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Agroecological survey of heterocystous Cyanobacteria in Thanjavur District, Tamilnadu, India

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ABSTRACT

The present investigation was carried out to increase knowledge of the nitrogen fixing cyanobacterial communities of Thanjavur rice field, Tamilnadu, India. Totally ten different study sites were selected (Latituded 10°47^{1}N and longituded 79°10^{1}E) in Thanjavur district. At each site two water samples and one soil samples were taken samples were fixed in 4% formalin before taxonomic determination. A total of 18 filamentous heterocystous taxa were isolated of which 8 species have not previously been recorded in Thanjavur. During the study period the maximum species occurrence and abaundance of species belonging to Nostocaceae, Scytonemataceae, Rivulariaceae, Stigonemataceae show less occurrence in the all sites.

INTRODUCTION

Cyanobacteria was also termed as blue-green algae due to the presence of characteristic pigments. Their morphology ranges from single cell of filamentous forms with or without branching. They are prokaryotic in nature, hence very close to bacteria rather then higher plants. All cyanobacteria are photosynthetic in nature and synthesize their organic carbon demand using carbondioxide, light and water from atmosphere. Certain cyanobacteria, however, convert atmospheric nitrogen into ammonia and are subsequently converted to various aminoacids through nitrogenase and glutamine synthetase or glutamate synthase enzyme action [1].

Nitrogenase enzyme in oxygen sensitive and always located in modified cells called heterocystous [2]. Heterocysts fix atmospheric nitrogen to ammonium and transport to other vegetative cells; in turn vegetative cells produce photosynthetate and supply to heterocysts. The presence of external fixed nitrogen sources, such as nitrate, nitrite and ammonium it the vicinity of the cyanobacteria cause the repression of heterocysts production, nitrogenes synthesis and stand using external nitrogen sources for the growth. However, it is likely that filamentous heterocystous cyanobacteria have an important role in the nitrogen cycle in the soils of Thanjavur rice fields [3]. The distribution in these taxa in Thanjavur rice fields is therefore of potential relevance. In the present study, the knowledge about distribution of the taxa obtained from this survey may help identify sources of cyanobacteria for use as biofertilizers in rice cultivation on nitrogen-poor or degraded soils.

MATERIALS AND METHODS

The study area encompassed at total of 10 sites situated between, 10°47^{1}N and 79°10^{1}E in the rice growing region of Thanjavur District, Tamilnadu, India (Table-I; Fig.1) Temperature of the waters samples were recorded between 19°C and 34°C during the growing season (July-Octo.) and pH ranged from 6.5-8.0.

Collection of algal material

At each site two water samples and one of soil were taken. Serially diluted samples were isolated and inoculated in freshly prepared BG11 media [4]and cultured under asceptic laboratory condition. After three weeks, the mother culture was sub cultured in the same BG11 medium. Cyanobacteria were identified following monographs of [5, 6, 7].

RESULTS AND DISCUSSION

An extensive study was made to find out the occurrence and abundance of heterocystous cyanobacterial population in different study sites of Thanjavur District, Tamilnadu, India. Totally 18 species of cyanobacteria belonging to 11 genera under 4 families viz., Nostocaceae, Scytonemataceae, Rivulariaceae, Stigonemataceae were recorded during the study period. Of these cyanobacteria, Nostocaceae with 10 species were recorded as maximum occurance, followed by stigonemataceae, Scytonemataceae each with 3 species and Rivulariaceae with 2 species were recorded (Table-I; Fig.2). There is attributed to favourable conditions of pH, soiltexture and temperature (Table-II) an observation which support [8, 9]suggest that cyanophyceae grow in luxuriously with great variety and abundance in paddy, because of alkaline pH, soiltexture and temperature. Similar observation were made in the present study with reference by soiltexture and pH (Table-II) Blue green algae (BGA) are the most promising biological systems, adding the nitrogen to the paddy field [10]. The occurrence of Blue green algae in paddy fields studied by several workers in India [11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 & 22].Table-I indicates the heterocystous cyanobacterial diversity in ten different paddy fields in Thanjavur. Maximum number was found in Ayyampettai (12) and minimum was in Pattukkottai (4) According to [3].Nostoc is the dominant genus of soil microflora in India and found in Tamil Nadu, Assam, Hariyana, Kerala and West Bengal. In the cyanobacterial flora of rice field soil in Thanjavur, *Nostoc communae* and *Anabaena flos-aquae* was the most dominant genus and maximum occurrence of Nostocace was found in all the sites. In the table-I (+) or (-) indicates the occurrence and non occurrence of cyanobacteria species in particular paddy fields.

Table I. List of cyanobacterial species of 10 different study site of Thanjavur

S. No.	Cyanobacterial organisms	Site									
		I	II	III	IV	V	VI	VII	VIII	IX	X
	NOSTOCACEAE										
1.	*Cylindrospermum musiocola* Kutzing ex Born, et Flah	+	-	-	+	-	+	+	+	+	-
2.	*Anabaena beckii* De Toni G.B.	+	+	+	+	+	-	-	-	-	-
3.	*A. fertilissima* Rao, G.B.	-	-	-	+	+	-	-	-	+	+
4.	*A. flos-aguae* (Lyngb.) Breb. ex Born. et Flah.	+	+	+	+	+	+	+	+	+	+
5.	*A. oryzae* Fritsch.	+	+	+	-	+	-	-	-	+	-
6.	*Nostoc calciala* vaucher ex Bor. et Flah.	+	+	+	+	-	-	-	-	+	-
7.	*N. communae*	+	-	-	+	-	-	-	+	-	-
8.	*N. microscopicum* Ag. ex. Born et Flah.	-	-	+	+	+	-	-	-	-	+
9.	*N. paludosum* Vaucher ex Born. et Flah.	-	+	+	-	-	+	-	-	-	+
10.	*Aulosira laxa kirchmer* ex born. et. Flah.	-	-	-	+	+	+	+	-	-	-
	Total	**6**	**5**	**6**	**8**	**6**	**4**	**3**	**3**	**5**	**4**
	SCYTONEMATACEAE										
11.	*Scytonema simplex* Bharadwaja	+	-	+	-	+	-	-	-	+	-
12	*Tolypothrix distorta* Lemm. Kutzing ex Bor, of Flah.	-	+	+	-	-	-	+	+	-	-
13.	*T. tenuis* Kutz. Johs. Schmidt em.	+	-	-	+	+	+	-	-	+	-
	Total	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**0**
	RIVULARIACEAE										
14.	*Rivularia aquatica* ex Born. et Flah.	+	+	-	-	-	+	-	+	+	-
15.	*Calothrix contarenii* (Zanard) Bornet et. Flahcult.	-	-	-	-	-	+	-	-	-	+
	Total	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**
	STIGONEMATACEAE										
16.	*Stigonema* sp.	+	-	-	-	+	-	-	+	-	-
17.	*Hapalosiphon* delicates	+	-	-	-	+	+	-	+	+	-
18.	*Westiellopsis prolifica* Janet	+	+	+	+	+	-	-	-	+	+
	Total	**3**	**1**	**1**	**1**	**3**	**1**	**0**	**2**	**2**	**1**

Fig.1 SHOW THE STUDY SITE

TABLE II. Shows soil parameters at ten different study sites of Thanjavur

S. No.	Name of the study site	pH	Soiltexture			Mean Average Temperature	
			% sand	% silt	% clay	Minimum Avg. Temp.	Maximum Avg. Temp.
1.	Ayyampettai	7.2	28	40	31	21.62	32.25
2.	Uluvur	7.5	30	39	27	20.00	34.00
3.	Tiruvonam	7.5	46	27	31	19.24	26.25
4.	Thiruvaiyaru	7.4	50	26	33	22.36	32.00
5.	Bhudalur	8.0	37	42	24	19.60	33.78
6.	Thiruvalanchuli	7.8	30	29	41	20.65	30.00
7.	Pattukottai	6.5	28	33	30	22.60	33.12
8.	Aduthurai	7.2	27	31	36	19.00	29.00
9.	Orathanadu	8.0	41	20	28	20.65	31.12
10.	Neyvasal	7.8	37	21	29	19.26	33.25

Fig :2 Cyanobacteria Isolated from paddy field

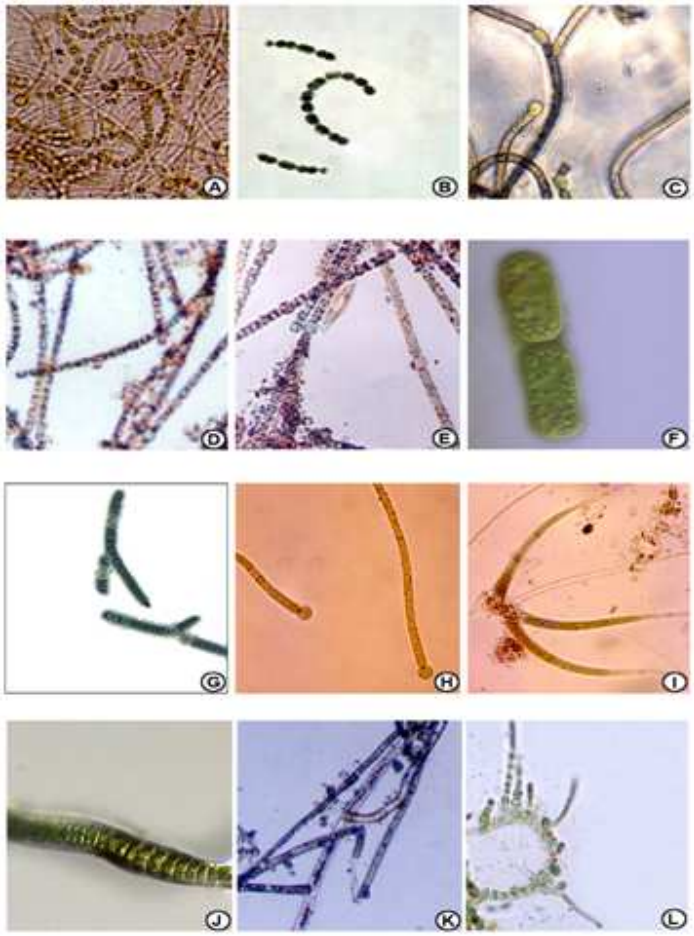

Fig :2 Cyanobacteria Isolated from paddy field

NOSTACACEAE A) Anabaena fertilissima B) A. flos-aquae C) Nostoc calcicola D) N. microscopium E) N. paludosum F) Aulosira laxa SCYTONEMATACEAE G) Scytonema simplex. H) Tolypothrix distorta RIVULARIACEAE I) Rivularia aquatica J) Calothirix contarenii STIGONEMATACEAE K) Haplosiphon delicates L) Westiellopsis prolofica

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