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Composition of ectomycorrhizal fungal communities along environmental gradient

The distribution of plants along environmental gradients is constrained by abiotic and biotic factors and often depends on directional changes occurring in fine roots diameter (< 2 mm) in particular on changes within mycorrhizal fungal communities, enabling plant growth in diverse habitats. Fine roots consist of compartments that perform different functions: absorptive fine roots are mainly involved in acquiring and absorbing soil resources, while transporting fine roots play structural and transportation roles. Due to their capacity in the absorption of water and nutrients, they are the most dynamic and functionally most important element of the tree root system. Mycorrhizal fungi are an integral part of the fine roots due to their potential to foraging nutrients, including nitrogen and phosphorus.

The aim of the doctoral dissertation was to determine the variability of diversity and composition of ectomycorrhizal (ECM) fungal communities inhabiting fine roots of Scots pine along the latitude gradient and the related variability of climatic conditions and nutrient availability in Sweden. ECM taxa were identified using internal transcribed spacer (ITS) sequencing from ECM root tips. Further in this study, it has been examined the variability of contents of important biogenic elements (such as macroelements (C, N, P, Mg, K, Ca) and microelements (Fe, Na, Zn, Cu, B, and Al)) in fine roots of Scots pine which perform a different function: absorption (first order) and transport (seventh order). For these purpose samples were collected in an extended transect covering Sweden, Finland and Poland.

Results showed that along the latitude gradient, with increasing distance from the equator, the observed ECM species richness did not substantially change across the research regions. This allows us to reject the hypothesis that a decrease in the average annual temperature would result in a decline in the species richness of the ECM fungi. Additionally, across the MAT gradient, there was a noticeable shift from ECM fungal community dominated by the genus *Suillus* to community where fungi from the genus *Piloderma* predominated. The result indicated that the main abiotic factors that affect and shape the ECM fungal communities of Scots pine across Sweden are the mean annual precipitation, soil pH and soil Fe concentration.

Moreover, the characterization of ECM fungal communities associated with European beech along local nutrient availability gradient was determined. Soil and roots samples were taken from beech forest located on 30% slope formed by glacial erosion in Poland. Slope location impact the spatial distribution of moisture and soil chemical properties, which give the opportunity to investigate the influencing factors of ECM fungi community in reduced impact

of climate conditions. The research findings indicated the significant species variability and an alteration in the number of beech first-order roots colonized by ECM symbionts and revealed that soil pH and phosphorus content had the crucial impact on the diversity and composition of root fungal communities of European beech at the tested location.

Key words: ectomycorrhizal fungi; fine roots; distribution; climate gradient