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



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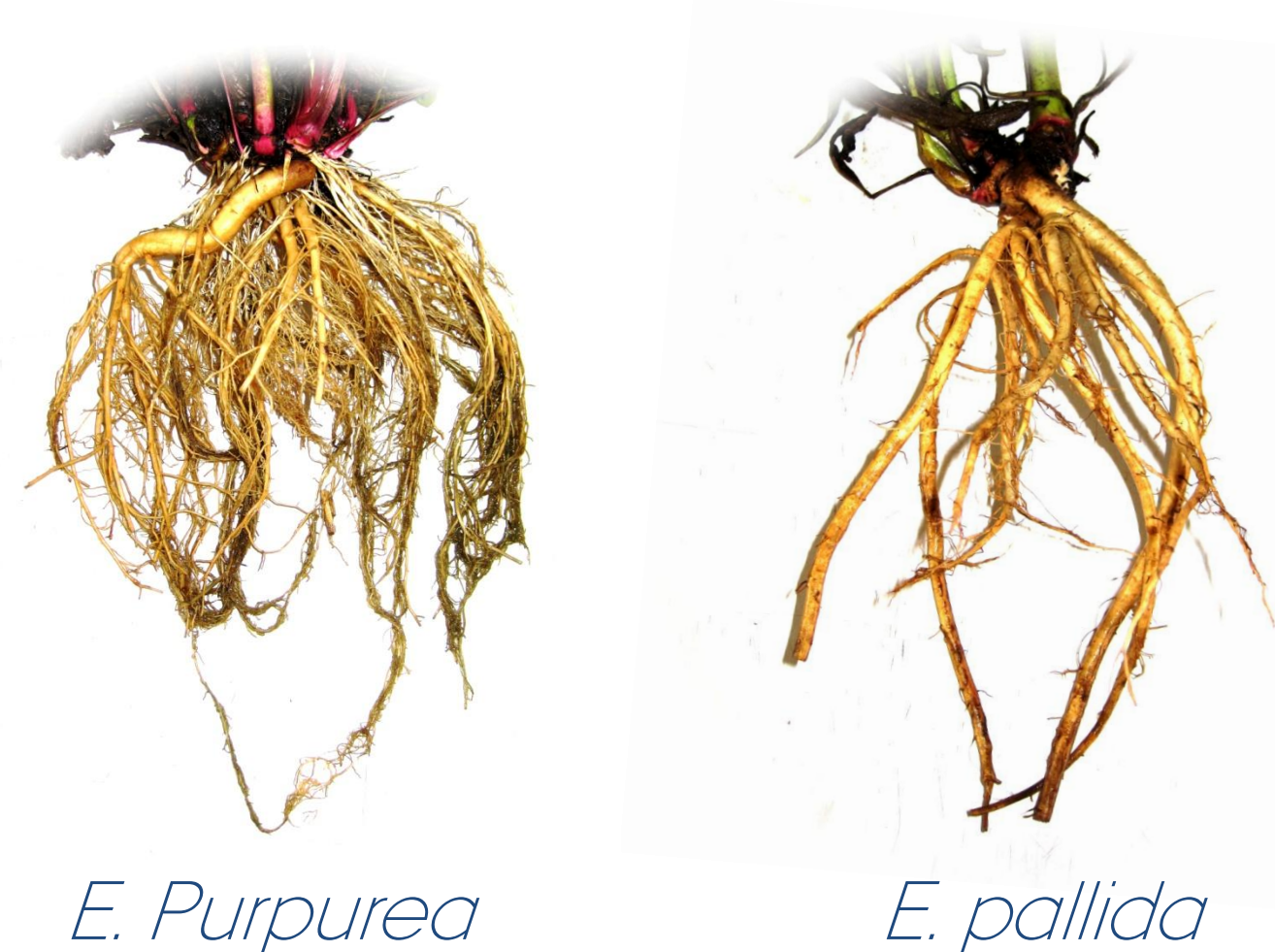
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## Introduction

*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.



## 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.

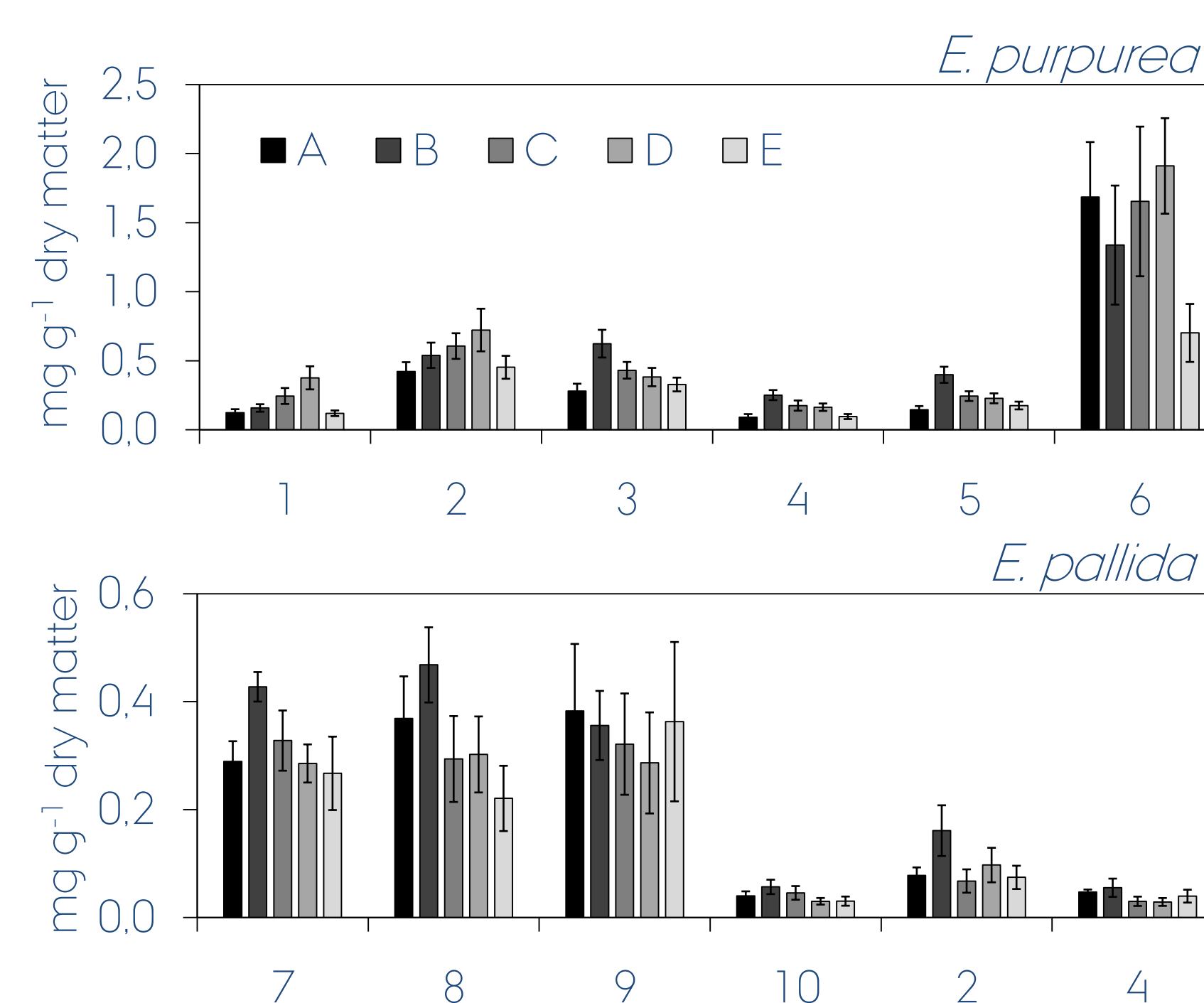


Figure 1: Lipophilic constituents in roots of *E. purpurea* and *E. pallida* throughout one year. At the top six alkamides from *E. purpurea* (1-6) and at the bottom six ketoalkenes/ketoalkynes and alkamides from *E. pallida* (7-10, 2 and 4). The letters (A-E) corresponds to sampling dates (see Fig.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

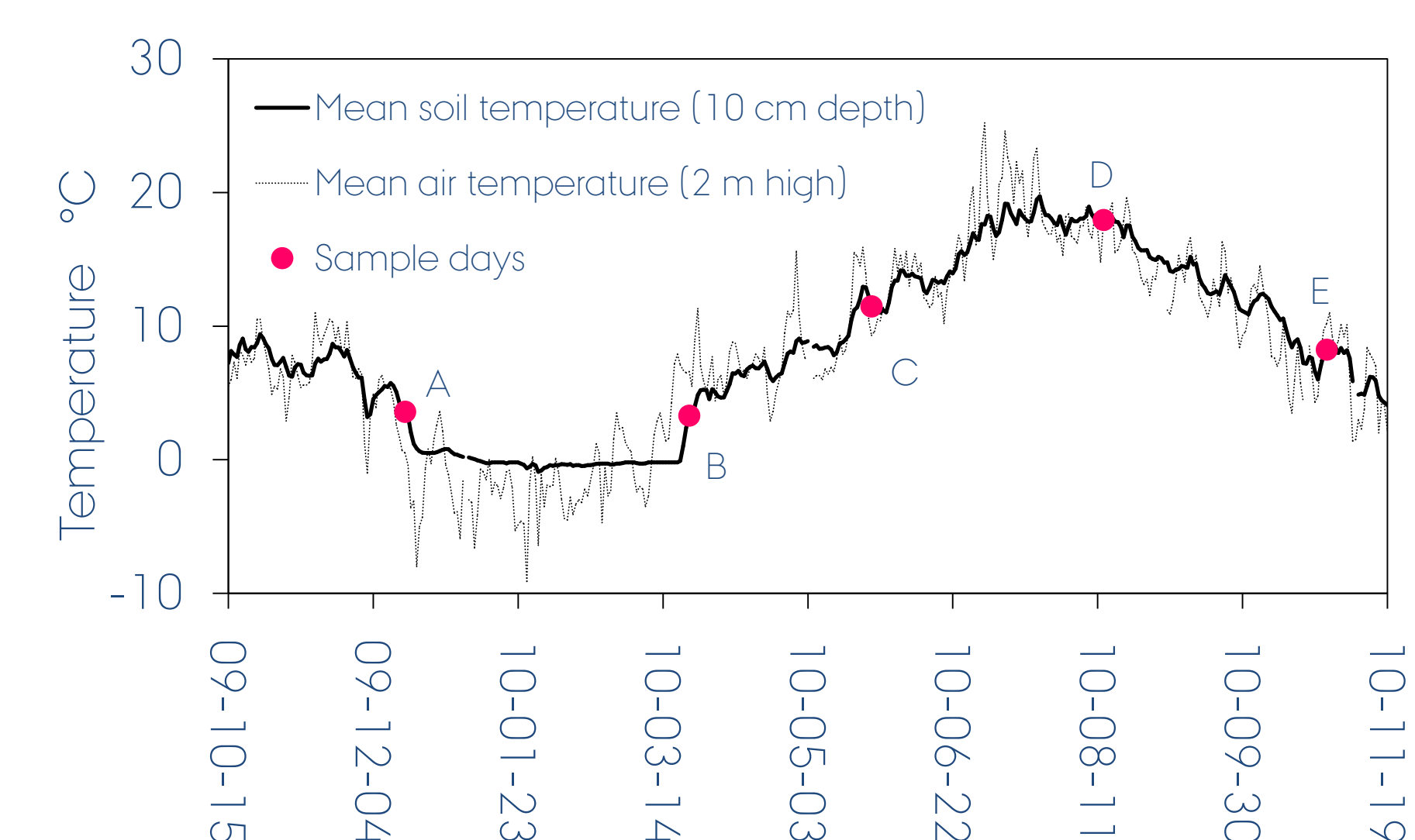


Figure 2: Mean soil temperature in 10 cm depth and mean air temperature in 2 m height from October 2009 to November 2010. Samples of *E. purpurea* and *E. pallida*, collected throughout one year (A-E), are indicated.

- 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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