Exploring the role of aldehyde-based signaling during kelps/herbivores interactions

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Abstract

In the terrestrial environment, volatile organic compounds, such as aldehydes, are emitted during defense responses by plants against herbivores and perceived by neighboring plants as warning distance signals, leading to priming. In the marine environment, similar distance signaling, based on water-borne cues, also exists during interactions between macroalgae and herbivores, but their biological and ecological roles remain unclear. In brown algae, chemical elicitation or grazing induces regulations of transcription and metabolic pathways, as well as emission of chemical compounds like aldehydes. In laboratory, upon stress conditions, the brown alga *Laminaria digitata* emits a wide range of volatile aldehydes, but their biological roles as potential defense signals remain unknown in this alga in response to grazing. In this context, bioassays using the limpet *Patella pellucida* and *L. digitata* from North-Atlantic Brittany are used for determining the effects of algal incubation with 4-hydroxyhexenal (4-HHE), 4-hydroxynonenal (4-HNE) and dodecadienal on algal consumption by grazers. Simultaneously, we have developed metabolomics approaches to study algal metabolic modifications after treatments of *L. digitata* with these aldehydes. The results displayed that, unlike treatment of the kelps with 4-HNE or dodecadienal, treatment with 4-HHE decreases algal consumption by herbivores, only at 100 ng/ml. Moreover, we showed that algal metabolome is modified according to the type of aldehyde, especially concerning fatty acid degradation pathways. As kelp beds constitute complex ecosystems with roles of habitat and food source for marine herbivores, the perception of specific aldehydes could have a major ecological role on the structuration of marine kelps/grazers communities.

Keywords: Kelps, herbivores, signaling, aldehydes

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