EGU22-5070
https://doi.org/10.5194/egusphere-egu22-5070
EGU General Assembly 2022

Enzyme activity gradients across the maize roots

Zeeshan Ibrahim, Negar Ghaderi, and Evgenia Blagodatskaya
Department of Soil Ecology, Helmholtz Centre for Environmental Research – UFZ, Halle (Saale), Germany
(ranazee2760@gmail.com)

The labile organic compounds provided by roots remove the nutrient limitation and thus stimulate microbial activity and facilitate biochemical process rates into the soil, forming microbial hotspots. However, the extent of root effect and the functional properties of microorganisms are dependent on the root morphology and can vary with the distance from the root. The objective of this study was 1) to investigate whether biochemical processes mediated by hydrolytic enzymes that are involved in C, N, and P cycling, are overlapping in the rhizosphere hotspots or whether they are hotspot-specific and 2) to evaluate the effect of plant genotype on the kinetic parameters in the hotspots. We identified the hotspots from two maize (*Zea mays* L.) plant genotypes (wild type and root hair deficient mutant) by applying zymography of β-glucosidase, acid phosphatase, and leucine aminopeptidase. Soil samples were taken at 1, 1-2, and >2mm from the hotspots epi-centrum. The V_{max} of β-glucosidase was 1.7 times higher at a 1mm distance from roots than 1-2mm and was 4 times higher than >2mm distance. The V_{max} of β-glucosidase was significantly higher in the wild type versus root hair-deficient mutant at a 1mm distance from the root. Acid phosphatase and leucine aminopeptidase in both 96-well microplate and image processing indicated higher enzymes activity at the epi-centrum than outside the hotspot. In general, the microplate assay demonstrated similar trends with soil zymography, but the latter ensured better statistical significance. The K_m values indicated similar enzyme systems within and outside the hotspots across the plant roots. The K_m values suggested that root hair deficiency was compensated by higher affinity of enzymes acquiring C, N and P for the plant. In contrast, wild type of maize attracts microorganisms with broader spectrum of functional traits compared to root hair-deficient mutant. This work was conducted within the framework of the priority program 2089 “Rhizosphere spatiotemporal organization – a key to rhizosphere functions”, funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project number: 403664478. Seeds of the maize were provided by Caroline Marcon and Frank Hochholdinger (University of Bonn).

Keywords: Zymorgaphy, Enzyme activity, Enzyme affinity