# Can soil microbial diversity influence plant metabolites and life history traits of a rhizophagous insect? A demonstration in oilseed rape.

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**Abstract**

Interactions between plants and phytophagous insects play an important part in shaping the biochemical composition of plants. Reciprocally plant metabolites can influence major life history traits in these insects and largely contribute to their fitness. Plant rhizospheric microorganisms are an important biotic factor modulating plant metabolites and adaptation to stress. While plant-insects or plant-microorganisms interactions and their consequences on the plant metabolite signature are well-documented, the impact of soil microbial communities on plant defenses against phytophagous insects remains poorly known. In this study, we used oilseed rape (Brassica napus) and the cabbage root fly (Delia radicum) as biological models to tackle this question. Even though D. radicum is a belowground herbivore as a larva, its

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adult life history traits depend on aboveground signals. We therefore tested whether soil microbial diversity influenced emergence rate and fitness but also fly oviposition behavior, and tried to link possible effects to modifications in leaf and root metabolites. Through a removal-recolonization experiment, three soil microbial modalities ('high', 'medium', 'low') were established and assessed through amplicon sequencing of 16S and 18S ribosomal RNA genes. The 'medium' modality in the rhizosphere significantly improved insect development traits. Plant-microorganism interactions were marginally associated to modulations of root metabolites profiles, which could partly explain these results. We highlighted the potential role of plant-microbial interaction in plant defenses against Delia radicum. Rhizospheric microbial communities must be taken into account when analyzing plant defenses against herbivores, being either below or aboveground.