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RESEARCH ARTICLE

STUDIES ON DIATOM FLORA AND DISTRIBUTION OF NUTRIENTS IN PALAMAN RIVER AT CHIDAMBARAM (TAMIL NADU)

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ABSTRACT

Monitoring of water quality with regards to physical and chemical properties and distribution of nutrients are inadequate. Biological indicators of water quality monitoring developed during the recent years have served an excellent tools in the area of water pollution studies. According to the Western Australian Planning Commission (2003) water protection integrated over time and space has become a high priority issue for the public and government at all levels. Among all the algae, fresh water diatoms are the most commonly used indicators of the conditions of the water. Several diatom indices are tested for lakes in other countries, but have not used for river water systems. Diatom monitoring studies in India have suffered since their identification is difficult and extensive literature is not available mainly. Therefore the study aims that identification of diatom flora and distribution of nutrients in fresh water river in Chidambaram. Water samples from palaman river were collected during January 2011 to December 2011 at monthly intervals for studying various physico-chemical parameters and nutrient were analysed viz. Temperature, pH, Salinity, Dissolved oxygen, Biological oxygen demand, Chloride, Phosphate, Sulphate, Nitrate, and Silicate. Phytoplankton density and diversity was more or less uniform throughout the study period. However the community structure of the phytoplankton varied from season to season. During post-monsoon and summer 15 genera of the phytoplankton were recorded whereas 9 genera were recorded during pre-monsoon season. *Nitzschia intermedia, Cyclotella meneghiniana, Cyclotella automus, Navicula cryptocephala, Melosira varians* were strong indicators of organic pollution, while *Amphora ovalis, Pinnularia gibba, Synedra ulna, Synedra acus, Cymbella tumida, Gomphonema olivaceum, Nitzchia gracilis, Cocconeis pediculus* and *Navicula amphiceropsis* were indicators of anthropogenic pollution which was mainly due to cattle ranching around these river. Possible causes for the temporal variation of the water quality parameters and community structure of the phytoplankton have been described.

INTRODUCTION

Diatoms are ubiquitous on earth. They are Epiphytic, Epilithic, Epipelic and free floating i.e. planktonic and distributed in fresh water, polluted water and thermal springs. Diatoms are microscopic, unicellular algae. In India, the pioneering work was done by Venkatraman (1956) on the systematic account of south Indian diatoms. Gonzalves (1947) was the first to record diatoms from Maharastra. Gonzalves and Gandhi (1953) published the systematic account of the diatoms of Bombay. Gandhi (1955) made contribution to our knowledge of freshwater diatoms of India. During the earlier part of the nineteenth century diatom study in India was mainly diverted towards taxonomy. Some of the reports include Ehrenberg (1845), Detoni (1891), Cleve (1878) and Leudger -Formorel (1893). During the later part more attention was diverted towards the distribution and periodicity of diatoms. Some of the classical works include those of Biswsa (1936). venkataraman (1939), Iyenger and Subramanyan (1942), Gonzalves and Gandhi (1952), Krishnamurthy (1954), Desikachary (1962), Ghosh and Gaur (1993), Juttner *et al.* (1996), Nautiyal and Nautiyal (1999) and Karthick *et al.* (2010). Sarode and kamat (1984) studied freshwater diatoms of Maharastra. Jena, M; S.K. Ratha and S.P. Adhikary 2006 a Diatoms from (Bacillariophyceae) from Orissa state and neighbouring regions in India. Diatoms are diverse groups with short life cycle, exhibiting quick response time to environmental condition and have characteristic cell walls that are often well preserved in lakes, ponds, river and wet land sediments. The basic components in the food chain of aquatic ecosystem are phytoplankton, as the food chain is initiated by phytoplankton. Secondary (zooplankton) and tertiary (shell fish, fine fishes and others) producers depend on them or indirectly for food phytoplankton serves as good indicators of water quality, including pollution. They reflect subtle changes taking in their immediate environment their species composition, biomass, community structure and productivity vary with varying environmental characteristic. Phytoplankton response is an easily measurable way to substance that affects primary productivity. The response can be measured in terms of biomass production or through the response generated by pollution. Algal community composition as well as single algal species has been used by many authors to describe the pollution status of river (Nyagaard, 1949; Patric, 1950; Palmer, 1969). Various procedures and indices of algal analysis of pollution are also available (Nandan, 1966). But still there are many such aquatic ecosystem that remain unexplore with special reference of diatom. The palaman river is one among them which has not received due attention. Hence the present study focuses attention on the diversity of diatoms and various physicio-chemical parameters and distribution of nutrients in Palaman River.

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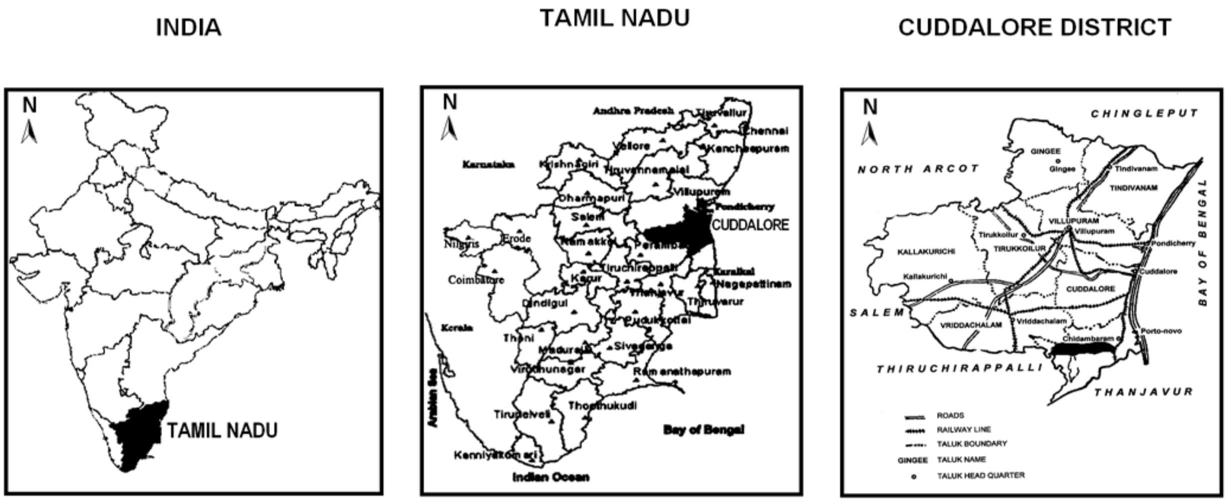
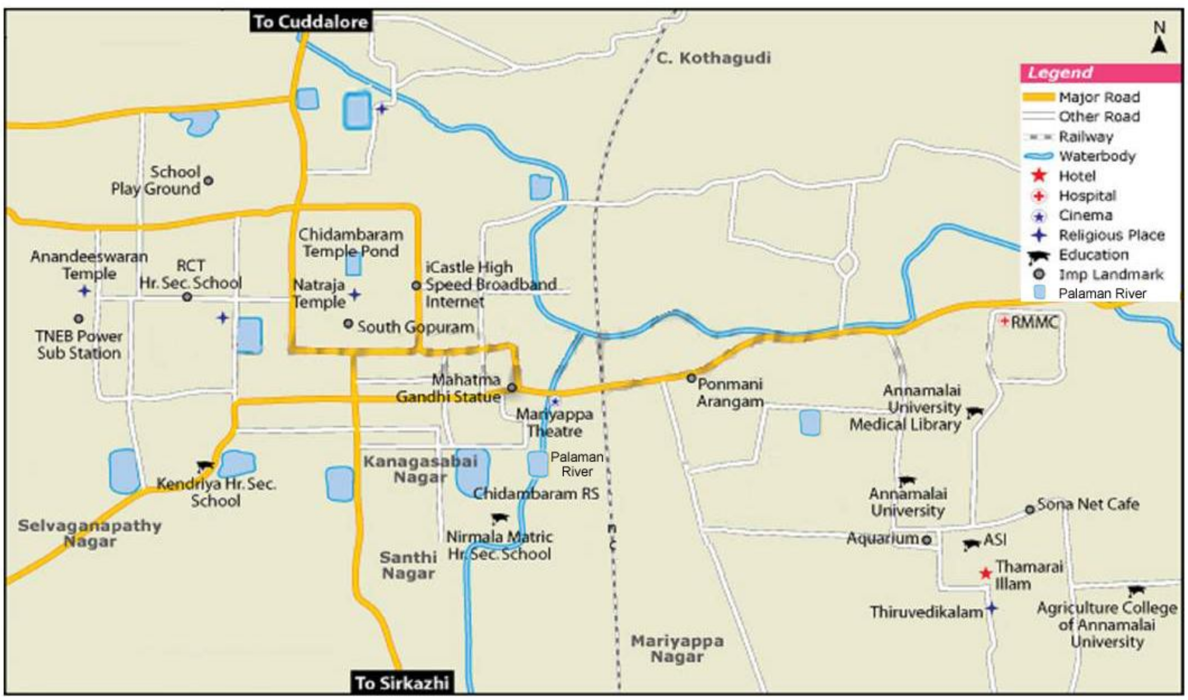
MATERIALS AND METHODS

Diatoms are not in pure form instead they are along with other algal forms dirt, debris and organic matter. Hence isolation of



SAMPLING STATIONS OF CHIDAMBARAM
PALAMAN RIVER



diatoms are essential. The collection of diatoms samples during the period of January 2011 to December 2011 in palaman river which is situated at Chidambaram Taluk in Cuddalore District of Tamil Nadu. Epiphytic forms were collected by squeezing submerged plants and planktonic forms with the help of planktonic mesh net size (0.05mm) in plastic bottles 250ml. Epilithic samples were collected with the help of scalpel and spoon from wet rock, stones, bricks and taken a plastic bottles. The Epipelic diatoms were removed by vigorously scrubbing the upper layer of the substratum, with a small tooth brush to dislodge the diatom community and transferred to a bottle of approximately 125ml and labelled. Then they were preserved in 4% of formalin. And the unpreserved samples were observed under microscope (10x100x magnification) for the presence of live cells. If majority of the diatoms were dead cells (empty frustules no chloroplast) the samples were discarded (Bate *et al*., 2002). Diatom analysis was based on the procedure of Hasic (1978) and adapted by Round *et al.* (1990).

Ten ml of potassium permanganate solution was added for 48 hours, followed by addition of hot hydrochloric acid (32% ; 90°c for 1-3) hours until the solution become clear and yellow after the sample was oxidized 1m of hydrogen peroxide was added drop wise. The cooled samples was centrifuged at 2500rpm for 10 minutes. The centrifuged samples were stored in a glass vials. Preparation of diatom slides was done as per the method described by Karthic *et al*. (2010), welsh (1964) and Lohman (1982) and mounted using pleurax or DPX (Hanna, 1949). The samples were finally viewed at 10x magnification of the ideal observation of diatom. Using fresh water epilithic diatoms for monitoring water quality. Water samples were collected from the palaman river at the mid depth by using water sampler. The physicochemical parameters were analysed by water and soil analyses kit Model 1160-E. The Dissolved oxygen, Biological oxygen demand, Chloride, Inorganic Phosphate, sulphate, Nitrate and Silicate were measured by using the standard methods established for examing of water in APHA and AWWA (1989).

Phytoplankton population density was assessed by chemocytometer(Adoni *et al*., 1985) and microscopic examination of the samples fixed in Lugol's iodine for light microscopic study.some species were observed by Scanning Electron microscope Phytoplankton samples were collected by towing a planktonic net (mouth diameter 0.35mm) made up of bolting silk (no.30; mesh size 48µ) for half an hour. The samples were collected in a black polythene bags and immediately preserved in 4% of formalin for quantitative and qualitative analyses. Plankton counting was made by drop method. Some of the specimens were fixed in 3% of glutaraldehyde in 0.1 M phosphate buffer at (pH 6.8) for scanning electron microscopic studies. Specimens were then dehydrated through a graded series of alcohol 12-15min interval at 4°c up to 70% of alcohol. Then dehydrated planktons were treated with critical point drier (CPD) were on a stub and the specimens were coated and they were examined with Joel JSM-56010 LV with INSA-EDS, photomicrographs were taken selectively from the computer screen (Hayet and falk, 1980). Taxonomic guides consulted include Gandhi (1988), Sarode and Kamat (1984) Schomen and Archibald (1976-1980), gasse (1986), Taylor *et al*., (2007) and Karthick *et al*. (2010).

RESULTES AND DISCUSION

The seasonal variation of physico-chemical and nutrient parameters are depicted in the Table 1.

Biological oxygen demand (BOD) is another parameter which is used for the determination of polluted status of a water body. In the present work, an inverse relationship between Dissolved oxygen and Biological oxygen demand was noticed. The maximum BOD recorded was 1.403mg/l during February 2011. The chemicals like chloride, Sulphate, Phosphate, Silicate and Nitrate were estimated. In the present investigation it was observed that the Chloride concentration fluctuated seasonally i.e., high concentration was recorded in summer which might be due to low level of river water and low level of Chloride recorded in winter might be due to dilution effect by heavy rainfall. The nitrate source of the water is Biological oxidation of organic nitrogenous substance from the catchment areas. In the present study, nitrate values fluctuated minimally except the month of November 2011 which was due to excess runoff of agriculture waste in palaman river. The presence of silica in natural water is due to degradation of silica containing rocks. The silicate showed the high value (3.71mg\l) during summer in April 2011 and low level of silicate (1.36mg\l) were observed during the month of January 2011. The solubility of silicate has been found to be more at high temperature and high pH (Trivedy 1985). Maximum diversity during post-monsoon and summer season. Minimum diversity observed during pre-monsoon season. Sulphates are the chemicals which can be enter in to the water through the agricultural wastes and aquatic animal wastes. The higher amount of sulphate (2.86mg/l) was observed during

Table 1. Seasonal variation of physico-chemical and Nutrient parameters of Palaman river During January 2011 to December 2011

S.No	Parameters	January - March (post - monsoon)			April - June (Summer)			July - September (Pre-monsoon)			October - December (Monsoon)			Mean ±S.d
1.	Air Temp. (°c)	30.7	29.5	29.1	33.4	36.3	36.5	31.2	30.0	29.7	28.0	27.5	27.4	±2.0
2.	Water Temp. (°c)	29.5	27.1	27.6	32.5	35.7	34.3	29.5	27.8	26.3	25.1	24.8	24.6	±2.0
3.	pH	8.3	8.2	8.1	8.5	8.4	8.4	8.3	7.8	8.1	8.2	8.1	8.3	±1.0
4.	Salinity (mg/l)	1.5	1.6	1.3	2.7	2.4	2.1	1.7	1.1	1.0	1.3	1.2	1.2	±1.0
5.	Do (mg/l)	4.11	4.09	3.43	2.61	3.07	2.65	3.41	3.47	3.17	4.34	4.07	4.15	±1.5
6.	BOD (mg/l)	1.346	1.403	1.253	1.071	1.214	1.374	0.203	0.703	0.810	1.171	1.237	1.205	±1.0
7.	Chloride (mg/l)	2.005	2.675	2.019	3.255	3.072	3.008	2.176	2.142	2.257	1.245	1.072	1.008	±0.40
8.	Sulphate (mg/l)	2.57	2.86	2.54	2.61	2.58	2.65	2.74	2.71	2.63	2.67	2.74	2.82	±0.50
9.	Phosphate (mg/l)	1.20	1.67	1.56	1.92	1.65	1.74	1.41	1.78	1.84	1.82	1.65	1.45	±0.35
10.	Silicate (mg/l)	1.36	1.45	1.72	3.71	3.35	3.61	2.42	2.46	2.53	2.61	2.70	2.78	±1.5
11.	Nitrate (mg/l)	0.126	0.120	0.128	0.131	0.133	0.136	0.138	0.141	0.143	0.146	0.76	0.14	±0.95

Values are mean ±S.D., sample size (n) = 6

In the present investigation, there was not much variation in the air and water temperature. Air temperature ranged from 27.4°c to 36.5°c and the water temperature ranged from 24.6°c to 35.7°c. During the study period, pH value ranged from 7.8 to 8.5, maximum (8.5) in summer and minimum (7.8) in winter. The high pH value during summer may be due to high photosynthesis of micro and macro vegetation resulting in high production of free carbon-di-oxide shifting the equilibrium towards alkaline (Suchi Tiwari *et al.*, 2004). This is an agreement with the findings of Jegatheesan, (1999), who studied the Cauvery river. Salinity acts as major ecological factor controlling the phytoplankton population of fresh water as well as brackish water and the appearance or disappearance of species depend upon the salinity condition. During the present study maximum value of salinity was recorded in summer season and minimum in pre-monsoon season and monsoon period. High salinity concentration was associated with high density of phytoplankton population as observed by Shibu (1991). The maximum dissolved oxygen was recorded during monsoon period in November and minimum during summer period in June. Dissolved oxygen is affected by the photosynthetic activity and aeration rate (Gautam *et al.*, 1993). The distribution of the dissolved oxygen in the reservoir water is governed by a balance between input from the atmosphere, rainfall and photosynthesis losses by the chemical and biotic oxidations.

February 2011 and minimum level (2.54mg/l) was observed during March 2011 so, from this results it can be concluded that there is no greater deviation in the amount of sulphates in Palaman river. The high level of phosphate (1.92)was obtained in April 2011 and low level of phosphate (1.20) was obtained on January 2011. The high during summer is due to the concentrated nature of water body result from the evaporation (Jagatheesan 1999). River water showed relatively higher phosphate, nitrate and sulphate value when compared to other aquatic bodies. High nutrient content might be due to pollution by sewage water rather than anthropogenic activities. In the present study diatoms were dominant algae during post-monsoon season. Ray and Rao (1964) found that temperature range from 25°c to 30°c is essential for dense growth of diatoms .Hence the abundance of diatoms noticed during the post-monsoon in palaman river was probably due to lower temperature record in the river. The results of the study revealed that hydrographical condition and nutrient content fluctuate moderately throughout the year. Both dissolved and suspended substances in the inputs of rain water. Agricultural runoff, animal waste and land drainage have a profound influence on the water quality of the river. Therefore relationship between physico-chemical parameters and nutrients has been examined. Presence of excessive amount of nutrients in the animal waste, agricultural runoff and land drainage has led to eutrophication in receiving waters. Recently more attention has been given to solve problems of nutrient loading and also

Table 2. List of phytoplankton species recorded at palaman river During January 2011 to December 2011

Bacillariophyceae					
Order: centrales					
DISCOIDEAE					
COSCINODISCACEAE					
1.	Cyclotella meneghiniana Kuetzing	+	+	-	+
2.	C.rupicola Grun.	+	+	+	+
3.	C.antiqua W.Smith.	-	+	+	-
4.	Melosira granulata Ehr. Ralfs	-	+	-	+
5.	M.moniformis (Muller)	-	+	+	-
6.	Sceletonema costatum (Grev.) Cleve	-	+	+	-
	Thalassiosiraceae				
7.	Thalassiosira leptopus (Grunow)	+	-	+	+
ORDER: PENNALES					
ARAPHIDEAE					
FRAGILARIODIDEAE					
8.	Fragillaria brevistriata Grun	+	+	+	-
9.	F.capucina Desmaziers	+	+	-	+
10.	F.crotonesis Kitton	-	+	-	-
11.	F.vaucheriae Kuetz	+	-	+	-
12.	F.virescens Ralfs	-	+	+	-
13.	F. intermedia Grun	+	-	-	+
14.	Synedra ulna (Nitz)	-	+	+	-
15.	Snafus Kutz	-	+	-	+
MONORAPHIDEA					
16.	Achnanthes lanceolata (Breb.)Grun.	-	+	+	-
17.	Ac.dispans Cleve	+	-	-	+
18.	Ac.hauckiana Grun	-	+	-	-
19.	Ac.exigua Grun	+	+	-	+
RAPHIDIOIDEAE EUNOTIOIDEA					
20. Eunotia pectinalis (Mull.) Rabenh		+	+	-	+
21. E. monodon her		+	+	-	+
BIRAPHIDEAE					
NAVICULOIDEAE					
22.	Cymbella muelleri Hust.	-	+	+	-
23.	C. alpina Grun.	+	+	-	-
24.	C. naviculiformis Auersward	+	-	+	-
25.	C. turgid (Gerg) Cleve	-	+	+	+
26.	C. cybiformis Kuetz.	+	-	+	-
27.	C. tumida (Berb.)	+	+	+	-
28.	C. amphicephala Naegeli	-	-	+	-
29.	C. aspera (Ehr.) Cleve	+	+	-	+
30.	C. gracilis (Ehr.) Kutz	+	+	+	-
31.	C. turgidula Her.	-	+	-	+
32.	C. ventricosa Kuetz	+	+	-	+
33.	Gomphonema intricatum (Kuetz)	+	-	+	-
34.	G. constrictum Ehr.	-	+	+	-
35.	G. gracile Ehr.	+	-	-	-
36.	G.lanceolatum Ehr.	-	+	-	+
37.	G.parvulum (Kuetz)	+	+	-	+
38.	G.acuminatum Ehrench	-	-	+	+
39.	G.olivaceum Kuetz.	+	-	+	-
40.	G.minutum (Ag)	+	-	+	-
41.	G.agustum Kutz.	-	+	+	+
42.	G.nodiferum Grunow.	+	-	-	+
43.	G.balticum Ehr.	-	+	-	+
44.	Gyrosigma accuminatum Kutz	-	-	+	+
45.	G.attenatum Kutz	+	-	+	-
46.	G.nodiferum Grunow	+	-	+	-
47.	G.oceanica Ehr.	-	+	+	-
48.	G.balticum Ehr.	+	-	-	+
49.	Navicula americana Ehr.	+	-	+	-
50.	N. cuspidata Kuetzi	-	-	+	-
51.	N.exigua (Greg.) Mueller.	+	-	-	+
52.	N. anglica Ralfs	+	+	-	+
53.	N.gracilis (Ehrenb).	-	+	-	+
54.	N.rostellata Kuetz	+	-	-	+
55.	N.radiosa Kuetz	-	+	+	-
56.	N.rhyncocephala Kuetz	+	-	-	+
57.	N.salinarum Grun	+	-	+	+
58.	N.platystoma Ehr.	+	+	-	-
59.	N.cuspidata Kuetz.	-	+	+	-
60.	Pinnularia gibba Ehr.	-	-	+	+
61.	P.acrosphoeria Breb.	+	+	+	-
62.	P.interrupta W.smith	-	+	-	+
63.	P.braunii (Grun) Cleve	+	+	-	+
64.	P.viridis (Nitzsch) Her.	-	+	-	-
65.	P.major (Kuetz.)	+	-	+	+
66.	Amphora coffoeformis Ag.	+	+	-	-
67.	A.ovalis Kuetz	-	+	+	+
68.	A. obtuse Greg	+	+	-	+
69.	A.monilifera Greg	+	-	+	-
70.	A. terroris Ehr.	-	+	-	-
71.	Stauroneis anceps Ehr.	-	-	+	+
72.	S.javanica (Grun.) Cleve	+	-	-	-
73.	Nedium amphirhynchus (Ehr)	-	+	-	+
74.	N. iridis (Ehr) Cleve.	+	-	+	-
75.	N.indicum Gonaz ves et. Gandhi	-	+	-	-
NITZSCHIOIDEAE					

76.	Nitzschia gracilis Hantzsch	+	+	-	+
77.	Ni.commulata Grun.	-	+	-	+
78.	Ni.amphibia Grun	+	-	+	-
79.	Ni.intermedia Hantzsch	-	+	-	+
80.	Ni. berbisonii W. smith	+	-	-	-
81.	Ni.obtuse W.smith	-	+	-	+
82.	Ni.frustulum Kuetz.	+	-	+	+
83.	Ni.sigma (Kutz).	+	-	+	-
84.	Ni.palea (kuetz.) W.smith	+	+	-	+
85.	Ni.normannii (Grounow)	-	+	+	-
86.	Ni.stagnarum (Rabenh.) Grunow	+	-	+	-
SURIRELLOIDEAE					
87.	Surirella elegance Ehr.	-	+	-	+
88.	S. ovate Kuetz	+	+	-	-
89.	S. robusta Ehr.	-	+	+	-
90.	Mastogloia exigua Lewis	+	+	-	+
91.	M. dolosa Venkatraman	-	+	+	-
92.	Cocconeis placentula Cleve	+	-	-	+
93.	Diploneis Subovlis Cleve	+	-	+	-
94.	D.ovalis (Hilse)	-	-	+	-
95.	D.interrupta (Kuetz)	+	+	-	+
96.	Anomoeneis sphoerophora (Kuetz)	+	+	-	-
97.	A. serians (Berb.) Cleve	-	+	-	-
98.	Calonies silicula (Ehr.) Cleve	+	-	-	+
99.	Pleurosigma delicatulum W.smith	+	+	-	+
100.	P.angulatum W. smith	-	+	+	-
101.	P.salinarum Grun	+	-	-	+

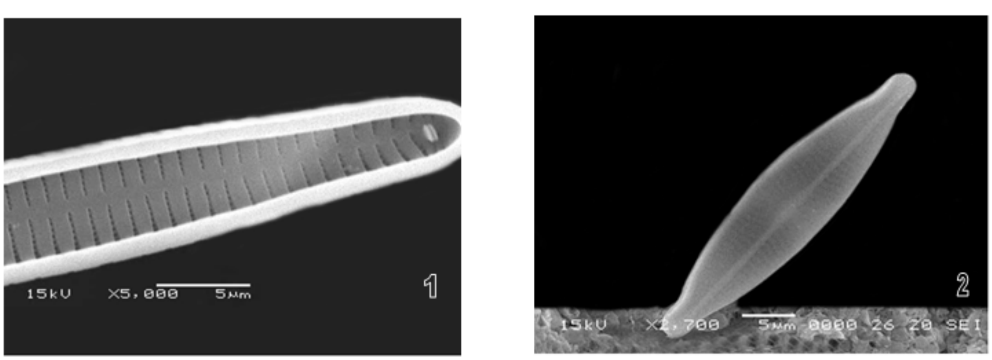
+ = Present: - = Absent

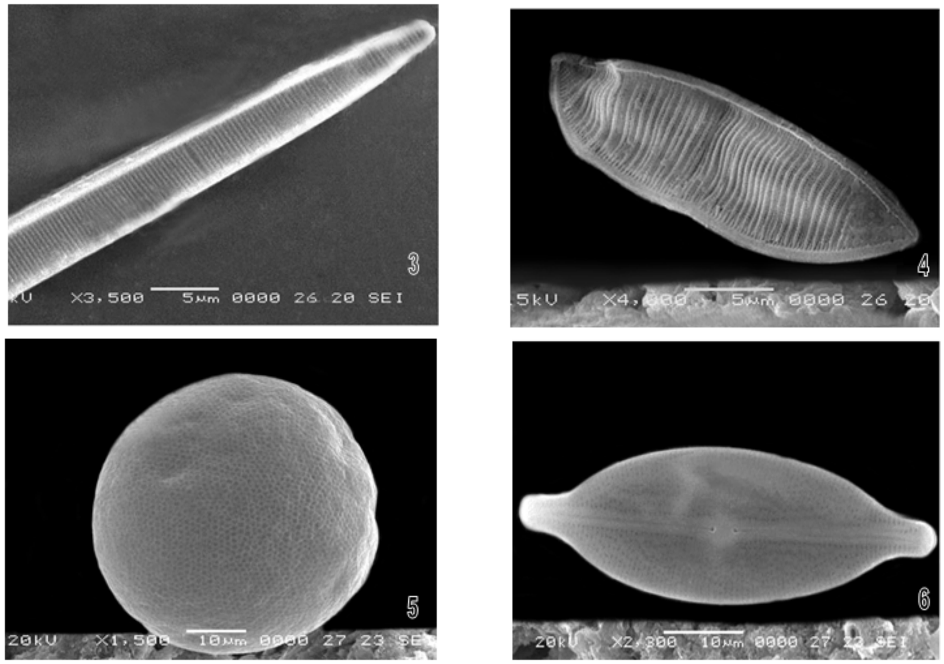
control eutrophication. Variations of hydrographical parameters and distribution of nutrients in water bodies are controlled by the physical, chemical and biological processes taking place in the pertinent environment (Astom 1950). This river water contains adequate nutrients for the growth and production of Diatoms. The variation in the nature of the water is depending on the freshwater influence during monsoon period and the anthropogenic waste discharges for surrounding area of palaman river and also due to high weed infestation in the river(Nair *et al*.,1983Devenda *et al*.,1986). The seasonal distribution of the phytoplankton biomass is much influence by the availability of inorganic nitrate and phosphate (welsh, 1964). In the present study, the phytoplankton productivity was high, where subsequently the nutrients such as phosphate and sulphate in the water were decreased, the low level of phytoplankton may be due to grazing by zooplankton and fishes. In the present study both centrales and pennales were found but pennales were dominant. Genrally variations in phytoplankton species composition and their production in fresh water bodies like ponds, lakes and rivers are due to the influence of some factors such as isolation, availability of nutrients, biomass, grazing and other environmental parameters. Sondergaard and Jensen (1979) suggested that seasonal distribution of phytoplankton is influenced by availability of inorganic nitrogen and phosphorus. The river water contain adequate nutrients for the growth and production of diatoms. Nuemann (1941) pointed out during the stagnation period nitrogen increased in river water whereas it decreased when the water circulated.

A total number of 101 Diatoms belonging to 24 genera were recorded and they where depicted in (Table 2) 11 species each of *Navicula, Cymbella and Gomphonema*. Six species each of *Fragillaria* and *Pinnularia* were recorded. 5 species each of *Gyrosigma* and *Amphora* were recorded. Four species each of *Cyclotella* and *Achnanthes* were recorded in palaman river. Species recorded in lower numbers were *Nedium, Surirella, Diploneis and pleurosigma* with 3 species each. *Melosira, Syndra, Enotia, Stauronies, Mastogloia, and Anomoeneis* occurred with 2 species each while *Cocconeis, Calonies, Actinella, Frustulia, Sceletonema* and *Thallassiosira* occurred in single numbers. Species rich in Diatom were *Navicula, Cymbella* and *Gyrosigma.* Other species were represented by *Amphor ovalis, Pinnularia gibba, Cymbella tumida, Gomphonema olivaceum, Syndera acus, Nitzschia gracilis, Navicula rhynocephala, Navicula Amphiceropisis* and *Cocconies pedicules* which were all indicators of organic as well as anthropogenic pollution. *Nitzschia Palea* is one of the most common and pollution dependent species in this genus (Palmer, 1969). Tuchman (1996) reported that *N.palea* was able to utilize 21 different organic substrates. *Eunotia* is the anomalous raphid diatom. The diotom *Genus Eunotia* is unusual among raphid diatoms is having a raphe system consisting of two short slits that they not integrated into the primary pattern center. Population of a Eunotia species found among a diverse diatom flora, including species of *Cymbella* and *Diploneis*,in squeezing the mosses collected from palaman river.

PLATE-1

Scanning Electron Micrograph of some commonly occurring diatoms in the Palaman river





1. ***Fragillaria capucina,*** **2.** ***Navicula radiosa,*** **3.** ***Nitzschia palea,*** **4.** ***Nitshia sp.,*** **5.** ***Diatom sp.,*** **6.** ***Anomoneis sphaerophora***

Some species of Diatoms were observed by Scanning Electronmicroscopy (Plate:1) such as *Fragillaria Capucina, Navicula Radiosa, Nitzschia Palea, Nitzschia sps, Diatom sps and Anomoneis Sphaerophora. Schmid* (1976) first noted the presence of distinctive silica spheres in the developing regions of diatom walls in *Anomoneis sphaerophora* with the SEM. The thin organic casings that reportedly cover the siliceous structures of *Navicula pelliculosa* (Reimann *et al*., 1966), and *Navicula cuspidate* (Edgar and pickett-Heaps 1982) consists of a thin undifferentiated layer about 10-mn thick that is tightly bound to the valves. According to these studies the organic casings are often intimately associated with the siliceous structures, so that treatment of frustules with hydrochloric acid to remove the silica leaver behind the thin organic casing that bears the fine patterning of the dissolved silica structure (eg: Reimann *et al*., 1966). Scanning electron Micrograph (SEM) of *Fragillaria* Fig :1) frustules are rectangular to lanciolate in gridle view. Valves are elliptical, lanciolate or lenear with rostrate to capitates apices. Oblique view of Diatoma (Fig:5) striae internally thickened transapical ribs, raised sternum along the axial axis of the valves, and the cingulum bands. *Nitzschia palea* (Fig:3) valve view the raphe system in *Nitzschia* is fibulate and is normally on or near the margin of the valve surface. The raphe is on opposite margins of the two valves of frustules from the present investigation it could be noted that Diatom population is closely related with seasonal variation in hydrograpy. The distribution of the Diatom remain similar to that of other major Indian rivers.

Conclusion

Water chemistry variables and distribution of nutrients are closely related to diatom indices, which is an indication that diatoms can be used as indicators of organic and anthropogenic pollution.

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