

## New records of blue-green algae from Goa

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### Abstract:

A survey along the Goa coast led to findings related to blue-green algae that have not been reported earlier from the coast. Four species of blue-green algae belonging to three orders have been recorded in the present study.

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### Introduction:

Cyanobacteria, commonly referred as blue-green algae are photosynthetic microorganisms and widely distributed over a wide range of habitats (Desikachary, 1959). Compared to terrestrial and fresh-water counterparts, limited floristic studies have been made on cyanobacteria from the marine or estuarine regions. Marine habitats comprising of intertidal, subtidal as well as mangroves have been found to be conducive for cyanobacteria (Thajuddin&Subramaniam, 1992). However, there is little information about the

floristic richness of cyanobacteria from the marine environment of Goa.

### Materials and methods:

Goa is situated along the Central West Coast of India and lies along 14° 49' - 15° 52' N and 73° 38' - 74° 24' E. The state has a coastline measuring about 120 km. It is segmented as a result of estuaries, beaches, rocky shores, cliffs, bays and creeks. There are seven estuaries and three bays, sandy as well as rocky beaches are found. The climate is warm (atmospheric temperature 20-35°C) and humid (humidity 60-90%) with an average annual rainfall of about 3000 mm (Jagtapet al., 2001).

Figure 1. Map showing study area.



Seventeen stations comprising of Terekhol, Chapora, Vagator, Anjuna, Baga, Reis Magos, San Jacinto, Dona Paula, Siridao, Mormugoa, Bogmalo, Holant, Betul, Cabo-de-Rama, Palolem, Talpona and Polem were selected (Fig.1.). These stations were surveyed during three different seasons of a year from October 2008 to September 2010. The biofilms attached to rocks as well as those attached to the larger algae were collected and preserved in 10 % formalin-seawater solution. The films were later studied under the microscope to identify them.

### Results & Discussion:

Apart from several seaweed species, four species of blue-green algae have been encountered, which were not recorded earlier from the Goa Coast. The four genera comprising of *Chroococcus*, *Microcoleus*, *Oscillatoria* and *Trichormus* belong to three different orders.

### Chroococcales

#### *Chroococcaceae*

*Chroococcus turgidus* (Kützing) Naegeli, Neue Denkschr. Allg. Schweiz. Ges. Gesammten Naturwiss. 10[7]: 46. 1849; Batters, Journal of Botany, British and Foreign 40 (Supplement): 1-107.1902; Desikachary, Cyanophyta, p.700.1959; Lawson & John, Beihefte zur Nova Hedwigia 93: 6 + 1-415.1987; Haroun, Bot. Mar. 45: 139-169.2002; Sherwood, Bishop Museum Occasional Papers 80: 1-26. 2004; Bárbara, Algas Bentónicas Marinas Y Salobres De Galicia: Índice, 429. 2009.

*Protococcus turgidus* Kützing, Tab. Phycol. 5, t. 6. 1846.

Thalli blue-green, epiphytic on other algae in middle to upper intertidal zone, spherical or oblong. Sheath thick, usually lamellose. Cells without sheath 10-14 µm in diam; 6.3-10 µm in length. Rarely found single, mostly in association of two or four.

Season: Post - monsoon.

Habitat: Found with other algae in rock pools. In this study it was found in a habitat of estuarine influence, San Jacinto.

Type locality: Germany (fide Drouet & Daily, 1956).

Distribution: Present study: San Jacinto Island.

India: East Coast: Tamil Nadu (Desikachary, 1959).

### Oscillatoriales

#### *Oscillatoriaceae*

*Microcoleus chthonoplastes* (Mertens) Zanardini, Bibliot. Ital. [Milano] 99: 200. 1840; Desikachary, Cyanophyta 700, 1959; Harounet al., Botanica Marina 45: 139-169, 2002; Nagasathya & Thajuddin, Asian J. Plant Sci. 7: 473-478, 2008; Bárbara, Algas Bentónicas Marinas Y Salobres De Galicia: Índice, 429, 2009.

*Conferva chthonoplastes* Mertens in Hornemann, Icones plantarum ... Florae danicae: t. 6. MCCCCLXXXV. 1813.

*Chthonoblastus lyngbyei* Kützing, Phycol. General.: 197. 1843.

*Microcoleus lyngbyei* (Kützing) P. Crouan & H. Crouan, Florule du Finistère ...: 114. 1867.

*Chthonoblastus salinus* Kützing, Phycol. General.: 197. 1843.

*Microcoleus salinus* (Kützing) Montagne in Castagne, Supplément au catalogue des plantes qui croissent naturellement aux environs de Marseille: 113. 1851.

Thalli dirty green or dark blue-green, intermixed with other algae forming a compact, stratified strata. Filaments simple or rarely branched, elongate, irregularly curved, 30-90 µm in diam. sheaths hyaline, occasionally diffluent, rough on the surface, apices attenuate or closed. Trichomes 2.5 - 6 µm in diam., numerous, aggregated in bundles. Cells 3.5 - 10 µm in length, not granulated, apical cell attenuate.

Season: Post - monsoon.

Habitat: Found in the upper intertidal zone.

Type locality: Odense Fjord, Denmark (fide Silva, 2012).

Distribution: Present study: Chapora, Anjuna, Dona Paula, Siridao, Mormugoa, Bogmalo, Cabo-de-Rama, San Jacinto.

India: Tamil Nadu (Desikachary, 1959; Nagasathya & Thajuddin, 2008).

*Oscillatoria nigroviridis* Thwaites ex Gomont, Annales des Sciences Naturelles, Botanique, Series 7, 16: 217, t. 1-7. 1892; Batters, Journal of Botany, British and Foreign 40 (Supplement): 1-107, 1902; Papenfuss, Israel Journal of Botany 17: 1-118, table 1, map 1, 1968; Taskinet al., The check-list of the marine algae of Turkey. [1-2]-[1]-87. 2008, The check-list of the marine algae of Turkey. [1-2]-[1]-87, 2008.

*Phormidium nigroviride* (Thwaites ex Gomont) Anagnostidis & Komárek, *Archivfür Hydrobiologie*, 80: 405, f. 35, 1988.

Thalli blackish, growing in form of caespitose mats. Trichome 6-7.5 µm broad, cells 1.5-2.3 µm long, nearly straight, fragile, constricted at cross walls.

Season: Post – monsoon.

Habitat: Found free-floating and on muddy substratum in brackish waters

Type locality: Shirehampton, near Bristol, England (fide Silva et al., 1996).

Distribution: Present study: Anjuna, Palem.

## Nostocales

### *Nostocaceae*

*Trichormus variabilis* (Kützing ex Bornet & Flahault) Komárek & Anagnostidis, *Algological Studies* 56: 304, 1989; Haroun et al., *Botanica Marina* 45: 139-169, 2002; Taskin et al., *The check-list of the marine algae of Turkey*. [1-2]-[1]-87, 2008.

*Anabaena variabilis* Kützing, *Phycologia generalis*, 210, 1843; Banerji, J. *Dept. Sci., Calcutt. Univ.*, 1: 95-109, 1938; Chapman, *Journal of the Linnean Society of London, Botany* 55: 333-501, t. 24-50, f. 153. 1956; Desikachary, *Cyanophyta*, 700.1959; Papenfuss, *Israel Journal of Botany* 17: 1-118, t. 1, map 1. 1968.

Thalli blue-green, solitary or aggregate. Trichomes without any sheath. Cells barrel shaped and distinctly constricted. Filamentous heterocyst-forming; fixes nitrogen and carbon dioxide; produces hydrogen.

Season: Post – monsoon.

Habitat: Found on middle to upper intertidal rocks.

Type locality: Wangerooge, East Frisian Islands, Germany (fide Silva, 2012).

Distribution: Present study: San Jacinto Island.

India: East Coast: Calcutta (Banerji, 1938); Madras (Desikachary, 1959).

It was observed that the blue-green algae were mostly found thriving in post-monsoon season i.e. November-March. Seasonal changes in the blue-green algae have been

studied by Naz et al. (2004) in Pakistan. All of the four species have already been reported from other parts of India, but have not been recorded from Goa, so far. Hence, this paper is probably a first account of their occurrence along the Goa coast. A periodic reassessment is needed to unearth the biological diversity of the coast (Mantri et al., 2007). Future surveys could unravel a greater diversity of blue-green algae from this region.

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