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THE ALGAL FLORA OF A SMALL FRESHWATER MARSH, SAN SALVADOR, BAHAMAS

Mark R. Luttenton and Teresa N. Luttenton
Biology Department
Grand Valley State University
Allendale, MI 49401

ABSTRACT

Four microhabitats were sampled in a small freshwater marsh during early June, 1995 to determine the composition of the freshwater algal flora. The microhabitats included the stems of emergent macrophytes, a brown organic floc accumulated on the sediment, *Chara* sp. and associated materials, and a cyanobacterial mat that occurs as isolated tufts and floating mats. A total of 30 genera and 37 species were identified. The cyanobacterial mat was dominated by three genera of filamentous Cyanobacteria: *Scytonema, Tolypothrix, and Schizothrix.* Algal communities associated with macrophyte stems were relatively sparse. This association included the diatom genera *Cymbella* and *Mastogloia,* and the Cyanobacteria *Scytonema* and *Schizothrix.* Ten genera were associated with the organic floc. Coccoid Cyanobacteria were most common, particularly the genus *Coelosphaerium.* Species richness was greatest in the *Chara* association. Eighteen genera were identified including three desmids and two dinoflagellates of which *Peridinium inonspicuum* was a common species in the association. Although the algal communities associated with each microhabitat are relatively distinct, the flora in general is relatively depauperate. A similar study of four freshwater habitats on Great Abaco Island found 27 diatom taxa in a single swamp and 52 diatom taxa total. The algal flora of the marsh does suggest that the marsh may be quite interesting ecologically. For example, *Chara* is often associated with relatively hard water, and relatively high carbonate concentrations. In contrast, the presence of desmids suggests that some microhabitats may be slightly acidic. Decomposition of terrestrial vegetation high in tannic acids may produce localized variation in pH. Additional samples collected at different times of the year may reveal a more complex flora.

INTRODUCTION

Although the macroscopic marine algal flora of the Bahamas and the Caribbean region has been of great interest (e.g., Littler et al. 1989), the microscopic marine algae have received somewhat less attention and the freshwater flora least of all.

Accounts of the freshwater algae of this region have been published on an irregular basis since the 1880's (e.g., Lagerheim 1885, 1887). Studies of nonsiliceous algae have concentrated on the freshwater habitats of Puerto Rico (Lagerheim 1885, 1887; Tiffany 1944; Tiffany and Britton 1944) and Jamaica (Lagerheim 1887; West and West 1899; Drouet 1942; Hegewald 1977 Whitford and Robertson 1981).

The siliceous algae particularly the diatoms, have been studied in greater detail. Mobius (1888, cited in Foged 1984) published the first account of diatoms from the region listing 9 taxa from Puerto Rico. The most extensive record of the Caribbean diatom flora (marine and freshwater) was compiled by Hagelstein (1938). Although a majority of the approximately 900 taxa reported were marine, he identified 210 oligohalobe taxa in samples collected from Puerto Rico and the Virgin Islands. Subsequently, Manguin (1952) reported a total of 430 freshwater diatom taxa from 68 sites on Guadaloupe Island. More recently, Foged (1984) and Podzorski (1985) both recorded just over 200 freshwater diatoms from Cuba and Jamaica respectively.

It is apparent from the published literature that the freshwater algal flora of the Bahamas is not well known. The lack of information is evident by the fact that we found only one published account of the freshwater algae (Reimer 1996). Thus, this study was conducted to add to the limited information available on the freshwater algae of the Bahamas.

METHODS

Algal samples were collected from a small marsh approximately 2.5k west of the Bahamian Field Station during early June 1995. The material collected was associated with one of four visually identifiable microhabitats which included; a brown organic floc, floating mats, *Chara* beds, and macrophytes. The brown floc forms a thin layer over the sediment generally less than a few centimeters thick. The floc appears to result from the partial decomposition of vascular plant material. The floating mats were

whitish in color and covered isolated portions of the marsh surface. Generally, mats were < 5 mm thick. *Chara* grew at moderate densities in several areas of the pond. Collections included individual *Chara* plants and material associated with the plant and the sediment immediately associated with the base of the plant. Submerged portions of macrophyte stems were collected with the attached epiphytes.

Individual species of nonsiliceous algae were identified from nonpermanent mounts using brightfield microscopy at 400x. The relative abundances of common genera of nonsiliceous algae were estimated by counting a minimum of 300 individuals using a Palmer-Malony counting chamber. Diatoms were grouped together for this analysis and the relative abundance of diatoms as a group was calculated for the community.

Prior to taxonomic identification of the diatoms, all organic material was removed by treating the samples with 30% H_2O_2. Following digestion, samples were washed at least 6 times with distilled water and slides prepared using a permanent mounting media. Diatom slides were examined at 1000x using an oil immersion brightfield lens with a 1.4 N.A. and a 1.32 N.A. condenser. Slide preparations were used for general taxonomic determinations and to determine the relative abundances of individual diatom taxa. Slides were not prepared for the floc sample.

RESULTS

A total of 37 algal species representing 30 genera and 6 divisions were identified from the marsh (Table 1). Cyanobacteria accounted for 12 genera whereas diatoms and green algae were represented by 10 genera and 7 genera respectively. Dinoflagellates, cryptomonads and Charophyta were least diverse with 1 genus each.

The distribution of species was relatively even among the three major divisions. The diatoms and Cyanobacteria were most diverse with 13 taxa each followed by the green algae with 8 species. Dinoflagellates were less diverse with two species and the Charophyta and cryptomonads were least diverse, both groups being represented by a single taxon (Table 1).

The algal community associated with *Chara* had the greatest variety at the generic level with 18 genera, although the floating mat and macrophyte associations each supported 16 genera. Diatoms associated with the brown floc were not identified to the genus or species level however, 9 genera of nonsiliceous algae were identified.

Considerable variation in the relative abundances of genera existed among microhabitats (Fig. 1). In addition to *Chara*, *Schizothrix*, *Anabaena*, *Chroococcus*, and *Aphanothece* were most common. Although the dinoflagellate *Peridinium inconspicuum* was more common in this association than in the other three, it was not numerically equal to the previous four genera. The three filamentous Cyanobacteria *Schizothrix*, *Tolypothrix*, and *Scytonema* dominated the macrophyte association whereas *Schizothrix* was relatively more important in the cyanobacterial-community. *Coelosphaerium*, a colonial Cyanobacteria, was most common in the floc, although *Schizothrix* was also relatively important. Similarly, the relative importance of diatom genera varied among the three samples analyzed (Fig. 2) however diatoms generally accounted for a relatively small percentage (<3%) of the total community composition.

DISCUSSION

Although the results of this survey should not be considered a complete listing, the algal flora of the marsh appears to be relatively depauperate. This conclusion is supported by the fact that 27 diatom taxa were identified in a single collection from Crossing Rock Village Marsh on Great Abaco Island (Reimer 1996). The number of taxa (diatoms specifically) identified during the present study does compare more closely with Reimer's (1996) collections from two wells near Sandy Point which contained 12 and 13 diatom taxa respectively.

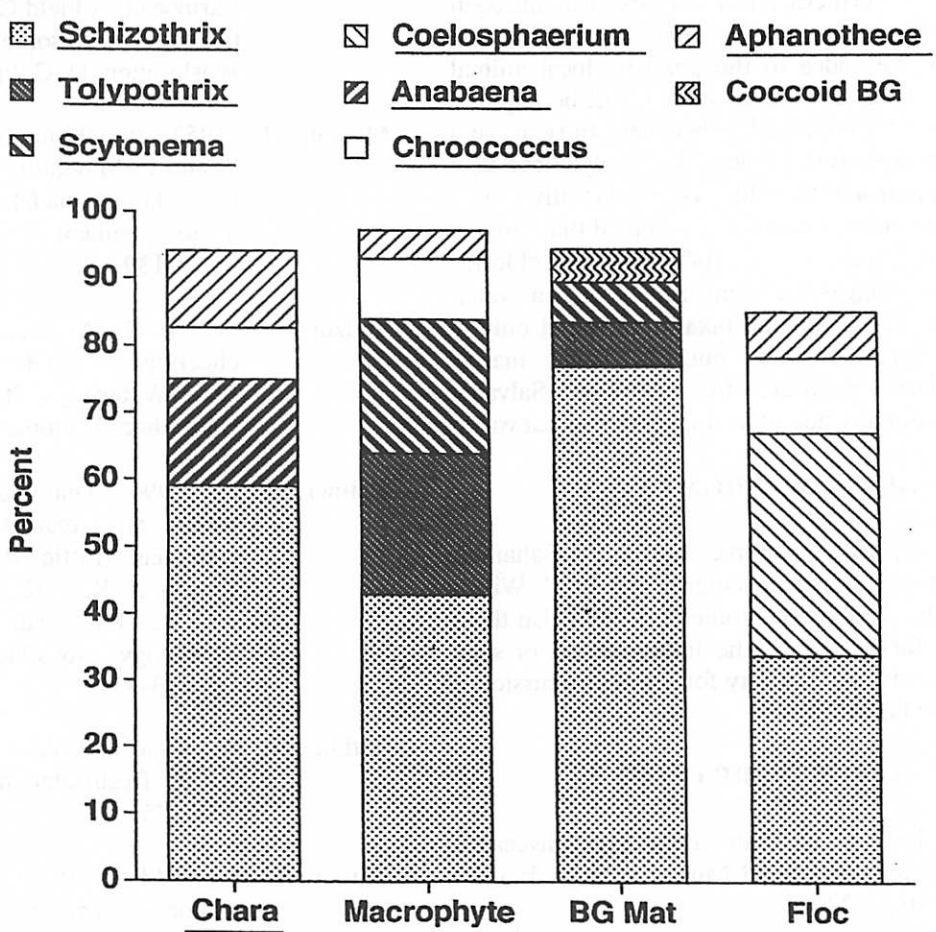
Based on the composition of the algal flora, some inferences about the ecological character of the system may be possible. For example, *Chara* is generally associated with relatively hard water and suggests high concentrations of carbonates. Similarly, some desmids (*Cosmarium, Desmidium, Euastrum*) are associated with circumneutral, slightly hard water, although they are more common in lakes with lower alkalinity and slightly acidic pH. These data suggest that microhabitats may be sufficiently different in chemical composition to allow both *Chara* and desmids to persist. Alternatively, the taxa present may be those which are tolerant of conditions which are marginal for each group in general.

Nutrient regime may also partially explain the floristic composition of the marsh. The high relative abundance of Cyanobacteria, many of which contain heterocysts, indicates that the pond may be nitrogen limited. This conclusion is further supported by the fact that some of the dominant taxa (e.g. *Schizothrix*) observed in the marsh are frequently

Table 1. List of algal taxa identified in samples collected from a small freshwater marsh, San Salvador, Bahamas.

CYANOBACTERIA
Anabaena sp.
Aphanothece saxicola Naegeli
Chroococcus pallidus Naegeli
C. turgidus (Kuetz.) Naegeli
Coelosphaerium kuetzingianum Naegeli
Fremyella striatula (Hy.) Drouet
Gloeocapsa sp.
Gomphosphaeria aponina var. *cordiformis* Wolle
Oscillatoria amphibia Agardh ex Gomont
Schizothrix calcicola (Agardh) Gomont
Scytonema dubium Wood
Spirulina laxa Smith
Tolypothrix limbata Thuret
CHLOROPHYTA
Cosmarium laeve Rabenhorst
Desmidium swartzii Agardh
Euastrum bidentatum var. *oculatum* (Istv.) W. Krieg.
E. hypochondrum var. *ohioense* (Taft) Prescott
Oedogonium sp.
Scenedesmus bijuga (Turp.) Lagerheim
Spirotaenia minuta Thuret
Tetraedron minimum (A. Braun) Hansgirg
CHAROPHYTA
Chara sp.
PYRROPHYTA
Peridinium gatunense Nygaard
P. inconspicuum Lemmermann
CRYPTOPHYTA
Cryptomonas sp.
BACILLARIOPHYCEAE
Achnanthidium affine (Grun.) Czarnecki
A. minutissimum (Kuetz.) Czarnecki
Anomoeoneis exilis var. *lanceolata* A. Mayer
Cymbella microcephala Grun.
C. minuta var. *pseudogracilis* (Cholnoky) Reimer
C. minuta var. *silesiaca* (Bleisch) Reimer
Encyonema sp.
Diploneis oblongella (Naegeli ex Kuetzing) Ross
Fragilaria sp.
Gomphonema gracile Ehrenberg
Mastogloia smithii var. *lacustris* Grun.
Nitzschia dissipata (Kuetz.) Grun.
Rossithidium linearis (W. Sm.) Round & Bukhtiyarova

Figure 1. Relative abundances of common nonsiliceous algal genera.



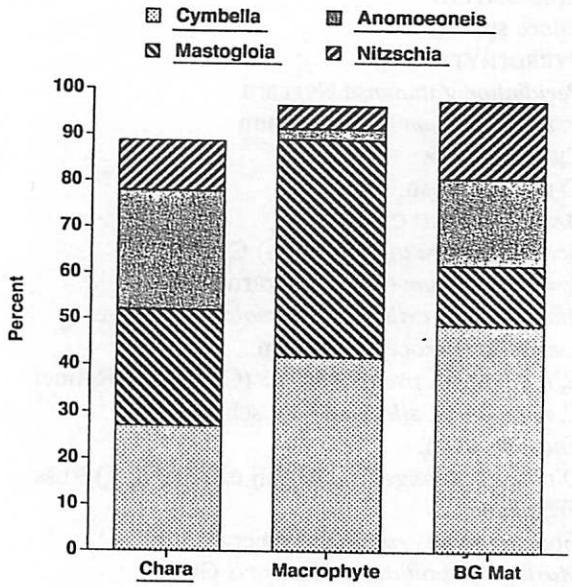


Figure 2. Relative abundances of common diatom genera.

associated with northern lakes that are near nitrogen limitation. However, visual observations indicate that nutrients may be added to the pond by local animal populations. Thus, additional studies will be required to understand the relationship between nutrients and community composition. The lack of polyhalobe taxa in the marsh indicates that this system is relatively free of marine influence. Reimer (1996) noted that three of his sample sites had elevated conductivity and chloride concentrations suggesting some inputs of sea water. The fact that 12 polyhalobe taxa were found only at these three sites further suggests some marine influence. The vertical elevation of the San Salvador marsh may limit any potential impact due to sea water.

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