



# The molecular composition of extractable soil microbial compounds and their contribution to soil organic matter vary with soil depth and tree species



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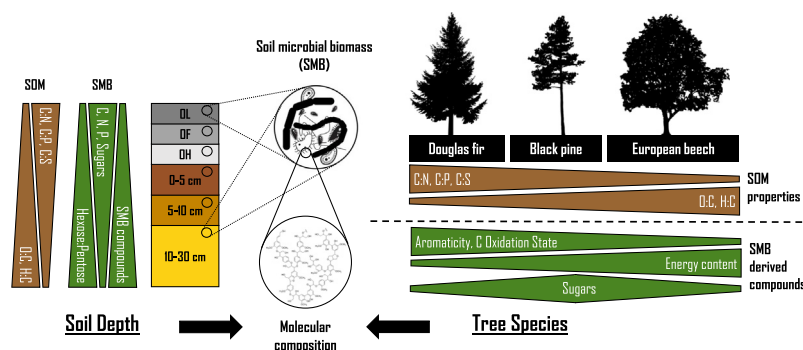
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## HIGHLIGHTS

- Microorganisms are adapted to their food resource provided by tree species.
- Transformation processes of SOM are depth-dependent.
- Supply of C-rich compounds determines type and amount of microbial produced sugars.
- Microorganisms produce SOM largely similar to their own molecular composition.

## GRAPHICAL ABSTRACT



## ARTICLE INFO

### Article history:

Received 18 November 2020

Received in revised form 15 March 2021

Accepted 21 March 2021

Available online 25 March 2021

Editor: Yucheng Feng

### Keywords:

Soil organic matter

Stoichiometry

Sugars

Common garden experiment

ESI-FT-ICR-MS

Post-mining soil

## ABSTRACT

Recent findings on soil organic matter (SOM) revealed that soil microorganisms are not only crucial for SOM formation through plant litter degradation but soil microbial biomass (SMB) may also directly contribute to SOM and its composition. However, the role and interactions of litter quality, microbial turnover and composition of SMB and SOM remain unclear. Hence, soil profiles (organic forest floor and mineral soil layers) at a recultivated and afforested post-mining site were investigated for the influence of litter quality from different tree species (*Fagus sylvatica*, *Pseudotsuga menziesii*, *Pinus nigra*) and soil depth – representing different degrees of organic matter (OM) turnover – on the molecular composition of chloroform fumigation extracted SMB-derived compounds in comparison with easily extractable (non-fumigated) SOM-derived compounds. The SMB extracts were analyzed for microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP). The molecular composition of SMB and SOM compounds were determined by electrospray ionization Fourier transformation ion cyclotron resonance mass spectrometry (ESI-FT-ICR-MS) complemented by the determination of nine monosaccharides representing microbial or plant origin. Van Krevelen diagrams obtained from the ESI-FT-ICR mass spectra revealed the substantial contribution of microbial-derived compounds to extractable SOM that further increased with soil depth. Analysis of the easily extractable monosaccharides implied that >99% were of microbial origin. Microbial sugars as well as MBC, MBN and MBP explained best depth-related variations of extractable SMB compounds indicating that supply and availability of C-rich OM drive these parameters. Furthermore, the contribution of microbial sugar C to MBC increased with depth, suggesting that recycling of carbohydrates is an adaptation strategy of microorganisms in

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