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Physico-Chemical characterization of *Anabaena* spp. in five district of Chhattisgarh state, India.

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Abstract

Physico- chemical characterization of *Anabaena* spp. has been studied in 192 rice field soil samples collected from five district of Chhattisgarh and influence of, soil type; pH and conductivity were correlated on their population. At different locations and seasons the pH of the soil varies from 4.08 ±0.20 to 8.05±0.305. Conductivity varies from 0.036±0.10 to 1.718±0.152. Altogether 14 species belonging to *Anabaena* genus were obtained and characterized. Factors in the soil, such as its texture, its ability to retain water, and the amount of organic matter contained in it, also affect by the amount of pesticide that will leave the area. The present study indicates that the soil of the rice fields of all the studied area are sufficiently nourished with nitrogenous fertilizers which is not much helpful in growth *of Anabaena* species. Lesser nitrogenous fertilizer application will be beneficial to the growth of the genus.

Keywords: *Cyanobacteria*, Rice fields, Abundance, Environmental variables and Agrochemicals.

Introduction

Cyanobacteria are extraordinarily diverse group of Gram-negative, oxygenic photosynthetic prokaryotes that are distributed in all possible biotopes of the world. Nitrogen fixing *cyanobacteria* are unique as they are able to assimilate both carbon and nitrogen. The Key enzyme nitrogenase involved closely to fix atmospheric nitrogen. Algalization of soil with living di-nitrogen fixing cyanobacteria has become a common practice in tropical countries for many years. Various workers have studied the cyanobacterial flora of rice fields of our country (Choudhury and Kennedy 2005, Bhakta et al. 2006, Rai 2006, Nayak and Prasanna 2007, Digambar Rao *et al*. 2008, and Prasanna et al. 2009) and few attempts have also been carried to explore their diversity in the state of Chhattisgarh(Sharma and Nayak, 1996 &1998, Shrivastav et al., 2009, Bajpai, 2013). Nevertheless, studies on cyanobacteria from the rice fields of this part of the state still remain largely unexplored.

Therefore, the objectives of the present investigation were (i) Collection and identification of *Anabaena* species from 5 district rice fields of Chhattisgarh, (ii) Study of distribution pattern of *Anabaena* spp. in different locations, (iii) Study of physico-chemical properties of rice field soils and correlating to different species of *Anabaena* (iv) The environmental impact of agrochemicals is on distribution of *Anabaena* species.

Materials and Methods

A. Collection and identification of samples:

Samples were collected randomly from 192 different sites of following 5 district of Chhattisgarh:
a. Baloda Bazaar-Bhatapara district (site-1)
b. Dhamtari district (Site-2)
c. Gariaaban district (Site-3) d. Mahasamund district (Site-4) e.Raipur district (site-5)

The strains were identified based on their morphological features and cell structure following the monograph of Desikachary (1959) and Anand (1989).

B. Physico-chemical properties:

a. Soil type: The soils of Chhattisgarh state comprise mostly of iron rich Bhata soil , Kachhar Soil, Dorsa soil ,Matasi soil, Kanhar soil.

b. pH and conductivity: The pH and conductivity of the soil samples were determined by using digital pH meter and conductivity meter, respectively.

Results and Discussion

The physico-chemical properties of the rice field's soil like pH, conductivity varies from different district/ sites (Table 1). At different locations the pH of the soil varies from 4.08±0.20 to ?8.05±0.305. Conductivity varies from 0.036±0.10 to 1.718±0.152.

Table-1 Distribution pattern of genus Anabaena observed in rice fields of Chhattisgarh in relation to physiochemical properties of soil

S.No.	Name of species	pH range	Conductivity range	Soil type	No. of fields	Dominant soil type	Dominant area
1.	*A. ambigua*	5.7-8.1	0.178-1.136	Bhata Dorsa Kankar Matasi	6	-	-
2.	*A.anomala*	5.7-7.8	0.166-0.864	Bhata Dorsa Kachhar Matasi	11	Dorsa	Palari (Site -1)
3.	*A. aphani - zomenoides*	7.8	0.864	Dorsa	01	Dorsa	-
4.	A. *fertil-issima*	6.3-8.2	0.254-1.484	Kanhar Matasi	06	Kanhar	Abhanpur (Site-4)
5.	*A. iyengarii*	5.7-7.6	0.178-0.748	Bhata Dorsa Kanhar	07	Dorsa Kanhar	-
6.	*A. iyengarii v.tenuis*	7.3-7.6	0.584-0.748	Dorsa Matasi	02	-	-
7.	*A. laxa*	7.6-7.7	0.758-0.826	Kankar Matasi	02	-	-
8.	*A. naviculoides*	7.0	0.486	Dorsa	01	-	-
9.	*A. orientalis*	6.5-7.4	0.284-0.636	Dorsa Matasi	02	-	-
10	*A. oryzae*	5.7-8.2	0.178-1.484	Bhata Dorsa Kachhar Kanhar	19	Kanhar	Bhatapara Deobhog (Site -1)
11	*A.oscillarioides*	7.8	0.878	Dorsa	01	-	-
12	*A.spherica*	6.5-7.4	0.278-0.636	Bhata Dorsa Kankar Matasi	05	Dorsa	Abhanpur (Site-4)
13	*A.spherica v. tenuis*	7.1-7.5	0.534-0.716	Dorsa Kanhar	02	-	-
14	*A.torulosa*	7.3	0.624	Kanhar	01	-	-

During the present investigation 192 samples were collected from five different district/site, total of 14 species belonging to genus were characterized (Table-1) from 49 fields of Chhattisgarh. Among the locations, site 1 was recorded with highest numbers of *Anabaena* strains followed by site 2, site 5, site 4 and site 2. Texture of soil greatly influences the distribution of *Anabaena* spp. High moisture contents and water holding capacity encourages *cyanobacterial* growth. With respect to moisture retaining capacity in the order: Bhata, Dorsa, Matasi, Kachhar and Kanhar. Unexpectedly with very poor water holding capacity of Bhata soil had higher number of *Anabaena* species (5 species: *A. ambigua, A. anomala, A. Iyengarii,. A. oryzae* and *A. shaerica*) (Table-1). While in Kachhar soil which is considered as one of the most fertile soil had lesser number of *Anabaena* species (*A. anomala*) (Table-1). Eleven species were recorded in Dorsa soil, nine species from Kanhar soil and eight species from Matasi soil (Table-1). Out of 14 species of *Anabaena* recorded from 192 rice fields soil *A. oryzae, A. anomala, A. Iyengarii, A. ambigua, A. fertilissima* exhibit wide range of pH (5.7-8.2) and conductivity (0.178-1.484). *Anabaena orientalis* and *A. spherical* exhibited slight acidic to slight alkaline soil (pH 6.3-7.4) and conductivity (0.284-0.636). *Anabaena laxa, A. aphanizomenoides, A. Iyengarii var. tenuis* preferred alkaline soil (7.3-7.8) and conductivity (0.624-0.864). None of the species were recorded in acidic soil (pH 4.8). So the present study revealed that *Anabaena* spp. favours the slight acidic to alkaline soil (5.7-8.5). It has been apparent with the study of Goyal (1997). At alkaline pH the predominance of *Anabaena* spp. is due to increased availability of organic or inorganic nutrients (Mitra 1961). The redox potential of the soil indirectly regulates the incidence of *Anabaena* spp. by controlling the availability of nutrients (Goyal, 1997). Although the *cyanobacteria* are autotrophic presence of organic matter increases the availability of CO_2 as a consequence of decomposition especially at low pH.

Cyanobacteria are the main recipients of agrochemicals. They are exposed to agrochemicals from direct application, through the uptake from soil and water and from atmospheric drift. It has been found that about half of agrochemicals applied by aircraft land outside the target cropland or forest and fall out either on adjoining ecosystem or drift into distant ecosystem (Ramesh, 2004).

The present study, thus indicate that soil of the rice fields of all the studied area are sufficiently nourished with nitrogenous fertilizers which is not much helpful in growth of *Anabaena* sp. Lesser nitrogenous fertilizers application will be beneficial to the growth of *Anabaena* species.

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