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STUDY ON DIVERSITY OF RICE FIELD BLUE-GREEN ALGAE FROM RICE FIELD OF CHAPRA IN BIHAR

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ABSTRACT

The blue-green algae are primitive but the fortunate and sustained organism during the course of evolution. They are emerging candidates for efficient conversion of solar energy into chemical energy. The cyanophyte system in rice field produces oxygen as a by-product and agricultural practices in such fields produces biomass to decrease carbon dioxide and accomplish nitrogen fixation. The blue-green algal diversity was investigated in local rice fields through soil samples from sites having spatio-temporal differences during the study period. The study revealed 17 genera and 21 species of blue-green algae population as a major nutritive material in rice fields.

Keywords: Cyanobacteria, Diversity, Rice fields, North Bihar, Species richness

INTRODUCTION

The algae are either unicellular or thalloid plants that contain characteristic photosynthetic pigments and channelize oxygen throughout the photosynthesis. The cyanobacteria are major parts of the micro-flora in rice fields and play an important role among the requirement and expression limits of soil fertility, consequently increasing rice production (Song et *al*, 2005). They have an important role among the biological process, especially within the rice fields (Hazarika et *al*, 2012). The rice fields are suitable site enriched with algal diversity (Dey et al, 2012). It constitutes enough favorable ecosystems for the expansion and reproduction of these microscopic creatures to adequate requirements for light, water and higher temperature (Whitton and Potts, 2000).

The cyanobacteria in turn offer adequate amount of nutrients, like nitrogen and phosphorus requirement for rice cultivation (Singh et al, 2014). Most rice fields have a natural population of blue-green algae which provides a sustainable source of

mineral cycling. There are many widespread genera in crop field soils that considerably contribute to their fertility (Rao et al, 2008; Choudhary et al, 2011). The studies on algal diversity have received wide attention within the recent times (Thajuddin and Subramanian, 2005). Thus rice fields are suitable habitat for algal population.

The serious ecological imbalance within the soil caused by pesticides indirectly affects the productivity of the rice fields. The agrochemicals, besides dominate over pests, harm an over-sized variety of non-target useful micro-organisms as they persist among the soil of such ecosystem (Kapoor and Arora, 2000).

The rice field researches on algal flora were additionally assigned in Indian rice ecosystems (Dasgupta and Ahmad, 2013; Singh et *al*, 2014). However, data on species diversity and its role in rice field productivity is restricted throught the last decades (Nandi and Rout, 2000). The agro-climatic condition of rice fields of Chapra (Saran) district favors the growth of several rice cultivars in conjunction with luxuriant algal population. This study provides an insight into various aspects of algal population in this agro-ecosystem.

METHODS AND MATERIALS

The study was conducted in four rice fields of Chapra District to explore existing algal diversity. The soil samples from rice fields were air dried, homogenized and mixed for experimentation. Now trace soil sample carried from different rice fields were kept in 5 petriplates with 40 ml sterilized algal medium under optimum condition of light and temperature in the laboratory. The quantity of each species (CFU) in appeared algal colonies on the plates after 10-12 days of incubation were recorded after microscopic examination. The microscopic studies were performed about morphology and fine structure of algal population. Identification of cyanobacteria was done using the keys given by Desikachary (1959) and J Komarek (2005). The data collection was performed about abundance, density, frequency with the help of existing formulae. The relative abundance of a selected algae was calculated by using the formula: $RA = Number\ of\ samples\ containing\ the\ species / Total\ No.\ of\ occurance\ of\ all\ the\ species \times 100$; whereas algal diversity has been calculated by Shannon's Diversity index.

RESULTS AND DISCUSSIONS

The cyanobacteriae are acting as bio-fertilizer to improve soil fertility with eco-friendly manner and so there is need of extensive researches to manage soil quality for enhanced productivity. The regional algal isolates can be simply more effective due to pre-adaptation to the existing natural conditions. The composite pure culture from specific regions might suitable as nitrogen fixing algae are being cultured for their demand as natural fertilizer in India (Venkataraman, 1981). However, only rare culture may established promptly in any specific area and this feature create gap for local biodiversity studies to derive optimum edges from endemic strains. There regional diversity documentation may help in screening of suitable algal inoculants to be applied as bio-fertilizer in crop fields likewise also to search new strains with alternative biotechnological potentials.

There algal isolates from soil samples of three different sites were examined under microscope for salient feature and identified in accordance with key provided by Desikachary (1959) and J Komarek (2005). The observation revealed Nostocalesare as abundant genera in the local rice fields. The total colony is abundant in irrigated fields rather than rain-fed rice fields. The rice fields near saryug river, while rain-fed region with CFU below 50% confirms low rate of nitrogen-fixation with low productivity.

The species abundance comprised *Aulosir afertilissima* and *Nostoc carneum*is as maximum (Table 1) followed by three species *Anabaena variabilis*, *Nostoc punctiforme* and *Nostoc opsislobatus* during study. Relative density of N. *lobatus* and *Nostoc carneum* is more than other cyanobacterial strains. Relative abundance of *N.lobatus*iae supports the finding of Nayak*et al* 2007. N. *lobatus,* A. *fertilissimia*, N. *carneum*, A. *variabilis*, N. *punctiforme,* are the dominating

Table 1: Diversity parameters of blue-green algae in selected rice fields

Sl no.	species	FO	RF	RD	RA
1	*Anabaena doliolum* var. Bhardwaja	100	5.36	5.64	4.42
2	*Anabaena oryzae* Dixit	100	5.42	6.20	4.50
3	*Anabaena variabilis* Kutzing	100	5.38	5.82	4.86
4	*Anabaena oscillatroides*	80	4.32	4.46	4.14
5	*Aulosira prolifica* Bhardwaja	80	3.80	3.92	3.20
6	*Cylindrospermum majus* Kutzing	80	3.60	3.80	3.40
7	*Nostoc puctiformi* (Kutzing) Hariot	80	3.40	3.60	3.00
8	*Anabaenopsis amoldii* var. Ramanathan	60	2.86	5.24	3.16
9	*Anabaena fertilissimia* CB Rao	60	2.56	2.12	1.42
10	*Anabaena orientalis* Dixit	60	2.22	3.10	2.32
11	*Cylindrospermum licheniformis* Born and Flah	60	2.86	2.70	2.20
12	*Cylindrospermum stagnata* Born and Flah	60	2.49	2.76	1.96
13	*Nodularia spermagina* Mertens	60	2.40	2.60	2.10
14	*Nostoc calcicola* Brebsson	60	2.20	2.40	2.00
15	Nostoc *sps* Born and Flah	60	2.00	1.94	1.80
16	*Nostoc hatei* SC Dixit	60	2.10	2.00	1.70
17	*Aphanizomenon volzi* Komarek	60	1.90	1.80	1.60
18	*Anabaena sphaerica* Bhardwaja	40	1.70	2.10	1.40
19	*Cylindrospermum indendatum* CS Rao	20	1.60	1.80	1.50
20	*Anabenopsis circularis* var. Javanica wolosz	20	1.50	1.70	1.30
21	*Aulosira fertilissimia* CB Rao	20	1.40	1.60	1.20

species of the tropical rice fields of this region. Many competent *Nostocsp* (Nilsson *et al* 2002), and *Anabaena sp.* (Adhikary, 2002) was able to colonize rice in root surfaces and intercellular spaces having higher nitrogenase activity compared to their free-living species.

Table 2: Abundance and distribution of Blue-green algae in various locations of Chapra district.

Collection site	Number of Genus	Species Richness	Hs
Doriganj	12	21	3.40
sonepur	10	19	3.25
Ishuapur	07	14	2.10
Marhowra	04	12	2.00
Masarakh	03	10	1.80

Diversity index of algal population in the Rice field of selected sites of Chapra were calculated by Shannon-Wienner Method (Table2). It also revealed more diversity index in rice field with riverine water supply rather than rain-fed rice fields through intoxication due to excessive use of chemical fertilizers and pesticides (Adhikary 2002). The earlier study (Deep *et al*., 2013) confirms that urbanization adversely affects the wetland algal populations. An extensive study is needed using these organism as inoculums for their use as bio-fertilizer as they are pre-acclimatized in all the collected sites.

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