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Diversity of fresh water algae of river Tapti. Part-II (Bhusawal, Maharashtra, India)

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Abstract
The present paper enumerates the data on the algal biodiversity of Tapti fresh water river situated within the Jalgaon district of Maharashtra state (India). It's the survey of algal flora of different sites of selected study area of river Tapti for the purpose of reporting the algal taxa. Microphotographs are taken from using Binocular research microscope in combination of digital camera. In the present investigation, numbers of algal species - Microphotograph have been recorded belonging to Class Chlorophyceae.

Keywords: Diversity, Tapti River, fresh water algae, Chlorophyceae, colony, Bhusawal, India

Introduction
Algae are a ubiquitous and ecological important group in most aquatic ecosystems. Algae constitute a part of food chain of aquatic life in the water. The oxygen production and utilization of nutrient substances by algae may be greatly modified color, odor or taste of the water. Unfortunately, pollution of the environment is one of the most horrible ecological crises to which we are subjected today. Palmer (1969) [18] studied on the floristic pattern and ecology of polluted water. Algae were prime importance to understand the basic problems correlated on account of pollution and its detrimental effect. Because algae respond rapidly to changes in environmental conditions also. It is well established fact that growth of aquatic organisms is controlled by physical and chemical properties of water.

Methodology
Algal collection were collected at monthly interval during Jan.2013 to Dec.2014 from the study of ecology of algae in specimen bottles during 8 to 10 A.M. Algal materials were brought to the laboratory after collection for further study. For taxonomic studies important characters of the taxa were studied as far as possible from fresh material and remaining material were preserved in 4% formalin for further studies. The attached epiphytic and floating form of algae were collected in acid washed container bottles separately and immediately preserved in 4% formalin for further taxonomic investigations.
For qualitative study of algae, Microphotographs were taken of some important taxa. Total 92 Collections were done at Four stations like T-1 is Deepnager-Thermal power station. T-2 is Water pumping at Bhusawal., T-3 is near bridge at Bhusawal-Yawal road.,T4 is beyond old pool-near Zugadevi temple. Identification of taxa was done in Four groups like Chlorophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae, Identifications are mostly based on the monograph of Philipose, Iyengar, M. O. P., Desikachary, T. V., Pascher, A., Prescott, Daniel, J.K., Gartner, G. Printz, H., Jagg, with the different Monographs, relevant literature's and published works. But in current Paper (Diversity of Fresh Water Algae of River Tapti. Part-II)
Contain Only Chlorophyceae flora was given.

Taxonomical account
Name of Taxa (Description.Plate-01)
1. *Pediastrum duplex* v. *asperum* (A.Br.) Hansg.
2. *Pediastrum obtusum* Lucks.
3. *Pediastrum simplex* Meyen v. *duodenarium* (Bailey) Rabenh.

4. *P. sturmii Reinsch* v. *echinulatum* (Wittr. Et Nordst.) Lemm.
5. *Pediastrum tetras* v. *tetraedon* (Corda) Hansgirg.
6. *Hydrodictyon reticulatum* (Linn) Lagerheim.
7. *Tetraedron triangulare* Korsch.
8. *Tetraedron regulare* v. *incus* Teiling.

1. *Pediastrum duplex* v. *asperum* (A.Br.) Hansg
Philipose, M. T. 1967, P. 123.
Colony 32 celled 136.4 µm in diameter, with inter-cellular spaces. Marginal cells with thick lobes which end in stout, toothed processes, cell membrane decorated with small Denticulations, cells 18-22.7 µm in diameter.

2. *Pediastrum obtusum* Lucks
Prescott, G. W. 1982, P. 226, Pl. 49, Fig. 6.
Colonies nearly entire, with minute interstices formed by the retuse margins of some cells; colony oblong, rarely sub circular (the rows of cells arrange: 7-1.), composed of from 8 cells which have a deep narrow sinus forming 2 major lobes, the lobes inside to form bluntly rounded lobules, the two central lobules in contact or nearly so, thus closing the sinus outwardly, interior cells about the same shape as the peripheral cells but with the lobules less prominent, sometimes wanting, with the wall merely emarginated or nearly straight; cells 10.5-18 µm in diameter; 8-celled colony up.

3. *Pediastrum simplex* Meyen v. *duodenarium* (Bailey) Rabenh
Philipose, M. T. 1967, P. 115, Fig. 36h.
Differs from the type in having large intercellular spaces or a single central space with the cells arranged in a ring at the periphery, inner face of marginal cells concave, outer face prolonged into a single delicately tapering process. Sides of marginal cells also concave or nearly straight, interior cell similar to marginal cells but with shorter processes, cell wall smooth or finely punctuate, colonies of 4-8-16-32-64-128 (usually 8-16-32) cells. Cells 8 are 21-26 µm broad.

4. *Pediastrum sturmii* Reinsch v. *echinulatum* (Wittr. et Nordst.) Lemm
Hortobagyi, T. 1973, P. 78, Fig. 305. Colony 8-16 celled, up to 65 µm in diameter; cells covered with spines, cells 10-15 µm in diameter, 21.6-26.5 µm long. There are no interring cellular cavities between the cells.

5. *Pediastrum tetras* v. *tetraedon* (Corda) Hansgirg
Philipose, M. T. 1967, P. 129, Figs. 45 d, e, g.
Coenobia 8-16 µm celled, 40.9 µm diameters, cells 13.2-15.8 µm in diameter. Incision of cell deep with the lobes adjacent to the incision of the marginal cells pronounced.
Genus: *Hydrodictyon* Roth, 1800

6. *Hydrodictyon reticulatum* (Linn) Lagerheim
Philipose, M. T. 1967, P. 134, Fig. 48
Colonies reticulate, meshes pentagonal or octagonal cells elongate-cylindrical, 8.2- 11 µm broad and 36.4-44.5 µm long, net up to 10 cm. long.
Subfamily - Tetraedronoideae
Genus: *Tetraedron* Kuetzing, 1845**.**

7. *Tetraedron triangulare* Korsch.
Hortobagyi, T. 1973, P.81, Fig. 345.
Cells long 7.5-19 µm slightly concave membrane punctuate, poles cary a small verruca each.

8. *Tetraedron regulare* v*incus incus* Teiling
Prescott, G.W. 1982, P.269, Pl. 61, Figs. 4-7.
Cells 12-20 µm in diameter without spines, cells tetragonal, flat or pyramidal concave lateral margins the angles slightly produced to form short lobes each tipped by a long spine.

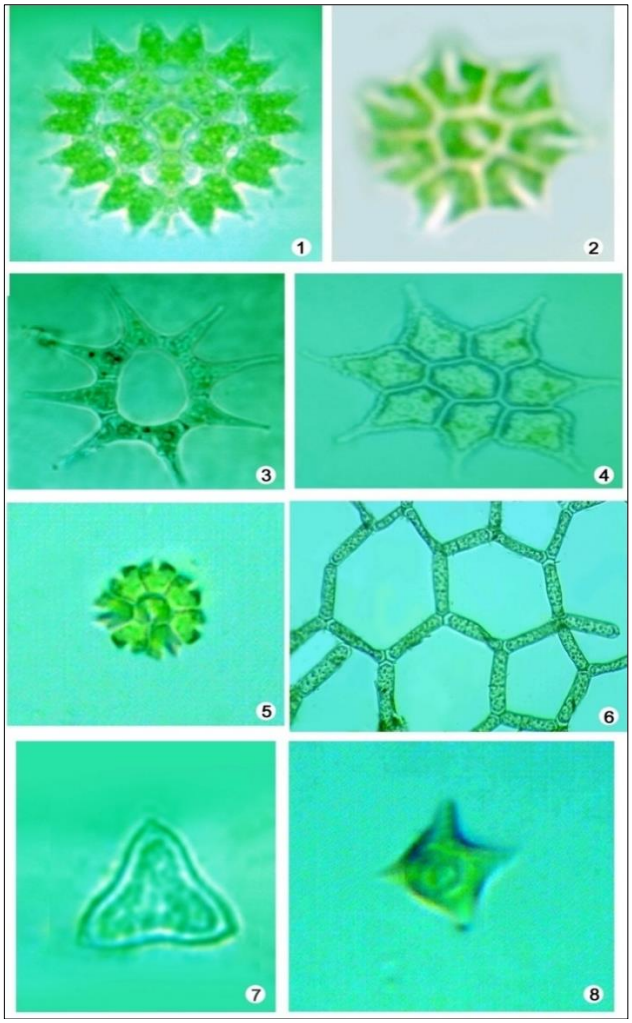

Plate 1

Name of Taxa. (Description- PLATE: 02)
1. *Closteridium siamensis* (W. et G. S. West) G. M. Smith.
2. *Franceia brevispina* (Fritsch) Hegewald.
3. *Chlorella vulgaris* Beijerinck.
4. *Palmellococcus saccharophilus* (Krueger) Chodat.
5. *Oocystis borgei* Snow.
6. *Oocystis crassa* Wittrock.
7. *Oocystis elliptica* W. West.
8. *Oocystis gigas* Archer.

Genus: *Closteridium* Reinsch 1888
1. *Closteridium siamensis* (W. et G. S. West) G. M. Smith.
Philipose, M. T. 1967, P. 142, Fig. 76. Cells solitary, free-floating and semispherical with the inner side more or less straight and the outer side convex, each end with slightly recurved spine, the two spines being usually unequal, cells 21-29 µm broad, 66-77 µm long.

Genus: *Franceia* Lemmermann, 1898
2. *Franceia brevispina* (Fritsch) Hegewald.

Hegewald, E. Schnep, E. and Aldave, A. 1980, P. 395, Fig.10. Colonies 4-celled, 15.5-25.5 µm in diameter; cells spherical, 8-9.9 in µm diameter, chloroplast parietal, pyrenoid single in each cell.

Subfamily - Chlorelloideae
Genus: *Chlorella* Beijerinck 1890
3. *Chlorella vulgaris* Beijerinck
Prescott, G.W. 1982, P.237, Pl.53, Fig.13 Cells solitary, spherical, free living; rarely in small colonies, membrane thin, chloroplast parietal, cup shaped with a pyrenoid. Cells 8.8-12.8 µm in diameter.

Genus: *Palmellococcus* Chodat, 1894b
4. *Palmellococcuss accharophilus* (Krueger) Chodat
Chodat, R. 1909, P.103. Cells spherical to ellipsoid, solitary, pear shaped. Cell membrane thin, colourless and slimy. Chromatophore in the form of a flat plate and devoid of a pyrenoid.

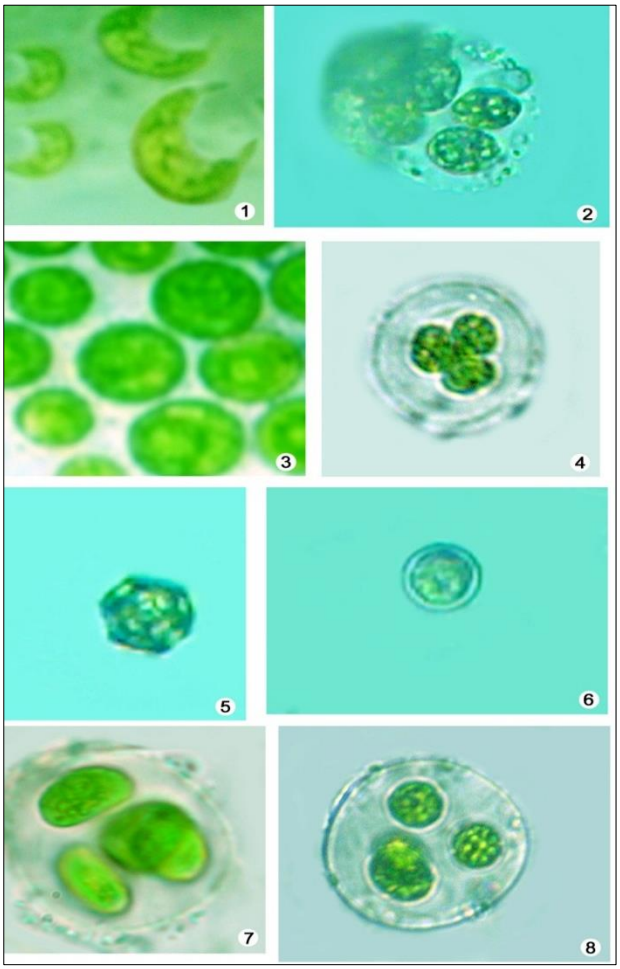

Plate 2

Subfamily - Oocystoideae
Genus: *Oocystis* Naegeli in A. Braun, 1855
5. *Oocystis borgei* Snow
Prescott, G. W. 1982, P. 243, Pl. 51, Fig.10. Unicellular or crowded in groups of 2-8, enclosed by the old mother cell wall; ellipsoid or ovate cells with the poles broadly rounded and smooth; chloroplasts 1 or as many as 4 parietal plates, each with a pyrenoid; cells 10 -15 µm in diameter, 12-18 µm long; colony of 3 celled, up to 31 µm in diameter, 34-38 µm long.

6. *Oocystiscrassa* Wittrock
Wittrock, V.B. and C.F.O. Nordstedt, 1880, P.117.
Cells solitary or in colonies of 2-4, ellipsoid, nearly twice as long as broad and with mammillary thickenings at the poles. Chloroplast large parietal with a pyrenoid, cells 8.5-11.7 µm broad, 20.8-27.5 µm long.

7. *Oocystis elliptica* W. West
Philipose, M.T. 1967, P.186, Fig.100.
Usually in 4-8 celled colonies with the envelope narrow, rarely solitary, cell elongateellipsoid, about 2½ times as long as broad with broadly rounded ends, chloroplast parietal without pyrenoids. Cells 11-15.6 µm broad, 20-25 µm long.

8. *Oocystis gigas* Archer
Philipose, M. T. 1967, P.183, Fig.94. Colonies 2-4 cells, envelope more or less round and narrow; cells broadly ellipsoid, about 1½ times longer than broad with the ends broadly and not thickened; cells usually 4.0-5.0 µm broad 4.1-5.1 µm long.

Results and Discussion
The biodiversity in specific area, water temperature played an important role in controlling the occurrence and abundance of algal flora supported by (Singh, V.P. 1960; Nandan and Patel; 1984a) [16. 12]. Study should be useful for sustainable development; Algae are the important component, since it is oxygen donor and primary producer in aquatic food chain. Algae being used for certified water quality. (Palmer 1969) [18] made identification of many genera and species of pollution index, as an indicator of organic pollution. For algal utility such as use in Medicine, Agriculture & Edible algal flora etc. Rout, Jayashree (2009) [21] observed algal diversity in Chatla Wetland in Cachar district Assam. Veeresha Kumar *et al*. (2010) [24] made assessment of algal biodiversity and Pollution in Santhe (Darga) Lake (Mysore District) Karnataka. They occurs total 168 planktonic algae. Raghuvanshi *et al*. (2011) [19] carried out biodiversity of algae in river Narmada at Hoshangabad. They reported 128 species of phytoplankton and group Chlorophyceae were dominant among others**.** Ravishankar *et al*. (2012) [20] encountered diversity of fresh water algae in two lakes of Tumkur. Kumar, Rita *et al*. (2010-12) [24-25] investigated spatial variation in phytoplankton diversity in the Sabarmati River at Ahmadabad, Gujarat. Chopra *et al*. (2013) [3] studied biodiversity and community composition of phytoplankton in three lentic water bodies of different human. Hariana. They indicated that seasonally the total population was high during summer months. Gunale and Chaugule (1980) [8] studied the importance of benthic algal flora in evaluation of pollution in rivers in Poona, Maharashtra. Same investigator (1980) encountered 46 benthic algae from Pavna, Mula and Mutha rivers at Poona., Somani *et al*. (2003) [22] specifically studied the dynamics of Chlorophyceae in phytoplankton of lake Masunda, Thane. They found Pediastrum and Scenedesmus as the consistent genera contribution to the peak of Chlorophyceae. contributed to the Algal flora (Chlorophyceae) of Namchi, Sikkim-Himalayas. They done survey of fresh water algal flora and search 13 taxa of Chlorophyceae. Sreelatha and Rajalakshmi (2005) [23]

studied the Chlorophyceae in river Goutami-Godavari Yanam U.T. of Pondicheri.

Conclusion

As above references, for study the algae & plankton was very important to the view of science & society**.** Because the microphyte's and macrophyte's communities in natural water were in definite order, they play an important role in keeping the water clean. Algae constitute a part of food chain of aquatic life in the water. Collected algal samples from different stations of river Tapti at monthly interval for the study of ecology of algae qualitatively examined. The survey of algal flora of different sites of selected study areas of river Tapti for the purpose of reporting the algal taxa as well as Algal Biodiversity was known. Life, Prosperity and Civilization revolve around water in the Indian sub-continent. The oxygen production and utilization of nutrient substances by algae may be greatly modified the color, odor or taste of the water. So the further uses of water were known.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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