Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

A Study on the Occurrence of Species Diversity *Pediastrum* in Selected Temple Tanks in Chennai, Tamil Nadu, India.

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ABSTRACT

A periodical survey on the occurrence of the green algae *Pediastrum* in the temple tanks of *Arulmigu Sri. Parthasarathy swamy* Temple, Thiruvallikeni,Chennai, and *Arulmigu Sri Kapaleeswarar* Temple , Mylapore, Chennai, India, was done during the period October 2016 to September 2017. A maximum of six species of *Pediastrum* along with physico-chemical parameters such as: colour, odour, turbidity, electrical conductivity, calcium, sodium, chloride, fluoride levels and TDS of water samples were recorded. The study showed interesting variations in physico-chemical parameters and species availability during the study period.

KEY WORD: *Pediastrum*, Temple tank, Microalgae, Phsico-chemical parameters.

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INTRODUCTION

Green algae are aquatic plants that act as pioneer photosynthetic organisms or producers, in an aquatic ecosystem. The genus *Pediastrum* Mayen, belongs to class Chlorophyceae and order Sphaeropleales. It is a free floating, coenobial, green algae occurring commonly in natural freshwater lentic environments like ponds, lakes, reservoirs.[1] However their occurrence in brackish and salty waters is rare.[2] The outer layer of cell wall of *Pediastrum* is composed of sporopollenin combined with oxides of silicon which makes them highly resistant to decay. Therefore, they remain preserved well in lake sediments as fossil record for palynological studies.[3] After the monograph of Philipose, many more species of *Pediastrum* have been added to the Indian algal flora. Eleven species were reported from the Indian region.[4]

Presence of pollution tolerant algae like *Melosira, Oscillatoria, Pediastrum* and *Scenedesmus* has been considered as indicative of enriched waters, thus providing evidence of pollution of water.[5]

Scenedesmus was the diverse genera with seven species followed by *Pediastrum* with five species and Schroederia and Phacus represented by three species each. Fifteen pollution tolerant algal species were identified from this pond during the period of study.[6]

The genus pediastrum was reported four species in birds visited ponds of kannyakumari[7] and the recorded eight *pediastrum* species in kerala temple tanks.[8]

MATERIALS AND METHODS

Algal and water samples collected from *Arulmigu Sri. Parthasarathy swamy* Temple, Thiruvallikeni, Chennai, india, tank located at 13° 3' 14.0724" N ; 80° 16' 37.2396" E and *Arulmigu Sri Kapaleeswarar* Temple , Mylapore, Chennai, India, located at 13° 2' 0.1176" N ; 80° 16' 7.41" E. The temple tank water samples were collected, during October 2016 to September 2017. The samples were collected in clean plastic containers, brought to the laboratory and divided into two parts, one part was preserved in 4% formalin, the water samples were analysed according to American Public Health Standards.[9]

Observations for micro-algal presence were made using light microscope unit. Taxonomical descriptions of taxa were determined on the basis of morphological features such as outline of cells, number of lobes and processi, depth of incisions in marginal cells, sculpture of cell wall. Cell dimensions are described as: width x length. In the case of marginal cells the length of a cell includes length of lobes and processi. All observations were made using oil immersion objective lens (10x X 100x Magnification). Identification of the microalgae was done using monograph on Chlorococcales.[4]

RESULT

Table 1: List of *Pediastrum* species identified from samples collected from *Parthasarathy swamy* Temple & *Kapaleeswarar* Temple.

S.No	Name of the *Pediastrum* species	Parthasarathy swamy Temple tank			Sri Kapaleeswarar Temple tank		
		M	W	S	M	W	S
1	*Pediastrum simplex* Meyen	+	-	-	+	+	+
2	*Pediastrum simplex var. duodenarium (J.W.Bailey) Rabenhors*	-	-	-	+	+	-
3	*Pediastrum ovatum (Ehrenberg) A.Braun*	-	-	-	+	-	-
4	*Pediastrum duplex var. genuinum (A.Braun) Hansgirg*	-	-	+	-	-	-
5	*Pediastrum duplex var. clathratum (A.Braun) Lagerheim*	-	+	+	-	-	-
6	*Pediastrum duplex var. reticulatum Lagerheim*	+	+	+	-	-	-
7	*Pediastrum duplex var. gracillimum West & G.S.West*	+	-	+	-	-	-
8	*Pediastrum tetras var. tetraodon (Corda) Hansgirg*	+	+	+	+	+	+
9	*Pediastrum tetras var. apiculatum Fritsch*	+	+	+	+	+	-

M-Monsoon, W-Winter, S-Summer

Present +, Absent -

Table:2 Physico-chemical parameters of water samples collected from *Parthasarathy swamy* Temple Tank & *Kapaleeswarar* Temple Tank

S.No	Parameters-mg/L	*Parthasarathy swamy* Temple tank				*Kapaleeswarar* Temple tank		
		Monsoon	Winter	Summer		Monsoon	Winter	Summer
1	Appearance	Slightly greenish	Slightly greenish	Slightly greenish		Slightly greenish	Slightly greenish	Slightly greenish
2	Odour	Agreeable	Agreeable	Agreeable		Agreeable	Agreeable	Agreeable
3	Turbidity	Turbid	Turbid	Turbid		Turbid	Turbid	Turbid
4	Electrical Conductivity (micro mho/cm)	244	230	225		285	260	275
5	pH at 25^{o}C	7.05	7.4	7.5		7.01	7	8.72
6	Alkalinity total	92	90	90		60	50	50
7	Total hardness	74	40	50		50	50	80
8	Calcium	26	19	20		16	14	17
9	Magnesium	2	1	2		2	2	1
10	Sodium	24	20	18		34	25	18
11	Potassium	2	2	1		3	2	1
12	Iron	0	0	0		0	0	1
13	Manganese	0	0	0		0	0	0
14	Free ammonia	5	2	3		3	0.5	0.5
15	Nitrite	0.1	0.1	0		0.5	0	0.1
16	Nitrate	1	1	0		1	1	0
17	Chloride	28	30	50		57	60	130
18	Fluoride	0.5	0.5	0.5		0.2	1	1.5
19	Sulphate	0	0	0		0	0	0
20	Phosphate	0.5	0.2	0.3		0.5	0.5	0.2
21	Residual chlorine	0.2	0.2	0.2		2.1	0.2	0.2
22	Total TDS	171	192	228		200	240	312

Species Identification

(Based on the monograph on chlorococcales by M.T. Philipose, 1967)

Phylum: *Chlorophyta*

Subphylum: *Tetraphytina*

Class: *Chlorophyceae*

Order: *Sphaeropleales*

Family: *Hydrodictyaceae*

Subfamily: *Hydrodictyoideae*

Genus: *Pediastrum* Meyen,

Pediastrum colonies are free-floating, disc-or stellate -shaped, generally of 4-8-16-32 more polygonal multinucleate cells arranged in a single layer one cell thick. Colony with or without perforations. (Marginal cells are with one, two or four processes, rarely without such processes). Cell wall is smooth, granulate or with reticulate ridges. (Chloroplast, single parietal, fills the adult cells with one or more pyrenoids). Asexual reproduction by zoospores which escape into a vesicle and orient themselves in the place of cells, rarely by 1-2 hypnospores are produced from each cell.

Eleven species are known from Indian region.

Taxonomic Description

1. *Pediastrum simplex Meyen* (Pl.2 Fig.1a,b)

M.T. Philipose 1967, p.113. fig.36a,36b.

Colonies are circular to oval, of 4-8-16-32 or more cells. Inner side of marginal cells nearly straight or outer side produced into a gradually tapering process with, sides concave. Inner cells are polygonal. Cells are in contact with adjacent ones and are usually without intercellular spaces. When present, intercellular spaces are very small. Cell wall smooth or punctuate to granulate. Cells are (7-) 8-13 μm broad and (15-) 19-26 (-30) μm long.

2. *Pediastrum simplex var. duodenarium (J.W.Bailey) Rabenhors* (Pl.2 Fig.2a,2b)

M.T. Philipose 1967 p.115. fig.36d,e

It differs from the type in having large intercellular spaces or a single central space with the cell arranged in a ring at the periphery. (Inner face of marginal cells are concave and outer face is prolonged into a single delicately tapering process). Sides of marginal cells also concave or nearly straight. Interior cells similar to marginal cells but with shorter processes. Cell wall is smooth or finely punctuate. Colonies are composed of 4-8-16-32-64-128 (usually 8-16-32) cells. Cells being 8-24 μm broad, and 10-45 μ long; if 16-celled colonies are 125 μm in diameter.

3. *Pediastrum ovatum (Ehrenberg) A.Braun* (Pl.2 Fig.3)

M.T. Philipose 1967, p.115. fig.37d.

Colonies, usually 4-8-16-(rarely 32-) celled, with the cells are 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, the perforations being small. Cells are plumier than in *P.simplex var. duodenarium* with the outer sides of periphera and often central cells convex. Cell wall is smooth or ornamented. Four-celled colonies up to 60 µ, 8-celled colonies up to 30 µ and 16-celled colonies up to 100 µ in diameter, each cell measuring 8.5-19 µm broad and 14-37 µm long.

4. *Pediastrum duplex* Meyen var. *genuinum (A. Braun) Hansgirg* (Pl.2 Fig.4)

M.T. Philipose 1967, p.123. fig.43d.

Colonies are 4-8-16-32 celled with fairly large intercellular spaces. Marginal cells are with stout processes which are straight or slightly curved, with cell membrane smooth or punctuate. Cells measure 6-18 µm , perforations up to 6 µm and colonies upto 45-65 µm in diameter

5. *Pediastrum duplex* Meyen var.*clathratum (A. Braun) Lagerheim* (Pl.2 Fig.5)

M.T. Philipose 1967, p.123. fig.43f.

Cells have deeply emarginate sides and large intercellular spaces in *Pediastrum duplex* .Colonies are 3-64 celled, cells being 9-25 µm in diameter. Sixteen –celled colonies measure up to 90 µm in diameter.

6. Pediastrum duplex Meyen var. reticulatum Lagerheim (Pl.2 Fig.6)

M.T. Philipose 1967, p.124. fig.43g.

Cells have (10-20 (-40) µm in diameter) more or less H-shaped with sides of processes of marginal cells nearly parallel. Intercellular spaces are large and oval. Colonies 8-16 celled are 58-70 µm in diameter.

7. Pediastrum duplex Meyen var. gracillimum W. Et G. S. West (Pl.2 Fig.7)

M.T. Philipose 1967, p.124. fig.43i.

Colonies with very large intercellular spaces have very narrow cells, as broad as or narrower than the processes. Body of marginal cells are curved outwards with two long processes having emarginated apices. Inner cells also similar to marginal cells but with shorter processes. Cells are 10-18.5 (-22) µm broad and 12-25 (-32) µm long with Perforations 4-16 µm in diameter. Sixteen celled colonies measure 65-140 µm in diameter.

8. Pediastrum tetras (Ehr.) Ralfs var. tetraodon (Corda) Hansgirg (Pl.2 Fig.8a,b)

M.T. Philipose 1967, p.129. fig.45d,g.

Colonies 4-8-16 celled. Incision of cells deep with the lobes adjacent to the incision of the marginal cells very pronounced. Cells 8-18 µm in diameter.

9. Pediastrum tetras (Ehr.) Ralfs var. apiculatum Fritsch (Pl.2 Fig.9)

M.T. Philipose 1967, p.130. fig.45h.

The colonies from Azhicode had processes with apical nodular thickenings as seen in *P. tetras* var. *apiculatum* Fritsch . The colony was 24.6 µm in diameter with cells 14-17.6 µm in diameter. Owing to insufficiency of material it could not be decided whether the alga belonged to this type.

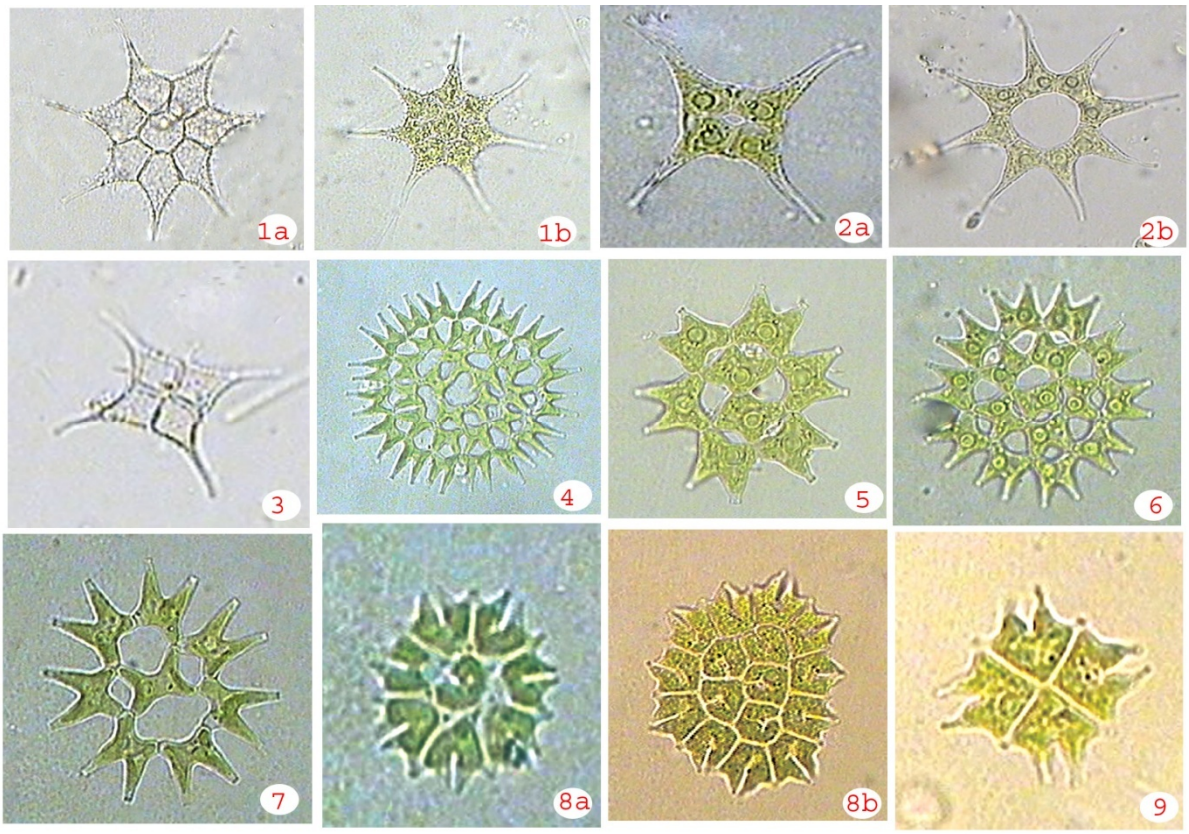

Plate: 1.Photomicrographs of *pediastrum* species recorded in the water samples collected from Parthasarathy swamy Temple and Kapaleeswarar Temple.

1a,b. Pediastrum simplex Meyen 2a,b. Pediastrum simplex var. duodenarium (J.W.Bailey) Rabenhors 3. Pediastrum ovatum (Ehrenberg) A.Braun 4. Pediastrum duplex var. genuinum (A.Braun) Hansgirg 5. Pediastrum duplex var. clathratum (A.Braun) Lagerheim 6. Pediastrum duplex var. reticulatum Lagerheim 7. Pediastrum duplex var. gracillimum West & G.S.West 8a,b. Pediastrum tetras var. tetraodon (Corda) Hansgirg 9. Pediastrum tetras var. apiculatum Fritsch.

DISCUSSION

Presence of algae like *Melosira, Oscillatoria, Pandorina, Pediastrum, Closterium, Navicula, Microcystis and Scenedesmus* has been considered indicative of nutrients - enriched water providing evidence of pollution.[10] High population by *Cosmarium Scendesmus, Pediastrum, and Pleuotaenium* species was observed during the period of August to October.[11]

In the present study, the water samples collected from temple tanks of *Arulmigu Sri. Parthasarathy swamy* Temple tank, Thiruvallikeni,Chennai, and *Arulmigu Sri Kapaleeswarar* Temple tank, Mylapore, Chennai, India, for a year, recorded a total of nine *pediastrum* species. The maximum number of *pediastrum* species was recorded in *Parthasarathy swamy* Temple tank during Summer . The species *Pediastrum tetras var. tetraodon (Corda) Hansgirg* was found to be present in both the temple tanks in all the seasons studied. The physico-chemical parameters of the water sample of *Kapaleeswarar* temple tank recorded maximum levels in Total TDS and Chloride during the summer season, contributing to the observed diversity of the alga. The pollution of the study area is due to increased drain of pollutants into the tanks by visiting devotees in summer.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the help and facilities extended by the Secretary, RKM. Vivekananda College, Mylapore, Chennai – 600 004 for carrying out the study.

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