



Molecular differences of root and needle decomposition

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Up to now there is only a poor understanding of the sources contributing to organic carbon in forest soils, especially the contribution of leaves and roots.

Incubation experiments have shown that root material is often degraded more slowly, than leaf or shoot material. This led to the hypothesis, that soil organic matter would be mainly root derived.

To be able to maintain high levels of organic carbon in soils, the factors that influence differences in decomposition dynamics have to be understood more deeply.

But surprisingly information's about the factors behind these empirical data's is scarce.

Differences in decomposition dynamics can be due to physical, biological and chemical parameters. We hypothesize, that differences in decomposition speed of litter materials are indicated by differences in chemical composition.

Therefore we analyzed the chemical composition of samples from a 3-year litterbag decomposition experiment with roots and leaves of spruce and pine, which was conducted in Finland.

In this study we focused on the following questions:

(I) What are the temporal decomposition patterns for main constituents of needles and leaves?

(II) Which of the main components explains the best weight loss over time?

(III) What are the major differences between needle and root decomposition?

The mass loss was largely different between the litter species and we always observed larger mass loss for leaf-derived litter in comparison to root derived litter. This trend was also observed by molecular analysis. The increase of the ratio of vanillic acid to vanillin was negatively correlated to the mass loss of the samples over time. Lignin oxidation was stronger for leaves and needles than for roots per unit mass loss.

Species could be best identified by the alkane patterns, but the total alkane contents decreased by nearly 90% in the first 3 years of decomposition for needles.

The alkane contents of roots were much lower than the alkane contents of needles and leaves, but root alkanes appeared to be more stable than leaf and needle Alkanes.

Preliminary results showed, that cutin and suberin derived monomers were selectively enriched in the first year of decomposition and were after that decomposed faster than lignin derived monomers and leaves which seem to be stable within the first 3 years of litter decomposition. The cutin moieties of the leaves and the suberin monomers of the needles showed the same trend.

The decomposition patterns of most major plant compounds generally seem to be slower for roots than for needles. This could indicate that root decomposition was limited from an external factor, as the present compounds did not differ chemically much between the samples.