

Desmid diversity for Northern Goa, India

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ABSTRACT

The present paper deals with the diversity of desmids from freshwater habitats of Goa. Desmids (Chlorophyta - Zygnematales) are the unicellular organisms which form important floristic component in the assessment of water quality. Random collection from diverse freshwater habitats has resulted in the discovery of 10 genera with 38 species. The present paper deals with the morpho-taxonomic account of desmids of Northern Goa, India.

Introduction

Freshwater makes up only 0.01% of world's water and supports around 100,000 species, that is, 6% of all described species (Dudgeon, *et al.* 2006). Freshwater biodiversity is a valuable natural resource. Algae form a dominant component of the aquatic vegetation. Although, Goa is blessed with variety of freshwater habitats, the freshwater algae from Goa have been overlooked from the documentation point of view. Gaunker and Kerkar (2004), Shetiya and Kerkar (2004), Kanolkar and Kerkar (2009) are the only reports available for freshwater green algae of Goa which are in the enlisted form.

In order to study the freshwater algae from distribution, diversity and taxonomic point of view the important component of microalgae "desmid" is chosen for the present study. Desmids occur exclusively in the freshwater habitats and belong to Chlorophyta (Order Zygnematales). Members of family Mesotaeniaceae are known as Saccoderm desmids and desmids belonging to family Desmidiaceae are known as Placcoderm desmids (Bold and Wynne, 1978). Desmids grow only in oligo- and mesotrophic waters hence are considered as the

quality (Ngearnpat and Peerapornpisal, 2007).

Desmids have been reported from various parts of the world. West and West (1902) reported 279 desmids from Ceylon and 148 desmid taxa from

Burma (Myanmar), West Bengal and Bangladesh and Madras presidency (Tamil Nadu) (West and West, 1907). Besides these Kreiger (1932), Hirano (1960; 1967; 1992), Scott and Preseott (1961) and Kanestsuna (2002) contributed on the distribution of tropical desmids in the Asian region.

Altogether 20 genera with 262 species of have been reported from India (Iyengar and Vimala Bai 1941; Patel and Ashok-Kumar, 1979; Prasad and Misra, 1982; Bordoloi, 1983; Hegde, 1984; 1986; Bongale, 1986; 1987; Issacs and Hegde, 1988a; b; Ashok-Kumar and Patel, 1988; 1990a; b; Habib and Pandey, 1990; Pal and Santra, 1993; Mishra and Srivastava, 2003; Perumal and Anand, 2008; Stanley and Baluswami, 2009).

Goa state is located between 14° 53' 54" to 15° 48' 00" N latitudes and 73° 40' 00" to 74° 20' 00" E longitudes with an area of 3,702 sq.Km (the area of North Goa district is 1736 sq.Km) and possesses various freshwater habitats such as ponds, puddles, springs, lakes, reservoirs, paddy fields, canals, etc. Altogether 24 places belonging to six different talukas of North Goa were surveyed (Fig. 1). The list of the localities surveyed is given in Table 1.

Materials and Methods

fixed in Lugol's iodine and allowed to settle. Supernatant was discarded by siphoning through 25 μ mesh and the pellet was retained in vials for microscopic observations. The specimens were

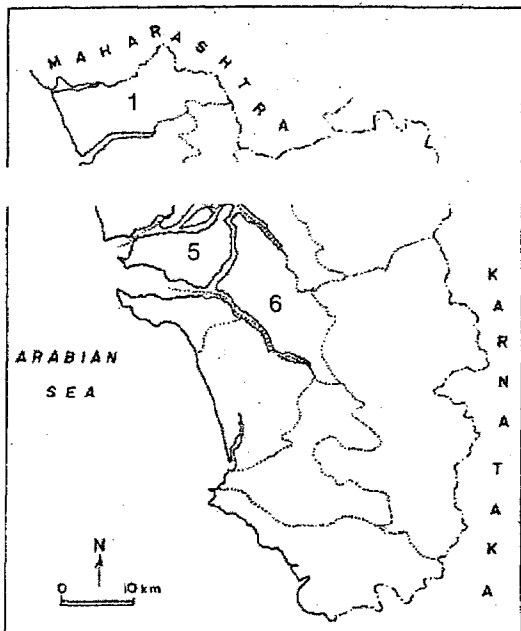


Fig. 1. Map showing the Study area - 1) Pernem; 2) Bardez; 3) Bicholim; 4) Sattari; 5) Tiswadi; 6) Ponda

Table 1. List of places surveyed for the present study

No.	Taluka	Places
1.	Sattari	Harwalle, Anjunem, Carambolim
2.	Bicholim	Narvem, Nannoda, Mayem
3.	Bardez	Ameshim, Koneshim, Pomurpa, Assonora
4.	Tiswadi	Bondval, Baiginnim, Panaji
5.	Pernem	Shri Mulvir Temple, Sukekulnan (Dhargal), Arambol, Pernem, Valpem, Khetrar (Tuvem), Korgao
6.	Ponda	Shri Kamakshi Temple, Shri Nagueshi Temple, Shri Mangueshi Temple, Nirancal, Panchawadi

observed under a compound microscope. Algae were identified using standard monographs and related research articles (Prasad and Misra, 1992; West and West, 1902; 1904; 1905; 1908; 1912; 1923). Photomicrographs of the algae were taken using an Olympus DP12 digital camera. The samples were labeled and deposited at Botany Department, Goa University.

Result and Discussion

The present survey undertaken along six talukas of North Goa has resulted in the discovery of 10 genera with 38 species of desmids.

Representation of the taxa is as follows: *Cosmarium* (10), *Closterium* (9), *Micrasterias* (5), *Staurastrum* (5), *Euastrum* (4), *Netrium* (1), *Desmidium* (1), *Pleurotaenium* (1), *Arthodesmus* (1), and *Triploceros* (1). The photo micrographs of the

represented taxa for each species is given below

Family: Mesotaeniaceae

Netrium digitus (Ehrenb.) Itzigsh. & Rothe. (Pl-2, m)

West, W and West, G.S. 1904, Vol. 1, p.99 pl. 6, figs. 14-16

Iyengar and Vimala Bai, 1941, p. 74, figs. 5, 6

Cells of medium size, 2-3 times longer than broad, not constricted, oblong-elliptic, margins convex, gradually attenuated towards apices; cell wall smooth; chloroplast with longitudinal plates and deeply serrated margins. Cell 160-180µm long and 45-60µm broad.

Family: Desmidiaceae

Arthodesmus curvatus Turner (Pl-1, k)

Prasad and Misra, 1992, p.199, Pl.25, fig. 3

Cells of medium size, about 1.4-1.5 times longer than broad (excluding spines), median constriction deep, sinus opening widely outwards; semicells more or less transversely elliptic, apical margin slightly more convex than basal, lateral angles rounded and furnished with rather stout and slightly incurved spine; cell wall smooth; chloroplast axile with 1-2 pyrenoids in each semicell. Cell 34-38.5µm broad and 46-53 µm long.

✓ *Closterium croasdale* Nurul Islam (Pl-2, r)

Prasad and Misra, 1992, p.103, Pl.17, fig. 7

Cells 4-6 times longer than broad, outer margin sharply curved, inner margin concave but slightly tumid in middle, apices slightly re-curved with rounded ends, cell wall smooth with a median girdle, chloroplast with ridges, containing numerous scattered pyrenoids, cells 98 µm long and 20 µm broad.

✓ *Closterium cynthia* De Not. (Pl-2, l)

West, W and West, G.S. 1904, Vol. 1, p.113 pl. 9, figs. 1-3

Cells rather small and stout, strongly curved, outer margin 125-130 degrees of arc, inner margin parallel to outer near apices but more or less straight

in the middle, cell gradually attenuated towards obtusely rounded apices, cell wall finely striate, chloroplast with 6, pyrenoids, cell 94-97.5 μm long and 13-15 μm broad

West, W and West, G.S. 1904, Vol. 1, p.184, pl.17, figs. 7-8

Cells fairly large, moderately curved, median portion somewhat straight and cell gradually attenuated towards the rounded apices; chloroplast ridged with axial row of 10-14 pyrenoids, cells 780-800 μm long and 25-30 μm broad.

✓ *Closterium diana* Ehrenb. (Pl-2, k)

West, W and West, G.S. 1904, Vol. 1, p.130, pl. 15, figs. 1-6

Iyengar and Vimala Bai, 1941. p. 77, figs. 9, 4, 15

Cells of medium size, 9-10 times longer than broad, outer margin strongly curved with 112-125 degrees of arc, inner slightly tumid, all gradually attenuated towards obtusely rounded apex, cell wall smooth chloroplast ridge with 6-8 pyrenoids, cell 262-280 μm long and 26-34.5 μm broad.

✓ *Closterium kuetzingii* Breb. (Pl-2, o)

West, W and West, G.S. 1904, Vol. 1, p. 186, pl. 25, figs. 6-11

Iyengar and Vimala Bai, 1941. p. 77, figs. 16-19

Cells of medium size, 21-22 times longer than broad, almost straight, medium part lanceolate with convex margins, cell tapering towards each extremity and ending in long setaceous processes with parallel sides and rounded apices, cell wall longitudinally striated, striate delicate, chloroplast with 4-5 pyrenoids, arranged in a row, cell 428.5-439 μm long and 21-22.5 μm broad.

✓ *Closterium prichardianum* Arch. (Pl-2, p)

West, W and West, G.S. 1904, Vol. 1, p. 172, pl. 23, figs. 6-14

Cells of median size or large, faintly curved to more or less straight, longer than broad, outer margin sharply curved, inner margin concave, cells gradually attenuated to narrow, truncate and faintly re-curved apices; cell wall striated, striations composed of fine punctate; chloroplast with 5-7 ridges, containing 6-8 pyrenoids arranged in a row. Cells 285-760 μm long and 38.5-51 μm broad.

✓ *Closterium recurvum* Prescott, G. W. (Pl-2, i)

Prasad and Misra, 1992, p.118, Pl.17, fig.6

Cells of medium size, strongly curved, outer

curved and not tumid in the middle gradually attenuated to faintly recurved and rounded apices, cell wall smooth, chloroplast with 7-8 scattered pyrenoids, cell 267 μm long and 32.5 μm broad.

✓ *Closterium rectimarginatum* Scott et Prescott (Pl-2, n)

Prasad and Misra. 1992, p.116, pl.15, fig. 16.

Cells large, 12-13 times longer than broad, spindle-shaped, lateral margins almost straight and converging from centre to narrowly rounded apices; cell wall smooth; Chloroplast with 6-7 ridges containing 14-16 large pyrenoids, cells 600-620 μm long and 35-40 μm broad.

✓ *Closterium sigmoideum* Lagerh. et Nordst. (Pl-2, j)

West, W and West, G.S. 1904, Vol. 1, p. 153, pl. 19, figs. 1-2

Cells of medium size about seven times longer than broad, faintly sigmoid, middle portion more or less straight and gradually attenuated towards moderately recurved and absolutely rounded apices; cell wall smooth; chloroplast with ridges and 7-8 pyrenoids arranged in median row, cells 215-225 μm long and 30-35 μm broad.

✓ *Cosmarium auriculatum* Racib. (Pl-1, q)

Prasad and Misra, 1992, p. 153, Pl. 22, fig. 14

Cells small, a little broader than long, constriction prominent, isthmus narrow and linearly open; semicells angularly ovoid with sharp angles, apex straight or slightly retuse; cell with minute and faint punctuations. Cell 23-27.5 μm long, isthmus 5-7.5 μm .

✓ *Cosmarium circulare* Reinsch (Pl-2, c)

Prasad and Misra, 1992, p.156, Pl.22, fig. 8

Semi cells more or less semicircular, sinus narrowly linear; cell wall distinctly punctate; chloroplast axile with ridges and two pyrenoids in each semicell. Cell 70.5 μm long and 59 μm broad.

✓ *Cosmarium decoratum* W. et G.S. West. (Pl-1, m)

Prasad and Misra, 1992, p. 158, Pl.24, fig. 9

Cells of medium size, slightly longer than broad, deeply constricted, sinus narrowly linear; semicells semi-elliptic, apex flattened truncate with

rounded angles, margin deeply crenate, crenations emarginated, 24-26 in number, margin followed by 4-5 concentric series of large granules, triangular pits surround granules in irregular fashion in the centre; semicell exhibit 2 chloroplast, each containing one pyrenoid. Cell 71 μm long and 52.5 μm broad.

✓ *Cosmarium lundellii* Delp. (Pl-1, n)

West, W and West, G.S. 1905, Vol. 2 p. 138, pl. 57, figs. 1-2

Cells of medium size, a little longer than broad, deeply constricted, sinus linear and open; semicells sub-semicircular, basal angles rounded; cell wall coarsely punctuate, cell 62.5-71 μm long and 51-56 μm broad.

✓ *Cosmarium obsoletum* (Hantzsch) Reinsch. (Pl-1, l)

West, W and West, G.S. 1905, Vol. 2, p. 133, pl. 56, figs. 1-3

Iyengar and Vimala Bai, 1941. p. 85, figs. 28, 29

Cells of medium size, transversely elliptic, almost as long as broad, deeply constricted, sinus narrow with dilated apex and slightly open outwards; semicells semicircular, basal portion slightly thickened, apex some what flattened; cell wall punctate; chloroplast axile with two pyrenoids, cell 48-55 μm long and 45-53.5 μm broad.

✓ *Cosmarium portianum* Arc. var. *nephroideum* Witter. (Pl-2, b)

West, W and West, G.S. 1908, Vol. 3, p. 167, pl. 80, figs. 1-3

Cells small, longer than broad, deeply constricted, sinus gradually opening from a rounded extremity, isthmus slightly elongated; semicells sub-reniform and granulate, granules rounded and evenly disposed in indistinct vertical series, about 24-29 visible at margin of each semicell; each semicell with an axile chloroplast and a pyrenoid. Cell 21-24.5 μm long and 16.5-19 μm broad.

✓ *Cosmarium pseudobroomei* Wolle (Pl-1, o)

West, W and West, G.S. 1912, Vol. 4, p. 22, pl. 100, figs. 7-8

constricted, sinus narrow with slightly dilated extremity; semicells sub-rectangular with angles, sides parallel, cell wall with granules, axile chloroplast and with 2 pyrenoids, cell 35-40 μm long and 35-40 μm broad.

✓ *Cosmarium pseudoconnatum* Nordst. (Pl-2, a)

West, W and West, G.S. 1908, Vol. 3, p. 26, pl. 67, figs. 19-21

Cells of medium size, slightly constricted sinus broad and shallow; semicells elliptic with circular outline; cell wall finely punctate; top-view sub-circular; each semicell with 2 axile chloroplasts, each containing one pyrenoid. Cell 51.5 μm long and 50 μm broad.

✓ *Cosmarium regnellii* Wille (Pl-1, p)

West, W and West, G.S. 1908, Vol. 3, p. 89, pl. 72, figs. 25-28

Cells very small, a little longer than broad deeply constricted, sinus narrow with slightly dilated extremity; semicells sub-hexagonal, basal angles more or less sub-rectangular, sides parallel, upper angles broad and oblique, apex truncate and straight; cell wall smooth; each semicell with an axile chloroplast and one pyrenoid. Cell 11.5 μm long and 10 μm broad.

✓ *Cosmarium quadrum* Lund. (Pl-2, d)

West, W and West, G.S. 1912, Vol. 4, p. 20, pl. 100, figs. 3-6

Cells rather small, quadrate, nearly as long as broad, deeply constricted, sinus narrowly linear with dilated extremities; semicells sub-rectangular, basal and apical angles rounded, sides convex, apex slightly retuse; cell wall granulate, granules in somewhat oblique and less distinct vertical series, 28-23 at the margin of semicell; top view oblong-elliptic; each semicell with chloroplast axile with 2 pyrenoids. Cell 34.5-37 μm broad and 35-38 μm long.

✓ *Desmidium swartzii* Agardh. (Pl-2, u)

West, W and West, G.S. 1923, Vol. 5, p. 246, pl. 163, figs. 5-8

Iyengar and Vimala Bai, 1941. p. 97, figs. 85, 89

Cells rather small, cells twice as broad as long, narrowly rectangular, moderately constricted with open sinus; semicells oblong with more or less straight apical margins, lateral margins obliquely rounded; cell wall smooth; chloroplast axile with 2 pyrenoids, cell 12.5-15 μm long and 27-32 μm broad.

✓ *Euastrum ansatum* Ehrenberg (Pl-2, g)

West, W and West, G.S. 1905, Vol. 2, p. 27, pl. 36, figs. 10-13

Variety differs from the species in

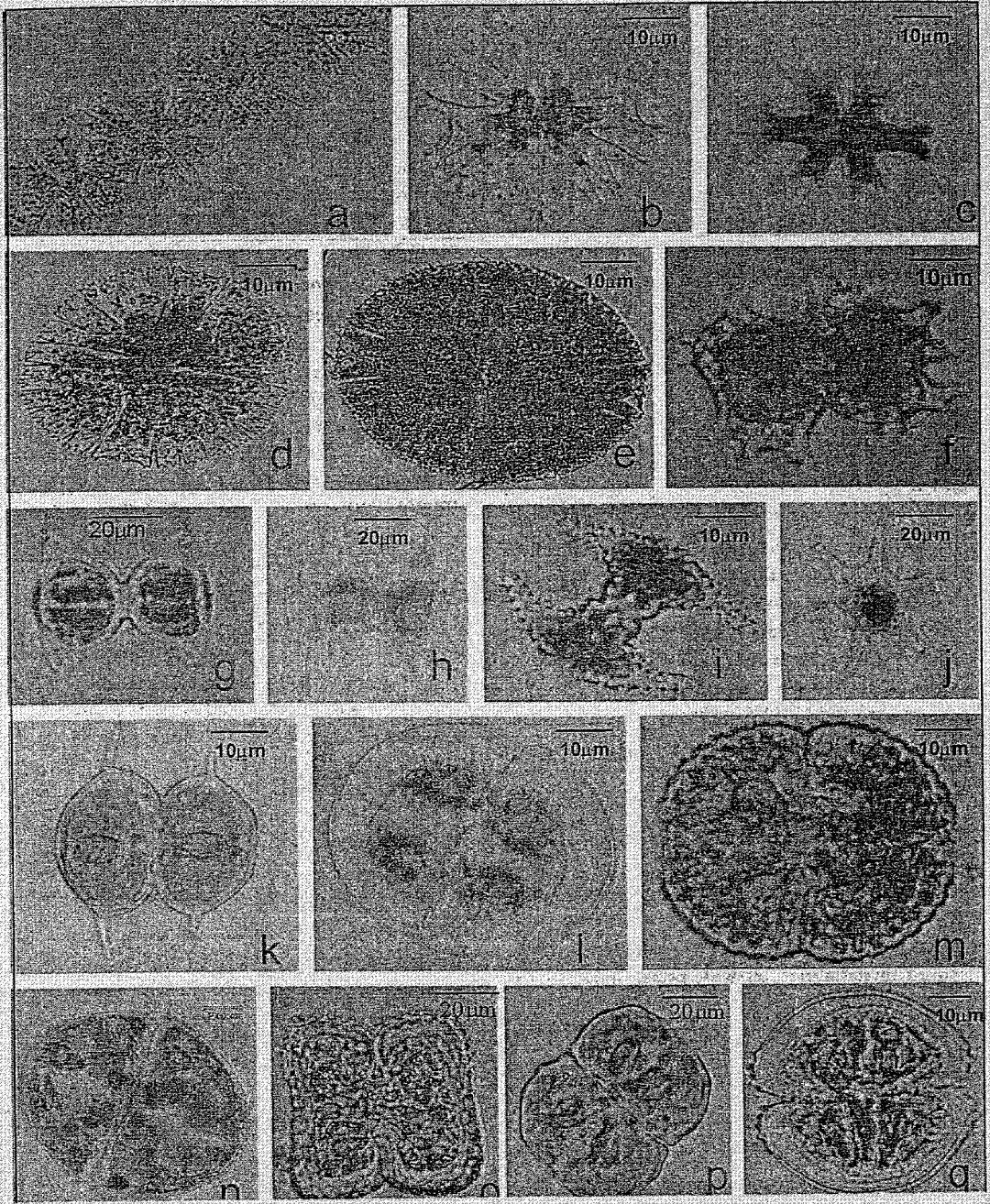


Plate 1.

- a) *Micrasterias foliacea*, b) *M. radians*, c) *M. mahabaleshwariensis*, d) *M. thomasiana*, e) *M. sol*, f) *Staurastrum wildemanii*, g) *S. granulosum*, h) *S. gracile*, i) *S. gracile* var. *coronulatum*, j) *S. arachne* var. *curvatum*, k) *Arthrodesmus curvatus*, l) *Cosmarium obsoletum*, m) *C. decoratum*, n) *C. lundellii*, o) *C. pseudobroomei*, p) *C. regnellii*, q) *C. auriculatum*

exhibiting large undulation above the basal angles in each semicell, apices sub-quadrate with rounded angles. Cell 70.5 μm long and 37 μm broad.

✓ *Euastrum sinuosum* var. *reductum* W. et G. S. West. (PI-2, h)

West, W and West, G.S. 1905, Vol. 2, p. 22, pl. 36, figs. 2-3

Cell small, 1.7 times longer than broad, deeply constricted, sinus narrowly linear with dilated extremity; semicells 3 lobed, lateral lobes bilobulate and less prominent, polar lobe quadrate oblong with deep median incision, semicell with 3 protuberances in the center and 2 above them on lateral sides; punctuations on cell wall not seen. Cell 58 μm long and 33.5 μm broad.

✓ *Euastrum spinulosum* var. *burmense* (West et West) Krieger (PI-2, f)

Prasad and Misra, 1992, p. 137, Pl. 19, fig. 8

Cell small, a little longer than broad, constriction deep, sinus narrow and open; each semicell 5 lobed with rounded angles; polar lobe broadly truncate with faint median notch, lateral and polar lobes furnished with 5-6 unevenly disposed, prominent and acute spines; cell wall with short spines within the polar and lateral lobes and one large median and 2 relatively small lateral protuberances above the isthmus. Cell 51-54.5 μm long and 43-45 μm broad.

✓ *Euastrum spinulosum* var. *inermius* Nordstedt. (PI-2, e)

West, W and West, G.S. 1902, p. 86, pl. 10, figs. 51

Broadly rounded to flattened lateral lobes and somewhat trapezoid polar lobe; cell wall with granules, arranged in more or less circular fashion, central protuberance with 10 big peripheral and 4 large internal granules. Cell 59.5-67 μm long and 51-54.5 μm broad.

✓ *Triploceros gracile* var. *undulatum* Scott & Prescott (PI-2, s)

Scott, A.M. and Prescott, G. W. 1961, p. 21, pl. 6, fig. 9.

Cells than broad. cell wall with spines. apex

430 μm long and 35-45 μm broad.

✓ *Micrasterias foliacea* Bail. (PI-1, a)

Prasad and Misra, 1992, p. 141, Pl. 20, fig. 6

Cells rather small, united in filaments by

inter-locking of polar lobes, rectangular in outline, deeply constricted, sinus narrowly linear; semicells 5-lobed, basal part of polar lobes with sub-parallel sides, upper part greatly expanded with an excavation in the median portion, base of excavation exhibits 2 asymmetric spines, lateral lobes asymmetrical, superior lobes divergent, inferior horizontally disposed, incisions simple and sub-acuminate; cell wall smooth. Cell 53.5-59 μm long and 66-73.5 μm broad.

✓ *Micrasterias mahabaleshwarensis* Hobson. (PI-1, c)

West, W and West, G.S. 1905, Vol. 2, p. 122, pl. 54, figs. 3-7

Cells of medium size, constriction deep, sinus open with acuminate extremity; semicell 3-lobed, with symmetry in three planes, incisions between lobes wide, polar lobe large with sub-quadrate lower half and dilated upper half producing prominent diverging, denticulate processes and exhibiting a pair of small, accessory, asymmetrical denticulate processes in front, margin with small and acute spines, lateral lobes with wide, deep and acute-angled incision, divided into two attenuated and denticulate processes, apices of all the processes tri- or quadri- denticulate, portion above the isthmus furnished with a row of denticulations; in this species. Cell 119-127 μm long and 88-91.5 μm broad.

✓ *Micrasterias radians* Turner (PI-1, b)

Prasad and Misra, 1992, p. 144, Pl. 20, fig. 2

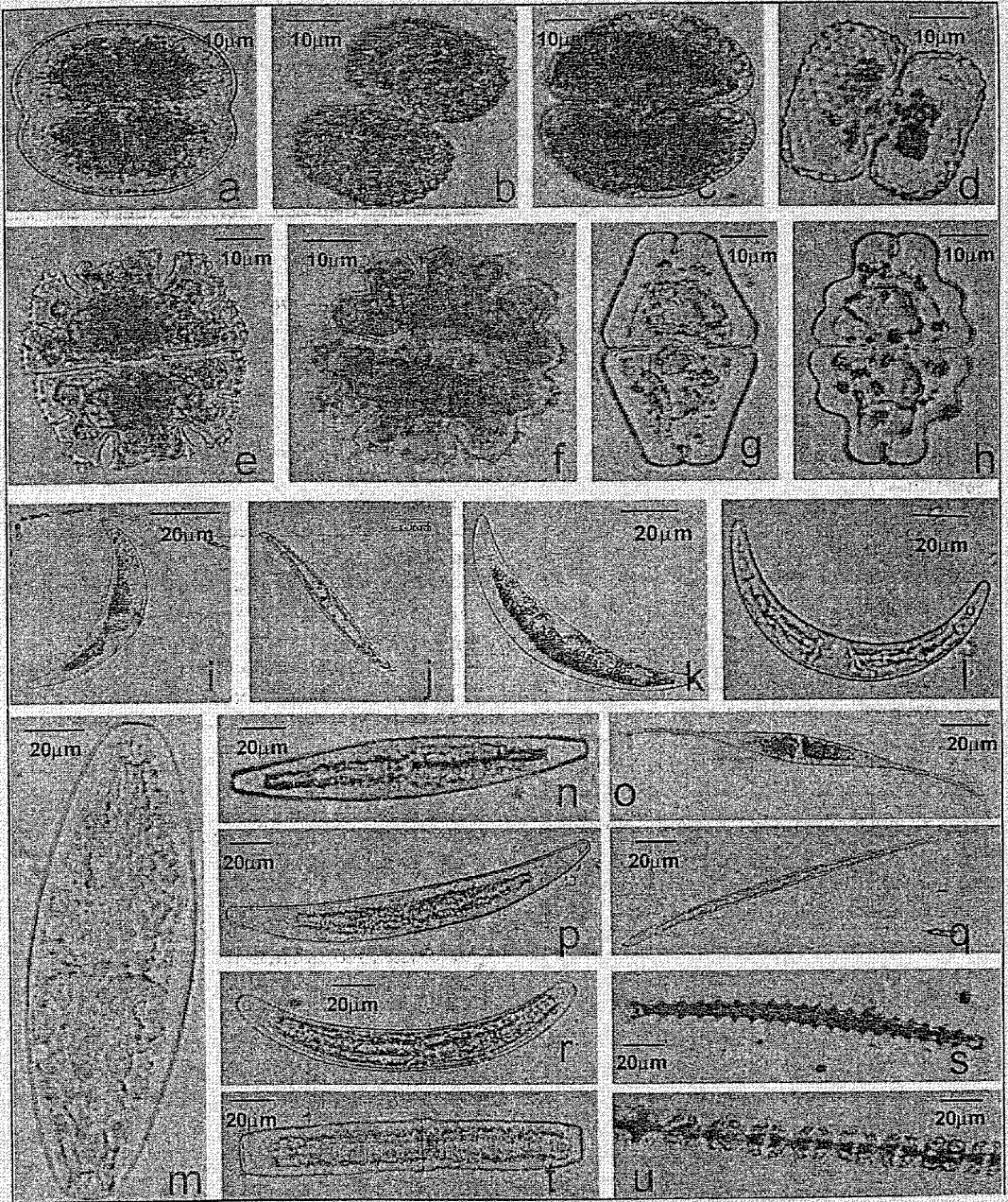
Cells of medium size, sub-circular, very deeply constricted, sinus with apical portion linear and outer open; semicells 5-lobed with deep, radial and widely open, polar lobe with sub-parallel sides emarginated and furcated-acuminate expanded apex, each lateral lobe divided into two lobules by incision as deep as between polar and lateral lobes; lobules with furcated- acuminate extremities; cell wall smooth. Cell 104-110 μm long and 15-18 μm broad.

✓ *Micrasterias sol* (Ehrenb.) Kuetz. (PI-1, e)

West, W and West, G.S. 1905, Vol. 2, p. 95, pl. 46, figs. 1-2

Cells of medium size, round, very deeply

undulate margins in apical half and open outwards; semicell 5-lobed with deep and slightly open incisions between lobes and lobules, polar lobe with sub-parallel sides at the base and expanded apex, apical margin retuse-emarginate with a small



a) *Cosmarium pseudoconnotum*, b) *C. portianum* var. *nephroideum*, c) *C. circulare*, d) *C. quadrum*, e) *Euastrum spinulosum* var. *inermius*. f) *E. spinulosum* var. *burmense*, g) *E. ansatum*, h) *E. sinuosum* var. *reductum*, i) *Closterium recurvum*, j) *C. sigmoideum*, k) *C. diana*, l) *C. cynihia*, m) *Netrium digitus*, n) *Closterium rectimarginatum*, o) *C. kuetzingii*, p) *C. pritchardianum*, q) *C. decorum*, r) *C. croasdale*, s) *Triploceras gracile* var. *undulatum*, t) *Pleurotaenium coronatum* var. *cambricum*, u) *Desmidiium schwartzii*

acuminating spine near the emarginated-dentate angles, lateral lobes by 3 incisions divided into 4 equal lobules, polar and lateral lobules bifid; cell wall smooth. Cell 237-238µm long and 263-275µm broad.

✓ *Micrasterias thomastiana* Arch. (Pl-1, d)

West, W and West, G.S. 1905, Vol. 2, p. 110, pl. 51, figs. 3-6

Cells large, sub-orbicular, very deeply constricted, sinus narrowly linear, semicells 5-lobed, incisions between lobes narrow and linear, polar lobes with slightly retuse deep median notch, angles on each side of apical notch furnished with 2 pointed processes; lateral lobes equal in size, each lateral lobe by a rather lower secondary and 2 tertiary incisions results into 8 ultimate divisions, each division with 2-3 sharp and pointed projections; cell wall smooth. Cell 229-4-245 µm long and 219-226 µm broad.

✓ *Staurastrum arachne* var. *curvatum* W & G.S West. (Pl-1, j)

West, W and West, G.S. 1923, Vol. 5, p. 152, pl. 150, fig. 2

Cells deeply constricted, sinus open and acute-angled produced into more or less horizontally disposed 5 long processes tipped with 3 minute spines; top view triangular with concave sides; cell wall finely punctate, punctuations arranged in radial series around the angles, cell 15-20 µm long.

✓ *Staurastrum gracile* Ralfs. (Pl-1, h)

West, W and West, G.S. 1923, Vol. 5, p. 96, pl. 144, figs. 3-7

Iyengar and Vimala Bai, 1941. p. 96, figs. 64-66

Cell small, about 2.7 times longer than broad with slightly constriction in the form of an acute notch; semicells slightly broadening towards the faintly convex apex, upper angles produced into more or less horizontally disposed long processes tipped with 3 minute spines and showing many concentric series of denticulations; top view triangular; chloroplast axile with one pyrenoid in each semicell, cell 18.5 µm long and 12 µm broad.

✓ *Staurastrum gracie* var. *coronatum* Boral. (Pl-1, i)

West, W and West, G.S. 1923, Vol. 5, p. 100, pl. 144, fig. 10

Cell slightly compressed, longer than broad

with constriction in the form of an acute notch; semicells slightly broadening towards the faintly convex apex, upper angles produced into more or less horizontally disposed long processes tipped with 3 minute spines; top view triangular; cell 20 µm long and 15 µm broad.

✓ *Staurastrum granulosum* (Ehrenb.) Ralfs (Pl-1, g)

West, W and West, G.S. 1912, Vol. 4, p. 188, pl. 128, figs. 10-12

Cell small with slight constriction in the form of acute notch; semi cells broadening towards faintly convex apex, long processes tipped with three minute spines and showing concentric series of denticulations. Chloroplast axile with one pyrenoid in each semicell, cells 15-20 µm long and 10-12 µm broad without processes.

✓ *Staurastrum wildemanii* Gutw. (Pl-1, f)

Prasad and Misra, 1992, p. 200, Pl. 26, fig. 3

Cell rather small, a little longer than broad, deeply constricted, sinus open with acuminate apex; semicells transversely sub-elliptical with slightly convex apex showing a long and sub-acute spine, ventral margin with more curvature, lateral angles somewhat truncate and furnished with a pair of diverging spines; cell wall smooth. Cell 31.5-34 µm long and 25-28 µm broad.

Pleurotaenium coronatum (Breb.) Rabenh. var. *cambricum* (Pl-2, t)

West, W and West, G.S. 1904, Vol. 1, p. 199, pl. 27, figs. 16-18

Cells 10-11.5 times longer than broad, margins undulate, basal inflation prominent; apical tubercles large, 14-16 in numbers; cell wall finely scrobiculate. Cell 520-535 µm long and 44-46.5 µm broad.

Conclusion

Goa supports a rich diversity of desmids and extended survey may result into the documentation of more taxa. The present paper is the first taxonomic

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