

Diversity of Genus *Scenedesmus* from Kalwan Tehsil, Nasik District (M.S.) India

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Abstract: The present communication deals with the genus *Scenedesmus*. It is diversified and common genus in fresh water habitats. During present investigation *Scenedesmus* was dominant genus from study area, 31 taxa observed from different aquatic habitats mostly lakes, dams and river of Kalwan tehsil for 2 years (January 2014–December 2015). Some species are common and some are rare. The *Scenedesmus tropicus* Crow is first time reported from Maharashtra.

Key words: Genus, *Scenedesmus*, Dominant, Kalwan, Nasik.

Introduction: The diversity means variety, difference, variation among the living organisms. Genus *Scenedesmus* is Chlorococcalian, colonial, fresh water green alga; arranged in row with 2, 4, 8 and 16 cells. Species identification is done on basis of terminal cell with number of spines. Name of the genus *Scenedesmus* was created by Meyen in 1829.

Genus *Scenedesmus* is studied from Maharashtra by different workers - Gonzalves and Joshi (1946), Kamat (1974), Kamat and Frietas (1976), Deore (1978), Ashtekar and Kamat (1980), Barhate and Tarar (1983), Pingale (1992), Tarar and Bodkhe (1998), Kumavat and Jawale (2004), Jawale and Dhande (2005), Deshmukh and Gunale (2007), Vanjari and Kumavat (2007), Hajare (2008), Mahajan and Nandan (2009), Jawale *et al.* (2010), Bhosale *et al.* (2010), Patil *et al.* (2011), Jaiswal *et al.* (2012), Kshirsagar *et al.* (2012), Beherepatil and Deore (2013), Gaikwad *et al.* (2013), Patil (2013), Reddy and Chaturvedi (2015), Tagad (2016), Patil *et al.* (2018).

Material and methods: The present study is based on the field and laboratory work, literature survey. Algal samples collected from different aquatic habitats of Kalwan tehsil during Jan. 2014 to Dec, 2015. Algal samples were preserved in 4% formalin and slides prepared by fresh material and mounted in glycerin. All sketches were taken with the help of mirror type of camera lucida. Camera lucida drawings drawn on the paper with the help of Rotering Pen using black water proof Indian ink.

Result and Discussion: Identification has been done after Smith (1916), Philipose (1967) and recent research publications.

Genus: *Scenedesmus* Meyen, 1829

Philipose, 1967:245

Cells colonial, flat plate 2-4-8-16 celled attached side by side, linearly arranged or in rows, cells acicular, ovoid, spindle shaped terminal cells with spines, cell was smooth.

1. *Scenedesmus abundans* (Kirchner) Chodat, 1913.

PI-1, F-1

Philipose, 1967:278:Pl.277, Fig.184a-d.

Colonies 2-4 celled, cells arranged in a linear series, oval-shaped. Spines from four corners of external cells at both poles, internal cell 1-2 spines from their poles. Cells 5 μm broad, 11.2-12.4 μm long, spines 3.2-7 μm long.

Habitat: Gobapur.

2. *Scenedesmus acuminatus* (Lagerheim) Chodat, 1902.

PI-1, F-2

Philipose, 1967:251:Pl.250, Fig.161b.

Colonies 4-8 celled, cells slightly curved, fusiform ends sharp pointed, tapers apex, Cell wall smooth without spines or teeth. Cells 5 μm broad, 20 μm long between apices.

Habitat: Chanakapur.

3. *Scenedesmus acutiformis* Schroeder, 1987b.

PI-1, F-3

Philipose, 1967:260:Pl.260, Fig.169a-b.

Colonies 2-4-8 celled, usually 4-8 celled, cells cylindrical-fusiform arranged in linear single series. Cells without spines, cell wall smooth. Median cells with a lateral longitudinal ridge extend from pole to pole on each side. Cells 3.2-6.2 μm broad, and 9.5-22.8 μm long.

Habitat: Chanakapur, Gobapur.

4. *Scenedesmus arcuatus* var. *capitatus* G.M.Smith, 1918.

PI-1, F-4

Philipose, 1967:257:Pl.258, Fig.166i.

Colonies curved 4-8 celled, arranged in double series. Ends of cells stumpy with nodular thickenings, cell wall smooth, without teeth and spines. Cell 3.5-4 μm broad, 9.5-12 μm long.

Habitat: Chanakapur, Markand Pimpri.

5. *Scenedesmus arcuatus* var. *playtdiscus* G.M.Smith, 1916a.

PI-1, F-5

Smith, 1916:451: Fig.101-105.

Cells colonial, without spines, commonly 8 celled, rarely four celled, cells enclosed by a gelatinous envelope. Eight cell colony 16.5-19.8 μm in diameter, 16.5-23.1 μm long. Cells with broadly rounded ends. Cells without spines, cell wall smooth.

Habitat: Chanakapur Dam.

6. *Scenedesmus arcuatus* (Lemmermann) Lemmermann, 1899.

PI-1, F-6

Philipose, 1967:256:Pl.258, Fig. 160a-c.

Colonies 4-8 celled, cells curved with intercellular spaces. Eight celled colony in two series, ovoid, cell wall smooth, without spines and teeth cells 3.5-9.9 μm broad, 9-12.5 μm long.

Habitat: Gobapur, Otur.

7. *Scenedesmus armatus* var. *bicaudatus* (Guglielmetti). Chodat, 1926.

PI-1, F-7

Philipose, 1967:262:Pl.263, Fig.171d-f.

Colonies 2-4 celled, cells 3.1-4.5 μm broad, 10-12.5 μm long, spines 8.5-10 μm long, it differs from the type in having a long spine from one of the poles of terminal cell only, the spines of the two terminal cells alternating with each other.

Habitat: Otur.

8. *Scenedesmus armatus* Chodat G.M. Smith, 1916.

PI-1, F-8

Philipose, 1967:261:Pl.263, Fig.171a-c.

Colonies 4 celled rarely 2 or 4 celled, cell oblong, ovoid with acute apices, cells arranged in linear series. Terminal cells curved with acute apex, middle cells fusiform. Cells 5-7 μm broad, 12-22 μm long. Terminal cells with single long spine from each pole.

Habitat: Otur.

9. *Scenedesmus bernardii* G.M.Smith, 1916.

PI-1, F-9

Philipose, 1967:251:Pl.250, Fig.162.

Cells colonial 4-8 cells, terminal cells lunate or fusiform attached to inner cells, inner cells lunate shaped acute apex, arranged alternate or zigzag manner. Cells 3-3.5 μm broad, 12.2-15.5 μm long, cell wall smooth without spines and teeth.

Habitat: Chanakapur, Otur.

10. *Scenedesmus bijugatus* forma *irregularis* Wille, 1903.

PI-1, F-10

Philipose, 1967:253:Pl.255, Fig.164i, m.

Differs from *S. bijugatus* sub-alternating or in an almost double series. Colony 4-8 celled. Cells 3.2-4.1 μm broad, 9.2-10 μm long. Cell wall smooth, without spines or teeth.

Habitat: Otur.

11. *Scenedesmus bijugatus* (Turpin) Kuetzing, 1833.

PI-, F-11

Philipose, 1967:252:Pl.255, Fig.164c, e, f.

Colonies of 2-4-8 cells arranged in a linear single series, cells ovoid, oblong ends rounded without spines. In some colonies middle cells larger than outer cells, otherwise cells uniform, smooth cell wall, without spines.

Habitat: Gobapur, Chanakapur.

12. *Scenedesmus bijugatus* (Turpin) Kuetzing var. *graevenitzii* (Bernard) Comb, 1908.**PI-1, F-12**

Philipose, 1967:254:Pl.255, Fig.164a, b.

Colony 4-8 celled, cells fusiform, oblong to ovoid with obtuse poles and arranged in an alternating series with adjacent cells in contact only along a short portion of their length. Cells 3.7-5 μm broad, 10-12.5 μm long.

Habitat: Markand Pimpri.**13. *Scenedesmus brasiliensis* Bohlin, 1897a.****PI-1, F-13**

Philipose, 1967:261:Pl.260, Fig.170.

Colonies 4-celled, sometimes 2-8 celled, cells cylindrical, oblong with alternate apices and with a longitudinal ridge extend from pole to pole on each side of the cell. Ends of cells with 1-4 teeth, cells 4.2-5 μm broad, 11.5-12.8 μm long.

Habitat: Chanakapur.**14. *Scenedesmus carinatus* (Lemm) Chodat, 1918.****PI-1, F-14**

Philipose, 1967:266:Pl.267, Fig.172a.

Colonies 4-8 celled, cells arranged in a linear series, cells fusiform to naviculoid with beaked ends. Inner cells with 2-3 teeth or without teeth. From their poles. Terminal cells with a long recurved spine from each pole, cells 2.9-3.8 μm broad, 12.5-15 μm long, spines 14-15.7 μm long.

Habitat: Gobapur.**15. *Scenedesmus denticulatus* var. *linearis* Hansgirg, 1886.****PI-1, F-15**

Philipose, 1967:270:Pl.269, Fig.176e.

Cells 4-8 in colony, the arrangement of the cells differs from the other, cells in a single linear series. Cells oblong with rounded ends, having 1-2 teeth, Cells 5.6-6.2 μm broad, 19.2-20.4 μm long, Teeth 1.5-1.8 μm long.

Habitat: Chanakapur, Otur.**16. *Scenedesmus denticulatus* var. *australis* Playfair, 1917.****PI-1, F-16**

Philipose, 1967:271:Pl.269, Fig.176f-h.

Colony 2-4 celled, two celled colony 11.25 μm broad, 13.4 μm long. Cells arranged in a single linear series, cells oblong cylindrical with rounded ends with one short teeth from the poles of cells. Cells 6.3 μm broad, 13.4 μm long, teeth 1-1.2 μm long.

Habitat: Otur, Chanakapur.**17. *Scenedesmus denticulatus* Lagerheim, 1882.****PI-1, F-17**

Philipose, 1967:268:Pl.269, Fig.176.

Colonies usually 4-celled arranged linear or sub alternate manner. Cells ovoid-oblong with 1-4 teeth from each pole, sometimes teeth absent from one end or inner cells. Cells 4.2 μm broad, 18 μm long.

Habitat: Chanakapur, Otur.

18. *Scenedesmus dimorphus* (Turpin) Kuetzing forma *tortus* G.M.Smith, 1926.

PI-1, F-18

Philipose, 1967:251:Pl.250, Fig.160d.

Colonies 4-8 celled, cell arrangement is linear or sub-alternating, colony being at an angle to the axes of the terminal cells instead of being parallel to them. Cells 6.2-8 μm broad, 24-35 μm long.

Habitat: Chanakapur.

19. *Scenedesmus hystrix* Lagerheim, 1882.

PI-1, F-19

Philipose, 1967:266:Pl.267, Fig.173.

Colonies 2 celled, cells oblong-cylindrical with obtuse ends and arranged in single linear series cells membrane covered with minute spines, cells 4.5-6 μm broad, 12-15 μm long.

Habitat: Gobapur.

20. *Scenedesmus incrassatulus* Bohlin, 1897.

PI-1, F-20

Philipose, 1967:252:Pl.255, Fig.163.

Colony 2-4 celled, cells spindle-shaped, arranged linear or sub-alternating series, fusiform, curved with outer side convex and inner side straight or slightly concave. Ends of cells with stumpy and apical nodules. Cells 3.5 μm broad, 7-8.2 μm long.

Habitat: Otur.

21. *Scenedesmus longus* Meyen, 1829.

PI-1, F-21

Philipose, 1967:273:Pl., Fig.180a.

Colonies 2-4 celled, cells flat arranged in a single linear series or sub-linear series, cells ovoid to oblong with rounded or sub-acute poles. Poles with 1-2 spines or without spines. Cells 2.5-6.2 μm broad, 10-19.9 μm long, spines 1.5-5 μm long.

Habitat: Gobapur, Otur.

22. *Scenedesmus longus* Meyen var. *naegeli* (Brebisson) Smith, 1920

PI-1, F-22

Philipose, 1967:274:Pl.273, Fig.180 b, c, g, h.

Cells colonial 2-4-8 celled, cells cylindrical, arranged in a single linear series, terminal cells with long spine from one pole and other pole short curved spine, cells long spine 4.2-6.2 μm long, short spine 1.5-3.1 μm long, cells 3.2-6.2 μm broad, 6.2-12.4 μm long.

Habitat: Otur, Markand Pimpri, Chanakapur.

23. *Scenedesmus longus* Meyen var. *dispur* (Brebisson) G.M. Smith**PI-1, F-23**

Philipose, 1967:275:Pl.273, Fig.-h.

Colonies 4-celled, cells oblong, fusiform with acute ends arranged in sub-alternating series, Inner cells with spine from each pole, cell wall smooth. Cells 2.8-3 μm broad, 9.8-12 μm long. Spines 1.5-4 μm long.

Habitat: Chanakapur, Otur.**24. *Scenedesmus opoliensis* P. Richter, 1897.****PI-1, F-24**

Philipose, 1967:275:Pl.277, Fig.181a, b.

Colonies 4-8 celled, cells spindle shaped, arranged in a single linear series, cells 6.2 μm broad, 12.5-7 μm long, outer spiny projections 12.15 μm long.

Habitat: Chanakapur, Otur.**25. *Scenedesmus opoliensis* var. *contacta* Prescott, 1944.****PI-1, F-25**

Philipose, 1951:279:Pl.63, Fig.19, 20.

Colonies 4 celled, cells attached adjacent at the centre, cells arranged in linear series, not a flat plane, cells spindle shaped, 5.5-7 μm broad, 17-20 μm long. Outer cells with 1-2 long and curved or straight spiny projections 11.5-15 μm long. Middle or inner cells without spines.

Habitat: Chanakapur.**26. *Scenedesmus perforates* Lemmermann, 1903.****PI-1, F-26**

Philipose, 1967:280:Pl.281, Fig.186a, b, g.

Colonies 4 celled, cells arranged in a linear series, cells sub rectangular with convex end walls and concave lateral wall, forms biconvex intercellular space. Poles curved outwards and with long recurved spine. Cell membrane smooth or punctuate, cells 2.5-3.2 μm broad, 9.6-10 μm long. Perforations 1-1.5 μm .

Habitat: Chanakapur.**27. *Scenedesmus perforates* var. *major* (Turner) Comb, 1892.****PI-1, F-27**

Philipose, 1967:282:Pl.281, Fig.186i.

Colonies usually four-celled, cells oblong, cylindrical with rounded ends and arranged in a linear series. Poles of terminal cells with a long or less straight or curved spine. Smooth cell wall and without ridges. Cells 4.6-5.5 μm broad, 8.6-10 μm long. Spines 6.2-9.3 μm long.

Habitat: Chanakapur.**28. *Scenedesmus quadricauda* (Turpin) Brebisson var. *parvus* G.M. Smith, 1916.****PI-1, F-28**

Philipose, 1967:286:Pl.283, Fig.187f.

Colonies 4-celled, cells cylindrical-ovoid, spines length larger than the cells, cells 3 μm broad, 8 μm long, spines 6.2-9.3 μm long.

Habitat: Gobapur.

29. *Scenedesmus quadricauda* (Turpin) Brebisson var. *westii* G.M.Smith, 1916a.

PI-1, F-29

Philipose, 1967:286:Pl.283, Fig.187 h-i.

Colony 4-8 celled, ovate, with broadly rounded apices, cells 4.2-5 μm broad, 10 μm long, spines 8.2-12 μm long.

Habitat: Chanakapur.

30. *Scenedesmus quadricauda* (Turpin) Brebisson, 1835.

PI-1, F-30

Philipose, 1967:283:Pl.283, Fig.187a.

Colonies usually 4-celled, cells oblong, cylindrical with rounded ends and arranged in a linear series. Poles of terminal cells with a long, more or less straight or curved spine. Cell wall smooth and without ridges, cells 4.6-5.5 μm broad, 8.6-10 μm long. Spines 6.2-9 μm long.

Habitat: Chanakapur.

31. *Scenedesmus tropicus* Crow, 1923.

PI-1, F-31

Philipose, 197:279:Pl.280, Fig.185.

Colony 4 celled sub-quadrate, cells more or less biconvex in the middle, attenuated towards the ends and with inflated poles, adjacent cells connected to each other by narrow processes with intercellular perforation, terminal cells with a long recurved spine, chloroplast parietal with single pyrenoid. Cells 6.2-7 μm broad, 18.6-21.7 μm long, spines 12.4-17.6 μm long.

Habitat: Chanakapur.

Conclusion: 31 taxa of *Scenedesmus* recorded from different aquatic habitats of Kalwan Tehsil.

Acknowledgement: The authors are very much grateful to the Principal, Z.B.Patil College, Dhule for providing research facilities.

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Legends

1. *S. abundans* (Kirchn.) Chodat.
2. *S. acuminatus* (Lagerheim) Chodat.
3. *S. acutiformis* Schroeder.
4. *S. arcuatus* (Lemmermann) Lemmermann var. *capitatus* G.M.Smith.
5. *S. arcuatus* (Lemmermann) Lemmermann var. *platydiscus*. G.M.Smith.
6. *S. arcuatus* (Lemmermann) Lemmermann.
7. *S. armatus* (Chodat) G.M.Smith var. *bicaudatus* (Guglielmetti) Chodat.
8. *S. armatus* (Chodat) G.M.Smith
9. *S. bernardii* G.M.Smith
10. *S. bijugatus* (Turpin) Kuetzing f. *irregularis* Wille.
11. *S. bijugatus* (Turpin) Kuetzing
12. *S. bijugatus* Kuetzing var. *graevenitzii* (Bernard) Comb.
13. *S. brasiliensis* Bohlin.
14. *S. carinatus* (Lemm.) Chodat.
15. *S. denticulatus* Lagerheim var. *linearis* Hansgirg.
16. *S. denticulatus* Lagerheim var. *australis* Playfair
17. *S. denticulatus* Lagerheim
18. *S. dimorphus* (Turpin) Kuetzing f. *tortus* G.M.Smith
19. *S. hystrix* Lagerheim.
20. *S. incrassatulus* Bohlin.
21. *S. longus* Meyen.
22. *S. longus* Meyen var. *naegeli* (Brebisson) Smith
23. *S. longus* Meyen var. *dispur* (Brebisson) G.M.Smith
24. *S. opoliensis* P. Ritcher.
25. *S. opoliensis* var. *contacta* Prescott.
26. *S. perforatus* Lemmermann.
27. *S. perforatus* Lemmermann var. *major* (Turner) Comb.
28. *S. quadricauda* (Turpin) Brebisson var. *parvus* G.M.Smith
29. *S. quadricauda* (Turpin) Brebisson var. *westii* G.M.Smith
30. *S. quadricauda* (Turpin) Brebisson
31. *S. tropicus* Crow.

Plate-1

