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Research Article

Cyanophycean Algal Flora From Arable Land Soils of Rahuri Tahasil District Ahmednagar (M.S.) India

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Abstract

Extensive survey of arable land soil of Rahuri tahasil was undertaken during 2016-17 for the exploration of Cyanophycean algal flora. 30 soil samples were collected randomly from different arable land soil of Rahuri tahasil. Physico-chemical parameter like pH, E.C., O.C., N, P and K were studied. It was found that pH of all soil ranges from 8.03 to 8.72, E.C.- 0.2 to 1.5 mmhos/cm, O.C.- 0.28 to 0.84 %, Nitrogen- 16 to 275 Kg/acre, Phosphorus 4.48 to 35.84 kg/acre and Potassium 168 to 884 kg/acre. The pH of soil form different Villages were almost alkaline. 46 species belonging to 21 different genera were identified from these soil samples with the help of monograph Cyanophyceae. Dominance of *Nostoc*, *Anabaena*, *Oscillatoria* were recorded during the investigation.

INTRODUCTION

Cyanobacteria (BGA) are autotrophic, prokaryotic microorganisms, which are capable of nitrogen fixation. It has ability to fix and convert atmospheric nitrogen into nitrate and nitrites, which are easily absorbed by the plant. Thus, enhance growth and productivity of the crop plant by providing usable nitrogen through soil and improve the fertility of soil (Subramanyam *et al.,* 1964; Sankaram, 1971; Venkataraman 1961 and 1981).

Since last four decade cyanophyceae have been drawing tremendous attention due to their mutually compatible functions, maintenance of soil status and addition of organic matter. Series of reports is available on the Cyanophycean algal flora from the Indian paddy fields (Ahmed and Kalita, 2002; Chatterjee & Chatterjee, 1983; Goyal *et al.*, 1984; Patil & Chaugule, 2004; Saikia & Boroloi, 1994; Pingle and Deshmukh, 2005; Tiwari, 1972). Cyanophycean algal flora from the soil and water from Ahmednagar district in Maharashtra state has been reported earlier by workers Pingle and Deshmukh, 2005; Abhang, 2009; Rode *et al.,* 2011; Shinde, 1995; Auti and Pingle, 2007; Abhang and Auti, 2013 and Abhang *et al.,* 2016. However studies on physico-chemical nature of soil and isolation of Cyanophycean algal flora from the arable land soil samples of Rahuri tahasil have not been attempted by any workers. Therefore present study was carried out to record cyanophycean algal flora from this region. Rahuri tahasil of Maharashtra state is located between 19^0 5' to 19^0 45' North latitude and 74^0 9' to 74^0 55' East longitudes. It is predominantly drought prone area with annual average rainfall 430 - 550 mm and maximum temperature around 44^0C in April and May and minimum 9^0 C in November-December.

MATERIALS AND METHODS

A total of 30 randomized soil samples were randomly collected (Somwanshi et. Al 1999.) From arable land soil. Each 100g soil Sample from upper layer was lifted. Thoroughly mixed soil samples dried, sieved and stored in polythene bags. 1 gm soil sample was used for culturing in BG-11 (Ripka, *et al.,* 1979) Pure culture was made by using serial dilution.

Cultures were incubated at 28± 20 ^{0}C temperature and 2500 Lux light intensity provided 19/8 hr L/D cycle. The B.G.A. forms appearing in the culture flasks were isolated and identified with the help of monograph by Desikachary (1959) and Anand N. (1989).

The relative abundance of Cyanophycean form was calculated by R.A.=Y/X ×100
X=Total nos. of soil sample
Y= Nos. of soil samples harboring the algae.

Methods used for soil analysis

Sr. No.	Parameter	Methods	References
01	Nitrogen	Alkaline permanganate method	Page *et al*., 1982; Subhiah & Asija, 1956
02	Phosphorous	Olson's Method	Olsen *et al*., 1954
03	Potassium	Flame photometer	Page (1982), Jackson,1973
04	Organic Carbon	Wet Oxidation (Walkley & Black)	Page *et al*., 1982, Jackson, 1973
05	pH	pH meter	Page *et al*., 1982
06	Electric conductivity	Conductivity	Page *et al*., 1982

Table No.1 Comparative account of soil parameter.

Ph			EC (mmhol/cm)			OC(%)			N (kg/ha.)			P (kg/ha.)			K (kg/ha.)		
Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
8	8.7	8.3	0.2	1.5	0.4	0.3	0.8	0.6	16	275	188	4.5	35.8	14.6	168	884	440

RESULTS AND DISCUSSION

In all 30 soil samples were collected from arable fields. The soil pH ranged from 8.03 to 8.97 and EC 0.20 to 1.50 mmhos/cm(Table:1). Altogether 46 Cyanophycean (Blue Green Algae) were encounter belonging to 21 genera from 03 orders embracing 07 families (Tables: 3). pH and conductance (E.C.) had a direct influence with the development of algal forms. Investigation shows that as pH and Electrical Conductivity of the soil increases the number of the algal forms decreases. Similar observation ware made by Abhang and Auti (2013) from the soils of Mula right and left canal irrigated area of Rahuri tahasil of Maharashtra.

A total 46 species of blue green algae belonging to 21 genera were recorded during the investigation 17 were heterocytous and remaining 29 were non-hetrocystous (Table: 2 & 3). Non-heterocystous shows dominance over heterocystous forms. Out of 17 heterocystous forms the genera *Nostoc* and *Anabaena* showed wide distribution. This was followed by *Scytonema*, *Tolypothrix* and *Calothrix* two species each while *Cylindrospermum*, *Rivularia*, *Spirulina*, *Hapalosiphon* and *Westiella* were represented by one species each. Non-heterocystous forms showed maximum distribution and diversity with 29 belonging to 12 genera. *Chroococcus* and *Lyngbya* were recorded to have five species each *Pmhormidum* comprises 04 species. *Microcystis*, *Aphanotheceae* and *Oscillatoria* were recorded to have 03 species each while *Gleocapsa*, *Aphinocapsa*, *Chlorogloea*, *Dasygloea*, *Microcoleus* and *Spirullina* were represented by single species. The percentage distribution of heterocystous blue green algae is 36.95% to which *Nostoc punctiforme* (93.36%) *Nostoc spongiaefrome* (76.66%), *Anabaena oryzae* (90%), *Anabaena circinalis* (76.66%) were abundant. While *Scytonema mychrous* (46.66%), *Scytonema millei* (36.66%), *Hapalosiphon welwitschii* (30%) were moderate and *Tolypothrix byssoidea* (10%), *Revularia dura* (13%) *and Cylindrospermum musicola* (16.66%) were rare (Table: 2).

Table No. 2: Cyanophycean algal flora from arable land soils of Rahuri tahasil District Ahmednagar (M.S.)

Sr. No.	Algal Forms	Number of soil sample harboring algae	Relative abundance %
1	*Anabaena orientalis* Dixit.	25	83.33
2	*Anabaena oryzae* Fritsch	27	90
3	*Anabaena circinalis* Rabenh ex Born. et Flah.	26	86.66
4	*Aphanocapsa biformis* A.Br.	02	6.66
5	*Gleocapsa kuetzingiana* Nag.	10	33.33
6	*Chlorogloea microcystoides* Geitler	04	13.33
7	*Dasygloea amorpha* Thwaites ex Gomont	05	16.66
8	*Aphanothece castagnei* (Breb.)Rabenh	04	13.33
9	*Aphanothece conferta* Richter	01	3.33
10	*Aphanothece pallida* (Kueta.)Rabenh.	05	16.66
11	*Calothrix marchica* lemm	04	13.33
12	*Calothrix brevissima* West,G.S.	02	6.6
13	*Chroococcus indicus* Zeller	10	33.33
14	*Chroococcus varius* A.Br.	07	23.33
15	*Chroococcus minor* (Kuetz) Nag.	11	36.66
16	*Chroococcus minutes* (Kuetz) Nag.	17	56.66
17	*Chroococcus tenax* (Kirchn.)Hieron	15	50
18	*Cylindrospermum musicola* Kuetz ex. Born. et Flah.	05	16.66
19	*Microcoleus lacustris* (Rabenh.) Farlow	05	16.66
20	*Lyngbya birgei* Smith, G.M.	05	16.66
21	*Lyngbya confervoides* C.Ag. ex Gomont	14	46.66
22	*Lyngbya nigra* C.Ag. ex Gomont	10	33.33
23	*Lyngbya majuscula* Harvey ex Gomont	15	50
24	*Lyngbya putealis* Mont. Ex. Gomont	08	26.66
25	*Microcystis aeruginosa Kuetz.*	08	26.66
26	*Microcystis robusta* (Clark) Nygaard	14	46.66
27	*Microcystis viridis* (A. Br.) Lemm	10	33.33
28	*Nostoc calciola* Breb. ex Born et Flah.	20	66.66
29	*Nostoc linkia* (Roth) Bornet ex Born et Flah.	15	50
30	*Nostoc punctiforme* (Kuetz.) Hariot	28	93.33
31	*Nostoc spongiaefrome* Agardh ex Born. et Flah	23	76.66
32	*Oscillatoria animalis* Ag. Ex Gomont	25	88.33
33	*Oscillatoria okenii* Ag. Ex Gomont	22	73.33
34	*Oscillatoria subbrevis* Bruhl et Biswas	20	66.66
35	*Phormidium rubroterricola* Gardner	11	36.66
36	*Phormidium fragile* (Meneghini) Gomont	05	16.66
37	*Phormidium lusidum* Keutz ex. Gomont	06	20
38	*Phormidium laminosum* Gomont	07	23.33
39	*Hapalosiphon welwitschii* W. et G.S.West	09	30
40	*Revularia dura* Roth ex Born. et Flah	04	13.33
41	*Scytonema millei* Bornet ex. Born. et Flah	11	36.66
42	*Scytonema mychrous (*Dillw.) Ag. ex. Born. et Flah.	14	46.66
43	*Spirulina Platensis* (Nordst.) Gietler	02	6.66
44	*Tolypothrix byssoidea* (Berk.)Kirchner	03	10
45	*Tolypothrix tenuis*(Kuetz)Johs. Schmidt em.	05	16.66
46	*Westiella intricate* Borzi	06	20

Table No. 3. Taxonomic categorization of BGA encounter in soil culture from Rahuri tahasil.

Sr. No.	Order	Family	Number of Genera	No. of Species	Heterocystous	Non-Heterocystous
1	Chroococcales	Chroococcaceae	05	13	00	13
		Entophysalidaceae	01	01	00	01
2	Nostocales	Oscillatoriaceae	06	15	00	15
		Nostocaceae	03	08	08	00
		Scytonemataceae	02	04	04	00
		Rivulariaceae	02	03	03	00
3	Stigonematales	Stigonemataceae	02	02	02	00
	Total		**21**	**46**	**17**	**29**

The percentage distribution of non-heterocystous blue green algae is 63.04%. among the non-heterocystous blue green algal species *Oscillatoria animalis* (88.23%), *Oscillatoria okenii* (73.33%), *Oscillatoria subbrevis* (66.66%), *Chroococcus minutes* (56.66%) *Chroococcus tenax* (50%), *Lyngbya majuscula*(50%) were abundant while *Gleocapsa kuetzingiana* (33.33%), *Chroococcus minor* (63.66%), *Chroococcus indicus* (33.33%), *Lyngbya confervoides* (46.66%), *Phormidium rubroterricola* (36.66%), *Lyngbya nigra* (33.33%), *Microcystis viridis* (33.33%) *were moderate and Aphanocapsa biformis* (6.66%), *Aphanothece conferta* (3.33%), *Spirulina platensis* (6.66%) *were rare.* Similar works in different fields were made by earlier workers Abhang *et al.,* 2016; Auti And Pingle, 2007; Chatterjee and Chatterjee, 1983; Goyal *et al.,* 1984; Saikia and Bordoloi RPM, 1994; Sankaram, 1971; Venkataraman, 1981 and Venkataraman, 1961.)

Conclusion

It can be concluded that blue green algae from study area appear to be poor as compare to that of other districts like Pune, Kolhapur and Sangali of Maharashtra. Patil and Satav (1986) reported 56 different algal species from Kolhapur area. The low number of blue green algae reported by us might be due to cultural practices, use of various chemicals and fertilizers used by farmers and environmental factors also. Our results were in consonance with shinde (1995) Rode *et al.,* (2011) and Abhang *et al.,* (2016)

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