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Diversity of fresh water algae of River Tapti Part-I at 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, fresh water algae, Tapti River, 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) studied on the floristic pattern and ecology of polluted water algae was 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 collectedat 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 group like Chlorophyceae.
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-I)
Only Chlorophyceae flora was given.
"TAXONOMICAL ACCOUNT"
Class-Chlorophyceae
Order Volvocales
Family-Chlamydomonadaceae
Genus: *Sphaerellopsis* Korsch. 1925.

1. *Sphaerellopsis reticularis* Iyengar.
Iyengar, M. O. P. and Desikachary, T. V. 1981 [10], P. 235, Fig. 131:5.
Cell 12-15 µm broad, 12.5-14.9 µm long, sphere-shaped; protoplast 9.5 µm long, 8.5 µm broad; protoplast removed away from the wall, often with a visible thin periplast closely investing it, ovate, metabolic, appearing in section somewhat lobed; chloroplast cup shaped, with a number of pyrenoids, parietals; eyespot median; contractile vacuoles 2, anterior; flagella 2, shorter than the body; cyst wall thick, mucilaginous.

Habitat: station T-4 in Aug. 2013, Coll. No.28 and station T-4 in Aug. 2013, Coll. No.40.

Genus: *Chlamydomonas* Ehrenb. 1833.
2. *Chlamydomonas conferta* Kors.
Pascher, A.1927, Die Suswaser-Flora, 4:216, Fig. 161-C.
Cells sphere-shaped, 10-18 µm in diameter; cell wall thick, with a small broad blunt papilla; flagella as long as the cell; chloroplast cup-shaped, with a prominently thickened, basal portion, occupying the posterior half even up to the anterior third; pyrenoid single axial, in the basal portion; eyespot single, large, median; contractile vacuoles two, anteriorly.

Habitat: station T-4 in Aug. 2014, Coll. No.76 and station T-4 in Sept. 2014, Coll. No.80.

Genus: *Carteria* Diesing 1866 em. Dill 1895.
3. *Carteria klebisii* (Dang.) Dill.
Prescott, G. W. 1982, P.73, Pl.17, Fig. 1.
Cells ellipsoid, narrower at the anterior end, which is sharply rounded with a papilla around which the flagella arise. Chloroplast a massive parietal cup, with 1 basal pyrenoid; pigment-spot lacking. Cells 5-15 µm in diameter, 12-18 µm long.

Habitat: Station T-1 in Dec. 2014, Coll. No.89, station T-3 in Aug. 2013, Coll. No. 39.

Genus: *Pteromonas* Seligo 1886.
4. *Pteromonas angulosa* (Carter) Lemm.
Iyengar, M.O.P. and Desikachary, T.V. 1981 [10], P. 362, Text Fig. 209: 37-40.
Cells broad-elliptical, oval; cell 12.8-15.5 um long, 10.9-13.7 um. Broad; posterior end rounded, long spindle-shaped to ovoid; lorica smooth, lateral wing like structures 7 µm thick; protoplast ovoid, biconvex, chloroplast cup-shaped, with a single pyrenoid.

Habitat: Station T-4 in Aug. 2013, Coll. No.28 and station T-4 in Aug. 2013, Coll. No.40.
Family: Volvocaceae
Genus: *Volvox* L. 1758 emEhrb. 1832.

5. *Volvox aureus* Ehr.
Iyengar, M.O.P. and Desikachary, T.V. 1981 [10], P. 468-470. Fig. 274.
Asexual colonies ellipsoidal, 250-450 um. Broad, 320-500 um. long, 1,300-3,000 celled; cells ovoid, connected, with one another by delicate cytoplasmic strands, internal portion of the colony filled with a homogeneous gelatinous mass, gonidia (4-) 5-9 (-12) per colony, irregularly distributed in the posterior half or 2/3 of the colony, 18-22 µm in diameter, dividing simultaneously; mature embryos Sub globose.

Habitat: Station T-2 in May and Apr. 2014, Coll. No.62 and 58 and station T-2 in Aug. 2014, Coll. No. 74.

Genus: *Sphaerocystis* Ettl, 1960.
6. *Phaeocystis globosa* Ettl.
Ettl, H. et. Gartner, G. 1988, P. 106-107, Fig. 80.
Cells solitary or in groups of 2-4 covered by a gelatinous sheath; chloroplast cup shaped with a large basal pyrenoid sheath 18.5-20 µm in diameter, cells 8.4-12.9 um. Broad, 9.2-12.2 µm. long.

Habitat: Station T-1 in Aug. 2013, Coll. No.37 and station T-1 in July. 2014, Coll. No.69.
Order: Chlorococcales
Family: Chlorococcaceae

Genus: *Chlorococcum* Meneghini emend. Starr, 1955.
7. *Chlorococcum humicolo* (Naegeli) Rabenhorst.
Philipose, M. T. 1967 [17], P. 73, Fig. 3.
Cell spherical, solitary or a number of cells crowded together to form a stratum; chloroplast a hollow sphere with a lateral notch and a single pyrenoid; cells 2-25 µm in diameter.

Habitat: Station T-1 in Nov. 2013, Coll. No.37, station T-1 in Aug. 2014, Coll. No.73 and station T-3 in Apr. 2014, Coll. No. 59.

8. *Chlorococcum infusionum* (Schrank) Meneghini.
Philipose, M. T. 1967 [17], P. 73, Fig.1.
Cell spherical and of variable dimensions; chloroplast completely filling the cell with single pyrenoid; cells 11.5-15.8 µm in diameter.

Habitat: Station T-4 in Oct. 2013, Coll. No.36, station T-2 in Aug. 2013, Coll. No. 26 and station T-4 in May. 2013, Coll. No. 20.

9. *Chlorococcum vitiosum* Printz.
Printz, H. 1921, P. 10, Pl. 1, Fig. 31-51.
Cells spherical with a thin cell-wall which is usually smooth, but sometimes crenulated on the outside locally or all over the surface, cells 10.2-14.5 µm in diameter; chloroplast hemispherical, with the edge even or sometimes emarginated or denticulate without a pyrenoid; nucleus central.

Habitat: station T-3 in Aug. 2013, Coll. No.41, station T-4 in Aug. 2014, Coll. No.76s and station T-1 in July. 2014, Coll No.69.
Family: Characiaceae
Genus: *Characium* A. Braun ex Kuetzing, 1849.

10. *Characium ambiguum* Hermann ex Rabenhorst.
Philipose, M.T. 1967 [17], P. 82-83, Fig.7.
Cells elongated and oblique; apex in the form of a hyaline beak, attached to the substratum by a short stalk without basal thickening; cells 3.8-7.3 µm in diameter, 19.6-28.4 µm long.

Habitat: station T-3 in Jun. 2013, Coll. No.23, station T-4

in Aug. 2014, Coll. No.76 and station T-4 in Aug. 2013, Coll. No. 40.

11. *Characium angustum* A. Braun
Philipose, M. T. 1967 [17], P. 84, Fig. 10.
Cells straight and lanceolate with a short hyaline apical beak, stalk short and thick with a colorless, disc-shaped basal thickening; cells 12-25 µm broad and 42-110 µm long.

Habitat: station T-4 in Feb and Dec. 2014, Coll. No 52 and 92 also, station T-4 in Aug. 2014, Coll. No.76.

12. *Characium debaryanum* (Reinsch) De. Toni.
Philipose, M. T. 1967 [17], P. 85, Fig. 12.
Cell ellipsoid with a short stalk enlarged at the base into an adhesive disc, or forked, cells 9-12 µm broad and 14-17 µm long.

Habitat: Station T-4 in Aug. 2013, Coll. No.28, station T-1 in Aug. 2014, Coll. No.73 and station T-1 in Aug. 2013, Coll. No.37.

13. *Characium ensiforme* Hermann.
Philipose, M. T. 1967 [17], P. 85.
Cell linear lanceolate with unequal curvature on two sides with short stalk without an attaching disc. Cell 6.5-9.2 µm broad and 35.5-38.5 µm long.

Habitat: station T-3 in Aug. 2013, Coll. No.27, station T-3 in Aug. 2013, Coll. No.39, station T-3 in Sept. 2014, Coll. No.80 and station T-4, Aug. 2013, Coll No. 40.

14. *Characium gracilipes* Lambert.
Prescott, 1970, P. 217, Pl. 45, Fig. 16.
Cells elongate, cylindrical, slightly curved, abruptly tapering anteriorly and extended to form a long hyaline hair and abruptly tapering below to a slender stripe with 2 to 3 fine rhizoidal branching at the base. Cells 2.5-5.0 µm broad and 32-40 µm long.

Habitat: Station T-2 in Aug. 2014, Coll. No.74 and station T-4 in Dec. 2014, Coll. No. 92.

15. *Characium lanceolatum* Jagg.
Jagg, 1938, P. 119-120, Fig. 26.
Cell rhombic lanceolate on a thick stalk with a basal attaching disc and broadly rounded anteriorly. Chloroplast laminate, nearly covering the entire wall with single pyrenoid. Cell 12-16 µm broad and 29.5-35 µm long.

Habitat: Station T-3 in Aug. 2013, Coll. No.39 and station T-3 in Sept. 2014, Coll. No. 80.

16. *Characium obtusum* A. Br. v. *Philiposii* Dhande et. Jawale.
Daniel, J.K. 1981 [5], P25-26, Pl-1, Fig 10.
Cell 10.8-15.5 µm broad, 30.7-34.5 µm long, oblong-ovate, anterior end rounded with thickened plug at the apex; stalk short; chloroplast parietal with a single pyrenoid.

Habitat: Station T-4 in July. 2014, Coll. No.72 and station T-4 in Dec. 2014, Coll. No. 92.

17. *Characium orissicum* Philipose.
Philipose, M. T. 1967 [17], P. 85.
Cells club shaped with broadly rounded apex and gradually attenuated base forming a very short stalk, thick, which enlarge at the base into an adhesive disc. Cell 12.7-15.5 µm broad and 22-26 µm long.

Habitat: Station T-3 in Aug. 2013, Coll. No.39 and station T-3 in Dec.2013, Coll. No.43 and station T-3 in Sept.2014, Coll. No.80.

18. *Characiumorn polycephalum* A. Br.
Prescott, G. W. 1982, P. 218, Pl. 46, Fig.14.
Cell asymmetrical, ellipsoid, convex on one side and nearly straight or slightly swollen on other side with a sharp pointed apex, stalk long with basal attaching disc, pyrenoid single, cell 5.7-10.9 µm in diameter, 23.8-46.8 µm long.

Habitat: Station T-1 in May. 2013, Coll. No. 19, station T-4 in Aug. 2013, Coll. No.40 and station T-1 in Aug. 2014, Coll. No. 73.

19. *Characium pringsheimii* A. Braun.
Prescott, G. W. 1982, P. 218, Pl. 45, Fig. 21 Cells narrowly elongate-ovoid to fusiform, erect but with a short oblique tip; stripe short; chloroplast with 1 pyrenoid; cell 7.8-16 µm in diameter, 23-34 µm long.

Habitat: Station T-2 in Apr. 2014, Coll. No. 58, station T-2 in Aug. 2014, Coll. No.74 and station T-2 in Dec.2014, Coll. No. 90.
Family: Micractiniaceae
Genus: *Trochiscia* Kuetzing, 1845.

20. *Trochiscia aciculifera* (Lagerh.) Hansgirg.
Philipose, M. T. 1967 [17], P. 99, Fig. 22.
Cells spherical to ovoid, solitary or in colonies of 2-4 embedded in mucilage. Cell wall thick and covered by numerous sharply pointed spines, cell 12-16 µm in diameter. Spines 2.5-4.5 µm long.

Habitat: Station T-3 in Aug. 2013, Coll. No.39, station T-1 in Jun. 2014, Coll. No. 65 and station T-3 in Aug. 2014, Coll. No. 75.

Plate:2. Genus: *Eremosphaera* De Bary, 1858.
1. *Eremosphaeraoocystoides* Prescott in Prescott.
Prescott, G.W. 1982, P. 240, Pl. 46, Fig.12.
Colony 4 celled, up to 32-39 µm long; cells elliptical; 4 cells in a old mother cell wall which are ovate; it often appearing spiny and showing flattened, thickened poles; cells 6-12 µm in diameter and 12-20.5 µm long.

Habitat: Station T-4 in Aug. 2013, Coll. No.40, station T-4 in Sept. 2014, Coll. No. 81, station T-4 in Apr. 2014, Coll. No. 60 and station T-4 in Jan. 2014, Coll. No. 48.

Genus: *Golenkinia* Chodat, 1894.

2. *Golenkinia radiate* (Chod.) Wille.
Prescott, G.W. 1982, P. 57, Pl.45, Fig.3.
Spherical, free, floating, solitary, unicell with long, slender tapering setae, false colonies sometimes formed by the

interlocking sets; cells 18.5-25.5 µm in diameter; setae 15-22 µm long.

Habitat: Station T-2 in Dec.2014, Coll. No. 90 and station T-2 in Jan. 2014, Coll. No. 66.

Genus: *Micractinium* Fresenius, 1858.
3. *Micractinium pusillum* Fresenius.
Philipose, M.T. 1967 [17], P. 104-105, Fig. 29.
Colonies of 4-8-16 cells, cells spherical with thin cell membrane with 2.2-3.9 µm long hyaline setae from their outer surface. Chloroplast single, parietal, cup shaped with a pyrenoid. Cell 5.2-7.7 µm in diameter; setae 11-20 µm long.

Habitat: Station T-3 in Jan.2014, Coll.No.47 and station T-3 in Jul. 2014, Coll. No.71.

4. *Micractinium quadrisetum* G.M. Smith.
Prescott, G.W. 1982, P. 288, Pl.68, Fig.1.
A free-floating colony of 4 ovate cells, wall with 1-4 very long, finely tapering setae; chloroplast a parietal cup with 1 pyrenoid; cells 4-7 µm in diameter, 8-12 µm long; setae 23-45µm long.

Habitat: Station T-3 in May 2013, Coll. No.19, station T-3 in Jun. 2014, Coll. No.67, station T-3 in Aug. 2013, Coll. No.39 and station T-3 in Sept. 2014, Coll. No. 80.
Family: Hydrodictyaceae.
Subfamily: Hydrodictyoideae.

Genus: *Pediastrum* Meyen, 1829.
5. *Pediastrum boryanum* Longicorne Reinsch.
Philipose, M. T. 1967 [17], P. 119-120, Fig. 40b.
Colony 16-32 celled, circular, intercellular spaces absent, cells sides are straight, outer cells with two long processes ending bluntly. Cell wall smooth. 16 celled colony 40 µm in diameter and 32 celled colony 70.9-110 µm in diameter, cells 3.5-12.5 µm in diameter and 12.5-20 µm long; processes 7.2-9 µm long.

Habitat: Station T-1 in Feb. 2014, Coll. No.49, station T-1 in Jun. 2014, Coll. No.65 and station T-1 in Aug. 2014, Coll. No. 73.

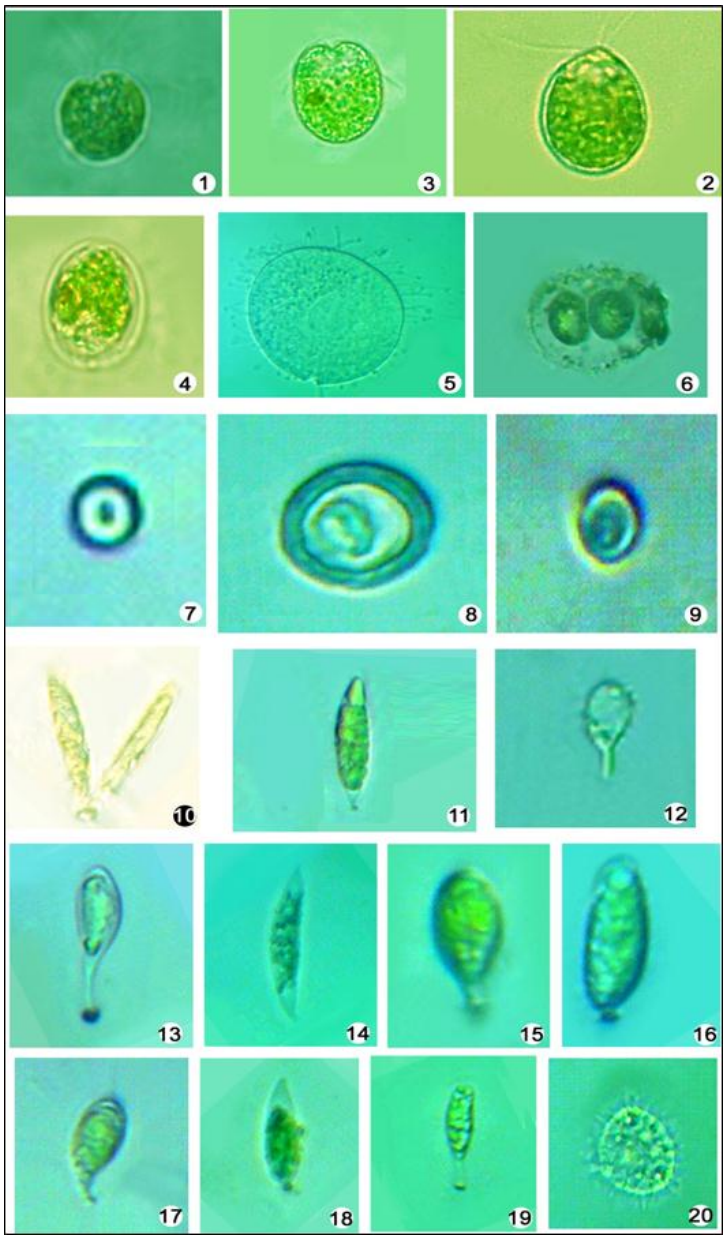

Plate 1

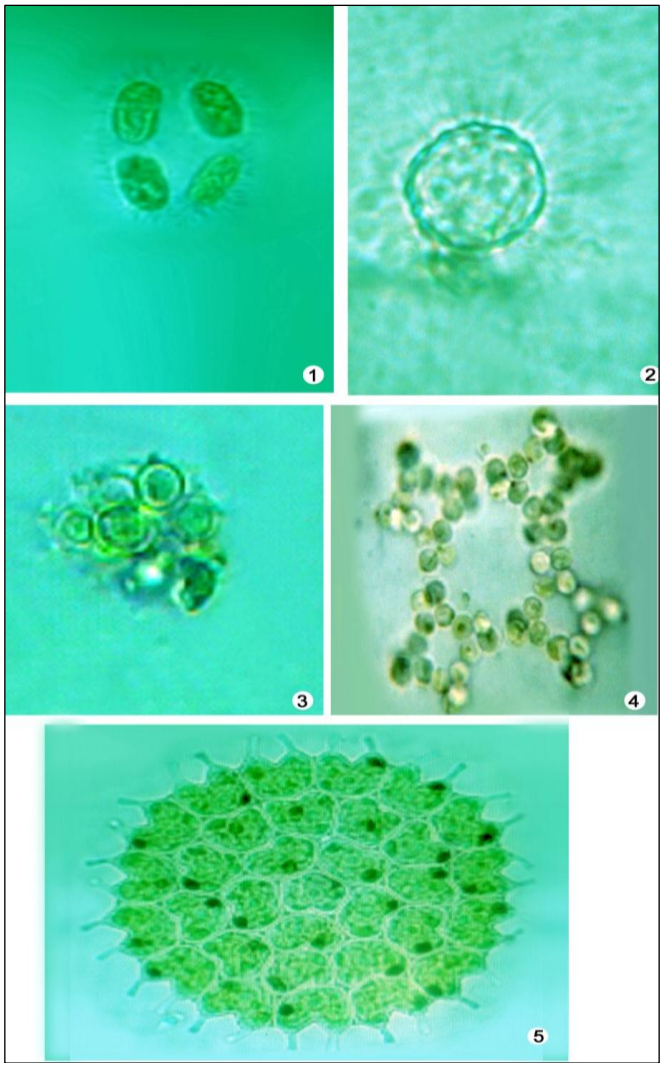

Plate 2

Plate 1

Sr. No.	Name of Taxa	Fig. No. (Description)
1.	*Sphaerellopsis reticularis* Iyengar.	1
2.	*Chlamydomonas conferta* Kors.	2
3.	*Carteriaklebisii* (Dang.) Dill.	3
4.	*Pteromonas angulosa* (Carter) Lemm.	4
5.	*Volvox aureus* Ehr.	5
6.	*Phaeocystis globosa* Ettl.	6
7.	*Chlorococcum humicola* (Naegeli) Rabenhorst.	7
8.	*Chlorococcum infusionum* (Schrank) Meneghini.	8
9.	*Chlorococcum vitiosum* Printz.	9
10.	*Characium ambiguum* Hermann ex Rabenhorst.	10
11.	*Characium angustum* A. Braun.	11
12.	*Characium debaryanum* (Reinsch) De. Toni.	12
13.	*Characium ensiforme* Hermann.	13
14.	*Characium gracilipes* Lambert.	14
15.	*Characium lanceolatum* Jagg.	15
16..	*Characium obtusum* A.Br. v. *Philliposii* Dhande et. Jawale.	16
17.	*Characium orissicum* Philipose.	17
18.	*Characium ornithocephalum* A. Br.	18
19.	*Characium pringsheimii* A. Braun.	19
20.	*Trochiscia aciculifera* (Lagerh.) Hansgirg.	20

Plate 2

Sr. No.	Name of Taxa	Fig. No. (Description)
1.	*Eremosphaera oocystoides* Prescott in Prescott.	1
2.	*Golenkinia radiata* (Chod.) Wille.	2
3.	*Micractinium pusillum* Fresenius.	3
4.	*Micractinium quadrisetum* G.M. Smith.	4
5.	*Pediastrum boryanum* Longicorne Reinsch.	5

Discussion and Results

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; Nazneen, 1980; Nandan and Patel; 1984a; More, 1997; Munawar, 1970). 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. Raghuwanshi *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 amongothers. Ravishankar *et al*. (2012) [20] encountered diversity of fresh water algae in two lakes of Tumkur. Kumar, Rita *et al*. (2010-12) [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 inevaluation of pollution in rivers in Poona, Maharashtra. Sameinvestigator (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. Kumar *et al*. (2005) 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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