

Abstract

Dead wood is one of the most important reservoirs associated with forest ecosystems. In natural forests, its volume is counted in hundreds of $\text{m}^3 \text{ha}^{-1}$, whereas it reaches only tens of $\text{m}^3 \text{ha}^{-1}$ in productive commercial forests. In contrast to soil and plant litter, deadwood is unevenly distributed on the forest floor. The specific physicochemical properties such as high content of recalcitrant polymers, low nitrogen level and impermeability negatively affect the rate of decomposition especially in the initial stages of wood deconstruction. The deadwood decomposition is very slow in comparisons with other substrates, it accumulates and thus it represents the important reservoir of nutrients.

This thesis is focused on the structure, development and function of microbial (fungal) community in decomposing deadwood in unmanaged forest. Functional screening of fungi isolated from fruit bodies collected from coarse deadwood was set aside. Physico-chemical properties of deadwood including pH, carbon and nitrogen content and microbial biomass were estimated for four wood decomposition stages and three different tree species. New generation sequencing (Illumina MiSeq platform) was applied for fungal community structure analysis based on ITS2 fragment. Fungal functional screening was based on physico-chemical properties of collected fruitbodies and their enzymatic activities towards lignocellulose substrates.

The length of decomposition and tree species were the main the variables explaining the differences in the composition of communities in deadwood in time and for samples from year 2013 and 2017. Relative abundance of fungal phyla and orders was rather similar, however, changes in fungal community composition was detectable in relative abundance of fungal genera. Changes in detected in physico-chemical composition of deadwood and extracellular enzyme activities. The nitrogen level and fungal biomass increased along the decomposition process, pH of decomposed deadwood decreased. Extracellular enzyme activity proved the running fungal driven decomposition. Fungal fruitbodies present on coarse deadwood can partially reflect the fungal community decomposition inside the deadwood. These fungi are active wood decompositors.

Key words: deadwood, decomposition, microbial communities, wood decomposing fungi, ITS, next-generation-sequencing, soil organic matter, forest ecosystem