

Metabolomics: What does it have to do with Weed Biocontrol?

Ronny Groenteman, Paul Barrett,
Andrea Clavijo McCormick,
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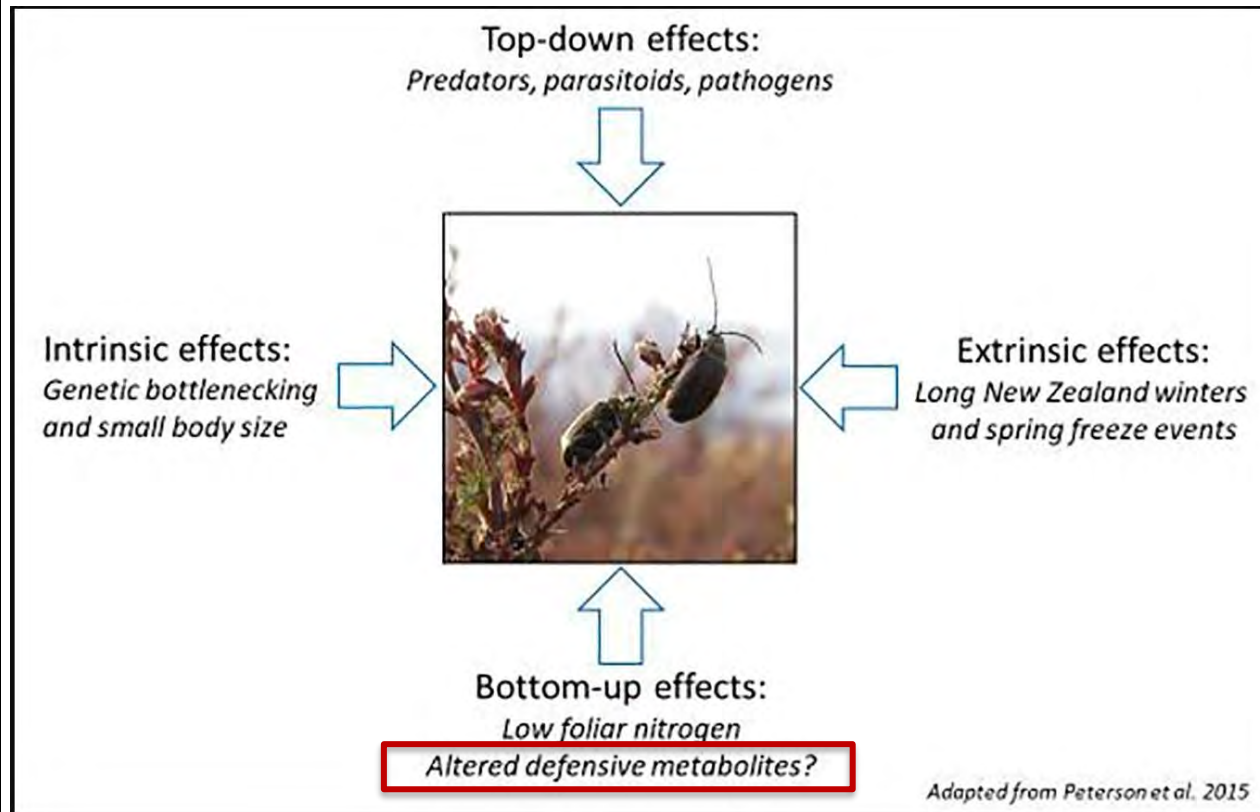


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The Issue

Agents sometime fail to establish or have little impact on the weed





Metabolomics 101

Genomics

Whole genome



Proteomics

Protein abundance

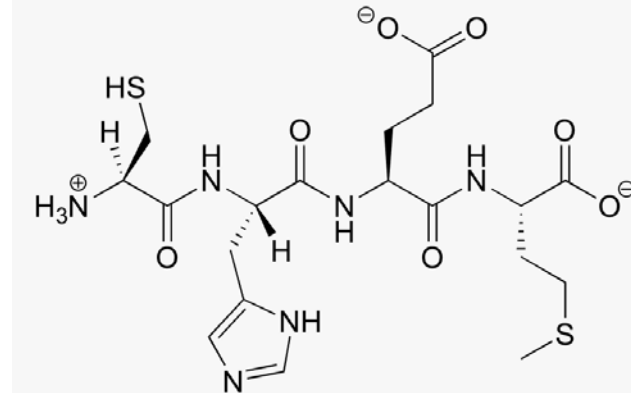


Metabolomics
Metabolite abundance

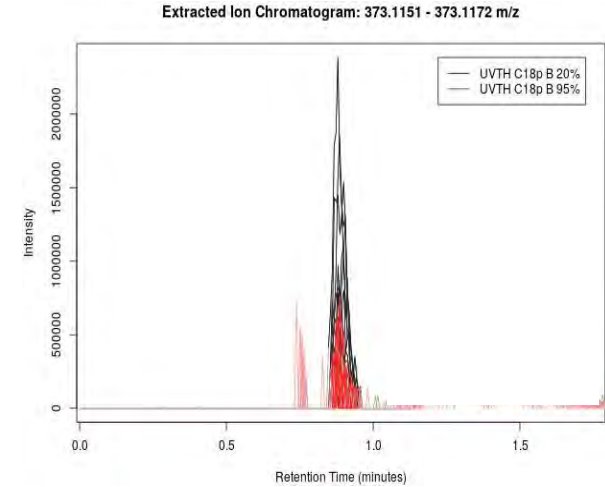
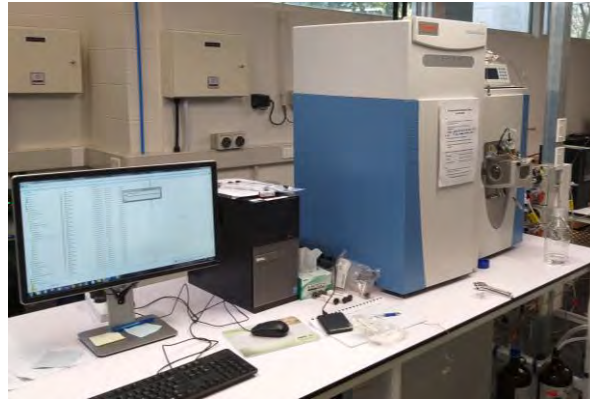
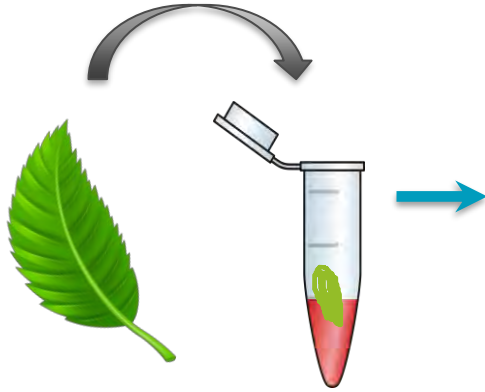
Transcription



Transcriptomics
Gene expression



Metabolomics 101



Literature Review: Weed Biocontrol

not Tapping into the Potential













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Review

Metabolomic analysis of host plant biochemistry could improve the effectiveness and safety of classical weed biocontrol

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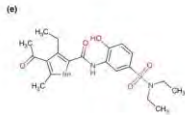
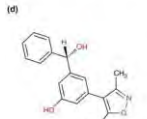
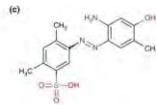
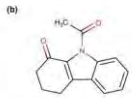
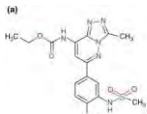
Review Findings



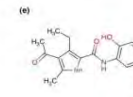
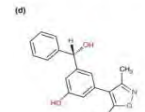
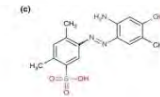
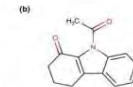
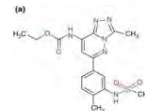
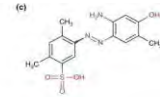
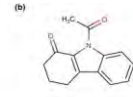
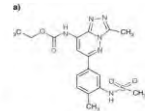
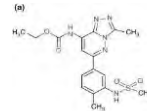
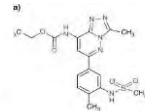
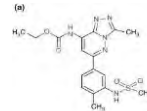
- Assessment of biocontrol agents safety/effectiveness seldom considers host plant biochemistry
- Host plant biochemical phenotype determines nutritional value & chemical defence
- Environmental conditions affect plants' metabolome



Environmental conditions can alter host plant metabolome



Native
environment



Invaded
environment



Review Findings (Cntd)



Plant biochemical phenotypes can change also in response to attack by natural enemies of different guilds (pathogens vs. chewers/miners vs. piercing/sucking)





Potential Applications 1

Matching target plant metabolomes at collection and release sites

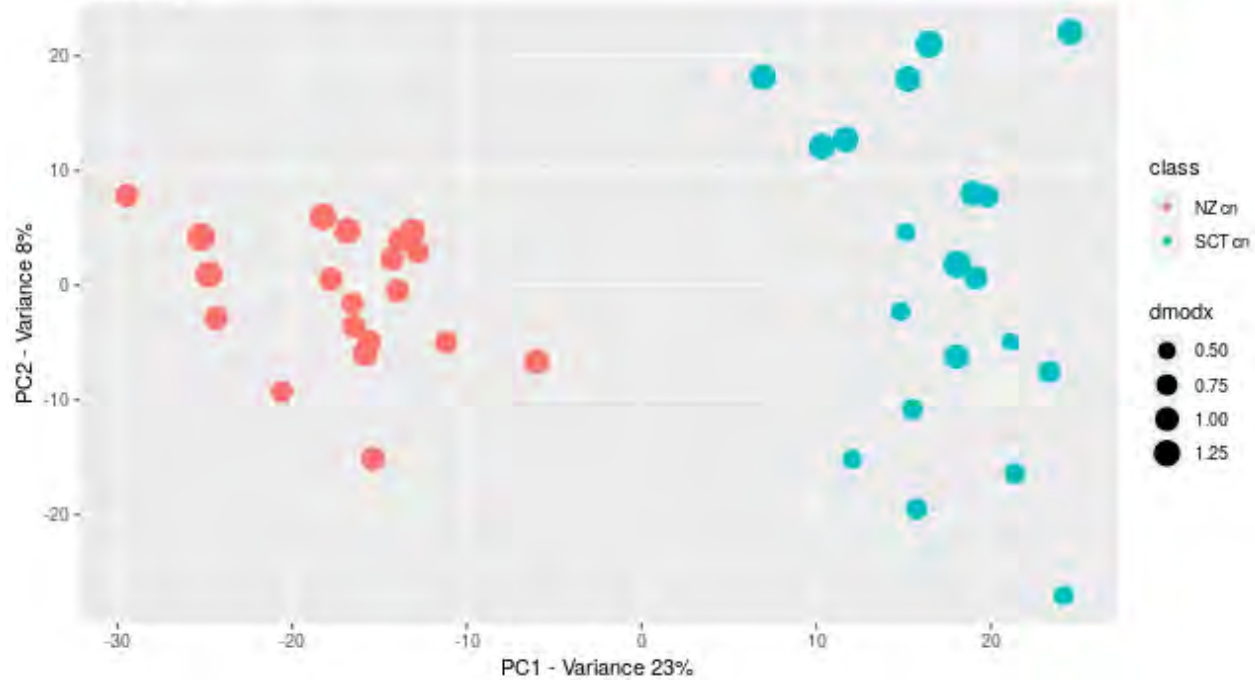
- Small changes in ratios of defensive plant compounds can alter herbivore attraction to and/or performance on this host
- It is challenging & costly to pinpoint which compound/s under which environmental conditions are responsible



Potential Applications 1: Example



Heather
metabolome in
NZ had different
levels of defence
compounds than
in the UK





Potential Applications 2

Is the Plant Stressed by the Agent/s?

- How strong is the plant's metabolic response to a single agent or a combination of agents?
- Is a candidate agent reliant on other enemies to induce plant response?



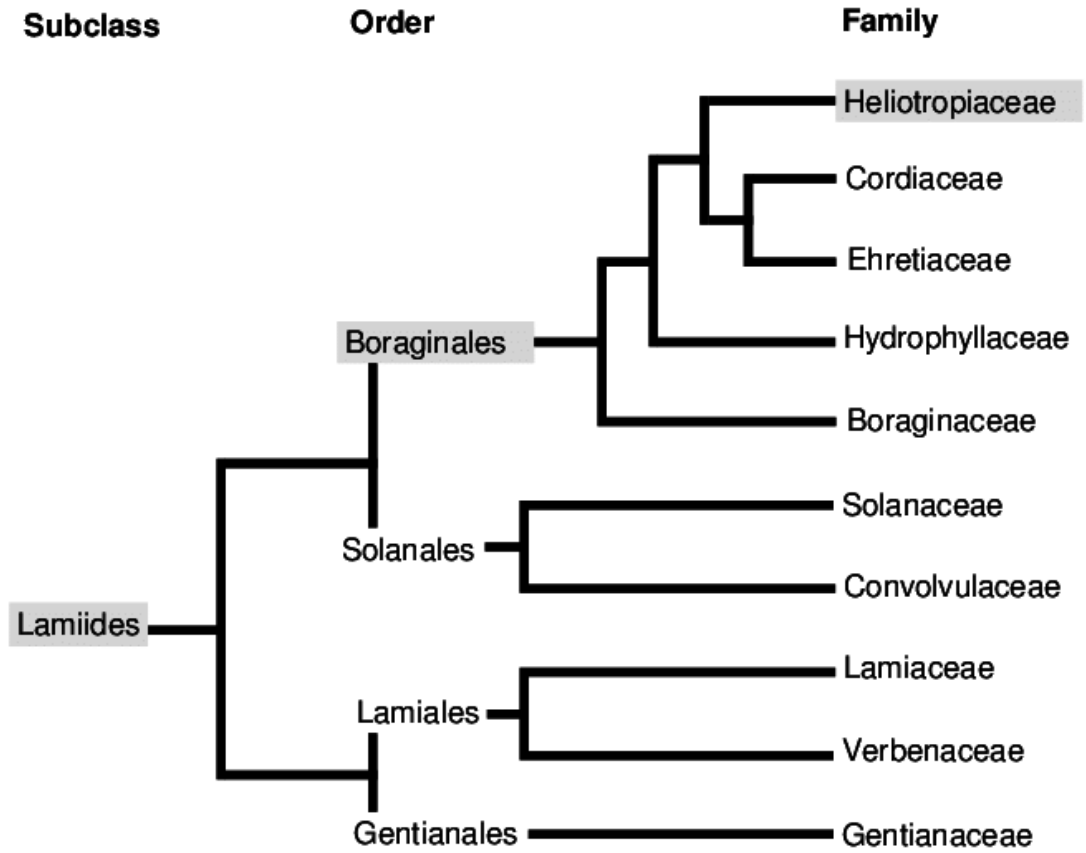
Potential Applications 3

Augment host-range testing lists

- Add species that are more distant phylogenetically, but share similar metabolite profile

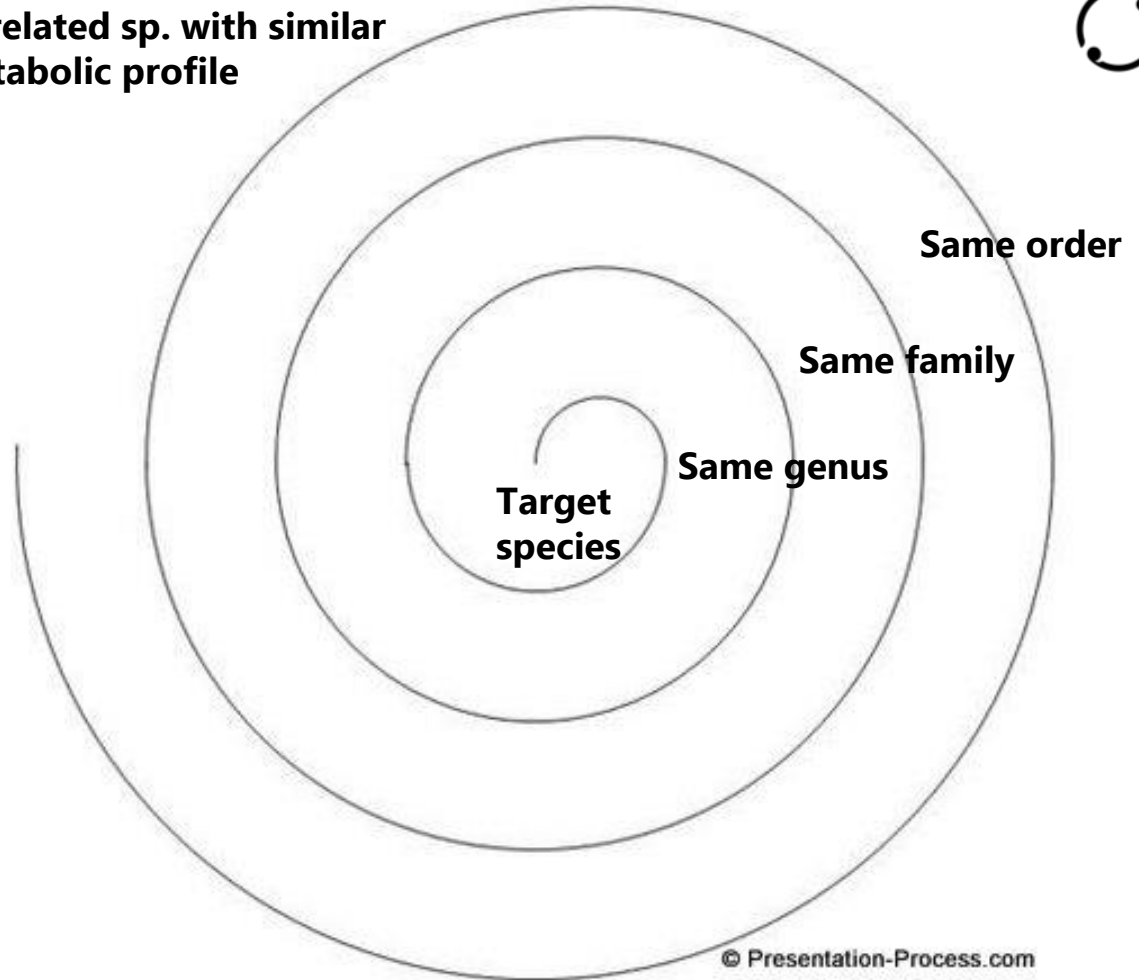


Representation of a Phylogenetic Tree



Phylogenetic Centrifuge

Unrelated sp. with similar metabolic profile





Potential Applications 3

Augment host-range testing lists

- Add species that are more distant phylogenetically, but share similar metabolite profile
- Help assessing risk to phylogenetically close species that are rare or protected and cannot be obtained for testing



What Might it Look Like in Practice?

- A starting point: retrospective testing of existing effective agents compared with ineffective ones, may reveal that higher levels of plant response correlate with greater impact
- Matching target plant metabolome at site of collection and site of release – improve establishment success?

