Role of bacterial quorum sensing 3-hydroxy-decanoyl-homoserine lactone signal molecule in the interaction of the beneficial endophyte *Acidovorax radicis* N35 with barley seedlings

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Abstract

Specific signaling based communication between microbes and their plant hosts are of key importance for a successful establishment of symbiotic interactions. There is evidence from many interactions of Gram-negative bacteria with host plants, that their N-acyl-homoserine lactone quorum sensing signal molecules play an important role in this interaction – either a pathogenic or a beneficial one. However, the detailed function of these AHL-molecules in the development of a cooperative interaction with a beneficial endophytic bacterium is not fully understood yet.

We compared the effects of the wild type PGPR *Acidovorax radicis* N35 with an AHL-deficient mutant on barley seedlings upon inoculation in an axenic system. The root colonization behavior was examined using GFP- and YFP-labelled strains and confocal laser scanning microscopy. The response of the barley seedlings was following using RNA seq-analysis and quantitative RT-PCR of transcripts with major changes upon bacterial inoculation. In addition, the content of flavonoid compounds in the barley shoots was qualitatively and quantitatively characterized. It could be demonstrated, that the AHL-deficient mutant has a different colonization pattern and is a less successful root colonizer than the wild type strain in competitive colonization assays.

Most interestingly, the AHL-producing wild type *A. radicis* strain is causing only priming response in selected plant genes, but no defense response, as is evidenced by RNAseq and qPCR-analysis. In contrast, the AHL-deficient mutant caused a clear defense response, especially the expression of flavonoid biosynthesis, which was proven by specific metabolite analysis. Therefore, AHL-signal molecules may have an important role in modulating the plant defense response – either by direct action or via regulation of bacterial compounds, which themselves influence the perception by the plant.

As practical consequence, the use of an AHL-producing beneficial bacterium within an inoculum mixture could improve the perception of the whole inoculum by the plant and may result in better and more consistent growth promotion.