Abstract

Litter is a source of carbon and energy for saprotrophic fungi. Due to production of wide range of lignocellulose-degrading enzymes they contribute to the turnover of soil organic matter. Litter degradation, activity of extracellular lignocellulolytic enzymes and production of biomass were studied on eight different types of litter colonized by Hypholoma fasciculare. Within 12 weeks of incubation the fungus exhibited 16-34% mass loss in different types of litter. Activity of all measured lignocellulolytic enzymes was detected in all different types of litter. Loss of lignin and also carbon, nitrogen and lignin content in litter did not affect laccase and Mn-peroxidase activity. But phosphorous content in litter had negative effect on activity of Mn-peroxidase. The analysis of the experiment showed that initial loss of dry mass significantly correlates with the activities of cellulobiohydrolase, β-N-acetylglucosaminidase, β-glucosidase, β-xylanase, acid phosphatase and also acetylsfattase. The highest fungal biomass was detected in week 8 and decreased until the end of the cultivation in the most of the litter type. Our results showed positive correlation between content of nitrogen and nitrogen in the form of NH₄⁺ in fresh litter and the activity of polysaccharide hydrolases. Fungal biomass content after four weeks of cultivation was also positively affected by initial content of nitrogen. In temperate deciduous forests, due to new litter input and microbial activities, it is possible to recognize three main horizons of soil profile: litter horizon (L), organic humus horizon (H) and mineral soil horizon (S). The composition and activity of fungal community is likely to differ among the litter horizon and underlying horizons and also among the seasons. The activity of all measured extracellular enzymes and also ergosterol content decreased with increasing soil depth. The activity of laccase (produced by fungi) was high in summer, while Mn-peroxidase, an enzyme produced exclusively by saprotrophic basidiomycetes, exhibited the highest activity in winter. The results also suggested that the fungal species richness decreased with increasing soil depth and the richness in litter and humus horizons was distinctively higher than in the upper mineral soil. Our investigation revealed that fungal community in litter horizon is more affected by the season than the communities in deeper soil. Using sequence analysis of ITS region of fungal clone libraries, it was demonstrated that the uppermost layer is predominantly colonized by ascomycetes and saprotrophic basidiomycetes, while the ectomycorrhizal basidiomycetes are dominant in deeper horizons. During our DNA-based analysis of fungal community it appeared that the primer set ITS1F/ITS4B biases against certain groups of basidiomycetes and is thus inappropriate for basidiomycete community studies.

Keywords: Hypholoma fasciculare, Quercus petraea, Denaturing gradient gel electrophoresis, rDNA - internal transcribed spacer sequence, Lignocellulose, Litter, Saprotrophic basidiomycetes, Fungal community, Forest soil