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Seasonal variation of lipophilic constituents in roots of ***Echinacea purpurea*** and ***E. pallida***

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Introduction

Echinacea purpurea and *E. pallida* are widely used for the unspecific enhancement of the immune system. Lipophilic constituents such as alkamides and ketoalkenes/ketoalkynes are believed to be among the active metabolites in *E. purpurea* and *E. pallida*, respectively, with the highest concentrations in roots.

This work investigated the impact of harvest season on lipophilic constituents in roots grown for four to five years in a north European climate.

E. Purpurea

E. pallida

Method

Five roots of 4 to 5 year old *E. pallida* (Nutt). Nutt. and seven roots of 3 to 4 year old *E. purpurea* (L.) Moench, each from the same population, were collected throughout one year from early winter 2009 to fall 2010.

Lipophilic constituents were extracted from freeze dried roots with ethanol-water (70:30). Extractions were performed in three replicates and analysed by HPLC-PDA.

Results

The alkamides in *E. purpurea* could be separated into two groups. One group (1, 2 and 6 in Fig. 1) had the significantly highest concentrations during summer (D), when the soil temperature was high. The other group (3-5, Fig. 1) had a significantly higher concentrations when the temperature was just above 0°C in early spring (B).

The significantly highest concentrations of ketoalkenes/ketoalkynes and alkamides in *E. pallida* roots (Fig. 1) were found, when the soil temperature was just above 0°C in early spring (B), except for compound 9 which did not show statistical differences.

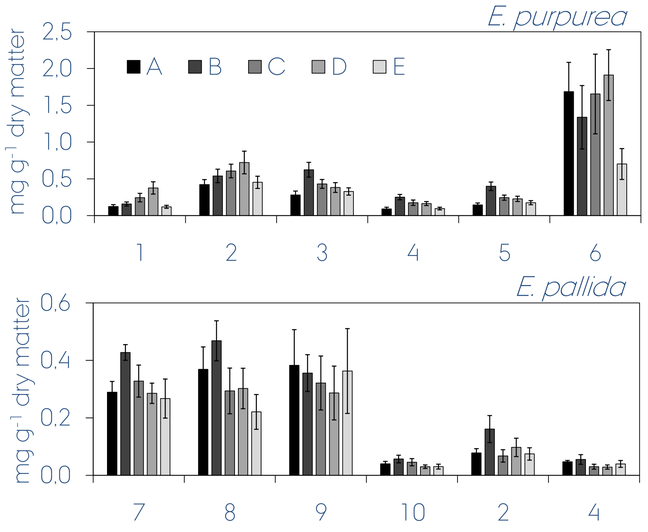

Figure 1: Lipophillic constituents in roots of E. purpurea *and* E. pallida *throughout one year . At the top six alkamides from* E. purpurea (1-6) *and at the bottom six ketoalkenes/ketoalkynes and alkamides from* E. pallida *(7-10, 2 and 4)* . The letters (A-E) corresponds to sampling dates (see Fig.2). Error bars correspond to 95% confidence intervals.

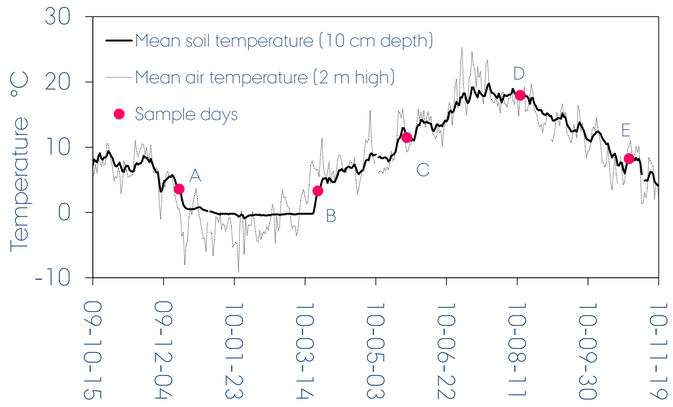

Figure 2: Mean soil temperature in 10 cm depth and mean air temperature in 2 m height from October 2009 to November 2010. Samples of E. purpurea *and* E. Pallida, *collected throughout one year (A-E), are indicated.*

1 Undeca-2E,4Z-dien-8,10-diynoic acid isobutylamide
2 Undeca-2Z,4E-dien-8,10-diynoic acid isobutylamide
3 Dodeca-2E,4Z-dien-8,10-diynoic acid isobutylamide
4 Undeca-2E,4Z-dien-8,10-diynoic acid 2-methylamide
5 Dodeca-2E,4Z-dien-8,10-diynoic acid 2-methylamide
6 Dodeca-2E,4E,8Z,10E/Z-tetraenoic acid isobutylamide
7 Tetradeca-8Z-ene-11,13-diyn-2-one
8 Pentadeca-8Z-ene-11,13-diyn-one
9 Pentadeca-8Z,13Z-dien-11-yn-2-one
10 Pentadeca-8Z,11Z,13E-trien-2-one

Conclusion

The concentration of lipophilic constituents in roots of *E. pallida* was highest in early spring (B), when the mean soil temperature was just above 0°C, whereas this was only the case for some lipophilic constituents in *E. Purpurea*. One group of alkamides in roots of *E. purpurea* showed the highest concentration in mid-summer (D).

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