – 87°91' East longitude (Plate-1) during 2009 to 2011. The total rice cultivable area in the district is about 3,29,261 hectare which is divided into three agricultural divisions namely Baripada (Locality-1), Rairangpur (Locality-2) and Karanjia (Locality-3) division.

The samplings were done randomly from both soil and water of the paddy fields. Samples were collected, assigned with collection numbers/date for field record and immediately brought to the laboratory. Temporary slides were prepared for each sample for identification. The samples were identified, based on their morphological features and cell structure, following the monographs of Desikachary (1959), Anand (1989) and Komarek & Anagnostidis (1989) etc. The collected samples were maintained in laboratory by culturing in freshly prepared BG₁₁-N medium (Rippka *et al.*, 1979) and incubated at 28±2°C with illumination at 25-30 μmol photon m⁻²s⁻¹ white continuous light and aeration.



Plate 1 Map showing the study localities of Mayurbhanj district (North Odisha)

Results and Discussion

In this study altogether 10 taxa belonging to 3 genera were documented (Plate-2) as follows.

Systematic Enumeration

1. ***Calothrix braunii* (A. Br.) Born. et Flah.**

Desikachary, 1959, p.541, Pl.114, Fig.3
Thallus blue green; filaments curved, 6-9 μm broad; sheath thin and colourless; trichome 6-7 μm broad, ending in a long hair, constricted at the cross-walls; cells 4.8-6.6 μm long and 3.0-3.8 μm broad; heterocysts basal (Pl.2, Fig.2).

2. ***Calothrix clavatoides* Ghose**

Desikachary, 1959, p.539, Pl.113, Fig.9
Trichome single or in groups, straight and 12-13 μm broad; sheath narrow, thin and colourless; cells at the base discoid, 10-11 μm thick, in the middle 2-3 times as long as broad, 3-4 μm in diameter; heterocysts basal, single and globose.

3. ***Calothrix gardneri* J. De Toni**

Desikachary, 1959, p.547, Pl.115, Fig.5
Filaments erect, swollen at the base and attenuated at the apex; sheath 2 μm thick and colourless; trichome cylindrical 5-6 μm broad,

ending in a short hair, cells quadrate to half as long as broad; heterocysts basal.

4. ***Calothrix javanica* De Wilde.**

Desikachary, 1959, p.518, Pl.106, Fig.1, 2, 5, 6, 7

Filaments single, gradually attenuated to pointed apex; trichomes 4.2-4.5 μm broad and blackish green; cells 2.8-4.8 μm long and 4.2-4.5 μm broad; spores two together, about 6.5-7.2 μm broad and 9-11 μm long; heterocysts basal, 5.2-5.8 μm long and 4.5-4.8 μm broad (Pl.2, Fig.4).

5. ***Calothrix marchica* Lemm.**

Desikachary, 1959, p.539, Pl.113, Fig.1- 4

Filaments brownish, slight bent, single, 8-9 μm broad at base with thin colourless sheath; trichome brownish green, constricted at the cross-walls; cells 6.0-6.8 μm long and 8.6-10.2 μm broad; heterocysts single, basal and spherical, 10-12 μm diameter (Pl.2, Fig.1, 3).

6. ***Rivularia* sp. (Roth) Ag.**

Desikachary, 1959
Trichomes unbranched, irregularly false branched; filaments in a hemispherical or spherical mucilaginous colony; trichome

ending in a hair; heterocysts basal or intercalary.

7. *Gloeotrichia ghosei* Singh, R.N.

Desikachary, 1959, p.559, Pl.118, Fig.1-3
Thallus spherical, yellowish brown; filaments with a thin stratified and brown sheath; trichome constricted at the cross walls; heterocysts terminal, 8.0-8.5 μm long and 5.3-5.6 μm broad; cells at the base barrel shaped and much shorter than broad; spore ellipsoidal with a hyaline smooth outer wall (Pl.2, Fig.8).

8. *Gloeotrichia indica* Schmidle

Desikachary, 1959, p.536, Pl.112, Fig.5, 6
Thallus soft, dark brown, filaments 200-250 μm long; cells barrel shaped and about 7-9 μm broad; spores nearly 50-65 μm long, with

sheath 18-23 μm broad; heterocysts terminal, spherical 10-11 μm diameter (Pl.2, Fig.7).

9. *Gloeotrichia longicauda* Schmidle

Desikachary, 1959, p.557, Pl.117, Fig.1, 7, 8
Thallus hemispherical, filaments about 1mm long, 25-26 μm broad, sheath diffluent, colourless; trichome gradually attenuated, 6-7 μm broad; many heterocysts of varying diameter.

10. *Gloeotrichia raciborskii* Woloszynska

Desikachary, 1959, p.559, Pl.118, Fig.4, 5, 6, 14
Thallus dark green, spherical; trichome 7-8 μm broad, ending in a long hair, dull brown; cells 7.8-11.5 μm long and 6.8-8.0 μm broad; heterocysts spherical, 11-13 μm diameter (Pl.2, Fig.5, 6).

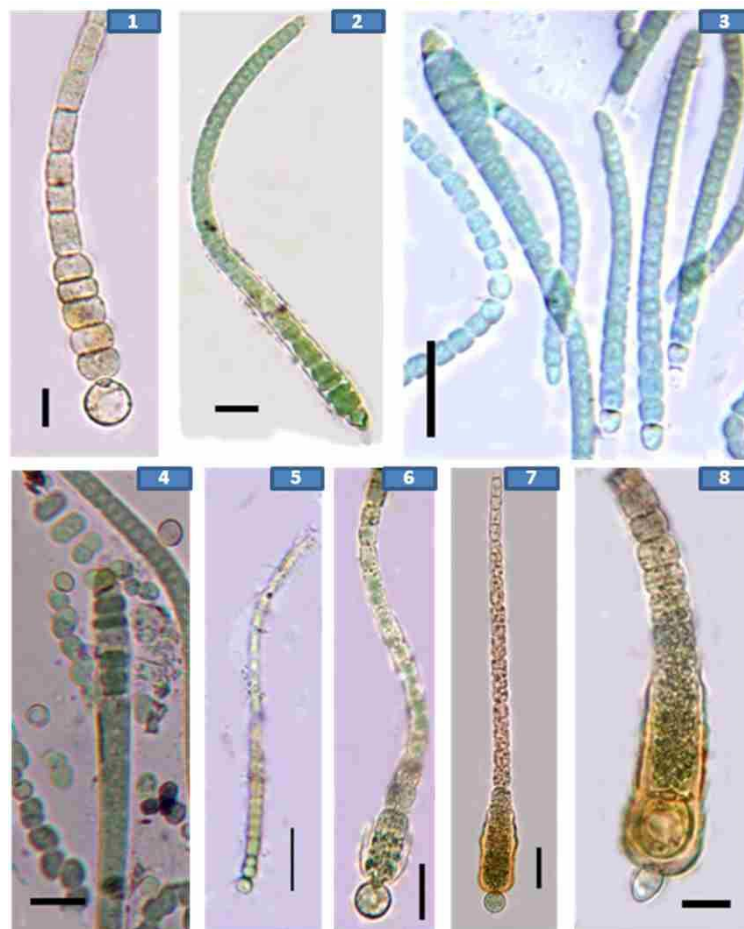


Plate 2 showing some selected Rivulariacean taxa of North Odisha.

1 & 3-*Calothrix marchica*, 2- *Calothrix braunii*, 4- *Calothrix javanica*, 5 & 6-*Gloeotrichia raciborskii*, 7- *Gloeotrichia indica*, 8- *Gloeotrichia ghosei*; Scale Bar:- 1, 2, 4, 8 = 10 μm , 3, 6, 7 = 20 μm & 5 = 40 μm

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