

Epiphytic Cyanobacteria Linked on Molluscs in Palk Strait, Tamilnadu, India

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Abstract: Coastal ecosystems are integral part of ocean and provide numerous benefits to human beings directly or indirectly. An inventory was carried out to study the epiphytic cyanobacteria on molluscs, their taxa and distributions. Samples were studied in the laboratory and identified. A total number of 17 genera belonging to chlorophyceae in *Actinastrum* (1), *Ankistrodesmus* (1), *Arthrodesmus* (1), *Botryococcus* (1), *Chaetophora* (1), *Chlorella* (1), *Chlorococcum* (1), *Dactylococcus* (1), *Hydrodictyon* (2), *Oedogonium* (1), *Oocystis* (1), *Scendesmus* (1), *Spirogyra* (1), *Ulothrix* (1), *Volvex* (1), *Westella* (1) and *Xanthidium* (1) are recorded in Thondi Coastal region, Bay of Bengal, India.

Keywords: Epiphytic Cyanobacteria • Chlorophyceae • Molluscus

INTRODUCTION

Epiphytic cyanobacteria are microscopically small, unicellular organisms, some of these form colonies and reach size visible to naked eye as minute green particles. The marine system includes the coastal, mangroves, estuaries and salt pans etc. The coastal ecosystem is differentiated into various types of planktons (free floating), benthos (attached to sediments) or epiphytic algae (on stones, sand, mud, rock of reservoir and other hard substratum like mollusc cells etc). Studies on epiphytic cyanobacteria for over a century were on understanding their structure and reproduction and several treatises [1-3] and monographs were published for several groups of algae with details on the occurrence and distribution with reference to diverse habitats [4-8]. Description of taxa have been restricted to generic level with diagnostic keys serving the means of identification of the species and also to identify the major-families of blue green algae in South Indian rice field [9]. Algae form assemblage of chlorophyllous organisms occurring in wide variety of fresh water and marine ecosystem in India [10]. The ecology of marine cyanobacteria from the Indian region was studied by many workers [4, 11-20].

Present investigation focus to understand to identify the epiphytic cyanobacteria on molluscs and their occurrence, taxonomy, morphology and general biology of the species. We obtained basic biological subsequences involving the epiphytic algae of the marine cyanobacteria and contribute to a better understanding of its distribution and occurrence in the Thondi coastal region, Palk Strait, Bay of Bengal.

MATERIALS AND METHODS

Study Area: Thondi (Lat. 9°45'N and Long. 79°3'E) is situated 40 km south of Manelmarkudi and 45 km north of Devipattinam. Thondi was popular as the historical Port. Here, the coastal region was muddy and swampy in nature. This coastal region was polluted by bulk quantity of domestic and agricultural wastes. Anthropogenic inputs including fecal contamination also very high in this area.

Collection Methods: Random sampling method has been applied in the algal collection procedure. Molluscs (Bivalves and Gastropods) samples were collected from Thondi coastal region. Collections were carried out during

the month of May 2011. The different types of epiphytic cyanobacteria forms were collected on the Mollucus only. If not immediately examined samples were preserved in a 4 % formaldehyde-seawater solution. To remove epiphytes, mollucus surfaces were scraped in filtered seawater and debris removed under a dissecting microscope. Samples were then examined microscopically as mount slides using a LABOMED microscope with attached to SANYO CCD camera.

RESULTS

Actinastrum gracillimum GM Smith: Description: Colonies of 4 or 8 cells radiating from a common centre. Cells elongated cylindrical tapering slightly too abruptly truncate ends and 7-10 times as long as board. Chloroplast single, parietal and laminate and with or without a pyrenoid, cells 1.7-3 µm broad, 14-21 µm long; colonies 30-45 µm in diameter (Plate-I A).

Ankistrodesmus falcatus (Corda) Ralfs

Description: Cells aciculate to narrow fusiform with the ends tapering to acute apices, usually in fasciculate bundles of 2-4-8 or more, rarely solitary, Chloroplast single, parietal and usually without pyrenoids. Cells long 50 µm, breath 8 µm (Plate-I B).

Arthrodesmus curvatus Turner: Description: Cell solitary, small and as long as broad, bilaterally symmetrical in front view, median construction pronounced with widely open to linear sinus, semi cells generally triangular, rarely elliptic subtrapezi form or sub rectangular with a simple, straight or curved, spines on lateral angles, top-view usually elliptic rarely triangular, each semi cell with an axile chloroplast. Cells 31-44 µm long and 37-44 µm breath with spine and isthmus 8-13 µm broad (Plate-I C).

Botryococcus braunii Kützing

Description: Colonies free floating and of irregular shape, without conspicuous gelatinous envelop but completely enclosed by a tough, hyaline, orange-coloured and fold of spines. Cells ovoid to ellipsoid and arranged radially at the periphery of the colony. Simple colonies up to long 80 µm, breadth 50 µm and compound colonies up to 1.5 mm (Plate-I D).

Chaetophora attenuata Hazen: Description: Plants coastal water branched filamentous arising from less developed prostrate cells and enclosed in a macroscopic

tough mucilaginous envelope of a definite shape. Thallus globose, discrete, firm gelatinous, usually less than 30 mm in radius, epiphytic on aquatic vegetation. Chloroplast laminar parietal, pyrenoids 5-9 µm and length 15-25 µm (Plate-I E).

Chlorella vulgaris Beijerinck

Description: Algae free living, cells usually solitary or in small colonies, spherical and with a thin cell membrane. Chloroplast parietal, cup shaped and with a pyrenoid which is sometimes indistinct, cells usually 5-10 µm in diameter (Plate-I F).

Chlorococcum humicola (Naegeli) Rabenhorst:

Description: Cells spherical, solitary or a number of cells crowded together to form a stratum, Chloroplast a narrow sphere with lateral notch and a single pyrenoid, Cells 7 µm breath and 11 µm lengths (Plate-I G).

Dactylococcus infusionism Nägel:

Description: Cells fusiform, solitary or attached pole to pole to form false branched filamentous or chains, Chloroplast parietal, sometimes with an indistinct pyrenoid, Cells 2.5 µm broad and 9 µm long (Plate-I H).

Hydrodictyon reticulatum L. Lagerheim:

Description: Colonies reticulate meshes pentagonal or hexagonal, Cells elongate-cylindrical. Cell wall two layered. Cells up to 250 µm broad and up to 1.5cm long, Nets up to 20cm long (Plate-I I).

Hydrodictyon Sp. Roth:

Description: Macroscopic, free-floating, closed cylindrical or flattened single layered, net like colonies of several hundred to many thousand cells which are cylindrical coenocytes with large central vacuole. Reticulation of colony 3-12 (generally 5-6) sided. Chloroplast parietal and with a single pyrenoid in young cells but different with a number of pyrenoids in old cells (Plate-I J).

Oedogonium capilliforme Kiitz:

Description: Filament single unbranched, vegetative cells uninucleate-cylindric or sometime capitellate, basal cell with holdfast, vegetative cell, except the basal one capable of division oogonia and antheridia produced by the direct division of vegetative cells (Plate-I K).

Oocystis sp. WH: Description: Cells oblong – ellipsoid with broadly rounded ends, Cell membrane thin and without polar thickening. Chloroplast 2-4-8, parietal and

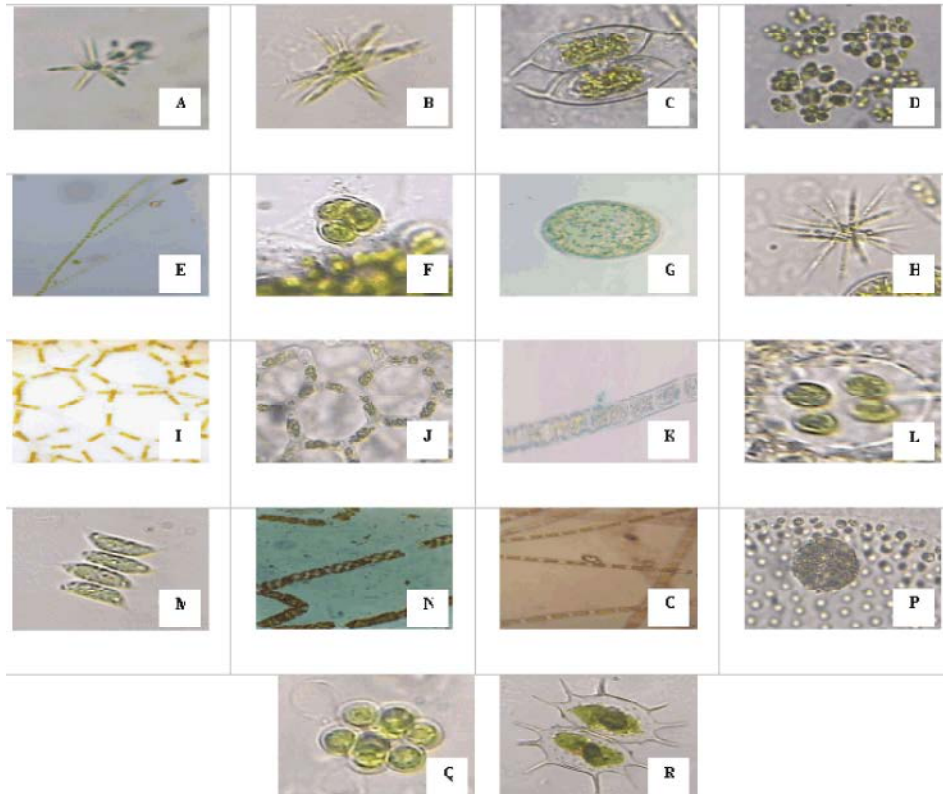


Plate I: A, *Actinastrum gracillimum* GM Smith. B, *Ankistrodesmus falcatus* (Corda) Ralfs-I. C, *Arthrodesmus curvatus* Turner-I. D, *Botryococcus braunii* Kütz. E, *Chaetophora attenuata* Hazen. F, *Chlorella vulgaris* Beyerinck. G, *Chlorococcum humicola* (Naeg) Rabenhorst. H, *Dactylococcus infusionum* Nägeli. I, *Hydrodictyon reticulatum* L. Lagerheim. J, *Hydrodictyon* sp. K, *Oedogonium capilliforme* Kütz. L, *Oocystis* sp. WH. M, *Scenedesmus acutus* Meyen. N, *Spirogyra aequinoctialis* G.S.West. O, *Ulothrix variabilis* Kützing. P, *Volvox aureus* Ehr. Q, *Westella linearis* GM Smith. R, *Xanthidium antilopaeum* (Brébisson) Kützing.

disc shaped each with minute pyrenoid. Reproduction by 2-4-8 autospores formed inside the distended mother cells wall, Adult cells 7-9.1µm broad, 18-24µm long, Young cells 5.5 µm broad and 16 µm long (Plate-I L).

***Scenedesmus acutus* Meyen:** Description: Colonies 4-8 celled with the cells arranged in a linear or sub alternating series (eight celled colonies always in sub alternating series). Differ from *S. obliquus* in the outer cells of the colony being more or less lunate and the apices of the cells being attenuated. Cells length and width are 3 µm (Plate-I M).

***Spirogyra aequinoctialis* G.S. WEST:** Description: Filaments, cell cylindrical. The chloroplasts are 1-16, spirally arranged, parietal ribbon like bodies with numerous prominent pyrenoid, the nucleus in centrally situated in a protoplasmic strand, Conjugation scalar form or lateral (Plate-I N).

***Ulothrix variabilis* Kützing:**

Description: Filament unbranched, indefinitely long, not apically attenuated with special hold fast cell, Vegetative cell uninucleate, cylindrical, chloroplast one. Cells 22.5 µm breath and 12.4 µm length (Plate-I O).

***Volvox aureus* Ehr:** Description: Colony spherical composed of from 500 to several thousand cells arranged at the periphery of a gelatinous sphere of homogeneous mucilage, each having 2 flagella of equal length (Plate-I P).

***Westella linear* GM Smith:** Description: colonies of irregular shape and of about 40-80 cells, Cells usually small, spherical and arranged in groups of four or eight. Chloroplast single, cup-shaped and with or without a pyrenoid, Cells 3-9 µm in diameter, Colonies 30-84 µm in diameter (Plate-I Q).

***Xanthidium antilopaeum* (Brébisson) Kützing:**

Description: Unicells loosely attached forming hyphae; cell body varied in shape, a constriction at the center in most species; cell walls consisting of two or more parts, with small pores and various ornaments. Cells are 80µm (with spines), 47µm (without spines) and isthmus 11µm (Plate-I R).

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REFERENCES

1. Smith, G.M., 1920. Phytoplankton of the Inland Lakes of Wisconsin part. I. Myxophyceae, Phaeophyceae, Heterokontae and Chlorophyceae, Wisconsin Geological and Natural History Survey. Bull. Sc. Ser., 12: 1-243.
2. Fritsch, F.E., 1935. The structure and reproduction of algae. Vol. I. Cambridge University Press, London, pp: 1-791.
3. Prescott, G.W., 1951. Algae of Western great lakes area: Wm. C. Brown Co. Publishers Dubuque Iowa.
4. Desikachary, T.V., 1959. Cyanophyta, Indian Council of Agricultural Research, New Delhi, pp: 1-686.
5. Randhawa, M.S., 1959. Zygnemaceae, Indian Council of Agricultural Research, New Delhi, pp: 317- 318.
6. Pal, B.P., B.C. Kundu, V.S. Sundaralingam and G.S. Venkataraman, 1962. *Charophyta*. ICAR, New Delhi.
7. Ramanathan, K.R., 1964. Ulotrichales, ICAR. New Delhi.
8. Philipose, M.T., 1967. Chlorococcales, Indian Council of Agricultural Research, New Delhi, pp: 1-365.
9. Anand, N., 1989. Handbook of blue-green algae. Bishen Singh and Mahendra Pal Singh, Dehradun, India, pp: 1-79.
10. Anand, N., 1998. Indian Fresh water Microalgae. Bishen Singh Mahendrapal Singh, 23-A, Cannought Place, Dehra Dun, pp: 94.
11. Iyengar, M.O.P. and T.V. Desikachary, 1944. A Syatamatic account of some marine myxophyceae of the South Indian Coasts. J. Madras Univ. Sect. B, 16: 37-68.
12. Ramamurthy, V.D., 1968. Studies on phytoplankton in Portonovo waters with reference to *Trichodesmium erythraeum* Her. Ph.D. Thesis, Annamalai University. pp: 137.
13. Ramachandran, S., 1982. Studies on blue- green algae from Porto Novo marine environments. Ph.D. Thesis, Annamalai University, India. pp 157.
14. Anand, N., T. Mohan, R.S.S. Hopper and T.D. Subramanian, 1986. Taxonomic studies on blue-green algae from certain marine environments. Seaweed Res. Utiln., 9(1&2): 49-56.
15. Ramachandra Rao, C.S.V., 1992. Cyanobacteria from the mangroves and estuary, Ph.D, Thesis, Annamalai University, India. pp: 178.
16. Thajuddin, N. and G. Subramanian, 1992. Survey of cyanobacterial flora of the southern east coast of India. Bot. Mar., 35: 305-314.
17. Palaniselvam, V., 1995. Studies on the cyanobacteria *Phormidium tenue* (Menegh.) Gomont for its utility in aquaculture, shrimp-feed and as biofertilizer for mangroves. M. Phil. Thesis, Annamalai University, India. pp: 45.
18. Selvakumar, G. and M. Sundararaman, 2001. Mangrove associated cyanobacterial species in Muthupet estuary. Seaweed Res. Utiln., 23(1&2): 19-22.
19. Selvakumar, G. and M. Sundararaman, 2007. Diversity of cyanobacterial flora in the backwaters of Palk Bay region. Seaweed Res. Utiln., 29(1&2): 139-144.
20. Lugomela, C., 2002. Cyanobacterial diversity and productivity in coastal areas of Zanzibar, Tanzania. Ph.D. Thesis, Stockholm University.