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Biodiversity of unicellular cyanobacteria from some rice field soils of Satara District (MS)

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ABSTRACT

Blue Green Algae which are also called as cyanobacteria are one of the most important nitrogen fixing photoautotrophs present on the earth since 3.5 billion years. They are known to be found in almost all photic habitats including water bodies, glaciers as well as all terrestrial ecosystems. Paddy fields represent one such habitat. Because of their autotrophic and diazotrophic nature they flourish in rice fields and known to sustain the fertility of this ecosystem. They vary in their morphology. Some of them are unicellular while some are multicellular filamentous. An attempt has been made to document unicellular cyanobacteria from rice fields of Satara district in Maharashtra State. As many as 18 species of unicellular cyanobacteria were recorded from the study area. Order Chroococcales has been reported by nine of genera and 18 species. The genera *Aphanocapsa, Aphanothece* and *Gloeocapsa* were frequently reported.

Keywords: Biodiversity, Chroococcales, Cyanobacteria, Rice fields, Unicellular.

INTRODUCTION

The Blue Green Algae are unicellular or filamentous that sometimes form structures recognizable with naked eye, but usually requires a microscope for identification, they differ from other groups in this flora in that they are prokaryotes.

Their cell contents are not differentiated in to membrane bound structures such as the nucleus, chloroplast, and mitochondria. The popular name for the group Blue Green Algae comes from the color of the cells seen under the microscope. The pigments in their cells like chlorophyll-a, phycocyanin, phycoerythrin express their colour (Kondo and Yasuda 2003). This is because many species have a sheath around individual cells or the whole filament and this sheath is often golden or dark brown, though sometimes a shade of red. The capacity of several cyanobacteria to fix the atmospheric nitrogen is a significant biological process of economic importance (Anand 1989). These

prokaryotic organisms are capable of fixing nitrogen. Cyanobacteria play an important role in maintenance and build-up of soil fertility (Board 2004), consequently increasing rice growth and act as a natural biofertilizer (Song *et al.*2005).

The paddy field ecosystem provides a favorable environment for the growth of cyanobacteria with respect to their requirements for light, water, high temperature and nutrient availability. This could be the reason for more abundant cyanobacteria growth in paddy soils than in uplands soils (Konda and Yasuda 2003, Roger and Reynaud1982). Information on the diversity of blue greens is essential to understand the algal dynamics and interaction with other microorganisms. Studies on Cyanobacteria have gained much importance especially after the recognition of their role in the natural environment and their ability to provide an alternate source of energy (Uheda 1980).
The aim of the present work is to identify the cyanobacteria enriched in the paddy fields of chosen area. Obsererervations revealed that most of them were from the orders Nostocales, Chroococcales and Stigonematals (Fritsch 1907 a, b).

Rice is one of the food as well as cash crops of the Indian subcontinent. The rice sharing the 11 percent cropped land of the Satara District. Out of the total rice crop area maximum area under rice cultivation is in Patan tahasil which occupies the 33 percent and Phaltan occupies the lowest area of the cropping area of the rice of the district (Khot 2016).

MATERIALS AND METHODS:

Study Area

Satara district lies between 16° 15' and 18° 10' North latitude and 73° 45' and 75° 0' East longitude. It occupies an area of 4792 square miles. Annual average temperature is 25°-28°C with average annual rainfall 1237-1284mm. Rice fields from ten sites were chosen for survey of unicellular cyanobacterial flora viz., Bamnoli, Yewateshwar, Kas, Petri, Ambeghar, Shirsinge, Falani, Pateghar, Thoseghar and Parali.

Collection and Storage of Soil Samples:

Soil samples were collected from the ten different sites within the Satara district. Samples were collected by removing the surface debris from randomly selected spots and scrapping about 20 gm of soil from upper 1 cm soil layers. After thorough mixing, these were air-dried (25-35^0 C; relative humidity 30-60%), sieved and 200 gm of sample, representing each spot were stored in poly bags for further observation. The soil samples from different parts of the paddy fields were also collected by lifting the soil-algal biomass floating in and on water during crop season. Algae growing on soil surface were also carefully scrapped with a scalpel, from an area of few cm^2 in each sampling. The samples were preserved in 4% Formaldehyde and Lugol's iodine solution. All the samples were deposited in laboratory. Algal samples were then examined immediately using binocular research microscope whenever possible. Identification was done by using keys and monographs (Desikachary1959 and Anand 1989). Microphotographs were taken using webcam companion unit.

Frequency distribution of different genera in the study area was calculated by using formula:

$$Y/X \times 100$$

Where X= Total number of samples collected
Y= Number of samples in which species was present.

RESULTS AND DISCUSSIONS:

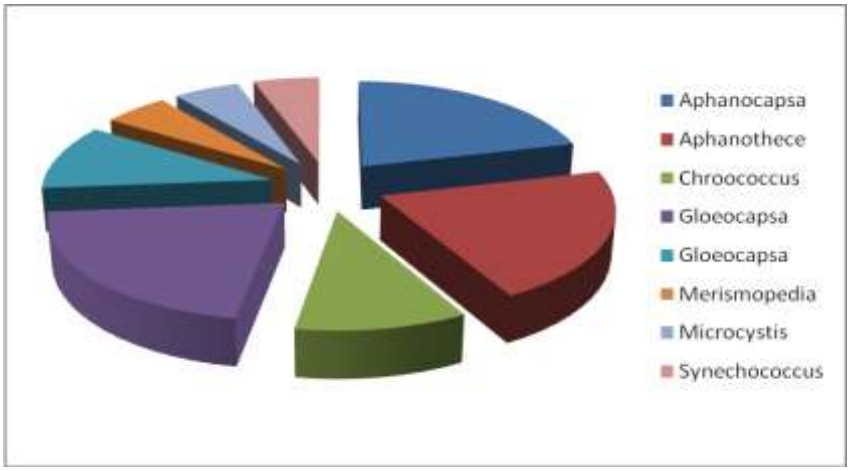
Satara district is one of the important rice producing district from western Maharashtra. Rice fields serves as a natural habitat for different types of cyanobacteria. An extensive study made to find out the diversity and occurrence of unicellular cyanobacterial population in different study sites of Satara district. Total of 18 species of unicellular cyanobacteria belonging family Chroococcaceae of order Chroococcales were recorded from different localities within study area as shown in Table 1.

As per the percentage frequency of cyanobacteria, the members of genus *Aphanothece, Aphanocapsa* and *Gleocapsa* were most abundant forms (Desikachary 1959). Our observations are similar to the reports of Srinivas and Aruna (2016).

Table I: List of cyanobacterial taxa recorded from study area

Sr. No.	Name of Cyanobacterium	Locality	No. of times encounter	Frequency %
1	*Aphanocapsa roeseana* de Bary	Ambeghar, Pateghar, Thoseghar	20	40
2	*Aphanocapsa biformis* A. Br.	Parali, Thoseghar	05	10
3	*Aphanocapsa roeseana* de Bary	Ambeghar,Pateghar, Thoseghar	15	30
4	*Aphanocapsa pulchra* (Kutz.) Rabenh	Ambeghar, Bamnoli, Falani,Yewateshwar	11	22
5	*Aphanothece saxicola* Nag.	Bamnoli, Parali, Shirsinge, Yewateshwar	30	60
6	*Aphanothece microscopia* Nag.	Bamnoli, Kas, Petri, Yewateshwar	15	30
7	*Aphanothece pallida* (Kutz.) Rbenh.	Shirsinge, Yewateshwar	14	28
8	*Aphanothece naegeli* Wartm.	Falani, Shirsinge	06	12
9	*Chroococcus minutus* (Kutz.)Nag.	Bamnoli, Kas, Petri	11	22
10	*Chroococcus pallidus* Nag.	Ambeghar, Falani, Pateghar, Thoseghar, Yewateshwar	16	32
11	*Gloeocapsa rupestris* Kutz.	Ambeghar, Bamnoli, Yewateshwar	08	16
12	*Gloeocapsa atrata* (Turp.) Kutz.	Bamnoli, Kas	02	04
13	*Gloeocapsa gelatinosa* Kutz.	Falani, Parali, Thoseghar	12	24
14	*Gloeocapsa polydermatica* Kutz.	Pateghar, Shirsinge	10	20
15	*Gloethece membracea* (Rbehn.) Bornet.	Parali, Kas	07	14
16	*Merismopedia glauca* (Ehrneb.) Nag	Ambeghar, Falani, Parali, Petri, Pateghar, Thoseghar	09	18
17	*Microcystis aeruginosa* Kutz	Bamnoli	03	06
18	*Synechococcus aeruginosus* Nag.	Bamnoli, Kas, Pateghar, Thoseghar	05	10

Diversity at genera level:



CONCLUSION:

From the present study, it could be concluded that rice field soil harbors the impressive cyanobacterial diversity in different sites within study area. Further studies are necessary for culturing and biochemical characterization of these species.

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