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RESEARCH ARTICLE

OCCURRENCE OF *Trichodesmium erythraeum* BLOOM IN THE COASTAL WATERS OF SOUTH ANDAMAN

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ABSTRACT

A highly intense (27,000 cells mL^{-1}) bloom of the nitrogen fixing cyanobacterium *Trichodesmium erythraeum* was observed in Burmanallah region of Port Blair in South Andaman during summer (March 2012). Hydrographical parameters were studied and nutrients like Nitrate, nitrite, phosphate and silicate were measured. It was found out that an increase in water temperature has initiated the bloom. Increase in salinity was also found to be a factor which had contributed to the bloom.

INTRODUCTION

The role of phytoplankton in the aquatic ecosystem is noteworthy as they initiate the marine food chain by serving as food to primary consumers (Tas and Gonulol, 2007). Favorable environmental conditions such as adequate nutrients, light and temperature, trigger periods of rapid reproduction of phytoplankton called 'blooms' (Castro and Huber 2003). Besides normal and periodic blooms of phytoplankton, exceptional, harmful algal blooms also occur (Richardson, 1997). Literature available on the distribution of phytoplankton in coastal waters around Andaman Islands is meagre (Devassy and Bhattathiri, 1981; Sarojini and Sarma, 2001; Siva Sankar and Padmavati, 2012).

Trichodesmium, a marine nitrogen fixing cyanobacterium, forms extensive surface blooms that discolour vast regions of tropical and subtropical seas. *Trichodesmium* normally occurs in macroscopic bundles or colonies and is responsible for most of the nitrogen fixation in the oceanic and coastal waters (Hood *et al*., 2000). These non-heterocystous cyanobacteria grow in long filaments (trichomes) which often aggregate in colonies (Capone *et al.,* 1994). *Trichodesmium* is responsible for more than 30% of the algal blooms of the world (Westberry and Seigel, 2006). Cyanobacterial blooms became much more numerous since the mid- twentieth century (Reynolds, 2006) *Trichodesmium* bloom produces many harmful effects, sometimes causing damages to coastal fish and shellfish fauna (Bhat and Verlencar, 2006).

Mortality events of farmed pearl oysters in West Australia were found to be associated with *Trichodesmium erythraeum*. (Negri *et al*., 2003). Thus, studying the causes that favour the appearance of this bloom has social and economical connotations. This paper brings to attention the *Trichodesmium erythraeum* bloom which occurred in the coastal waters of South Andaman.

MATERIALS AND METHODS

Description of the study area

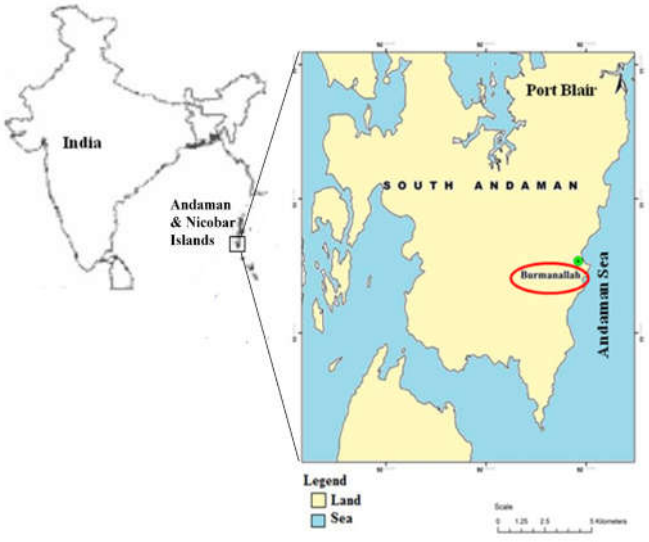

Fig.1. Map showing Study Area

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Burmanallah (11° 33' 20'' N and 92°42'52''E) is a highly wave affected region found in the West Coast of Andaman Sea, located in the East Coast of Port Blair. The entire area is bay shaped, with freshwater influxes on both the ends. There is another freshwater influx in the center of the region. All these influxes are bordered by dense mangrove forests. The anthropogenic influence is quite low here when compared to the other coastal waters of South Andaman, though there is a small fisherman community in the shore.

Sample collection and analysis

Plankton samples were collected by using plankton net (mesh size, 20µm) from the surface. The plankton samples were fixed in 4% formaldehyde solution and fixed with Lugol's iodine solution immediately after collection. Surface water temperature was measured by using standard mercury Centigrade Thermometer. Salinity was estimated with the help of a hand – held Refractometer (ATAGO). pH was measured using a pH meter (OAKTON) from Eutech Instruments. Dissolved Oxygen was estimated by the modified Winkler's method. *Chlorophyll-a* (90% acetone method) was measured spectrophotometrically in the laboratory (Strickland and Parsons, 1972) and expressed as mgL^{-1}. Surface water samples were collected separately in clean polyethylene bottles for the analysis of nutrients, which were kept immediately in an ice box, and then transported to the laboratory. The collected water samples were filtered by using a Millipore filtering system and then analyzed for dissolved inorganic nitrate, nitrite, reactive silicate and inorganic phosphate, adopting the standard procedures described by Strickland and Parsons (1972) and are expressed in μML^{-1}. 1 to 2 drops of the sample was put on a slide, covered with a cover slip and examined under light microscope and inverted microscope to identify the species. Species identification of the phytoplankton samples was done by referring the identification keys (Venkataraman, 1939; Cupp, 1943; Santhanam, 1987 and Carmelo R. Thomas, 1997). The phytoplankton cell counts were performed on Sedgewick-Rafter Counting Slide (Guillard, 1978).

$$N = \frac{n \times v \times 1000}{V}$$

Where N is the total number of phytoplankton cells per liter of water filtered, n is an average number of phytoplankton cells in 1mL of sample, v is the volume of phytoplankton concentrates and V is the volume of total water filtered.

RESULTS AND DISCUSSION

Bloom forming species

During March 2012, *Trichodesmium erythraeum* (Fig.2) dominated 95-99% of the total phytoplankton biomass. Based on this data, *Trichodesmium erythraeum was* determined as the bloom forming species with a population density of 27,000 cells mL^{-1}.

Hydrography

As shown in the results (Table 1), there was an increase in temperature during the bloom. Most of the marine cyanobacteria exhibit substantial growth in the temperature range 25-35°C (Krishnan *et al*., 2007).

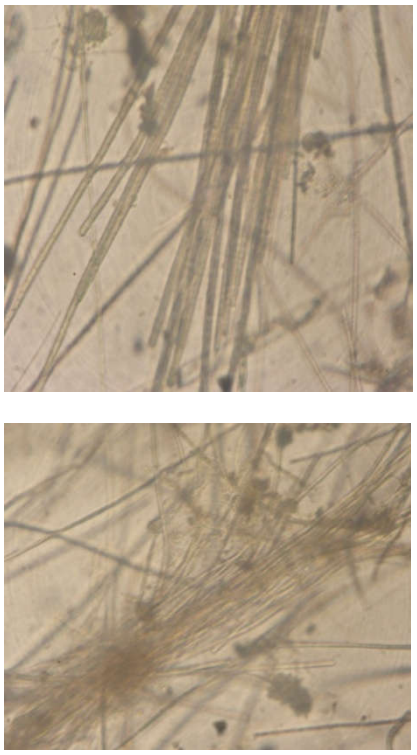


Fig.1. ***Trichodesmium erythraeum***

Table 1. Hydrographical parameters during the study period

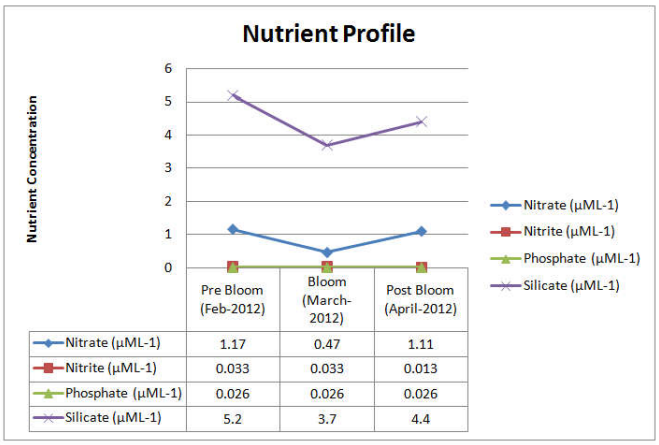
Parameters	Pre -Bloom February 2012	Bloom March 2012	Post – Bloom April 2012
Salinity (PSU)	30	32.5	31
Temperature (°C)	27	29	28
pH	7.9	7.9	7.9
Dissolved Oxygen (mg L^{-1})	4.4	3.8	4.13
Chlorophyll a (mg L^{-1})	0.08	0.161	0.06

Temperature has long been recognized as an important factor that controls *Trichodesmium* abundance (Marumo and Nagasawa, 1976). Generally, bloom of this filamentous algae occur during summer (Ramamurthy et.al., 1972), as cyanobacteria require relatively high temperature for their growth compared to other phytoplankton (Suvapepant, 1992). Cyanobacteria are especially sensitive to lower temperatures and they are apparently excluded in the winter months due to lower temperature (Reynolds, 2006). The results of this study are in accordance with the previous studies.

Also, this bloom has occurred during the summer month, which is a dry period for Andaman and Nicobar islands. This is contrary to the frequent diatom blooms observed earlier by the authors in the coastal waters of South Andaman which occurred only during the rainy months (Unpublished data).This once again proves that cyanobacterial species are not dependent on the nutrient flux which is brought by the rainfall unlike the diatoms which are nutrient dependent (Egge and Aksnes, 1992). The salinity was found to be the highest (32.5 PSU) during the bloom. Previous studies (Mohanty et.al., 2010) have also confirmed the fact that stable salinity

conditions close to typical value of 32 PSU and above are known to support the growth and abundance of *Trichodesmium*. Contrary to a previous study (Mohanty et.al., 2010), Dissolved Oxygen was found to be lower during the bloom period than during the pre bloom and post bloom periods. This is probably due to the decaying of the cells of the bloom forming species during sampling.

PHYSICOCHEMICAL PARAMETERS



	Pre Bloom (Feb-2012)	Bloom (March-2012)	Post Bloom (April-2012)
Nitrate (µML-1)	1.17	0.47	1.11
Nitrite (µML-1)	0.033	0.033	0.013
Phosphate (µML-1)	0.026	0.026	0.026
Silicate (µML-1)	5.2	3.7	4.4

Figure 3. Nutrient profile of Burmanallah during the study period

The details of the nutrient profile are given in Figure 3. The nitrate concentration was at its lowest during the bloom period and this is in accordance with the previous studies (Jyothibabu et.al., 2003). Nitrite and Phosphate showed insignificant variations during the study period. The silicate concentration showed a marked decrease during the bloom. This concurs with the patterns observed in the previous studies on non-diatom species (Sargunam et.al., 1989 and Dharani et.al., 2004).

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