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Fresh Water Algae of Sindh. V. The Desmids from the lakes and ponds of Sindh, Pakistan

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Abstract: In the present survey Fifty nine taxa of Desmids representing 34 species, 7 var. and 4 forms of *Cosmarium*, 5 sp. and 3 var. of *Euastrum*, 2 species of *Microsterias* and 1 specie each of *Arthrodesmus*, *Cosmocladium*, and *Staurastrum*, were recorded from Riverian ponds, Bakar and Kinjhar lakes of Sindh. In which *Cosmarium* sub *impressulum*, *C. regnelli*, *C. leave*, *C. impressulum*, *C. granatum*, *Euastrum bidentatum*, *E. dubium*, *E. spinolosum*, *Cosmocladium constrictum*, *Arthrodesmus convergens* and *Desmidium baileyi* are very common planktonic speices through out the year.

Key words: Fresh water, algae, desmids, lakes/ponds, Sindh

Introduction

The unicellular, colonial or filamentous desmids belonging to the order Zygnematales are exclusively fresh water algae. Their cells are composed of two halves interrupted by pores through which mucilaginous substances are secreted. The cell wall also consists of two layers, surrounded by a gelatinous sheath (Bold and Wynne, 1978).

In Pakistan Sarims and Faridi (1992), has made a study on the *Desmids*, *Euastrum*, *Staurodesmus* and *Micrasterias* from N.W.F. Province. Masud-ul-Hasan and Batool (1987) has described few species of *Desmids* of Punjab and Azad Jammu Kashmir. Hirano (1977) has also published his work on fresh water algae of Afghanistan in Plants of Pakistan and Afghanistan.

The present work is a further contribution to the fresh water algae specially *Desmids* from Sindh, Pakistan.

Materials and Methods

The algal samples were collected on monthly basis during 1994-98 with plankton Net # 25 μm . The samples were taken from the different places of fresh water bodies of Districts Badin, Dadu, Hyderabad, Sanghar and Thatta. Algal material was preserved in 3-4% Formaldehyde at the spot. Then the sample was washed with 2-3% Acetic acid in order to clear the algal material from organic matter, sand and silt particles. The samples were identified under the light microscope and compared with that of Sarims and Faridi (1992) and Hirano (1977).

The drawings were made with the help of Camera lucida at the magnification 8x X 40.

Results

Systematic account:

Genus *Cosmarium* Corda

Cosmarium arnelli Boldt (Pl.1, Fig. 1).

Cells 54-57.6 μm long, 43-44.8 μm broad, Isthmus 15.5-17 μm Cell wall granulated, chloroplast with pyrenoids.

Cosmarium bioculatum Breb. (Pl. 1, Fig. 2).

Patel *et al.* 1977:100.

Cells 17.5 broad, 20.8-24.5 μm long, wall coarsely punctate.

Habitat: Free floating rain water pool Jamshoro.

Cosmarium blyttii, Wille *var. novaesylvae* West and West. (Pl.1, Fig. 3).

Prasad and Mehrotra, 1977:346.

Cells 25-33 μm long, 24 μm broad, Isthmus. 5.5-6 μm .

Locality: Hussainabad Pond, Distt: Hyderabad.

Cosmarium blyttii Wille. (Pl. 1, Fig. 4).

Prasad and Mehrotra, 1977:346.

Cell 15-20 μm long, 16-22 μm broad. Isthmus 6-7.5 μm .

Locality: Rice field Jamshoro District Dadu 14.8.1996.

Habit. Free floating.

Cosmarium conspersum Ralfs *var. latum* (Breb.) West et G.S.

West. (Pl.1, Fig. 5).

Oleksowicz, 1984:246.

Cells 77-79 μm long, 57-74 μm broad.

Isthmus 20-22.5 μm .

Locality: Planktonic in River Indus pond at Jamshoro

Distt: Dadu.

Cosmarium constrictum Deplonte.(Pl.1, Fig. 6)

Tiffany and Britton, 1952:185.

Cells 27-31 μm long. 18-21 μm broad, broadly longer than wide, deeply constructed, sinus narrow toward the apex, chloroplast axil with one central pyrenoid.

Occurance: Rain water in river malir near Karachi 22.8.96.

Cosmarium constrictum var. ellipsoideum (Eflw) West

and West. (Pl.1, Fig. 7)

Krieger, 1937: 173.

Cells 35-42 μm long, 24.5-26 μm broad, Isthmus 6.5-7 μm .

Occurance: Planktonic in riverin ponds at Kotri Distt: Dadu, 13.2.98.

Cosmarium ctenoideum (Pl.1, Fig. 8).

Cells 27-32 μm long, 18-21.5m broad. Isthmus 4.5-6 μm .

cell wall punctate. Locality: River Indus water ponds, in the water foam near the Kotri Pond. 29.6.97.

Cosmarium cycelicum Lund. (Pl.1, Fig. 9)

Prasad and Mehrotra, 1977:346;

Cells 45-50 μm long, 46-51 μm broad. Isthmus 12.5-17 μm .

Locality: Rice field and also in Fresh water ponds of District Hyderabad in Planktonic form. This species is common in December.

Cosmarium decoratum West and West.(Pl.1, Fig. 10A)

Patel *et al.* 1977:100.

Cells 6.5-7 μm long, 45-50 μm broad. Isthmus 22.5-27 μm .

Locality; Planktonic Kinjhar Lake Distt: Thatta 4.12.97.

Cosmarium divergens, (Pl.1, Fig. 10B).

Krieger, 1937 : 175.

Cells 27-28.4 μm long, width 19.8-22 μm , Isthmus 6.6-7 μm .

Locality. Planktonic in Kinjhar lake, Distt. Thatta.

Distribution: cosmopolitan.

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- Cosmarium dorsitruncatum*** (Nordst) West. (Pl.1, Fig. 11).
Krieger, 1932:176 .
Cells 35-39 μm long, 40.5-45 μm broad, Isthmus 9-10 μm .
Locality: Planktonic in Chalgari Pond Distt: Hyderabad 15.2.98
- Cosmarium excavatum*** var. ***excavatum***. (Pl.1, Fig. 12).
Yamagishi, 1994.12:9.
Cells smaller in size, twice longer than broads, slightly constricted in the middle sinus is widely open, cell wall and margin with granules.
Cells 25-30 μm long, 12-15 μm broad, Isthmus 7-9.5 μm long.
Locality. Planktonic in Bakar Lake Distt: Sanghar .
- Cosmarium gibrellum*** Lutkem. (Pl.1, Fig. 13)
Cells 37-45 μm long, 28-30 μm broad, Isthmus 12 μm .
Semi cell flattened at the apex.
Locality: Free floating in Mancher Lake Distt: Dadu 10-2-96.
- Cosmarium granatum*** Brebisson ex Ralfs.(Pl.1, Fig. 14).
Gerrath and Lobban, 1991:180. Olekswiez, 1984:246.
Cells 42-47.5 μm long, 26.4 μm broad, Isthmus 9-9.9 μm .
Locality. Planktonic with other algae in Bakar lake District Sanghar and Kotri pond Distt: Dadu, November 1996 .
- Cosmarium impressulum*** Elfving.(Pl.1, Fig. 15).
Gerrath and Lobban, 1991:182, Patel and Satyanarayan 1976:57.
Cells 29-36.3 μm long, 22-23.1 μm broad, Isthmus 6-7.8 μm .
Locality: Planktonic in Kotri pond Distt: Dadu 20-12-1996.
- Cosmarium javanicum*** Nordst.(Pl.1, Fig. 16).
Krieger and Gerloff, 1969:88.
Cells 123-135 μm long, 69-75 μm broad, Isthmus 38-5 μm
Commonly occur in free floating Ponds at Jamshoro, Distt: Dadu.
- Cosmarium leave*** Rabenhorst. (Pl.1, Fig. 17)..
Patel and Satyanarayan, 1976:57; Agarkar, 1968:5.
Cells 36-42.5 μm long, 24-28 μm broad, Isthmus 6 μm .
Locality: Rain water in Malir river near Karachi 22-7-97.
Rice field near Hyderabad. Also growing with *Riccia* sp. beside the River Indus.
- Cosmarium leave*** Rabenhorst f. ***mayus*** Borge. (Pl.1, Fig. 18).
Tadashi Bando *et al.* 1989:16.
Cells small and longer than broad with deeply constricted. Wall delicately, punctate, chloroplast axil with central pyrenoid. Cells 50-55 μm long, 36-42 μm broad. Isthmus 7.5-12 μm
Locality: Hussainabad Pond Distt: Hyderabad. 24-5-1997 .
- Cosmarium lundellii*** Delponte var. ***ellipticum*** West and West. (Pl.1, Fig. 19).
Patel *et al.* 1977:101.
Cells 55-60 μm long, 45-50 μm broad, Isthmus 14-15 μm .
Wall punctate Locality: Planktonic in Hussainabad Pond Distt: Hyderabad, 26-5-1995.
- Cosmarium maculatiforme*** Shm. (Pl.1, Fig. 20).
Islam, 1970:924.
Cells 112-125 μm long; 59.5-65 μm broad, Isthmus 38-41.5.
Locality: Riverin Pond Hussainabad Hyderabad.
- Cosmarium mamilliferum*** Nordst. (Pl.1, Fig. 21).
Prasad and Mehrotra, 1977:347.
Cells 33 μm long, 27.5 μm broad. Isthmus 6.5-7 μm .
Locality: Khairpur Saline pond 20-6-1996 .
- Cosmarium margaritatum*** (Lund) Roy et Biss. var. ***quadrum***. (Pl.1, Fig. 22).
Krieger, 1932:179.
Cells 74.8 μm long, 51.8-56 μm broad. Isthmus 23.5 μm .
Locality. Plankton in River Indus water at Kotri 29-11-97.
- Cosmarium microsplinctum*** Nordst. (Pl.1, Fig. 23).
Islam *et al.* 1980:576.
Cells 84-92.4 μm long, 36-45 μm broad, Isthmus 12-14.4 μm body minutly warted.
Locality: Bakar Lake District Sanghar 19-8-1997
- Cosmarium moniliforme*** f. ***panduriformis*** Heimel. (Pl.1, Fig. 24).
Krieger, 1937:180.
Cells 36-42 μm long, 21-22 μm broad. Isthmus 13.2-14 μm .
Locality: Kotri pond Distt: Dadu, 20-12-1997.
- Cosmarium norimbergense*** f. ***depressa*** West and West, (Pl.1, Fig. 25).
Agarkar, 1968:5.
Cells 15-19.5 μm long, 12-15.5 μm broad. Isthmus 5.5-6.9 μm .
Locality. Bakar lake Distt: Sanghar, 8-6-97.
- Cosmarium pseudopyramidatum*** Lund. (Pl.1, Fig. 26)
Prasad and Mehrotra, 1977:349.
Cells 40-45 μm long, 42 μm broad. Isthmus 9.5-11.5 μm .
Locality: Rice field Jamshoro Distt: Dadu 14-8-1996.
- Cosmarium quadrum*** Lund. (Pl.II, Fig. 27).
Patel *et al.* 1977:101.
Cells 46-50 μm broad, 47-55 μm long. Isthms 15-17.5 μm . Cells as long as broad, or broader than long, densely granulated.
Locality: Plankton in Phulal and Bakar Lake Distt: Sanghar.
- Cosmarium quinarium*** Lundell, (Pl.II, Fig. 28).
Agarkar, 1968:3.
Cells 36-39 μm long, 30-35 μm broad, Isth. 8-12 . Cell wall wavy in outline. Locality: Commonly occur in Lakhra thermal power water effluent Distt: Dadu..
- Cosmarium regnelli*** Wille. (Pl.II, Fig. 29).
Islam, 1982:254.
Cells 33-35 μm long, 21 μm broad. Isthmus 4.5-5 μm .
Localaity: Plankton in Phulel lake Distt: Sanghar. 7-10-97.
- Cosmarium regnellii*** Wille f. ***minus*** Boldt. (Pl.II, Fig. 30).
Krieger and Gerloff, 1969, 43:6.
Cells 15-18 μm long, 9-12.5 μm in broad. Isthmus 2-2.5 μm .
Habit: free floating in thermal power effluent Distt: Dadu.
- Cosmarium regnellii*** Wille var. ***chondrophorum*** Skuja. (Pl.II, Fig. 31)
Suxena and Venkateswarlu, 1968:179.
Cells 18-21 μm long, 15-16.5 μm broad. Isthmus 5-6.5 μm .
Locality: plankton Rivirne ponds Jamshoro Distt: Dadu and also in Ponds near Thatta. This is very common species .
- Cosmarium rectangulum*** Reinsch (Nordst.). (Pl.II, Fig. 32)

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- Forest, 1954:229.
Cells slightly longer than broad with rectangular shape. Cells 24-28 μm long, 17.5-23 μm broad. Isthmus 7-9.5.
Locality: Free floating in Bakar Lake Distt: Sanghar, 1-5-1996 and Khadajifall, near Thano Bola Khan. .
- Cosmarium reniforme** (Ralfs) Arch. (Pl.II, Fig. 33)
Suxena and Venkateswarlu, 1968:179.
Cells 46-48 μm long, 40-44 μm broad. Isthmus 9-12 μm .
Locality: Plankton in Kinjhar Lake Distt: Thatta 19-8-1997..
- Cosmarium trilobulatum** Reinsch. (Pl.II, Fig. 34)
Agarkar, 1968:5
Cells 15-17.5 μm long, 13-15 μm broad. Isthmus 3-4.9 μm .
Locality: Hussainabad pond Distt: Hyderabad,13-4-1997.
- Cosmarium subcostatum** Nordst fa. (Pl.II, Fig. 35).
Islam, 1982:254.
Cells 35-40 μm long, 30-33 μm broad. Isthmus 7-9 μm .
Locality: Saline Lake Karo gangharo Distt: Badin.
- Cosmarium subimpresulum** Borge. (Pl.II, Fig. 36)
Suxena and Venkateswarlu, 1968:180.
Cells 36-42 μm long, 27-30 μm broad. Isthmus 7-9 μm .
Locality: Rivirian pond at Jamshoro . June 1997 .
- Cosmarium sexangulare** Lund. (Pl.II, Fig. 37).
Kriegar, 1932:185.
Cells 30-34 μm long 22-26 μm broad. . Isthmus 4.5-6 μm .
Locality: Fresh water pond near Jamshoro, Distt: Hyderabad. 23-9-1994.
- Cosmarium vexatum** W.West. (Pl.II, Fig. 38).
Islam, 1982:254.
Cells 66-70 μm long, 49-56 μm broad. Isthmus 17-21 μm .
Locality: Seri District Hyderabad and Bakar lake Distt: Sanghar
- Genus Euastrum** Ehrenberg ex-Ralfs
Euastrum bidentatum Nageli. (Pl.II, Fig. 39).
Oleksowicz, 1984:246.
Cells 59-63.5 μm long, 39.5-50.5 μm broad. Isthmus 17.5-22.5, apex 24.3-25 μm .
Habit: Free floating Jamshoro colony pond. Distt: Dadu.
- Euastrum dubium** Nag. (Pl.II, Fig. 40).
Prasad and Mehrotra, 1977:344.
Cells 42-46.1 μm long, 36.3-39.6 μm broad. Isthmus 5-6.6 μm .
Locality: Planktonic in Kotri pond March 1995. This form is longer and broader as recorded by West and West (1905).
- Euastrum insular** (Wittr) Roy. (Pl.II, Fig. 41)
Prescott *et al.* 1975:72.; Suxena and Venkateswarlu, 1968:171.
Cells 33-34.5 μm long, 23-24.5 μm broad, Isthmus 6-6.6 μm .
Locality: Kinjhar lake Distt: Thatta 4-12-1996. Habit. Free floating. Distribution: cosmopolitan
- Euastrum sinuosum** Lenorm.(Pl.II, Fig. 42).
Islam, 1980:566.
Cells 47-52.8 μm long. 28.8-31.5 μm broad. Isthmus 6.8 μm . Cells with granulation.
Locality. Hussainabad pond Distt: Hyderabad and Khadheji fall near Thano Bola Khan Distt: Dadu .
- Euastrum subincisum** Reinsch forma.(Pl.II, Fig. 43).
Krieger, 1932:215.
Cells 20-23.5 μm long, 16.5-18 μm broad. Isthmus 6.5-8.
Locality: Chilia fish hatchery Distt: Thatta, 21-12-1996 .
- Euastrum sphyroides** var. **intermedium** Luetkm. (Pl.II, Fig. 44).
Agarkar, 1968:5.
Cells 51 μm long; 36 μm broad. Isthmus 6-7 μm , cell wall punctates on the side. Locality: Bakar lake Distt: Sanghar.
- Euastrum spinulosum** Delponate var. **spinulosum**. (Pl.II, Fig. 45).
Prescott *et al.* 1975:107
Cells 65-80 μm long, width 60-70 μm . Isthmus 15-17.5 μm , spine conical rounded at the base.
Locality: Nai Malir rain water 22.8.1996. Habit. Planktonic. Distribution: Cosmopolitan.
- Euastrum spinulosum** Delponate var. **inermius** Nordtsedt.(Pl.II, Fig. 46).
Gerrath and Lobban, 1991:186.
Cells 66-70 μm long, 55-60 μm in broad. Isthmus 12.5-16.5 μm .
Locality: Planktonic in Kinjhar lake Distt: Thatta. 4-12-1996. Distribution: Cosmopolitan .
- Genus: Micrasterias** Agardh
Micrasterias crux-melitensis (Ehrenb) Ralfs var. **superflua** (Turn) Croasdale.
(Pl.II, Fig. 47)
Prescott *et al.*, 1975:151.
Cells with upper lateral lobules tridentate and the extension of the polar lobe bearing curved teeth . Cells 129-145 μm long, 131-135 μm wide. Isthmus 17.5-20 μm .
Locality: Ring dam of river Indus 19.7.1997. Distribution: Cosmopolitan.
- Micrasterias Pinnatifida** (Kuetz) Ralfs var. **Pinnatifida**.(Pl.II, Fig. 48)
Prescott *et al.* 1975:173. Patel *et al.* 1977:103.
Cells broader than longer deeply constricted, lateral lobes single undivided, conical, extend just before the bifid, polar lobe widely horizontally spreading, its apex flat, slightly convex. Bifid at the end of the branches. Chloroplast with few pyrenoids. Cells 72-80 μm long, 55-85 μm wide, at the apex 55-60 μm . Isthmus 9-12 μm .
Locality: Ring dam of River Indus 19-7-97. Distribution: Cosmopolitan.
- Genus: Cosmocladium** Breb
Cosmocladium constrictum Arch. (Pl.II, Fig. 49).
Sarim and Faridi, 1988:18.
Cells longer than broad, 16.5-20 μm long, 9.5-12 μm broad, isthmus 7.8-9 μm , sub cylindrical, with slightly constriction at the middle. Chloroplast axile, one in each cell, with central pyrenoid. Cells united by gelatinous filaments to form branched colonies with irregular shape. Cells arranged distinctly at intervals also at the end of the strands.
Locality: Plankton in Bakar lake Distt: Sanghar.
Distribution. Canada, Europe, Japan, Pakistan and U.S.A. .

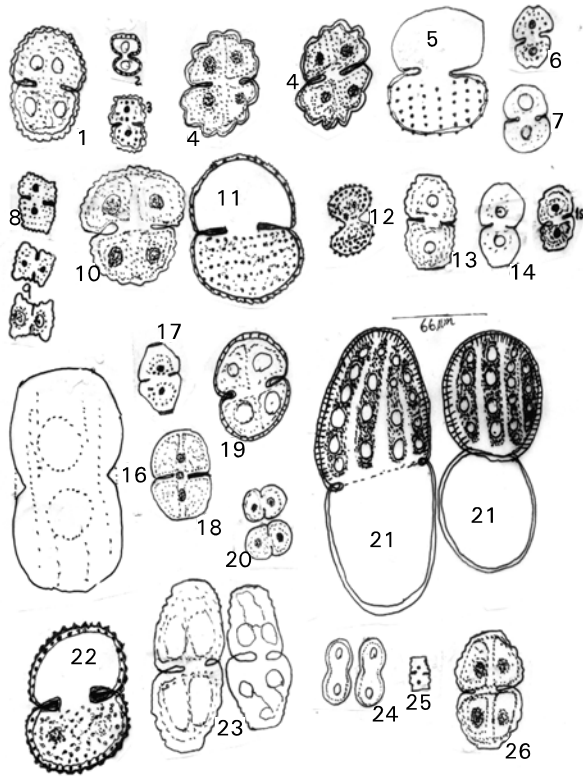


PLATE -2

- Fig. 1 *Cosmarium arnelli* Boldt
- Fig. 2 *C. bioculatum* Breb
- Fig. 3 *C. blyttii* Wille var. *novaesylvae* West and West
- Fig. 4 *C. blyttii* Wille
- Fig. 5 *C. conspersum* Raf var. *latum* (Breb) West and West
- Fig. 6 *C. constrictum* Deplonte
- Fig. 7 *C. contractin* var. *ellipsoideum* West and West.
- Fig. 8 *C. ctenoideum*
- Fig. 9 *C. cyclericum* Lund
- Fig. 10A *C. decoratum* West and West
- Fig. 10B *C. divergens* Krieger
- Fig. 11 *C. dorsitruncatum* (Nordst) West
- Fig. 12 *C. excavatum* var. *excavatum*
- Fig. 13 *C. gibrellum* Lutkem
- Fig. 14 *C. granatum* Bre'bission ex Ralfs
- Fig. 15 *C. impressulum* Elfving
- Fig. 16 *C. Javanicum* Nordst
- Fig. 17 *C. leave* Rabenhorst
- Fig. 18 *C. leave* Rab. f. *mayus* Borge
- Fig. 19 *C. lundellii* Delponate var. *ellipticum* West and West
- Fig. 20 *C. maculatiforme* Shm.
- Fig. 21 *C. mamilliferum* Nordst
- Fig. 22 *C. margaritatum* (Lund) Roy and Biss var. *quadrum*
- Fig. 23 *C. microsplinctum* Nordst
- Fig. 24 *C. monilliforme* f. *panduriformis* Heimel
- Fig. 25 *C. norimbergense* f. *depressa* West and West.
- Fig. 26 *C. pseudopyramidatum* Lund

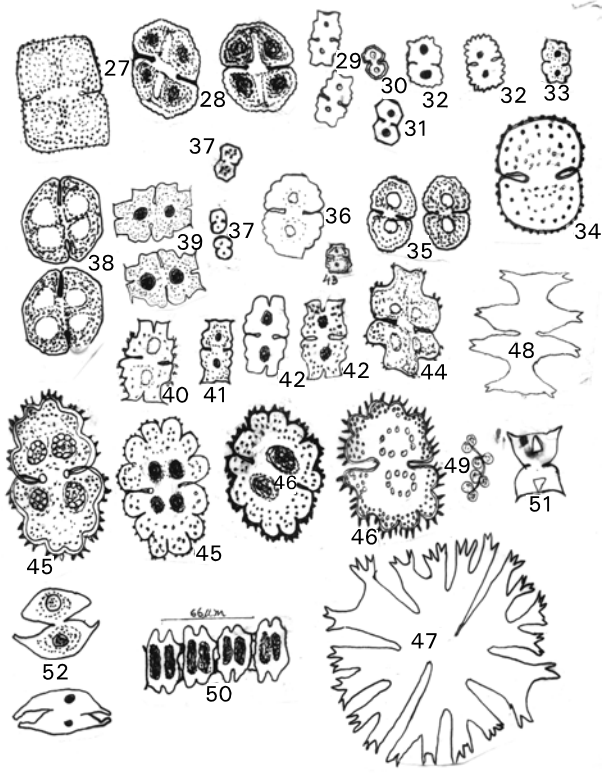


PLATE -2

- Fig. 27 *C. quadrum* Lund
- Fig. 28 *C. quinarium* Lundell
- Fig. 29 *C. regnelli* Wille
- Fig. 30 *C. regnelli* Wille f. *minus* Boldt
- Fig. 31 *C. regnelli* Wille var. *chondrophorum* Skuja
- Fig. 32 *C. rectangulum* Reinsch (Nordst) Silva
- Fig. 33 *C. reniforme* (Ralfs) Arch
- Fig. 34 *C. trilobulatum* Reinsch
- Fig. 35 *C. subcostatum* Nordst
- Fig. 36 *C. subimpressulum* Borge
- Fig. 37 *C. sexangulare* Lund
- Fig. 38 *C. vexatum* W.West
- Fig. 39 *Euastrum bidentatum* Nageli
- Fig. 40 *E. dubium* Nageli
- Fig. 41 *E. insular* (Wittr) Roy
- Fig. 42 *E. sinuosum* Lenorm
- Fig. 43 *E. subincisum* Reinsch forma
- Fig. 44 *Euastrum sphyroides* var. *intermedium* Luetkm
- Fig. 45 *E. spinulosum* Delponte var. *spinulosum*
- Fig. 46 *E. spinulosum* Delponte var. *inermius* Nordst
- Fig. 47 *Micrasterias crux-melitensis* (Ehr.) Ralfs var. *superflua* (Turn) Croasdale.
- Fig. 48 *Micrasterias pinnatifida* (Kuetz) Ralfs. var. *pinnatifida*
- Fig. 49 *Cosmocladium constrictum* Arch
- Fig. 50 *Desmidium baileyi* (Ralfs) Nord. var. *baileyi* f. *tetragonium* Nordst
- Fig. 51 *Staurostrum connatum* (Lund) Roy et al Besset var. *connatum*
- Fig. 52 *Arthrodesmus convergens* Ehrenberg

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enus: *Desmidium* Agardh

Desmidium baileyi (Ralfs) Nordst. var. *baileyi* f.. *tetragonium* Nordst.

(Pl.II, Fig. 50).

Scott and Prescott, 1961:24; Islam, 1982:256.

Cells 20-21.5 μm long, 28-33 μm broad.

Occurance: Free floating and also attached with grasses, in phulel Distt: Sanghar (Bakar).

Genus: *Staurastrum* Meyen

Staurastrum connatum Lund. Roy *et al* Besset var. *connatum*. (Pl. I, Fig. 51)

Patel *et al.* 1977:102.

Cells 18-21 μm long, 16.5-20 μm broad without out spines. 24-26 μm long with spines.

Locality: Plankton in Bakar Lake Distt: Sanghar..

Genus: *Arthrodesmus* Ehrenberg

Arthrodesmus convergens Ehrb. (Pl.II, Fig. 52).

Bharati and Pai, 1972:33.

Cells 43-45.5 μm , 43-44.5 μm broad. Isthmus, 6.5-7 μm .

Occurance: This species occur as planktonic in Riverian Pond Hussainabad Distt: Hyderabad and also in Bakar Lake Distt: Sanghar.

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