Spatial response of root foraging strategies to heterogeneous resource availability in a temperate forest

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Résumé

Roots are essential plant organs, particularly important in the acquisition of soil resources. Recent research on root trait variation have substantially advanced the field, especially regarding the root economic space and the linkage between root traits and root foraging strategy. However, most research assessing the impact of resource availability on root traits were done on plants in containers or common garden experiments, and have rarely included spatial resource heterogeneity. However, heterogeneity of resources is predominant in most ecosystems, particularly in forests, where soils are characterised by a highly heterogeneous repartition of nutrients at very small scale.
By focusing on a dominant understory plant species, *Vaccinium myrtillus*, this research aims at assessing the impact of heterogeneous and limiting resource supply on the spatial variation in absorptive fine-roots traits in temperate forests. It is hypothesized that an increased soil resource heterogeneity at small-scale will promote spatially contrasting root foraging strategies, involving higher variation in traits tightly linked to resource acquisition such as mycorrhizal association rate or root phosphatase activity.

In this research, a three years fertilization experiment was carried out in 10 sites (1 ha) in the Southern Black Forest, Germany. In each site, three different treatments were implemented yearly on subplots of 6.25 m2: one *homogeneous* treatment where a mixture of N, P, K and Ca fertilizers was applied, one *heterogeneous* treatment where these fertilizers were applied separately in patches of 0.25 m2 and one *control* treatment. After three years, roots of *V. myrtillus* were sampled in each treatment and the following traits were measured: specific root length (SRL), root mean diameter, root C/N concentrations, mycorrhizal colonization rate and root phosphatase activity.

Preliminary results show that root morphological traits did respond to the treatments with reduced SRL and increased diameter in the fertilized subplots. However, no differences in morphological traits were observed between the two types of fertilized treatments, nor within the *heterogeneous* subplot.
The change in morphological root traits following fertilization suggests that roots adopted a more conservative strategy in richer environments. However, this change was only observed at the scale of the subplot (6.25 m2) suggesting that morphological traits are unresponsive to specific nutrient changes at smaller scale (0.25 m2). Analysing the additional traits will

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further improve our understanding of root traits response to small-scale soil resource heterogeneity, and further complete our knowledge on the linkage between root traits and root foraging strategy.

Mots-Clés: fine roots, functional traits, resource acquisition, spatial scales, heterogeneity, intraspecific trait variability, temperate forest