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FRESH WATER ALGAE OF SINDH-IV. THE GENUS CLOSTERIUM NITZSCH AND PLEUROTAENIUM NAGELI FORM LAKES & PONDS OF SINDH, PAKISTAN

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Abstrect

In the present report 33 taxa of *Closterium* and 3 taxa of *Pleurotaenium* are reported from fresh water ponds and lakes of Sindh.

Introduction

The study was under-taken to report *Closterium* and *Pleurotaenium* (Family *Desmidaceae*, Order Zygnematales)from the distributaries of river Indus where the alkalinity level is low. These species occour in planktonic form in fresh water bodies located in various districts of Sindh Province.

In Pakistan Sarim & Faridi 1976, 1988 & 1995 were the first to report *Closterium* and *Pleurotaenium* from N.W.F. Province followed by Masud-ul-Hassan *et al.,* (1995) from the rice fields of the Punjab.

The present report desceribes the occurrence of these species for the first time from the fresh water lakes and ponds of the Sindh, Pakistan.

Materials and Method

Plants were collected from rice fields, drains, marshy places, pools & riverine pond of Hussainabad (Distt: Hyderabad), Kinjhar lake (District Thatta) and Bakar lake, (District Sanghar). Planktons were studied after presvering in 3-4% formaline. Dust and other organic material were removed by washing with 2-3% acetic acid to clear the specimen. The desicription is accompanied with camera lucida drawings, at magnification of 8x X 10 and 8x X 40 under the light microscope. Specimens were identified and compared with that of Sarim & Faridi (1976, 1995) and Prescott *et al* (1975).

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Systametic Enumaration

Closterium acerosum (Schrank) Ehrenberg var. ***acerosum***.

Prescott *et al*, 1975:27; Sarim and Faridi, 1976: 224; Yamagishi, 1984, 1:18

(Pl, 1, Fig. 1)

Cells 7-12 times longer than broad; 430-500 µm long, 60-66 µm broad, slightly curved and gradually attenuated to the end. Chloroplast with 5-8 longitudinal ridges containing 20 or more axil pyrenoids. Apex 7.5 - 9µm; terminal vacule with 7-10 granules.

Locality: Ponds at Shikarpur. Ricefields around Hyderabad. Very common species in Lakes & ponds throughout Sindh.

Distribution: Cosmopolitan.

Closterium acerosum (Schrank) Ehr. var. ***elongatum*** de Brebisson

Prescott *et al* 1975: 28; Sarim & Faridi, 1976:224

(P1. I, Fig. 2)

Cells 15-18 times longer than broad, mostly longer then gradually tapered to the poles, Chloroplast with longitudinal ridges 14-20 axil pyrenoids; terminal vacule with many granules cells, 700-900 µm long and 45-57 µm broad. Apex 6-9 µm.

Locality: Bakar lake 25-7-97; and Riverin Indus pond at Jamshoro Barriage
Distribution: Cosmopolitan.

Closterium acerosum (Schrank) Ehr. var. ***minus*** Hantzsch.

Prescott, *et al* 1975:228. Sarim & Faridi; 1976:225.

(P1. I, Fig. 3).

Cells 9-12 times longer than broad slightly curved, inner wall almost stright. Cells 275-300 µm long and 24-26.4 µm broad. Apex 4.5-6 µm.

Locality: Makli pond near Thatta.

Distribution: U.S.A. Europe and Asia.

Closterium attenuatum Ehr. Prescott, *et al* 1975:35

(P1.I, Fig. 4)

Cells 10-15 times longer than broad slightly curved, inner margin not tumid gradually attenuated to the apical region and narrow at the poles,

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Choloroplast with 4-6 or more visible ridges with 6-12 pyrenoids in a series, Terminal vacuole with many granules. Cells 500-750 µm long; with 65-70 µm broad. Apex 6-8.5 µm.

Loicality: S.U. pond Jamshoro 18-07-1997.

Distribution: U.S.A, Europe and Asia.

Closterium calosporum var. ***brasiliense*** Borg. Prescott *et al* 1975:39; Yamagishi, 1986.5:12

(P1.I, Fig. 6.)

Cells longer than broad, curved midian part of the cell not tumid, gradually attenuated to the apex. Cells 200 µm long, 9.5 - 11 um broad. Apex acute with granules. Chloroplast contaning 3-4 pyrenoids in each semi cell.

Locality: River Indus pond at Kotri 29-11-1996.

Distribution: Cosmopolitan

Cloesterium cornu Ehrenbergii, Prescott, *et al*, 1975:40; Sarim & Faridi, 1976: 226.

(P1.I, Fig 5)

Cells 12-15 times longer than broad, slightly curved, ventral margin striaght and dorsal side slightly convex, chloroplast with 5-7 pyrenoids in sieries. Terminal vacuole with one granule. Cells 110-121 µm long; 9-12 µm wide. Apex 3.4-4 µm.

Locality: Bakar lake, dated 8-7-1997.

Distribution: Cosmopolitan.

Closterium dianae Ehr var. ***arcuatum*** (Brebisson) Rabenhorst.

Yamagishi, 1989, 9:9

(P1.IV, Fig. 41)

Cells 13-15 times longer than broad, curved gradually attenuated towards the end, which are slightly truncate and founded with granule, Chloroplast with 5-8 pyrenoids. Cells 300-330 µm long, 21-24 µm broad. Apex 3.5-4 µm.

Locality: Karoghanghro lake District Badin, 6-5-1997

Distribution: Cosmopolitan.

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Closterium dianae Ehr. var. ***dianae*** Prescott *et al* 1975:46

(P1.I, Fig. 7)

Cells 6-7 times longer than broad, strongly curved, and ventral margin slightly tumid. Chloroplast with 4-6 longitudinal ridges and with 6-8 pyrenoids in a series. Terminal vacuoles 10-20 granules. Cells 261-280 um long, 36-42 um wide. Apex 4.5-7.8 um.

Localioty: Khadejifall 22-8-1996.

Distribution: Cosmopolitan.

Closterim dianae Ehr. var. ***brevius*** (Wittr) Petkoff.

Prescott *et al,* 1975:47; Sarim & Faridi, 1976:227

(P1.I, Fig. 8)

Cells 5-7 times longer than broad, swollen in the mid region. Chlotoplast with 5-7 pyrenoids. Cells 180-200 µm long 24 µm broad. Apex 2.5 - 3.5 µm.

Locality: River Indus pond at Kotri. 6-7-1995.

Distribution: Cosmopolitan.

Closterium ehrenbergii Meneg. Prescott, *et al*, 1975:49; Islam *et al,* 1985:880.

(P1.I, Fig. 9)

Cells 350-500 um long 30-57 um wide. Apex 9-19.7 um, Slightly tuimid in the middle on the concave side.

Locality: Hussainabad pond, Distt Hyderabad.

Distribution: Cosmopolitan,

Closterium ehrenbergii Meneghini var. ***ehrenbergii,*** Prescott *et al*, 1975:49.

P1. I, Figs. 10 & 11)

Cells 6-7 time longer than broad, slightly curved dorsal wall convex, gradually attenuated to round poles; wall smooth colourless. Chloroplast with 3 or more gridle bands, pyrenoids numerous & scattered. Terminal vacuole with many garanules.

Locality: Bhitai Town, and Hussain abad pond, 15-5-1996.

Distribution: Cosmopolitan.

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Closterium enhrenbergii var, ***atumidum*** Gronblad. Prescott *et al*, 1975:49

(Pl.I, Fig. 12)

Cells 150-210 um long, 25-30.5 um broad, chloroplast with longtiudinal ridges, with numerous scattered pyrenoids. Apex 4.5-6 µm, terminal vacuole with few granules.

Locality: Ponds, Distt . Jakaυabad, 22-3-1997.

Distribution: Cosmopolitan.

Closterium exile west and west. Sarim & Faridi, 1976:228

Prescott et al, 1975:51,

(Pl. 1, Fig. 13)

Cells 7-10 times longer than broad, slightly curved, ventral margin concave, striaght in the middle region, acuminately rounded, chloroplast with 2-3 pyrenoids. Cells 72-80 µm long 9-10 µm broad. Apex 1.5-2.5 µm.

Locality: Hussainabad, Distt Hyderabad, 6-9-1997.

Distribution: U.S.A. Norway and Asia.

Closterium lanceolatum **Kuetzing,** Precott, et al, 1975:59;

Sarim & Faridi, 1976:230

(P1:I, Fig, 14)

Cells 6-7 times longer than broad, striaght, slightly curved on the outer margin convex, the inner margin stright or slightly convex, with rounded poles. Chloroplast with 6-10 ridges and 7-10 axil pyrenoids. Cells 191-210 um long, 29.7-30 µm broad. Terminal vacuole with 8-10 granules. Apex round 6.6 µm.

Locality: River Indus at Kotri, 29-11-1996 Distt: Dadu.

Distribution: Cosmopolitan.

Closterium leibleinii Kuetzing. Prescott *et al,* 1975:60;

Sarim & Faridi, 1976:230

(P1,IV, Fig. 40)

Cells 7-8 times longer than broad, cruved and slightly inflanted in the mid region gradually attenuated with rounded poles. Chlotoplast with 2-6 longtudinal ridges with 4-10 Pyrenoids in a series. Terminal vacuole with 8-10 granules. Cells 240 µm long and 30-33 µm broad. Apex 3.5-4.5 µm.

Locality: Chalgari pond, Distt: Hyderabad.

Distribution: Cosmopolitan,

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Closterium leibleinii var. cf. **c. *minimum*** Schmidle. Prescott *et al*, 1975:60; Sarim & Faridi, 1976:23

(P1.II, Fig. 15)

Cells 4-6 times longer than broad wall smooth, chloroplast with 2-4 pyrendoids. Cells 90 µm long 15 µm broad. Apex 2.5-3 µm.

Locality: River Indus pond Hussainabad Distt. Hyderabad, 6-7-1995.

Distribution: U.S.A, Europe and Asia

Closterium lineatum Ehre. var. ***lineatum***

Prescott *et al*, 1975:63

(P1.II, Fig, 16)

Cells 15-20 times longer than broad, slightly curved midregion staright with parallel margins. Chloroplast with 5-9 longitudinal ridges and 20-24 axial pyrenoids. Terminal vacuole with 6-10 granules. Cells 900-950 µm long, and 48-52 µm broad. Apex 7.9-10 µm.

Locality: Hussainabad ponds Distt. Hyderbad, 6-7-1996.

Disrtibution: Cosmopolitan.

Closterium lunula (Mull.) Nitzsch. var. ***lunula*** Prescott *et al*, 1975; 65

(P1.II, Fig. 17)

Cells 12-15 times longer than broad, slightly curved. Chloroplast with 7-12 longtiudinal ridges, pyrenoids numerous scattered. Nucleus large. Terminal vacuole with 10-30 granules Cells.

Locality: Wapda Colony Hyderabad. 4-6-1997.

Distribution: Cosmopolitan.

Closterium moniliferum (Bory.) Ehr, var. ***moniliferum***.

Prescott *et al*, 1975:70; Sarim & Faridi, 1976:231*Yamagishi, 1990:46.*

(P1.II, Fig. 18)

Cells 5-8 times longer than broad, The outer wall convex, ventral wall inflanted in the midregion, Poles broadly rounded. Chloroplast 5-10 longitudinal ridges with 4-10 axil pyrenoids. Terminal vacuole with 5-10 granules.Cells 245-300 µm long and 36-42 µm broad. Apex 6.5-13 µm.

Locality: Hussainabad pond Distt. Hyderabad. 21-6-1997.

Distribution: cosmopolitan.

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Closterium parvulum var. ***maius*** west. Prescott *et al,* 1975:74

(P1, II, Fig,. 19)

Cells longer than broad, 235-270 µm long, 18-25 µm broad. Apex 3.3-4 µm.

Locality: Khadaje fall, Thano Bola Khan, Distt. Dadu. 22-8-1996.

Diustribution: U.S.A. Europe, South America and Asia.

CLosterium parvulum Nageli, Perscott *et al* 1975:74; Sarim & Faridi, 1976:232

(P1. II, Fig. 20)

Cells 8-10 times longer than broad, less curved, poles bluntly rounded. Chloroplast with 4-5 pyrenoids, terminal vacuole with 6.8 granules. Cells 120-140 µm long, 12.5-14 µm broad Apex 2-3.5. µm.

Locality: Hussainabad pond Distt. Hyderabad.

Distribution: Cosmopolitan.

Closterium pritchardianum Archer. var. ***pritchardianum.***

Prescott *et al,* 1975:77; Sarim & Faridi, 1976:232

(P1. II, Fig. 21)

Cells 13-20 times longer than broad, slightly curved, ventral side almost straight gradually attenuated with conical poles which are narrrow and truncate. Chloroplast with 6-8 longtiudinal ridges and with pyrenoids. Terminal vacuole with numerous granules. Cells 570-627 µm long and 45-52 µm broad. Apex 6-9.5 µm.

Locality: Rice field along with Jamshoro Road & effluent Thermal Power house Jamshoro. Distt. Dadu. 14-8-1996.

Distribution: Cosmopolitan.

Closterium pseudolunula Borge var. ***Pseudolunula***

Prescott *et al,* 1975:79; Sarim & Faridi, 1976:233

(P1. II, Fig. 22)

Cells 7-8 times longer than broad, scarcely curved, chloroplast 4-7 ridges, with 6-10 axil pyrenoids. Terminal vacuole with more than 5 granules. Cells 245-300 µm long, 40-48 µm broad. Apex 7-10.5 µm.

Locality: Kinjhar Lake, Distt. Dadu. 4-12-1996.

Distribution: Cosmopolitan.

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Closterium cf. c. pulchellum West and West. Prescott *et al,* 1975:80

(P1. II, Fig 23)

Cells longer than broad, slightly curved in the ventral margin, concave not inflanted in the midregion, poles narrowly rounded, wall smooth. Chloroplast with 2 or more pyrenoids. Cells 80-85 um long, 11.5-15 um broad.

Locality: Hussainabad. Distt. Hyderabad.

Distribution: U.S.A and Asia.

Closterium rostratum Ehre. Prescott *et al*,, 1975: 83

(P1. III, fig. 24)

Cells 9-12 times longer than broad, slightly curved, inflanted in the mid region, tapering in the apical region. Chloroplast 3-8 longitudinal ridges, with 6-8 axil pyrenoids, terminal vacule with 10-15 granules. Cells 262-300 µm long and 23 µm broad. Apex 2.5-3.4 µm.

Locality: River Indus pond near Jamshoro Barriage, Distt. Hyderabad.

Distribution: Cosmopoitan.

Closterium spetsbergense Borge var. ***spetsbergense*** Perscott *et al*, 1975:85

(P1. III, Fig, 26)

Cells 5-7 times longer than broad, dorsal margin strongly bowed, the internal margin slightly concave. Chloroplast with 5-6 axil pyrenoids. Cells 290-300 µm long and 40-45 µm broad. Apex 5.9-6.8 µm.

Locality: Rawal Kot Kashmir 15-9-1995. Thano Bola Khan. 15-9-1995.

Distribution: U.S.A, Europe & Asia.

Closterium subfusiforme Messiko. Prescott *et al*, 1975:89

(P1. III, Fig, 25)

Cells 10-12 times longer than broad, stright, fuisform equally convex on margin, Chloroplast with 3-4 longitudinal ridges, with 4-6 axil pyrenoids. Cells 198-220 µm long, 20-22.5 µm broads. Apex 4.5-5 µm.

Locality: River Indus pond, at Hussainabad Distt. Hyderabad.

Distribution: Cosmopolitan.

Closterium venus kuetz. var. ***major*** Strom.

Prescott *et al*, 1975:96; Sarim & Faridi, 1968:235; Croasdale, 1955:527

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(P1. III, Fig. 27)

Cells curved 125-150 µm long and 20-22 µm broad. Chloroplast with 3-4 pyrenoid. Terminal vacuole with 2-3 granules.

Locality: Jamshoro pond, Distt. Dadu.

Distribution: Cosmopolitan.

Closterium venus kuetz. var. ***croasdale*** Croasdale, 1955:527; Sarim & Faridi, 1976:235

(P1. III, Fig. 28)

Cells 70-95 µm long, 13.5-15 µm broad. Apex 1.9-2.3 µm wide, Chloroplast with 2-3 pyrenoids, Terminal granules 2-3, Apex acute.

Locality: Jamshoro pond Distt. Dadu. 18-7-1997.

Distribution: Cosmopolitan.

Closterium venus Kuetz. var. ***Crassum*** croasdale.

Prescott *et al*, 1975:97; Sarim & Faridi, 1976:235

(P1. III, Fig. 29)

Cells 5-8 times longer than broad, wall smooth clorless. Chloroplast with 2-5 pyrenoids. Terminal vacuole with 4-5 granules. Cell 85-90 µm long, 12-15 µm broad. Apex 2.4-3 µm.

Locality: Hussauin abad pond Distt. Hyderabad.

Distribution: Cosmopolitan.

Closterium venus kutz. var. ***apollonionis*** Croasdale. Prescott *et al*,, 1975:96

(P1. III, Fig. 30)

Cells 6-9 times longer than broad. Chloroplast with 3-4 pyrenoids. Terminal vacuole with 1-5 granules. Cells 130-140 µm long, 24-29 µm broad. Apex 3-3.5

Locality: Bakar lake Distt. Sanghar.

Distribution: U.S.A and Asia.

Closterium venus var. ***venus f. major strom***. Prescott. 1975:96

(P1. III, Fig, 31)

Cells 35 µm long, 8.5-9 µm wide. Apex 1.2 µm with 2-3 granules.

Locality: Riverin pond. Kotri Distt. Dadu.

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Distribution: Cosmopolitan.

Closterium venus kuetzing var. ***westii*** (West) Kriger. Prescott *et al*, 1975:97

(P1. II, Fig 32)

Cells 8-10 times longer than broad curved. Chloroplast with 2-3 pyrenoids. Cells 60-100 µm long, 8.5-10 µm broad. Terminal vacuole with few granules.

Locality: Hussainabad Pond Distt. Hyderabad.

Distribution: Cosmopolitan.

Closterium gracele var. ***elongatum*** West & West. Proscott *et al* 1975:52

(P1. III, Fig. 33)

Cells 411-452 um long, 6-7.5 µm broad Apex 1.5-3 µm. In the centre 15-17.5 um long pore between the chloroplast. Chloroplast with 4-6 pyrenoids. Terminal vacuole with 3-5 granules.

Locality: Bakar lake. Distt. Sanghar.

Distribution: Cosmopolitan.

Pleurotaenium trabecula (Ehr) Nageli, Prescott et al. 1975:133;

Sarim, 1995:131

(P1. IV, Fig, 34)

Cells medium size, 14-16 times longer than broad, with 1-2 swellings in the midregion tapered to the apex which is truncate with rounded apex, wall punctate. Chloroplast with 3-4 lateral bands, with a scattered pyrenoids. Cells 360-450 µm long, 36-42 µm broad Apex 30-33 µm. Isthmus, 27-32 µm.

Locality: Typha pond near Bhitai Nagar, Distt. Hyderabad. 18-4-1996.

Distribution: U.S.A. Europe and Asia.

Pleurotaenuium ehrenbergii (Breb) De Bary var. ***ehrenbergii.***

Prescott *et al*, 1975:114; Sarim, 1995:129

(Pl. IV, Fig. 36-39)

Cells 14-18 times longer than broad, slightly constricted, with 2-3 swellings in the middle near the centre. Apex of semicell slightly tapered to rounded-truncate. Chloroplast longitudinal parietal bands with many pyrenoids. Cells 340-450 µm long and 30-35 µm broad. Apex 24-26 µm.

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Terminal vacule with many granules.

Locality: Jamshoro Colony S.U. Distt. Dadu. 10-2-1998.

Distribution: Cosmopolitan.

Pleurotaenium nodulosum (Breb) De Bary. Prescott *et al*, 1975:126;

Sarim, 1995:130

(P1. IV, Fig. 35)

Cells 11-14 times longer than broad, walls of semi cells undulating from moderate basal inflation to a tapering apical side. Apex smooth with rounded margin & 5-9 undulatio decreasing in size toword apex, cell wall punctate. Cells with 6-8 bands and chloroplast with many pyrenoids, 340-360 µm long, 30-36 µm broad. Isthmus 29.5.34 µm. Apex 29.5-32 µm.

Locality: Pond near Rajputana Hospital, Distt. Hyderabad. 2-4-1996.

Distribution: U.S.A., Europe, South America, and Asia.

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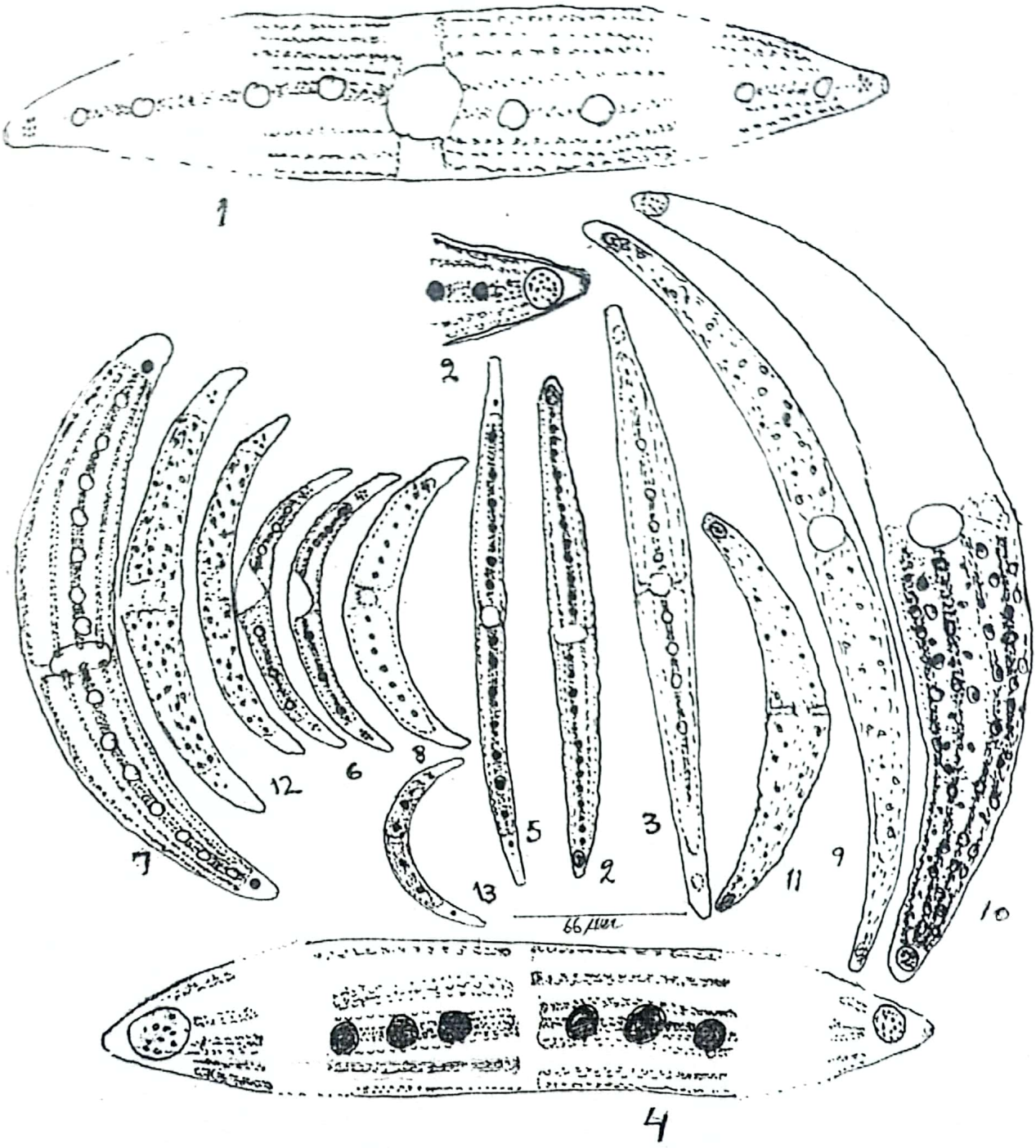


Plate I

Fig. 1. ***Closterium acerosum*** (Schrank) Ehr. var. ***acerosum***.
Fig. 2. ***Closterium acerosum*** (Schrank) Ehr. var. ***elongatum*** de Brebission.
Fig. 3. ***Closterium acerosum*** (Schrank) Ehr. var. ***minus*** Hantzsch.
Fig. 4. ***Closterium attenuatum*** Ehr.
Fig. 5. ***Closteruim Cornu*** Ehr.
Fig. 6. ***Closterium Calosporum*** var. brasiliense Borgesen.
Fig. 7. ***Closterium dianae*** Ehr. var. ***dianae***.
Fig. 8. ***Closterium dianae*** Ehr. var. ***brevius*** (witter) Pet Koff.
Fig. 9. ***Closterium ehrenbergii*** Meneghini.
Fig.10-11. ***Closterium ehrenbergii*** Meneghini var. ehrenbergii.
Fig. 12. ***Closterium ehrenbergii*** Ehr, var. ***atumidum*** Gronblad.
Fig. 13. ***Closterium*** cf. ***c. exile*** West and West.

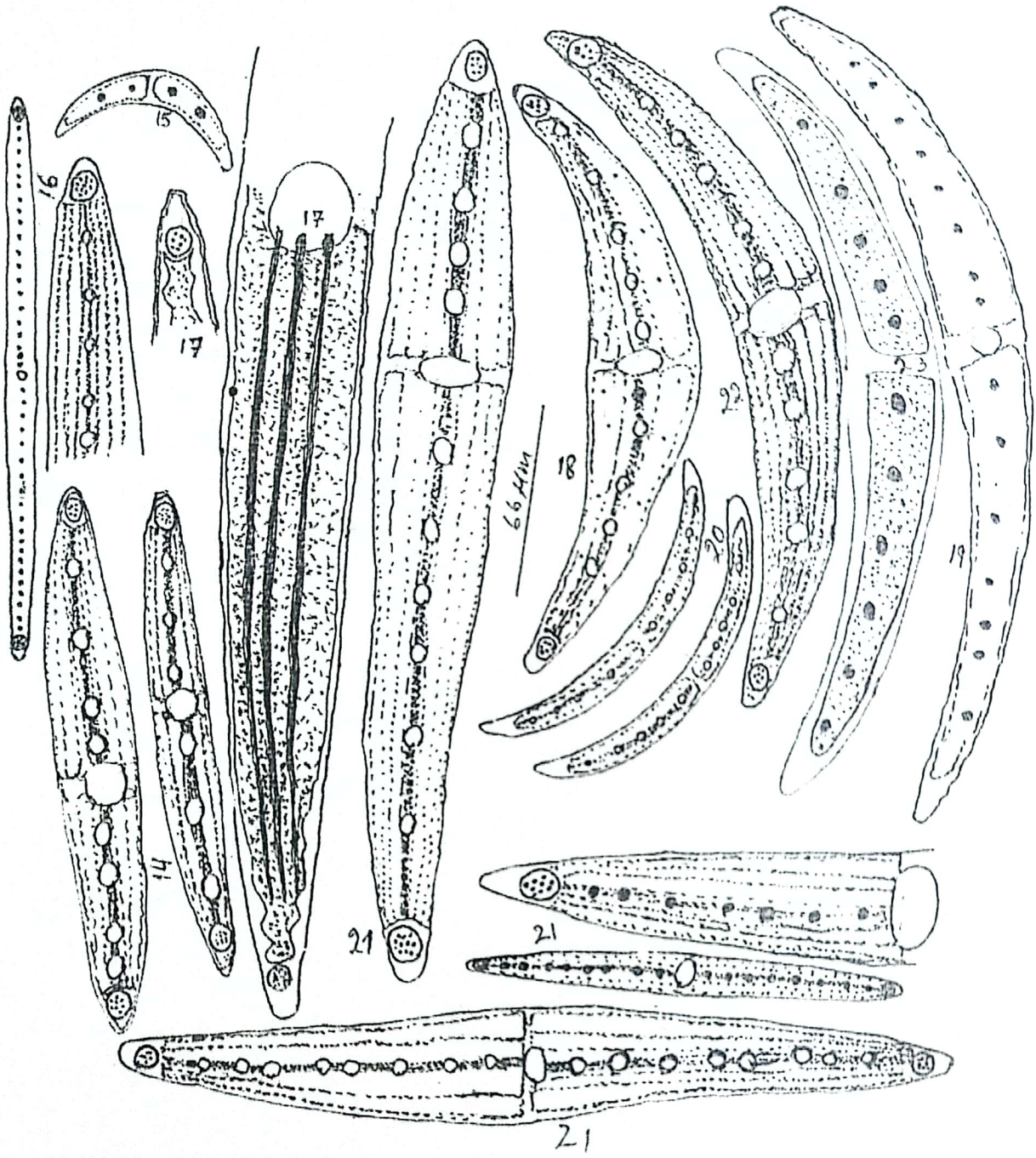


Plate II

Fig. 14. ***Closterium lanceolatum*** Kuetz.
Fig. 15. ***Closterium leibleinii*** Kuetz var. cf ***minimum*** Schmidle.
Fig. 16. ***Closterium lineatum*** (Ehr) var. ***lineatum.***
Fig. 17. ***Closterium lunula*** (Mull) Nitzsch var. ***lunula.***
Fig. 18. ***Closterium moniliferum*** (Bory) Ehr. var. ***moniliferum.***
Fig. 19. ***Closterium parvulum*** var. ***maius*** West & West.
Fig. 20. ***Closterium parvulum*** Neageli.
Fig. 21. ***Closterium pritchardianum*** (Archer) var. ***pritchardianum.***
Fig. 22. ***Closterium pseudolunula*** Broge var. ***pseudolunula.***
Fig. 23. ***Closterium cf. c. pulchellum*** West and West.

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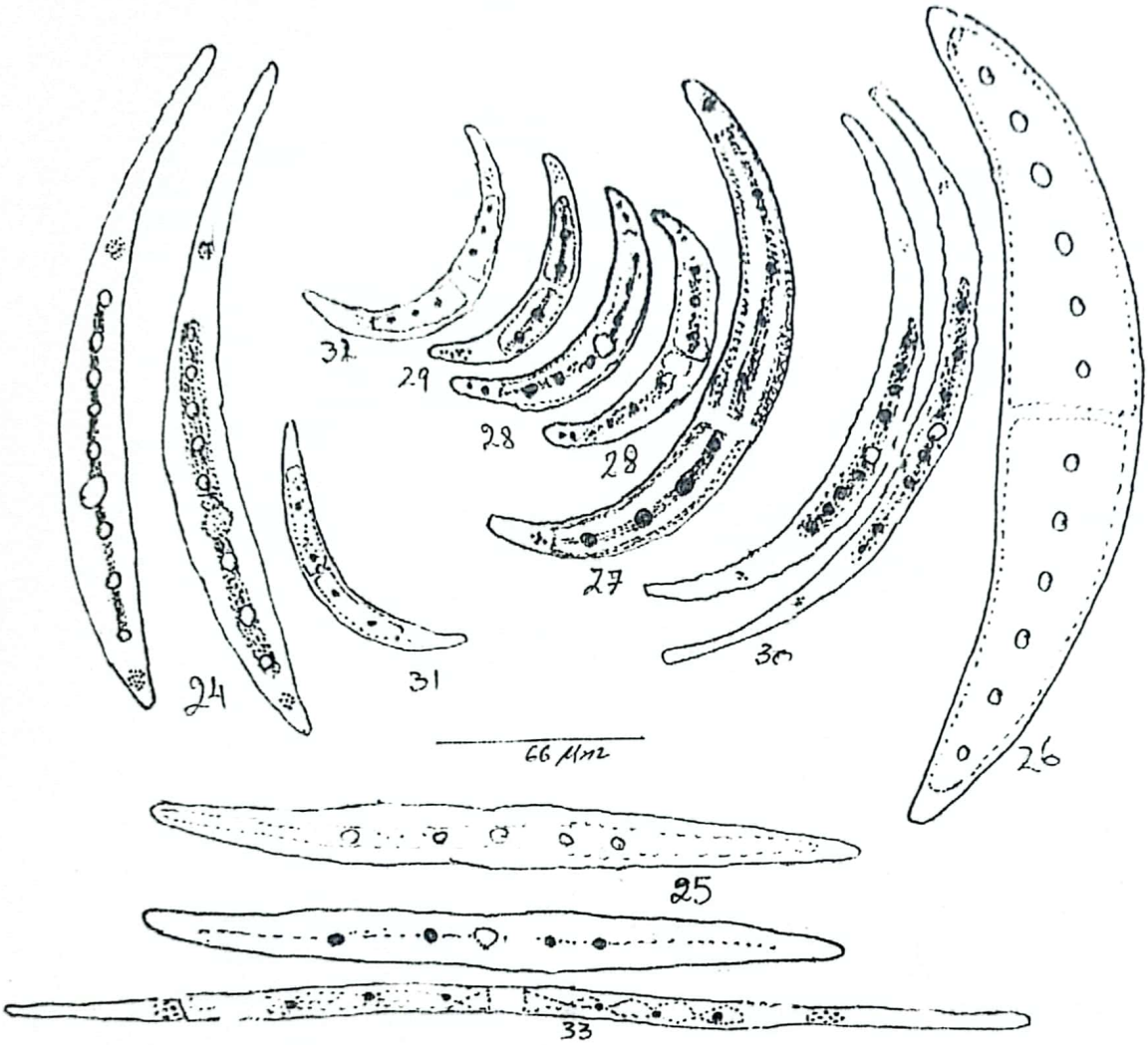


Plate III

Fig. 24. ***Closterium cf. c. rostratum*** Ehrenberg.
Fig. 25. ***Closterium subfuisforme*** Messikommer.
Fig. 26. ***Closterium spetsbergense*** Borge var. ***spetsbergense***.
Fig. 27. ***Closterium venus*** Kutzing var ***major*** Strom.
Fig. 28. ***Closterium venus*** Kutzing var. ***croasdale***.
Fig. 29. ***Closterium venus*** Kutzing var. ***crassum*** Croasdale.
Fig. 30. ***Closterium venus*** Kutzing var. ***apollonionis*** Croasdale.
Fig. 31. ***Closterium venus*** Kutzing var. ***venus f.major*** Strom.
Fig. 32. ***Closterium venus*** Kutzing var, ***westii*** (West) Kriger.
Fig. 33. ***Closterium gracele*** var. ***elgongatum*** West & West.

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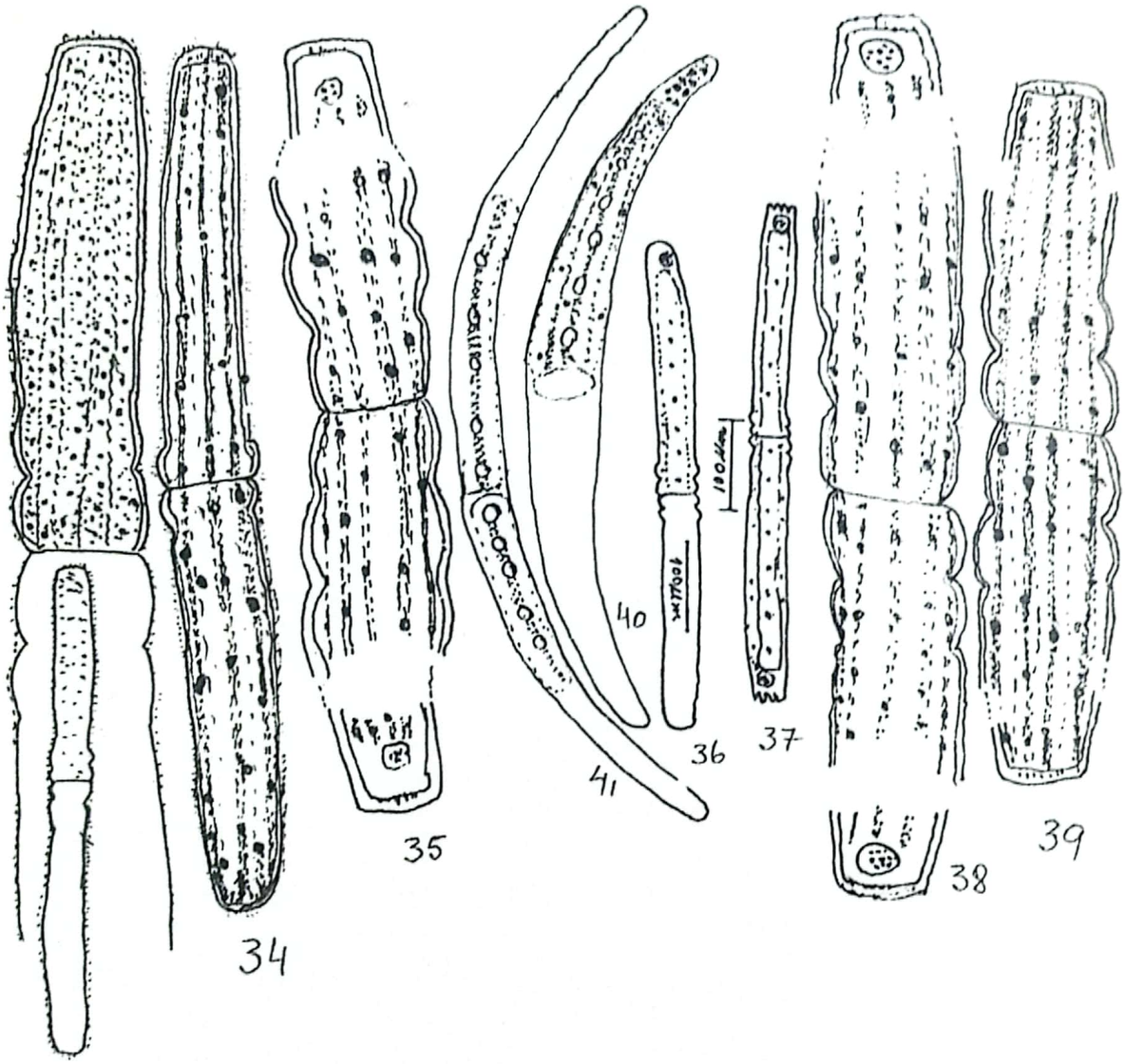


Plate IV

Fig. 34. ***Pleurotaenium trabecula*** (Ehr.) Nageli.
Fig. 35. ***Pleurotaenium nodulosum*** (Breb) De Bary.
Fig. 35-39. ***Pleurotaenium ehrenbergii*** (Breb) De Bary var. ***ehrenbergii.***
Fig. 40. ***Closterium leiblenii*** Kutzing.
Fig. 41. ***Closterium dianae*** Ehr. var. ***arcuatum*** (Breb) Raben.