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DISTRIBUTION OF INDUSTRIALLY IMPORTANCE MARINE CYANOBACTERIA INRAMANATHAPURAMDISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Marine water environments are supporting the growth of marine organisms with affluent diversity. In this study, distribution of cyanobacteria from the coastline of Ramanathapuram, Tamil Nadu, India was studied. Water samples were collected from five different sampling sites during the month of January 2016 to March 2016. Totally 13 morphologically different cyanobacteria were identified by microscopic examinations. The identified species of cyanobacteria are *Microcystis flos-aquae*, *Gloeocapsa* sp, *Aphanocapsa* sp, *Synechocystis* sp. *Oscillatoria earlei*, *Oscillatoria subsalsa*, *Oscillatoria tenuis*, *Oscillatoria amoena*, *Phormidium fragile*, *Phormidium retzii*, *Phormidium tenue*, *Lyngbya confervoides*, and *Spirulina subtilissima* which are being the non heterocystous forms which are being useful for producing many bio-products industrially.

KEYWORDS: Cyanobacteria, Distribution, Coastline, *Oscillatoria.*

INTRODUCTION

The cyanobacteria are a morphologically distinct group of oxygenic, photosynthetic and gram negative prokaryotic organisms that inhabit terrestrial and aquatic ecosystems. Litavitis[1] has stated that India is one of the mega-biodiversity countries of the world, having almost all possible kind of climatic variations, with a great diversity of microbes especially the cyanobacteria. Traditionally, cyanobacteria have been classified based on the morphological and ecological characters by Geitler[2] and Desikachary.[3] The most fundamental meaning of

biodiversity probably lies in the concept of species richness that is indicating the number of species occurring at a site, in a region or ecosystem. Uncontrolled dumping off waste, nutrient discharges from intensive agriculture and human activities are the major cause of biodiversity variation.[4]

Cyanobacterial diversity possesses the largest untapped metabolites from the various reservoirs of biosphere which reserve the diverse novel bioactive products. It has been reported that the saline tolerant cyanobacteria possess the single cell protein.[5] In addition, it has also been reported that many cyanobacteria have ability to fix the molecular atmospheric nitrogen by the presence of heterocyst.[6] Sea water environments have a richer flora and fauna than the other environments. There are limited survey has been done in coastline area of Ramanathapuram District. This present studies were aimed to highlight the distribution of cyanobacteria in coastline area of Ramanathapuram district, Tamil Nadu, India.

MATERIALS AND METHODS

Study area

The sites were selected for this present study from coastline of Ramanathapuram, Tamil Nadu, India. The following five different coastline areas of Ramanathapuram District were selected for this study, such as Rameswaram, Pamban, Keelakkarai, Thondiand Uchipuli. Samples were collected from January to March 2016.

Sample collection and identification

Water samples were collected in a sterilized bottle and were transported to the laboratory immediately. The collected water samples were concentrated by centrifugation at 4000 rpm for 10 min. To the samples, one drop of Lugol's iodine solution was added for cell count estimation. A small quantity of the concentrated samples were analyzed for the dominant cyanobacterial group based on the colour of the thallus, unicells, colony formation, arrangement of trichome and presence or absence of mucilaginous sheath, etc. under 10x, 40x and 100x objectives of light microscope.[3,7]

Physicochemical parameters of water samples

The physico-chemical parameters like salinity, dissolved oxygen, pH, turbidity, nitrate, total phosphorous, sulphates and ammonia in the samples were estimated by standard procedures. Water temperature was measured by mercury thermometer having 0.1°C accuracy; salinity, dissolved oxygen, pH and other parameters were analyzed by standard methods.[8]

RESULTS

In this study, a total of 10 samples were collected from 5 different sampling sites with the interval of one month. Among the 10 samples, nearly 13 different types of cyanobacteria were identified. All isolated cyanobacteria were belonging to 8 different genera (Table 1). In this finding, the genera *Oscillatoria* was dominant, followed by the genera *Phormidium*.

Table 1: Cyanobacterial distribution in five coastline area of Ramanathapuram District [from January 2016 to March 2016].

S.No.	Cyanobacterial Species	Rameswaram			Pamban			Keelakkarai			Thondi			Uchipuli		
		Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar
1	*Aphanocapsa* sp.	+	+	+	+	+	+	+	+	+	+	-	-	+	-	-
2	*Gloeocapsa* sp.	-	-	+	-	-	+	-	+	+	-	-	-	+	+	-
3	*Lyngbya confervoides*	+	-	-	-	-	-	-	-	-	+	+	+	+	-	+
4	*Microcystis flos-aquae*	+	-	-	+	-	-	-	-	-	-	+	-	-	-	-
5	*Oscillatoria amoena*	-	-	-	+	+	+	-	+	+	-	+	+	+	+	-
6	*Oscillatoria earlei*	+	-	+	-	-	-	+	+	+	+	-	-	-	+	+
7	*Oscillatoria subsalsa*	-	-	-	-	-	-	+	+	+	-	-	-	-	+	-
8	*Oscillatoria tenuis*	+	+	+	-	-	-	-	+	+	+	+	+	-	+	+
9	*Phormidium fragile*	+	+	+	+	+	-	-	+	+	+	+	+	-	+	+
10	*Phormidium retzii*	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-
11	*Phormidium tenue*	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-
12	*Spirullina subtilissima*	-	-	-	+	+	+	-	+	+	-	+	+	+	+	-
13	*Synechocystis* sp.	-	-	+	+	-	-	+	+	+	+	-	+	+	+	+

Note : + indicates the presence of species; - Indicates the absence of species

The physico-chemical parameters such as the pH, salinity turbidity, dissolved oxygen; ammonia and sulphate were recorded in Table 2. The physico-chemical variations were statistically not significant. The pH of the sample was highest (8.44) in Rameswaram and the lowest value (pH 7.55) was observed in sample Pamban. The higher salinity was recorded as 27 ppt at Pamban, and the lower salinity was recorded as 22 ppt Thondi.

Table 2: Physiochemical parameters of the water sample collected from different sampling sites in five coastline area of Ramanathapuram District, Tamil Nadu. [from January 2016 to March 2016].

Parameters	Rameswaram	Pamban	Keelakkarai	Thondi	Uchipuli
pH	7.99	7.15	7.3	7.62	7.74
Salinity (ppt)	24	27	23	22	24
Turbidity (OD)	0.3	0.34	0.36	0.18	0.19
DO (mgl-1)	0.8	0.7	0.9	0.92	0.11
Ammonia (mgl-1)	0.08	0.05	0.06	0.064	0.036
Total Phosphorous (mgl-1)	0.14	0.015	0.33	0.042	0.062
Nitrate (mgl-1)	0.3	0.026	0.045	0.25	0.3
Sulphate (mgl-1)	0.26	0.058	0.083	0.036	0.04

DISCUSSION

Cyanobacteria are ubiquitous in nature and they must possess a high potential of adaptation to diverse environments.[9] Coastline areas are perennial ecosystems with variable cyanobacterial diversity, which composed optimum levels of light, water, temperature, humidity and nutrient availability that are providing a favorable environment for the luxuriant growth of cyanobacteria. In this study, samples obtained from five different sites, which have 13 morphologically different cyanobacterial species. The isolates identified in this study were grouped under two families that is, *Oscillatoriaceae* and *Chroococcaceae* which includes *Oscillatoria earlei*, *Oscillatoria tenuis*, *Oscillatoria pseudogeminata*, *Oscillatoria amoena*, *Phormidium fragile*, *Phormidium retzii*, *Phormidium tenue.*, *Lyngbya confervoides.*, *Spirulina subtilissima*, *Microcystis flos-aquae*,*Gloeocapsa* sp., *Aphanocapsa* sp., and *Synechocystis* sp. (Table 1). No heterocystous cyanobacteria were identified from the study area. Sugumar *et al.*[10] reported that 18 species of marine cyanobacteria were found in salt pans of Cape Comorine coast. Selvakumar and Sundararaman[11] observed twelve species of unicellular and filamentous species of cyanobacteria belonging to either *Chroococcaceae* or *Oscillatoriaceae* families in estuarine water Nagasathya and Thajuddin.[12]

Plankton species favors the development of cyanobacteria.[13] It has also been reported that environmental factors[14], nutrient, and hydrologic conditions[15] may also influence the morphological and cyanobacterial bloom dynamics in aquatic ecosystems. In this present study, the results of physicochemical composition of sampling sites reveal that they were nutrient rich environments; in particular, total phosphorous, ammonia and nitrate concentrations were higher and may have greatly supported the abundance of different cyanobacterial morphovers. Among the 13 different cyanobacteria the genus *Oscillatoria* was dominant; this may have been influenced by higher availability of nutrient, particularly

nitrate and phosphate.

In this investigation, the cyanobacterial abundance was high at sites four and eight. Total phosphorous, ammonia, and nitrate concentrations of site four and eight were higher than the other sampling sites. It has been suggested that environmental nutrient positively influences the magnitude and diversity of cyanobacterial species. High phosphate, nitrate and trace metals and low N: P has been widely reported as major factors limiting cyanobacteria abundance.[16-17] About 27 species of cyanobacteria are belonging to four families from salt pans of South East Coast of India. Generally, non-heterocystous *Oscillatoria* spp., *Lyngbya* spp. and *Microcystis* spp. were the dominant cyanobacteria found in these coastline areas. The intense proliferation of cyanobacteria in coastline ecosystems is well documented in several studies.[18-19] The differences in cyanobacterial species composition could be conceivably attributed to differences in physicochemical parameters between the cyanobacterial sampling sites. Nutrient accumulation may have different forces on the ecosystem at different periods.[20]

Itiswell knownthattheenvironmentaldegradation which results from eutrophication strength of less tolerant ample organic matters in the soil and water, as well as the physicochemical conditions such as pH, temperature, organic sources, etc. that influence the propagation.[21] In this investigation, most of the cyanobacterial species identified in the water samples did not matched with temperature, DO and pH. *Spirulina* sp. was recorded only in the saline rich environments (22 to 25 ppt) and also they occur in the environments with higher nutrient levels and varying temperature and salinity.[22] Jewel *et al.*[23] reported cyanobacteria especially *Microcystis* sp. was found to be controlled by relatively high temperature (>25°C) and nutrient enrichment especially high nitrate concentration. Affan *et al.*[24] and Wetzel[25] suggested that in summer, blue green algae dominated in water bodies. Some cyanobacteria such as *M. flos-aquae*, *Microcystis aeruginosa* and *Aphanizomenon subcylindrica* were more susceptible to low pH.[26]

CONCLUSION

The cyanobacteria especially *Oscillatoria*, *Microcystis* and *Phormidium* were observed mostly. The cyanobacterial distribution was significantly higher during March than the January and February months. During this period, higher cyanobacterial diversity was observed. The present basic information of the cyanobacterial distribution would be a useful tool for further ecological assessment and monitoring of these coastline area of

Ramanathapuram District. Further molecular identification is required to analyze phylogenetic relatedness of the isolated strains. In addition to this, studies are required to analyze the cyanobacterial diversity at seasonal variation, which would give the clear picture of species richness and diversity variation at this region.

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