



# Biodiversity of *Schizothrix* (Kurtz.) in rice field soils of Chhattisgarh State.

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**Abstract:** For environmentally safe agro-ecosystem in rice cultivation, algalization helps to reducing cost and energy inputs. Chhattisgarh which is popularly known as “rice bowl of India”, so for local algalization programme the biodiversity of unexplored cyanobacteria has been a subject of attention. The present study deals with the investigation of the genus *Schizothrix* in the rice field Chhattisgarh. 9 species of *Schizohrix* had been isolated.

**Key words:** Algalization, rice field soil, biodiversity, *Schizothrix*.

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## Introduction

The largest oxygen donor cyanobacteria are gram negative prokaryotic organisms. They are also nitrogen fixing potential of diazotrophic microorganism, which is of great significance for enriching of nitrogen level in soil. Cyanobacteria exhibit a great morphological diversity and their broad spectrum of physiological properties reflects their widespread distribution and tolerance to environmental stress (Tandeau de Marsac and Howard, 1993). Zhang (2010) and Halder (2015) observed some problem for the cyanobacterial distribution and its peculiarity to proper identification.

## MATERIALS AND METHODS

**a. Collection of soil samples:** 192 soil samples were collected from major rice growing and non-rice growing places of different districts of Chhattisgarh state. During the collection, prominently visible growths of cyanobacteria were collected in plastic and polythene containers for direct observation with the help of microscope. In the beginning the they were culture in Chu No 10 culture media has been used.

**b. Physico-chemical analysis of soil:** A number of physico-chemical properties such as pH and electrical conductivity were analyzed from different study sites.

- a. **Determination of pH:** For measuring soil pH 10 gram of rice field soil was dissolved in 25 ml of distilled water. Suspension was shaken for 30 minutes, pH meter was calibrated by using buffer solutions of pH 4.0 and 7.0. The electrode was dipped in soil-water suspension. The reading was measured in triplicate.
- b. **Determination of Electrical Conductivity:** The electrical conductivity have been calculate by using the procedure 1:2 soil water soil water- suspension was prepared by dissolving 10 gram of soil in 20 ml distilled water. Suspension was shaken for 30 minutes. The conductivity cell was dipped in soil water suspension. The galvanometer of conductivity meter was balanced and the conductance of soil solution was measured
- c. **Culture preparation/ Isolation:** Moist cultures of cyanobacteria were prepared by taken 1gram rice field's soil and moistened with Chu-10 media (Gerloff et al. 1950) amended with 1ml Fogg's micronutrients a solution (Fogg, 1949) in previously sterilized conical flask. In about a fortnight after incubation, the visible growth of cyanobacterial stains appears in the culture. The enrichment flasks were regularly monitored for growth and observed microscopically. One of the replicates was disturbed for microscopic examination while others were left undisturbed for further observation. Standard plating / streaking techniques were used for isolation and purification of cyanobacterial strains (Stanier et al.2014)
- d. **Identification of cyanobacteria:** The growth pattern and morphological examination of the cyanobacterial strains was carried out at different stages of growth in nitrogen-free liquid and solid (agar) Chu-10 medium. Morphological observation of cyanobacteria: [filament texture, shape and size of the vegetative cells] in the axenic cultures were studied by using an Olympus microscope as described by Prescott (1950), Desikachary (1959) and Anand (1989). Cyanobacterial images were study at 100X magnification.

## Results:

*Schizothrix* Kurtz. Trichome generally many, seldom single, in large soft to firm thallus, enclosed in a thin or thick sheath, often each trichome with its each sheath. Sheath colourless to yellow brown, red or seldom violet or blue in colour, its end often pointed, filament densely packed, forming a leathery stratum, occasionally only a trichome and sparsely branched, forming a tuft like growth or indirect bundles which are more or less branched, thallus attached, seldom free swimming.

**Nine species of *Schizothrix* Kurtz** were recorded from rice fields of Chhattisgarh. These are:

1. *S. aerinaria* (Berk.) Gomont- Thallus thin, not incrustated with calcium filament densely grouped, with branching at the tip, branches much contorted, sheath firms, at the end pointed, outside even, in the lower portions thick and lamellate, coloured violet by chlor-zinc-iodide, with a few trichome, trichome constricted at the cross walls or unconstricted, 1.5-3u broad, cells up to 5u long, end cell pointed and conical.
2. *S. bacularii* Gomont: Filament blue-green, long, intricate, tortuous, unbranched, more entangled, sheath colourless, cylindrical, coloured blue with chlor-zinc iodide, n the basal part many trichome in each sheath and often congested, in the upper part in each sheath, constricted at the cross walls, 6-7u broad, cells 2-6u long, end cell rounded.
3. *S. fragilis* (Kutz.) Gomont- Thallus up to 1mm high, filzing, olive green or blue-green, filaments more or less bent, parallel forming short, erect bundles or tufts, sheath more or less gelatinizing, colourless, uneven on the outside, coloured violet by chlor-zinc-iodide, with many trichome in each sheath, trichome constricted at the cross walls, 1.4-2.5u broad, cell nearly quadrate or somewhat shorter than broad, 1-2u long.
4. *S. friesii* (Ag.) Gomont- Thallus blackish or greenish steel blue, filaments in lower part contorted, above rarely straight, parallel, fascicles rigid, erect, sheath colourless and lamellated, acuminate at the ends, coloured violet by chlor-zinc-iodide, with few trichomes or single trichome, trichome distinctly constricted at the cross walls, 3-6u broad, cell nearly quadratic or up to 2 times longer as long as broad, cells 4-11u long, blue-green end cell obtuse conical.

5. *S. friesii f. repens* Fremy- Stratum expanded, blackish, filaments united in fascicles which are not erect, but creeping, trichome as in type.

6. *S. fuscescens* Kutzing ex Gomont: Filament yellowish blue-green, richly branched, branched closely appressed outside, sheath lamellated ,inside yellowish brown and colourless outside, at the end long pointed, outside mostly uneven, coloured violet by chlor-zinc-iodide, mostly only with two trichome, trichome constricted at the cross walls, 2-3u broad, cells 8-13u long, end cell rounded.

7. *S. penicillata* (Kutz.) Gomont- Thallus soft, in penicillate tufts, dark green, ascending, filament unbranched or sparsely branched, sheath colourless and not lamellated, in the basal part thick or uneven with two or more trichomes, above thin and mostly with single trichome, not coloured violet by chlor-zinc-iodide, trichome not distinctly constricted at the cross walls, 2.7-5u broad, cell a little shorter to twice as long as broad, 2-9u long, end cell obtuse conical.

8. *S. pulvinata* (Kutz.) Gomont – Thallus cushion shaped or crustaceous, outside warted, inside zonated, prominently incrustated with calcium and more or less hardened, blue-green in colour, filament arranged parallel, more or less straight, closely arranged , sparsely branched with adpressed branches, sheath colourless, pointed at the end, coloured violet by chlor-zinc-iodide, with many trichome in each sheath, trichome constricted at the cross walls, 1-2u broad, cell quadrate or up to 2 times longer than broad, end cell rounded.

9. *S. tenuis* Woronich- Filaments up to 3m long and forming 30-50u bundles, contorted, 2-4u broad, trichomes 0.8-1.5u broad, trichome not constricted at the cross walls, cell cylindrical, and sheath coloured violet by chlor-zinc-iodide.

Table-1. Distribution pattern of Schizothrix in relation to physicochemical properties

S. No	Name of schizothrix species	Soil Type	Soil pH	EC value	Dominant soil type	Name of the area from where they occurred	No. Of fields
1	<i>S. aerinaria</i>	Dorsa,Kacc har, Kanhar, Matasi	5.9-8.17	Wide 0.138-1.036	Matasi	Aarang, Bagbahra, Bilaigarh,Mainpur Bindranavadarh, Fingeshwar,Simga Kasdol, Saraipali	15
2.	<i>S. bacularii</i>	kanhar	8	Below 1m 0.902		Mainpur, Simga	1
3.	<i>S. fragilis</i>	Dorsa, Kanhar, Matasi	5.8-8.1	Below 1m 0.194-1.400	Matasi	Dharsiwa, Kasdol, Magarload, Simga, Mainpur, Saraipali, Tilda	10
4.	<i>S. friesii</i>	Dorsa,Kacc har, Kanhar, Matasi	5.1-7.9	Wide 0.050-1.100		Basna, Deobhog, Tilda, Fingeshwar, Magarload, Balodabazar, Bhatapara, Bilaigarh	06
5.	<i>S. friesii f. repens</i>	Dorsa,Kacc har, Kanhar, Matasi	5.1-7.9	Wide 0.080-0.888		Arang, Kasdol, Mainpur, Bagbahra, Bilaigarh, Sihawa-nagari,Bindranavadarh, Tilda	16
6.	<i>S. fuscescens</i>	Dorsa	6.7	Low 0.380		Bagbahra, Balodabazar Deobhog,	1

						Fingeshwar, Kasdol	
7.	<i>S. penicillata</i>	Dorsa,Kacc har, Kanhar	6.0-8.2	Wide 0.220-1.236		Kurud, Mainpur	02
8.	<i>S. pulvinata</i>	Dorsa,Kacc har, Kanhar, Matasi	5.9-8.2	Wide 0.206-1.236		Davbhog, Mainpur, Tilda	03
9.	<i>S. tenuis</i>	Dorsa,Kacc har, Kanhar, Matasi	5.0-7.9	Wide 0.060-0.896	Dorsa,Kacc har, Kanhar, Matasi	Arang, Basana, Bagbahra, Kasdol Balodabazar, Kurud Bhatapara,Palari Mahasamund, Tilda Magarload,Pithora Bilaigarh, Davbhog, Dhamtari,Dharsiwa, Saraipali,Sihawa-nagari, Simga	42

## DISCUSSION:

The abundance of cyanobacteria in rice fields was first observed by Fritsch, 1907. Exorbitant use of agrochemicals to increase soil fertility and crop productivity are reported to substantially reduce or eliminate cyanobacterial flora from rice fields (Stewart et al., 1972; Susheela and Goyal, 1995, Sharma and Naik 1996 and 1998, Halder, 2015, 2016 and 2017, Sharma and Jain, 2016, Sharma et al. 2017, Sharma, 2018 and 2019). *Oscillatoria* Vaucher, *Phormidium* Kuetzing, *Spirulina* Turpin em. Gardner, *Lyngbya* Agardh and *Schizothrix* Kuetzing forms were more sensitive due to environmental changes i.e., temperature, nutrients, pH level and water level (Halder, 2017).

**Conclusion:** The present study shows that in the Chhattisgarh region *Schizothrix tenuis* was the most frequent species of the genus. This genus was more common in Mainpur area from where 5 species were recorded (Table-1) in soil pH range 5.0-6.7. No such extensive study for genus *Schizothrix* has been carried out yet.

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