Are the metabolic 'toolkits' of temperate trees species-specific?

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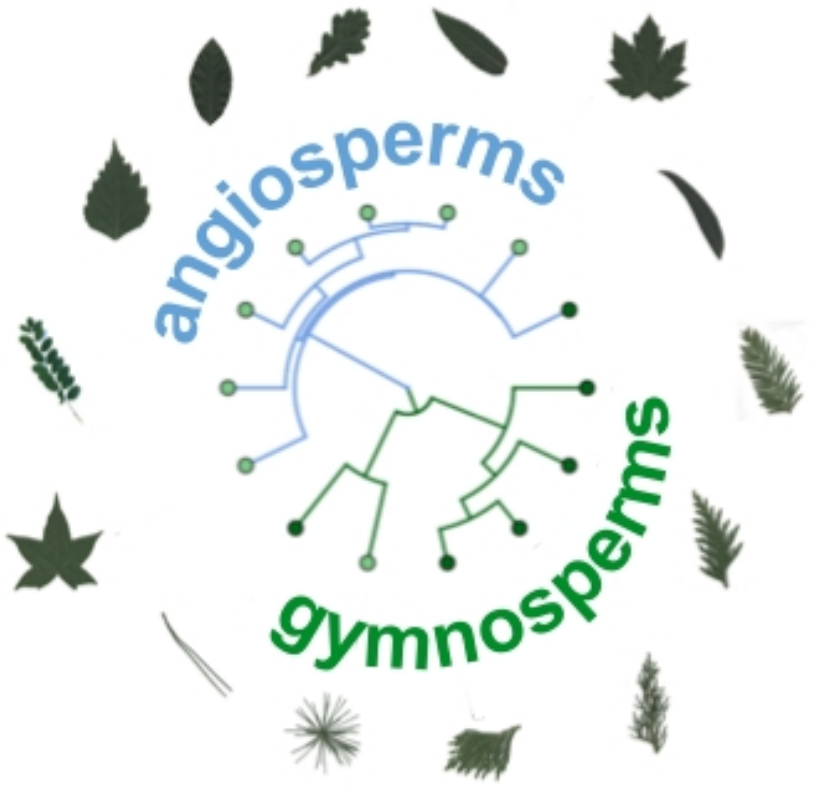
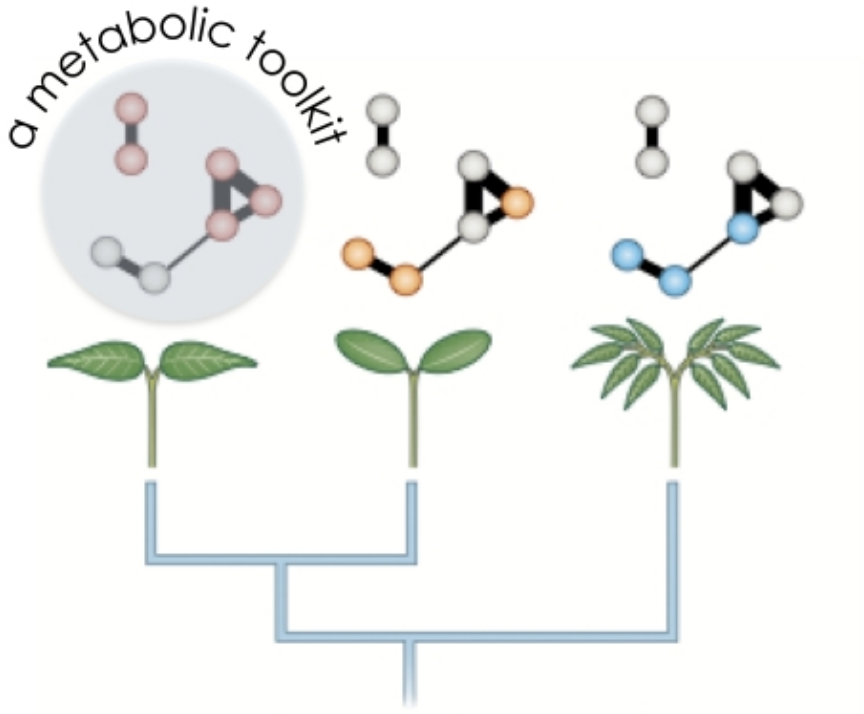
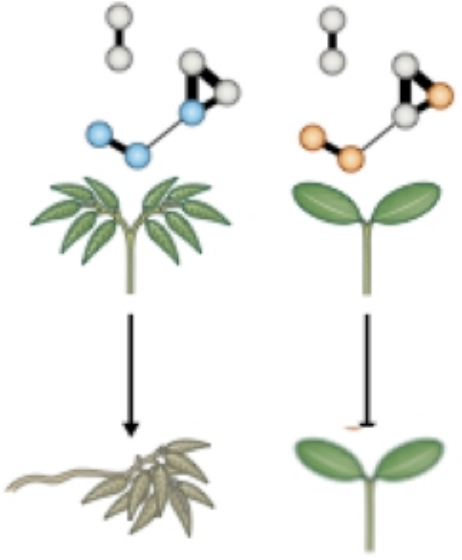


Different factors shape plant metabolic 'toolkits'



Evolutionary innovations
in plant metabolic pathways



Resistance to
environmental stress

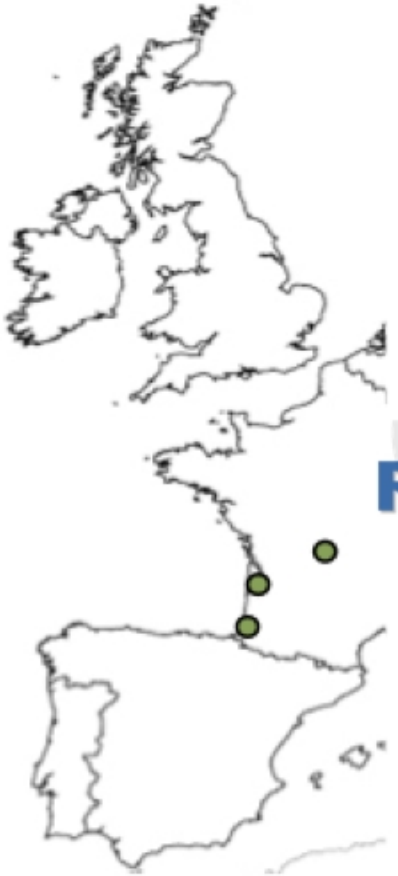
Sedio, New Phytologist, 2017

Study site characteristics

Sandy podzol
pH: 3,9

Cambisol eutric
pH: 4,4-4,7

Cambisol dystic
pH: 4,7-5,7



REINFORCE

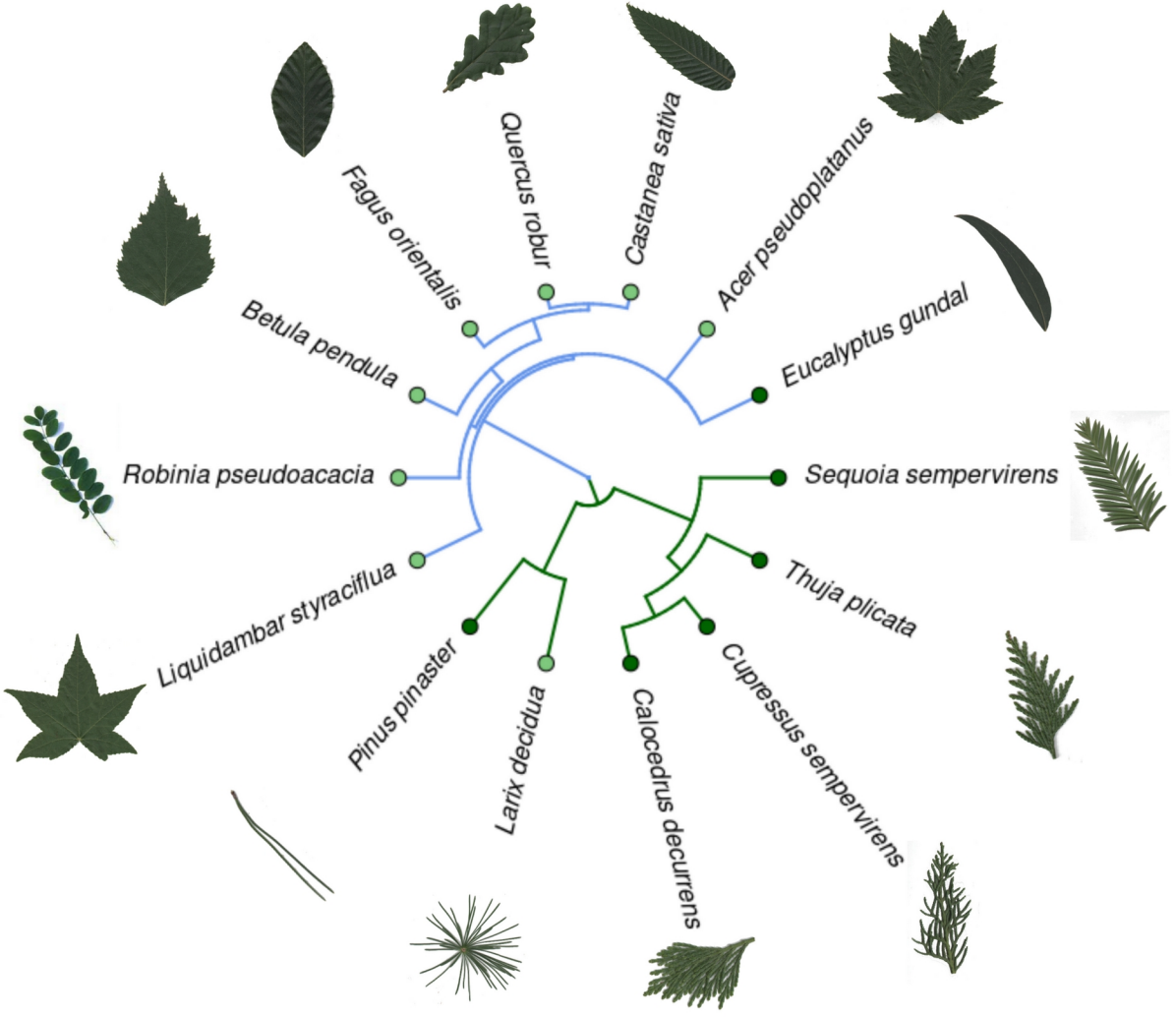
Different plant functional types and species sampled

Plant material

14 species

angio-/gymnosperms,
deciduous/evergreen,
8 families

197 trees
sampled in total

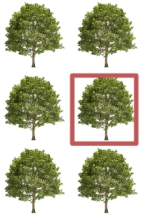


Leaf traits and metabolomes sampled on each species and site

14 species

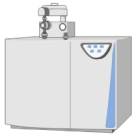
angio-/gymnosperms, deciduous/evergreen, 8 families

For each species and site : 6 trees



For each tree : 6 leaves

Elemental analyzer

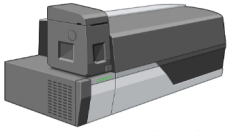


Flatbed scanner

HPLC

Chemical composition
Elemental contents: C, N, P, Si
Majors compounds: chlorophylls, sugars, amino acids
Phenolic composition: total polyphenols

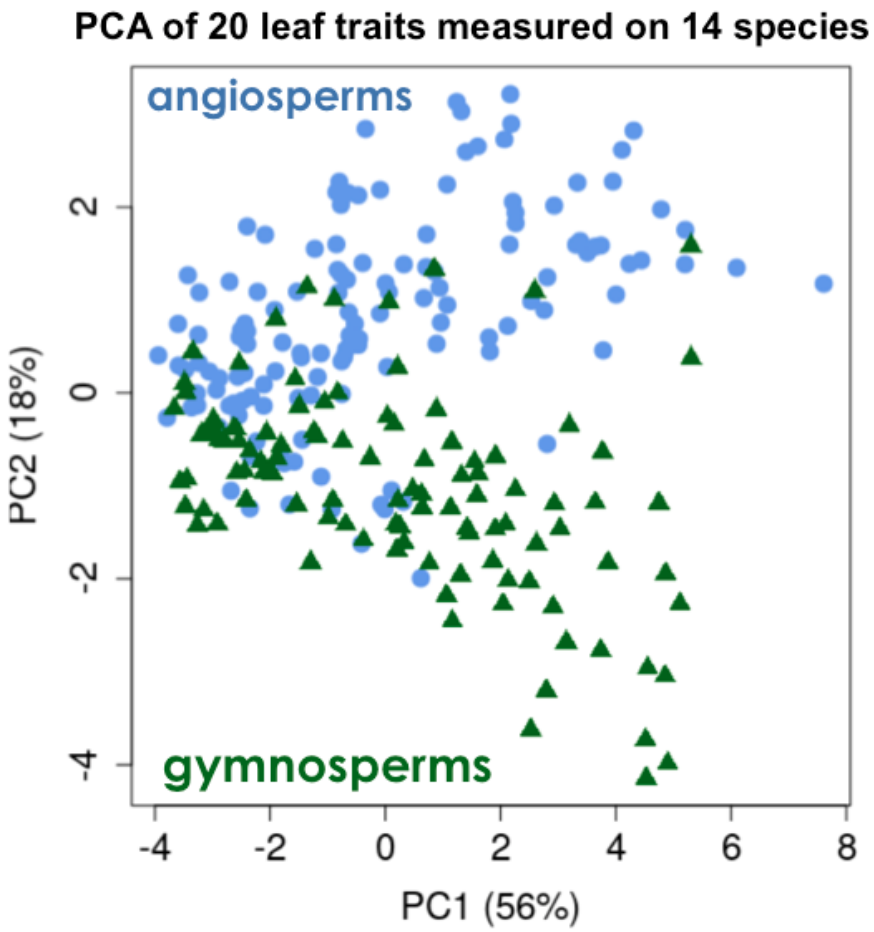
Colors & Area
RGB chromatic coordinate, LMA

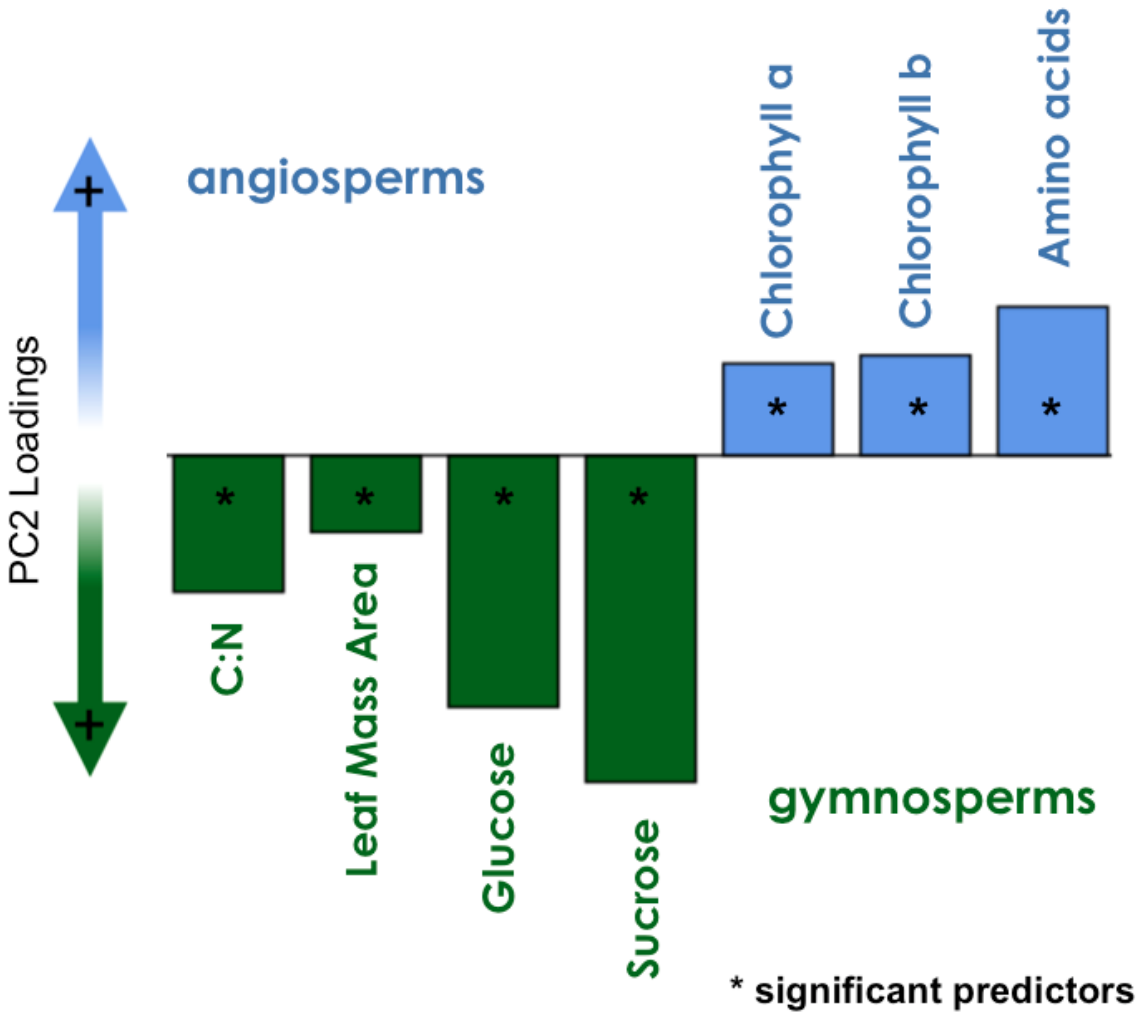


LCMS

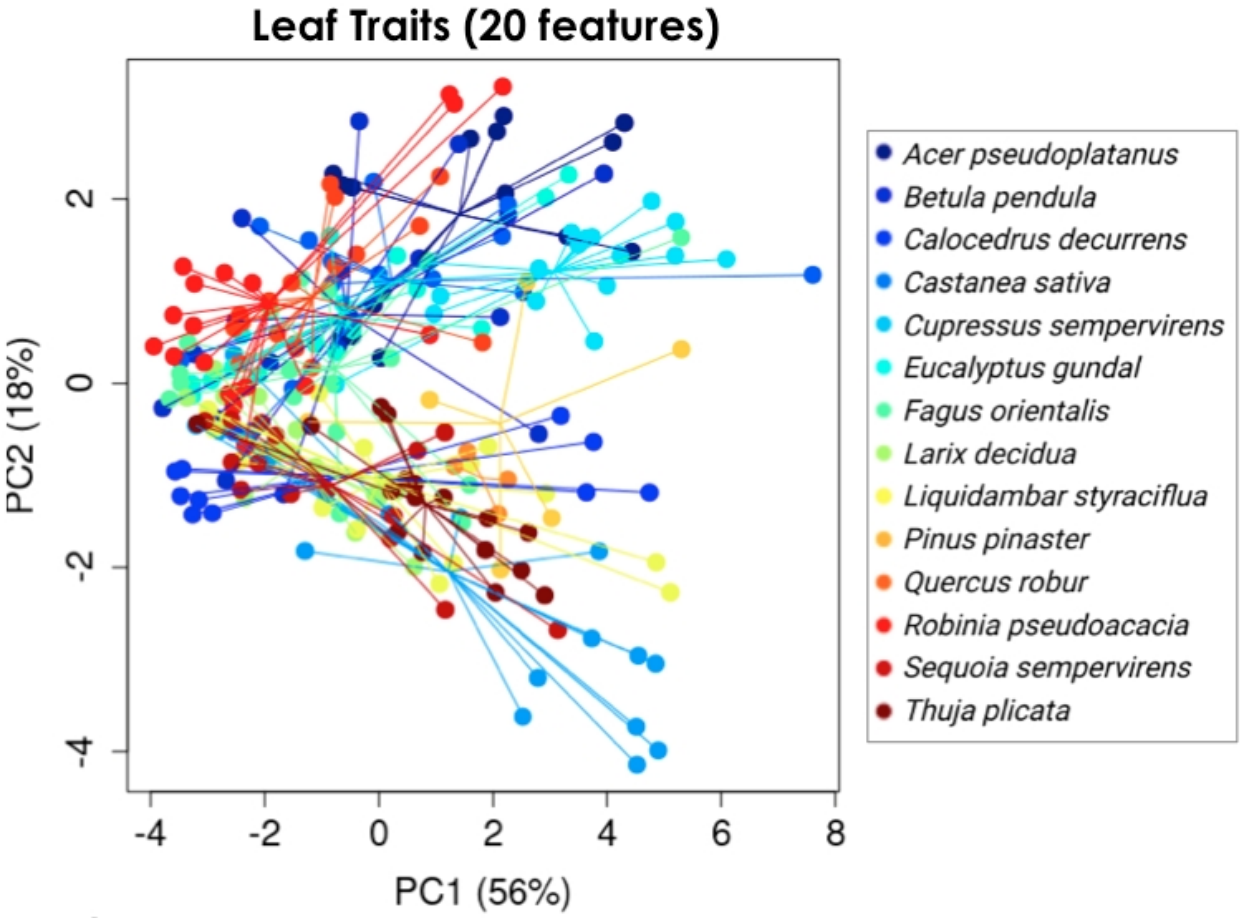
Metabolome
Metabolomics: 7607 RT-m/z pairs

General leaf traits resolve differences between plant functional types

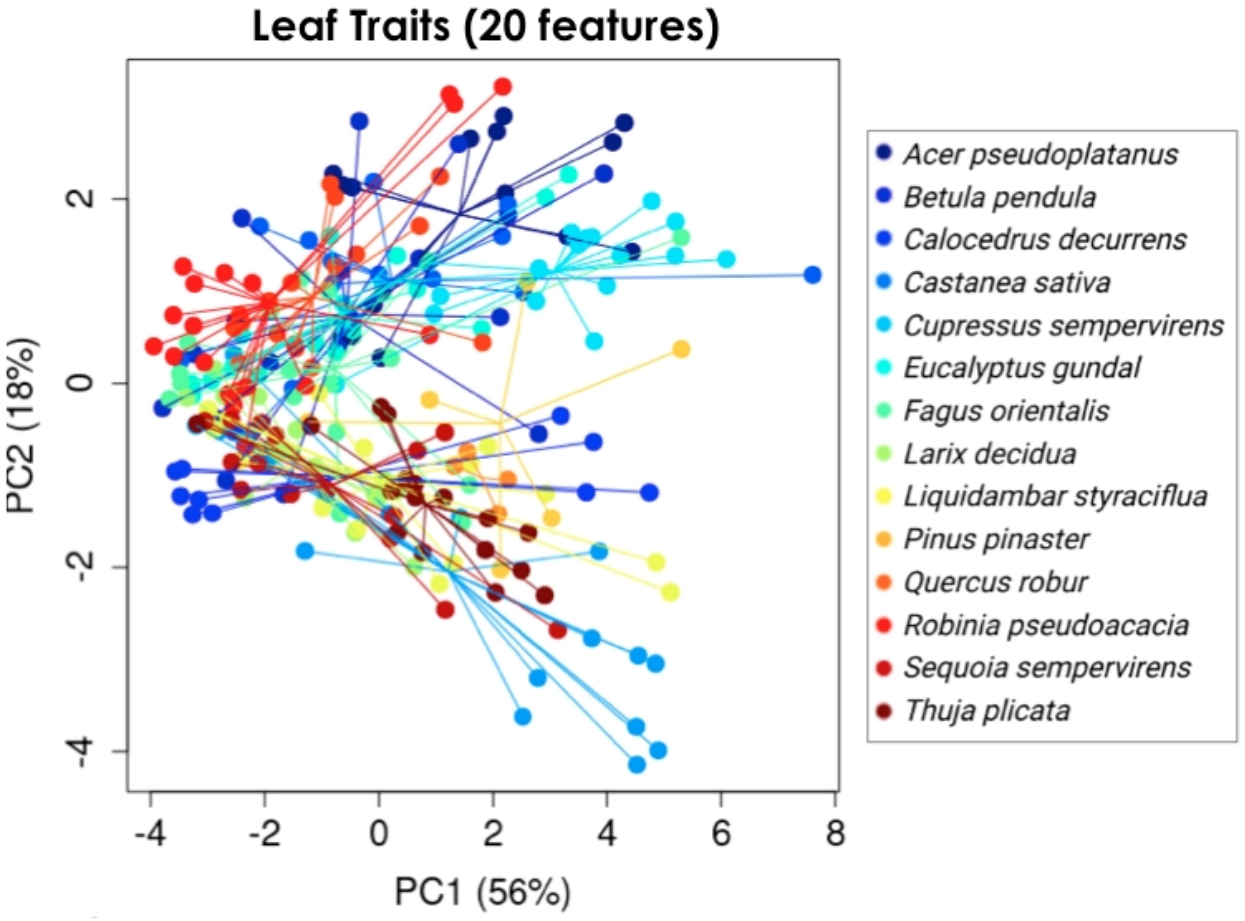


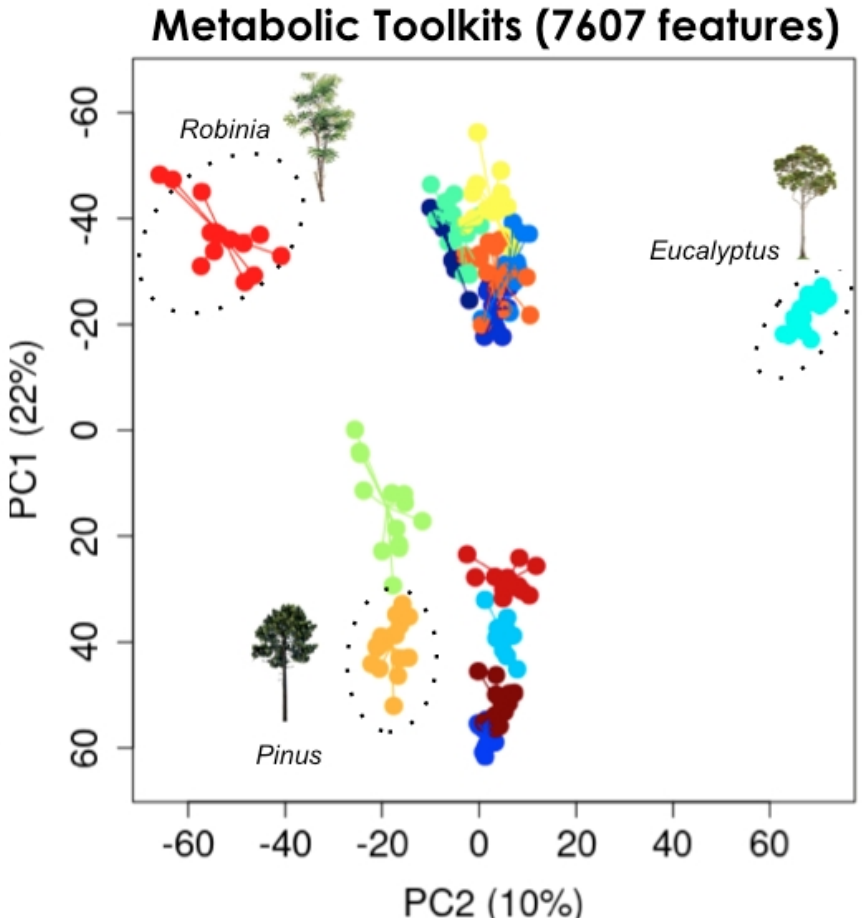


General leaf traits cannot resolve differences between plant families



Different plant families have distinct metabolic 'fingerprints'





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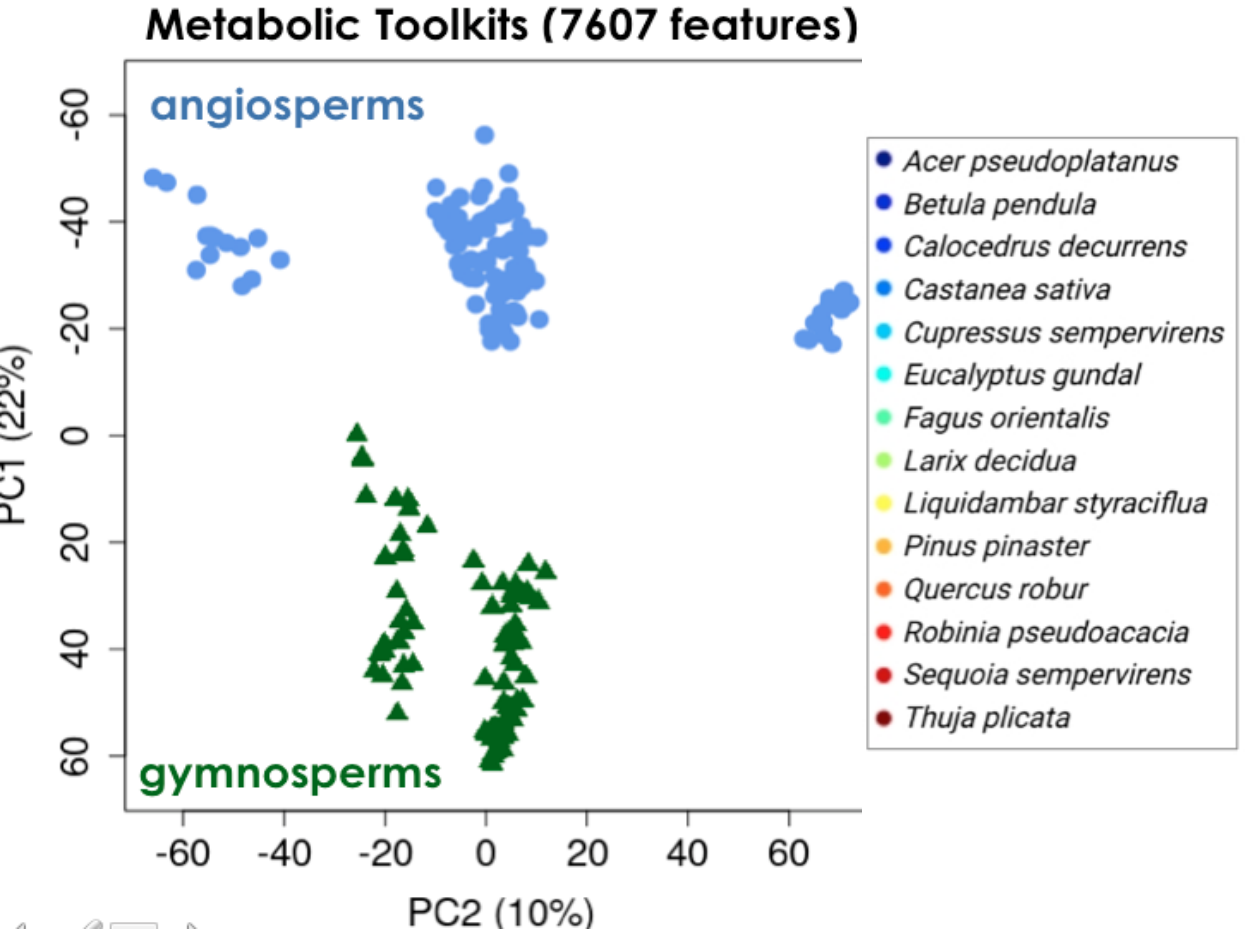
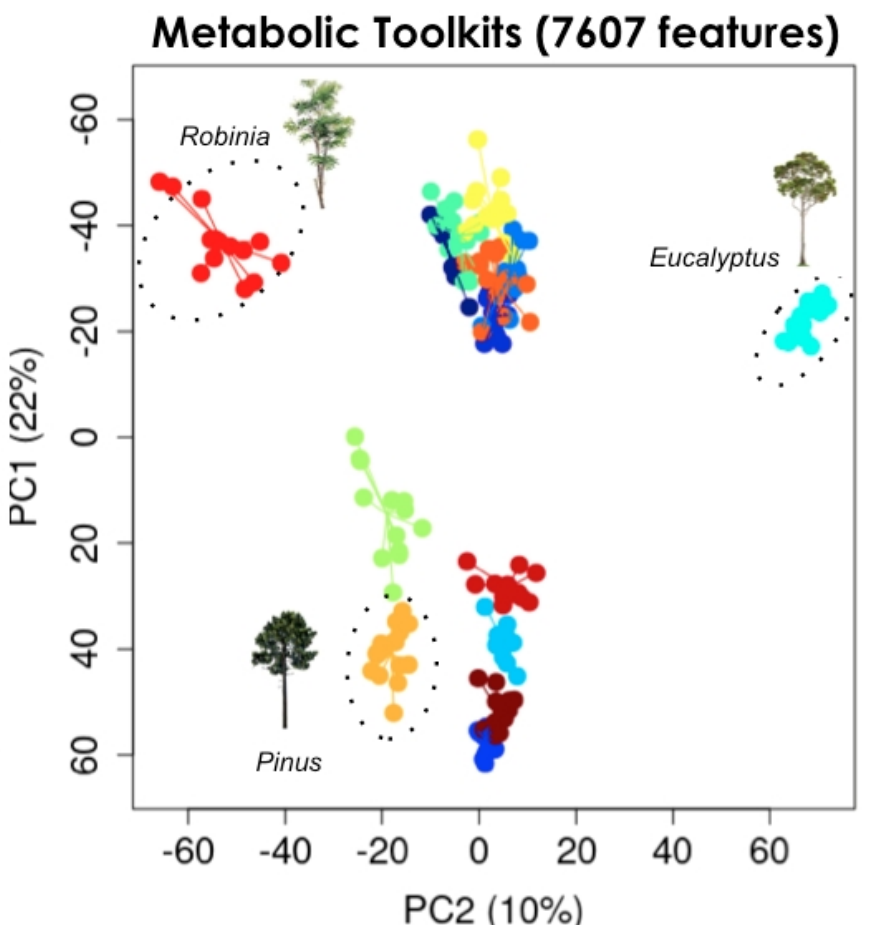
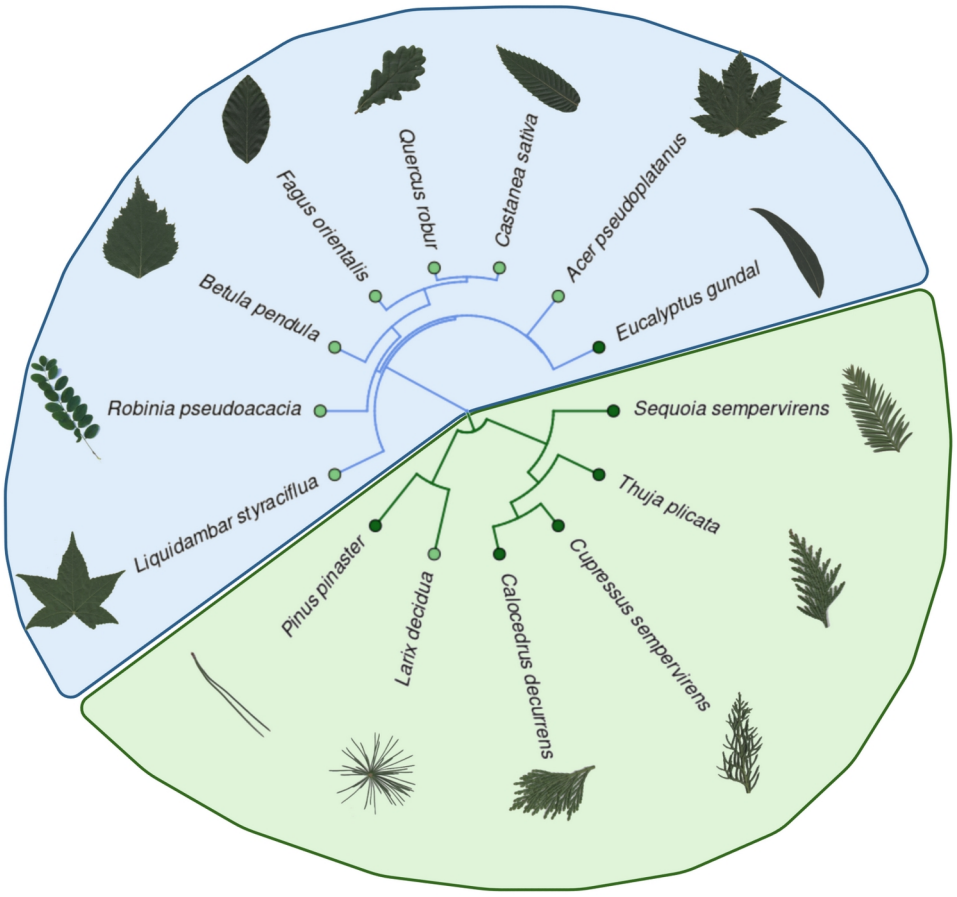




Broad PFT groupings can be predicted from leaf traits

	Dataset	PLS-DA prediction accuracy Leaf traits (20 features)
angiosperms vs **gymnosperms**	Cross-validation site **pH 4.4**	**84%**
	validation site **pH 3.9**	**83%**
	validation site **pH 4.7**	**78%**



Predicting plant family groupings from leaf traits is less reliable

	Dataset	PLS-DA prediction accuracy Leaf traits (20 features)
angiosperms vs **gymnosperms**	Cross-validation site **pH 4.4**	**84%**
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plant families	Cross-validation site **pH 4.4**	**70%**
	validation site **pH 3.9**	**46%**
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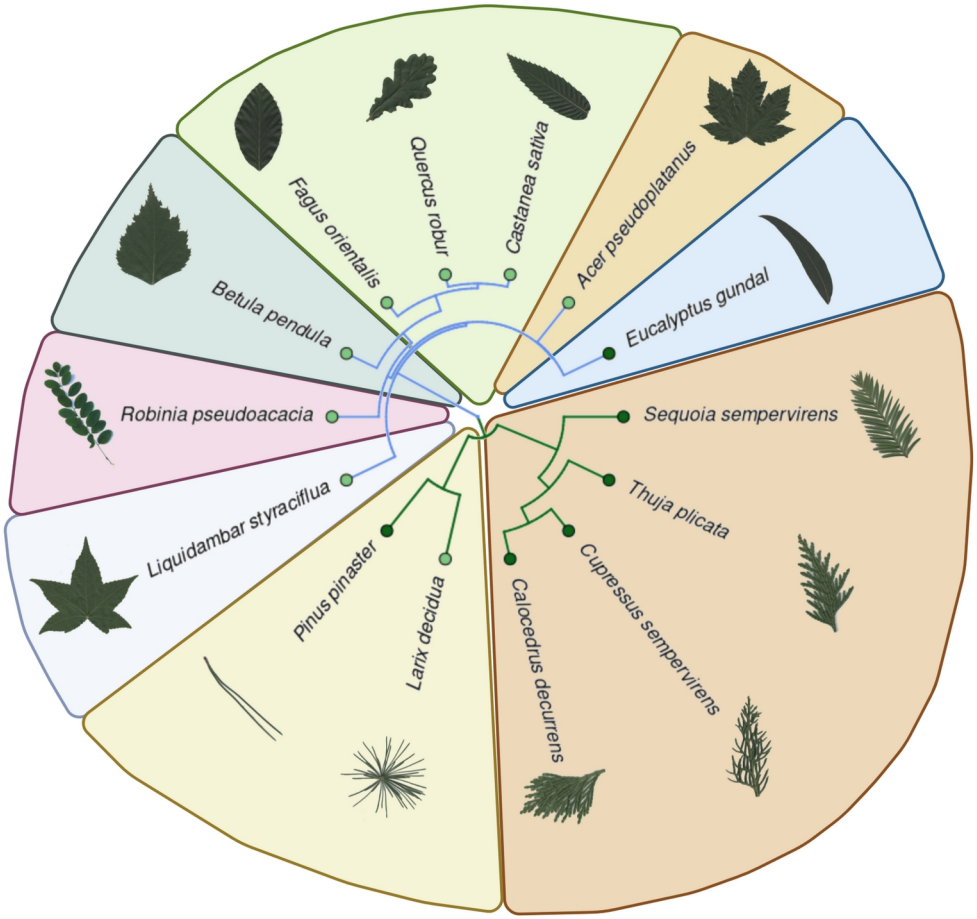

Possible to predict PFT and family groupings from metabolic fingerprints

	Dataset	PLS-DA prediction accuracy: Leaf traits (20 features)	PLS-DA prediction accuracy: Metabolic toolkits (7607 features)
angiosperms vs gymnosperms	Cross-validation site **pH 4.4**	**84%**	**100%**
	validation site **pH 3.9**	**83%**	**100%**
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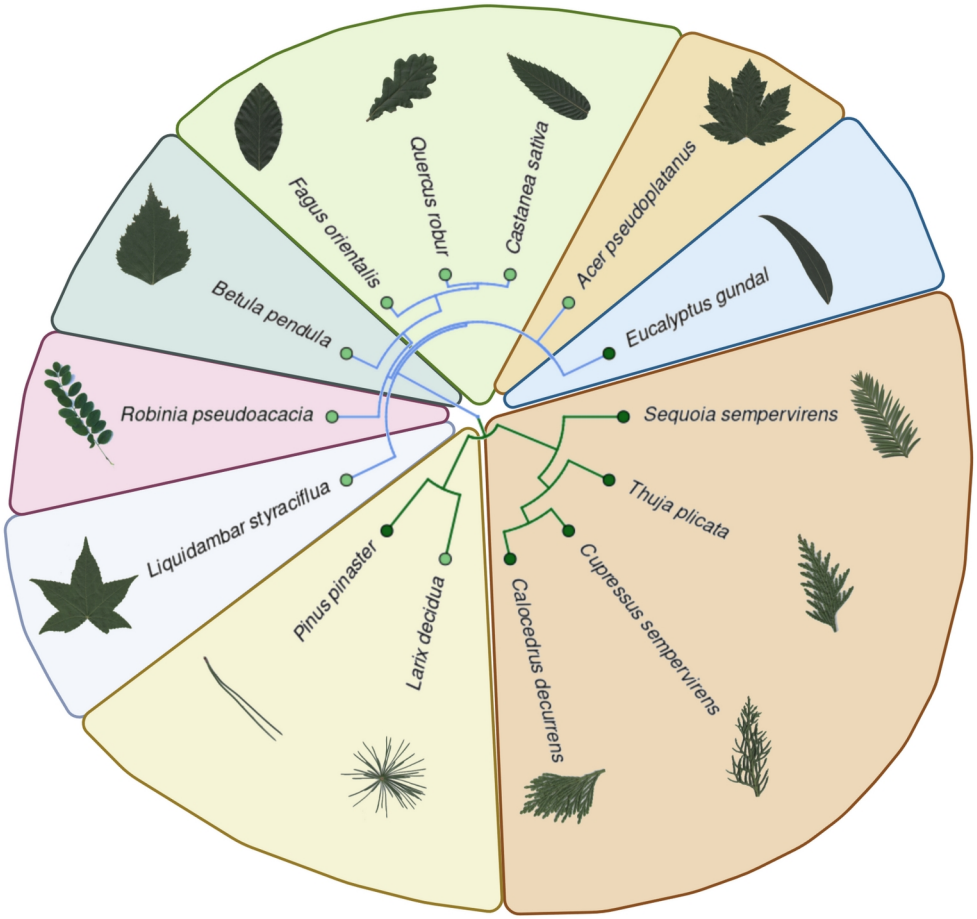

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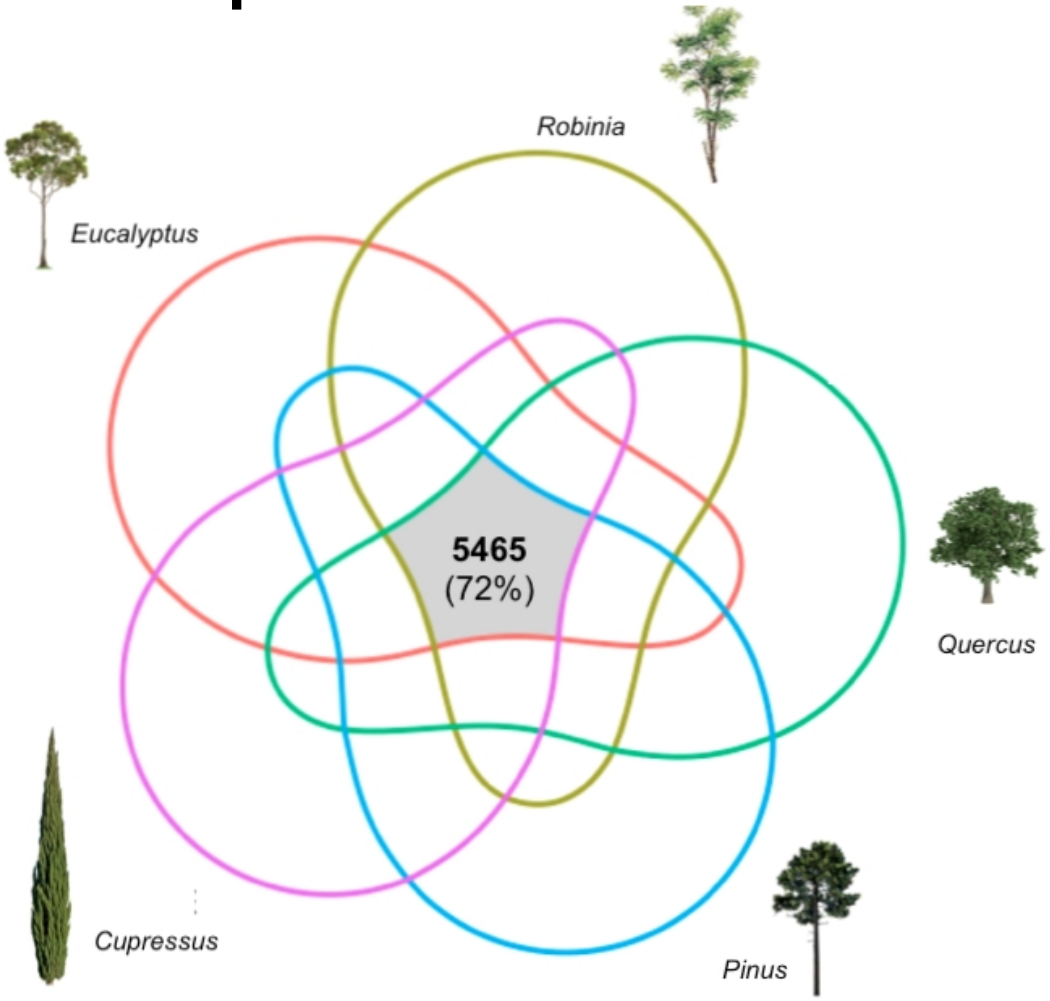
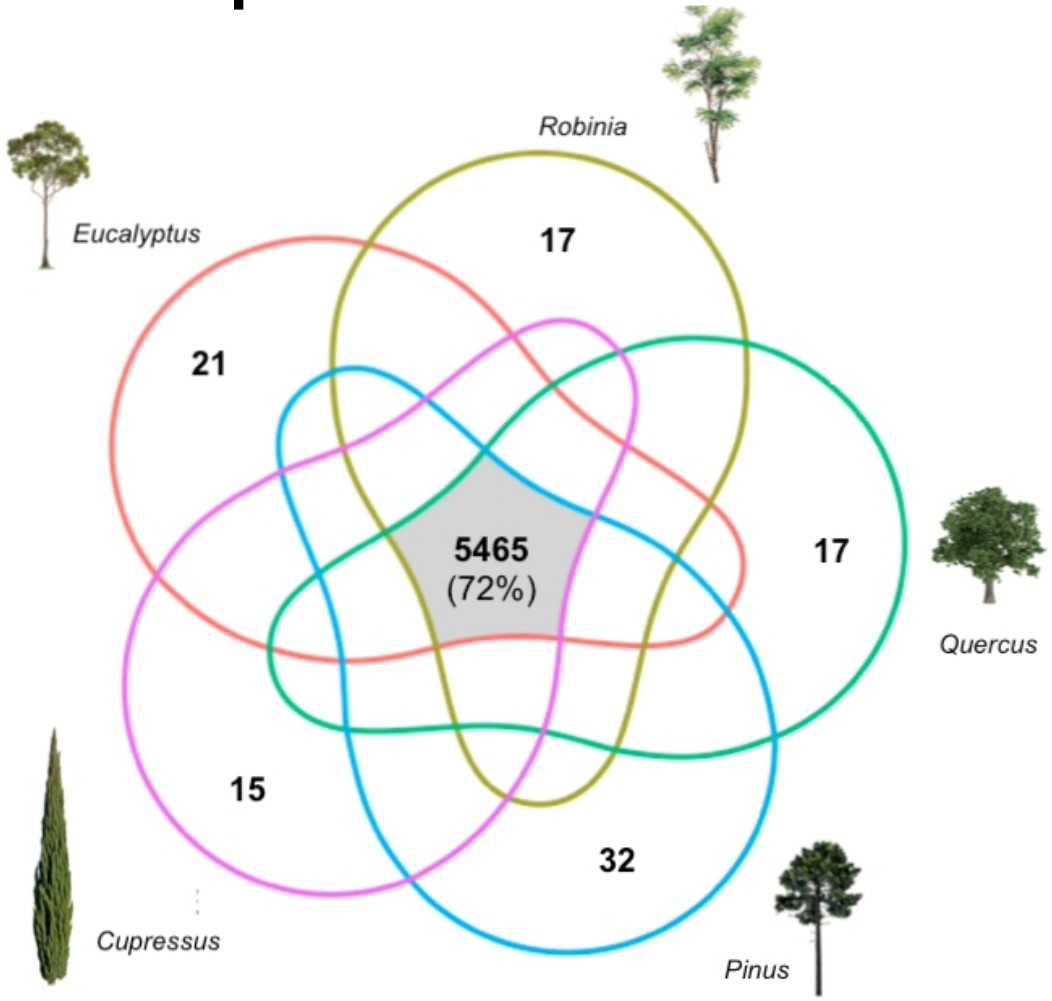


European temperate tree species share **a core set of metabolites**

Are the metabolic 'toolkits' of temperate trees species-specific?



European temperate tree species share **a core set of metabolites**

Each tree species had a **distinct metabolic fingerprint**

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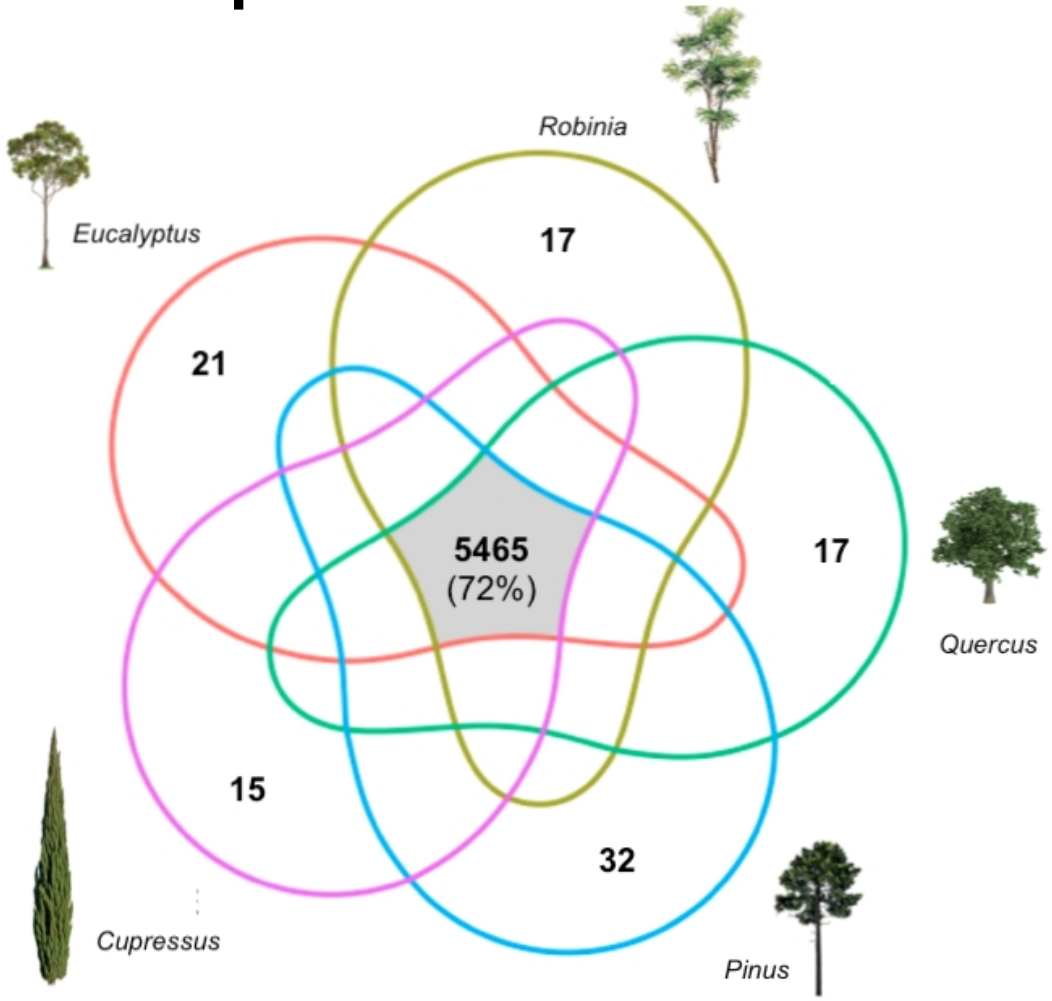

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The unique metabolic toolkits were **conserved across sites**

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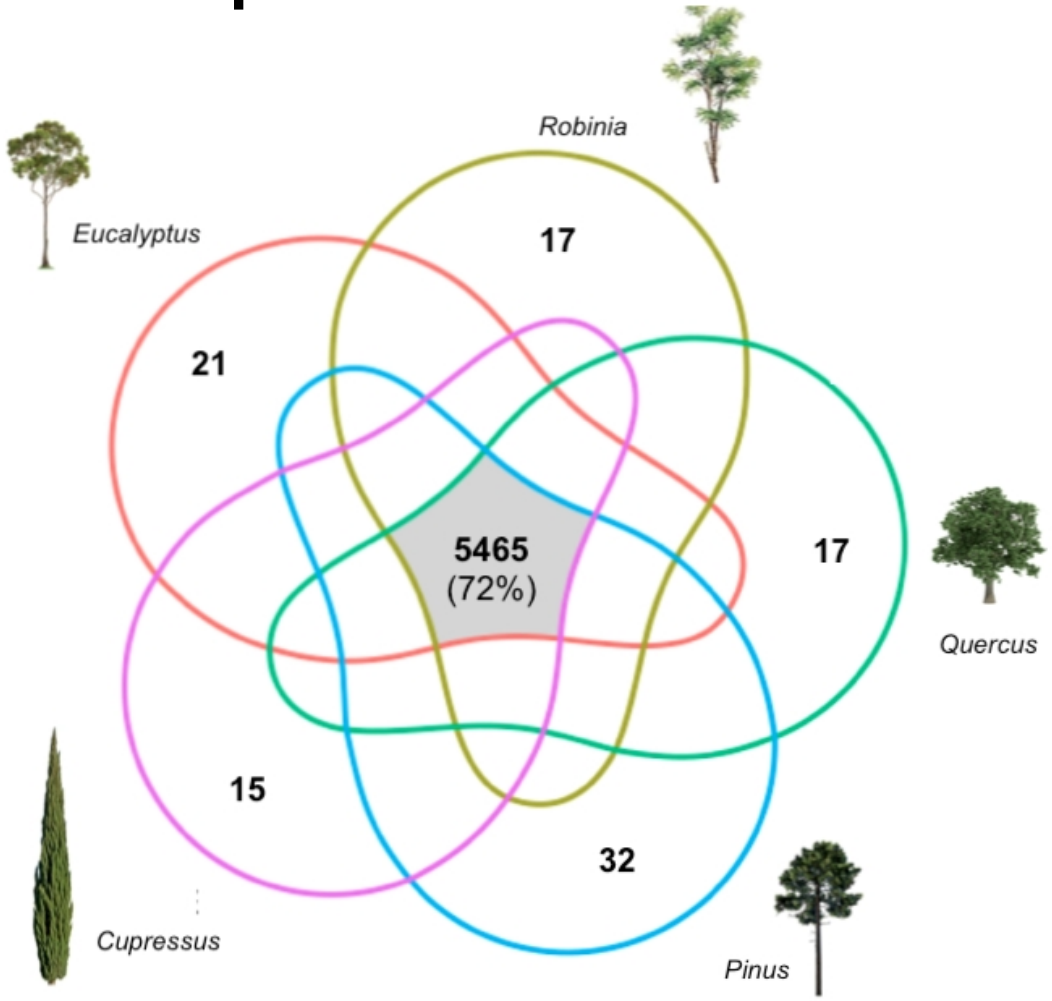

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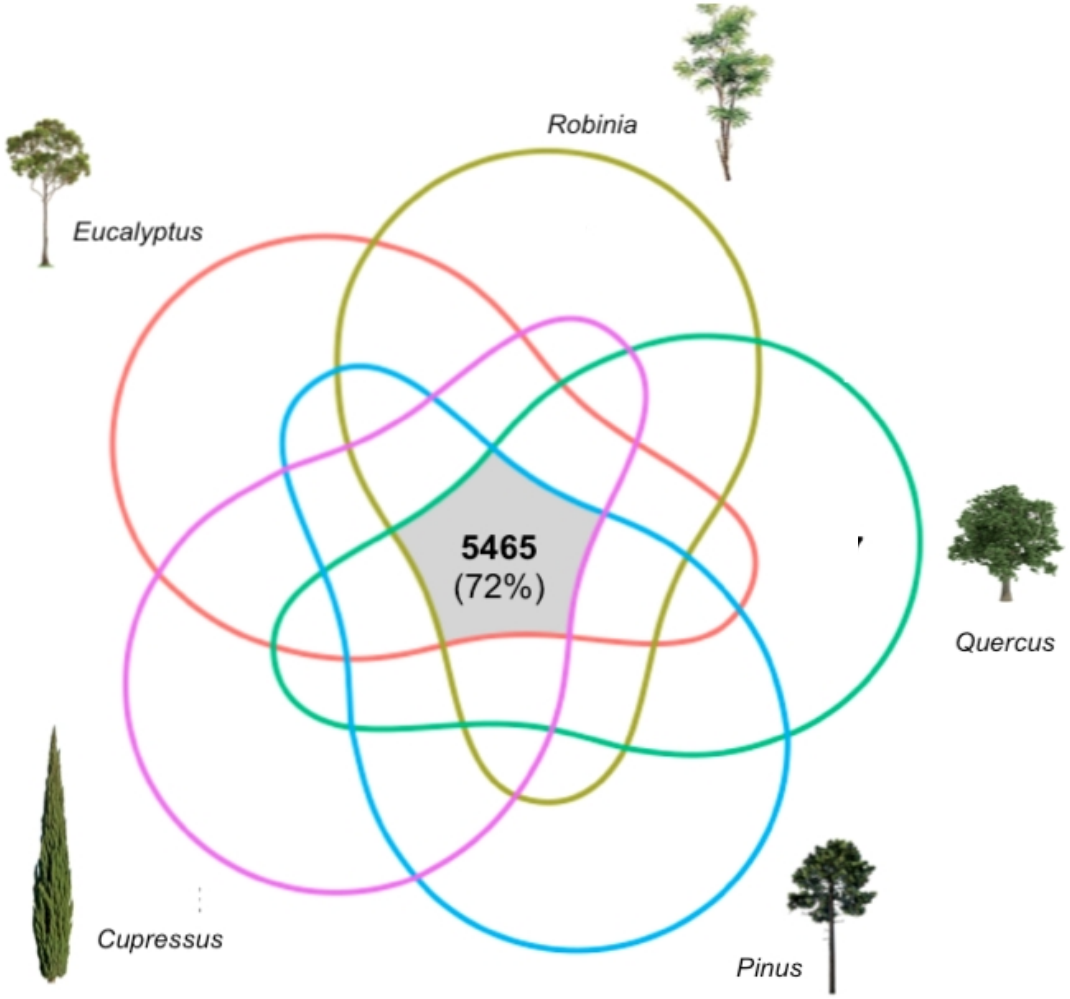
Thank you for your attention



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