Allelopathic and Antigrazing Compounds in Marine Cyanobacteria and Dinoflagellates: Characterization, Community Effects, and Mode of Action

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Our project focused on identifying and isolating allelopathic compounds produced from various bacteria isolated from Atlantic and Pacific waters. Total small molecule extracts (molecules of 2000 Dalton or less) were obtained from various cyanobacteria and proteobacteria. Toxicity of crude small molecule extracts to phytoplankton cultures were assessed through bioassays against key bloom-forming phytoplankton. We found that extracts from cyanobacteria Trichodesmium erythraeum strain K-11 #131 and Microcoleus sp., as well as the heterotrophic bacterium Rheinheimera aquimaris strain A500, generated the greatest cytotoxicity towards a model oceanic phytoplankter, Emiliania huxleyi (371) (Figure 1). Toxicity of extracts towards E. huxleyi was manifested by dramatic declines in photosynthetic efficiency (Fv/Fm) and mortality, generally within 24h (Figure 2, 3). Other cyanobacterial extracts from Crocosphaera (8501p), Lyngbya, Nostoc, Synechococcus, and Cyanothece, induced only slight but significant declines in Fv/Fm for E. huxleyi after 7 days, with little or no mortality (Figure 4). Extracts from K-11 #131 and 8501p caused acute mortality in a cryptophyte alga, Rhodomonas sp., but had little affect on the marine diatom Phaeodactylum tricornutum, while extracts from A500 revealed little or no negative responses in either phytoplankter. Our results show that small molecules produced by bacteria can be significant in influencing photosystem health or growth of major bloom-forming phytoplankton, and thus may play a role in structuring phytoplankton diversity. Future work will focus on the structure elucidation of the active molecules in our assays and determining their mode of action with the ultimate goal of testing these compounds in mesocosm and field-based studies.

Growth rate responces of *Emiliania huxleyi* to extracts from *Trichodesmium erythraeum* (K11-131), *Rheinheimera aquimaris* (A500), and *Microcoleus*



Mortality induced by bacterial extracts





Emiliania huxleyi and Trichodesmium erythraem

Effects of various cyanobacterial extracts (0.2%) on the photosynthetic efficiency (Fv/Fm) of *Emiliania huxleyi*

