
Chemical interactions between host and epiphytes – example of benthic microalgae

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Abstract

Chemical interactions including allelopathy are important processes in shaping communities in aquatic environment. However, the role and effects of allelopathic interactions in the structure and functioning of photosynthetic microbial biofilms is still poorly known. In order to improve our understanding of the mechanisms associated with allelopathic interactions in biofilms, an in depth study of an interaction between the filamentous green alga *Uronema confervicolum* and benthic diatoms was realised. Benthic diatoms are competitors and potential epiphyte of the green alga. Bioassay-guided fractionation and comparative metabolomic profiling were used to identify allelopathic compounds produced by *U. confervicolum*. Growth, photosynthesis efficiency and adhesion inhibition assays were realised to measure the effect of allelopathic compounds produced by *U. confervicolum*. The responses of target cells were studied through scanning electron microscopy, transcriptomic and metabolomic analyses.

The results indicate that beside an allelopathic inhibition of diatom growth and photosynthesis by two polyunsaturated fatty acids, other allelopathic compounds inhibited specifically diatom ability to adhere to a substrate. The process of adhesion inhibition was further analysed in depth; our results revealed that this inhibition was associated with an inhibition of the formation of the extracellular polymeric substances matrix of the biofilm. Metabolomic profiling indicated an involvement of carnitine, in the response of diatoms to allelopathic compounds. Transcriptomic analyses suggested a stimulation of energy metabolism and photosynthesis while cell cycle and the production of adhesion related proteins were inhibited.

These results highlighted the importance of taking into account the multiplicity of allelopathic compounds produced by a single organism and acting together. The mode of action of these allelochemicals must be further studied. The compounds responsive for the inhibition of adhesion may be either allelopathic compounds inhibiting directly adhesion mechanisms or infochemical, *i.e.* a signal of the presence of inhibiting allelopathic compounds.

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