Agroecological Survey of Cyanobacterial Population in Paddy Field Soils of Gunupur

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Abstract-Cyanobacteria are the pioneer oxygenic, gram negative photosynthetic prokaryotes distributed in almost all conceivable habitats. Cyanobacteria exhibit great diversity of forms and functions. Gunupur is a part of the southern belt of Orissa, rich in Cyanobacterial biodiversity in paddy ecologies. The study aimed to characterize the abundance and occurrence of Cyanobacteria in various paddy fields of Gunupur, identify the isolates and determine diversity indices in relation to the genera wise distribution. Average population counts of various locations brought out the major diversity among the locations sampled. This study indicate the maximum occurrence and abundance of *Oscillatoriaceae* and *Nostocaceae* in all sites of the Gunupur and *Stigonemataceae* shows less occurrence.

Key words: Cynobacteria, Biodiversity, Occurrence, Habitat, Paddy ecology.

Introduction

Blue green algae (BGA) are ubiquitous in nature covering almost all adverse climatic conditions. The studies of Oklahoma found that soil within algal covering had moisture content of 8.9% compared with 1.3% in the absence of algae. Blue Green Algae (BGA) are important as contributors of combined nitrogen. Although molecular nitrogen is abundant in the earth's atmosphere, it gets incorporated in to the biosphere only by assimilation by microbes and plants. Blue green algae help higher plant growth by supplying growth substances Venkataram & Nilakanthan (1927). The algal flora appear to be more abundant in cultivated soils than in uncultivated one (Tiffany, 1951). The algal flora could be used as an indicator of soil type and condition in various habitat (Shtina and Roizin, 1966). In paddy field soils species, *Anabaena circinalis*, *Nostoc muscorum*, *Oscillatoria* species and *Westiellopsis prolifica* are usually abundant. The ecology of paddy field environment has been relatively studied but the effect of cultivation and physico-chemical conditions the effect of these on the growth of different algal species and the interrelations between the various microorganism and the plants are all undoubtedly complex. Extensive studies on the distribution of nitrogen fixing Cyanobacteria on paddy fields and other tropical soils have been carried on by Watanabe over 30 years period. Watanabe and Yamamoto, (1971). In India the nitrogen fixing species are widely distributed but are more abundant in soils south of 30° latitude than north of it (11.8 and 1.7% of total flora respectively). That is they are more common in tropical and subtropical soils in temperate areas.

Materials and Methods

The samples were collected from 10 different study sites of Gunupur Block during morning hour (9.30-11.30am) and in the evening hour 3pm -5 pm.. Then serially diluted samples were isolated and identified under microscope by the help of the monograph and then listed. The identified

samples were inoculated in freshly prepared BG 11 media and cultured under aseptic laboratory condition. After three weeks, the mother culture was sub cultured in the same BG 11 media. During collection of samples the soil pH, temperature and texture were recorded (Table-II).

Results and Discussions

An extensive study was made to find out the occurrence and abundance of cyanobacterial population in different study sites of the Gunupur, Rayagada district (Orissa). Cyanophyta constitute seven major groups i.e. Chroococcaceae, Plerocapsaceae, Oscillatoriaceae, Nostocaceae, Rivulariaceae, Scytonemataceae and Stigonemataceae. Blue green algae (BGA) are the most promising biological systems, adding the nitrogen to the paddy fields (Goyal, 1982). The occurrence of blue green algae in Indian paddy fields studied by several workers (Mitra, 1951; Pandey, 1965; Venkataraman, 1972; Bendra and Kumar, 1975; Sinha and Mukharjee, 1975; Prasad et al 1978; Kannaiyan, 1979; Bongale and Bharati, 1980; Sardesh Pandey and Hoyal, 1981a; Kannaiyan, 1993a). Table – I indicates the Cyanobacterial diversity in ten different paddy ecologies in Gunupur. Maximum occurrence of Oscillatoriaceae was found in all the sites. In the Table-I '+' or '-' indicates the occurrences or non-occurrence of Cyanobacteria sps in particular paddy fields. In all sites the pH, is slightly alkaline, favours maximum occurrence of Cyanobacterial population at ten different study sites. Cyanobacteria are more common in tropical and subtropical paddy field soils. The figure 1-10 shows the percentage of occurrence of different taxa of Blue green algae at ten different study sites are Chroococcaceae, Plerocapsaceae, Oscillatoriaceae, Nostocaceae, Rivulariaceae, and Scytonemataceae & Stigonemataceae. The observation shows the maximum dominance of *Oscillatoriaceae* and *Nostocaceae* family over the other families of Blue green algae at all study sites, where as the family Stigonemataceae shows

least occurrence at the ten different study sites. During collection of samples the soil pH, temperature and texture were recorded (Table-II).

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Table 1- List of Blue green algal species at 10 different study sites of Gunupur

Sl.No.	Cyanobacterial Organism				S	I	T	E			
		I	II	III	IV	V	VI	VII	VIII	IX	X
Family	CHROOCOCACEAE										
1	<i>Chroococcus turgidus.</i>	+	+	-	-	+	-	+	-	+	+
2	<i>Chroococcus choaerens.</i>	-	+	-	+	-	-	+	-	+	+
3	<i>Gleocapsa compactica</i>	-	+	+	-	-	-	+	-	-	+
4	<i>Microcystis aeuroginusa</i>	+	+	+	+	-	+	-	+	-	+
5	<i>Microcystis flo aquee</i>	+	+	-	+	+	+	-	-	+	+
6	<i>Microcystis protocystis</i>	+	+	-	+	+	+	-	+	-	+
7	<i>Gleocapsa pleorocapsoida</i>	+	+	+	-	+	-	+	-	-	+
	Total number	5	7	3	4	4	3	4	2	3	7
Family	PLEUROCAPSACEAE										
1	<i>Dermocarpa sphaerica</i>	+	-	-	+	+	-	-	-	-	+
2	<i>Dermocarpa proea.</i>	+	-	-	+	+	-	-	-	-	+
3	<i>Xenococcus gigantean.</i>	-	+	-	-	+	-	+	-	+	-
	Total number	2	1	0	2	3	0	1	0	1	2
Family	OSCILLATORIAEAE										
1	<i>Lyngbya aerugineocoerulea.</i>	-	+	+	-	-	-	-	+	-	-
2	<i>Lyngbya ceylanica.</i>	+	+	+	-	-	-	-	-	+	-
3	<i>Lyngbya estuarii.</i>	+	+	+	+	-	+	-	+	-	-
4	<i>Lyngbya spiralis.</i>	+	-	+	-	+	-	-	+	-	+
5	<i>Oscillatoria anguina.</i>	+	+	-	+	+	-	-	+	-	+
6	<i>Oscillatoria animalis.</i>	+	+	-	+	+	-	+	-	-	+
7	<i>Oscillatoria limosa.</i>	+	+	+	-	-	-	+	-	-	+
8	<i>Oscillatoria okeni.</i>	+	-	-	+	-	-	-	+	-	+
9	<i>Oscillatoria rubescens.</i>	-	-	-	+	-	-	-	+	-	+
10	<i>Oscillatoria tenue.</i>	+	+	+	+	-	+	+	+	-	+
11	<i>Phormidium purpurascens.</i>	+	+	-	-	-	+	-	-	+	-
12	<i>Phormidium tenue</i> (Mench).	+	+	+	-	+	+	-	+	-	+
13	<i>Phormidium uncinatum</i>	+	+	+	-	-	-	+	-	+	+
	Total number	11	10	8	6	4	4	4	8	3	10
Family	NOSTOCACEAE										
1	<i>Anabaena circinalis</i>	+	+	-	+	+	+	+	+	-	+
2	<i>Anabaena cylindrica.</i>	+	+	-	-	+	+	+	-	-	+
3	<i>Anabaena oryzae</i>	+	+	+	+	-	+	-	+	+	-
4	<i>Aulosira laxa kirchn</i>	+	+	+	+	-	+	-	+	+	-
5	<i>Cylindrospermum muricola.</i>	+	+	-	+	-	-	-	+	+	+
6	<i>Nostoc muscorum.</i>	+	+	-	+	+	+	+	+	+	+
	Total number	6	6	2	5	3	5	3	5	4	4
Family	RIVULARIAEAE										
1	<i>Calothrix elenkinii</i> Agardh	+	-	+	+	-	-	+	-	+	-
2	<i>Calothrix marchica</i>	+	-	+	-	-	+	-	+	+	-
3	<i>Rivularia minutata.</i>	-	+	-	-	+	-	-	+	-	-
	Total number	2	1	2	1	1	1	1	2	2	0
Family	SCYTONEMATACEAE										
1	<i>Plectonema buttersii.</i>	-	-	+	-	+	-	-	+	-	+
2	<i>Scytonema coactile.</i>	+	+	+	-	+	+	-	+	-	-
3	<i>Scytonema crustaceum.</i>	-	+	-	+	-	+	-	+	-	-
4	<i>Scytonema schmidlei</i>	+	+	+	+	-	-	-	+	-	-
5	<i>Tolypothrix distorta.</i>	-	+	-	-	-	+	-	+	+	-
	Total number	2	4	3	2	2	3	0	5	1	1
Family	STIGONEMATACEAE										
1	<i>Mastigocladus laminosus.</i>	-	-	+	-	-	+	-	+	-	+
	Total number	0	0	1	0	0	1	0	1	0	1

Study Sites:

Site-1	Titimari	Site-6	Puttasing
Site-2	Bhimpur	Site-7	Ghadiakhala
Site-3	Dombosora	Site-8	Sirijhali
Site-4	Chalkamba	Site-9	Chinasari
Site-5	Jaltar	Site-10	Jagannathpur

Sites	Name of the study site	pH	Soil texture			Mean Average Temperature	
			% Sand	%Silt	%Clay	Minimum Avg. Temp	Maximum Avg. Temp
1	Titimari	8.10	29	43	28	22.35	33.35
2	Bhimpur	8.1	30	41	29	21.64	34.00
3	Dombosora	7.60	45	27	28	19.6	33.51
4	Chalakamba	7.90	50	20	30	21.23	32.00
5	Jaltar	7.11	35	40	25	20.00	32.00
6	Puttasing	7.05	36.5	39.5	24	22.30	33.32
7	Ghadiakhala	6.30	35.5	37.5	27	20.42	32.68
8	Sirijhali	7.10	35.5	37.5	27	19.34	32.12
9	Chinasari	6.91	37	40	23	21.45	33.35
10	Jagannathpur	7.75	40	30	30	20.65	29.23

Table 2- shows soil parameters at ten different study sites of Gunupur

Fig. 1-10- shows the percentage occurrence of cyanobacterial population at Different study sites of Gunupur.

Fig: 01

Fig: 02

Fig: 03

Fig: 04

Fig: 05

Fig: 06

Fig: 07

Fig: 08

Fig: 09

Fig: 10