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BIODIVERSITY OF CHLOROCOCCALES (CHLOROPHYCEAE) FROM CEMENT FACTORIES IN AND AROUND AREAS OF ARIYALUR DISTRICT, TAMIL NADU

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ABSTRACT
The present paper deals with 114 taxa of Chlorococcales were recorded from different water bodies of Eight Cement factories and nearby Twenty sites of Ariyalur District, Tamil Nadu. These belong to 28 genera. e.g. Chlamydomonas (3), Pandorina (2), Volvox (1), Chlorosarcina (1), Characium (1), Chlorococcum (3), Ettlia (1), Chlorella (6), Golenkinia (1), Tetraedron (11), Keratococcus (1), Oocystis (2), Actinastrum (2), Ankistrodesmus (4), Dactylococcus (1), Kirchneriella (3), Monoraphidium (4), Selenastrum (3), Dictyosphaerium (4), Dimorphococcus (1), Westella (2), Pediastrum (13), Coelastrum (7), Crucigenia (4), Tetrastrum (1), Tedrastrum (1), Desmodesmus (3), Scenedesmus (28). All these microalgal species were recorded first time from this region and out of these 44 species reported first from Tamil Nadu.

KEYWORD: Chlamydomonas, Keratococcus, Crucigenia.

INTRODUCTION
Ariyalur is one of the most important District which is situated in central Tamil Nadu, India between Latitude 10.53' and 11.26' of N and Longitude 78_0 56' and 79_o 31' of E, it covers an area of 1944 Sq.Km. It is an inland district without any coast line. The district has an average Rainfall of 1096 mm (Annual). The maximum temperature is 38°C and Min: 24°C. Land of Limestone Ferruginous red loam occurs in Ariyalur district. The texture is usually loamy, the colour varying from red at the surface to yellow at the lower horizon. The soils are of medium depth with good drainage, free from accumulation of salt and calcium carbonate, ranging from 6.5 to 8.0 and contain low amounts of organic matter, nitrogen and phosphorus but with generally adequate amounts of potash and lime. Almost in all the months the water looks green by the abundant growth of algae. Algae are the most abundant predominant members in all fresh water environments and the water quality is assessed by the physico-chemical and biological parameters. Much work has been carried out throughout India regarding the diversity (Anand, 1980; Iwona and Luari, 2003; Jisha Jacob et al., 2008; Mane and Deshmukh, 2008;Mishra et al., 2005; Murugesan and Sivasubramanian, 2008; Pandey et al., 2004; Philipose, 1967; Prescott, 1978; Shastri and Pendse, 2001; Shanthi et al., 2002; Sharma and Sarang, 2004; Sankaran, 2005; Rajkumar et al., 2006; Gose and Pingale, 2007; Murugan, 2008; Jawale and Patil, 2009; Manimegalai et al., 2010; Mayakkannan, 2010; Mahendraperumal and Anand, 2008; Baluswami, Adhikary, 2007). However, the freshwater algal forms including Chlorococcales flora of this region has not been documented. In this paper we reported for the first time the chlorococcalean taxa from Ariyalur District, Tamil Nadu.

The present study, 114 taxa of Chlorococcales were recorded from different water bodies of 8 Cement factories and nearby Twenty sites of Ariyalur District between September 2010 to August 2013, out of 114 species 44 species new reported first from Tamil Nadu with special reference to biodiversity.

MATERIALS AND METHODS
Totally 50 samples were collected from 28 sites comprising of various habitats, e.g. ponds, lakes, ditches, moist soil surfaces, reservoirs, streams, waterlogged rice fields and lime caves from Ariyalur District between September 2010 to August 2013. Samples were collected using plankton net (25 µm pore size) and stored in sterilized Tarson specimen tubes. Samples were kept in cool ice chest while being transported to the laboratory. After initial observation of the materials were fixed in Lugol's iodine solution (0.5%) for immobilizing the cells to facilitate microscopic examination and preserved in (4% v/v) formaldehyde. Temperature, pH and specific conductivity and water depth were recorded of each collection site was measured on the spot using YSI Multi-Parameter Water Quality Monitor (600XL). Microphotograph of each specimen was taken using OLYMPUS CH20i microscope with attached SONY

camera. The organisms were identified following the monographs of Prescott (1961), Philipose (1967), Anand (1998), Hegewald and Silva (1988), Hindák (1977, 1980, 1984, 1988), Komárek and Fott (1983), Fritsch (1977), Komárek and Jankovska (2001) and research publications on chlorococcales from India. The taxa were arranged following Komárek and Fott (1983).

RESULTS AND DISCUSSION

In the present study a total of 50 samples were collected from different pools, puddles, puddles, ponds, reservoirs, lakes and agricultural fields. The fresh water algae from the areas of Cement factories and Natural water bodies of Ariyalur District, Tamil Nadu were totally 114 taxa of chlorococcales belonging to 28 genera were recorded from several freshwater bodies of Ariyalur District in and around Cement Factorys of Tamil Nadu. Out of these 44 species are new reported first time from Tamil Nadu. Description of each species and systematic enumeration is presented.

Chlamydomonas gracilis Snow (Plate-1, Fig.1)

Cells cylindrical, rarely oval or spherical, 10.5-13 µm long, 5-6.5 µmbroad, color a dull bluish green; cilia 2,about 1 ½ times as long as the cell; pigment spot a dull red disk, often equally distant from the two ends; pyrenoid at the extreme posterior end.

Occurrence

United State (Julia W. Snow, 1902);Collected from: Ariyalur Pond.

Chlamydomonas communis Snow (Plate-1, Fig.2)

Shape, ovoid, cylindrical or ellipsoidal, 10.5-13 µm long, 6.5-8 µm broad; color a light yellowish green, the pyrenoid near the center; pigment spot an inconspicuous red rod; cilia 2, slightly longer than the cell; division longitudinal.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu.

Collected from

Ariyalur Canal.

Chlamydomonas globosa Snow (Plate-1, Fig.3)

Cells spherical or slightly ellipsoidal, 5.2-7.8 µm in diameter; membrane smooth at anterior end; two flagella as long or slightly longer than the cell: Pigment spot small and inconspicuous; chloroplast much thickened at the posterior end; pyrenoid Present; a pulsating vacuole at anterior end.

Occurrence: United State (Julia W. Snow, 1902);Collected from: Udayarpalayam Temple Tank.

Pandorina Cylindricum Iyengar (Plate-1, Fig.4)

Colonies cylindrical with rounded end, 38-41 µm in diameter 45-48 µm long, 16 celled arranged in 4 alternating tiers of 4 cells each, Cells compactly arranged 10.5-12.0 µm long and 9-12 µm in diameter.

Occurrence

Tamil Nadu: (Iyengar, and Desikachary, 1981); Collected from: Ariyalur Canal.

Pandorina morum (Muller) Bory (Plate-1, Fig.5)

Colonies spherical 8-16 celled, rounded to ovate, 8 celled colonies 45-48 µm in diameter, cells 11-12.5 µm diameter, 16 celled colonies 144-148 µm diameter and cells 25-28 µm in diameter.

Occurrence

Tamil Nadu (Iyengar, 1933; Singh, 1960); Collected from: Ottakovil Lake.

Volvox aureus Ehr. (Plate-1, Fig.6)

Spherical colonies of (500) - 1300 – 3200 ellipsoidal cells, 6.0-8.0 in diameter with interconnections of fine protoplasmic strands; Cells contain a circular, parietal plate like chloroplast, below the point of flagella attachment.

Occurrence

Tamil Nadu: Iyengar, and Desikachary, 1981; Collected from: Nakkampadi Lake.

Chlorosarcina elegans Gerneck (Plate-1, Fig.7)

The individual cells are round or slightly ellipsoidal, 6 µm in diameter, length of 27 µm and a width of 23 µm.

Occurrence: This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.

Characium orissicum sp. nov. (Plate-1, Fig.8)

Cells club-shaped to pyriform with broadly rounded apex and a gradually attenuated base forming a very short stalk. Base of stalk without any clear attaching disc. Young cells with a parietal chloroplast having a single pyrenoid. Older cells undergoing division with two or more chloroplasts, each with a pyrenoid. Cells 5.6-16.9 µm broad, 11.3-27.4 µm long.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.

Chlorococcum humicola (Naeg) Rabenhorst (Plate-1, Fig.9)

Cells spherical, solitary or in small clumps, variable in size within the same plant mass; cells 15-30 µm in diameter.

Occurrence: Tamil Nadu (Anand, 1998); Collected from: Nakkampadi Stream.

Chlorococcum infusionum (Schrank) Meneghini (Plate-1, Fig.10)

Cells usually spherical, rarely ovoid or elongated and of variable dimensions solitary or in flat irregular colonies.

Chloroplast like a hollow sphere with a notch on one side and with a single pyrenoid. Cells 10-109, rarely up to 135 µ in diameter.

Occurrence
C.f. India (Phlipose, 1967); Collected from: Vengadakrishnapuram Pool.
Chlorococcum echinozygotum Starr (Plate-1, Fig.11)

Spherical shape, smooth cell walls, indefinite form and parietal chloroplast without a peripheral opening and many pyrenoids and uninucleate. Cells 20-24 µm in diameter.

Occurrence
C.f. India (Phlipose, 1967); Collected from: Thamaraikulam Lake.
Ettlia spp. (Plate-1, Fig.12)

Cells were unicellular and zoospores posses a very fine cell wall. Cells 7.7 µm broad, 8.4 µm long.

Occurrence
This is reported for the firtst time from fresh water bodies of Tamil Nadu; Collected from: Jayankondam Pond.

Chlorella vulgaris Beijerinck (Plate-1, Fig.13, 14, 15, 16 and 17)
Alga free living. Cells usually solitary or in small colonies, spherical and with a thin cell membrane. Chloroplast parietal, cup shaped and with a pyrenoid which is sometimes indistinct. Cells usually 4.1 µ broad; 4.7 µ long.
Occurrence: Orissa; (Jena et al., 2005); Collected from: Udayarpalayam Temple Pond.

Chlorella sorokiniana spec. nov (Plate1-, Fig.18)
Cells spherical or ellipsoidal in inorganic liquid media, 3 x 2 p in small cells to 4.5 x 3.5 p in large cells, often becoming spherical, 4.5 to 6.1 µ in diameter when grown on glucose. Chromatophore shallow, bowl-shaped; green but turning white in old inorganic cultures, and even more quickly onglucose media. Pyrenoid present.
Occurrence: This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Elanthakuzhi Pool.

Golenkinia radiate Chodat (Plate-1, Fig.19)
Cells usually solitary, rarely in 4-celled colonies, spherical, with the entire cell wall covered by a number of (usually ten) long bristles. Chloroplast cup-shaped and with a pyrenoid. Cells 7-15 µm in diameter. Bristles 25-45 µm long.

Occurrence
C.f. India (Phlipose, 1967); Collected from: Sendurai Sivan Kovil Pond.
Tetraedron proteiforme (Turner) Brunnthaler (Plate-1, Fig.20)

Cells 2 to 3 cornered, angles drawn out and ending in a long spine; in side view more or less acicular. Sides wavy. Two angled cells 12 µm broad and up to 65 µm long. Three-angled cells 36 µm diameter without spines.

Occurrence
C.f. India (Phlipose, 1967); Collected from: Kulumur Lake.
Tetraedron hemisphaericum Skuja (Plate-1, Fig.21)
Cells triangular in vertical view, concave and depressed in the form of a hemisphere in lateral view, angels broadly rounded and without spines. Cell wall hyaline and densely punctuate. Chloroplast parietal and with a pyrenoid. Cells 42-49 µ in diameter, 20-30 µ thick.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Sokanathapuram Stream.

Tetraedron minimum (A. Br.) Hansg (Plate-1, Fig.22)
Cells small and quadrangular with the sides concave and angles rounded. Cell wall smooth. Cells 6-20µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kadur Lake.
Tetraedron tumidulum (Reinsch) Hansgirg (Plate-1, Fig.23)

Cells tetragonal with margins more or less concave and angles rounded, or sometimes with knob-like projections. Cells 16-60 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Irumbulikurichi Pond.
Tetraedrontrigonum (Naegeli) Hansgirg (Plate-1, Fig.24)

Cells flat, triangular with somewhat concave sides and rounded corners each ending in a stout spine. Cells, without spines, 18-30 µ in diameter. Spines 5-10 µ long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Palanganatham Lake.
Tetraedrontrigonum forma crassum (Reinsch) De Toni(Plate-1, Fig.25)

Cells with straight or convex sides and stumpy angles, each with a short spine. Cell membrane very thick and frequently with pores. Diameter of cells 14-27 µm, Thickness 12-17 µm, Spines 5-6 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Karaivetti Bird Sanctuary.
Tetraedron caudatum (corda) Hansgirg (Plate-1, Fig.26)

Cells small, flat, five-sided with four of the sides concave and the fifth in the form of a notch of varying depth. Angles rounded and produced into a short straight spine. Cells 6-23 µ in diameter. Spines 1-4 µ long.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Gangikondacholapuram Lake.

Tetraedron regulare var. torsum (Plate-1, Fig.27)

Cells medium sized, tetragonal, with the two halves of the cells cruciately arranged. Sides of cells straight or convex. Angles of cells with a single short stout spine. Cells 25-40 µm diameter.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Udayarpalayam Temple Tank.

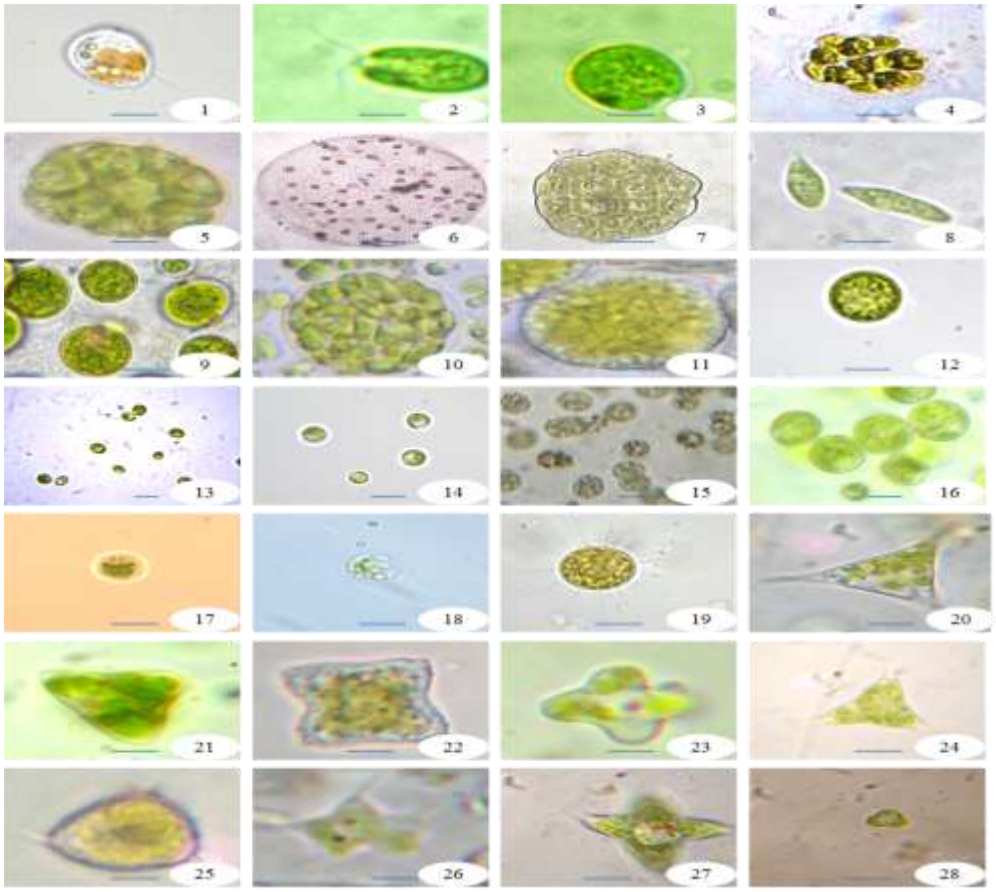

Plate – 1:1. Chlamydomonas gracilis Snow. 2. Chlamydomonas communis Snow. 3. Chlamydomonas globosa Snow. 4. Pandorina Cylindricum Iyengar. 5. Pandorina morum (Muller) Bory. 6.Volvox aureus Ehr. 7. Chlorosarcina elegans Gerneck. 8. Characium orissicum sp. nov. 9. Chlorococcum humicola (Naeg) Rabenhorst. 10. Chlorococcum infusionum (Schrank) Meneghini. 11. Chlorococcum echinozygotum Starr. 12. Ettlia spp. 13, 14, 15, 16, 17. Chlorella vulgaris Beyerinck. 18. Chlorella sorokiniana spec. nov. 19. Golenkinia radiate Chodat. 20. Tetraedron proteiforme (Turner) Brunnthaler. 21. Tetraedron hemisphaericum Skuja. 22. Tetraedron minimum (A. Br.) Hansg. 23. Tetraedron tumidulum (Reinsch) Hansgirg. 24. Tetraedrontrigonum (Naegeli) Hansgirg. 25. Tetraedrontrigonum forma crassum (Reinsch) De Toni. 26. Tetraedron caudatum (corda) Hansgirg. 27. Tetraedron regulare var. torsum. 28. Tetraedron trigonum var. setigerum (Archer) Lemmermann.

Tetraedron trigonum var. setigerum (Archer) Lemmermann. (Plate-1, Fig.28)

Cells small, triangular, flattened, with a conspicuous emargination on each side in front view. Corners of cells rounded and produced into a long delicately tapering spine. Chloroplast single, filling the entire cell; with one pyrenoid. Cells (with out spine) 7-9 µm; length of spines 12-15 µm diameter.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Pond.

Tetraedron trigonum var. gracile (Reinsch) de Toni (Plate-2, Fig.29)

Cells triangular, flattened, concavity of sides very marked. Angles of cells ending in short spines. Several

parietal, disciform chloroplasts without pyrenoids. Cells 23-50 µm braod; 6-10 µm thick.

Occurrence
United Kingdom (Smith, G.M, 1920); Collected from: Keezhapalur Temple Tank.
Tetraedron gracile (Reinsch) Hans. (Plate-2, Fig.30)

Cells medium size, conspicuously flattened, rectangular, with flattened sides. Angles of cells produced into narrow processes that generally branch twice and end in minute spines. The primary branching of the processes are at an angle of 90 degrees with one another and always parallel with a side of the cell. Each cell containing several, parietal disciform to laminate chloroplasts without pyrenoids. Cells (without processes) 15-30 µm; (with processes) 35-80 µm; thickness of cells 6-12 µm.

Occurrence
United Kingdom (Smith, G.M, 1920); Collected from: Ariyalur Canal.
Keratococcus bicaudatus (A. Braun) Petersen (Plate-2, Fig.31)

The cells are spindle-shaped, with long acuminate, apices, and have a thin wall; in some cells the apices are merely acute. The longest cells measure 25 µ, while smaller ones are form 14.5 to 19 µ long; the width at the broadest part is from 3 to 5 µ. The chloroplast is parietal and sometimes folded, with or without a small pyrenoid.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.
Oocystis gigas Archer (Plate-2, Fig.32)

Usually in colonies of 2-4 cells. Envelope more or less round and narrow. Cells broadly ellipsoid, about $1\frac{1}{4}$ times longer than broad with the ends broadly rounded and not thickened. Cells usually 29-40 µ broad and 41-51.8 µ long, rarely 18-20 µ broad and 31-32 µ long.
Occurrence: C. f. India (Philipose, 1967); Collected from: Keezhapalur Temple Tank.

Oocystis rhomboidea Fott (Plate-2, Fig.33)
Coenobia 4-celled; cells elongated-oval with rounded ends 2-3 times as long as broad, 9-15.6 µm broad and 15-25 µm long; 4-celled embedded in a single sheath; coenobia 25-35 µm broad and 30-50 µm long.

Occurrence
Komarek and Fott, 1983; Collected from: Tamil Nadu Cement Factory.
Actinastrum gracillimum GM Smith (Plate-2, Fig.34)

Colonies of 4 or 8 cells radiating from a common centre. Cells elongate-cylindrical, tapering slightly to abruptly truncate ends, and 7-10 times as long as broad. Chloroplast single, parietal and laminate, and with or without a pyrenoid. Cells 1.7-3µ broad, 14-21 µ long; colonies 30-45 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Ariyalur Meenakshinagar Lake.
Actinastrum hantzschii Lagerheim (Plate-2, Fig.35)
Coenobia 4-8 celled, 50 µm in diameter, radially arranged from a common centre; cells spindle-shaped, middle of the cell slightly broad, apices attenuated, slightly rounded; chloroplast single, parietal without pyrenoid; cells 3.2-4 µm broad and 16-19 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Colony Lake.
Ankistrodesmus spirals (Turner) Lemm (Plate-2, Fig.36)

Cells acute apices; 4-8-16, cells spirally twisted rounded one another in the median region, but free at the ends. Cells 1.5-3.0 µm broad, 20-50 µm long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Jayankondam Pond.
Ankistrodesmus spiralis var. fasciculatus G.M.Smith (Plate-2, Fig.37)

Cells curved or sigmoid, twisted around one another and united in colonies 50-200 cells with the median portion of the cells in contact and the apices free. Cells 3.75-5 µ broad, 55-75 µ long. Colonies 75-180 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Udayarpalayam Temple Tank.
Ankistrodesmus sigmoides (Rabenh.) Bruhl et Biswas (Plate-2, Fig.38)

Cells solitary or in fasciculate bundles of 2-3-4, fusiform, slender, gradually attenuated from the middle towards the ends and distinctly sigmoid. Ends of cells very acute. Cells 2-3 µ broad and about 28 µ long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Palanganatham Lake.
Ankistrodesmus falcatus var. radiates (Chodat) Lemmermann (Plate-2, Fig.39)

Cells in radiating bundles, straight or curved, 2-3 µ broad and 70-80 µ long.

Occurrence

This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Keezhapalur Temple Tank.
Dactylococcus infusionum Naegeli (Plate-2, Fig.40)

Fusiform cells, either solitary or attached pole to pole to form false, branched filaments or chains; chloroplast a parietal plate, sometimes with a pyrenoid; cells 2.5-3.5 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Irumbulikurichi Pond.
Kirchneriella obesa (W. West) Schmidle (Plate-2, Fig.41)

Colonies of 4-8 or more 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 2-8 µ broad, 6-16µ long.

Occurrence
Uttar Pradesh (Venkataraman, 1957); Collected from: Udayarpalayam Temple Tank.
Kirchneriella lunaris (Kirch) (Plate-2, Fig.42)

Colony, 4-16 within a close, gelatinous envelope, cells flat, strongly curved crescent with rather obtuse points; cells 4-8 µm in diameter, 8.0-12 µm, long; colonies 100-250 µm in diameter.

Occurrence
Rajasthan: Srivastava and Odhwani, 1993; Collected from: Kallankurichi Kuvari.
Kirchneriella phaseoliformis T.Hortobágyi (Plate-2, Fig.43)

Colonies spherical to ellipsoid with an outer gelatinous envelope. Cells irregularly arranged, flattened and cresent-shaped with pointed ends. Cells 3-8 µm broad, 6-15 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Kallankurichi Kuvari.
Monoraphidium arcuatum (Korshikov) Hindak (Plate-2, Fig.44)

Cells (0.8-) 1-3 (-4.5)µm long, narrowly spindle-shaped, arched to slightly sigmoid and screw-shaped, arched to slightly sigmoid and screw-shaped, narrowing equally to each finely pointed apex, sometimes slightly curved.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Gangikondacholapuram Lake.

Monoraphidium contortum (Thuret) Komarkova. Legnerova (Plate-2, Fig.45)
Cells solitary, arcuate, slightly sigmoid, Some times helically twisted, ends pointed, cells 1.5-5 µm broad and 20-32 µm long.

Occurrence
British Isles (David M. John, Brian A. Whitton, Alan J. Brook 2002, 2011); Collected from: Udayarpalayam Temple Tank.

Monoraphidum griffithii (Berkely) Komarkova-Legnerova (Plate-2, Fig.46)
Cells (1-) 2-4.5 µm wide, (28-) 50-72(-110) µm long, usually about 12 times longer than wide, narrowly spindle-shaped, straight, each apex gradually narrowing and terminating in an acute point or short spine.

Occurrence
British Isles (David M. John, Brian A. Whitton, Alan J. Brook 2002, 2011); Collected from: Kallankurichi Temple Pond.

Monoraphidium circinale (Nygaard) Nygaard (Plate-2, Fig.47)
Cells cylindric, fusiform, strongly curved in circle to spiral, tapering to pointed ends,
2.5-5 µm broad, diameter of spiral 6.5-16.5 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ottakovil Lake.
Selenastrum minutum (Naegeli) Collins (Plate-2, Fig.48)

Cells crescent-shaped, usually uniformly curved and plump with pointed ends, solitary or, rarely, united in colonies. Cells 2-3 µ broad, 7-9 µ long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Gangikondacholapuram Lake.
Selenastrum bibraianum Reinsch (Plate-2, Fig.49)

Colony ovate in outline composed of 4-16 lunate or sickle-shaped cells with sharp apices and arranged so that the convex surfaces are apposed and directed towards the center of the colony; cells 5-8 µm broad, 12-26 µm long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Gangikondacholapuram Canal.
Selenastrum gracile Reinsch (Plate-2, Fig.50)

Colonies of 6-64 sickle-shaped cells in irregular arrangement, but with the convex surfaces apposed; apices of the cells sharply pointed; cells 4-8 µm in diameter broad, long 14.0-22.0 µm.

Occurrence
Orissa; (Rath and Adhikary, 2005); Collected from: Kollidam River.
Dictyosphaerium ehrenbergianum Naegeli (Plate-2, Fig.51)

Colonies spherical to ovoid and consisting of 4-8-16, rarely more, cells. Cells ovoid to ellipsoid or nearly spherical. Chloroplast one to two in each cell, parietal and with a pyrenoid. Cells 4-7 µ broad, 6-10 µ long. Colonies up to 80 µ in diameter.

Occurrence
Tamil Nadu (Mahendraperuaml and Anand, 2008); Collected from: Vengadakrishnapuram Pool.
Dictyosphaerium indicum Iyengar (Plate-2, Fig.52)

Colonies spherical too broadly ovoid, 4-16-64 or more cells. Cells ellipsoid, spindle shaped, mature cells 6.5 µm broad, 12.0-14.0 µm long.

Occurrence
C. f. India (Philipose, 1967);Collected from: Alathiyur near Manjal River.
Dictyosphaerium pulchellum Wood (Plate-2, Fig.53)
Colonies nearly spherical and of 4-64 or more cells. Cells spherical to ovoid, with a single parietal cup-shaped chloroplast having a single pyrenoid. Cells 3-10 µ in diameter. Colonies up to about 64 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kollidam River.

Dictyosphaerium spp. (Plate-2, Fig.54)
Cells were spherical, and of 4-64 or more cells. Cells spherical to ovoid, with a single parietal cup-shaped chloroplast having a single pyrenoid. Cells 3-10 µm in diameter. Colonies up to about 64 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kuruchikolam pond.

Dimorphococcus lunatus A. Braun (Plate-2, Fig.55)
Cells in groups of 4, the 2 inner cells of the quarter ovate or 2 outer cells cordate; cells 4-6.0 µm in diameter.

Occurrence
M.T. Philipose 1967; Collected from: Udayarpalayam Temple Tank.
Westella botryoides (W. West) de Wildeman (Plate-2, Fig.56)

Colonies of irregular shape and of about 40-80 cells. Cells usually small, spherical and arranged in groups of four or eight. Chloroplast single, cup-shaped and with or without a pyrenoid. Cells 3-9 µ in diameter. Colonies 30-84 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Ariyalur Canal.

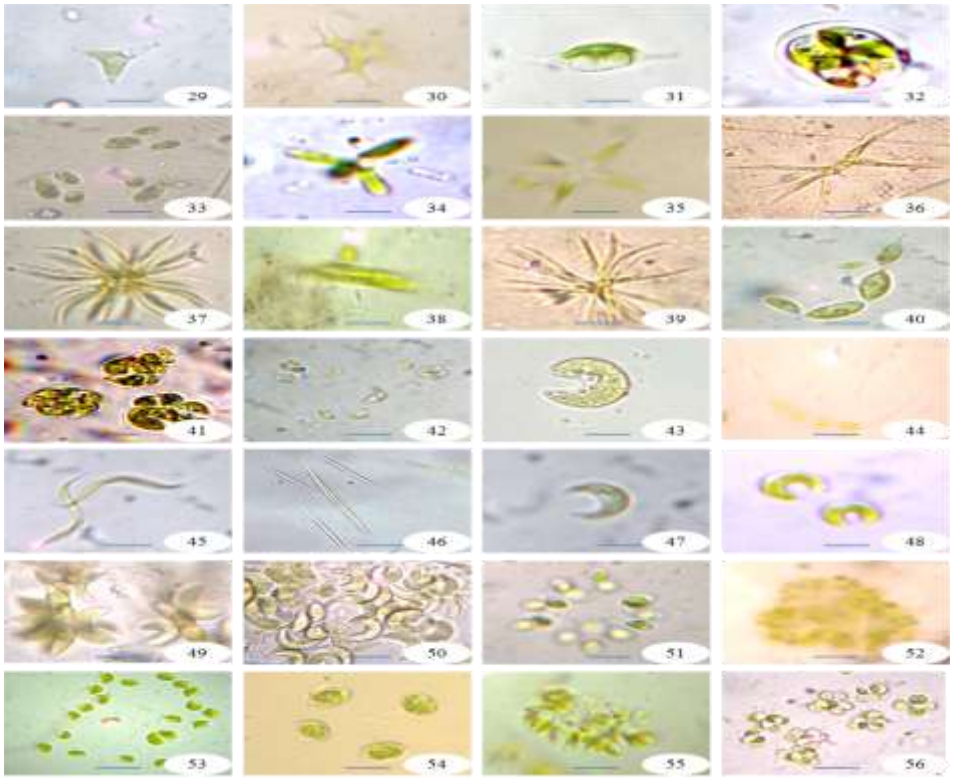

Plate – 2: 29. Tetraedron trigonum var. gracile (Reinsch) de Toni. 30. Tetraedron gracile (Reinsch) Hans. 31. Keratococcus bicaudatus (A. Braun) Petersen. 32. Oocystis gigas Archer. 33. Oocystis rhomboidea Fott. 34. Actinastrum gracillimum GM Smith. 35. Actinastrum hantzschii Lagerheim. 36. Ankistrodesmus spirals (Turner) Lemm. 37. Ankistrodesmus spiralis var. fasciculatus G.M.Smith. 38. Ankistrodesmus sigmoides (Rabenh.) Bruhl et Biswas. 39. Ankistrodesmus falcatus var. radiates (Chodat) Lemmermann. 40. Dactylococcus infusionum Naegeli. 41. Kirchneriella obesa (W. West) Schmidle.42. Kirchneriella lunaris (Kirch). 43. Kirchneriella phaseoliformis T.Hortobágyi. 44. Monoraphidium arcuatum (Korshikov) Hindak. 45. Monoraphidium contortum (Thuret) Komarkova. Legnerova. 46. Monoraphidum griffithii (Berkely) Komarkova-Legnerova. 47. Monoraphidium circinale (Nygaard) Nygaard. 48. Selenastrum minutum (Naegeli) Collins. 49. Selenastrum bibraianum Reinsch. 50. Selenastrum gracile Reinsch. 51. Dictyosphaerium ehrenbergianum Naegeli. 52. Dictyosphaerium indicum Iyengar. 53. Dictyosphaerium pulchellum Wood. 54. Dictyosphaerium spp. 55. Dimorphococcus lunatus A. Braun. 56. Westella botryoides (W. West) de Wildeman.

Westella linearis G.M.Smith (Plate-3, Fig.57)
An irregularly shaped colony of about 40 spherical cells arranged in a linear series of 4, cells 20 µm.
Occurrence: C. f. India (Philipose, 1967); Collected from: Kuruchikolam pond.

Pediastrum constrictum Hassall (Plate-3, fig.58)
Colonies spherical and compact, 16-32 celled. Inner cells many sided and in the front wall sinuous. Marginal cells irregularly two-lobed with shallow sinus; lobes unequal. Colonies 34.0-42.0 in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kulumur Lake.

Pediastrum simplex Meyen (Plate-3, Fig.59)
Colonies circular to oval of 4-8-16-32 or more cells. Inner side of marginal cells nearly straight, outer side produced in a gradually tapering process, sides concave. Inner cells polygonal, without intercellular spaces. The cell wall surface of each cell is ornamented with teeth like protuberance; teeth 1-1-1.5 µm long, cells 8-10 µm broad, 16-20 µm long.

Occurrence
Orissa; (Rath and Adhikary, 2005); Collected from: Nakkampadi Stream.

Pediastrum simplex Meyen var. sturmii (Reinsch) Wolle (Plate-3, Fig.60)
Coenobia 8-16 celled, inner side of marginal cells nearly straight, outer side produced into a gradually tapering process, sides concave, cells polygonal, cells in contact with adjacent cells without intercellular spaces; chloroplast single and parietal, cell wall smooth, cells 5-13 µm broad and 20-30 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Thamaraikulam Stream.

Pediastrum duplex Meyen (Plate-3, Fig.61)
Colonies 16-32 celled, inner cell quadrate to angular, inner side of the marginal cell concave, outside produced into a short truncate process, cells 15.0 µm in diameter, 16 cell colonies up to 90 µm in diameter.

Occurrence
Orissa (Rath and Adhikary, 2005; Collected from: Jayankondam Pond.

Pediastrum duplex Meyen var. subgranulatum Raciborski (Plate-3, Fig.62)
Colonies 8-16-32-64 celled. Cells and intercellular spaces more or less as in the type of the species, but the cell wall distinctly granulates. Cells 10-25 µm in diameter. Colonies 16-64 celled, 100-180 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Irumbulikurichi Pond.

Pediastrum duplex Meyen Var. genuinum (A. Braun) Hansgirg (Plate-3, Fig.63) Colonies 16-32 celled with fairly large intercellular spaces. Marginal cells with stout processes which are straight or slightly curved. Cells 18.0 µm in diameter, colonies 45-65 µm in diameter.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Kattyankudikkadu Lake.
Pediastrum duplex Meyen var. clathratum (A. Braun) Lagerheim (Plate-3, Fig.64)

Colonies 8-64 celled. Cells with more deeply emarginated sides and larger intercellular spaces. Cells 9-25 µm in diameter, colonies 90 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Sokanathapuram Stream.

Pediastrum simplex Meyen var. pseudoglabrum Parra (Plate-3, Fig.65)
Coenobia 8-16 celled, cells arranged in a ring round a central space with one or more interior cells a number of marginal cells, perforate; central cell convex, cell wall smooth; chloroplast single parietal with a large pyrenoid; 8 celled coenobia up to 80 µm and 16 celled coenobia up to 100 µm in diameter; cells 8.5-18 µm broad and 14-37 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Valaja Nagaram Pond.
Pediastrum tetras (Ehrenberg) Ralfs (Plate-3, Fig.66)
Colonies 4-8 celled, lobes adjacent to incision more or less deeply concave, diameter of colonies 20-22 µm and cells 12-14 µm in diameter.

Occurrence
Tamil Nadu (Anand, 1998); Collected from: Ariyalur Pond.
Pediastrum tetras var. tetraodon (Corda) Hansgirg (Plate-3, Fig.67)

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.

Occurrence
This is reported for the second time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.
Pediastrum tetras (Ehrenberg) Ralfs Var. apiculatum Fritsch(Plate-3, Fig.68)

Colonies 4 celled, cells without intercellular spaces.Marginal cells divided into two lobes by a deep linear to cuneate incision on the outer side reaching to the middle of the cell. Each lobe truncate, divided into two lobes. Inner cells 4 sided with a single linear incision. Colonies 24.6 µm in diameter and cells 14-17.6 µm in diameter.

Occurrence
This is reported for the second time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Pond.
Pediastrum biradiatum Meyen (Plate-3, Fig.69)

Colonies 4-8-16 celled with medium sized perforations. Lobes trishula shape. Colonies 20-22 µm and cells 14-18 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kallankurichi Temple Pond.

Pediastrum spp. (Plate-3, Fig.70)
Colonies 4-8 celled, lobes adjacent to incision more or less deeply concave, round shape with out gape, diameter of colonies 20-22 µm and cells 12-14 µm in diameter.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu.

Collected from
Villangudi Lake.

Coelastrum cambricum Archer var. cambricum (Plate-3, Fig.71)
Colonies of 8, 16, 32 or 64 cells, spherical in shape; cells spherical, covered by a delicate gelatinous sheath; sheaths with 5 or 6 short, stout, truncate processes radially projected and a single process toward the outer face of the cell; cells connected to adjacent ones by marginal processes of the sheath; intercellular spaces circular or triangular; cells 6-21 µm diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Ariyalur Colony Lake.

Coelastrum cambricum W. Archer. (Plate-3, Fig.72)
Coenobium spherical, 32 globose cells (ranging from 8 to 128 in number) short projections of the sheath so that triangular intercellular spaces results; outer free wall of the cells with a flattened, truncate projections; cells 20-25 µm in diameter, including sheath.

Occurrence
Orissa: Rath and Adhikary, 2005; Collected from: Palanganatham Lake.

Coelastrum cubicum Naegeli (Plate-3, Fig.73)
Colonies subspherical. Cells six-sided when seen from the poles and with three obliquely truncate polar processes which are sometimes thickened at their apices. Cells 10 – 20 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Irumbulikurichi Pond.

Coelastrum microporum Naegeli (Plate-3, Fig.74)
Colonies more or less spherical and of 8-16-32-64 (usually 16-32) cells with small intercellular spaces. Cells spherical to ovoid, enclosed by delicate gelatinous sheaths and interconnected by almost imperceptible gelatinous processes. Cells with sheath 4-27 µ in diameter. Colonies 20-29 µ in diameter.

Occurrence
Tamil Nadu (Anand, 1998); Collected from: Unjini Temple Pond.

Coelastrum proboscideum Bohlin (Plate-3, Fig.75)
Coenobium pyramidal or cubical (rarely polygonal) composed of 4-8-16-32 truncate cone shaped cells with the apex of the cone directed outward, 4-celled colony as much as 35 µm in diameter.

Occurrence
Tamil Nadu: Anand, 1998; Collected from: Elanthakuzhi Pool.

Coelastrum reticulatum (Dangeard) Senn (Plate-3, Fig.76)
Coenobium spherical, composed of 8-32 globose cells by gelatinous large intercellular spaces; outer free wall of

the cells without protuberances or processes; cells 28-35 µm in diameter including sheath.

Occurrence
C. f. India (Philipose, 1967); Collected from: Sirukalathoor Pond.

Coelastrum morus W. et G. S. West (Plate-3, Fig.77)
Colonial spherical, 8-16 celled. Cells spherical with 4-10 small wart—like processes all round the cell membrane. Cells 8.0-12.0 µm in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Mathur pond.

Crucigenia apiculata (Lemm.) Schmidle (Plate- 3, Fig.78)
Colonies 4-celled, quadrate, with a small rectangular space at the centre, or very often in mutiple colonies of 16 or more cells. Cells elongate ovoid or three-cornered with a short conical projection at the apex and frequently at the inner corner. Cells 2.5-7 µ broad, 4-10 µ long. Colonies 6-12.5 µ broad, 9-18 µ long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kulumur Lake.

Crucigenia fenestrata (Schmidle) Schmidle (Plate-3, Fig.79)
Colonies rectangular with a large central space, 4-celled or very often in irregularly arranged multiple colonies. Cells trapezoidal, 2-5 µm braod, 5-13 µm long. 4-celled colonies 8-14 µm in diameter.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Kadur Lake.

Crucigenia tetrapedia (Kirchner) W. et G. S. West (Plate-3, Fig.80)
Colonies 4-celled or joined in 16 or more-celled mutiple colonies. Four-celled colonies quadrate with a multiple colonies. Four-celled colonies quadrate with a minute rectangular space at the centre. Cells flattened and triangular with rounded ends. Outer sides of cells always concave. Cells 4.5-9.5 µ in diameter. Four-celled colonies 8-15 µ in diameter.

Occurrence
C. f. India (Philipose, 1967); Collected from: Vengadakrishnapuram Pool.

Crucigeniella rectangularis (A. Braun) (Plate-3, Fig.81)
Coenobia 4-celled, 7-14 µm broad and 8-20 µm long, rectangular space at the centre, sometimes united together forming multiple coenobia; cells elongated, contacts exist with adjacent ones at the poles; chloroplast single, parietal, without pyrenoid; cells 4-7 µm broad and 4-10 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Kallankurichi Temple Tank.

Tetrastrum elegans Playfair (Plate-3, Fig.84)
Coenobia 4 celled, cells spherical, each cell with transparent appendage from the outer side of the wall, about three times longer than the diameter of the cell; chromatophore green, one parietal chloroplast with a central pyrenoid; cells 5-6 µm in diameter and appendage 12-15 µm long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Jayankondam Pond.

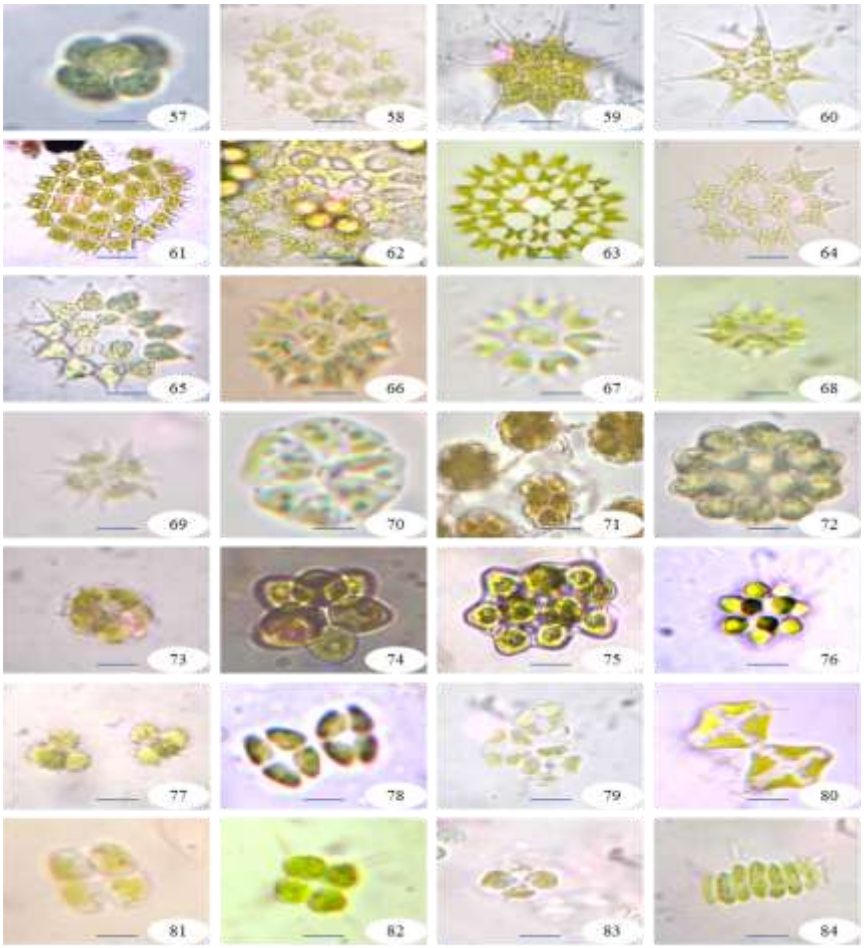

Plate – 3: 57**. Westella linearis G.M.Smith. 58. Pediastrum constrictum Hassall. 59. Pediastrum simplex Meyen. 60. Pediastrum simplex Meyen var. sturmii (Reinsch) Wolle. 61. Pediastrum duplex Meyen. 62. Pediastrum duplex Meyen var. subgranulatum Raciborski. 63. Pediastrum duplex Meyen Var. genuinum (A. Braun) Hansgirg. 64. Pediastrum duplex Meyen var. clathratum (A. Braun) Lagerheim. 65. Pediastrum simplex Meyen var. pseudoglabrum Parra. 66. Pediastrum tetras (Ehrenberg) Ralfs.67. Pediastrum tetras var. tetraodon (Corda) Hansgirg. 68. Pediastrum tetras (Ehrenberg) Ralfs Var. apiculatum Fritsch.69. Pediastrum biradiatum Meyen. 70. Pediastrum spp. 71. Coelastrum cambricum Archer var. cambricum. 72. Coelastrum cambricum W. Archer. 73. Coelastrum cubicum Naegeli. 74. Coelastrum microporum Naegeli. 75. Coelastrum proboscideum Bohlin. 76. Coelastrum reticulatum (Dangeard) Senn. 77. Coelastrum morus W. et G. S. West. 78. Crucigenia apiculata (Lemm.) Schmidle. 79. Crucigenia fenestrata (Schmidle) Schmidle. 80. Crucigenia tetrapedia (Kirchner) W. et G. S. West.81. Crucigeniella rectangularis (A. Braun). 82. Tetrastrum elegans Playfair. 83. Tedrastrum heteracanthum (Nordstedt) Chodat. 84. Desmodesmus protuberans (Fritsch etRitch).**

Tedrastrum heteracanthum (Nordstedt) Chodat (Plate-3, Fig.83)

Colonies 4-celled and flat with the cells quadrately arranged. Cells nearly heart-shaped (triangular with the outer face slightly concave, rarely convex) with a long and short seta from the outer surface. Setae straight or curved. Chloroplast parietal and usually with a pyrenoid. Cells 3.5-11.5 µ in diameter. Long seta 8-24 µ long. Short seta 1-9 µ long.

Occurrence

C. f. India (Philipose, 1967); Collected from: Tamil Nadu Cement Factory.

Desmodesmus protuberans (Fritsch et Ritch) (Plate-3, Fig.84)

Coenobia 2-8 celled; cells in linear series, laterally in close contact with adjoining cells except at the ends; long spine arising from outer side of each at the ends; long spine arising from outer side of each ends of terminal cells; inner cells end slightly truncate, inner edge with very minute spine or granular thickening; cells 5-7 µm broad and 10-25 µm long; spines 25-30 µm long.

Occurrence

Bhubaneswar: Mrutyunjay Jena and Siba Prasad Adhikary, 2007; Collected from: Elanthakuzhi Pool.

Desmodesmus spinosus (Chodat) Hegewald (Plate-4, Fig.85)
Coenobia 2-4 celled; cells oblong-ellipsoid, arranged in a linear series; single short spine arising at each pole of terminal cells, straight, one spine at the middle of terminal cell; cells 2-4 µm broad and 8-15 µm long; spines 5-12 µm long.

Occurrence
Bhubaneswar (Mrutyunjay Jena and Siba Prasad Adhikary, 2007);Collected from: Sendurai Lake.

Desmodesmus abundans (Kirchner) Hegewald (Plate-4, Fig.86)
Colonies of 2-4 cells arranging linearly; cell body ovoid or ellipsoidal in shape; outer cells with long spines at both ends and short spines at outer side; inner cells have a short spine at both ends. Cell size 9-20x3-5µm.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Udayarpalayam Temple Tank.

Scenedesmus dimorphus (Turpin) Kuetzing (Plate-4, Fig.87)
Colonies 4-8 celled with the cells arranged in a linear or subalternating series (eight-celled colonies always in subalternating series). Differ from S. obliquns in the outer cells of the colony being more or less lunate and the apices of the cells being attenuated. Cells 2-8 µ broad, 14-35 µ long.

Occurrence
Tamil Nadu (Iyengar and Venkataraman, 1951); Collected from: Kollidam River.

Scenedesmus acuminatus (Lagerheim) Chod. var. Acu. Kom. and Fott (Plate-4, Fig.88)
Coenobia 4-8 celled, arranged in linear to sub alternating series, outer cells of the coenobia more or less lunate apices of the cells attenuated, chloroplast single and parietal with a pyrenoid at the centre. Cells 18-23 µm long and 3.2-8.6 µm broad.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Valaja Nagaram Pond.

Scenedesmus acuminatus (Lagerheim) Chodat (Plate-4, Fig.89)
Colonies curved and of four to eight (usually four) fusiform cells with sharp pointed ends. All the cells in a colony lunate, or the interior cells forming a flat plate and the other cells lunate and at an angle to the plane of the interior cells; rarely, all cells in the same plane. Cell wall smooth and without teeth or spines. Cells 2-7 µ broad, 12-48 µ between apices.

Occurrence
C. f. India (Philipose, 1967); Collected from: Kadur Lake.

Scenedesmus bernardii G. M. Smith (Plate-4, Fig.90)
Colonies of four to eight cells. Internal cells fusiform, lunate or sigmoid with acute apices and arranged alternately with their apices in contact with the apices or median portions of adjacent cells. Terminal cells fusiform or lunate, usually attached to the apices of the inner cell and frequently at an angle to the plane of the colony. Cell wall smooth and without spines or teeth. Cells 3-6.3 µ broad, 8-35 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Jayankondam Pond.

Scenedesmus arcuatus var. capitatus G. M. Smith (Plate-4, Fig.91)
Colonies curved, four-eight celled (usually eight-celled). Cells in eight-celled colonies arranged in a double series. Cells in four-celled colonies in a linear or sublinear series. Cells slightly curved with one side convex and the other straight or slightly concave. Ends of cells stumpy and with nodular thickening. Cells 5-11.3 µ broad, 10.6-28 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Udayarpalayam Temple Tank.

Scenedesmus arcuatus (Lem.) Lemmermann (Plate-4, Fig.92)
Colonies usually eight-celled, rarely four or 16 celled, curved and with small intercellular spaces. Cells in eight-celled colonies in two series, oblong-ovoid, sometimes slightly angular at the base due to mutual pressure. Cell wall smooth, without teeth or spines. Cells 3.5-9.5 µ broad, 8.5-18 µ long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Karaivetti Bird Sanctuary.

Scenedesmus armatus (Chodat) G. M. Smith (Plate-4, Figs.93, 94)
Plant composed off 2-8 cells arranged in a single, partially alternating series, oblong-ellipsoid but with ends broadly rounded; terminal cells with a single, long, usually curved or unevenly bent spine at each pole; central cells with a median, cells 3-8 µm broad, 8-12 µm long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Nakkampadi Pool.

Scenedesmus armatus Var. bicaudatus (Guglielmetti) Chodat (Plate-4, Fig.95)
Colonies two to four celled. Differs from the type in having a long spine from one of the poles of the terminal cell only, the spines of the two terminal cells alternating with each other. Longitudianl ribs usually seen only in the internal cells. Cells 2.5-4.6 µ broad, 8.3-12 µ long. Four-celled colonies 8.3-12 µ broad, 10-18.5 µ long. Spines 3.5-8.8 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Birla Cement Factory.

Scenedesmus armatus forma bicaudatus Hortobagyi (Plate-4, Fig.96)
Colonies four to eight celled. Cells with prominent longitudinal ribs which are smooth or rugged. Terminal cells with a long spine from the outer edge of one of their poles, the spines of the two terminal cells alternating with each other. The other pole of the terminal cells and poles of internal cells short spine from their poles. Cells 4.4-5.6 µ broad, 12-19.5 µ long. Long spines 12.3-16.5 µ long. Short spines 1.8-2.5 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Gangikondacholapuram Lake.

Scenedesmus longus Meyen(Plate-4, Fig.97)
Colonies flat, of two-four-eight cells arranged in a single linear series, or, rarely, in a sublinear series. Cells ovoid to oblong cylindrical with rounded or sometimes subacuate poles. Poles of all cells with 1-2 spines. Cells 2.3-8 µ broad, 8-19 µ long. Spines 1.5-15 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Valaja Nagaram Pond.
Scenedesmus abundans (Kirchner) Chodat (Plate-4, Figs.98, 99)
Colonies usually 2-4 celled, rarely eight-celled, and arranged in a liner series. Cells ovoid to oblong-ovoid. External cells with one or more median lateral spines from the outer face in addition to spines from their poles, or rarely without spines. Cells 2-7 µ broad, 6-15 µ long. Spines 3.5-8 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Keezhapalur Temple Tank.

Scenedesmus quadricauda Var. quadrispina (Chodat) G. M. Smith (Plate-4, Fig.100)
Colonies usually 2-4 celled. Cells broadly ovoid and about twice as long as broad. Poles of terminal cells with a single short recurved spine. Cells 3.5-8.5 µ broad, 8.5-15-19 µ long. Spines 2.5-5.5 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Irumbulikurichi Pond.

Scenedesmus quadricaudav var. eualternans Proschk. (Plate-4, Fig.101)
Colonies usually four-celled. Cells fairly small, broadly ellipsoid with broadly rounded poles, and arranged in a subalternate series. Cells 2.3-5 µ broad, 5-18 µ long. Spines 4-10 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Sirukalathoor Pond.

Scenedesmus quadricauda var. parvus G. M. Smith (Plate-4, Fig.102)
Cells ovoid-cylindrical, about 2-2.5 times as long as broad and equal to the length of the spines. Cells 3-4 µ broad, 5.5-8 µ long. Spines 4.5-8.8 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Kuruchikolam pond.

Scenedesmus bijugatus forma parvus (G.M. Smith) comb. nov. (Plate-4, Fig.103)
Colonies four-celled with the cells arranged in a regular subalternating series. Cells much smaller than in var. alternans and oblong-ovoid. Cell wall smooth (or rarely, finely punctuate). Cells 2.8-4 µ broad, 4.8-9 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.

Scenedesmus bijugatus var. graevenitzii (Bernard) comb. nov. (Plate-4, Fig.104)
Colonies four to eight celled. Cells fusiform, ellipsoid, oblong-ellipsoid to ovoid with obtuse poles and arranged in an alternating series with adjacent cells in contact only along a short portion of their length. Colonies frequently aggregated in syncoenobia by the broken remains of parent cell walls as in Dimorphococcus. Cells 4.5-7.9 µ broad and 10-16.7 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Canal.

Scenedesmus bijugatus (Turpin) Kuetzing (Plate-4, Fig.105)
Colonies flat or slightly curved, of 2-4-8 cells arranged in a single linear series. Cells oblong-ellipsoid to ovoid with the ends broadly rounded. Cells 3.5 – 7 µ broad, 7-23µ long.

Occurrence
Tamil Nadu (Anand, 1998); Collected from: Ariyalur Pond.

Scenedesmus bernardii G.M. Smith (Plate-4, Fig.106)
Colonies of four to eight cells. Internal cells fusiform, lunate or sigmoid with acute apices and arranged alternately with their apices in contact with the apices or median portions of adjacent cells. Terminal cells fusiform or lunate, usually attached to the apices of the inner cell and frequently at an angle to the plane of the colony. Cell wall smooth and without spines or teeth. Cells 3-6.3 µ broad, 8-35 µ long.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Ariyalur Pond.

Scenedesmus perforates Lemmermann (Plate-4, Fig.107)
Colonies usually eight-celled, sometimes four-celled. Cells with capitates ends. Outer face of external cells slightly convex, inner face concave; poles curved outwards and with a long recurved spine. Internal cells with concave sides and with linear to lenticular perforations between adjacent cells. Cell membrane smooth or punctuate. Cells 3-10 µ broad, 10-28 µ broad, 10-28 µ long. Spines 10.6-25 µ long. Perforations 1.5-3.6 µ broad.

Occurrence
C. f. India (Philipose, 1967); Collected from: Ariyalur Canal.

Scenedesmus acutiformis Schroeder (Plate-4, Fig.108)
Cells arranged in a single series of 4 (2 to 8), fusiform-elliptic, with poles sharply pointed; inner cells with a single facial longitudinal ridge; outer cells with 2-4 longitudinal ridges; cells 7-8 µm in diameter, (16)-22.5 µm long.

Occurrence
C. f. India (Philipose, 1967); Collected from: Nakkampadi Lake.

Scenedesmus acutus Meyen (Plate-4, Fig.109)
Colonies 4-celled, sharp edge. Cells 3-7 µm broad, 9-18.5 µm long.

Occurrence: C. f. India (Philipose, 1967); Collected from: Valaja Nagaram Pond.

Scenedesmus spp. (Plate-4, Figs.110, 111)
Colonies were usually two-celled, rarely four-celled with the cells arranged in groups of two. Solitary ellipsoid-cylindrical cells also not uncommon. Autospores formed by the single bipartition of the cell contents. Colonies often seen enclosed within the ruptured parent cell membrane. Cells 2.6 – 5.3 µm broad, 6 – 11 µm long.

Occurrence: This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Vengadakrishnapuram Pool.

Plate – 4: 85. Desmodesmus spinosus (Chodat) Hegewald. 86. Desmodesmus abundans (Kirchner) Hegewald. 87. Scenedesmus dimorphus (Turpin) Kuetzing. 88. Scenedesmus acuminatus (Lagerheim) Chod. var. Acu. Kom. and Fott. 89. Scenedesmus acuminatus (Lagerheim) Chodat. 90. Scenedesmus bernardii G. M. Smith. 91. Scenedesmus arcuatus var. capitatus G. M. Smith. 92. Scenedesmus arcuatus (Lem.) Lemmermann. 93. Scenedesmus armatus (Chodat) G. M. Smith. 94. Scenedesmus armatus (Chodat) G. M. Smith. 95. Scenedesmus armatus Var. bicaudatus (Guglielmetti) Chodat. 96. Scenedesmus armatus forma bicaudatus Hortobagyi. 97. Scenedesmus longus Meyen. 98. Scenedesmus abundans (Kirchner) Chodat. 99. Scenedesmus abundans (Kirchner) Chodat. 100. Scenedesmus quadricauda Var. quadrispina (Chodat) G. M. Smith. 101. Scenedesmus quadricaudav var. eualternans Proschk.102. Scenedesmus quadricauda var. parvus G. M. Smith. 103. Scenedesmus bijugatus forma parvus (G.M. Smith) comb. nov. 104. Scenedesmus bijugatus var. graevenitzii (Bernard) comb. nov. 105. Scenedesmus bijugatus (Turpin) Kuetzing. 106. Scenedesmus bernardii G.M. Smith. 107. Scenedesmus perforates Lemmermann. 108. Scenedesmus acutiformis Schroeder. 109. Scenedesmus acutus Meyen. 110. Scenedesmus spp. 111. Scenedesmus spp. 112. Scenedesmus subspicatus Chodat. 113, 114. Scenedesmus deserticola L.A.Lewis & V.R.Fle. ex E.Heg., C.Bock & Kr.

Scenedesmus subspicatus Chodat (Plate-4, Fig.112)
Colonies of 2-4 cells arranging linearly; cell body ovoid to oblong-ovoid. External cells with one or more median lateral spines form the outer face in addition to spines from the four corners of the colony. Internal cells with 1-2 spines from their poles. Cells 2-7 µm broad, 6-15 µm long. Spines 3.5-8 µm long.
Occurrence: This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Sirukalathoor Pond.

Scenedesmus deserticola L.A.Lewis & V.R.Fle. ex E.Heg., C.Bock & Kr. (Plate-5, Figs.113, 114)

Cell solitary, variable in form. Cells crescent to lemon-shaped with pointed ends when young, becoming oval to almost spherical with age. Small protrusions evident at poles in some cells. Cresent cells 3-8 µm wide, 1.5-2 times long as wide.

Occurrence
This is reported for the first time from fresh water bodies of Tamil Nadu; Collected from: Keezhapalur Temple Tank.

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