



## Desmid diversity in Khanajan - a manmade channel linking Deepor beel Ramsar site to Brahmaputra River (India)

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### ARTICLE INFO

#### Article history:

Received : 17 November 2013  
Accepted : 12 December 2013

#### Keywords:

Desmids  
Khanajan  
Seasonality  
Brahmaputra River  
Deepor beel

### ABSTRACT

For compilation of desmid flora, the authors studied the species diversity of planktonic desmids collected from Khanajan water channel regularly at the interval of one month from November 2011 to December 2012. A total of 22 taxa of desmids have been identified belonging to seven genera, that are *Closterium* Nitzsch (5 species), *Euastrum* Ehrenberg (1 species), *Micrasterias* C.A.Agardh (2 species), *Cosmarium* Corda ex Ralfs (9 species), *Anthrodesmus* Ehrenberg (1 species), *Staurastrum* Meyen (3 species) and *Desmidium* C.A.Agardh (1 species). All the taxa are taxonomically enlisted. The annual mean values of the total cell density and biomass were  $84.02 \times 10^2$  cells/L and 0.048 mg/L respectively. Higher occurrence of desmids with 17 taxa in post-monsoon season had attributed to heavy rainfall and back flow of Brahmaputra water. *Cosmarium* was the most abundant genus particularly in monsoon and pre-monsoon season.

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## 1. Introduction

Desmids are the freshwater phytoplankton belonging to the green algal order Zygnematales. They may be unicellular or filamentous, comprising of two semicells which are identical in shape. They are often found in water bodies where the conductivity and nutrient concentrations are very low (Ngearapat and Peerapornpisal, 2007). They are more common and diverse in oligotrophic water ecosystems (Gerrath, 1993) and have been playing an important role in aquatic ecosystem as one of the pioneer groups in food chain. High sensitivity to the changes in the environmental parameters makes them one of the important microbial bio-indicators of any water body (Coesel, 2001).

Knowledge regarding the diversity of desmids in India can be found from the works of Prasad and Misra (1992), Sindhu and Panikkar (1995), Misra and Srivastava (2003), Dwivedi *et al.* (2004), Misra *et al.* (2006), Dwivedi *et al.* (2009). A little work has so far been done in North East India in general and Brahmaputra river valley in particular (Deka

*et al.*, 2011; Yasmin *et al.*, 2011). In order to understand the basic nature of water body in changing environment, an attempt has been made to study the diversity of desmid flora in the Khanajan channel, which carries excess water of Deepor beel Ramsar site during winter and pre-monsoon seasons and takes part in recharging the beel during monsoon to post-monsoon when river Brahmaputra flows above the normal water level. The aim was also to construct the baseline data on desmids for future study. Being a bioindicator of oligotrophic condition, desmids of this discharge and recharge channel of Deepor beel is supposed to tell the health of the Ramsar site.

## 2. Materials and methods

### 2.1 Study site

The present study was carried out in a man-made channel that links the Deepor beel Ramsar site to the mighty Brahmaputra River. The Deepor beel, which is located within the co-ordination of 91°35' E to 91°43' E and 26°05' N to 26°11' N on 165-186 feet above MSL (Saikia and Bhattacharjee, 1987) has been considered of riverine origin and lies on the southern bank of river Brahmaputra covering

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an area of about 40 km<sup>2</sup>. It is a large natural wetland having great biological and ecological importance besides being the only major storm water storage basin for the Guwahati city, the gateway of North East India. The beel is endowed with rich floral and faunal diversity. Deepor beel is characterised by a humid, tropical, prolonged monsoon season from May to September, a short post-monsoon period in October and November, a relatively dry, cool winter starting from December till February and a pre-monsoon period from March to May with occasional storms. The Khanajan, around 5 km long channel with an average width of 65 m was constructed by a local King in the mid seventeenth century to make the Deepor beel a hide out for military boats (Bhuyan, 1989) and thereafter, it has been taking part in natural recharge and discharge of storm and flood water to and from the beel. The channel has thus been performing one crucial role in maintenance of Deepor beel Ramsar site.

## 2.2 Sampling technique

Samples were collected monthly from November 2011 to December 2012. Collections were made with the help of planktonic mesh net (pore size 50µm) and were fixed in 4% formalin (aqueous solution of formaldehyde). Specimens were preserved in the Department of Botany, Gauhati University, Assam. These were microscopically examined (Magnus LXi microscope) and identified using standard literatures (Prasad and Misra, 1992; Perumal and Anand, 2009; Yamagishi, 2010).

The samples for total cell and volume analysis were concentrated into 30 ml after 24 h sedimentation. The procedure of Lund *et al.* (1958) was followed for counting precision. The cell counts were converted into biomass values using the formula as proposed by Yinxi and Minjuan (2005).

## 3. Results and discussion

### 3.1 Species composition and seasonal fluctuation

A total number of 22 species of desmids belonging to seven genera had been identified during the study period. *Cosmarium* was found to be the dominant genus comprising of 9 species (41%) of the total desmids identified (Fig.1). Other genera are *Closterium* (5 species, 23%), *Euastrum* (1 species, 4%), *Micrasterias* (2 species, 9%), *Anthrodesmus* (1 species, 4%), *Staurastrum* (3 species, 14%) and *Desmidium* (1 species, 4%). Majority of the taxa are unicellular, with the exceptions of *Micrasterias foliacea* and *Desmidium bengalicum*, which are filamentous in nature. All species of desmids were, of course, reported earlier from the state of Assam in different explorations in different occasions but seasonal composition was different. The dominant species were different in different seasons. No single species was found during every collecting date (Table-1) indicating that there is no single species dominance in

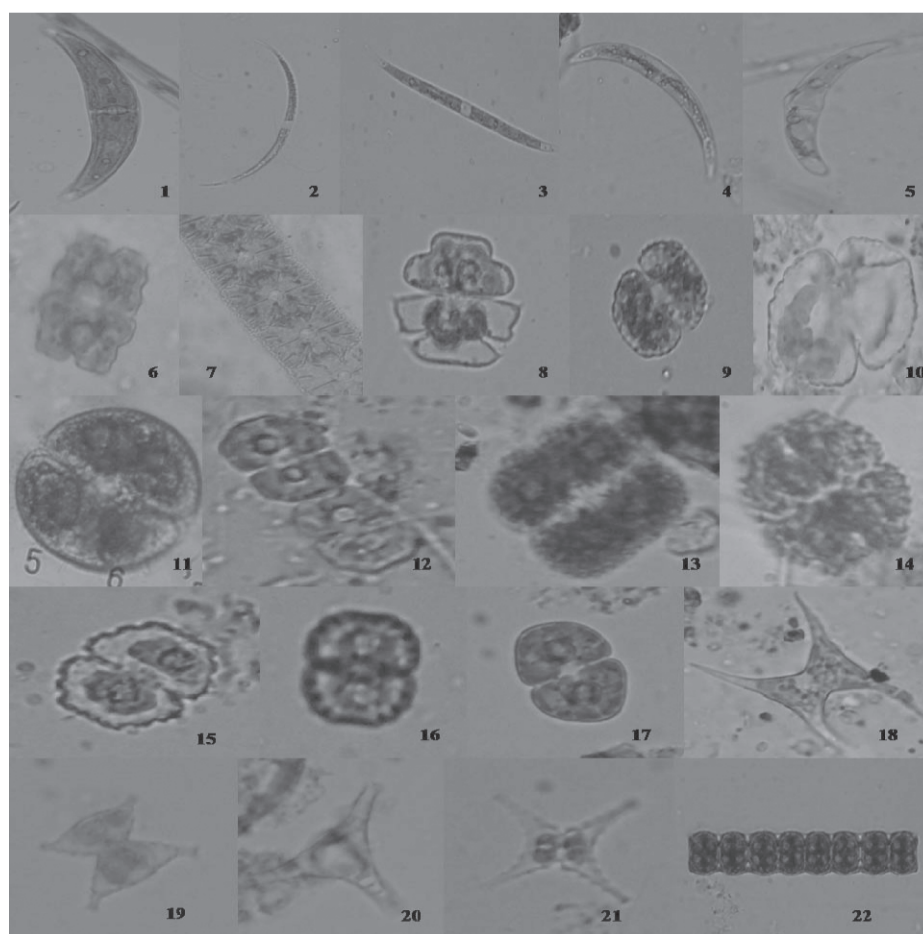


Fig. 1. 1.*Closterium acerosum* (Sch.) Ehrenb. X 1000 2.*Closterium acutum* (Lyngb.) Breb. X 1000 3.*Closterium decorum* Breb. X 800 4.*Closterium diana* Ehrenberg X 800 5.*Closterium leibleinii* Kuetz. X 1000 6.*Euastrum coralloides* Josh X 400 7.*Micrasterias zeylanica* Fritsch X 800 9.*Cosmarium formulosum* Hoffmann X 800 10.*Cosmarium granatum* Breb. X 1200 11.*Cosmarium miscellum* Skuja. X 1200 12.*Cosmarium obsoletum* (Hantzsch) Reinsch. X 400 13.*Cosmarium pseudoretusum* F. Duce. X 1000 14.*Cosmarium quadrum* Lund. X 1000 15.*Cosmarium sexnotatum* Gutw. X 1000 16.*Cosmarium subcrenatum* Hantzsch X 1000 17.*Cosmarium subprotomidum* Nordst. X 1000 18.*Anthrodesmus incus* (Breb.) Hass. X 1000 19.*Staurastrum crenulatum* (Näg.) Delp. X 800 20.*Staurastrum gracile* Ralfs. X 1000 21.*Staurastrum tetracerum* (Kütz) Ralfs. X 1000 22.*Desmidium bengalicum* C.A. Agardh. X 400.

the water body. This is an interesting finding that might be attributed to change of water qualities during recharging and discharging of water either from Brahmaputra river to Deepor beel, or vice versa. Besides such characteristic of the water body also showed that there is no danger of the appearance of algal bloom. All the species reported in the channel are common and distributed worldwide.

The species number and species composition of phytoplanktonic desmids were different in different seasons (Table 1). Maximum was 17 taxa in post-monsoon season followed by monsoon (10 species) and pre-monsoon (6 species) and minimum was 4 taxa during winter months.

### 3.2 Taxonomic enumeration

The systematic positions of the taxa were assigned according to the classification system of Fritsch (1935).

Order: Zygomatales

Family: Desmidiaceae

Genus: *Closterium* Nitzsch 1817

1. *Closterium acerosum* (Sch.) Ehrenb. (p. I, f. 1)  
Collection number and date- KJR/192, 18-07-2012.
2. *Closterium acutum* (Lyngb.) Breb. (p. I, f. 2)  
Collection number and date- KJR / 045, 14-02-2012.
3. *Closterium decorum* Breb. (p. I, f. 3)  
Collection number and date: KJR /221, 16-10-2012.
4. *Closterium diana* Ehrenberg (p. I, f. 4)  
Collection number and date: KJR /229, 16-10-2012..
5. *Closterium leibleinii* Kuetz. (p. I, f. 5)  
Collection number and date: KJR / 292, 14-12-2012.

Genus: *Euastrum* Ehrenberg 1832

1. *Euastrum coralloides* Josh (p. I, f. 6)  
Collection number and date: KJR / 036, 06-01-2012.

Genus: *Micrasterias* C.A. Agardh

1. *Micrasterias foliacea* Bail. (p. I, f. 7)  
Collection number and date: KJR / 009, 25-11-2011.
2. *Micrasterias zeylanica* Fritsch (p. I, f. 8)  
Collection number and date: KJR / 223, 16-10-2012.

Genus: *Cosmarium* Corda ex Ralfs 1848

1. *Cosmarium formulosum* Hoffmann (p. I, f. 9)  
Collection number and date: KJR / 165, 25-06-2012.
2. *Cosmarium granatum* Breb. (p. I, f. 10)  
Collection number and date: KJR / 235 16-10-2012.

3. *Cosmarium miscellum* Skuja (p. I, f. 11)  
Collection number and date: KJR / 276, 25-10-2012.
4. *Cosmarium obsoletum* (Hantzsch) Reinsch (p. I, f. 12)  
Collection number and date: KJR / 238, 16-10-2012.
5. *Cosmarium pseudoretusum* F. Duce. (p. I, f. 13)  
Collection number and date: KJR / 244, 16-10-2012.
6. *Cosmarium quadrum* Lund (p. I, f. 14)  
Collection number and date: KJR / 180, 06-07-2012.
7. *Cosmarium sexnotatum* Gutw. (p. I, f. 15)  
Collection number and date: KJR / 184, 06-07-2012.
8. *Cosmarium subcrenatum* Hantzsch (p. I, f. 16)  
Collection number and date: KJR / 182, 06-07-2012..
9. *Cosmarium subprotumidum* Nordst. (p. I, f. 17)  
Collection number and date: KJR /278, 25-10-2012.

Genus: *Anthrodesmus* Ehrenberg 1838

1. *Anthrodesmus incus* (Breb.) Hass. (p. I, f. 18)  
Collection number and date: KJR /115, 25-04-2012.

Genus: *Staurastrum* Meyen 1829

1. *Staurastrum crenulatum* (Näg.) Delp. (p. I, f. 19)  
Collection number and date KJR / 078, 14-03-2012.
2. *Staurastrum gracile* Ralfs (p. I, f. 20)  
Collection number and date: KJR / 119, 23-03-2012.
3. *Staurastrum tetracerum* (Kütz) Ralfs. (p. I, f. 21)  
Collection number and date: KJR / 121, 23-03-2012.

Genus: *Desmidium* C.A. Agardh 1824

1. *Desmidium bengalicum* Turner (p. I, f. 22)  
Collection number and date: KJR / 279, 25-10-2012.

### 3.3 Seasonal fluctuation of cell density and biomass

The annual mean values of the total cell density and biomass were  $84.02 \times 10^2$  cells /L and 0.048 mg/L respectively on the basis of average values recorded. The seasonal fluctuation trends of phytoplanktonic desmids were approximately similar in entire extent of the Khanajan channel. The maximum values on cell density were observed in Monsoon ( $683.34 \times 10^2$  cells /L) and on biomass in postmonsoon (0.078 mg/L). The minimum values for both were in premonsoon and the values were  $19.56 \times 10^2$  cells / L and 0.013 mg/L respectively.

This study provides a useful baseline data of the desmidian flora of the state of the Assam belongs to Eastern Himalaya which would certainly help in the further studies based on the algal floristic account of the ecologically

Table 1  
Seasonal occurrence of the desmids taxa in Khanajan during the study period

Sl. No.	Name of the taxa	Seasons			
		Winter	Pre Monsoon	Monsoon	Post monsoon
1.	<i>Closterium acerosum</i>	-	A	A	A
2.	<i>C. acutum</i>	-	C	-	C
3.	<i>C. decorum</i>	-	-	-	O
4.	<i>C. diana</i>	-	-	-	O
5.	<i>C. leibleinii</i>	C	-	-	-
6.	<i>Euastrum coralloides</i>	O	-	C	C
7.	<i>Micrasterias foliacea</i>	-	-	-	C
8.	<i>M. zeylanica</i>	O	-	-	O
9.	<i>Cosmarium formulosum</i>	-	-	A	A
10.	<i>C. granatum</i>	-	-	C	C
11.	<i>C. miscellum</i>	-	-	C	A
12.	<i>C. obsoletum</i>	-	-	-	A
13.	<i>C. pseudoretusum</i>	-	-	-	C
14.	<i>C. quadrum</i>	-	-	C	C
15.	<i>C. sexnotatum</i>	-	-	A	A
16.	<i>C. subcrenatum</i>	-	-	O	A
17.	<i>C. subprotumidum</i>	-	-	-	C
18.	<i>Anthrodesmus incus</i>	O	O	-	-
19.	<i>Staurastrum crenulatum</i>	-	C	C	-
20.	<i>S. gracile</i>	-	C	-	-
21.	<i>S. tetracerum</i>	-	C	C	-
22.	<i>Desmidium bengalicum</i>	-	-	-	A

Note: According to the number of desmids under microscope in each view field: abundant = A; Common = C; occasional = O.

sensitive Eastern Himalaya. Out of the total 22 species identified from the Khanajan channel, which was totally unexplored along with Deepor beel Ramsar site, 9 species were belongs to the Genus *Cosmarium*, an oligotrophic plankton as substantiated by Reynolds (2006) and Dwivedi *et al.* (2009) particularly during monsoon and post monsoon season. Absence of the genus during winter was the indication of change of water quality once the incoming of river water from the Brahmaputra stopped till the onsetting of monsoon. The study thus, revealed that the water quality of the Khanajan channel in monsoon to post monsoon is so far in good condition harbouring the ecologically important desmidian flora. The majority of the desmids enlisted here seemed to be remarkably sensitive to environmental conditions, especially to water chemistry of

the Khanajan and the Deepor beel and were suitable indicator of seasonal eutrophication. The result thus indicated that back flowing of river water from mighty Brahmaputra might be a boon for maintenance of Khanajan channels and Deepor beel Ramsar site too.

#### Acknowledgements

Authors are thankful to University Grant Commission (New Delhi) for financial assistance. The Head, Department of Botany, Gauhati University is also acknowledged for his constant encouragement.

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