

SEASONAL DISTRIBUTION OF 5-N-ALKYLRESORCINOLS FROM *MOLINIA CAERULEA*: POTENTIAL IMPLICATIONS FOR VEGETATION DYNAMICS IN PEATLANDS

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Sphagnum-dominated peatlands constitute an important stock of carbon (C) in soil at the global (Gorham 1991; Yu et al., 2010). *Sphagnum* mosses have a key role in peat accumulation by creating acidic, nutrient poor, wet and anoxic conditions and generating recalcitrant litters (van Breemen, 1995). However, in response to global change, many peat bogs are colonized by vascular plants (such as *M. caerulea*), that could disrupt their carbon storing capacities. In this context, the effect of the interaction between *Sphagnum* and colonizing plants on carbon storage needs to be elucidated. Specifically, chemical interactions between plant species can have a significant effect on the structure and functioning of the ecosystem.

La Guette peatland (Neuvy-sur-Barangeon, France) is a *Sphagnum* fen invaded by vascular plants since the 1970s. *M. caerulea* (Poaceae) is the most abundant vascular plant in this peatland. Here, we report for the first time the occurrence of a series of 5-*n*-alkylresorcinols (AR) homologues in *M. caerulea* leaves and in underlying peat samples in the peatland. These compounds were previously reported in bog-forming plant species classified as sedges (Avsejs et al., 2002). They are reputed to play a key role in plant chemical interactions by stimulating seed germination and shoot elongation *via* enzymes activity (Scognamiglio et al., 2012). This could be the key to the success of *M. caerulea* in colonizing peatlands.

In order to untangle the role of these molecules in peatland functioning, we first explore abiotic factors that determine their amount and distribution in *M. caerulea* leaves. Then we study AR accumulation in peats in order to discuss their potential use in paleoenvironmental studies.

M. caerulea leaves were collected in the La Guette peatland between April and December 2014 during seven field campaigns. During each campaign, leaves were collected near 4 plots where a specific monitoring of environmental parameters was done (air and soil temperature, water level, photosynthetically active radiation and number of *M. caerulea* leaves). Peat profiles were sampled in two zones: (i) invaded and (ii) not invaded by *M. caerulea*. Lyophilized and crushed samples were ultrasonically extracted and separated according to Zocatelli et al. (2014) into neutral, acidic and polar compounds on aminopropyl bonded silica. The alcohol fraction was silylated and 5 α -cholestane was added as internal standard prior to analysis using gas chromatography-mass spectrometry.

In *M. caerulea* leaves, homologues series of 5-*n*-alkylresorcinols ranged from 5-*n*-C₁₅ to 5-*n*-C₂₅ with a strong odd-over-even predominance. AR dominant homologues vary through the season. Total ARs contents found in *M. caerulea* leaves varied between 3.6 \pm 0.5 $\mu\text{g g}^{-1}$ in April to 28.3 \pm 2.4 $\mu\text{g g}^{-1}$ in November. Dominant 5-*n*-C₁₇, 5-*n*-C₁₉ and 5-*n*-C₂₁ homologues in April samples gradually shift towards 5-*n*-C₁₉, 5-*n*-C₂₁ and 5-*n*-C₂₃ in December samples. Average chain length (ACL) of ARs varied from 19.7 \pm 0.7 to 21.4 \pm 0.11 during *M. caerulea* season life cycle. Total AR contents in leaves are negatively correlated with photosynthetically active radiation ($r^2 = 0.64$; $p < 0.05$). Other measured parameters do not appear to have any significant effect on AR content and distribution. The correlation between photosynthetically active radiation and AR concentration are unlikely to result from photodegradation (Magnucka et al., 2014). Reversely, it could be linked to AR accumulation rates in cuticular waxes of plants (Ji and Jetter, 2009).

AR were present in high contents (from 8.0 to 15.1 $\mu\text{g g}^{-1}$ of total AR) in peat samples invaded by *M. caerulea*, although contents are lower than those reported by Avsejs et al. (2002) in an ombrotrophic peat. AR series varied from 5*n*-C₉ to 5*n*-C₂₅, with a maximum at 5*n*-C₁₉ (ACL = 19.6). In samples of peat that were not invaded by *M. caerulea*, AR contents were low (from 0.06 to 2.41 $\mu\text{g g}^{-1}$), and distributions ranged from 5*n*-C₁₉ to 5*n*-C₂₅ with a maximum at 5*n*-C₂₁ (ACL = 21.8). This study reveals that AR could respond to photosynthetically active radiation in *M. caerulea*. In addition to sedges, AR could be used as specific biomarkers of *M. caerulea* in palaeoenvironmental studies.

References:

Avsejs et al., 2002. 5-*n*-Alkylresorcinols as biomarkers of sedges in an ombrotrophic peat section. *Organic Geochemistry* 33, 861-867.

Gorham, 1991. Northern peatlands: role in the carbon cycle and probable responses to climatic warming. *Ecological Applications* 1, 182-185.

Ji and Jetter, 2008. Very long chain alkylresorcinols accumulate in the intracuticular wax of rye (*Secale cereale* L.) leaves near the tissue surface. *Phytochemistry* 69(5), 1197-1207.

Magnucka et al., 2014. Various effects of the photosystem II – inhibiting herbicides on 5-*n*-alkylresorcinol accumulation in rye seedlings. *Pesticide Biochemistry and Physiology* 116, 56-62.

Yu et al., 2010. Global peatland dynamics since the Last Glacial Maximum, *Geophysical Research Letters* 37, L13402, 1-5.

Scognamiglio et al., 2012. Allelopathic potential of alkylphenols from *Dactylis glomerata* subsp. *Hispanica* (Roth) Nyman. *Phytochemistry Letters* 5, 206-210.

van Breemen, 1995. How Sphagnum bogs down other plants. *Trends in Ecology & Evolution* 10, 270-275.

Zocatelli et al., 2014. Spatial variability of soil lipids reflects vegetation cover in a French peatland. *Organic Geochemistry* 76, 173-183.