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RESEARCH ARTICLE

A PRELIMINARY REPORT ON PLANKTONIC ALGAE OF TEMPLE TANKS OF KANCHEEPURAM DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Planktonic algae were collected from eight different temple tanks of Kancheepuram district and studied thoroughly. Taxa belonging to *Cyanophyceae*, *Chlorophyceae*, *Chrysophyceae*, *Cryptophyceae*, *Euglenophyceae* and *Dinophyceae* were examined. A total number of 78 taxa were identified and their descriptions are given, of these 10 belong to the class *Cyanophyceae*, 42 to *Chlorophyceae*, one each to *Chrysophyceae* and *Cryptophyceae*, 22 to *Euglenophyceae* and 2 to the *Dinophyceae*. Of the 78 taxa investigated, a total number of 39 taxa are found to be new reports to Tamil Nadu.

INTRODUCTION

Planet earth is endowed with a rich variety of life forms. The teaming of millions of these living organisms is well-knit by the law of nature. Approximately 80% of the earth's surface is covered with water of which 97% is the seas and oceans and 2% is frozen ice and glacier, while only 1% of the total water comes under lotic (rivers and streams) and lentic (ponds, lakes and reservoir, etc.) fresh water systems.

Algae comprise of morphologically diverse chlorophyllous organisms, inhabiting both marine and freshwater ecosystems. No other group of plants is so highly diverse as algae and for this reason it has long been assumed fundamental significance for unraveling the mysteries of nature that the plant life holds. Algae gain their importance in the modern times not only as alternative potential source of proteins for the hungry man but also as the means of controlling pollution in the aquatic ecosystem, apart from being put to use as inexpensive and more acceptable bio-fertilizers in the crop field and as an efficient means of sewage treatment and purification of eutrophic waters. But, before the algae are put into such important uses it is very essential to have a base line data (i.e. proper identification of the concerned organism) to know the exact algal forms to be exploited for various purposes.

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Lentic system in south India falls under three different categories; viz., lake, pond and tank or kulam. Lake is a large earthenware tank dug out of the ground with the dug out mud making the sidewall or bunds. Pond is a small rectangular tank constructed to collect the water coming out from the ground. A winding staircase is provided for people to go down and collect the water for their domestic use. A tank or kulam was built with bricks (and occasionally granite) and was attached to a temple, giving it the name temple tank (Kovil Kulam in Tamil).

The tradition of establishing a tank along the side of a temple trace back to long history. Since every village has a temple and also has a tank with it. These tanks were constructed to harvest rain water. Sometimes channels are constructed to bring water from a nearby stream or a river. The water from the temple tank was mainly meant for the ritual bath of the deity and to provide water for the flowering plants in the 'nandavanam'. Devotees also wash their hands and feet or even bathe in the temple tank before entering the temple. However other activities such as fishing, etc., are not permitted in these tanks. Hence they remain undisturbed to a large extent. On this basis temple tanks could be considered as safe asylum for fish and other organisms. In other words, temple tanks serve as an ideal habitat for aquatic microorganisms.

In Tamil Nadu, studies on algal flora of temporary pools were started by Iyengar (1940) and followed by Ganapathi (1941), Ganapathi *et al*., (1953), Prasad and Janaki (1981). River ecology was studied by Iyengar and Venkataraman (1951), Sankaran, (1972), Ragothaman (1974) and Anand (1976). Even though the Kancheepuram district of Tamil Nadu is abounding with varied form of lentic ecosystems, studies concerned with algal diversity especially in temple tanks are very meager. In order to fill this lacuna an attempt has been made to study the planktonic algae of some of the temple tanks of Kancheepuram district.

MATERIALS AND METHODS

Kancheepuram district is in the northeast of Tamil Nadu, adjacent to the Bay of Bengal. It is bounded in the west by Vellore and Thiruvannamalai districts, in the north by Thiruvallur district and Chennai district, in the south by Villupuram district. It lies between 11° 00' to 12° 00' North latitudes and 77° 28' to 78° 50' East longitudes. The district has a total geographical area of 4,432 km² and a coastline of 57km. The town of Kancheepuram is the district headquarters. Samples were collected from eight different temple tanks of Kancheepuram district and the name of the temple, place and date of collection are given in Table 1 (Plate I).

Table 1. Name of the temple and place of collection

S. No	Name of the Temple	Place	Date of Collection	Bottle No.
1	Kothandaramar temple	Chengalpattu	28.08.2006	T0601
2	Sangutheerthakulam	Thirukalukundram	03.09.2006	T0602
3	Vedhagireeshwar temple	Thirukalukundram	03.09.2006	T0603
4	Kandhaswamy temple	Thiruporur	07.09.2006	T0604
5	Sivan temple	Madhuranthagam	10.09.2006	T0605
6	Subramanyaswamy temple	Vallakotai	16.09.2006	T0606
7	Kachabasewarar temple	Kancheepuram	16.09.2006	T0607
8	Ekambaranathar temple	Kancheepuram	16.09.2006	T0608

Water samples were collected from the locality by using plastic water cans or containers after stirring the water. One liter of water was collected from the locality to which 10ml of Lugol's iodine was added (to get the final concentration of 1%) and left undisturbed for about 24 hours. The planktons fixed and settled at the bottom of the containers were collected and preserved in bottles containing 4% formalin glycerin preservative after decanting the supernatant fluid. All the samples were serially numbered, labeled with date and place of collection. Samples after examination are deposited in the Laboratory of Phycology, Department of Plant Biology and Plant Biotechnology, Madras Christian College (autonomous) Tambaram, Chennai - 600 059. Algal samples were examined immediately after fixation using calibrated student's research microscope and measurements were taken and photomicrographs were taken using Nikon automatic photomicrographic unit. Algae were identified using standard algal monographs and publications of Turner (1892), Iyengar and Vimala Bai (1941), Smith (1950), Thompson (1950), Desikachary (1959), Kossinskaja (1960), Prescott (1962), Philipose (1967, 1982 and 1984), Forster (1970), Islam (1970), Crosdale and Scott (1976), Iyengar & Desikachary (1981), Capdevielle (1982), Patel and Daniel (1990), Krishnamurthy (2000), Komarek (2003), Cronberg and Komarek (2004) and Database on Algae of Tamilnadu (Baluswami, 2006).

RESULTS

A total number of 78 taxa were identified (excluding diatoms), of these 10 taxa belongs to the class Cyanophyceae, 42 to the Chlorophyceae, one each to the Chrysophyceae and the Cryptophyceae, 22 to the Euglenophyceae and 2 to the Dinophyceae.

PLATE I. 1. Ekambaranathar temple, Kancheepuram; 2. Kachabasewarar temple, Kancheepuram; 3. Sangutheerthakulam, Thirukalukundram;

The descriptions of the taxa of algae collected during the present study are given below.

CYANOPHYCEAE

***Microcystis aeruginosa* Kuetz. (Plate II, Fig. 1)**

Colonies when young round or slightly longer than broad, solid, when old becoming clathrate with distinct hyaline colonial mucilage. Cells spherical 1-2 µm in diameter, densely arranged with gas vacuoles; individual sheath absent.

***Aphanocapsa pulchra* (Kuetz.) Rabenh. (Plate II, Fig. 2)**

Thallus gelatinous, homogenous, blue green, free floating; cells 3.5-4.5 µm in diameter; loosely arranged without an order, occur singly or in pairs, pale blue- green; individual sheaths of cells indistinct.

***Coelosphaerium* sp. (Plate II, Fig. 3)**

Colony spherical with a thin colonial mucilage envelope, 12-20 µm broad; cells sub-spherical 2.5-3 µm board, closely arranged.

***Gomphosphaeria aponina* Kuetz. (Plate II, Fig. 4)**

Colonies 4-8 celled, cells pyriform or cuneate, cordate at longitudinal cell division, 2-3 µm board and 3-4 µm long, blue green to olive-green with a distinct mucilaginous envelope, placed at the ends of regularly dichotomously or trichotomously branched radial mucilaginous stalk; colonies 15-18 µm in diameter.

***Merismopedia tenuissima* Lemm. (Plate II, Fig. 5)**

Tabular colonies consisted of 32 cells, arranged in homogenous mucilage generally in fours, arranged in a single plane, free floating. Cells pale blue-green, oblong before cell division but sub-spherical after division, 1.5-2 µm broad, individual cells with distinct mucilaginous envelopes.

***Romeria* sp. (Plate II, Figs. 6 & 7)**

Trichomes are short, curved to spirally twisted, with gelatinous sheath external to trichome. Cells cylindrical 1- 1.3 µm broad, with more less broadly rounded poles, and with length twice to several times the breadth.

***Spirulina labyrinthiformis* (Menegh.) Gomont (Plate II, Fig. 8)**

Trichomes unicellular upto 5 µm broad coiled into regular spiral, spirals very close to each other. Yellowish green, spiral 2.5 µm broad.

***Lyngbya circumcreta* West G.S. (Plate II, Fig. 9)**

Filaments single, free floating short, spirally coiled, mostly 2-2½ turns; sheath very thin, firm, colourless; cell nearly quadrate or somewhat shorter than broad 1.8 µm broad, upto 2 µm long, not constricted at the cross walls, pale blue green; end cell rounded, with calyptra.

***Anabaenopsis tanganyikae* (West, G.S.) Wolosz. et Miller (Plate II, Fig. 10)**

Trichomes free floating very short, spirally coiled, 1-1½ spirals, without sheath; trichomes not constricted at the cross wall; cells 2.5 -3 µm broad and 4-5 µm long, without gas vacuoles, heterocyst ellipsoidal , 3 µm broad and 5.5 µm long.

***Anabaenopsis arnoldii* Aptekarj (Plate II, Fig. 11)**

Trichome single, with a thick, hardly perceptible gelatinous sheath, trichome spirally coiled; spiral upto one, measuring 25-28 µm in diameter. Cells adpressed, spherical, seldom nearly ellipsoidal, 4-5 µm broad, and 5-6 µm long, with gas vacuoles; heterocyst ellipsoidal 5.5-6 µm broad and 6.5-7 µm; spores single, spherical 5-5.5 µm broad with a smooth colourless membrane.

CHLOROPHYCEAE

***Phyllocardium complanatum* Kors. (Plate III, Fig. 1)**

Cells naked, cell wall absent, with a distinct periplast; complanate, elliptical in side view, cordate on the broad side, 15 µm broad and 25 µm long not contorted; anterior end rounded or sub-truncate with an apical papilla having two flagella; posterior end generally pointed, with an small portion at the posterior end; chloroplast cup shaped, entire, parietal extending upto the anterior end; pyrenoid absent; starch grains strewn all over; eyespot anterior or nearly median in position, nucleus in the middle of the cell; contractile vacuole two, anterior.

***Korshikoviella limnetica* (Lemm.) Silva (Plate III, Fig. 2)**

Cells slightly curved, broadly fusiform with one end drawn out into a long hyaline spine and the other into a delicate seta without any basal disc or furcation. Chloroplast more, each with one pyrenoid; cells 3-3.5 µm broad, 25-35 µm long; stipe 5 µm long.

***Schroederia planctonica* (Skuja) Comb. nov. (Plate III, Fig. 3)**

Cells solitary, free-floating, straight fusiform, tumid in the middle with drawn out apex. Cell membrane fairly thick and produced into a long solid spine at either end. Chloroplast single parietal with 4 pyrenoids. Cells 4-5 µm broad, 54 -56 µm long with spines, and 34-37 µm without spines.

***Golenkinia radiata* Chodat (Plate III, Fig. 4)**

Cells solitary free floating, spherical with the entire cell wall covered by a number of long bristles. Chloroplast cup-shaped and with a pyrenoid. Cells 14-15 µm in diameter. Bristles14-17 µm long.

***Micractinium pusillum* Fres. (Plate III, Fig. 5)**

Colonies quadrate, tetrahedric with 32 cells arranged in groups of four, each group being quadrate. Cells spherical with a thin

PLATE II. 1. ***Microcystis aeruginosa*****; 2.** ***Aphanocapsa pulchra*****; 3.** ***Coelosphaerium*** **sp.; 4.** ***Gomphosphaeria aponina*****; 5.** ***Merismopedia tenuissima*****; 6 & 7.** ***Romeria*** **sp.; 8.** ***Spirulina labyrinthiformis*****; 9** ***Lyngbya circumcreta*****; 10.** ***Anabaenopsis tanganyikae*****; 11.** ***Anabaenopsis arnoldii.*** **(Scale: All figures 50 µm)**

firm cell membrane and with a pyrenoid Cells upto 3 µm in diameter. Setae usually upto 20 µm long.

Pediastrum duplex **var.** ***subgranulatum*** **Racib. (Plate III, Figs. 6 & 13)**

Colonies 16 celled, with small lens shaped perforations between cells. Inner cells quadrate to angular and does not contact at the central portion of the side wall, inner side of marginal cells concave outer side produced into two short truncate process. Cells 5-15 µm in diameter. Colonies upto 60 µm in diameter.

Pediastrum duplex **var.** ***gracillimum*** **W. et. G.S. West (Plate III, Fig. 7)**

Colonies 16 celled with very large intercellular spaces. Cells very narrow, as broad as or narrower than the processes. Body of the marginal cells curved downwards and with two long processes with emarginated apices. Inner cells are similar to marginal cells but with shorter processes. Cells upto 10 µm broad and 12 µm long. Colonies upto 45 µm in diameter.

Pediastrum simplex **Meyen (Plate III, Fig. 8)**

Colonies circular, 8 celled. Inner side of marginal cells nearly straight, outer side produced into a gradually tapering process,

sides concave. Inner cell polygonal, intercellular spaces are absent, cell wall granulated. Cells 7 μm broad and upto 15 μm long.

***Pediastrum simplex* var. *duodenarium* (Bailey) Rabenh. (Plate III, Fig. 9)**

Colony 4 celled, differs from the type in having a single central space with the cells arranged in a ring at the periphery. Inner face of the cells concave, outer face prolonged into a single delicately tapering process. Sides of marginal cells also concave, cell wall smooth. Cells 8-9 μm broad and 15-17 μm long. Colonies upto 37 μm in diameter.

***Pediastrum tetras* (Ehr.) Ralfs (Plate III, Fig. 10)**

Colonies circular of 8 cells without intercellular space. Marginal cells divided into two lobes by a deep linear to cuneate incision on the outside reaching to the middle of the cell. Each lobe truncate, slightly emarginated or further divided into two lobes. Inner cells 4-6 sided with a single linear incision. Cells 5-6 μm in diameter. Colonies upto 20 μm in diameter.

***Pediastrum tetras* var. *excisum* (Rabenh.) Hansg. (Plate III, Fig. 11)**

Colonies squarish made of 4 cells. Differs from the type in the lobes being more or less deeply concave. Cells 5 μm in dimension.

***Pediastrum tetras* var. *tetraodon* (Corda) Hansg. (Plate III, Fig. 12)**

Colonies 8 celled, circular. Incision of cells deep with the lobes, adjacent to the incision of the marginal cells very pronounced. Cells 5-7 μm in diameter.

***Tetraedron muticum* (Braun) Hansg. (Plate III, Fig. 14)**

Cells solitary, free floating small, flat and triangular with the sides slightly concave and angles broadly rounded or truncate. Chloroplast single, parietal, cell membrane thick and smooth. Cells upto 12 μm in diameter.

***Tetraedron trigonum* forma *minus* (Reinsch) De Toni (Plate III, Fig. 15)**

Cells flat, triangular with slightly concave sides. Cell membrane smooth, cells 13-16 μm in diameter. Spines 1 μm long.

***Tetraedron trigonum* forma *gracile* (Reinsch) De Toni (Plate III, Fig. 16)**

Cells flat, triangular with more markedly concave sides. Cell membrane smooth, cells 14-15 μm in diameter. Spines upto 4 μm long.

***Chlorella vulgaris* Beijerinck (Plate III, Fig. 17)**

Cells small, solitary, spherical with a thin cell membrane. Chloroplast single parietal cup shaped with a pyrenoid. Cells 5-6 μm in diameter.

***Oocystis borgei* Snow (Plate III, Fig. 18)**

Cells free floating, with 4 cells enclosed within the expanded mother cell membrane to form temporary colonies. Cells broadly ellipsoid with rounded ends. Poles not thickened. Chloroplasts 1-4 parietal, each with a pyreniod. Cells 7-8 μm broad, 9-10 μm long.

***Radiococcus* sp. (Plate IV, Fig. 1)**

Colonial, free-floating; cells globose, pyramidately grouped in fours with in a broad radially fibrillar gelatinous matrix. When there is more than one group of four cells with in a colony they are connected by non-gelatinized remains of old parent cell wall. Cells 4-5 μm in diameter, having a parietal cup shaped chloroplast with one pyrenoid.

***Dictyosphaerium pulchellum* var. *minutum* Deflandre (Plate IV, Figs. 2 & 3)**

Colony spherical, free floating upto 44 μm in diameter and composed of 4-16 cells, without any evident gelatinous envelope. Cells globular, 4-5 μm in diameter and with a cup-shaped chloroplast having a single median pyrenoid. Cells are connected to each other by cruciately or dichotomously branching threads.

***Westella botryoides* (W. West) de Wildeman (Plate IV, Fig. 4)**

Colonies irregular, free floating and usually without a gelatinous envelope, made up of 16 cells held together by the non-gelatinizing remains of the old mother cell walls. Cells spherical and arranged in groups of fours, chloroplast single and cup shaped without pyrenoid. Cells 6-7 μm in diameter, colonies upto 42 μm in diameter.

***Ankistrodesmus falcatus* (Corda) Ralfs (Plate IV, Fig. 5)**

Colonies free floating, solitary without a mucilaginous envelope. Cell acicular to narrowly in fasciculate bundles of 4-8 or more. Chloroplast single, parietal and usually without pyrenoid. Cells 1.5-2 μm broad, upto 50 μm long.

***Actinastrum hantzschii* Lagerh. (Plate IV , Fig. 6)**

Colonies free floating and made up of 4-8 spindle shaped cells radiating from a common centre. Sometimes joined together to form irregular multiple colonies. Cells with a single parietal chloroplast without a pyrenoid. Middle of the cell twice as board as the apices. Cells 2-2.5 μm broad, upto 10 μm long, colonies upto 20 μm in diameter.

***Kirchneriella obesa* (W.West) Schmidle (Plate IV, Fig. 7)**

Colonies free floating, 4-8 cells irregularly arranged within a wide gelatinous envelope. Cells strongly lunate with the ends almost near each other. Outer side of cell markedly convex, inner side nearly parallel to it. Ends of cells tapering slightly and with rounded or bluntly pointed apices. Chloroplast covering the entire convex portion of the cell wall. Cells 2-2.5 μm broad upto 7 μm long.

***Coelastrum cambricum* var. *intermedium* (Bohlin) G.S. West (Plate IV, Figs. 8 & 9)**

Colonies spherical 8-16 celled. Cells spherical and thickened at the poles, outer face of the external cells being sub spherical

PLATE III. 1. *Phyllocardium complanatum*; 2. *Korshikoviella limnetica*; 3. *Schroederia planctonica*; 4. *Golenkinia radiata*; 5. *Micractinium pusillum*; 6 & 13. *Pediastrum duplex* var. *subgranulatum*; 7. *Pediastrum duplex* var. *gracillimum*; 8. *Pediastrum simplex*; 9. *Pediastrum simplex* var. *duodenarium*; 10. *Pediastrum tetras*; 11. *Pediastrum tetras* var. *excisum*; 12. *Pediastrum tetras* var *tetraodon*; 14. *Tetraedron muticum*; 15. *Tetraedron trigonum* forma *minus*; 16. *Tetraedron trigonum* forma *gracile*; 17. *Chlorella vulgaris*; 18. *Oocystis borgei.* (Scale: All figures 50 µm)

and gradually arched. The outstanding projections are also blunt and rounded. Intercellular spaces between cells upto 13 µm in diameter, colonies upto 34 µm diameter in diameter.

***Coelastrum proboscideum* Bohlin (Plate IV, Figs. 10 & 11)**

Colonies more or less pyramidal and of 4-8-16, rarely more cells. Intercellular space usually large and polygonal. Cells conical, truncate and six-sided with the lateral sides slightly concave poles of thickened. Cells 12 µm in diameter, colonies upto 45 µm in diameter.

***Crucigenia crucifera* (Wolle) Collins (Plate IV, Fig. 12)**

Colonies 4 celled, rhomboidal with slightly concave sides and a small rectangular space at the center often joined together in multiple colonies of 16 or more cells. Cells elongate with the outer side concave and in the inner side straight or slightly convex. Chloroplast parietal with a pyrenoid. Cells 3-3.5 µm broad, 5-6 µm long, four celled colonies upto 10 µm broad and 14 µm long.

***Tetrastrum heteracanthum* (Nordst.) Chodat (Plate IV, Fig. 13)**

Colonies 4 celled and flat with the cell quadrately arranged. Cells nearly heart-shaped (triangular with the outer face slightly concave) with a long and short setae from the outer surface, setae straight. Chloroplast parietal with single pyrenoid. Cells upto 5 µm in diameter. Long setae 10 µm long, short setae 2 µm long.

***Scenedesmus acuminatus* (Lagerh.) Chodat (Plate IV, Fig. 14)**

Colonies curved and of 4 fusiform cells with sharp pointed ends. Cell wall smooth and without teeth or spines. Cells 1.5-2 µm broad, 9-10 µm between apices.

***Scenedesmus armatus* var. *bicaudatus* (Gugl.) Chodat (Plate IV, Fig. 15)**

Colonies 4 celled, having a long spine from one of the poles of the terminal cells; the spines of the two terminal cells alternating with each other, longitudinal ribs usually seen only in the internal cells. Cells 2.5-3 µm broad, 8-10 µm long, spines upto 8.5 µm long.

***Scenedesmus antennatus* De Breb. ex Ralfs (Plate IV, Fig. 16)**

Colonies 4 celled, arranged in single linear series, in contact with half or nearly third portion of the lateral walls. Cells ellipsoidal with two protuberances at both ends. Cell wall smooth without teeth or spines. Cells 4.5-5 µm broad and upto 10 µm long.

***Scenedesmus bijugatus* var. *graevenitzii* (Bernard) Comb. nov. (Plate IV, Fig. 17)**

Colonies 4 to 8 celled. Cells fusiform, ellipsoid to ovoid with obtuse pole and arranged in an alternating series with adjacent cells in contact only along a short portion of their length. Cells 4.5-5 µm broad and upto 10 µm long.

***Scenedesmus denticulatus* Lagerh. (Plate IV, Fig. 18)**

Colonies 2-4 celled with the cells arranged in a cruciate to sub-alternate manner. Cells ovoid-oblong to ellipsoid with 1-3 teeth from each pole. Teeth sometimes absent from one end of the inner cell. Cell membrane somewhat thick. Cells 5-7 µm broad, 11-13 µm long.

***Scenedesmus dimorphus* (Turpin) Kutz. (Plate IV, Fig. 19)**

Colonies 4 celled with the cells arranged in a linear series. The outer cells of the colony being more or less lunate and the apices of the cells being attenuated. Cells 3-4 µm broad, 14-16 µm long.

***Scenedesmus longus* var. *naegelii* (Breb.) G.M. Smith (Plate IV, Fig. 20)**

Colonies two celled, cells more or less oblong to cylindrical to sub-pyriform with round ends, and arranged in a linear series. Both cells with a long recurved spine from one pole and a long or short, straight or slightly curved spine usually from other pole. Cells 5-5.5 µm broad, 13-14 µm long.

***Scenedesmus quadricauda* var. *longispina* (Chodat) G.M. Smith (Plate IV, Fig. 21)**

Colonies usually 4 celled. Cells ovoid to cylindrical, spines proportionately longer, compared to the length of the cells. Internal cells some times with very short delicate spines from some of their poles. Cells 4-5 µm broad, 10-11 µm long, spines upto 10 µm long.

***Scenedesmus platydiscus* (G.M. Smith) Chodat (Plate IV, Fig. 22)**

Colonies flat, 8-celled, with oblong elliptic cells arranged in double series. Interstices between cells are absent. Cells 5-5.5 µm broad, 8-8.5 µm long.

***Tetrallantos lagerheimii* Teiling (Plate IV, Figs. 23 & 24)**

Colonies free floating usually 4-celled but sometimes 8-celled, cells being held together by the remnants of the mother cell wall and usually enclosed by a delicate mucilaginous envelope, which is often visible only after staining. Cells crescent to sausage shaped with their ends rounded. Two cells arranged in the same plane facing each other and with their ends touching and the other two cells vertical to the former and joined to their meeting points. Chloroplast a parietal plate with the pyrenoid. Cells 3-4 µm broad, 7-8 µm long.

***Cosmarium proteiforme* Wallich (Plate V, Fig. 1)**

Cells single, small semicells elliptical, moderately constricted, cell wall smooth. Chloroplast one in each semicell with a single pyrenoid. Cells upto 14 µm long, 10 µm broad; isthmus 5 µm in width.

***Cosmarium lundellii* var. *corruptum* (Turn.) West & G. S. West (Plate V, Fig. 2)**

Cells single, deeply constricted, semicells some what ovate, cellwall smooth. Chloroplast one in each semicell with a central pyrenoid. Cells upto 12 µm long, 10 µm broad; isthmus 4 µm in width.

***Cosmarium circulare* Reinsch (Plate V, Fig. 3)**

Cells circular, slightly longer than broad, deeply constricted, cell wall smooth. Chloroplast one in each semicell with pyrenoid towards the isthmus. Cells upto 2 µm long, 10 µm broad; isthmus 4 µm in width.

***Cosmarium sikhimense* Turn. (Plate V, Fig. 4)**

Cells longer than broad, semicells oval in shape, cellwall smooth. Chloroplast one per semicell, axile in position with a single pyrenoid. Cells upto 11 µm long, 7 µm broad; isthmus 4 µm in width.

***Staurastrum paradoxum* Meyen (Plate V, Fig. 5)**

Cells 10 µm broad, semicells are somewhat lunate shaped, processes long and widely bifurcated terminating in 2-3 spines. Cell wall ornamented with short spines; isthmus 5 µm in width.

CHRYSOPHYCEAE

***Centritractus* sp. (Plate V, Fig. 6)**

Unicellular, free floating, cylindrical with a length several times the breadth and with both poles prolonged into a long straight spine. Cell wall is composed of two halves which overlap each other. Protoplast has two more or less longitudinal laminate chromatophores. Cells upto 24 µm long, 4.5 µm broad; spines upto 17 µm long.

CRYPTOPHYCEAE

***Cryptomonas* sp. (Plate V, Fig. 7)**

Cells elliptical to elongatedly ovoid, with a firm pellicle; biflagellated, two flagella emerge from the invaginated canal from the anterior end. Posterior end slightly conical; chromatophores two, lateral in position green to blue-green in

PLATE IV. 1. *Radiococcus sp.*; 2 & 3. *Dictyosphaerium pulchellum* var. *minutum*; 4. *Westella botryoides*; 5. *Ankistrodesmus falcatus*; 6. *Actinastrum hantzchii*; 7. *Kirchneriella obesa*; 8. *Coelastrum cambricum* var. *Intermedium*; 9, 10 & 11. *Coelastrum proboscideum*; 12. *Crucigenia crucifera*; 13. *Tetrastrum heteracanthum*; 14. *Scenedesmus acuminatus*; 15. *Scenedesmus armatus* var. *bicaudatus*; 16. *Scenedesmus antennatus*; 17. *Scenedesmus bijugatus* var. *graevenitzii*; 18. *Scenedesmus denticulatus*; 19. *Scenedesmus dimorphus*; 20. *Scenedesmus longus* var. *naegelii*; 21. *Scenedesmus quadricauda* var. *longispina*; 22. *Scenedesmus platydiscus*; 23 & 24. *Tetrallantos lagerheimii*. (Scale: All figures 50 µm)

colour, nucleus found at the posterior end. Cells upto 15 µm long, 8.5 µm broad.

EUGLENOPHYCEAE

Euglena granulata Klebs (Plate V, Figs. 8 & 13)

Body fusiform with changes in the ratio of length to breadth caused by bulging slightly in front or behind the middle; anterior end more or less conical, posterior end narrowed and ending in a short nearly cylindrical hyaline tail which is frequently bent to one side. Chromatophores large, somewhat spindle shaped to elongate in side view; anterior end generally free of chromatophores but at posterior end they well extend to the caudal tip; flagellum less than body length. Cells 25-34 µm long, upto 14 µm broad.

Euglena truncata var. *baculifera* Thompson (Plate V, Fig. 9)

Body cylindrical with rounded end at the base with the anterior end frequently narrower. Chromatophores numerous small and discoid; flagellum equal to the body length. Cells upto 65 µm long, 12 µm broad.

Euglena geniculata Duj. (Plate V, Fig. 10)

Body elongate, fusiform to cylindrical with the anterior end being some what rounded and the posterior end more or less

conical. Chromatophores numerous; flagellum not observed. Cells upto 54 μm long, 62 μm broad.

***Euglena limnophila* Lemm. (Plate V, Fig. 11)**

Body spindle shaped with a slightly drawn out neck, truncate anterior end and with a straight tail at posterior end. Chromatophores numerous; flagellum smaller than body length. Cells upto 53 μm long, 13 μm broad.

***Euglena* sp. (Plate V, Fig. 12)**

Body fusiform, some what blunt towards the anterior end and tapering towards the posterior end. Chromatophores numerous distributed throughout the cell; flagellum twice that of the body length. Cells upto 31 μm long, 14 μm broad.

***Euglena spirogyra* Ehr. (Plate V, Fig. 14)**

Body elongated and more or less cylindrical with sides parallel, body sometimes bent but not twisted, anterior end slightly tapering with a rounded end, posterior end ending abruptly in a hyaline tail piece. Chromatophores small, discoid and numerous; flagellum shorter than the body length. Cells upto 43 μm long, 6 μm broad.

***Phacus brachykentron* Pochm. (Plate V, Fig. 15)**

Body more or less elliptical to oval and slightly bent tail; paramylum two one slightly lateral and the second excentric to the first, eyespot usually small and disc-like. Cells upto 22 μm long, 20 μm board.

***Phacus circumflexus* Pochm. (Plate V, Fig. 16)**

Cell more or less asymmetrical and more unequally bend than twisted; anterior end somewhat pointed with the lip close together, posterior end with a straight, bent, slightly twisted tail; pellicular striae prominent and spiral; paramylum central and oval shaped. Cells upto 55 μm long, 28 μm broad.

***Phacus contortus* Bourr. (Plate V, Fig. 17)**

Cell oval and in two asymmetrical twisted halves separated by two broad furrows, with one half spread out in the form of a wing which is projected backward like a beak with a stout oblique tail from the hind end of other half; periplast with faint longitudinal striate following the twist; paramylum two irregular disc and in each of the cell. Cells upto 36 μm long, 26 μm broad.

***Phacus curvicauda* Swir. (Plate V, Fig. 18)**

Cell nearly round with the anterior end slightly narrow and the hind end slightly broadened and bearing at its tip a short tail which is turned slightly towards one side; pellicular striate longitudinal; chromatophore numerous and discoid; eyespot discoid. Cells upto 25 μm long, 19 μm broad.

***Phacus granum* Drez. (Plate V, Fig. 19)**

Cell nearly cylindrical, rounded anteriorly, ending in a short conical tail; apical groove short; paramylum two elongated cylinders with rounded ends placed longitudinally. Cells upto 19 μm long, 7 μm board.

***Phacus platalea* Drez. (Plate V, Fig. 20)**

Cell broadly oval and flat, slightly asymmetrical and with a sharply pointed oblique tail; paramylum a sing large central disc; apical furrow usually reaching upto the middle only. Cells (with tail) upto 45 μm long, 29 μm broad.

***Phacus pseudonordstedtii* var *minuscula* (Conrad) Huber (Plate V, Fig. 21)**

Cell rigid and ovate in front view and is provided with a short caudal process, conspicuously compressed and more or less twisted. The periplast is usually ornamented with longitudinal striae or lows of short spines. The chromatophore are numerous and discoid, paramylum one or ring shaped. Cells upto 31 μm long, 12 μm broad.

***Phacus helicoides* Pochm. (Plate VI, Fig. 1)**

Cell spirally twisted (usually 3 twists) with the anterior end slightly narrowed and ending in a forked cleft; cell markedly broad in the anterior third, and with a straight hyaline tapering tail at the posterior end; outline of cell like a delta; dorsal and ventral sides forming a spiral keel from the middle of the cell, pellicular striae spiral and following the twists; paramylum single disc like at the centre. Cell (including tail) upto 83 μm long, 36 μm broad.

***Phacus tortus* (Lemm.) Skv. (Plate VI, Fig. 2)**

Cell slightly twisted, the number of twists being usually one and usually symmetrical in relation to the middle line; anterior and posterior ends narrowed, broadest at middle; posterior end produced into a long, straight or slightly bend tail pellicle with a longitudinal striae which follow the twist, with one large or medium sized, central ring like paramylum. Cells (including tail) upto 62 μm long, 17 μm broad.

***Phacus triqueter* Duj. (Plate VI, Fig. 3)**

Cell anteriorly broadly rounded, narrowed posteirorly asymmetrically to form a sharp, pointed slightly deflacted tail; dorsal surface with a high flange appearing triangular when seen in end view; longitudinal furrow on ventral side Pellicle longitudinally striated, striations slightly extending into tail; paramylum two small rings. Cells upto 60 μm long, 33 μm broad.

***Phacus suecicus* Lemm. (Plate VI, Fig. 4)**

Cell broadly ovoid to ellipsoid and slightly asymmetrical, elliptical side view, anterior end somewhat truncate slopingly or retuse with a central papilla; posterior end with a short stout slightly oblique or curved tail; pellicle upto 14 of longitudinal rows of wart-like excrescences or tubercles; chromatophores small, numerous and discoid; paramylum two lateral pads. Cells (including tail) upto 22 μm long, 18 μm broad.

***Phacus pyrum* (Ehr.) Stein (Plate VI, Fig. 5)**

Cell elongate, pear shaped, slightly asymmetrical with a straight tail, anterior end slightly narrowed with an apical notch; pellicle with ribs running to the left; paramylum two and in the form of two lateral pads; chromatophores small, numerous and discoid. Cells (including tail) upto 24 μm long, 13 μm broad.

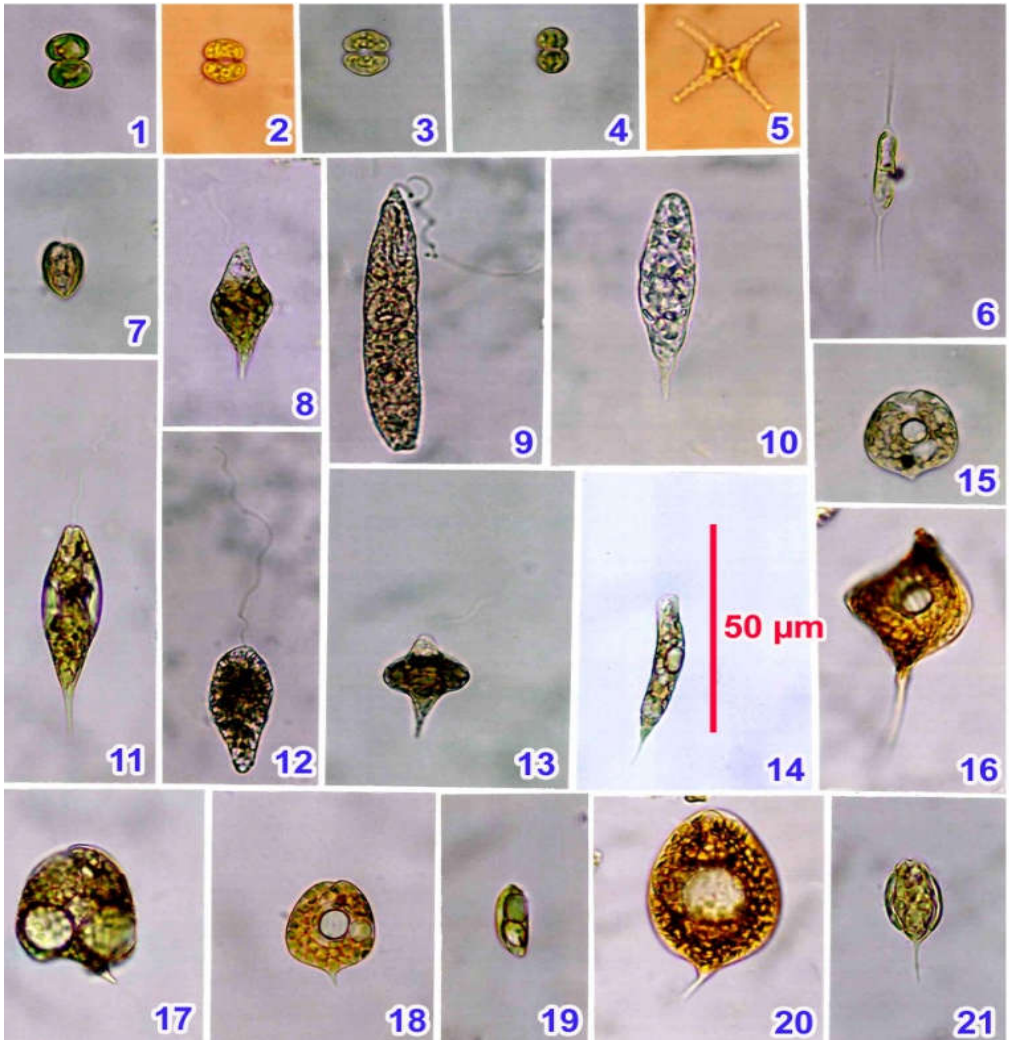

PLATE V. 1. *Cosmarium proteiforme*; 2. *Cosmarium lundellii* var. *corruptum*; 3. *Cosmarium circulare*; 4. *Cosmarium sikhimense*; 5. *Staurastrum paradoxum*; 6. *Centritractus* sp.; 7. *Cryptomonas* sp.; 8 & 13. *Euglena granulata*; 9. *Euglena truncata* var. *baculifera*; 10. *Euglena geniculata*; 11. *Euglena limnophila*; 12. *Euglena* sp. 14. *Euglena spirogyra*; 15. *Phacus brachykentron*; 16. *Phacus circumflexus*; 17. *Phacus contortus*; 18. *Phacus curvicauda*; 19. *Phacus granum*; 20. *Phacus platalea*; 21. *Phacus pseudonordstedtii* var. *minuscule*. (Scale: All figures 50 µm

***Trachelomonas similis* Stokes (Plate VI, Fig. 6)**

Lorica oval to slightly cylindrical, covered with short spines, a short slightly bend collar present, wall is dark brown in colour. Lorica 21-22 µm long, 16 µm broad.

***Trachelomonas volvocina* Ehr. (Plate VI, Fig. 7)**

Lorica spherical with depressed collar, wall yellowish brown and smooth, flagellum slightly longer than the body, lorica 15 µm in diameter.

***Lepocinclis elongata* Swir. (Plate VI, Fig. 8)**

Cell fusiform with the anterior cleft slightly towards one side; posterior end prolonged into a conical tail; pellicle with spiral striae; paramylum as two rings. Cells upto 25 µm long, 11 µm broad.

***Lepocinclis fusiformis* Carter (Plate VI, Fig. 9)**

Cell short and broadly ellipsoid to spindle shaped with both ends obtuse, the hind and being in the form of a teat and the front end with a marked cleft; pellicle firm, thick with spiral striae; chromatophores small, numerous and discoid; paramylum two large rings, one on each side. Cells upto 24 µm long, 16 µm broad.

DINOPHYCEAE

***Gymnodinium* sp. (Plate VI, Fig. 10)**

Cells are apporoximately ovoid and with the portions above and below the transverse furrow (girdle) dissimilar in shape. The girdle is approximately equatorial in position and usually in a slight descending left spiral. The longitudinal furrow (sulcus) extends only a short distance form the girdle; it often extends further along the lower cell-half (hypocone) than the upper cell-half (epicone). There are two flagella; one transverse and encircling the cell in the girdle region, the other straight and directed backward from the hypocone portion of the sulcus; chromatophores numerous, discoid of narrowingly elliptical, variously coloured. Cells upto 26µm long, 20 µm board.

Glenodinium penardiforme **(Lind.) Schiller**
(Plate VI, Fig. 11)

Cells are asymmetrically globose and some what dorsiventrally flattened, surrounded by a thin wall with a definite number of plates, lower half wall of the cell (hypotheca) has five to six postcingular and two antapical plates. All plates are generally smooth and with delicate sutures between them. The girdle is wide deepmedian, completely encircles the cell, sulcus produces a very marked concavity in the profile of the antapex; chromatophore numerous. Cells upto 20 µm long, 23 µm broad.

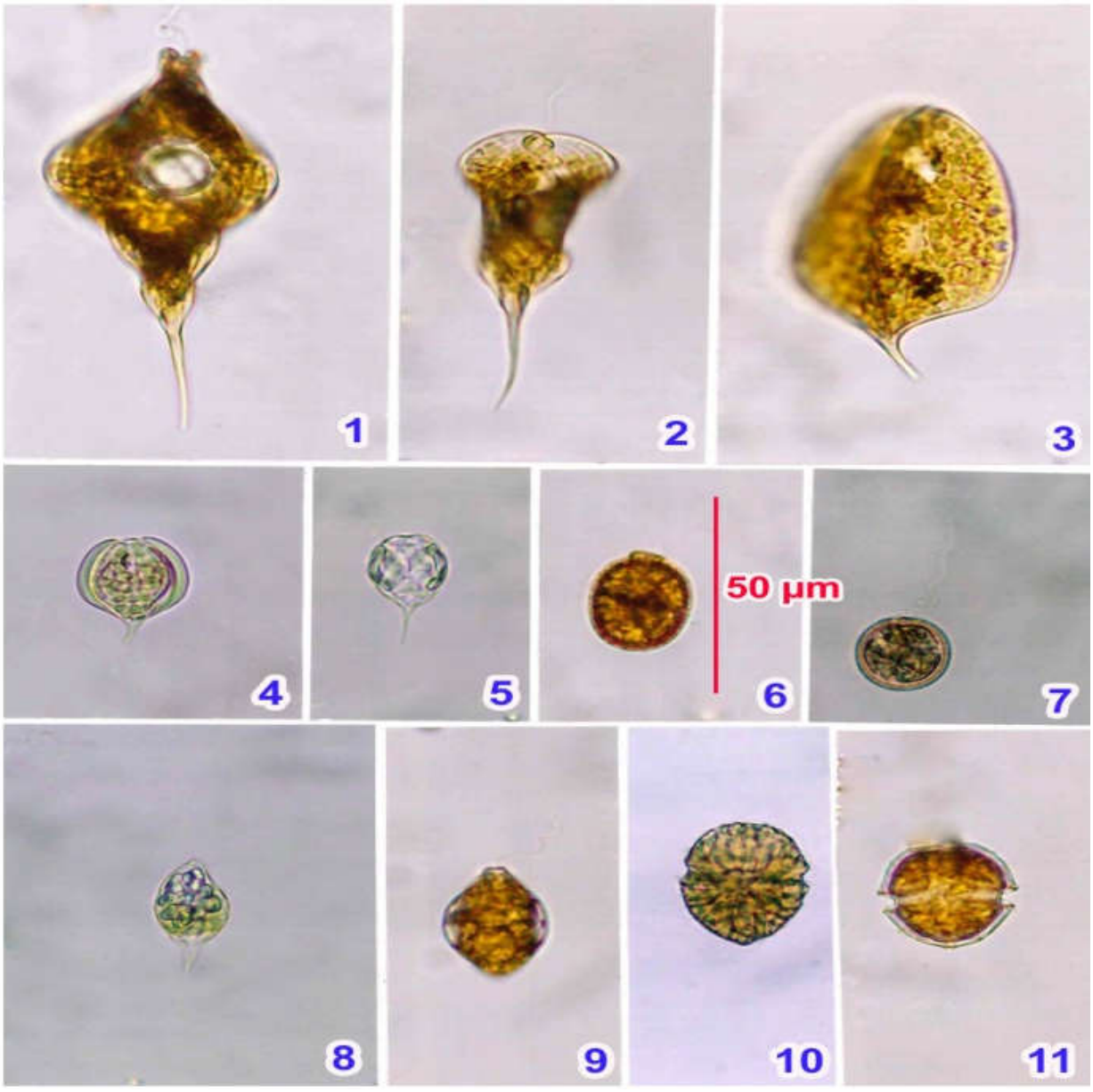

PLATE VI. 1. *Phacus helicoides*; 2. *Phacus tortus*; 3. *Phacus triqueter*; 4. *Phacus suecicus*; 5. *Phacus pyrum*; 6. *Trachelomonas similis*; 7. *Trachelomonas volvocina*; 8. *Lepocinclis elongata*; 9. *Lepocinclis fusiformis*; 10. *Gymnodinium* sp.; 11. *Glenodinium penardiforme*. (Scale: All figures 50 µm)

Of the 78 taxa investigated, a total number of 39 are found to be new reports to Tamil Nadu viz., *Lyngbya circumcreta*, *Romeria* sp., *Pediastrum simplex*, *Pediastrum tetras var. tetraodon*, *Pediastrum tetras* var. *excisum*, *Tetraedron muticum*, *Tetraedron trigonum* forma *minus*, *Coelastrum proboscideum*, *Kirchneriella obesa*, *Crucigenia crucifera*, *Tetrastrum heteracanthum*, *Scenedesmus acuminatus*, *Scenedesmus platydiscus*, *Scenedesmus longus* var. *naegelii*, *Scenedesmus antennatus*, *Scenedesmus denticulatus*, *Cosmarium sikhimense*, *Cosmarium proteiforme*, *Cosmarium circulare*, *Cosmarium lundellii* var. *corruptum*, *Staurastrum paradoxum*, *Centritractus* sp., *Cryptomonas* sp., *Euglena truncata var. baculifera*, *Euglena geniculata*, *Euglena limnophila*, *Phacus contortus*, *Phacus helicoides*, *Phacus suecicus*, *Phacus granum*, *Phacus pseudonordstedtii* var. *minuscule*, *Phacus triqueter*, *Phacus pyrum*, *Trachelomonas similis*, *Trachelomonas volvocina*, *Lepocinclis elongate*, *Lepocinclis fusiformis*, *Gymnodinium* sp. and *Glenodinium penardiforme*.

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