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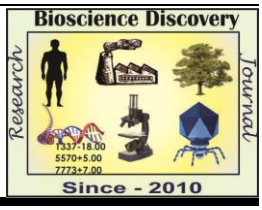

Diversity of cyanobacteria in the cultivated fields of Ahmednagar districts (M.S.) India

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Abstract

Cyanobacteria is an important group of soil. Ecologically they are significant and plays a crucial role in fertility of soil. Cyanobacteria fixes atmospheric nitrogen and increases fertility of soil. Majority of the species of cyanobacteria helps in retention of soil moisture and provides germination ground for seeds of flowering plants. The cultivated field ecosystem provides a favourable environment for the growth and development of cyanobacteria. In order to study diversity of cyanobacteria of cultivated fields, sugarcane and onion fields from Ahmednagar district of Maharashtra were selected. The work was carried out from October 2015 to September 2016. Cyanobacterial samples were collected at regular intervals froms moist soil surface of selected cultivated fields. A total of 29 species under 12 genera were identified and recorded. Maximum number of cyanobacterial forms were recorded from sugarcane field. Taxa of *Aphanothece, Oscillatoria, Phormidium, Microcoleus and Plectonema* were found dominant. *Aphanothece nidulants, Oscillatoria acuminata, Phormidium jenkelianum, Phormidium molle, Phormidium usterii, Lyngbya hieronysmusii, Microcoleus acutissimus, Microcoleus lacustris, and Microcoleus subtorulosus* were recorded in both the fields. Physicochemical analysis of soil of selected cultivated fields was also performed by selecting certain physicochemical parameters such as pH, electrical conductivity, organic carbon, available nitrogen, available phosphorus and available potassium. A positive correlation among composition of cyanobacterial flora and physicochemical analysis of soil were observed.

INTRODUCTION

Cyanobacteria is a large and diverse group of plant kingdom, resembling gram negative bacteria in cellular organization and green plants in oxygenic photosynthesis. They occupy a variety of terrestrial habitats including soil, rocks, walls and caves. Soil habitats are the most important ecosystems for cyanobacteria. Soil cyanobacteria performs important functions for agro-ecosystems. They contribute in soil formation and stabilization of mature soil (Metting, 1981). They promote the aggregation of soil particles and enhance water retention capacity of soil through the production of extracellular polysaccharide. The most important effect of cyanobacteria in soil on agriculture is the input of carbon and nitrogen (Shields and Durrell, 1964). Cyanobacteria fixes atmospheric nitrogen and increase fertility of soil (Singh, 1961; Santra 1993; Goyal, 1997). The agronomic potential of cyanobacteria was recognized in 1938 by De, who attributed the natural fertility of tropical rice fields to nitrogen fixing cyanobacteria.

The cultivated field ecosystem provides a favourable environment for the growth of cyanobacteria with respect to their requirements of light, water, temperature and nutrient availability. In india, diversity and distribution of cyanobacteria in different crop fields have been studied by Bongale and Bharati (1980), Prasad and Mehrotra (1980), Sirdeshpande and Goyal (1981), Chatterjee and Chatterjee (1983), Chaporkar and Gangawane (1984), Kolte and Goyal (1985), Patil and Chaugule (2004), Auti and Pingle (2007), Jadhav (2010), and Jadhav and Nimbhore (2015). Present paper deals with the studies on diversity of cyanobacteria from soils of sugarcane *(Saccharum officinarum L.)* and onion (Allium cepa L.) fields in relation to physicochemical analysis of soil.

MATERIALS AND METHODS

In order to study the diversity of cyanobacteria from cultivated fields, sugarcane field located in Newasa thesil area and onion field located in Nagar thesil area have been selected. Cyanobacterial samples which are grown on moist soil surface of sugarcane and onion fields were collected at regular intervals from October 2015 to September 2016 and October 2015 to January 2016 respectively. These samples were collected in sterilized collection bottles. Collected samples were brought to the laboratory for observation and identification.

The sun dried soil samples collected from same sugarcane and onion fields were examined for their cyanobacterial components by petriplate culture method. 1gm of pulverized soil poured and spread uniformly into the petriplates containing agarized Bold's basal medium (Bold 1942). Liquid nutrient medium was poured into the plates at the time of keeping those for incubation and frequently supplemented with the same. The petriplates were incubated under tubelights having 1000 to 1500 lux capacity in the algal culture chamber. Petriplates were checked for the growth of algal colonies. After sufficient growth, colonies were picked up for identification.

Cyanobacterial samples were observed under research microscope and indentified with the help of standard literature. In order to know the fertility status of selected sugarcane and onion fields, physicochemical analysis of soil was performed by selecting certain physicochemical parameters such as pH, electrical conductivity, organic carbon, avilable nitrogen, avilable phosphorus and avilable potassium (Trivedi *et al.*, 1998).

RESULTS AND DISCUSSION

In order to study cyanobacterial diversity of cultivated soil, sugarcane and onion fields were selected from Ahmednagar district of Maharashtra. A total of 29 species under 12 genera were recorded during present study. 21 species under 9 genera of cyanobacteria from sugarcane field and 17 species under form 9 genera from onion field were identified and recorded (Table 1). Maximum number of cyanobacterial forms were recorded form sugarcane field. Bongale and Bharati (1980), Sirdeshpande and Goyal (1981), Chatterjee and Chatterjee (1983), Chaporkar and Gangawane (1984), Auti and Pingle (2007), Jadhav (2010), and Jadhav and Nimbhore (2015) extensively studied diversity and distribution of cyanobacteria form rice, wheat, sorghum, bajra, gram, sugarcane, cotton and fenugreek. During present study taxa of *Aphanothece, Oscillatoria, Phormidium, Microcoleus and Plectonema* were found dominant. Prasad (2005) observed dominance of *Chroococcus, Gloeothece, Phormidium, Oscillatoria and Nostoc* from wheat field of Nepal. Jadhav and Nimbhore (2015) reported dominance of *Aphanothece, Oscillatoria, Microcoleus, Phormidium, Plectonema, Chroococcus, Lyngbya and Myxosarcina* from Wheat and Fenugreek fields.

Aphanothece nidulans, Oscillatoria acuminata, Phormidium jenkelianum, Phormidium molle, Phormidium usterii, Lyngbya hieronysmusii, Microcoleus acutissimus, Microcoleus lacustris, Microcoleus subtorulosus, were recorded from both the fields. Heterocystous as well as non heterocystous cyanobacterial forms were recorded. Heterocystous forms such as *Cylindrospermum michailovskaense, Nostoc linckia* and *Nostoc muscorum* were recorded. Unicellular, Colonial and filamentous forms of cyanobacteria were recorded during present study. The overall fertility status of sugarcane and onion fields is moderate alkali with moderate electrical conductivity. Organic carbon was high in sugarcane field where as it is low in onion field. Available nitrogen was found very low in sugarcane field and low in onion field. Phosphorus was found high in sugarcane field where as it was very low in onion field. Potassium was low in sugarcane field and it was found very low in onion field (Table 2 and 3) Soil pH is the most important factor determining cyanobacterial flora composition.

Table 1: Cyanobacterial taxa recorded from Sugarcane and onion field.

Sr. No.	Name of Cyanobacteria	Sugarcane field	Onion field
1	*Gloeothece palea*	+	-
2	*Aphanothece nidulans*	+	+
3	*Aphanothece saxicola*	-	+
4	*Merismipedia tenuissima*	-	+
5	*Myxosasrcina burmensis*	-	+
6	*Spirulina major*	+	-
7	*Oscillatoria acuminata*	+	+
8	*Oscillatoria acuta*	+	-
9	*Oscillatoria animalis*	+	-
10	*Oscillatoria obscura*	+	-
11	*Oscillatoria princeps*	+	-
12	*Oscillatoria subbrevis*	-	+
13	*Oscillatoria quadripunctulata*	+	-
14	*Phormidium abronema*	-	+
15	*Phormidium corium*	+	-
16	*Phormidium jenkelianum*	+	+
17	*Phormidium molle*	+	+
18	*Phormidium usterii*	+	+
19	*Lyngbya hieronysmusii*	+	+
20	*Lyngbya major*	-	+
21	*Lyngbya martensina*	+	-
22	*Microcoleus acutissimus*	+	+
23	*Microcoleus lacustris*	+	+
24	*Microcoleus subtorulosus*	+	+
25	*Cylindrospermum michailouskaense*	-	+
26	*Nostoc linckia*	+	-
27	*Nostoc muscorum*	-	+
28	*Plectonema gracillimum*	+	-
29	*Plectonema nostocorum*	+	-

+ = Present, - = Absent

Table 2: Physicochemical analysis of Sugarcane field Soil

Sr. No.	Parameter	Observation	Fertility Status
1	pH	7.98	Moderate alkali
2	Electrical Conductivity (Mili mohs / Centimeter)	0.16	Moderate
3	Oragnic Carbon (%)	1.51	High
4	Avilable Nitrogen (Kg / hectare)	125.00	Very Low
5	Avilable Phosphorous (Kg / hectare)	57.66	High
6	Avilable Potassium (Kg / hectare)	47.04	Very Low

Table 3: Physicochemical analysis of onion field Soil.

Sr. No.	Parameter	Observation	Fertility Status
1	pH	8.15	Moderate alkali
2	Electrical Conductivity (Mili mohs / Centimeter)	0.38	Moderate
3	Oragnic Carbon (%)	0.39	Low
4	Avilable Nitrogen (Kg / hectare)	159.93	Low
5	Avilable Phosphorous (Kg / hectare)	10.97	Low
6	Avilable Potassium (Kg / hectare)	392	Very High

Under natural conditions cyanobacteria grow preferentially in environments that are neutral to alkaline. Moderate electrical conducitivity of soil favours the growth of cyanobacteria. In the present study, it is noticed that there is a significant positive correlation between organic carbon and abundance of cyanobacteria. High organic carbon in sugarcane field favours growth of cyanobacteria whereas it was low in onion field affected diversity of cyanobacteria. Soil rich in nitrogen phosphorus and potassium supports growth of cyanobacteria.

Hence it is concluded that, the cultivated field ecosystem provides a favourable environment for the growth and development of cyanobacteria. Maximum numbers of cyanobacterial forms were found in sugarcane field than onion field. Cyanobacterial flora of sugarcane is rich and it is found in diverse from. A Positive correlation among cyanobacterial flora and physicochemical parameters of soil was observed.

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