

Genus *Staurastrum* Meyen from central and western Uttar Pradesh, India

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In the present communication 13 taxa of the genus *Staurastrum* Meyen have been reported from fresh water bodies of central and western Uttar Pradesh. Out of these the species *S. leptocladum* var. *cornutum* has been reported for the first time from India, while *S. kalapanii* Prasad et Misra has been recorded, for the first time from main land of Indian subcontinent. Rest of the species are new record from the area. Key of the species is provided for species level identification.

Key words : *Staurastrum*, Desmidiaceae, Uttar Pradesh, India.

INTRODUCTION

THE genus *Staurastrum* Meyen (Gr. *Stauron*, cross + Gr. *astrum*, star), is commonly distributed in permanent or semi permanent fresh water pools, lakes, ponds. The unicells are highly constricted and radially symmetrical in end or polar view, the semi cells are often tri-radiate or hexa-radiate and may be highly ornamented with spines and other protuberances (Graham and Wilcox, 2000). The walls are impregnated with polyphenolic compound which confer decay resistance (Gunnison and Alexande, 1975 a,b). Earlier Turner (1892); Iyengar and Vimala Bai (1941); Bharati (1965, 1966); Saxena and Venkateswarlu (1966 a-b) have described various desmids from Bengal, Mumbai and Chennai. Kamat (1962, 1963, 1968 a,b, 1975) in a series of publication has described fresh water algae (including desmids) of Kolhapur, Alibag (Maharashtra) and Simla (Himanchal Pradesh), 31 taxa from Ahmedabad (Gujarat) adding 6 new species 8 new varieties and 6 new forms of Desmids to the area. Patel and Kumar (1980) have also reported some species of genus *Staurastrum* Meyen from different localities of Gujarat state.

Bharati and Hegde (1982) have reported 47 desmids from Goa region. Hegde and Bharati (1985) have recorded 2 new species from Shimoga district of Karnataka. Sidhu and Panikkar (1995) have described twenty two species from Quilon, Kerala out of these 15 are new to Indian algal flora.

Very little information is available regarding desmids and their distribution in Uttar Pradesh. Gupta (1956), Sharma (1962), Prasad (1965) have given a preliminary report on desmids from Allahabad and Varanasi districts. Prasad and Mehrotra (1977) have described 77 taxa of desmids from north Indian paddy fields out of which 13 belong to *Staurastrum* Meyen.

The present communication deals with the genus *Staurastrum* Meyen found in lakes, ponds of central and western region of Uttar Pradesh. These area are located in different agro climatic zones i.e. Lucknow, Raibareli and Farukhabad in central plain zone; Mahoba in Bundelkhand zone and Barabanki in eastern plain zone.

MATERIAL AND METHOD

Algal samples were collected from different natural fresh water bodies from central and western part of Uttar Pradesh during 1998-2001 and preserved in 4% formaline. The preserved material was stored at National Botanical Research Institute, Lucknow. Camera Lucida line drawing were made and the final accurate measurements were taken for species level identification. Photo micrographs were taken in Nikon microscope SZ 1450.

KEY TO THE SPECIES

1. Angles of semicells not continued into process.

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- 1 a. Cell was smooth or punctuate
 - i. Semicells sub-elliptic, angles thickened and slightly produced with a faint upwards felt, cell wall smooth *S. pachyrhynchum*(8)
 - ii. Semicells narrowly cuneate with ventral margin more convex than dorsal, lateral angles rounded and upwardly turned, cell wall punctate *S. kalapanii* (6)
2. Angles of semicells continued in to processes.
 - i. Semi-cells broadly triangular with apices showing undulate margin*S.gracile* (4)
 - ii. Semicells with very long processes *S. leptocladum* (7)
 - iii. Semicells with downwards processes, vertical view triangular with deeply concave margin *S. sebaldi* (12)
 - iv. Semicells with downwards curved process with two terminal teeth *S. peristephes* (9)
 - v. Semicells with small downwards process without terminal teeth *S. dicodon*(3)
3. Cells bearing a single spine at each angle *S. dickiei* (2)
4. Semicells with six processes *S. tohopekaligense* (13)
5. Cells with five process in top view *S. arachene* (1)
6. Cells with undulate cell wall and size processes *S. pinnatum* (10)
7. Semicells angularly elliptic, apex distinctly convex *S. punctulatum* (11)

TAXONOMIC DESCRIPTION

1. *Stauastrum arachne* Ralfs var. *sumatranum* Scott & Prescott

Pl. 1, Fig. 9 (top view)

Cells small, longer than broad (excluding the processes) depresses, constriction shallow with an acute notch, semi cells some what broadening towards the slightly convex apex, short and emarginate processes tipped with 2-3 minute spines, top view with five processes.

Cells 15 μm diameter, 35 μm long with processes.

Locality - Pond on Khajuraho road, Mahoba.
 Sample No. - UPCBR 20263
 Date of Coll. - 3.12.2000

2. *Stauastrum dickiei* Ralfs var. *circularis* Turner Pl. 1, Fig. 10, 11

Cells small circular slightly longer than broad, semicells semicircular sinus open, vertical view usually triangular, sides concave, each with a straight spine, cell wall smooth, chloroplast triangular, with two parallel lobes extending to each angle of the semicell, pyrenoid single.

Cells 20 μm diameter, 30-31.5 μm with spines, isthmus 6.5 μm , spines 5-6.5 μm long.

Locality - Charkhari lake, Mahoba.

Sample No. - UPCBR 20328

Date of Coll. - 5.5.2000

3. *Stauastrum dicodon* (Bruhl and Biswas) Prasasoterto

Pl. 1, Figs. 14 & 15

Cell of medium size, slightly longer than broad, sinus widely open, apices showing undulate margin and relatively shorter and emarginated process with out spines.

Cells 30-32 μm diameter, 35-40 μm with processes, isthmus 12.6 μm ,

Locality - Keerat Sagar lake, Mahoba.

Sample No.: - UPCBR 20325

Date of Coll. - 19.2.2000

4. *Stauastrum gracile* Ralfs. var *coronulation* Bold

Pl. 1, Figs 4 & 5

Cells of medium size about 2.3 times longer than broad (excluding the processes), depressed, constriction shallow with an acute notch; semi cells some what broadening towards the slightly convex apex, apices showing undulate margins and relatively shorter and emarginate processes tipped with 2-3 minute spines and showing 4-5 concentric rows of dentations, top view triangular with dentation within the lateral mar-

gins.

Cells 35-37 μm long, with processes 40-50 μm diameter, isthmus 9-10 μm .

Locality - National Botanical Garden pond, Lucknow

Sample No. - UPCBR 99107

Date of Coll. - 7.9.99

5. *Staurastrum gracile* Rolfs. F Iyengar & V Bai
Pl. 1, Figs. 12, 16 & 19

Cells small, about 1.5 times longer than broad with slight constriction in the form of an acute notch; semi cells slightly broadening towards the faintly convex apex, upper angles produced in to more or less horizontally disposed long processes tipped with three minute spines and showing many concentric series of denticulations, top view triangular, chloroplast axile with one pyrenoid in each semi cell.

Cells 20 μm diameter, 32-34 μm with processes, 26-27 μm long, isthmus 6-7 μm .

Locality - Pond near Gopal Khera, Mohanlalganj Lucknow.

Sample No. - UPCBR 20407

Date of Coll. - 20.8.2000

6. *Staurastrum kalapanii* Prasad & Misra
Pl. 1, Fig. 7

Cells small, slightly broader than long, deeply constricted, sinus open and acute-angled; semicells narrowly cuneate, ventral margin some what more convex than dorsal margin, lateral angles round and upwardly turned, top view triangular with concave sides; cell wall finely punctuate, punctuations arranged in concentric series around the angles.

Cell 20-22 μm diameter, 18-20 long, isthmus 6 μm .

Locality - Charkari lake, Mahoba

Sample No. - UPCBR 20328

Date of Coll. - 5.5.2000

7. *Staurastrum leptocladum* Nordst. var. *cornutum* Wille.

Pl. 1, Figs 1

Cells single, medium size, fairly constricted, sinus dividely open, semi cells truncate gradually attenuated towards the apex, angles of the semi cells produced into long hollow slender processes with sharply dentate upper and lower margins, at the end of arms two divergent teeth, the apex of the semi cell is distinctly elevated and flattened, with two short sub-apical spines inserted one on each side, chloroplast axile with a four radiating forked processes.

Cells 35-38 μm diameter, 78-92 μm with processes, isthmus 8.5-9.5 μm .

Locality - Charkhari lake, Mahoba.

Sample No. - UPCBR 20328

Date of Coll. - 5.5.2000

8. *Staurastrum pachyrhynchum* Nordst.
Pl. 1, Fig. 3 (Top view)

Cells rather small, almost as long as broad, deeply constricted, sinus open and acute angled, semicells sub elliptic, dorsal margin strongly convex, angles thickened, obtusely rounded and slightly produced with a faint upward till; top view triangular showing convex sides; cell wall smooth.

Cells 25 μm diameter, 22 μm long, isthmus 8.5-9.5 μm .

Locality - Charkhari lake, Mahoba.

Sample No. - UPCBR 20328

Date of Coll. - 5.5.2000

9. *Staurastrum peristephes* Scott and Prescott
Pl. 1, Figs 2

Cells medium size, smaller than the width with processes, deeply constricted, sinus widely open, semicells subtrapezoidal, ventral margins of semicell with two large emarginate verrucae; upper lateral angles produced in to stout down warty curved processes with two terminal teeth, verrucose, ventral margins and dorsal margins bearing size large verrucae, each with two to four teeth, apical margin bearing four verrucae. Invertical view a triangular body with slightly convex sides, angles produced into very stout processes with two terminal teeth and size bifid verrucae, apical area bearing six verrucae.

Cells 50-55 μm diameter with processes, 40 μm long, isthmus 12 μm

Locality - National Botanical Garden pond, Lucknow.

Sample No. - UPCBR 99130

Date of Coll. - 7.9.99

10. *Staurastrum pinnatum* Turn. var. *subpinnatum* (Schm.) West and forma *robustum* Krieg.

Pl. 1, Fig. 8

Cells small, longer than wide, deeply constricted sinus widely open, semicells subtrapezoidal, upper angles produced in to more or less horizontally disposed long processes tipped with three minute spines; top view with five processes, chloroplast axial, cell wall undulate.

Cells 25 μm diameter, 50 μm with processes

Locality - Charkhari lake, Mahoba.

Sample No. - UPCBR 20330

Date of Coll. - 5.5.2000

11. *Staurastrum punctulatum* Brebisson

Pl. 1, Fig. 13

Cells small, as long as broad with processes, deeply constricted, sinus acute and widely open, semi cells angularly elliptic with dorsal and ventral margins convex, angles acutely rounded, vertical view triangular, sides usually concave, angles acutely rounded, cell wall with flattened granules arranged in regular series. Cells 28 μm diameter, with processes 27 μm long, isthmus 10 μm .

Locality - Charkhari lake, Mahoba.

Sample No. - UPCBR 20328

Date of Coll. - 5.5.2000

12. *Staurastrum sebaldi* Reinsch var. *ventriverrucosum* Scott & Pres.

Pl. 1, Fig. 6

Cells medium size, wider than long, deeply constricted, sinus open, semi cells sub-elliptical, lateral angles produced short stout processes with two terminal teeth, ventral margins with six emarginated bifid to quadrifid verrucae, dorsal margin also bearing similar verrucae, in vertical view triangular with deeply concave margins continuous with the processes which have narrowly rounded ends and a single visible terminal tooth with sometimes another smaller tooth visible at its base, intra-marginally three curved rows of emerginate bifid to quadrifid verrucae of which a group of six near the center and larger than the others and set at a different angle, forming a hexagon.

Cells 40 μm diameter, with processes 30 μm long, isthmus 10 μm .

Locality - National Botanical Garden pond Lucknow.

Sample No. - UPCBR 99102

Date of Coll. - 1.10.99

13. *Staurastrum tohopekaligense* Wholte and Orma f minus Scott & Prescott

Pl. 1, Figs 17,18

Cells small, with processes slightly broader than long, deeply constricted, sinus open, each semicells with eight bifurcate short processes, chloroplast axial with one central pyrenoid cell wall smooth.

Cells 25-27 μm with processes, 22 μm long, isthmus 12-15 μm .

Locality - Keerat Sagar lake, Mahoba.

Sample No. - 20324

Date of Coll. - 19.2.2000

PLATE 1

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|------|--|-----------|--|
| 1. | <i>Staurastrum leptocladum</i> var. <i>cornutum</i> x 1000 | 8. | <i>S. pinnatum</i> var. <i>subpinnatum</i> (top view) x 1000 |
| 2. | <i>S. peristephes</i> x 1000 | 9. | <i>S. arachne</i> var. <i>sumatranum</i> (top view) x 1000 |
| 3. | <i>S. pachyrhynchum</i> (top view) x 1000 | 10, 11. | <i>S. dickiei</i> var. <i>circular</i> x 1000 |
| 4,5. | <i>S. gracile</i> var. <i>coronulatum</i> x 1000 | 12,16,19. | <i>S. gracil</i> forma Iyengar et Vimala Bai x 1000 |
| 6. | <i>S. sebaldi</i> var. <i>ventriverrucosum</i> x 1000 | 13. | <i>S. punctulatum</i> x 1000 |
| 7. | <i>S. kalapanii</i> x 1000 | 14,15. | <i>S. dicodon</i> x 1000 |
| | | 17,18. | <i>S. tohopekaligense</i> forma <i>minus</i> |

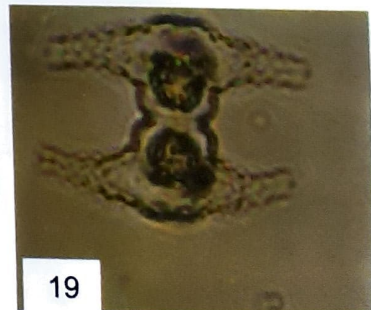
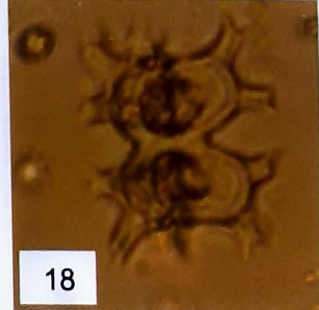
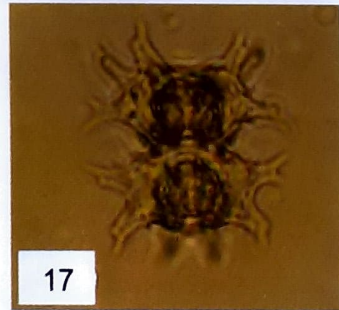
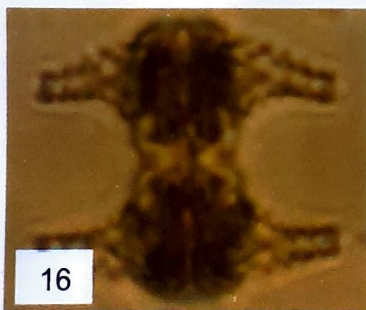
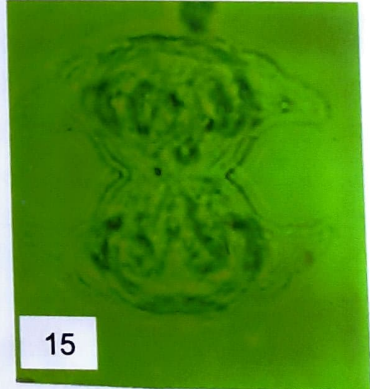
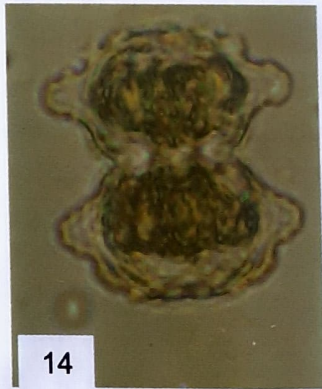
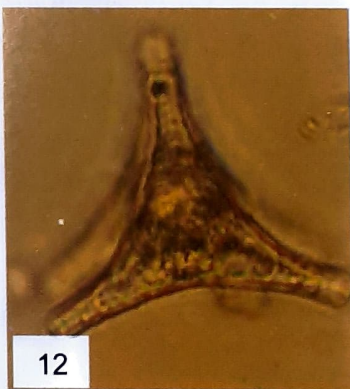
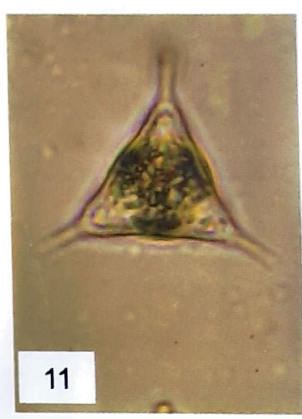
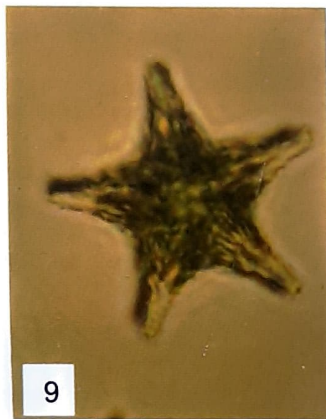
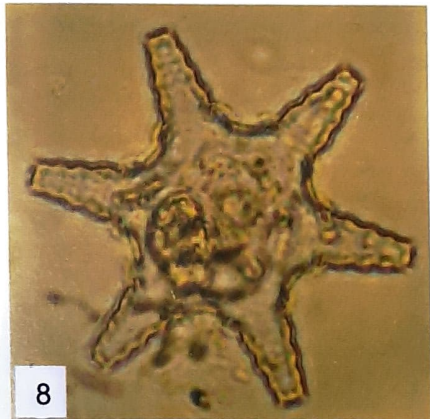
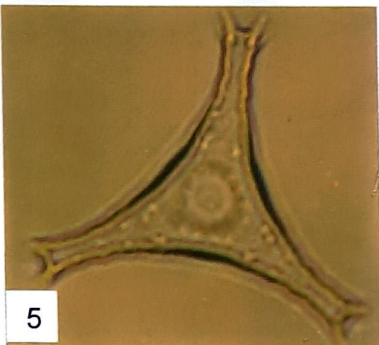
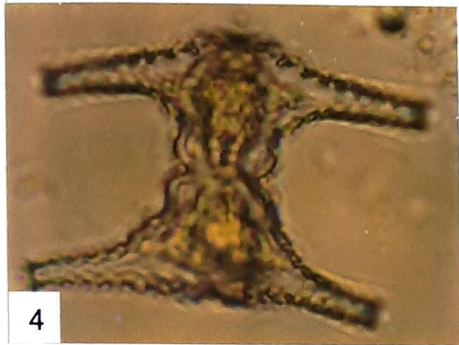
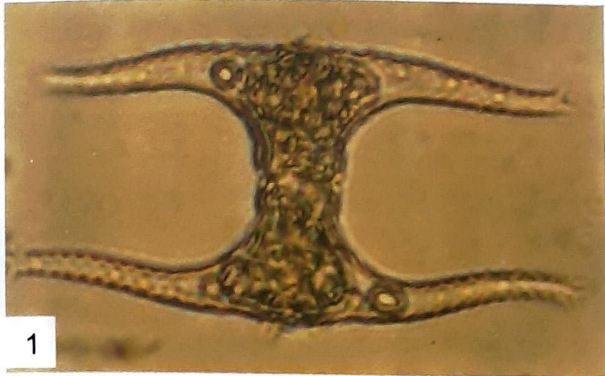


Table1. Distribution and dominance of different species of genus *Staurastrum* Meyen from central and western Uttar Pradesh.

S. N.	Name of species	Central region									Western region					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	<i>S. leptocladum</i> var. <i>cornutum</i>	-	-	-	+	-	-	-	-	+++	-	-	-	-	-	-
2.	<i>S. peristephes</i>	+	-	-	-	-	-	-	+	+	-	-	-	-	-	+
3.	<i>S. gracile</i> var. <i>coronulatum</i>	++	+	+	+++	+	-	-	-	+	-	++	+	-	+	++
4.	<i>S. sebaldi</i> var. <i>ventriverrucosum</i>	-	-	-	+	-	-	-	-	+++	-	-	-	-	-	-
5.	<i>S. gracil</i> forma Iyengar et Vimla Bai	+	+++	+	-	-	+	+	-	+++	-	++	-	-	-	+
6.	<i>S. punctulatum</i>	+	-	-	-	+	-	-	-	++	-	+	-	-	+	-
7.	<i>S. tohopekaligense</i>	-	-	-	+	-	-	+	-	+++	-	-	-	-	-	+
8.	<i>S. kalapanii</i>	-	-	-	-	-	-	-	-	++	-	++	-	-	-	-
9.	<i>S. pinnatum</i> var. <i>subpinnatum</i>	+	-	-	-	-	-	-	-	-	+	-	+	-	-	-
10.	<i>S. arachne</i> var. <i>sumatranum</i>	-	-	-	-	-	-	-	-	-	-	-	-	+++	-	-
11.	<i>S. dickiei</i> var. <i>circularae</i>	+	-	-	++	-	+	-	+	+	-	-	-	-	+	-
12.	<i>S. pachyrhynchum</i>	-	-	-	-	-	-	-	-	-	-	+++	-	-	-	-
13.	<i>S. dicodone</i>	+	+	-	++	-	-	+	+	-	+	++	-	++	-	+

(+++) Dominant, (++) Common, (+) Rare, (-) Absent.

Central Region Localities:

1. Pond near Gaughat
2. Pond Indrajeet khera, Mohanlalganj
3. Pond Telibaj, Lucknow
4. Pond N.B.R.I. Lucknow
5. Pond on Deva road Barabanki
6. Pond near Moti village Barabanki
7. Pond near Bachrawa, Raibareilly,
8. Pond near Neem Tekerri, Raibareilly

Western Region

9. Keerat sagar lake Mahoba
10. Madan sagar lake Mahoba
11. Charkhari lake Mahoba
12. Tola lake Mahoba
13. Pond on Khajuraho road Mahoba
14. Pond near Kiamganj, Farukhabad
15. Pond near Rashidpur, Farukhabad

DISCUSSION

During present investigation, a total number of 13 species of the genus *Staurastrum* Meyen belonging to family Desmidiaceae of class Chlorophyceae have been studied on the basis of morphotaxonomic observation. Collections were made from 15 different localities in central and western region of Uttar Pradesh. In the Keerat sagar lake of Mahoba district nine species were found while seven species were found at Charkhari lake. The *Staurastrum gracile* var. *cornulatum* was common planktonic alga found at 10 localities, while *S. gracile* occurring at eight localities out of 15 localities. *S. kalapanii* was common at Charkhari pond Mahoba. *S. peristephes*, *S. gracile* and *S. pinnatum* var. *subpinnatum* were rare at Gaughat of central region. Detailed distribution pattern and dominance of various species of the genus *Staurastrum* Meyen are given in Table 1.

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