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# THE GENUS *SORASTRUM* KÜTZING (HYDRODICTYACEAE, SPHAEROPLEALES, CHLOROPHYTA) FROM INDIA, WITH A NEW SPECIES *S. PHILIPOSIANUM*

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**Abstract**

In the present paper five species of *Sorastrum* Kützing including a new species, *Sorastrum philiposianum* have been described from Bankura and Purulia districts of West Bengal, India. Amongst these species *S. indicum* Bernard and *S. hathoris* (Cohn) Schmidle are being reported for the first time from India. Moreover, *S. americanum* (Bohlin) Schmidle is an addition to West Bengal algae. All the specimens have been collected from desmids habitats of West Bengal having a low pH (5.0-6.5) and those were growing lodged on submerged portions of the aquatic weeds like *Ceratophyllum demersum* L., *Hydrilla verticillata* (L.f.) C. Presl and *Ipomoea aquatica* Forssk.

## Introduction

*Sorastrum* Kützing (1845) is a rare planktonic coenobial member of the Family Hydrodictyaceae under the Order Chlorococcales occurring mostly in a mixed assemblage with other planktonic members and lodged on submerged aquatic weeds. Although the genus is treated under Chlorococcales, the recent taxonomic revisions (Deason *et al*., 1991; Buchheim *et al*., 2005; McManas and Lewis, 2005; Graham *et al*., 2009) suggest its inclusion under the members of Hydrodictyaceae belonging to Sphaeropleales. Due to its small size and sparse occurrence the genus is easily overlooked. Komárek and Fott (1983) recognized 7 species of this genus world over. Patel and George (1984) added one more species *S. sphericum* Patel *et* George to this list. Earlier following taxa of the this genus have been recorded from India, *viz*., *S. bengalicum* Philipose, *S. americanum* (Bohlin) Schmidle, *S. americanum* var. *undulatum* G. M. Smith, *S. sphericum* Patel *et* George and *S. spinulosum* Nägeli (Carter, 1869; Turner, 1892; Carter, 1926; Subba Raju, 1963; Philipose, 1967; Anand, 1975, 1987; Sarma and Khan, 1980, 1991; Patel, 1970; Patel and George, 1984; Patel and Isabella, 1977; Kamat,1974; Freitas, 1980; Ashtekar and Kamat, 1980; Compère, 1983; Habib and Chaturvedi, 2001; Jaiswal and Tiwari, 2003; Gupta 2012). During the systematic investigations on the planktonic algae of West Bengal the authors recorded five species of the genus from the desmid habitats of Bankura and Purulia districts of West Bengal.

## Materials and Methods

The algal samples were collected from different desmid habitats of Bankura and Purulia districts of West Bengal, India. The pH, temperature and detailed ecological notes were recorded at collection spots. The specimens were preserved in 5% formalin. Camera Lucida drawings were made both from live and preserved specimens using G.W.F. solution (Bando, 1988).

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## Results and Discussion

### Taxonomic treatment

**1. Sorastrum americanum** (Bohlin) Schmidle 1900 (**Pl. 1; Figs 1, 2**).

(Komárek and Fott, 1983, p. 312, pl. 94, f. 1a-g; Comas, 1996, p. 47, f. 5A-C).

Colony of 16 heart shaped or pyramidal cells, 42-47 µm in diameter (26-32 µm without spines), with distinct pith; cells 6.0-9.5 µm broad, 10-14 µm long, narrowed towards the base, attached to the centre by a short cylindrical stalk and with two long stout outwardly directed spines at each end; spines 12-14 µm long, 3.5-6.0 µm thick.

Collection No. PM 664, dated 1.12.2001, Saheb-bandh, Purulia (Dist. Purulia) growing lodged on submerged leaves of *Ceratophyllum demersum* L. in a creamy colour assemblage (pH 5, temp. 24°C).

*Distribution in India:* Maharashtra (Kamat, 1974), Kashmir (Subba Raju, 1963), U.P (Mathur and Pathak, 1990; Jaiswal and Tiwari, 2003).

*Note:* This is the first report of the species from West Bengal, India.

**2. Sorastrum indicum** Bernard 1908 (**Pl. 1, Fig. 3**).

(Komárek and Fott, 1983, p. 312, pl. 94, f. 6).

Colony of 8 cells, 32-35 µm in diameter (19-22 µm without spines), cells reniform, 9-12 µm broad, 3-4 µm long and 3 µm thick, both ends blunt with two sharp 5.5-7.5 µm long spines at each end; cells attached to a short central stalk.

Collection No. PM 1140, dated 17.2.2003, Lal-bandh, Bishnupur (Dist. Bankura), growing lodged on rotting submerged *Hydrilla verticillata* (L.f.) C. Presl leaves in a form of brownish colour mass in a lake (pH 5.5, temp. 23.5°C).

*Note:* This is the first report of the species from India.

**3. Sorastrum hathoris** (Cohn) Schmidle 1900 (**Pl. 1, Fig. 4**).

(Komárek and Fott, 1983, p. 312, pl. 93, f. 8).

Colony of 16 cells, 38 µm in diameter (27 µm without spines); cells 9-14 µm broad, 6-7 µm long and 8-9 µm thick, crescent shaped to cuneate with long stalk and having two short pointed spines from each angle; spines 7-8 µm long.

Collection No. 344, dated 17.10.2001, Lal-bandh, Bishnupur (Dist. Bankura) growing lodged on the *Ipomoea aquatica* Forssk. stems in a form of a yellowish mass with some filamentous green algae (pH 6, temp. 33°C).

*Note*: This is the first record of the species from India.

**4. Sorastrum spinulosum** Nägeli 1849 (**Pl. 2, Figs 8, 9**).

(Philipose, 1967, p. 132, f. 47; Hindak, 1980, p. 183, pl. 69, f. 16; Komárek and Fott, 1983, p. 310, pl. 93, f. 5a-e; Comas, 1996, p. 48, f. 4B).

Colony of 4-8 cells, 27-30 µm in diameter (19-23 µm without spines); cells 10-12 µm broad, 5.5-7.0 µm long, 4-6 µm thick, reniform to cuneate, three-angled with a short stalk, having two sharp pointed spines from each angle; spines 6.0-7.5 µm long.

Collection No. PM 1116, dated 31.12.2002, Lal-bandh, Bishnupur (Dist. Bankura) growing on submerged and rotting leaves of *Hydrilla verticillata* (L.f.) C. Presl and *Ceratophyllum demersum* L. in a form of a brown colour mass (pH 6, temp. 19°C).

*Distribution in India:* Andhra Pradesh (Philipose, 1967), Assam (Carter, 1926), Bihar (Singh and Saha, 1982), Jammu (Anand, 1975, 1987), Kashmir (Compère, 1983), Maharashtra (Carter, 1869; Gonzalves and Joshi, 1946; Kamat, 1963; Freitas, 1980), Meghalaya (Turner, 1892), M.P. (Mathur and Pathak, 1990), Orissa (Philipose, 1967), Tamilnadu (Rani *et al.*, 2007), Uttarakhand (Gupta, 2005), U.P. (Pandey *et al.*, 1981; Pandey *et al.*, 1983; Habib *et al.*, 1988; Habib and Charaurvedi, 2001; Jaiswal and Tiwari, 2003) and West Bengal (Turner, 1892; Mallick and Keshri, 2008).

*Note:* This is a fairly common and cosmopolitan species of the genus.

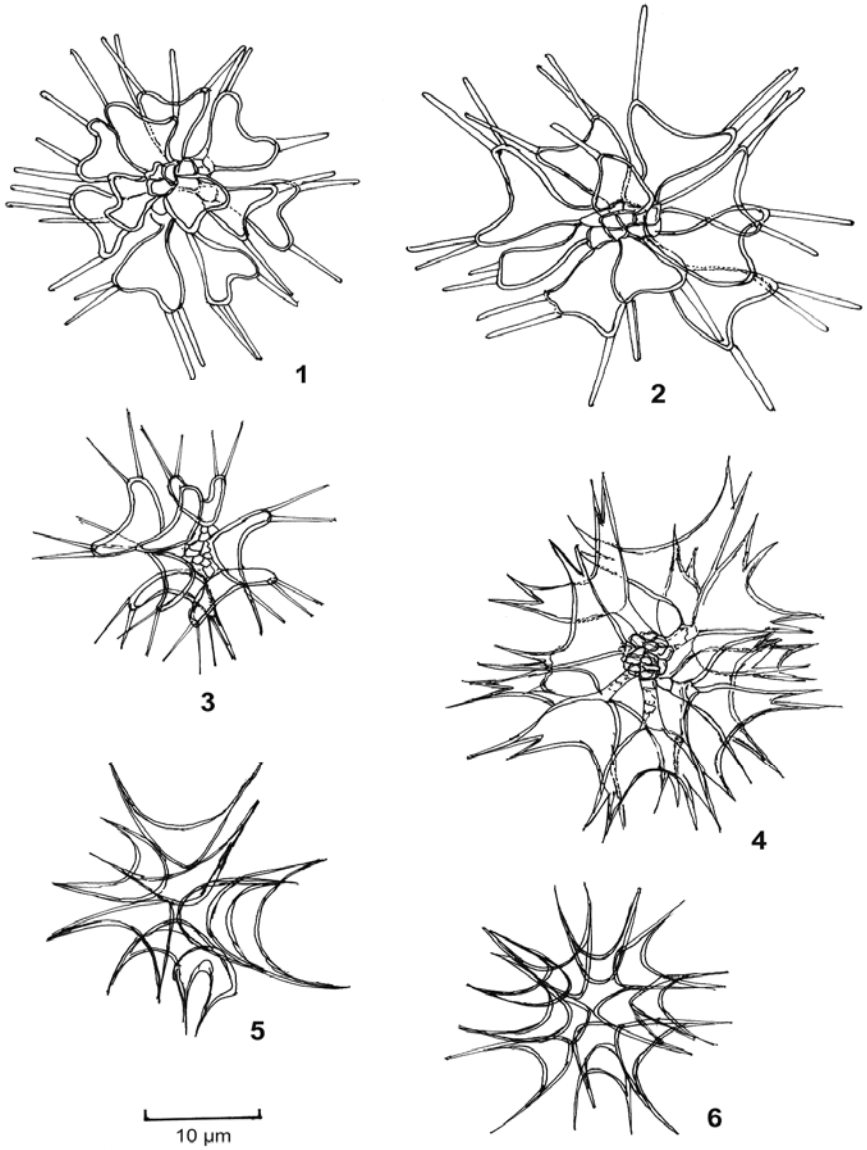


Plate 1. Figs 1 & 2. *Sorastrum americanum* (Bohlin) Schmidle; Fig. 3. *S. indicum* Bernard; Fig. 4. *S. hathoris* (Cohn) Schmidle; Figs 5 & 6. *S. philiposianum* Keshri *et* Mallick, **sp. nov**.

**5. Sorastrum philiposianum** Keshri *et* Mallick, **sp. nov.** (**Pl. 1, Figs 5, 6; Pl. 2, Fig. 7**).

**Diagnosis**: *Colonia 8-16 cellularum, medulla praetermissa, 36-42 µm in diametro (28-30 µm sine spinis); Cellulae pulchre curvatae, semi lunatae vel crescentiformes, 9-12 µm longae, cum extremis mutatis in spinis acutis dispositis subparallis ad axem verticallem; spinae 6-9 µm longae et 5.0-6.5 µm crassae ad basin.*

*Holotypus*: lectus die 1.12.2001 sub numero PM 664, ad locum Saheb-bandh, Purulia, crescens affixus in *Ceratophyllum demersum* L. foliis submerses in lacu (pH 5, temp. 24°C).

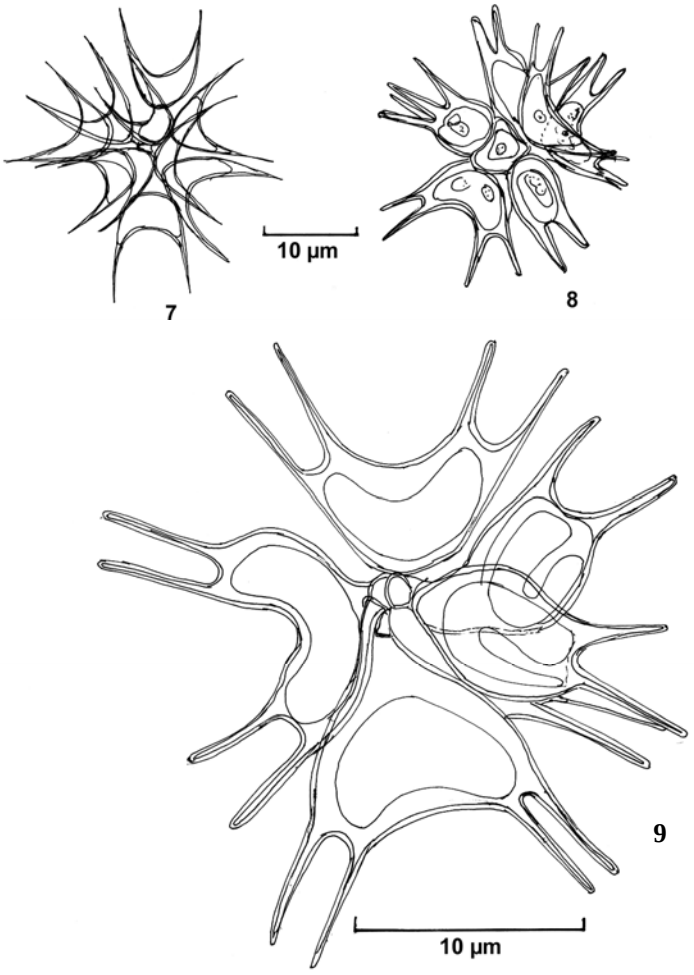


Plate 2. Fig. 7. *S. philiposianum* Keshri *et* Mallick, **sp. nov.**; Figs 8 & 9. *S. spinulosum* Nägeli (Scale Bar = 10 µm).

Colony of 8-16 cells with negligible pith, 36-42 µm in diameter (28-30 µm without spines); cells gracefully curved, semi-lunate to crescent shaped, 9-12 µm broad, 6.5-8 µm long with ends into a sharp spine disposed almost parallel to the vertical axis; spines 6-9 µm long and 5.0-6.5 µm thick at base.

**Table 1. A comparative account of the *Sorastrum* species.**

| Species | Cell Shape | Stalk of the cell | Pith | Spine | Colony Size | Cell size |
|---|---|---|---|---|---|---|
| *S. americanum* | Heart shaped | Distinct, short & broad | Distinct, multicellular | 4, long, blunt, apart | 22-61 µm | 4.8-20.0 µm broad, 4-8 µm thick |
| *S. bengalicum* | Spherical to ovoid | Short, not discernible | Short, not discernible | 2, small, apart | 25 µm | 3-5 µm diameter |
| *S. bidentatum* | More or less rectangular with extended arms | Short, not discernible | Short, not discernible | Absent, mere elevation only | 28-32 µm | * |
| *S. hathoris* | Crescent shaped | Distinct, long | Distinct, multicellular | 4, sharp, narrow | 27-38 µm | 16-22 µm broad, 10 µm thick |
| *S. indicum* | Reniform | Indistinct, short | Negligible | 4, sharp, not broad at base | 15-20 µm | 6 x 10 µm |
| *S. minimum* | Triangular | Distinct | Short, distinct | 2, blunt | Not recorded | 4-6 µm broad |
| *S. philiposianum* **sp. nov.** | Semilunate to crescent shaped | Negligible | Negligible | 2, sharp, long | 36-42 µm | 9-12 µm broad (thick), 6.5-8.0 µm long |
| *S. sphericum* | Spherical | Not discernible | Short, distinct | 2, stout, closely placed | 60-80 µm | 22-30 µm |
| *S. spinulosum* | Reniform or cuneate | Distinct, short | Distinct, multicellular | 4, pointed or blunt, short, broad at base | 27-35 µm | 6-8 µm long, 8-20 µm broad, 5-8 µm thick |

*Not mentioned in the description of type species.

*Holotype*: No. PM 664, dated 1.12.2001, Saheb-bandh, Purulia growing lodged on submerged *Ceratophyllum demersum* L. leaves in a form of creamy colour assemblage in a lake (pH 5, temp. 24°C).

*Repository*: Algae Herbarium, Department of Botany, The University of Burdwan, West Bengal, India (BURD).

*Etymology*: The species has been named in honour of Late Professor M. T. Philipose, who has significantly contributed to the taxonomy of this group.

*Notes*: This new species differs from all the existing species of *Sorastrum* in the distinctive nature of colony, its cell shape and nature and disposition of spines. A comparative account of the species is appended in Table 1.

## Conclusion

Our knowledge about the planktonic green algae of India is still insufficient (Sarma and Khan, 1980, 1991; Gupta, 2012). Since they play distinctive roles in aquatic ecosystem this knowledge may be utilized for various purposes. *Sorastrum* Kützing is a rare genus, not well explored. In this work attention has been given to taxonomic and ecological perspective. It has been observed that some aquatic angiosperms like *Ceratophyllum demersum* L., *Hydrilla verticillata* (L.f.) C. Presl and *Ipomoea aquatica* Forssk. provide suitable substance for the growth and survival of the coenobial members of Sphaeropleales as well as to the desmids. Little acidic pH is also a determining factor.

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