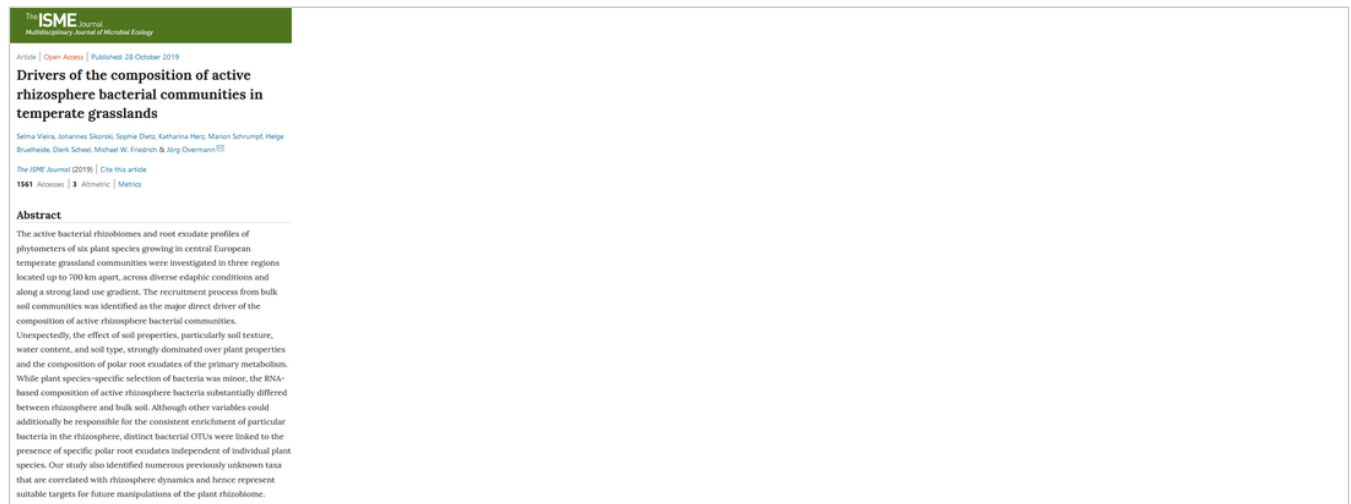


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Drivers of the composition of active rhizosphere bacterial communities in temperate grasslands

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Abstract

The active bacterial rhizobiosomes and root exudate profiles of phytometers of six plant species growing in central European temperate grassland communities were investigated in three regions located up to 700 km apart, across diverse edaphic conditions and along a strong land use gradient. The recruitment process from bulk soil communities was identified as the major direct driver of the composition of active rhizosphere bacterial communities. Unexpectedly, the effect of soil properties, particularly soil texture, water content, and soil type, strongly dominated over plant properties and the composition of polar root exudates of the primary metabolism. While plant species-specific selection of bacteria was minor, the RNA-based composition of active rhizosphere bacteria substantially differed between rhizosphere and bulk soil. Although other variables could additionally be responsible for the consistent enrichment of particular bacteria in the rhizosphere, distinct bacterial OTUs were linked to the presence of specific polar root exudates independent of individual plant species. Our study also identified numerous previously unknown taxa that are correlated with rhizosphere dynamics and hence represent suitable targets for future manipulations of the plant rhizobiosome.

Drivers of the composition of rhizosphere bacterial communities.

Recently, a team of researchers including IPB scientists, published a comprehensive study on the bacterial communities of the rhizosphere in temperate grasslands - a dominant ecosystem in Germany. In frame of their study, the scientists planted a total of 324 phytometer plants in three biosphere reserves up to 700 km apart, which were beforehand cultivated under uniform conditions in sterile soil. After one year, they collected the remaining phytometers and other bulk soil samples. By analyzing the bacterial rRNA sequences from the soil material, the scientists were able to compare the bacterial composition of the rhizosphere with that of the bulk soil.

Unexpectedly, abiotic factors, such as texture, soil type or water content were the major drivers for the enrichment of certain taxa in the rhizosphere. The plant species and plant exudates were largely uncoupled from the composition and selection of rhizosphere communities. Detailed knowledge of rhizosphere dynamics forms the basis for increasing agricultural productivity and reducing the risk of disease.

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