International Journal of Botany Studies
ISSN: 2455-541X
Impact Factor: RJIF 5.12
www.botanyjournals.com
Volume 2; Issue 5; September 2017; Page No. 118-120

A study of Closterium in Tapti pond of Multai, district Betul, M.P. India

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Abstract
This paper presents the diversity based study of Closterium in Tapti pond from Multai, district Betul (M.P.). Closterium is a crescent – shaped or elongate desmid. Closterium is a genus of unicellular Charophyte green algae in the family Closteriaceae. Some species of Closterium are straight and needle like, but most are broader with curved ends like smile. The ends of the cell are usually tapered and may be pointed or rounded. This placoderm, unconstricted desmid is found in freshwater reservoirs like ponds, ditches, pools, streams etc, often mixed with some other free-floating algal members.

Keywords: closterium, species, classification, conjugation (reproduction)

Introduction
The source of Tapti river is located in Betul district of M.P. India. The location is also known as Multai. Multai is one of the southern cities of Madhya Pradesh, occupping almost half of the Satpura plateau. Considering the small villages around, it occupies a large area in width of the Satpura range between the valley of the Narmada on the north and the bearer plains on the south. Tapti pond is located in Multai at 21.77º Latitude and 78.25º Longitude. It has an average elevation of 749 meters (2457 feet).

Algae are the most beautiful microflora of the microscopic world. Many species of algae are found in ponds and rivers. Algae act like other plants and convert sunlight in energy, forming the base of a food chain. In the present study maximum number of desmids were observed in Tapti Pond during winter season when the temperature was as low as 18 – 20^0C. The maximum number of desmids were noted in the Tapti Pond in winter. This does not conform to the observations of Rao (1955) [2] who recorded the greatest number of desmids in high water temperature and strong illumination. Pearsall (1932) [3] who noted an abundance of desmids in summer in English Pond and wood-head and Tweed (1947) who found a desmids maxima in spring. According to Raynolds (1973) certain desmids of North Shropshire Meres (chiefly Closterium sp.) were found in many of the waters throughout the year, the highest populations were recorded in autumn and winter. He also has not reported the occurrence of desmid maxima in monsoon.

Charophytes, present in Upper Pond only, were found to flourish best between September and March when temperature varied from 16 to 29^0C and drying out in the later summer season, may be due to their optimum temperature being exceeded. The optimum temperature for the growth of maximum number of Charophytes was found to be 16 – 23 ^{0}C. Dissolved oxygen is one of the most important and oritical factors for aquatic life and its measurement provides valuables clues to the metabolic balance of a pond. The principal sources of dissolved oxygen to the water are direct from the atmosphere through the exposed surface and from the photosynthesis of chlorophyll bearing plants. Production of oxygen by plants and its consumption by plants, animals and bacteria. So the amount of oxygen present at any time in the pond will be the resultant of several factors mentioned above (Ganapati, 1943) [5]

Closterium is a crescent-shaped or elongate desmid. Some species are straight and needle like, but most are broader with curved ends rather like smile. The ends of the cell are usually tapered and may be pointed or rounded. The structure of these algae is unicellular, while the cell is sometimes divided into two compartment separated by a narrow bridge, where in the spherical nucleus is located. Each semi-cell houses a large, often folded chloroplast for photosynthesizing.

Closterium cell walls have pores to secrete mucilage, even though the cells are only slightly constricted in the middle compared to other placoderms. The cell wall may be smooth or lined by thin longitudinal striae or large pores that are visible with high resolution microscopy. The wall is sometimes yellow or brown in colour. Some species have extra sections in the cell wall called girdle bands. Polymers in the cell wall may help protect the cell from drying out and allow them to survive for months in environments such as the dried mud at the edges of lakes. Like some desmids, closterium can move in a somersaulting motion by secreting mucilage from the ends of the cell.

Study Area
Tapti pond are located in Multai district Betul (M.P.) at 21.77º Latitude and 78.25ºLongitude. It has an average elevation of 749 meters (2457 feet).

Algal samples were collected from the Tapti pond in pre-monsoon, monsoon and post-monsoon. The climate of Multai is characterized by a hot summer and general dryness except rainfall during the south-west monsoon season. The south-west monsoon starts from middle of June and lasts till end of

September. October and middle of November constitute of the post monsoon or retreating monsoon season. The normal annual rainfall of Betul district is 1192.6 mm.

The samples were mainly collected in monsoon season. Studied algal samples were preserved in 3-4% formalin for further examination and slides were prepared by staining chlorophycean algae by Iodine and mounted in Glycerine.

Method and Materials-

Algal sample of the pond were studied from June 2017 to October 2017 for a period of five months. The algal specimens were collected regularly from floating habitat, attached with some sub merged plants and growing on side walls of pond. Algae samples were preserved in 3-4% formalin for further examinations and slides were prepared with suitable stains and observed under compound microscope and picture were taken by Nikon camera. Micrometric measurement with the help of stage and ocular micrometer has been taken. It is a widely distributed solitary desmid found at the bottom of ponds and drains. There are 23 genera and some 2500 species in all fresh-water. Some species occur intermingled with other free floating fresh water algae.

Table 1: Different species of Closterium

Sr. no.	Name of Species	Pre-monsoon	Monsoon	Post-monsoon
1	Closterium acerosum	√	x	√
2	Closterium calosporum	x	√	x
3	Closterium cornu	x	x	√
4	Closterium ehrenbergii	√	√	√
5	Closterium littorale	x	√	x
6	Closterium lunula	√	x	√
7	Closterium moniliferum	x	x	√
8	Closterium evesiculatum	√	x	√
9	Closterium dianae	x	√	√
10	Closterium closterioides	x	x	√

Result and Discussion

Closterium is a common desmids in most fresh water habits. The genus closterium is the best characterized charophycean green algae with respect to the process of sexual reproduction. In the process of sexual reproduction, two sexually competent cells recognize each other, followed by conjugation or fertilization. In some algae, dormant zygospores are formed as a result of sexual reproduction and show resistance to severe environmental conditions, such as drought stress. The desmids closterium,which belong to zygnematophyceae, is the most successfully characterized unicellular charophycean in terms of the maintenance of strains and sexual reproduction.

The cell wall of each vegetative cell consists of two halves, of which one half is older than the other and belongs to previous generation. Cell wall of Closterium contains many mucilage-secreting pores. Each cell contains two beautiful chloroplasts located one in each semicell. Each chloroplast is elongate or rod-shaped having many longitudinal ridges.

Classification of Closterium

Kingdom- Plantae
Phylum- Charophyta
Class- Chlorophyceae
Order- Desmidiales / Zygnematales
Family- Closteriaceae / Desmidiaceae
Common name- Green algae / Desmid
Genus- Closterium

Fig 1

Reproduction

A sexual reproduction is by cell multiplication via transverse division. Mature cells may undergo conjugation where by the cell walls breaks and the cell contents migrate towards each other. The resulting zygote germinates forming two individual cells.

These algae (closterium) are capable of forming two types of dormant diploid zygospores. Some populations form zygospores with in single clones of cells (homothallic), where as others form zygospores between different clones of cells (heterothallic). The heterothallic strains have two mating types, mt(-) and mt(+) cell pair with each other and release protoplasts. Then paired cells release their protoplasts to form zygospores. Sex pheromones termed protoplast release inducing proteins produced by mt(-) and mt(+) cells facilitate this process.

Conclusion

This study was done in a short period of time for (closterium) algae from Tapti pond at the origin of Tapti river in Multai district Betul of Madhya Pradesh.

Therefore from the above study it is concluded that closterium is dominant in Tapti pond. The closterium are minimum in monsoon and maximum in post monsoon in Tapti pond. Local people who are engaged in washing cloths and discharge soap water and people from the surrounding area discharge their waste and domestic sewage directly into the pond. There are some reasons of water pollution. The study of closterium were collected and identified by using the method suggested by APHA (1985) and fresh water biology.

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