CHEMICAL DIVERSITY OF SOIL LIPIDS REFLECTS SURROUNDING BIODIVERSITY IN A FRENCH PEATBOG

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CHEMICAL DIVERSITY OF SOIL LIPIDS REFLECTS SURROUNDING BIODIVERSITY IN A FRENCH PEATBOG

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Introduction

The spatial heterogeneity of molecular biomarkers preserved in soils and sediments, and their representativeness of the spatial distribution of the surrounding vegetation, are seldom taken into account in environmental or paleoenvironmental studies. Here we examine the distribution of lipids in peat soils in relation to their potential plant sources in the surroundings.

Sampling Site

La Guette peatland is located in Neuilly-sur-Barangeon (Sologne, Cher) in the French Centre Region (154 m a.s.l.; N 47°19’, E 2°16’). This site covers 25 ha and is a transitional fen (pH about 4-4.5). Around each station, trees were counted in concentric circles of increasing radius (1, 2, 3, 4 and 5 m, giving areas of 3.14; 12.6; 28.3; 50.3 and 78.5 m², respectively). Then, tree density (d_trees) and cover index (CI) were calculated by GC/MS.

Specificity of biomarkers

We first explored lipid compounds that could be specific for distinct vegetation by comparing molecular imprints in soils with those of the surrounding plants.

Tree counting

Around each station, trees were counted in concentric circles of increasing radius (1, 2, 3, 4 and 5 m, giving areas of 3.14; 12.6; 28.3; 50.3 and 78.5 m², respectively). Then, tree density (d_trees) and cover index (CI) were calculated.

Lipid Analyses

About 5 g of soil or plant sample were sonicated with CH2Cl2 (3 x 10 min x 15 ml). Total extract was fractionated into neutral and acidic compounds using amionropyl-bonded silica. Neutral fraction was separated into five fractions using a sequence of solvents of increasing polarity. Alcohol fractions were analyzed by GC/MS.

Conclusions

- Pentacyclic triterpenyl acetates detected in Erica tetralix and Calluna vulgaris were found in high concentrations in open stations.
- Tricyclic diterpenes and methoxy-serratenes detected in Pinus sylvestris were found in high concentrations in semi-close and close stations dominated by Pinus sylvestris.
- Betulin derivatives detected Betula pendula were found in high amounts in semi-close and close stations dominated by Betula pendula.
- Non-specific compounds showed rather homogeneous distribution along the stations. Reversely, the spatial dispersion of specific compounds appears controlled by the surrounding vegetation.
- Concentration of B. pendula and P. sylvestris biomarkers in soils are well correlated with tree density when an area of 80 m is considered. Here, the influence zone is valid over an area of at least 80 m².

Variability of molecular imprints in stations

We then compared the distribution of these lipid classes among soil samples in stations under varying vegetation cover.

Tree cover x Tree specific biomarkers

Once demonstrated the efficiency for some lipid classes to be reflective of the surrounding vegetation, we test to what extent they spatially represent the surrounding vegetation. This test is realized on tree specific and achieved by comparing the correlation between biomarker concentration and tree density with the considered area.