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Thank you!

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Decrypt the fundamental processes behind the ^{2}H-fractionation in plant carbohydrates

P. Schuler, V. Vitali, M. Saurer, O. Rehmann, N. Buchmann, A. Gessler, M. M. Lehmann

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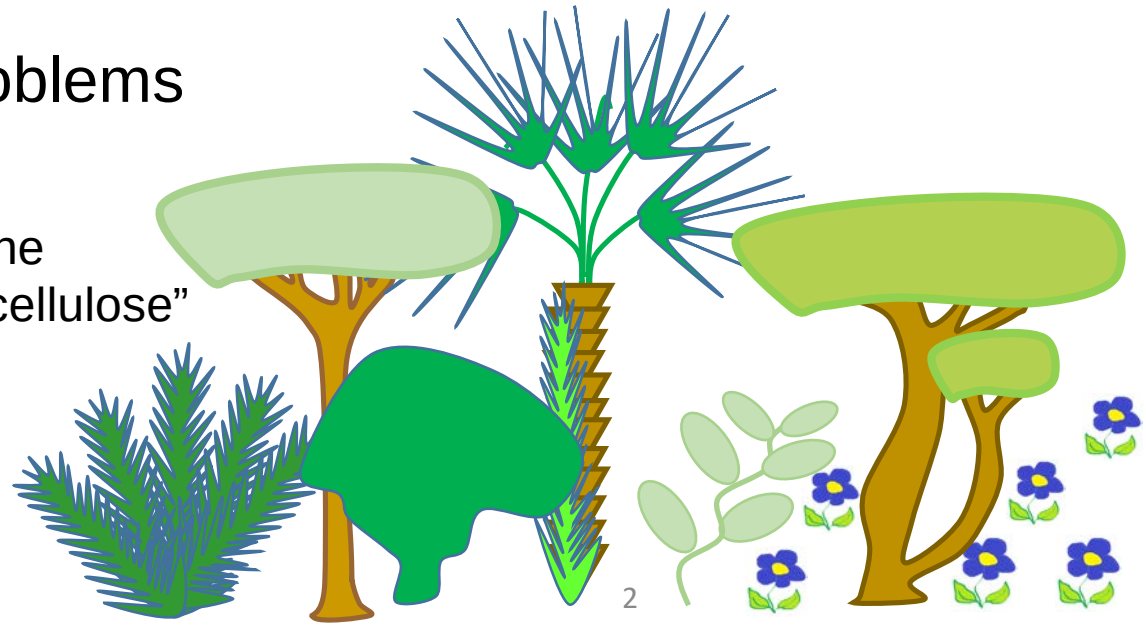
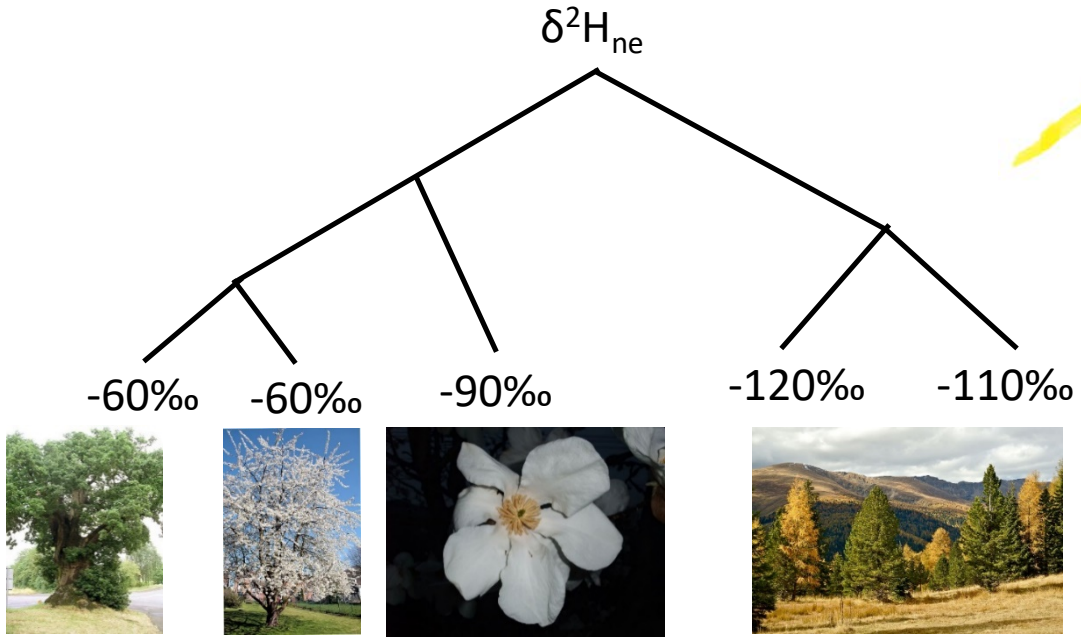
Why hydrogen?

- C, O, and H most common elements in organic matter
- $\delta^{13}C$ used to reconstruct stomatal conductance / drought
- $\delta^{18}O$ used to reconstruct hydrological conditions (source water, transpiration etc.)
- $\delta^{2}H$ might carry information about plant metabolism, BUT analysis of $\delta^{2}H$ of sugar/starch/cellulose with methodological problems

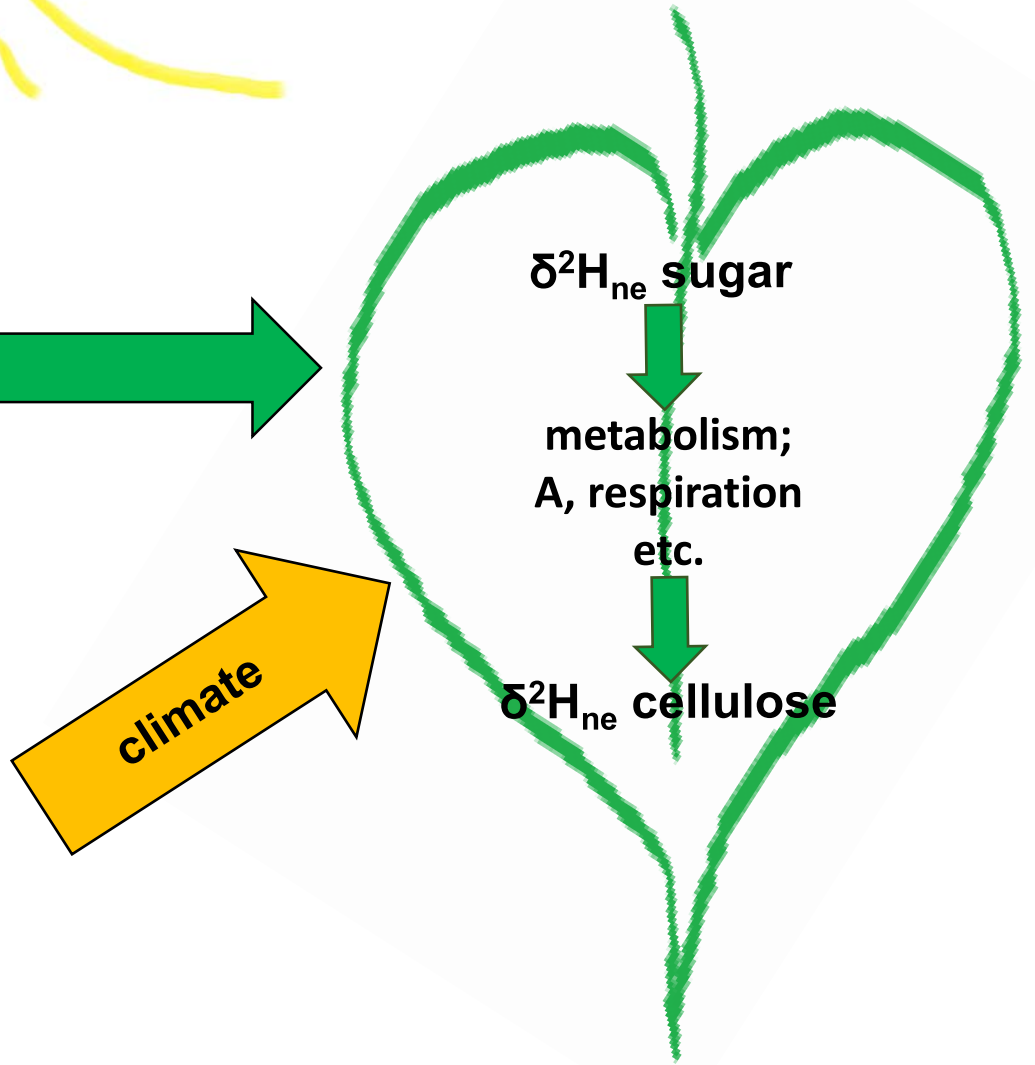
→ Schuler et al. 2022; PCE:
“A high-temperature water vapor equilibration method to determine non-exchangeable hydrogen isotope ratios of sugar, starch and cellulose”



Impact of phylogeny

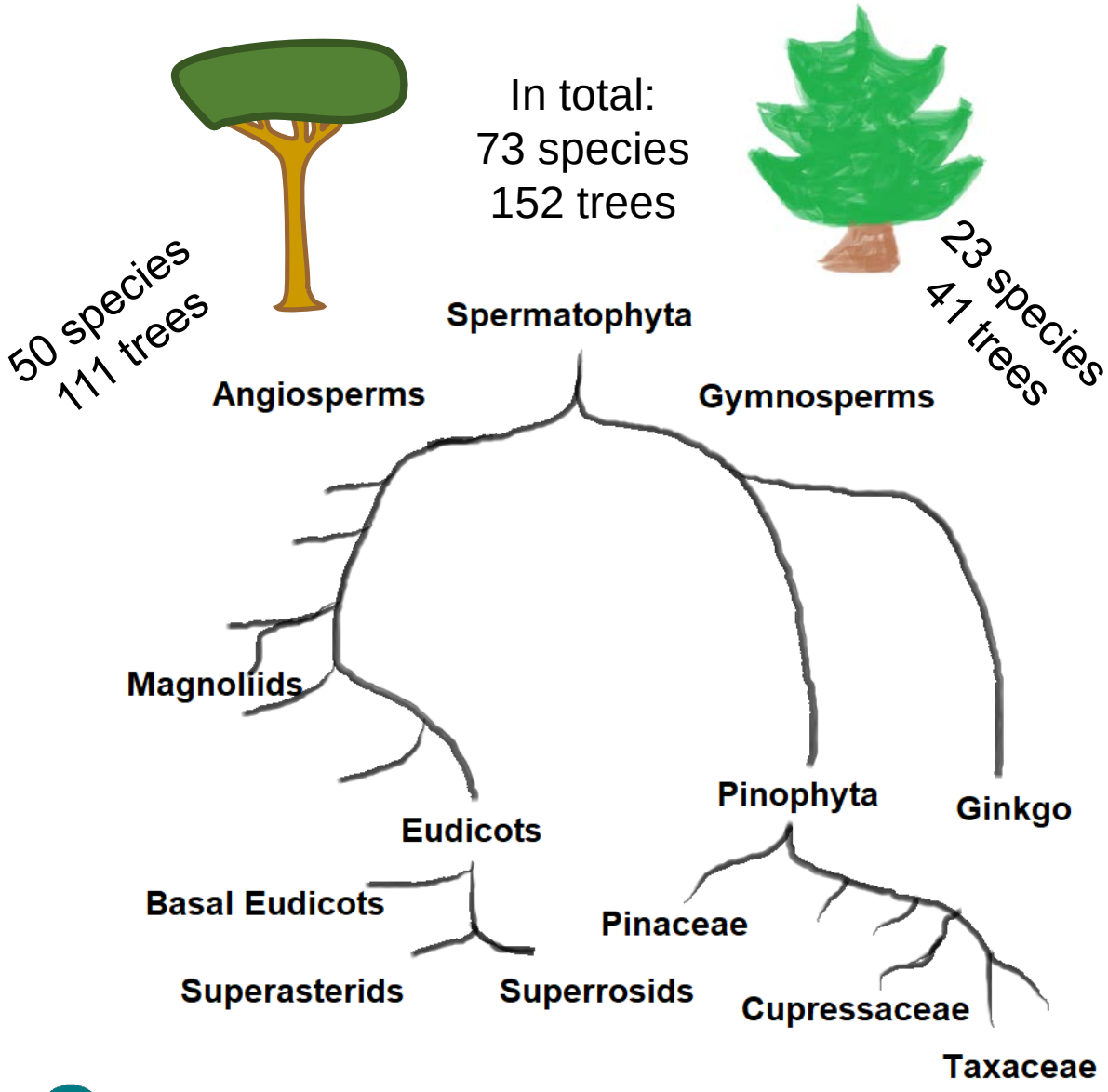


Leaf level processes → metabolism & physiology

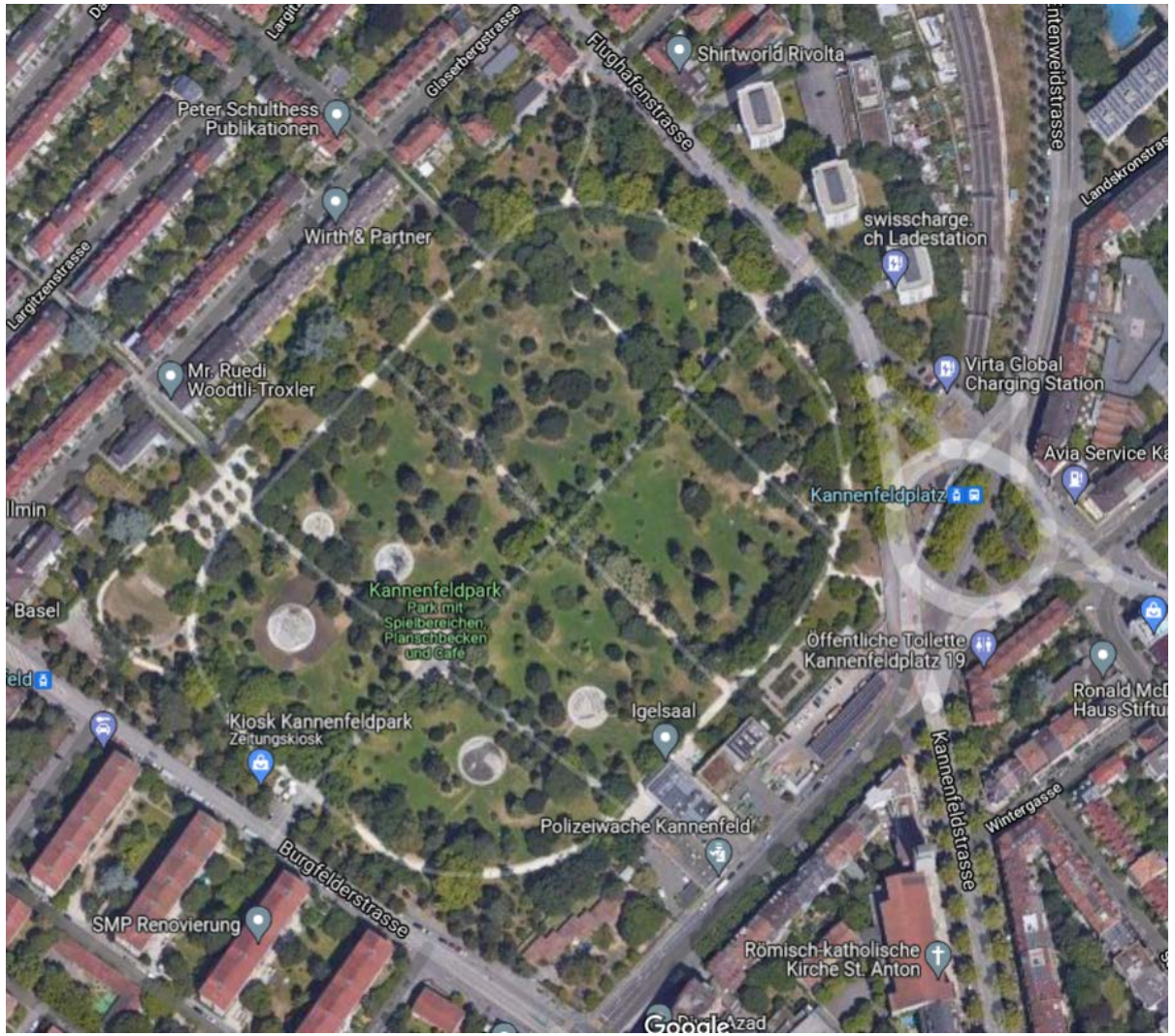


δ^2H_{ne}: carbon bound hydrogen that do not exchange with hydrogen of water and keeps signal imprinted during synthesis

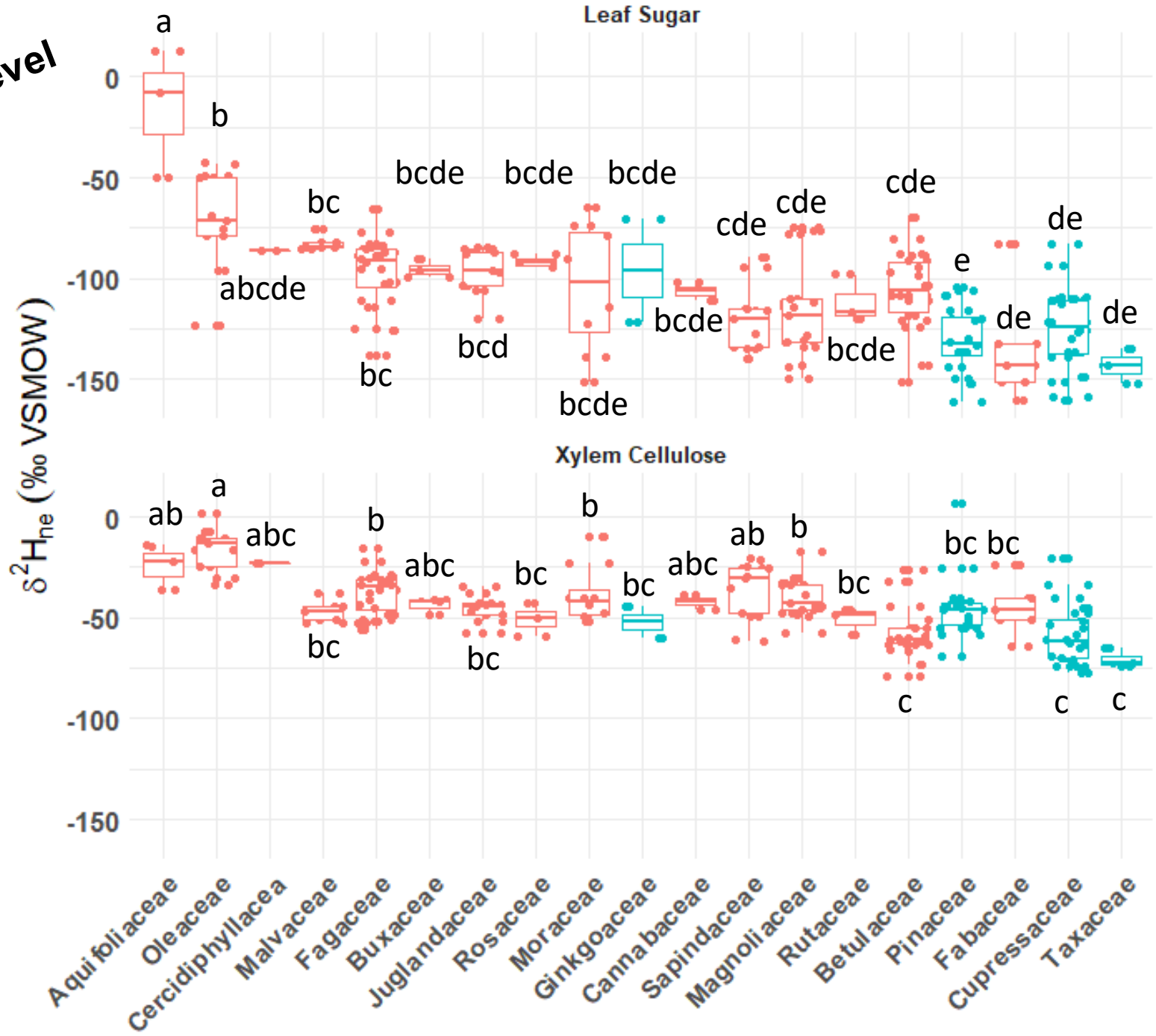
Experiment 1: phylogenetic influence on ^{2}H-fractionation



Common garden: Kannenfeldpark, Basel, Switzerland



Results experiment 1: Comparison on the family level



Red: Angiosperms
Blue: Gymnosperms

Experiment 2: leaf level fractionation processes

20 °C

low VPD

30 °C

low VPD

30 °C

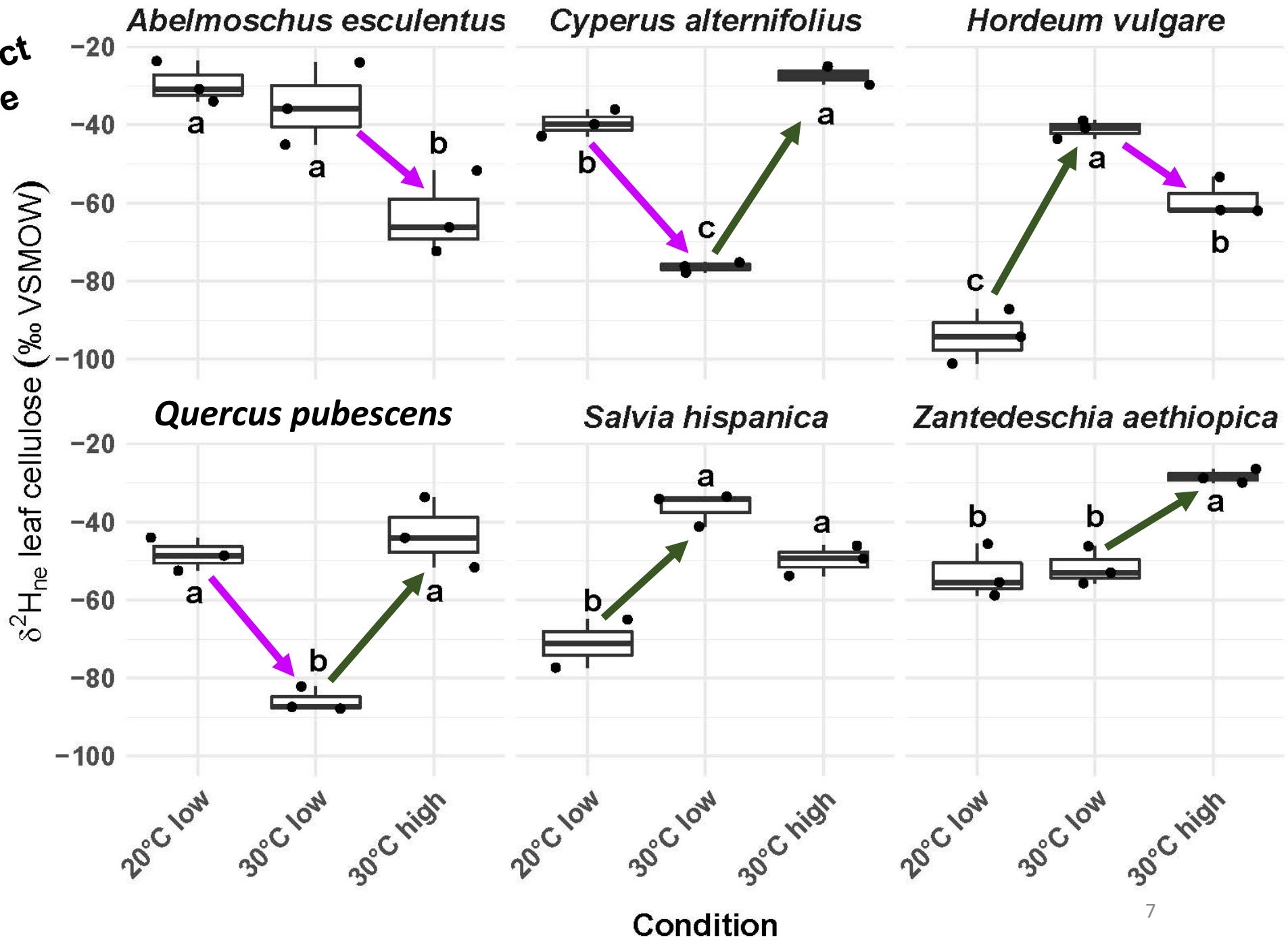
high VPD

Results experiment 2: Temperature and VPD effect on δ^2H_{ne} of leaf cellulose

^{2}H depletion

^{2}H enrichment

^{18}O (& ^{13}C) needed to disentangle temp & VPD effects!



Summary

^{2}H-fractionation is a dynamic process:

- Different species with different amplitude in ^{2}H-fractionation
- Species specific response to changes in temperature and VPD
- Combination of $\delta^{2}H$/ $\delta^{18}O$/ $\delta^{13}C$ –analysis might hold the key to increase precision of climate reconstructions using tree rings

Thank you for your attention! ☺

And 1000 thanks to the isotope gang @ WSL & ETH for all the amazing work and support!