Amphipod herbivory on the freshwater cyanobacterium Lyngbya wollei: Chemical stimulants and morphological defenses

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ABSTRACT: The freshwater cyanobacterium *Lyngbya wollei* forms dense mats in lentic systems throughout the southeastern United States and produces paralytic shellfish poisons (PSPs), such as saxitoxins, that could provide a chemical defense against herbivory. In addition, *Lyngbya* filaments are surrounded by a prominent extracellular polysaccharide sheath that might function as a structural defense against herbivory. We investigated the roles of PSPs and sheath structure in deterring consumption of *Lyngbya* by an omnivorous amphipod, *Hyalella azteca*. A series of two-choice feeding assays paired *Lyngbya* with a highly palatable green alga, *Rhizoclonium hieroglyphicum*. These assays included comparisons of whole *Lyngbya* and *Rhizoclonium*, freeze-dried and ground *Lyngbya* and *Rhizoclonium*, artificial food treated with *Lyngbya* crude extract, artificial food treated with pure saxitoxin, and artificial food containing *Lyngbya* sheath material, with and without *Lyngbya* crude extract. *Hyalella* preferred whole, live *Rhizoclonium* over fresh *Lyngbya*. Similarly, *Hyalella* preferred freeze-dried and ground *Rhizoclonium* over *Lyngbya*. However, *Hyalella* preferred treated foods containing *Lyngbya* crude extract or pure saxitoxin over control foods. The sheath constituted over 55% of the total dry mass of *Lyngbya*. In assays combining sheath material and crude extract in artificial foods, *Hyalella* avoided foods containing sheath material. Therefore, morphological defenses play an important role in deterring consumption of *Lyngbya* by *Hyalella*, whereas PSPs stimulate feeding. Our study indicates that structural defenses can partially explain the high abundance of filamentous cyanobacteria observed in aquatic communities under grazing pressure.