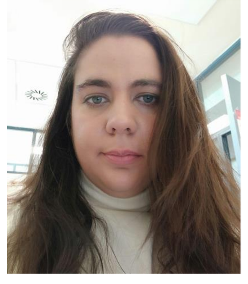

Exploiting Metabolomics to Unravel Priming of Defence in Oak seedlings against Powdery Mildew

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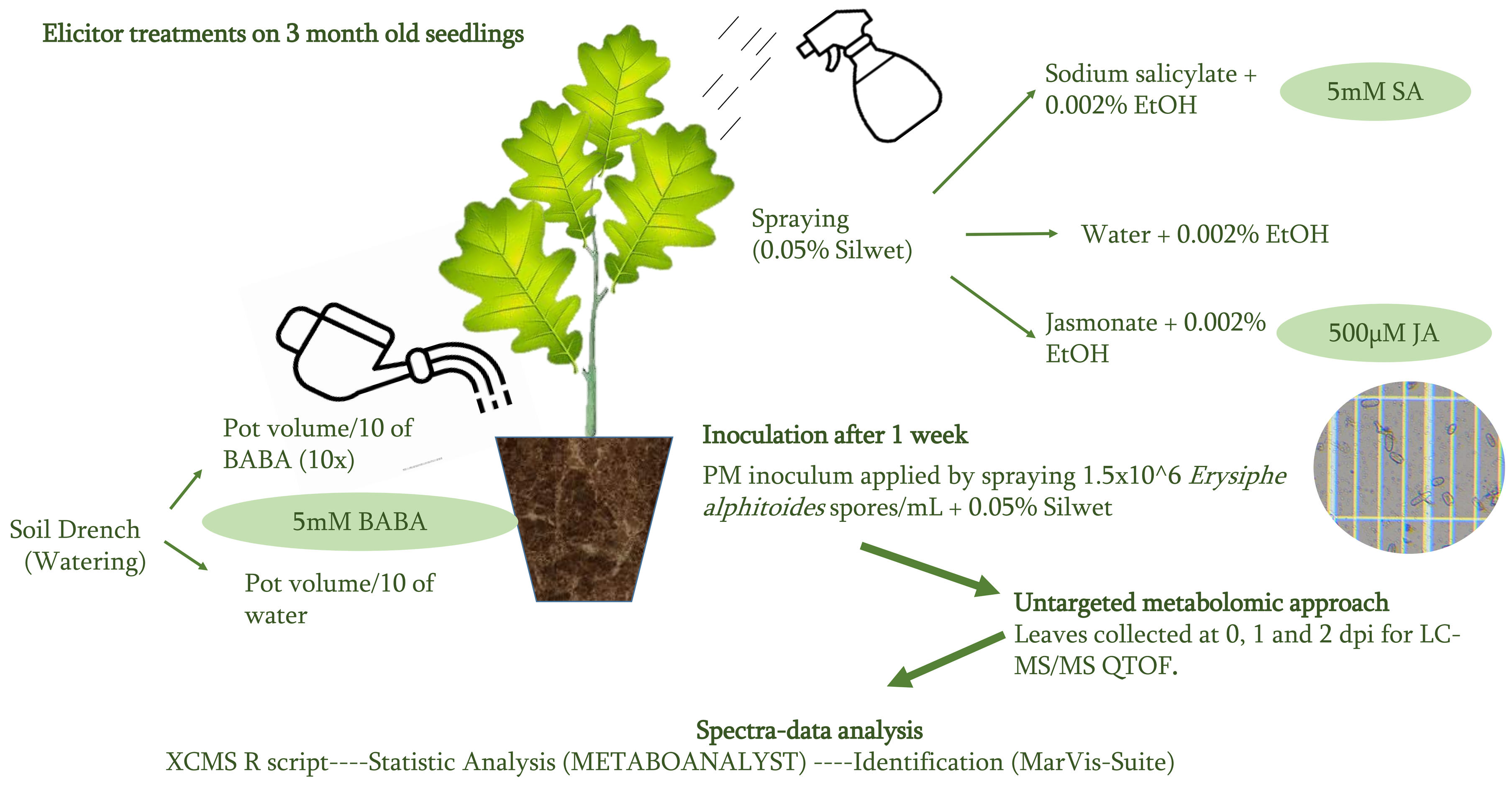
Introduction

- Plants are continually exposed to multiple stresses and have highly sophisticated strategies to fight against these threats.
- Priming of defence is a sensitisation of defence mechanisms for a faster and stronger activation upon subsequent attack.
- Some chemicals are known to trigger priming but there have been a lack of studies in oak seedlings.
- Oaks predominate deciduous European forest and are endangered by climate change and pathogens.
- Powdery mildew (PM) is a bottleneck to natural regeneration in UK woodlands (seedling mortality, reduced photosynthetic capacity). reduction,

Aims

- To determine whether oak seedlings can express chemically-induced priming resistance against PM.
- To unravel priming mechanism by LC-MS/MS QTOF Untargeted Metabolomic Analysis.

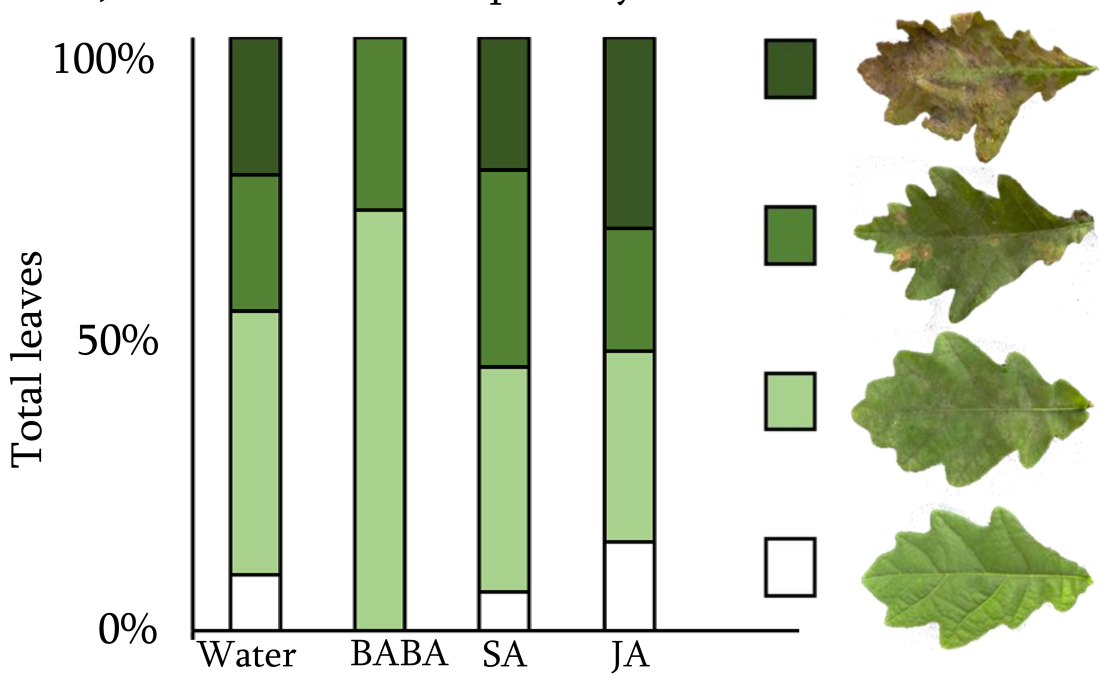
Materials and Methods



Results

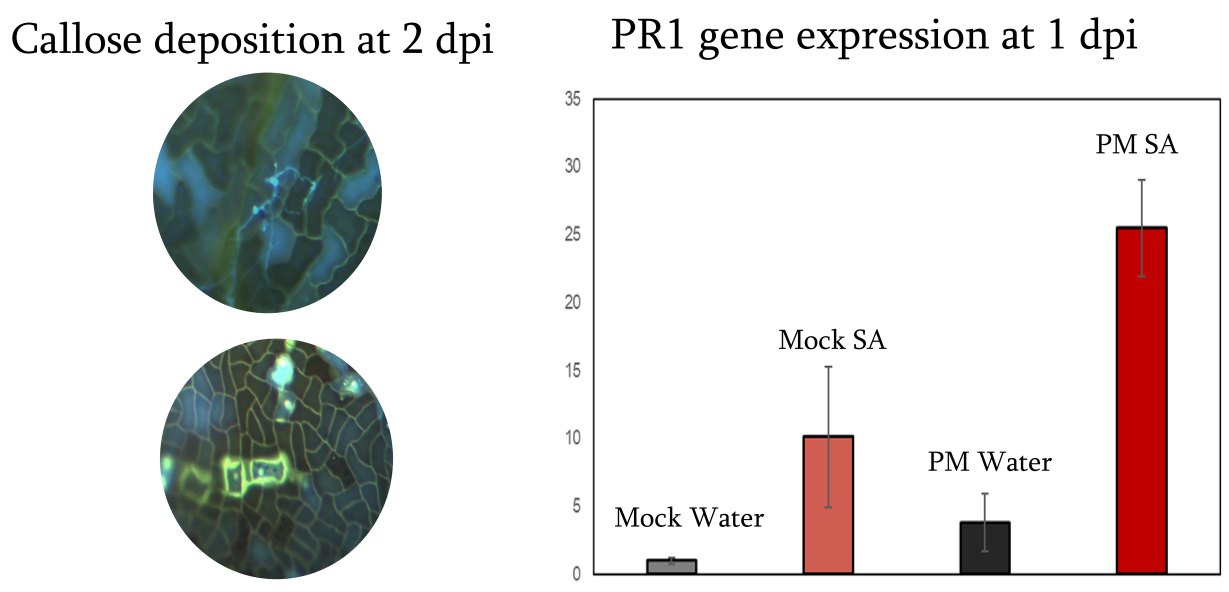
Disease resistance phenotypes

Treatments with SA and BABA result in enhanced resistance to PM and JA in enhanced susceptibility.

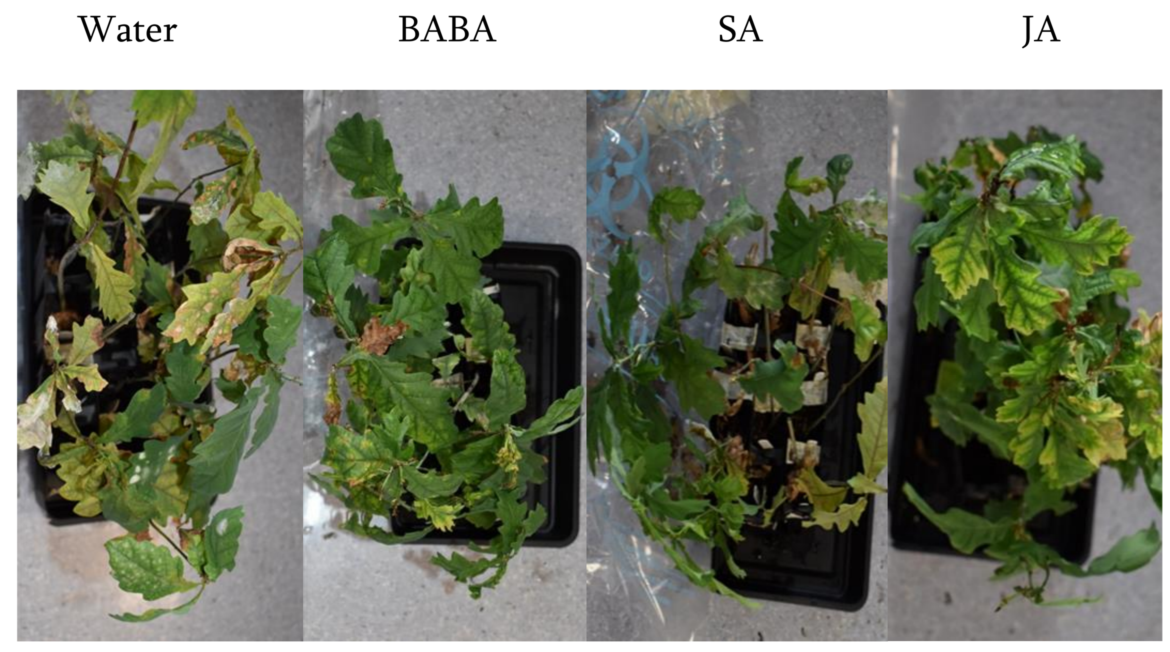


Priming phenotypes at early times

Resistance by SA and BABA was based on priming of SA-dependent gene expression and callose deposition, respectively.

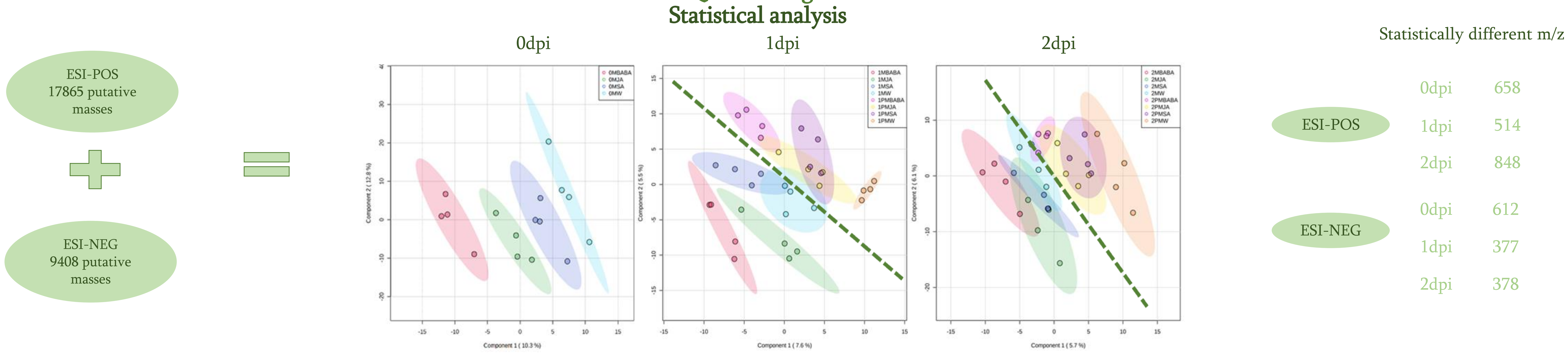


Long-lasting resistance phenotypes



LC-MS/MS QToF untargeted metabolomics

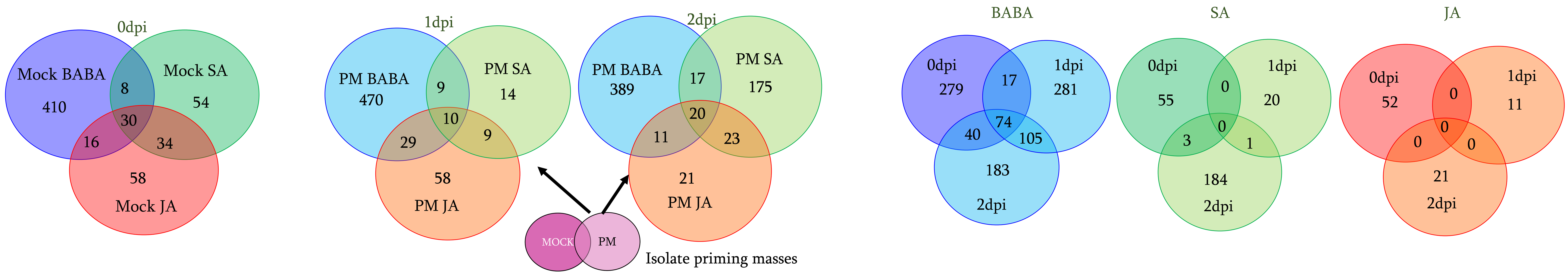
Statistical analysis



Elicitors effects

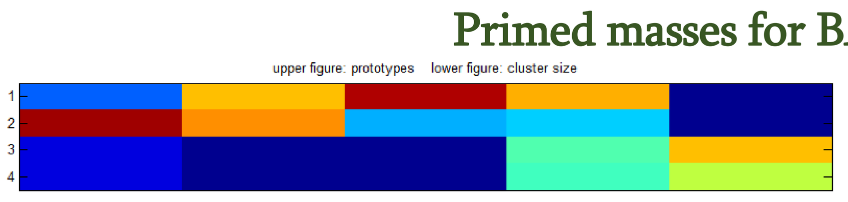
Powdery mildew-elicitor interactions

Time course response is elicitor-dependent



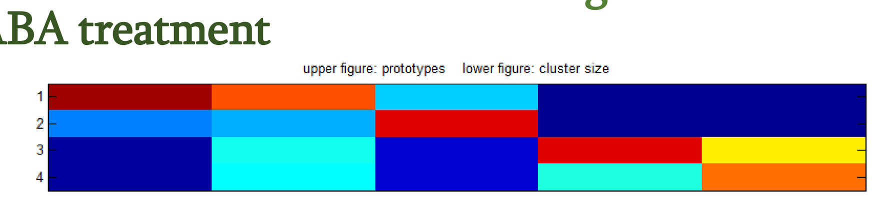
Priming mechanisms (MarVis-Pathway)

Primed masses for BABA treatment



109 putative masses primed
37 tentative identifications
Major represented pathways:
alkaloids/flavonols

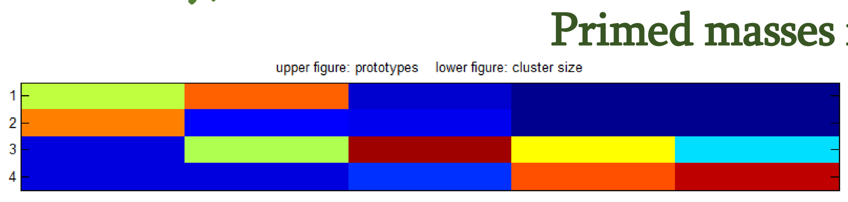
ESI-NEG



460 putative masses primed
51 tentative identifications
Major represented pathways:
Lignans
Aromatic compounds

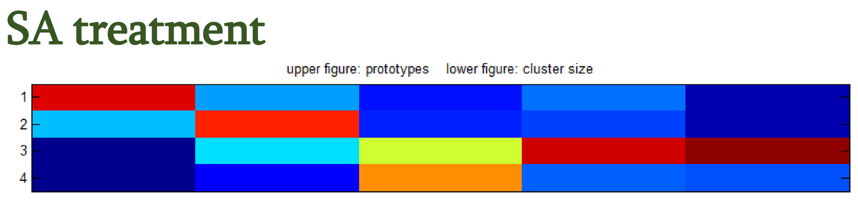
ESI-POS

Primed masses for SA treatment



32 putative masses primed
21 tentative identifications
2 identification max per pathway

ESI-NEG



180 putative masses primed
13 tentative identifications
2 identification max per pathway

ESI-POS

Conclusions

- Trees can be primed successfully by chemicals, showing different defence responses with SA, JA and BABA treatments.
- BABA treatment causes greater metabolome changes.
- SA and BABA mediate different response mechanisms.
- BABA triggers earlier metabolome changes than SA.
- Preliminary enrichment analyses are inconclusive (low percentage of identified masses)
  - BABA priming is mostly dependent on alkaloids biosynthesis, whereas SA failed to identify any specific pathways.

Future perspectives

The next steps in the project are:

1) To identify the metabolites responsible for priming by BABA and SA and propose putative biomarkers.
2) To test these elicitors against other stresses including:
   - Acute Oak Decline (bacteriosis disease)
   - Drought
   - Increased CO2 levels

   } Climate change resilience (Drought, Increased CO2 levels)
3) To link metabolome and transcriptome changes.