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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 twochoice feeding assays paired Lyngbya with a highly palatable green alga, Rhizoclonium hieroglyphicum. These assays included comparisons of whole Lyngbya and Rhizoclonium, freezedried 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.

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