

## BRIEF NOTE

ASSOCIATION OF *VORTICELLA CAMPANULA* AND *ANABAENA FLOS-AQUA* DURING A BLUE-GREEN ALGAL BLOOM IN WESTERN LAKE ERIE<sup>1</sup>

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Peritrichous ciliates are commonly found attached to a variety of substrates in aquatic habitats, but large numbers of peritrichs in plankton are infrequent (Pratt and Rosen 1983). However, several investigators have reported this phenomenon (Chandler 1940, Davis 1954, 1962, Kerr 1983). The purpose of this note is to document the occurrence of a particular association between a vorticellid species and a planktonic blue-green alga observed in western Lake Erie.

During mid-summer of 1980, a marked blue-green algal bloom occurred in the islands region of western Lake Erie which persisted from 5 July to 21 July. The dominant blue-green taxa were *Aphanizomenon flos-aqua* (up to 20,000 cells/ml) and *Microcystis aeruginosa* (up to 300 cells/ml).

Microscopic examination of the *Anabaena* colonies, which average 36 cells/filament interwoven to form a spherical mass, revealed that a large number of protozoan *Vorticella campanula* was associated with each colony. As many as 66 epiphytic ciliates/ml were found on the algal filaments. The contractile stalks of the *Vorticella* were attached to the outer filament segments forming a pulsating corona around the entire algal mass (fig. 1). The association of the protozoan and the algae remained relatively constant throughout the period of the bloom.

Since *Vorticella* has a substrate requirement, we suspect that the initial attachment may take place near the lake bottom but then persists as the algal colony rises in

the water column. The pulsating feeding behavior of *Vorticella* produced a distinct gliding motion of the algal colony. Such observations suggest that mutual benefits may be assigned to this association. Stiller (1940) observed similar rotary movements for a different peritrichous species (*Vorticella anabaenae*) associated with an *Anabaena* sp. in central European lakes. The often rapid movement of the algal mass may provide an advantage not available to other non-motile planktonic algae. Pratt and Rosen (1983) speculated that the "swimming" motion created by sessile protozoans on algae may be advantageous in maintaining nutrient flow past the algal cells preventing local nutrient depletion and in changing position in the water column. They also hypothesized a nutrient

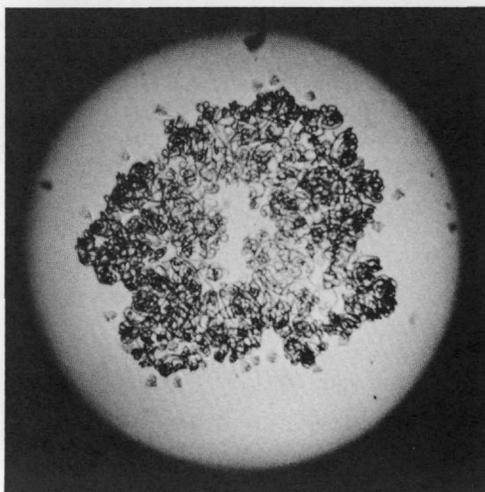


FIGURE 1. Microphotograph of dispersed *Anabaena flos-aqua* colony showing *Vorticella campanula* attached to filaments.

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exchange between the organisms, including dissolved organic and inorganic nutrients and epiphytic bacteria.

In 1981 and 1982, the algal densities were much decreased during mid-summer compared with the previous year, but *Anabaena* colonies were common. However, fewer colonies of *Anabaena* had the epizoic association with *Vorticella*. Davis (1968), working in western Lake Erie, found that the maxima for *Vorticella* usually occurs coincident with the phytoplankton maxima.

Ciliate epibionts, particularly through the association described above, may have a significant role in blue-green algal productivity within eutrophic lakes. Kerr (1983) showed the numerical importance of epiphytic vorticellids on planktonic blue-green algae but did not explore the possibility of mutualistic associations. Laboratory investigations are needed to determine if the benefits suggested for each organism may be assigned to the associations.

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