

## Effect of carbon limitation on ectomycorrhizal fungal enzyme activities under different phosphorus availability

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Beech trees form symbiotic associations with ectomycorrhizal fungi (EMF), which ensheathe the root tips as a mantle and surround them by extensive emanating hyphae. This symbiosis increases the host plant access to soil nutrients in exchange to carbon (C), which is transferred from plant to the fungus. EMF species show a high morphological and functional diversity with regard to soil exploration type (i.e. development of extraradical mycelium), nutrient-mobilizing enzyme activities, weathering capacity, and C use. EMF survival and functional abilities depend on plant C supply. While the significance of a decline in C availability on EMF communities has been previously reported [1], little is known about its effect on fungal functional response.

We studied the activities of eight enzymes of the community-dominant EMF species of beech forests in relation to host C resources by severely reducing C supply by tree stem girdling. Since EMF community structure and species functional abilities are shaped by soil chemistry and availability of nutrients, we conducted the study in forests with different soil phosphorus (P) concentrations whose mycorrhizal composition has been characterized [2]. We hypothesized that (i) the pattern of EMF enzyme activities in response to the decline of plant C supply varies with EMF species identity, with some putative EMF species, which access alternative C sources; (ii) the decline of plant C supply results in a decrease of EMF enzyme activity, but this is less apparent in the plots of lower than higher phosphorus availability since some EMF species might have an essential role in P mobilization from organic sources.

First results reveal significant differences in the enzyme activity profile of different EMF fungal species and an increase in the enzymatic activity under the girdling compared to control treatment. Currently, we analyze the root C resources in the attempt to render the importance of some EMF species in nutrient mobilization under P limitation.

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[1] Pena R., Offermann C., Simon J., Naumann P. S., Geßler A., Holst J., Dannenmann M., Mayer H., Kögel-Knabner I., Rennenberg H., Polle A. 2010. Girdling affects ectomycorrhizal fungal (EMF) diversity and reveals functional differences in EMF community composition in a beech forest. *Applied and Environmental Microbiology* 76: 1831-1841.

[2] Zavišić A, Nassal P, Yang N, Heuck C, Spohn M, Marhan S, Pena R, Kandeler E, Polle A (2016) Phosphorus availabilities in beech (*Fagus sylvatica* L.) forests impose habitat filtering on ectomycorrhizal communities and impact on tree nutrition. *Soil Biology and Biochemistry* 98: 127-137