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Some member of chlorococcales from Jalgaon district, Maharashtra

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Abstract
While studying the desmid flora of Jalgaon district, Maharashtra authors visited to different freshwater bodies of Jalgaon district and collected 40 taxa of Chlorococcales. The present communication deals with the systematic enumeration and descriptions of 40 taxa of Chlorococcales. Of these *Tetraedroncruciatum*, *Lagerheimiachodati*, *Oocystisparva*, and *Dimorphococcuscordatus* are recorded for the first time from Maharashtra. *Tetraedronobesum* and *Palmellocystis plectonica*are additions to Indian algal flora of Chlorococcales.

Keywords: chlorococcales, freshwater, taxa, Maharashtra, India

Introduction
During the present investigations the authors recorded 40 taxa under order Chlorococcales. Present communication includes 18 genera, 34 species, 04 varieties and 02 forms of Chlorococcales.

Several workers have explored the occurrence and distribution of Chlorococcales flora from different water bodies of the Maharashtra is known through the works of Kamat (1963, 1974, 1976) [16, 17], Ashtekar and Kamat (1980) [2], Freitas (1980) [7], Barhate and Tarar (1983) [3], Deore (l983) [5], Pingle (1992) [31], Nandan (1993) Patil and Badgujar (1994) [27], Tarar and Bodkhe (1998) [37], Jawale and Kumawat (2003) [13], Kumawat and Jawale (2003a-b, 2004, 2005) [22] Jawale and Dhande (2005, 2007) [11, 12], Deshmukh and Gunale (2007) [6], Jawale *et.al* (2008) Jawale and Patil (2009), Andhale and Papdiwal (2010) [1] Dhande (2013), Dhande (2013), Jadhavar and Papdiwal (2016) [9], Tagad (2016) [36], Patil (2017, 2019), Jain *et.al* (2018) [10], Yadav (2018, 2020 a-b) [40], Kadam (2020) [15] and Reddy (2020) [34].

Materials and Methods
During the study on desmid flora of Jalgaon district, Maharashtra the algal samples were collected early in the morning in every months between 7.00 to 10:00 a.m. during August,2018 to July, 2019 from different freshwater bodies of Jalgaon district. All the collected samples were tagged and labeled, then preserved with 4% formalin solution on the spot. Morphological details were studied by using Labomed Trinocular Research Microscope (Labomed LX-400).Camera lucida drawings were made with the help of mirror type of camera lucida from fresh as well as preserved material. The identification of the taxa were based on monograph (Philipose, 1967) and relevant research publications. The collection have been deposited at Department of botany, S.V.P. Arts and Science College, Ainpur (M.S.) bearing Accession numbers JD 101 to JD 300.The numbers in the brackets at the end of description of each taxon, indicates the code number of algal samples.

Systematic Enumeration
Chlorococcum humicola (Naeg.) Raben. **Pl. 1, Fig. 1**
M. T. Philipose, 1967, P. 73, Fig.3.
Cells 11.8 -19 µm in diameter; cells spherical, solitary or a number of cellscrowded together to form a stratum. Chloroplast a hallow sphere with a single pyrenoid.

Habitat: Padamalaya lake, 22-10-2018, (JD 211).

Characium ambiguum Her. *ex* Raben. **Pl. 1, Fig. 2**
M. T. Philipose, 1967, P. 82, Fig. 7; G. W. Prescott, 1982, P. 216, Pl. 15, Fig. 11.
Cells 4.9 - 6.5 µm broad, 21.5 - 29.9 µm long, small, elongated and oblique; apexin the form of a slightly bent hyaline beak, attached to the substratum by a short stalkwithout basal thickening.

Habitat: Puddle, near Mahalaxmi irrigation, Faizpur - Savdaroad, 05-08-2018, (JD 204).

Characium obtusum A. Br. **Pl. 1, Fig. 3**
J. K. Daniel, 1981, P. 25-26, Pl. 1, Fig. 10.
Cell 11.8 µm broad, 32.7 µm long, oblong-ovate, anterior end rounded withthickened plug at the apex; stalk short; chloroplast parietal with a single pyrenoid.

Habitat: Hartala lake, 02-09-2018, (JD207).

Characium obtusum A. Br. var. ***philiposii*** Dhande *et* Jawale. **Pl. 1, Fig. 4**
J. S. Dhande, 2007, P. 30, Pl.6, Fig. 9.
Cell 8.1 µm broad, 29.9 µm long, oblong-ovate to ellipsoid; anterior end rounded, stalk absent, attached to substratum by horizontally elongated hyaline attaching disc; chloroplast parietal with a single pyrenoid.

Habitat: Hartala lake, 02-09-2018, (JD 209).

Characium pringsheimii A. Br. **Pl. 1, Fig. 5**
G. W. Prescott, 1982, P. 218, Pl.45, Fig. 21.

Cell 4.9 µm broad, 14.2 µm long, narrowly elongate, ovoid to fusiform, erect butwith a short oblique tip; stipe short; chloroplast a laciniate plate with one pyrenoid.

Habitat: Rain water pool, Bhusawal road,Faizpur 05-08-2018 , (JD205).

Schroederia setigera (Schroed.) Lemm. **Pl. 1, Fig. 6**
M. T. Philipose, 1967, PP. 89-90, Fig.17; G. W. Prescott, 1982, P. 256, Pl. 57, Fig. 4.
Cells 4.9-5.3 µm broad, 27.2-69.8 µm long, solitary, free floating, spindle shaped,straight or curved with ends produced into a long, delicate or stout seta which is curved orstraight; chloroplast single, parietal and with a single pyrenoid.

Habitat: Rivulet**,** Padamalaya lake, 22-10-2018, (JD 212).

Trochiscia reticularis (Reinsch) Hansg. **Pl. 1, Fig. 7**
M. T. Philipose, 1967, P. 100, Fig. 25.
Cell 29.1 µm in diameter, solitary or in palmelloid aggregates; cells spherical, cellwall fairly thick and covered by linear ridges which intersect to form polygons.

Habitat: Waghur dam, 07-02-2019, (JD 221).

Conococcus elongatus Carter **Pl. 1, Fig. 8**
M. T. Philipose, 1967, P.109, Fig. 349.
Cells 3-3.4 µm in diameter, spherical, united together in colonies of 4 cells, eachcell with transparent conical appendages from the outer side of the cell wall which is aboutthree times longer than the diameter of the cell.

Habitat: Waghur river, Sakegaon, 22-10-2018, (JD 214, 215).

Tetraedron cruciatum (Wallach) W. *et* G. S. West. **Pl. 1, Fig. 9**
M. T. Philipose, 1967, P. 155, Fig. 70.
Cells 23.8 – 24.6 µm in diameter, cells cruciate with the corners produced intoirregular processes which are not all in the same plane; processes ending in 2-3 shortspines.

Habitat: Water tank, D.N. College, Faizpur, 05-08-2018, (JD 202).

Tetraedron incus (Teiling) G. M. Smith **Pl. 1, Fig. 10**
M. T. Philipose, 1967, P. 148, Fig. 61a.
Cells 6.5–12.7 µm in diameter, cells tetragonal and flat or pyramidal with concavesides, angles slightly produced to form short lobes, each ending in a fairly long, slightlycurved spine, spines 3.4 – 5.3 µm long.

Habitat: Mor dam, 02-12-2018, (JD 218) Mor river, Mohomandali, 20-07-2019, (JD 281).

Tetraedron minimum (A. Br.) Hansg. f. ***apiculatum*** (Reinsch) De Toni **Pl. 1, Fig. 11**
M. T. Philipose, 1967, P. 13, Fig. 53d.
Cells 11.9 µm in diameter, small and quadrangular with sides concave and anglesrounded with a very fine papilla; cell wall smooth and papilla about 1-5 µm long.

Habitat: Tapi river, near Kandari, 02-06,2019 (JD 276)

Tetraedron obesum (West *et* West) Wille *ex* Brunnthal **Pl. 1, Fig. 12**
G. W. Prescott, 1982, P. 268, Pl.60, Figs. 19, 20.
Cells 4.9 µm broad, 15.7 µm long, ovate or broadly elliptic in outline, but with 3lobes which are scarcely produced one lobe lateral to the long axis of the cell, lobes tipped with a short sharp spine.

Habitat: Padamalaya lake, 22-10-2018, (JD 211).

Tetraedron pentaedricum W.*et* G. S. West. **Pl. 1, Fig.13**
M. T. Philipose, 1967, P. 151, Figs. 65 a-b.
Cell 10.3 µm in diameter without spine, small, irregularly five lobed with fourlobes in one plane and the fifth at an angle to the former; corners somewhat acute, eachwith a short slightly curved spine, spines 3 µm long.

Habitat: Gul River, near Kharad, 02-11, 2018, (JD 214)

Tetraedron regulare Kuetz.var. ***granulate*** Prescott **Pl. 1, Fig. 14**
M. T. Philipose, 1967, P. 147, Figs. 60 i, l; G. W. Prescott, 1982, P. 269, Pl. 61, Figs. 2, 3.
Cells 14.5–15.3 µm in diameter, pyramidal with convex or slightly concave sides,angles broadly rounded with a blunt stout spines; cell wall granular.

Habitat: Mor dam, 02-12-2018, (JD 219).

Tetraedron trigonum (Naeg.) Hansg. f. ***minus*** (Reinsch) De Toni **Pl. 1, Fig. 15**
M. T. Philipose, 1967, P. 142, Fig. 58c.
Cells 8.6–11.9 µm in diameter, smaller than the type; spines 1.1-1.3 µm long.

Habitat: Tapi river, near Kandari, 02-06,2019 (JD 278).

Tetraedron trilobulatum (Reinsch) Hansg. **Pl. 1, Fig. 16**
M. T. Philipose, 1967, P. 137, Fig. 50.
Cells 7.7-8 µm in diameter, triangular, sides equal in length and slightly concave; angles of the cells broadly rounded.

Habitat: Mor dam, 02-12- 2018 (JD 221).

Closteridium bengalicum Turner **Pl. 1, Fig. 17**
M. T. Philipose, 1967, P. 162, Fig. 75.
Cell 5.7 µm broad, 18.4 µm long without spine, crescent-shaped with rounded endsand with a spine from each end, spines 5.7–6.9 µm long.

Habitat: Road side ditch, near Sairam Auto Faizpur - Savdaroad, 05-08-2018, (JD-206).

***Closteridium obesum* (**W.*et* G. S. West) G. M. Smith **Pl. 1, Fig. 18**
M. T. Philipose, 1967, P. 162, Fig. 77b.
Cell 10.7 µm broad, 18.4 µm long, solitary or in twos, rarely in threes, ovoid withthe outer side strongly convex and the inner side nearly straight or slightly concave, polesof cells with a single short inwardly curved spine; spines 2.3 µm long.

Habitat: Waghur dam, 07-02-2019, (JD 222)

Lagerheimia chodati Bernard **Pl. 1, Fig. 19**
M. T. Philipose, 1967, P. 167, Fig. 79.
Cells 7.6 - 8 µm in diameter, more or less spherical with four long setae arrangedin the form of a cross setae with a small basal tubercle and gradually tapering towards thetip; chloroplast single, parietal and with a pyrenoid; setae 11.9–12.6 µm long.

Habitat: Haratala lake, 02-09-2018, JD-210).

Palmellocystis planctonica Korsch. **Pl. 1, Fig.20**
T. Hortobagyi, 1973, P. 77, Figs. 295-296.
Cells 7.2–9.5 µm in diameter; spherical coenobia built up of 4-32 cells, parietalchloroplast large, pyrenoid clearly seen, diameter of coenobium 35.4 – 38.6 µm.

Habitat: Tapi river, near Kandari, 02-06- 2019 (JD 278).
Gloeotaeniumloitles bergerianum Hansg. **Pl. 1, Fig. 21**
M. T. Philipose, 1967, P. 178, Fig. 88c.
Cells 19.9–20.9 µm in diameter; spherical to ovoid and completely filling the spaceinside the mother cell wall; colony 2-4 celled broadly ellipsoid in front view and oblong inside view; colonies 32.7–59.9 µm in diameter and 32.7 µm thick; gelatinous bands broad;chloroplast usually with a distinct pyrenoid.

Habitat: Road side ditch, near Nhavi 20-07-2019, (JD 282); Mor river, Mohomandali
20-07-2019, (JD 283).

Oocystis crassa Wittr. **Pl. 1, Fig. 22**
M. T. Philipose, 1967, P. 181, Fig. 90a.
Cell 15.7 µm broad, 26.8 µm long, solitary or in colonies of 2-4, ellipsoid, nearlytwice as long as broad and with mammillary thickenings at the poles, chromatophoresparietal, fairly large and 4-10 in each cell, each cell with a pyrenoid.

Habitat: Road side ditch, near Nhavi 20-07-2019, (JD 282);

Oocystis ecballocystiformis Iyengar **Pl. 1, Fig. 23**
M. T. Philipose, 1967, P. 186, Figs. 90 a, b, c.
Cell 13 µm broad, 23.8 µm long, oblong-ellipsoid with broadly rounded ends; cell membrane thin and without polar thickenings; chloroplasts 2-4-8, parietal and disc-shaped,each with a minute pyrenoid.

Habitat: Rain water pool, near KrishiUtpanna Bazar Samiti, Savda 05-08-2018, (JD-206,209).

Oocystis naegelii A. Br. **Pl. 1, Fig. 24**
M. T. Philipose, 1967, P. 185, Fig. 98.
Cells 9.9 – 11.8 µm broad, 10.9 – 12.7 µm long, sometimes a solitary, ovoid toelongate with rounded ends; colonies usually 2-4-8 celled with the envelope more or lessclose fitting; cell membrane fairly thick, chromatophore single and in the form of aparietal plate, which is partially or completely lobed and without a pyrenoid.

Habitat: Gul project, near Chopda 02-11-2018, (JD 215).

Oocystis parva W. *et* G. S. West. **Pl. 1, Fig. 25**
A. K.M. Nurul Islam and Z. Tahmida Begum, 1970, P. 239, Pl.2, Figs. 53-56.
Cells 6.1–6.9 µm broad, 8-8.12 µm long, sixteen celled colony upto 21.5–27.2 µmin diameter; cells solitary or in colonies of four, enclosed in the mother cell wall; cellswith pointed ends, polar nodules absent; chloroplasts 1-3, parietal, laminate, withoutpyrenoids.

Habitat: Waghur dam, 07-02-2019 (JD 221).

Oocystis pusilla Hansg. **Pl.1, Fig. 26**
M. T. Philipose, 1967, P. 184, Fig. 97a.
Cell 5.7 µm broad, 10.7 µm long, usually solitary but sometimes in colonies of2-4-8 cells enclosed by an enlarged mother cell wall, cells cylindrical, about two timeslonger than broad and with the poles rounded and without nodular thickenings,chromatophores 2-3, not occupying the entire cell and without pyrenoid.

Habitat: Waghur dam, 07-02-2019 (JD 224).

Oocystis solitaria Wittr. **Pl. 1, Fig. 27**
M. T. Philipose, 1967, P. 180, Fig. 89
Cells 6.1–9.9 µm broad, 11.1–17.6 µm long, solitary or in colonies of 2,4 or 8cells enclosed within the old mother cell wall; ovoid to ellipsoid, thick walled and withmarkedly thick polar nodules; chloroplasts numerous, parietal and discoid.

Habitat: Gul River, near Kharad 02-11-2018 (JD 216); Tapi river, near Kandari 02-06-2019 (JD 277).

Oocystis submarina Lagerheim **Pl.1, Fig. 28**
G. W. Prescott, 1982, P. 247, Pl. 54, Fig. 12.
Cell 6.5 µm broad, 13.8 µm long, usually a family of 2-16 oblong- cylindricalcells, rarely solitary; cells narrowed at the poles and furnished with a nodular thickening; chloroplast 1-3, parietal plates with one pyrenoid each.

Habitat: Puddle, Faizpur- Nhavi road 02-05-2019 (JD 270)

Nephrocytium agardhianun Naeg. **Pl. 1, Fig. 29**
M. T. Philipose, 1967, PP. 189-190, Fig. 104; G. W. Prescott, 1982, P. 248, Pl. 54,Figs. 15-16.
Cells 3.8 – 4.2 µm broad, 8.4 – 9.2 µm long, more or less reniform with roundedends and usually in colonies of 4, 8 or rarely 1,2 cells, within a gelatinous envelope; cellsarranged somewhat spirally in young and irregularly in old colonies; 4 celled colony19.2– 34.1 µm in diameter; chloroplast single, parietal and with one pyrenoid.

Habitat: Water tank, D.N.College, Faizpur 05-08-2018 (JD 203); Mor river, Mohomandali
02-05-2019, (JD 271).

Nephrocytium lunatum W. West **Pl. 1, Fig. 30**
M. T. Philipose, 1967, P. 189, Fig. 103
Cells 2.7–3.6 µm broad, 13.6–14.9 µm long, eight celled colonies upto 29–45.4 µmin diameter, colonies free floating, ovate, composed of 4-8 cells; cells ovoid to kidney shapedor semispherical to lunate or sickle shaped, with bluntly pointed ends, cells spirally orirregularly arranged within a hyaline gelatinous envelope; chloroplast single parietal with apyrenoid.

Habitat: Mor dam, 02-12-2018 (JD 219, 220).

Dimorphococcus cordatus Wolle **Pl. 1, Fig. 31**
M. T. Philipose, 1967, P. 206, Fig. 116; T. Yamagishi, 1975, P. 50, Pl.3, Fig. 2.
Cells 3.4 – 4.2 µm in diameter; colonies like bunch of grapes; cells heart to kidneyshapedwith a concave side directed outwards and with short basal gelatinous stalks.

Habitat: Hartala lake, 02-12-2018 (JD 219).

Ankistrodesmus convolutes Corda **Pl. 1, Fig. 32**
M. T. Philipose, 1967, PP. 213-214, Figs. 122 a-d.
Cell 4.2 µm broad, 26.8 µm long, solitary or in groups of 2-4 cells, cells stronglycurved or twisted with the ends pointed, rarely blunt and stumpy.

Habitat: Mor River, Mohomandali 20-07-2019, (JD 283).

Ankistrodesmus falcatus (Corda) Ralfs **Pl. 1, Fig. 33**
M. T. Philipose, 1967, P. 211, Figs. 121 a, e.
Cells 1.5–2.7 µm broad, 38.4–58.1 µm long; acicular to narrowly fusiform withtapering ends to acute apices, usually in fasciculate bundles of 2-4-8 or more, rarelysolitary; chloroplast single, parietal and usually without pyrenoids.

Habitat: Tapi river, near Kandari, 02-06-2019 (JD 276); Mor River, Mohomandali 20-07-2019, (JD 283).

Ankistrodesmus falcatus (Corda) Ralfs var. ***mirabilis*** (West *et* West) G. S. West **Pl. 1, Fig. 34**
G. S. West, 1904, P. 372, Pl. 1, Fig. 8166.
Cell 3.6 µm broad, 59 µm long, solitary, lunate or sigmoid, with acute apices; cellsmuch longer than the typical form, chloroplast without pyrenoid.

Habitat: Mor river, Mohomandali 02-05-2019, (JD 272).

Selenastrum bibraianum Reinsch **Pl. 1, Fig. 35**
M. T. Philipose, 1967, P. 219, Fig. 127
Cell 6.9 µm broad, 14.9 µm long, crescent to sickle-shaped with sharply pointedends and in colonies of 4-8-16 or more cells; distance between apices 6.5-13.4 µm;chloroplast single, parietal and usually with a pyrenoid.

Habitat: Mor river, Mohomandali 02-05-2019, (JD 272).

Selenastrum gracile Reinsch **Pl. 1, Fig. 36**
M. T. Philipose, 1967, P. 219, Fig. 128.
Cells 3.6–4 µm broad, 32.7 µm long, lunate to sickle-shaped and quite narrow inproportion to the length, apices of cells acute chloroplast without a pyrenoid.

Habitat: Gul river and Gul project, near Kharad and Chopda 02-11-2018 (JD214, 216).

Kirchneriella contorta (Schm.) Bohlin **Pl. 1, Fig. 37**
M. T. Philipose, 1967, P. 224, Fig. 133.
Cells 1.8–2.7 µm broad, 17.2–19.9 µm long, enclosed within a gelatinous envelope,cells vermiform, cylindrical, curved or twisted with rounded ends and irregularly scatteredwithin the envelope; colonies 4-8-16 celled upto 53.6 µm in diameter.

Habitat: Gul project, near Chopda 02-11-2018 (JD 217).
Coelastrum cambricum Arch. var.***intermedium*** (Bohlin) G. S. West **Pl.1, Fig. 38**
M. T. Philipose, 1967, P. 231, Figs. 138 a,b.
Cells 8.4 – 22.7 µm in diameter; colonies usually up to 33.7 – 85.4 µm in diameter;colonies spherical and usually 32-celled, sometimes 8, 16, 64 or 128 celled, cellsspherical and thickened at the poles, 10-12 sided when seen from the apex connected toeach other by 4-6 short gelatinous flat truncate projections, interspaces between cellscircular to triangular, differ from the type in the outer face of the external cells beingsub-spherical and gradually arched, the projections are also blunt, rounded and not truncate.

Habitat: Tapi river, near Kandari, 02-06-2019 (JD 276); Water tank, D.N. College, Faizpur,
05-08-2018, (JD 202).

Coelastrum microporum Naeg. **Pl.1, Fig. 39**
G. W. Prescott and W. C. Vinyard, 1965, P. 453, Pl.8, Fig.3.
Cell with sheath 9.9 µm in diameter, spherical to ovoid, enclosed by a delicategelatinous sheath and inner connected by very short gelatinous processes; coloniesspherical, composed of 8-16-32 cells with small intercellular spaces.

Habitat: Waghur dam, 07-02-2019 (JD 224).

Suxenella crucigenaeformis Srivastava *et* Nizam **Pl. 1, Fig. 40**
P. Srivastava and J. Nizam, 1969, P. 238, Fig. 1.
Four celled colonies 11.9 µm in diameter, free floating, united, quadrate with aminute rectangular space at the centre; cells 3.8–4.6 µm in diameter, triangular, sidesequal in length and deeply concave; angles of cells broadly rounded, completely filledwith chloroplast with single pyrenoid.

Habitat: Gul project, near Chopda 02-11-2018 (JD 216).

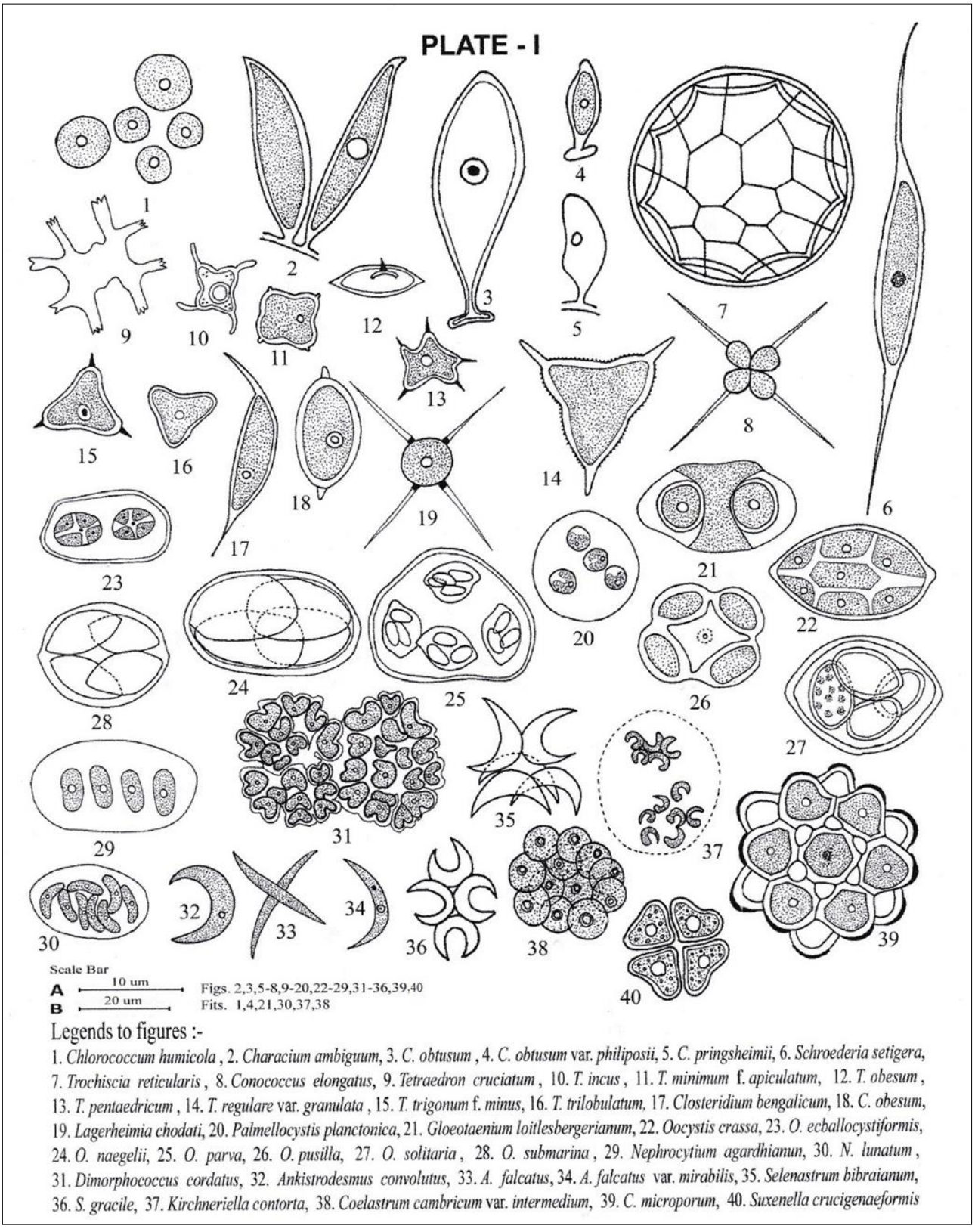

Plate 1

Conclusion

During the present investigation a total of 40 algal taxa were identified. Present communication includes 18 genera belonging to 34 species, 04 varieties and 02 forms of chlorococcales. Of these *Tetraedron cruciatum, Lagerheimia chodati, Oocystis parva,* and *Dimorphococcus cordatus* are recorded for the first time from Maharashtra. *Tetraedron obesum* and *Palmellocystis plectonica* are additions to Indian algal flora of Chlorococcales.

On the basis of dominance winter and rainy seasons are more favorable for the growth of Chlorococcales.

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