



Spatio-temporal patterns of enzyme activities in the rhizosphere: Effects of plant growth and root morphology

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Plant growth and root morphology affected microbial and enzyme activities in the rhizosphere through change the composition and quantity of root exudates. The effects of plant growth stage and root morphology on the spatial distribution patterns of enzymes activity in the in situ rhizosphere remain unclear. Lentil and lupine was chosen to test the effects of root development (vegetative plant growth: 1, 4 weeks and reproductive growth: 8 weeks after sowing) and root morphology (lateral and tap roots) on the in situ spatial distribution of β -glucosidase, cellobiohydrolase, leucine aminopeptidase and acid phosphomonoesterase. Lentil root radius was stable and the rhizosphere extent remained constant, while 3-4 times higher enzyme activities on week 8 versus on week 1. Lupine turned into reproductive growth on the 7th week accompanied by increased root radius and 1.5-2 folds broader rhizosphere extent, but 1.5-3 times decreases enzyme activity than vegetative stage. Rhizosphere extent was 4-60 times broader and enzyme activity per root area was 6-14 folds higher in lupines' lateral roots than in tap roots. In conclusion, plant growth stage and root morphology influence enzyme activity and shape rhizosphere: 1) the rhizosphere extent and enzyme activity increase with plant growth until change into reproductive stage; 2) the enzyme activity per root surface was higher and rhizosphere extent was broader around lateral roots than old tap roots.