

Methane Exchange and Microbial Functional Potential in Forest Tree Tissues

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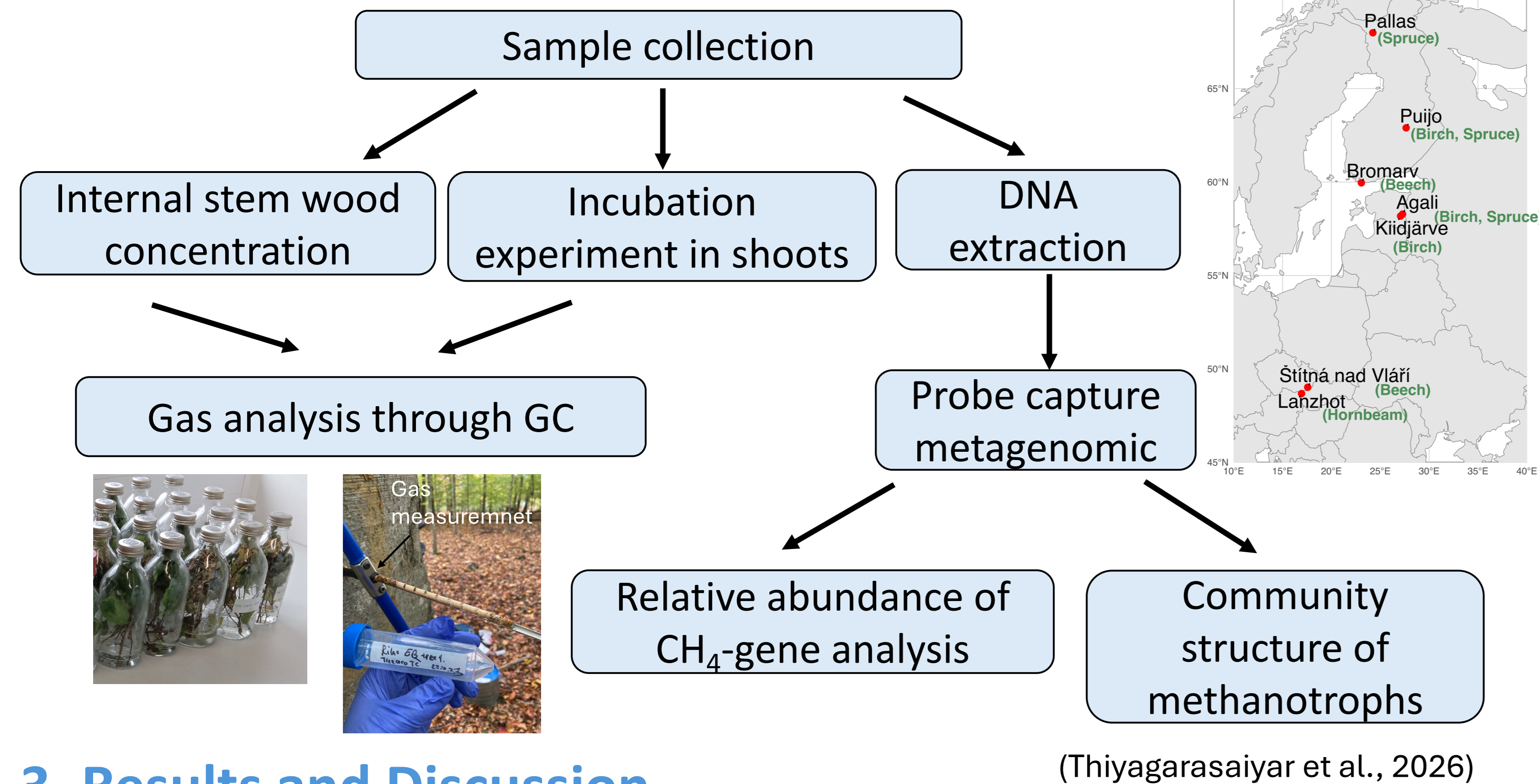
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1. Introduction

- Methane (CH₄) cycling in forests involves interactions among soil, plants, and microorganisms.
- The role of internal tree tissues in CH₄ dynamics remains poorly understood.
- Functional genes provide insight into the functional potential of plant-associated microorganisms.

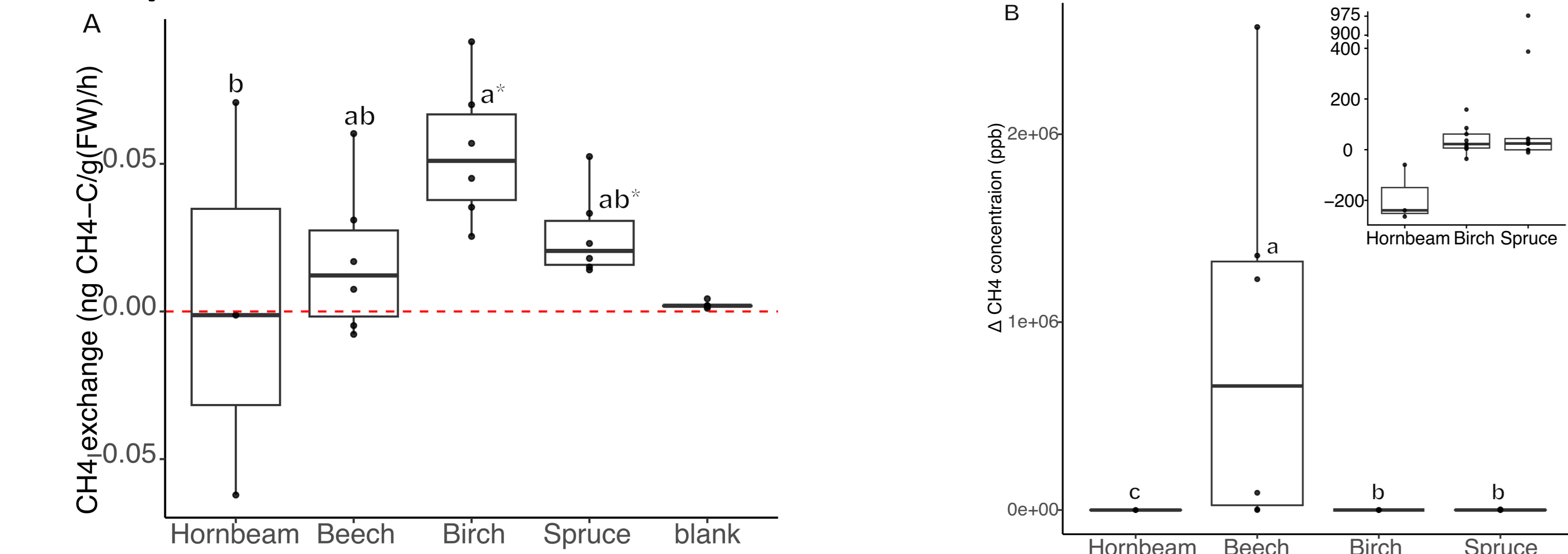
Aim: To investigate CH₄-cycling gene abundance and methanotroph community structure in shoots and wood cores of tree species across temperate to boreal forests.

2. Methods



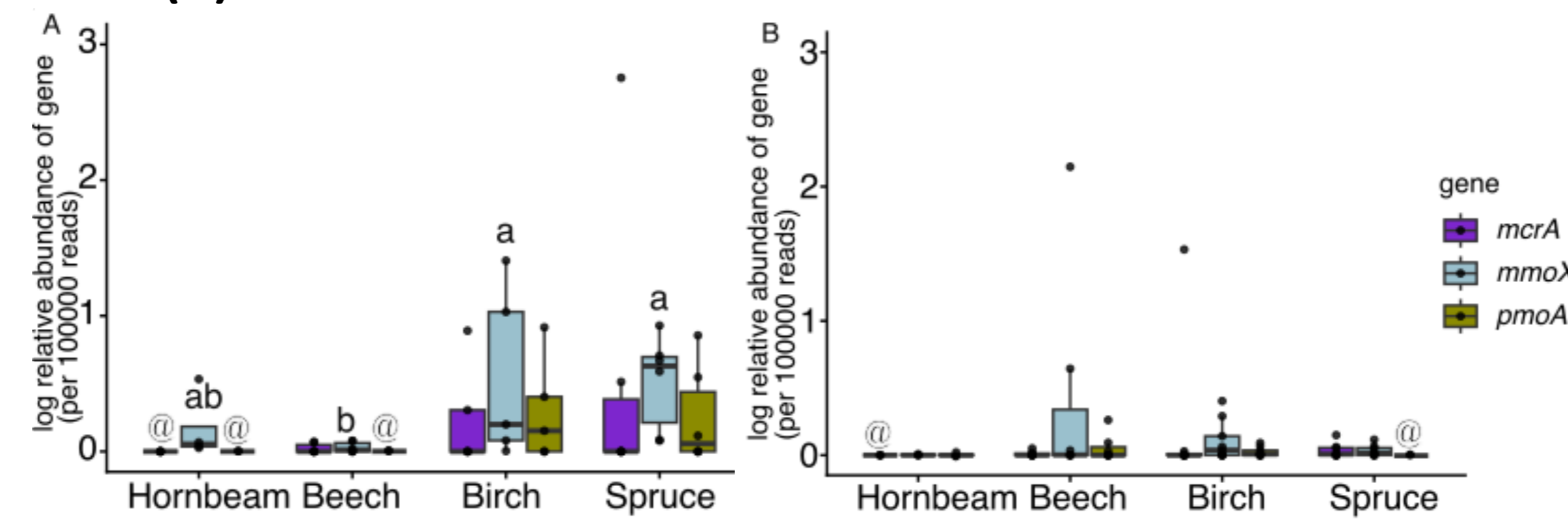
3. Results and Discussion

I. CH₄ exchanges in shoots (A) and CH₄ concentration in stem wood (B) across tree species



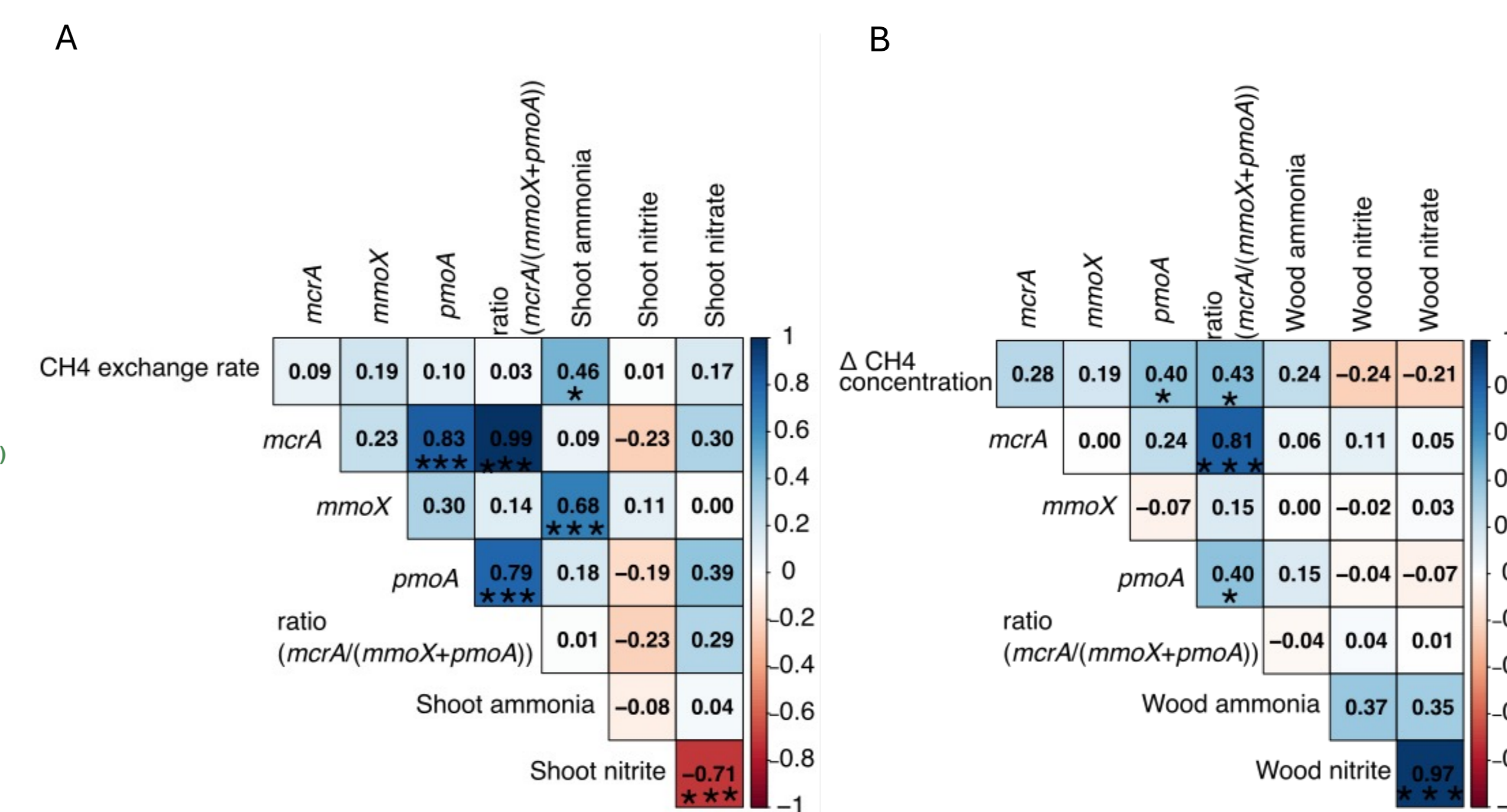
- Potential CH₄ consumption in hornbeam and CH₄ emission in beech, birch, and spruce.

II. CH₄ cycling gene relative abundance in shoots (A) and wood cores (B)



- CH₄ cycling genes are unevenly distributed within trees, showing strong differences between shoot and wood tissues.

III. Correlation analysis in shoots (A) and wood cores (B)

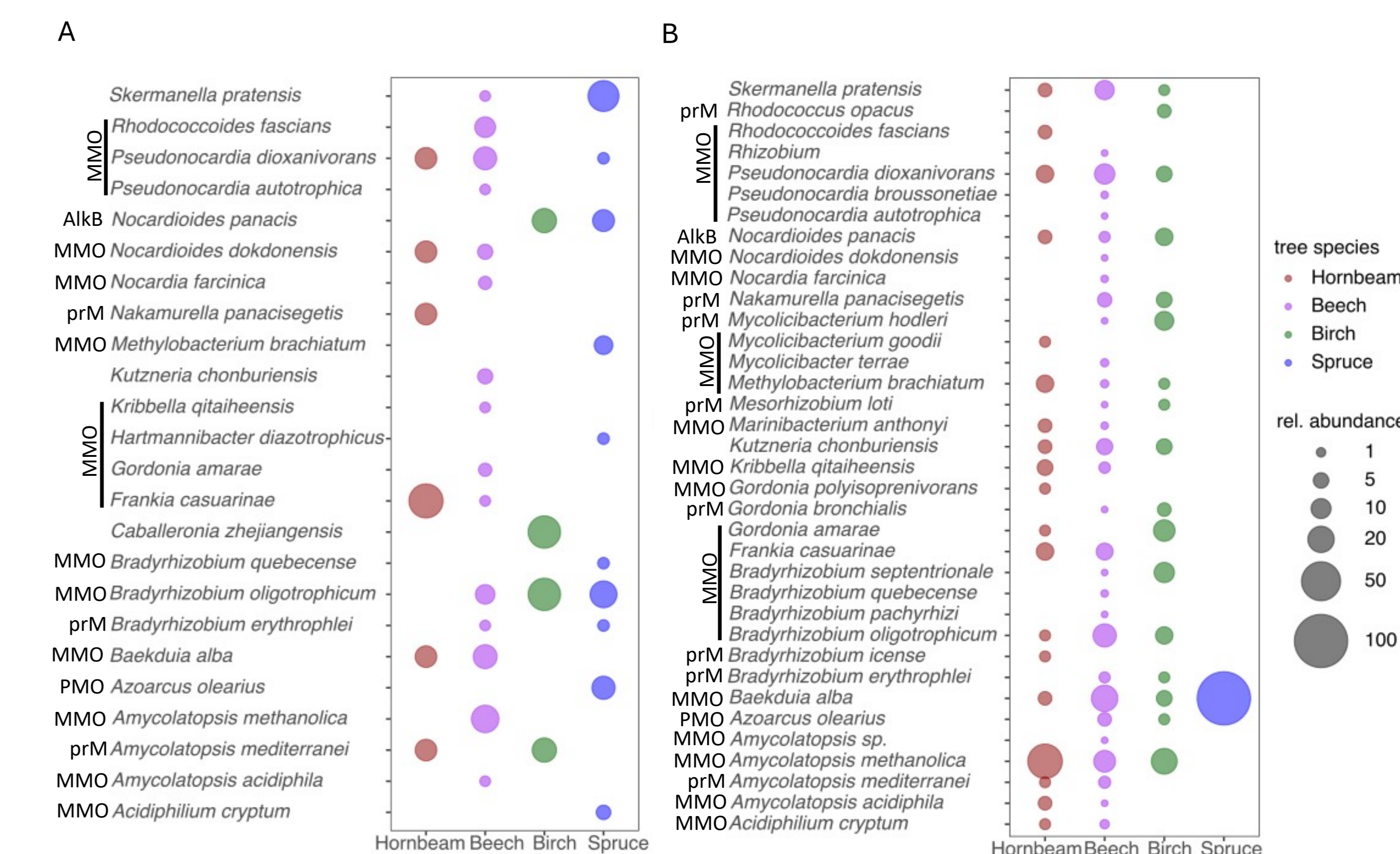


- CH₄ exchanges showed strong positive correlation with shoot ammonia.
- CH₄ concentration showed strong positive association with *pmoA* and methanogen-to-methanotroph gene ratio.

4. Conclusion and future study

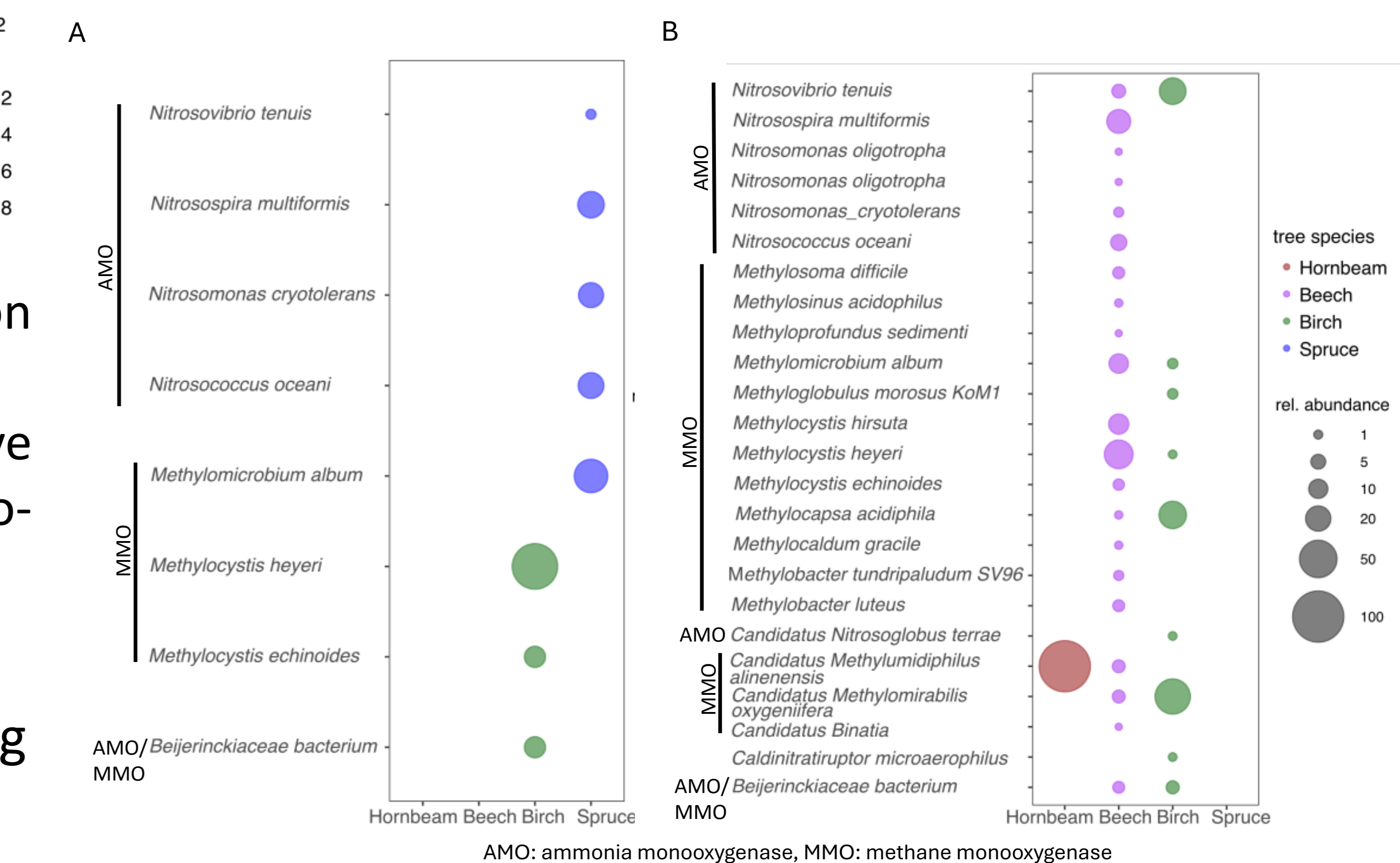
- Tree tissues harbour distinct CH₄-cycling microbial assemblages.
- Trees may function as localized CH₄ sinks or sources depending on tissue type and microbial composition (e.g., *Ca. Methyllumidiphilus alinenensis* consumes CH₄ in hornbeam)
- In situ* flux measurements and gene expression-based analysis are needed to understand microbial activity that drives forest CH₄ fluxes.

IV. *mmoX* community structure in shoots (A) and wood cores (B) based on probe-captured metagenomic



MMO: methane monooxygenase, prM: propane monooxygenase, AlkB: alkane monooxygenase PMO: phenol monooxygenase *based on NCBI annotation

V. *pmoA* community structure in shoots (A) and wood cores (B) based on probe-captured metagenomic



- Distinct methanotroph community structures based on *mmoX* and *pmoA* profiles reflect tissue-specific niche differentiation and host species effects within trees.

Key Take Away Message:

Tree tissues contain CH₄-cycling genes with the potential to influence CH₄ dynamics in forest ecosystems.

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Reference

Thiyagarasaiyar, K., Paul, D., Kerttula, J. et al. Genetic Potential for N₂O Metabolism in Tree Tissues: Insights From Nitrogen Cycling Gene Prevalence and *nosZ* Diversity Across Tree Species. *Microb Ecol* (2026).

Acknowledgement

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