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Mountain Spruce Forest Soils after Bark-Beetle Damage: Changes in Microbial Processes and Soil Microclimatic Conditions

M. Šťursová, J. Šnajdr, and P. Baldrian

Laboratory of Environmental Microbiology, Institute of Microbiology of the ASCR, v.v.i., Praha 4, Czech Republic (baldrian@biomed.cas.cz / fax: +420241062384)

Mountain forests in the Central European mountains are affected by a long-term N deposition and acidification, resulting in the increased mobility of aluminium and a consequent damage to trees. The weakened forests growing under unfavorable climatic conditions with low mean annual temperature and a short vegetation period are then susceptible to other types of damage. One of the typical results is the dieback of old forests after bark-beetle invasion. The aim of this work was to analyse the changes of soil properties in the topsoil of *Picea abies* forests in Bohemian Forest National Park, Czech Republic after the destruction of tree cover due to a bark-beetle invasion. The bark-beetle damaged and non-damaged sites were located at 1250-1300 m a.s.l. and characterised by a vegetation period length of 6 months and a mean air temperature during the vegetation period around 10°C. Temperatures were monitored on the soil surface and in 2, 5, and 10 cm depth. The activity of extracellular enzymes cellobiohydrolase, 1,4-β-glucosidase, 1,4-β-xylosidase, 1,4-β-glucosidase, chitinase, arylsulfatase, phosphomonoesterase, phosphodiesterase, alanine aminopeptidase and leucine aminopeptidase was monitored in the L and O horizons in the beginning (late May), middle (August) and end (late October) of the vegetation period. The bark-beetle damaged sites, approx. 3-5 years after dieback, were devoid of living trees with a soil surface covered mainly by grasses while the control sites were dominated by *P. abies* trees and had typically a litter layer of spruce needles on the surface. During vegetation season, the bark-beetle damaged sites exhibited higher amplitude of daily temperature (9°C compared to 4°C on the soil surface) and a sharper gradient of soil temperature. The mean soil surface temperature maxima were also higher (36°C compared to 26°C) at these sites. The activity of extracellular enzymes was significantly different between the damaged and control sites in the L horizon during the whole vegetation season and also in the H horizon in October. This was mainly due to the differences in phosphomonoesterase, phosphodiesterase and aminopeptidases activity. The season was the most important factor affecting the enzyme activity. Its effect was more pronounced at the bark-beetle damaged sites compared to control sites where the activities of individual enzymes in both the L and O horizons were typically significantly higher in August than in May and October. This is most probably due to the changes in the temperature regime since the changes of soil moisture between seasons were low. Preliminary results indicate that the differences in the microbial processes in soils can be due to the differences in the composition of soil microbial communities. This work was supported by the Czech Science Foundation (526/08/0751), the Ministry of Education, Youth and Sports of the Czech Republic (LC06066)and the Ministry of Agriculture of the Czech Republic (QH72216).