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Diversity of Pediastrum species in Tapti pond Multai (M.P.)

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Abstract
This paper presents the study under-taken for Pediastrum species in Tapti Pond Multai, District Betul (M.P.). A total 11 species of Pediastrum have been identified and recorded from Tapti pond in Multai. Pediastrum is a non-motile, coenobial green algae met with in ponds, ditches and plankton of fresh water lakes and ponds. It prefers still water and avoids flowing or running water. The coenobia are free-floating. The genus includes 30 species. The paper gives descriptions of the genus Pediastrum coenobia and physico-chemical conditions of the habitat. Pediastrum occur in the temperature zone in lower frequency in warm seasons.

Keywords: study of pediastrum, their species, reproduction, cell structure and shapes

Introduction

The present study of Pediastrum in Tapti Pond. The Tapti Pond is located in Multai district Betul (M.P.) at 21.77°N 78.25°E. It has an average elevation of 749 meters (2457 feet). In India Narmada and Tapti are the only two rivers flowing westwards across central India. Multai is one of the southern cities of Madhya Pradesh occupying almost half of the Satpura Plateau. Multai is the holy place and origin of Tapti River. Tapti river flows on either side of the Satpura ranges, travels across Madhya Pradesh over a long stretch, enter Gujarat before joining the Arabian Sea. Rivers are one of the most important sources of water but their pollution due to anthropogenic activities has created a major global problem. Rivers are life line of civilization. The Tapti Pond has been polluted due to human and religious activities. During the study water samples and biotic samples have been collected from the pond.

Algae can make their own food using photosynthesis. Algae can grow faster in warmer temperatures. These algae are found in lakes and ponds and long shores, where water is rich in nutrients, especially nitrogen, they are rare in deep water. Green algae are mainly in fresh water. Only 10% of them are in sea, while 90% are in fresh water. Many other algae play an important role for all creatures. It produces Oxygen through a photosynthetic process.

There is a long history of study on the algal classification, while studies on the dynamics of algal ecology and algal floristic have been taken recently. Study of algae as an indicator of water quality rests on the identifications of different algal taxa present. Therefore to study the quality of water there is a need for taxonomical identification of the algal flora.

A number of researchers have studied the Pediastrum in water bodies. S.K. Rai and P.K. Misra (2012) [9] worked on taxonomy and diversity of genus Pediastrum Meyen in East Nepal. They recorded 10 taxa of Pediastrum in East Nepal.

Distribution of Pediastrum in Dal Lake, Kashmir, by K. Navatha and P. Manikya Reddy (2013) [5]. They identified and described 22 species of Pediastrum. A study on Morpho-taxonomy Hydrodictyon reticulatum Lagerheim and Hansgirg, Hooghly, West Bengal by Nilu Halder (2015) [3]. The two taxa were collected from aquatic ecosystem in Hooghly district.

Ramaraj Rameshprabu *et al*. (2014) [10] research a newly isolated green alga, Pediastrum duplex Meyen, from Thailand with efficient hydrogen production. They all identified and isolated a new green alga, Pediastrum duplex Meyen, from fresh water fish pond at a location near Maejo University, Sansai, Thailand.

Studied at Lakhpat Meena (2017) [7] the fresh water micro-algal diversity-chlorococcales from Sawai Madhopur, Rajasthan, India. 42 species were recorded and described in research paper. Study of order chlorococcales from Jal Mahal Lake of Jaipur by Sharma *et al*. (1999) [11] and chlorococcales identified from Agra in Keetham Lake were published by Tiwari *et al*. (2001) [12]. Report of the abundance of orders in the lake.

Material and Method

Algae and water sample were collection from the Tapti Pond in Multai. This sample was collected for four month (March to June). The samples were brought to the laboratory to study the fresh algal material.

Algal sample were collected at four direction of the Tapti Pond. The floating forms of algal were collected separately in acid washed collection bottles and preserved in 4% formalin for further taxonomic investigations. Studied algal sample were preserved in 3-4% formalin for further examinations and slides were prepared by staining algae by Iodine and mounted in Glycerin.

The collection of water samples were done in bottles and analyzed in the laboratory. The physico-chemical analysis of water samples from the Tapti Pond were carried out by standard methods of APHA (1985). The life in an aquatic ecosystem is directly and indirectly depends on the water quality. Water quality can be defined in the terms of physical, chemical and biological characterization of water.

Cell structure

Pediastrum with some 30 species is a widely distributed algae that grows free-floating in pools, ditches and the plankton of lakes. It rarely occurs in abundance. The coenobia (fixed number of cells) have 2, 4, 8, 16, 32, 64 or 128 Polygonal cells. If coenobium has 16 or more cells, there is a tendency for the cell to be in concentric rings and to have a definite number in each ring.

The cell consists of the cell wall and the protoplast. The cell wall is differentiated into two layers - inner and outer. The inner layer is cellulose and the outer is loose mesh construction. Protoplast is differentiated into the plasma membrane, cytoplasm and the usual cell organelles.

Pediastrum is a genus of green algae in the family Hydrodictyaceae. It is Photoautotrophic non-motile coenobial green alga that inhabits fresh water environments. Pediastrum consists of disk-shaped colonies or coenobia composed of a variable number of cells. Cells are arranged in a concentric pattern with each cell of the outer ring containing one to three spines. Number of cells per colony varies (2-128) depending on the species. Young cells are uninucleate; whereas mature cells may have up to eight nuclei. Pediastrum is green algae forming flat, radially symmetrical, discoid colonies in fresh water. Species differ in the number of cells, always a power of two. The cells are thick-walled and commonly the marginal cells bear two horn-like projections giving the colonies their characteristic appearance.

Reproduction

Pediastrum reproduces asexually by producing auto colonies. Pediastrum produces biflagellate gametes that are formed in the same manner as zoospore. They are spindle-shaped instead of ovoid and fuse in pairs to form a spherical zygote. After the zygote has increased greatly in size, their protoplasts divide to form a considerable number of biflagellate zoospores. The zoospores are berated through a large opening at one side of the zygote walls and they swim freely in all directions after liberation. During asexual reproduction the cell contents divide and form motile spores that arrange themselves into colonies before being liberated sexual reproduction is by motile gametes. Pediastrum reproduces sexually via the fusion of small, biflagellate gametes that are released from the parent cell. The zygotes gamete into zoospores, which turn into thick-walled polyeders that generate the new coenobia. These polyeders can also result from asexual reproduction.

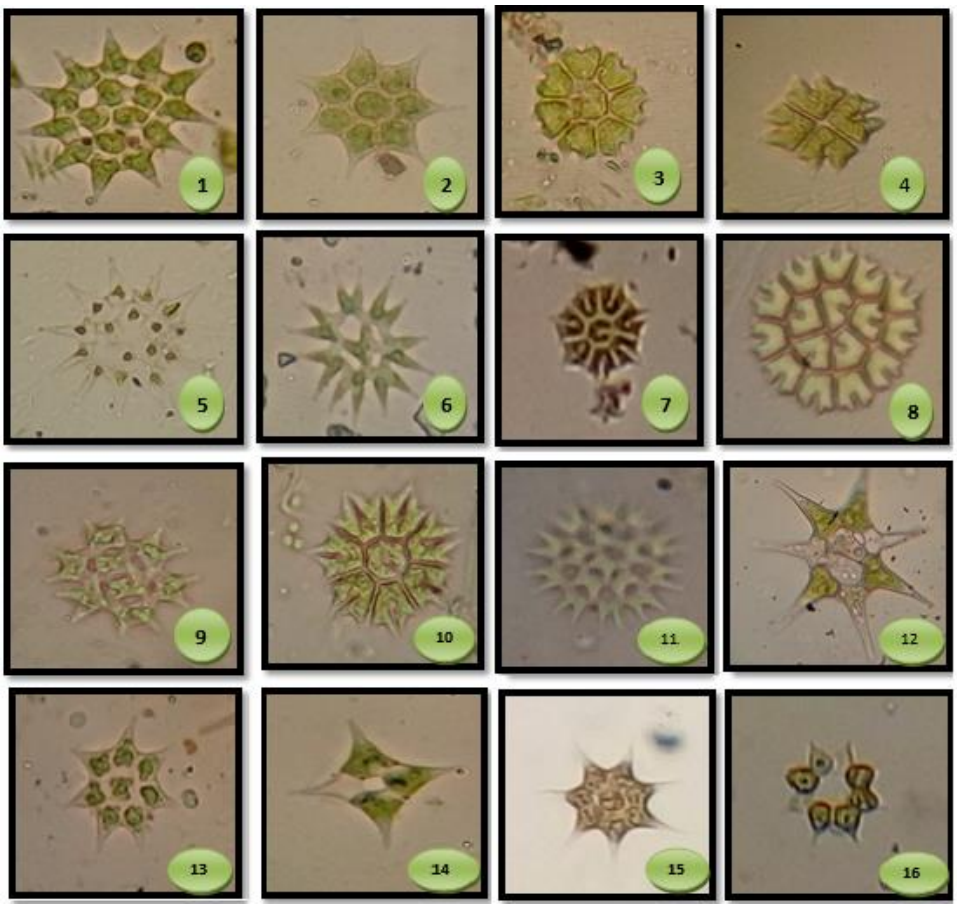

Fig 1: (1), (5) *Pediastrum simplex* var. duodenarium, (2) (13) (15) (14) *P. simplex* var. echinulatum, (4) *P. tetras* var. excisum, (6) *P. duplex* var. gracillimum, (7) *P. tetras* var. (Ehr.) Ralfs (10) *P. biradiatum*, (3) (8) *P. tetras* var. tetraodon (Corda) Hansging, (9) *P. duplex* var. reticulatum Lagerherim, (11) *P. boryanum* (Turpin) Meneghini, (12) *P. simplex* (Meyen) Lemmermann, (16) *P. ovatum* (Ehr.) A. Braun

Result and Discussion

An algae that is in no sense a plankton organisms but one which sometimes grow in abundance in shallow. Algae can be found free-floating in large patches a considerable distance from the shore. Pediastrum occur in the temperature zone in lower frequency in warm season. The above mentioned

investigation shows that in order to protect the water, the inland water such as ponds in relation to dynamic algae vegetation. Should be mentioned for water quality. Ecological studies of algae vegetation of Tapti Pond have not been taken up till now.

Systematic Position

Class: Chlorophyceae
Order: Chlorococcales
Family: Hydrodictyaceae
Genus: Pediastrum Meyen 1829

During the period of study all the Pediastrum species were recorded in Tapti Pond during summer season 2018. The results of our observations are presented below:-

Pediastrum simplex var. duodenarium (fig.1, 5) - Cell wall smooth or finely punctuate. Colonies of 4-8-16-32-64-128 (usually 8-16-32) cells. Cells 8-24µ broad, 10-45µ long, 16 celled colonies upto 125µ diameter.

Pediastrum simplex (Meyen) Lemmermann (fig. 12) - Colonies circular to oval, of 4-8-16-32 or more cells. Inner side of marginal cells nearly straight, outer side produced into a gradually tapering process, side concave. Inner cells polygonal. Cells (7-) 8-13µ broad (15-) 19-26 (-30)µ long.

Pediastrum simplex Meyen var. echinulatum (fig. 2,13,15,14) – Colonies of a fixed number of cells, flat, circular in shape, cell body polygonal in shape, with horn-like projections. Colonies of 4, 8, 16, 32, cells, intercellular space absent, cells 20-30µm long, 6-15µm wide.

Pediastrum tetras var. excisum (fig. 4) – Marginal cells with more or less deeply concave lobes, rest are similar as in P.tetras, colonies 18.5µm in diameter, cells 10.5µm long, 12µm broad.

Pediastrum duplex var. gracillimum (fig.6) - Colonies with very large intercellular spaces. Cells very narrow, as broad or narrower than the processes. Cells 10-18.5 (-22)µ broad, 12-25 (-32)µ long. Perforations 4-16µ in diameter. Sixteen celled colonies 65-140µ in diameter.

Pediastrium duplex var. reticulatum Lagerherim (fig.9) - Cells more or less H – shaped with sides of processes of marginal cells nearby parallel. Inter cellular spaces large and oval. Cells 10-20(-40) µ in diameter. Colonies 8-16.

Pediastrum biradiatum Meyen (fig. 10) – Colonies 4-8-16-32-64 celled with medium sized perforations. Cells 9-22µ board, 15-30 long. Colonies 32- celled, 80-50µ in diameter.

Pediastrum boryanum (Turpin) Meneghini (fig.11) - Colonies circular to oval and usually of 16-32 (rarely 4-8 or up to 128) cells arranged in concentric rings without inter cellular spaces. Horns 7-10µ long, 16 celled colonies up to 100µ in diameter.

Pediastrum tetras (Ehr.) Ralfs (fig.7) -Colonies rectangular, oval, or circular of 4-8-16(-32) cells without intercellular spaces. Marginal cells divided into lobes by a deep linear to cuneate incision on the outer side reaching to the middle of the cell. Eight celled colonies 20-33µ and 16 celled colonies up to 50µ diameter.

Pediastrum tetras var. tetradon (Corda) Hansgirg (fig. 3, 8) - Colonies 4-8-16 celled. Incision of cells deep with the lobes adjacent to the incision of the marginal cells very pronounced. Cells 8-18µ in diameter.

Pediastrum ovatum (Ehr.) A. Braun (fig.16) - Colonies usually 4-8-16 (rarely 32-) celled, with the cells arranged in a ring round a central space or with one or more interior cells and a number of marginal cells, perforate or almost imperforate. Four celled colonies up to 60µ, 8 celled colonies up to 80µ and 16 celled colonies up to 100µ in diameter. Cells 8.5-19 µ broad, 14-37µ long.

Conclusion

This study was done in four months of time for pediastrum species and water quality assessment from Tapti Pond Multai. The Pediastrum are minimum in monsoon and maximum in post monsoon in Tapti Pond. The present study present information of several Pediastrum species and varieties recorded in the Tapti Pond. The genus Pediastrum is a free-floating, coenobial, green algae occurs commonly in natural fresh water lentic environments like ponds, lakes reservoirs etc.

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