GENERAL DISCUSSION
AND
CONCLUSION
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In the present investigation two districts of West Bengal have been selected. These two districts adjoining to Jharkhand state are comparatively unexplored so far the studies on algal flora are concerned. The soil of large sector of these districts is lateritic and water in general is acidic in nature. Moreover rural context of these two districts are more obvious. Due to scanty urbanization pollution level is also low. This background obviously reflects good source of material under study. Extensive field works and ecological notes were taken at collection spots. For ecological studies and intensive investigations two important spots has been selected: one at Bishnupur (Lalbandh) in Bankura district and other at Purulia (Sahebbandh) in Purulia district. The collected samples were brought to laboratory for microscopic observations. Camera lucida drawings were made during microscopic observations. A standard scale was prepared with the help of stage and ocular micrometer and then measurement were taken. Several permanent slides were made for future reference and photomicrography.

Desmids are difficult material for SEM studies, as they secrete copious quantities of mucilage. The surface ornamentation of desmids is an important character for taxonomic identification. Scanning Electron Micrograph (SEM) reveal morphological details not distinguishable under the light microscope. In our observation, it was noticed that the location of pores present on or between warts like projections in the outer surface of the Cosmarium could not be identified or easily distinguished under light microscope. As observed under SEM, the mucilage pore and spines are arranged in a regular group following a specific pattern. Equatorial and polar view could be clearly distinguished with their modifications, for example presence or absence of apical notch helped to distinguish two desmids genera viz. Cosmarium, where apical notch is absent and Euastrum, where it is present. This feature might not always be established by light microscopy. Some taxa under other genera were also studied under SEM viz: Actinotaenium, Staurastrum, Xanthidium, Euastrum, Triploceras, Pleurotaenium and Desmidium. Some interesting observations were made. But the time and fund limits the detailed investigations.

Present investigations also include physicochemical analysis of water [in one of the important desmid spots (Bishnupur – Lalbandh)] and phytosociological associations
of desmids. The methods for physicochemical analysis of water were followed according to APHA (1998). Following parameters were taken into consideration during the investigation –

1. Temperature (°C) - [(a) Atmospheric, (b) Water]
2. pH
3. DO
4. BOD
5. Total Hardness
6. Magnesium Hardness
7. Calcium Hardness
8. Chloride
9. Nitrate
10. Phosphate

In this investigation it was noticed that winter season is the best time for desmid growth including reproductive stage also. So all data provided by the winter season gives us a clue for good desmid growth.

Some desmidologists like Brook (1981) also noticed that desmid growth prefers a number of angiospermic associations. Our observation also supports the earlier accounts. In this investigation it has been found that number of angiosperms are commonly associated with desmid growth. These are Hydrilla, Ceratophyllum and Utricularia.

On the basis of above mentioned observations, identifications were made with the help of available standard monographs (Croasdale et al. 1983; Dillard 1990, 91, 93, 03; Krieger, 1937, 39; Krieger & Gerloff, 1962, 65, 69; Lenzenweger, 1996, 97, 99, 03; Prescott 1962; Prescott et al. 1975, 77, 81, 82; West and West 1904-12; West et al. 1923; Wehr and Sheath, 2003; Ling & Tyler 1986; Scott & Prescott, 1961; Turner, 1892.) and research paper appeared in various national and international journals.

About 1200 samples have been collected throughout the research programme (between September 2000 to March 2005). 320 taxa have been identified in the present investigation; of them 26 taxa under saccoderm (Mesotaeniaceae) and 294 taxa belonging to placoderm desmid (Gonatozygaceae, Peniaceae, Closteriaceae and Desmidiaceae). It is interesting to note that out of 45-50 genera known world over (Bando, 1988; Brook 1981, 98; Coesel 1993, 97; Compère 1996; Croasdale et al. 1983; Dillard 1990, 91, 93, 03; Krieger, 1937, 39; Krieger & Gerloff, 1962, 65, 69; Lenzenweger, 1996, 97, 99, 03; Prescott 1962; Prescott et al. 1975, 77, 81, 82; West and West 1904-12; West et al. 1923; Wehr and Sheath, 2003) 33 have been recorded in the present study. Out of 320 taxa, 59 taxa have been described as new to science that include 6 under saccoderm and 53 under placoderm. In addition, one new combination of placoderm desmid has been proposed in the genus Haploptaeenium. Twenty five taxa under following five genera – (Cylindrocystis,
Mesotaenium, Spirotaenia, Netrium and Roya) are added to West Bengal algal flora that also included 21 as additions to the Indian algal flora. 267 taxa of placoderm desmid under 28 genera (Gonatozygon, Genicularia, Penium, Closterium, Euastrum, Cosmarium, Actinotaenium, Brachytheca, Bourrellyodesmus, Xanthidium, Arthrodemesmus, Spinocosmarium, Stauroastrum, Staurodesmus, Pleurotaenium, Haplootaenium, Docidium, Streptonema, Hyalotheca, Spondylosium, Groenbladia, Teilingia, Onychonema, Sphaerozosoma, Desmidium, Micrasterias, Triploceras and Triplastrum) have been reported as addition to West Bengal algal flora including 198 as additions to the Indian algal flora. In this investigation, out of 33 genera, 23 had already been reported by earlier workers (Turner 1892, Pal & Santra 1993, Mukherjee & Srivastava 1993). Ten (10) genera, namely Netrium, Roya, Actinotaenium, Brachytheca, Bourrellyodesmus, Spinocosmarium, Haplootaenium, Groenbladia, Teilingia and Triplastrum are being recorded for the first time to West Bengal algal flora. It is noteworthy that eight (8) genera namely Actinotaenium, Brachytheca, Bourrellyodesmus, Spinocosmarium, Haplootaenium, Groenbladia, Teilingia and Triplastrum are being recorded for the first time from India in this investigation. Under these eight genera several new taxa have been introduced as new to science.

The genus Actinotaenium was created by Teiling (1954). The genus possesses special features not found in others existing genera, such as cells never compressed and mostly elongated with minimum median constriction. In this investigation five taxa have been described.

Brachytheca Gontcharov & Watanabe (1999) is a rare and recently described genus under desmidiaceae has been recorded in this investigation, is known from two countries only [Papua New Guinea (Gontcharov & Watanabe 1999) & New Zealand (Fumanti & Alfinito 2004)]. A new species Brachytheca indica sp. nov. has been proposed in this work.

Bourrellyodesmus Compère (1976) is the interesting member of desmidiaceae observed in investigation, which otherwise is known from very few countries around the world. In this study a new variety [Bourrellyodesmus heimii (Bourrelly) var. indica var. nov.] has been proposed.
The genus *Spinocosmarium* was erected by Prescott et Scott (1942). It is an example among desmids wherein integradations resulting from variation break down erected generic boundaries. The genus is known from very few localities of the world. In this investigation a new species *Spinocosmarium indicum* has been proposed.

*Haploetaenium* is the new genus erected by Bando (1988) which is splitted out of *Pleurotaenium* has also been observed. Four new taxa have been introduced under this genus.

The genus *Groenbladia* was separated from *Hyalotheca* by Teiling (1952). The earlier workers described the genus under different names. After the establishment of the genus *Groenbladia* this is the first report of its occurrence from India. In this investigation two taxa have been described.

The *Teilingia* is the another important desmid genus separated from *Sphaerozosma* by Bourrelly (1964) due to its flattened elliptic cells, well marked median isthmus and bearing a pair of small granules. In this investigation six taxa have been described. Of them one new variety (*Teilingia excavata* var. *echinata* var. nov.) has been proposed.

*Triplastrum* is a rare desmid genus. Iyengar & Ramanathan (1942). Four taxa of the genus have been identified during this investigation. These are *T. abbreviatum*, *T. indicum*, *T. spinulosum* and *T. simplex*. *T. abbreviatum* is recorded here more than century after its original description as *Triploceras abbreviatum* from nearby locality (i.e. Raniganj area), while other three species are new records for West Bengal. *T. simplex* being recorded for the first time from India.

Reproduction in desmids is not very common phenomenon except for a few common genera. Still very good number of desmids have been observed in reproductive stage in nature. These are belonged to different species under following genera viz: *Cylindrocystis*, *Gonatozygon*, *Cosmarium*, *Staurastrum*, *Pleurotaenium*, *Streptonema*, *Onychonema*, *Desmidium*, *Closterium*, *Triploceras* and *Micrasterias*. Reproductive stages of the above mentioned desmids have been observed, mostly during the month of November to February. Applied aspects of this study should not be underestimated as these water bodies supporting desmid growth are also used significantly for domestic, as well as in fisheries and agriculture. With reference to the national perspective this work
adds over 200 taxa to the existing list of desmids (Sarma & Khan 1981, 92; Prasad & Misra 1992, Vidyavati 1995, and other workers). As such it's a study contributing about more than one third of the work done on Indian desmids.

Recording of such a huge number of desmids indicates that natural habitats of many parts of West Bengal have not been degraded to certain extent and careful handling of the habitats may preserve our natural biodiversity significantly. This is also evident from the fact that some rare desmids recorded by Wallich (1860) and Turner (1892) have again been recorded from West Bengal only.