

DESMIDS FROM SOUTH SIKKIM, INDIA

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ABSTRACT

During the systemic investigations on the desmid biodiversity of Eastern Himalaya the authors visited various regions of Namchi, South Sikkim, India and recorded 12 taxa belonging to the 6 genera viz. *Desmidium* C. Agardh ex Ralfs, *Hyalotheca* Ehrenberg ex Ralfs, *Micrasterias* C. Agardh ex Ralfs, *Pleurotaenium* Nägeli, *Spondylosium* Brébisson ex Kützinger and *Staurastrum* Meyen ex Ralfs. Three taxa *Pleurotaenium ehrenbergii* (Brébisson) de Bary var. *crenulatum* (Ehrenberg) Krieger f. *crenulatum*, *Staurastrum botanense* Playfair var. *botanense* and *Micrasterias alata* Wall have been recorded as new to Indian flora. The remaining taxa are new record for Sikkim & Eastern Himalaya.

Keywords: Desmids, Eastern Himalaya, India, Namchi, Sikkim, taxonomy.

INTRODUCTION

The state of Sikkim, is one of the richest phyto-geographical regions of India, shows a great deal of diversity in both flowering and non-flowering plant groups. The flora of this region is highly diverse and well known for its high species diversity and endemism. (Hara, 1966, 1971; Sain, 1974; Bose & Bhattacharjee, 1990; Hajra & al., 1996; Singh & al., 2005; Tiwari & Chauhan, 2006; Lucksom, 2007). In this region, the algal flora including the Desmids which constitute the most fascinating group are least studied. Perusal of literature (Dickie, 1882; Rao, 1963; Carter, 1967; Dutt & al., 1973, 1975, 1976; Santra & Adhya, 1973, 1976a, 1976b, Prasad & Misra, 1987) reveals that very little attention was given in past for the study of the algal flora. However, during the last decade the desmid diversity of Eastern Himalaya was studied by different workers (Kumar & Rai, 2005; Suseela & Toppo, 2006, 2007; Bhakta & al., 2010; Yasmin, & al., 2011 Das & Keshri, 2012 a & b). The present paper deals with the 12 desmids growing in Namchi and adjoining regions of South Sikkim. All the species recorded here are the new record to the state of Sikkim.

Namchi, the capital of the South Sikkim district is located at an average elevation of 1,675m (5500 feet) above sea level and latitude of 27.16° 54' 73'' N and 88.36° 71' 57''. It is situated at a distance of 92km from the state capital Gangtok and 90km from the town of Siliguri of West Bengal.

MATERIALS AND METHODS

Algal specimens were collected from various places of Namchi region, on, mainly associated with wet mosses on the rocks as well as soil surfaces. Few collections were also made from stagnant water of small ditches. The temperature and pH of water were recorded with short habitat notes. Samples were preserved in 5% formalin in polythene bags. Lugol's iodine solution was also used to preserve the samples. Total 16 collections were made from Namchi, among them 9 collections were investigated for desmids. Observations were made under Olympus GB microscope using GWF as mountant (Bando 1988). Photomicrographs were taken using Zeiss Axiostar plus research microscope with Nikon SLR camera-attachment system. Camera Lucida drawings were also made from preserved samples and identified following the standard literature (Krieger, 1937; Croasdale & al., 1983; Prescott & al., 1975, 1977, 1982; Ralfs, 1848; Lenzenweger, 1996, 1997, 1999, 2003; West & G.S. West, 1904 and West & al., 1923). All specimens collected are preserved in the algal depository of Phycology section, Botany department, University of Burdwan, West Bengal, India.

RESULTS

Total 12 taxa under 6 genera of desmids have been along with other green and blue green algae. Detailed description of each taxon of desmids observed are appended below followed by a note on its habitat, quality of water, collection number in parenthesis and a small note on its distribution if any.

1. ***Desmidium baileyi*** (Ralfs) Nordstedt var. ***baileyi*** f. ***minus*** (Allorge & Allorge) Bicudo.

(Croasdale & al., 1983, p. 41, pl. 464, f. 10).

(Fig. 1a, 1b)

Cells of medium sized, slightly broader than long, faintly constricted, sinus reduced to faint undulations; semicells rectangular, the lateral margins parallel; the apices with a broad, deep semielliptic depression in the middle but produced at the angles to form fairly long connecting processes, so that a cavity of considerable size is left between the adjacent cells; semicells in vertical view 4-angled. Length: 14 - 15µm, Breadth: 20 - 22µm, Isthmus: 19 - 20µm.

Habitat : In association with light-green floating filaments from stagnant water of small ditches. pH of the water: 6.5, temperature of the water: 10°C. (584, 585)

Notes : In gross morphology it resembles *D. baileyi* f. *minus* but differs in larger in dimension and rectangular semi cells with four processes (tetra-radiate).

Distribution : Veli lake, Kerala (Mathew & Nair, 1981); Kuttanad wetland, Kerala (Alexander & al., 2010).

2. ***Hyalotheca mucosa*** (Mertens) Ehrenberg ex Ralfs

(West & al., 1923, p. 235, pl. 162, f. 1-4; Croasdale et al. 1983, p. 30, pl. 461, f. 6-8; Lenzenweger 1997, p. 141, pl. 43, f. 5) **(Fig. 1c, 1d)**

Cells small, slightly longer than broad, attached end to end to form short filament; devoid of any indication of constriction, very slightly constricted at the joints; semicells transversely sub-rectangular, lateral margins nearly parallel, convex with upper angles broadly rounded; apex broad and truncate; cell wall smooth except 2 parallel, transverse series of tiny granules just beneath the apices. Length: 15 - 18µm, Breadth: 12 - 14µm.

Habitat : In association with green filamentous mass, attached to the surface of the wet mosses growing on the wet rock surfaces beside a small waterfall. pH of the water: 6.5, temperature of the water: 10°C. (589)

Distribution : Northern India (Turner 1892).

3. ***Micrasterias alata*** Wall.

(Wall. 1860, p. 279, pl. 13, f. 11; Krieger 1937, p. 61, pl. 114, f. 1-4; Prescott et al. 1977, p. 138, pl. 112, f. 3-8) **(Fig. 1e, 1f)**

Cells medium sized, about as long as broad; sinus closed and narrow in inner quarter, then widely open; lateral lobes once divided, the upper member again divided, the lower member simple, all divisions deep; lobules swollen at base, then abruptly and narrowly tapering to tri-dentate extremities, the upper margin of the upper member extending vertically parallel to the polar lobe, separated by it from a deep and narrow incision; polar lobes slender with parallel sides, abruptly branching at the apex into 2 slender diverging processes; wall coarsely punctuate. Length: 126 - 130µm, Breadth: 126 - 129µm, Isthmus: 15 - 16µm, Breadth at the apex: 52 - 55µm.

Habitat : In association with green filaments on wet mosses on the soil surface. pH of the water: 6, temperature of the water: 10°C. (584)

Distribution : East India (Turner, 1892).

Notes : The specimen collected differs from the protologue in being granulate.

4. ***Micrasterias foliacea*** Bailey ex Ralfs var. ***foliacea***

[Bailey (in Ralfs) 1848, p. 210, pl. 35, f. 3; Turner 1892, p. 94, pl. 6, f. 12-14; Dillard 1993, p. 91, pl. 26, f. 4; Prescott & al., 1977, p. 158, pl. 139, f. 3-8] **(Fig. 1g, 1h)**

Cells small, united in filaments by the interlocking of the polar lobes, rectangular, slightly broader than long; sinus sub-linear; lateral lobes divided to the second or third order, dissimilar, the lower lobules horizontal, the upper diverging, its upper part reduced to a conical projection, other extremities bi-dentate and emarginated; polar lobes very distinctive; basal part expanded, anvil-shaped, with a very broad, deep sub-rectangular excavation in the middle of the apex, apex stout, ending in 2 diverging teeth; depressed portion of the apex bearing 2 stout spines of each side, unequal in size. Length: 51 - 54µm, Breadth: 58 - 62µm, Isthmus: 11 - 12µm.

Habitat : In association with greenish-brown scum with the wet mosses growing on the surface of the rock. pH of the water: 6, temperature of the water: 10°C. (594, 595, 596).

Distribution : Elephant tank, West Bengal (Turner, 1892), Siddharth Nagar, Uttar Pradesh (Prakash & al., 2005); Birbhum, West Bengal (Debnath & Mondol, 2011); Urapad Beel, Assam (Deca & al., 2011).

5. ***Micrasterias mahabuleshwarensis*** Hobson var. ***mahabuleshwarensis*** f. ***mahabuleshwarensis***

(Hobson 1863, p. 168, f. 169; Prescott & al., 1977, p. 164, pl. 143, f. 1, 2, 4, 5; Dillard 1993, p. 94, pl. 12, f. 14) **(Fig. 1i, 1j)**

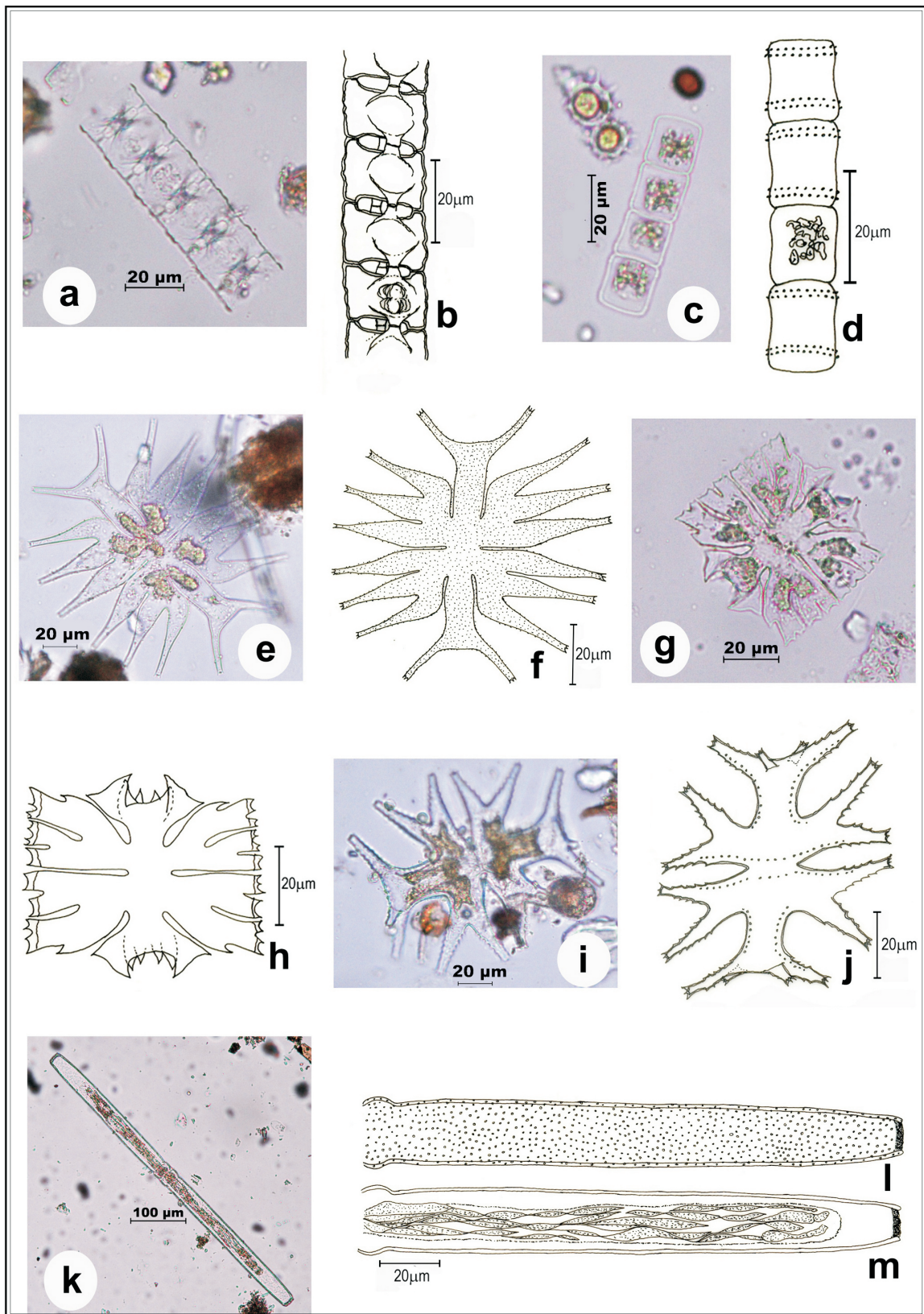


Fig. 1 : **a, b:** *Desmidium baileyi* (Ralfs) Nordstedt var. *baileyi* f. *minus* (Allorge et Allorge) Bicudo; **c, d:** *Hyalotheca mucosa* (Mertens) Ehrenberg ex Ralfs; **e, f:** *Micrasterias alata* Wallich; **g, h:** *Micrasterias foliacea* Bailey ex Ralfs var. *foliacea*; **i, j:** *Micrasterias mahabuleshwariensis* Hobson var. *mahabuleshwariensis* f. *mahabuleshwariensis*; **k, l, m:** *Pleurotaenium ehrenbergii* (Brébisson) de Bary var. *crenulatum* (Ehrenberg) Krieger f. *crenulatum*

Cells of medium size, slightly longer than broad; sinus sharp angled, widely open; polar lobe in lower half quadrate, above widely expanding into narrow diverging processes at the angles, with more nearly erect accessory processes at their base, arising asymmetrically, one at the front and one at the back of the apex, apex between processes nearly straight; lateral lobes once divided into narrow tapering processes; all processes with serrate margins, ends tri-denticulate; semicells with a row of acute intra-marginal granules along the inner part of the major incisions, with a small granulate central protuberance above the isthmus. Length: 110 - 115µm, Breadth: 96 - 100µm, Isthmus: 21 - 22µm, Breadth at the apex: 62 - 64µm.

Habitat : In association with dark greenish filamentous mat floating freely on the surface of water in a small ditch. pH of the water: 6.5, temperature of the water: 10°C. (583, 585).

Distribution : Pakhal Lake, Andhra Pradesh (Suxena & Venkateswarlu, 1966); Bandhabgarh, Madhya Pradesh (Agarkar & al., 1979).

6. **Pleurotaenium ehrenbergii** (Brébisson) de Bary var. **crenulatum** (Ehrenberg) Krieger f. **crenulatum**

(Prescott & al., 1975, p. 116, pl. 45, f. 12, 13)

(Fig. 1k, 1l, 1m)

Cells large, 16 - 18 times longer than broad, slightly constricted; semicells with a somewhat conspicuous basal inflation; margin of the semicell slightly tapered to a truncately-rounded apex, bearing 5 rounded tubercles visible in the face view; wall minutely porous; chloroplast composed of several longitudinal, parietal bands with several pyrenoids. Length: 527 - 534µm, Breadth: 30 - 33µm, Apex: 16 - 19µm.

Habitat : In association with greenish-brown scum growing on wet mosses on the rock surfaces. pH of the water: 6, temperature of the water: 10°C. (586, 595)

Distribution : This is the first report of this taxon from India.

7. **Pleurotaenium repandum** (Wolle) Krieger var. **repandum** f. **repandum**

(Krieger 1937, p. 405, pl. 41, f. 9; Prescott & al., 1975, p. 129, pl. 41, f. 10)

(Fig. 2a, 2b)

Cells medium sized, 14 - 17 times longer than broad; semicells only slightly tapered from base to apex, basal inflation very slight, the entire margins undulate; apex truncate, wall punctuate. Length: 247 - 252µm, Breadth: 15-18 µm, Apex: 11-12µm.

Habitat : In association with green filaments on wet mosses. pH of the water: 6, temperature of the water: 10°C. (585)

Distribution : Kashmir & Ladakh (Compère, 1983).

8. **Pleurotaenium truncatum** (Brébisson) Nägeli var. **crassum** Boldt f. **crassum**

(West & G.S. West 1904, p. 204; Prescott & al., 1975, p. 137, pl. 46, f. 9-11; Lenzenweger 1996, p. 60, p. 8, f. 5)

(Fig. 2c, 2d)

Cells large, stout, 2-3 times longer than broad; semicells swollen beyond the basal inflation, margins strongly convex and tapering to the apex; apex truncate with rounded angles, apical tubercles absent; wall smooth, whitish-yellow in colour. Length: 225 - 228µm, Breadth: 75 - 82µm, Isthmus: 44 - 47µm, Apex: 25 - 26µm.

Habitat : In association with light-green filaments on wet mosses. pH of the water: 6, temperature of the water: 10°C. (583).

Distribution : Northern India (Turner, 1892), Kashmir & Ladakh (Compère, 1983).

Note : In the collected specimen apical tubercles are absent, similar to the type.

9. **Spondylosium nitens** (Wall.) Archer var. **triangulare** Turner

(Croasdale & al., 1983, p. 21, pl. 458, f. 4, 5; Turner 1892, p. 44, pl. 18, f. 17)

(Fig. 2e, 2f)

Cells small, slightly broader than long, loosely arranged end to end forming pseudo-filament; semicells 3-lobed, the sinus open and broadly rounded within; some portion of the apex elevated and flattened; semicells in face view dumbbell-shaped. Length: 16 - 19µm, Breadth: 19 - 22µm, Isthmus: 14 - 16µm.

Habitat : In association with dark greenish filamentous mass floating freely on the surface of water. pH of the water: 6.5, temperature of the water: 10°C. (594).

Distribution : Kashmir & Ladakh (Compère, 1983).

10. **Staurostrum botanense** Playfair var. **botanense**

(Prescott & al., 1982, p. 144, pl. 363, f. 6-8)

(Fig. 2g, 2h)

Table 1. List of taxa reported from Namchi by earlier workers:

No.	Name of the species	Localities	Investigators
1	<i>Closterium macerosum</i> (Schrank) Ehrenberg var. <i>elongatum</i> Brébisson	Water spring at Namchi	Kumar & Rai (2005)
2	<i>Closterium lundellii</i> Lagerheim var. <i>ellipticum</i> West et GS West	Waterfalls at Namchi towards Namthang	Kumar & Rai (2005)
3	<i>Closterium lunula</i> (Müller) Nitzsch var. <i>massartii</i> (De Wildeman) Krieger	Waterfalls at Namchi towards Namthang	Kumar & Rai (2005)
4	<i>Closterium tumidum</i> West	Pond near Namchi towards Jorhang	Kumar & Rai (2005)
5	<i>Cosmarium connatum</i> Brébisson ex Ralfs	Kalimpong, Namchi, Nayabazar, Phalut	Santra & Pal (2006)
6	<i>Cosmarium garrolense</i> Roy et Bisset	Namchi, Darjeeling Sandakphu, Rimbick	Santra & Pal (2006)
7	<i>Cosmarium pseudogranatum</i> Nordstedt var. <i>rotundatum</i> (Krieger) Messikomer	Stream at Namchi	Kumar & Rai (2005)
8	<i>Cosmarium quadratum</i> Ralfs	Namchi	Santra & Pal (2006)
9	<i>Euastrum ceylanicum</i> (West et GS West) Krieger	Kurseong, Lava, Namchi, Mongpoo, Tonglu	Santra & Pal (2006)
10	<i>Euastrum dubium</i> Nägeli	Namchi, Kurseong, Mongpoo	Santra & Pal (2006)
11	<i>Netrium digitus</i> (Brébisson ex Ralfs) Itzigsohn et Rothe	Water spring at Namchi Namchi, Nayabazar	Kumar & Rai (2005) Santra & Pal (2006)
12	<i>Pleurotaenium ehrenbergii</i> (Ralfs) Delponte	Tonglu, Kalimpong, Namchi	Santra & Pal (2006)
13	<i>Staurostrum pachyrhynchum</i> Nordstedt	Stream at Namchi	Kumar & Rai (2005)
14	<i>Xanthidium antilopaeum</i> (Brébisson) Ku"tzing	Namchi	Santra & Pal (2006)

Cells small, 1 - 1.5 times longer than broad; median constriction deep, the sinus acutely rounded at the apex, widely open; semi cells obversely triangular, with the apical lobes produced and bearing two superimposed spines, the lower bifid, the basal margin convex and diverging, the apical margin truncate and straight; in vertical view cells triangular, the margins slightly concave; the poles rounded and bearing 2 superimposed spines. Length: 21 - 22µm (with spine), Length: 16 - 18µm (without spine), Breadth: 17 - 18µm (with spine), Breadth: 14 - 15µm (without spine), Isthmus: 7 - 8µm.

Habitat : In association with light-green filaments on wet mosses. pH of the water: 6, temperature of the water: 10°C. (596).

Distribution : This is the first report of this taxon from India.

11. **Staurostrum muticum** (Brébisson) Ralfs var. **muticum** f. **minus** Rabenhorst

(Prescott & al., 1982, p. 257, pl. 332, f. 1-3, 5)

(Fig. 2i, 2j, 2k)

Cells medium sized, very slightly longer than broad; semicells narrowly elliptic-oval, wide; the dorsal margins less convex than the ventral; medium constriction deep, the sinus obtusely rounded at the apex, linear but open; in vertical view cells triangular, narrowly rounded at the angles, the margins retuse between the lobes; cell wall finely and densely punctate. Length: 21 - 22µm, Breadth: 19 - 21µm, Isthmus: 7 - 8µm.

Habitat : In association with light-green filaments on wet mosses. pH of the water: 6, temperature of the water: 10°C. (589).

Distribution : Kolhapur, Maharashtra (Kamat, 1963); Karnataka & Goa (Bharati & Hegde, 1982).

12. **Staurostrum morbiculare** (Ehrenberg) Ralfs var. **minor** Prescott

(Prescott & al., 1982, p. 269, pl. 331, f. 8)

(Fig. 2l, 2m)

Cells medium sized, very slightly broader than long; median constriction deep, the sinus slightly dilated at the apex, linear, closed; basal angles rounded; cell wall punctate; in vertical view cell triangular, the margins concave between broadly rounded lobes.

Length: 20 - 22µm, Breadth: 22 - 25µm, Isthmus: 10 - 11µm.

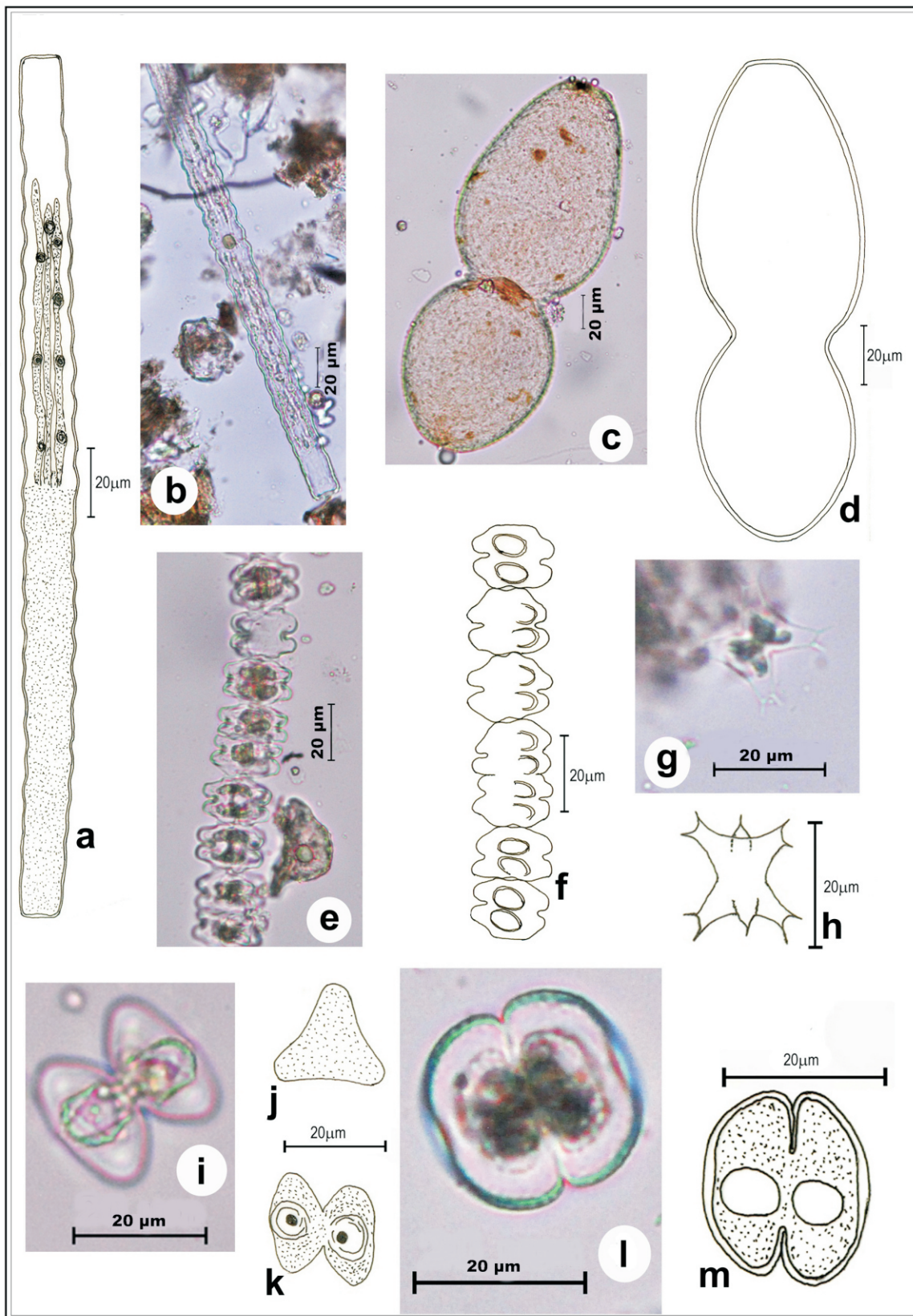


Fig. 2 : a, b: *Pleurotaenium repandum* (Wolle) Krieger var. *repandum* f. *repandum*; c, d: *Pleurotaenium truncatum* (Brébisson) Nägeli var. *crassum* Boldt f. *crassum*; e, f: *Spondylosium nitens* (Wall.) Archer var. *triangulare* Turner; g, h: *Staurastrum botanense* Playfair var. *botanense*; i, j, k: *Staurastrum muticum* (Brébisson) Ralfs var. *muticum* f. *minus* Rabenhorst; l, m: *Staurastrum orbiculare* (Ehrenberg) Ralfs var. *minor* Prescott

Habitat : In association with yellowish-green filaments on wet mosses. pH of the water: 6, temperature of the water: 10°C. (593).

Distribution : Kashmir & Ladakh (Compère, 1983).

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दक्षिणी सिक्किम, भारत से डेस्मिड

देवज्योति दास एवं जय प्रकाश केशरी

सारांश

पूर्वी हिमालय के डेस्मिड जैव विविधता पर क्रमबद्ध अन्वेषण के क्रम में लेखकों ने दक्षिणी सिक्किम, भारत के नामची अंचल से ६ वंशों डेस्मिडियम, हायलोथेका, माइक्रोस्टेरिअस, प्लियूरोटेनिअम, स्पोंडायलोसिअम एवं स्टॉरेस्ट्रम के १२ जातियों के अभिलेख किये। प्लियूरोटेनिअम इहरेनबर्गी, क्रेनुलेटम (इहरेनबर्गी), स्टॉरेस्ट्रम बोटेनेस प्रभेद बोटेनेस एवं माइक्रोस्टेरिअस एलेटा भारतीय वनस्पतिजात में नये अभिलेख हैं। अन्य सभी जातियों के पूर्वी हिमालय एवं सिक्किम राज्य से पहली बार अभिलेख हुई हैं।