



HAL
open science

Forest trees species shape the biochemistry of soil organic matter under the control of their associated microbial communities

Fadwa Khalfallah, Marie-France M.-F. Dignac, Philippe Biron, A. Felbacq, An de Schrijver, Arnaud A. Legout, Aino Smolander, Elena Vanguelova, Kris Verheyen, Lars Vesterdal, et al.

► To cite this version:

Fadwa Khalfallah, Marie-France M.-F. Dignac, Philippe Biron, A. Felbacq, An de Schrijver, et al.. Forest trees species shape the biochemistry of soil organic matter under the control of their associated microbial communities. 4. Conference on the Ecology of Soil Microorganisms, Jun 2022, Prague, Czech Republic. hal-03712383

HAL Id: hal-03712383

<https://hal.inrae.fr/hal-03712383v1>

Submitted on 3 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Forest trees species shape the biochemistry of soil organic matter under the control of their associated microbial communities

Khalfallah F(1,2), Dignac MF(3), Biron P(3), Felbacq A(3), De Schrijver A(4), Legout A(2), Smolander A(5), Vanguelova E (6), Verheyen K(7), Vesterdal L(8), Zeller B(2), Augusto L(9), Buée M(1)*, Derrien D(2)*

Soil organic matter (SOM) is the largest carbon reservoir on the continents. It contains three to four times more carbon than vegetation. SOM content is particularly high in forest ecosystems, which cover 30% of Europe. The tree species is one of the main factors influencing the storage and biochemistry of soil organic matter, through its litter quality and the species-specific microbial communities.

The objectives of our study were (i) to compare the effect of tree species on the biochemical quality of SOM (ii) to investigate the impact of the biochemical quality of SOM on microbial communities and vice versa.

We hypothesized, that the tree effect on SOM biochemical quality was regulated by the pedoclimatic conditions. Also, we thought that the microbial community enriches the SOM with N compounds and some specific polysaccharides.

In this aim, we sampled forest floor and topsoil (0-10 cm) in seven monospecific plantations of different tree species in five European sites (total of 24 conditions). We characterized the organic matter using a technique combining pyrolysis and gas chromatography (Pyro-GC/MS). We also described the microbial communities present in these same samples using metabarcoding (16S and ITS Miseq) and we measured microbial functions involved in SOM decomposition and nutrient mobilisation through enzymatic activities.

Our Pyro-GC/MS results revealed that some organic compounds were tree species-specific and others were site-specific. In particular, we showed that N-fixing tree species and arbuscular mycorrhizal (AM) tree species increased the proportion of N-compounds in SOM. These biochemical results will be discussed in relation to microbial community and functional diversity data.

AFFLIATION

1. Université de Lorraine, INRAE, IAM, F-54000 Nancy, France, <fadwa.khalfallah@inrae.fr> & <marc.buee@inrae.fr>*
2. INRAE, BEF, F-54000 Nancy, France, <delphine.derrien@inrae.fr>*, <arnaud.legout@inrae.fr> & <bernhard.zeller@inrae.fr>
3. UMR Institut d'écologie et des sciences de l'environnement-Paris, 75005 Paris, France, <marie-France.dignac@inrae.fr>, <philippe.biron@inrae.fr> & <axel.felbacq@inra.fr>
4. Forest & Nature Lab, Ghent University, Geraardsbergsesteenweg 267, BE-9090 Gontrode-Melle, Belgium, <An.DeSchrijver@UGent.be> & <an.deschrijver@hogent.be>
5. Natural Resources Institute Finland, Latokartanonkaari 9, FI-00790 Helsinki, Finland, <aino.smolander@luke.fi>
6. Forest Research, Alice Holt Lodge, Farnham, Surrey GU10 4LH, UK, <elena.vanguelova@ForestResearch.gov.uk>
7. Department of Geosciences and Natural Resource Management, University of Copenhagen, Rolighedsvej 23, 1958 Frederiksberg C, Denmark, <lv@ign.ku.dk>
8. Laboratory of Forestry, Ghent University, Geraardsbergse Steenweg 267, B-9090 Melle-Gontrode, Belgium, <kris.verheyen@ugent.be>
9. INRAE, UMR 1391 Interaction Soil Plant Atmosphere, Bordeaux France <laurent.augusto@inrae.fr>

* These authors jointly supervised this work: M. Buée and D. Derrien