Evaluating native insectary plants to boost beneficial arthropod populations in vineyards (Initial PhD findings)  
Presented by Mary Retallack

Findings of two studies in Australian vineyards

1. Which native insectary plants enhance biological control of vineyard pests throughout the year?
2. Which species of Tortricidae (pest leafrollers) are present in grapevine canopies?

The problem
Key vineyard pests and diseases

Mean Economic Impact $M/annum (Australian Vineyards)

- Powdery Mildew
- Downy Mildew
- Botrytis and other bunch rots: $1 M
- Light Brown Apple Moth: $18 M
- Powdery Mildew
- Other key pests

The solution
Beneficial predators can provide natural biological control for free!

The solution
Native insectary plants enhance natural biological control

Food
Nectar = Carbohydrates and energy
Pollen = Protein to produce more eggs, ladybird beetles, lacewings

Shelter

Alternative prey

Study 1
Bursaria spinosa (Christmas Bush)

Vacuum sampler
(STIHL Petrol Blower with tube attached to the air intake)

Modified insect collecting net

Bursaria spinosa (Christmas Bush)

Vitis vinifera (grapevine)

Modified beat net

Pitfall trap
(charged with propylene glycol)

Bursaria spinosa (Christmas Bush)
**Bursaria spinosa**
Each collection comprised 5 shakes of foliage x 5 sub-samples into insect collecting net (modified) = 1 sample, repeated 10 times per collection date.

**Leptospermum continentale (Prickly tea-tree)**
Each collection comprised 5 shakes of foliage x 5 sub-samples into insect collecting net (modified) = 1 sample, repeated 10 times per collection date.

**Austrodanthonia sp (Wallaby Grass)**
10 x pitfall traps emptied fortnightly.

**Vitis vinifera (Shiraz and Chardonnay)**
Each collection comprised 5 taps of the cordon x 5 sub-samples to collect arthropods in a beat net (modified), process repeated 10 times for each sampling date.

**Processing**
1,400 containers collected and processed, comprising 140 samples (10 sub-samples ea)
27,470 arthropod specimens were collected and preserved in 95% ethanol
681 individual arthropod reference specimens stored in the Waite Insect and Nematode Collection (WINC)

**Observed arthropods**
> 285 taxa (77 predator taxa, 52 predator taxa found in vineyards)

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18 Spider functional groups:
- Family Araneidae: Orb weaving and bird-dropping spiders
- Family Deinopidae: Net-casting spiders
- Family Desidae: Lace web or house spiders
- Family Dysderidae: Woodlouse (slater) hunters
- Family Gnaphosidae: Ground spider
- Family Linyphiidae: Money spiders
- Family Longothoridae: Money spiders
- Family Oxyopidae: Lynx spiders
- Family Philodromidae: Running crab spiders
- Family Salticidae: Jumping spiders
- Family Thomisidae: Flower or crab spiders
- Family Zodariidae: Ant spiders

Active predators:
- Cernetulus nasalis
- Oechalia schellenbergi

Common spotted Ladybird beetle:
- Harmonia conformis

Transverse Ladybird beetle:
- Coccinella transversalis

Orange Assassin Bug:
- Gminatus australis

Damsel bug:
- Nabidae
Observations

**Vegetation flowering times?**
*Insectary plantings versus grapevines*

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<tr>
<th>Phenology</th>
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*Modified from Eichhorn and Lorenz (1977) and referred to as the Modified 'E-L' system.*

**Peak predator activity?**

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*www.viticulture.org.au*
### Presence of Araneae by vegetation type and potential significance as a vineyard predator

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Salticidae (Jumping Spiders)</th>
<th>Lycosidae (Wolf Spider)</th>
<th>Thomisidae (Long Jawed Spiders)</th>
<th>Lycosidae (Ground Spiders)</th>
<th>Araneidae (Jumping Spiders)</th>
<th>Diogenidae (Shingled Spiders)</th>
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</table>

### Average abundance of Salticidae (Jumping Spiders) on key vegetation types in season 2013/14

![Average abundance of Salticidae (Jumping Spiders) on key vegetation types in season 2013/14](image)

### Number of Salticidae (Jumping Spiders) collected on Bursaria spinosa and adjacent Chardonnay in season 2013/14

![Number of Salticidae (Jumping Spiders) collected on Bursaria spinosa and adjacent Chardonnay in season 2013/14](image)

### Number of Pentatomidae (shield bugs) collected on each vegetation type in season 2013/14

![Number of Pentatomidae (shield bugs) collected on each vegetation type in season 2013/14](image)

### % Brown and Green Lacewings collected from each vegetation type in season 2013/14

![% Brown and Green Lacewings collected from each vegetation type in season 2013/14](image)

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September 2016

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Bursaria spinosa (Christmas Bush)
- Only vegetation type where orange assassin bugs found (most abundant assassin bug species).
- Excellent host for a range of spiders (including active hunting predators Salticidae “jumping” and ambush hunters Thomisidae “flower” spiders).
- Excellent host for Brown and Green Lacewings.
- Good host for shield bugs (Predatory Shield Bugs in particular).
- Good host for Common Spotted Ladybird Bugs and Damsel Bugs.
- No Grapevine Moth observed.
- Very few LBAM observed (n=2 instars total).

Leptospermum continentale (Prickly Tea-tree)
- Excellent host of a range of spiders (including active hunting predators Salticidae “jumping” and some Lycosidae “Wolf” spiders, and ambush hunters Thomisidae “flower” spiders).
- Excellent host for Brown Lacewings and good host for Green Lacewings.
- Good host for shield bugs (Predatory Shield Bugs in particular).
- Good host for Common Spotted Ladybird Bugs and Damsel Bugs.
- No Grapevine Moth observed.
- Low number of Elephant Weevil observed (n=11 at one site, on one date = average 1 per sample).
- Very few LBAM observed (n=6 instars total).

Austrodanthonia sp (Wallaby grass)
- Three species of assassin bug predominantly found in Wallaby Grass (Coranus granosus, brown assassin bug, black ground assassin bug).
- Excellent host of Lycosidae “Wolf” spiders, earwigs, brown lacewings and glossy shield bugs.
- No LBAM or Grapevine Moth observed.
- Lepidoptera: Agrolis sp (Army and Herringbone Cullworms) (n=230) were found early in the season at a single site (may present an issue if planting young vines).
Biodiversity (species richness)
- 287 taxa (all) including predators, known pests, alternative prey, detritivores etc.
- 77 predator taxa found
  - 52 predator taxa found in vineyards (room to improve?)
  - 53 predator taxa found in Bursaria spinosa
  - 29 predator taxa found in Wallaby Grass
- overlap between vegetation types and capacity to control different pest life stages (=diversity is important).

- 14 Tortricidae (leafrollers) found on native plants versus 5,189 predators found on native plants
  - 0.27% leafrollers
  - 370 predators for every leafroller instar.

**Study 2**
Confirming the presence of key leafroller species in grapevine canopies

3 x Tortricidae species have been collected in vineyard mid rows previously

**Question:** Are Acropolitis rudisana and Merophyas divulsana (Lucene Leaf Roller) also present in grapevine canopies?

**Sanger sequencing results (n=407)**

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<tr>
<th>Species</th>
<th>Percentage</th>
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<tr>
<td>Epiphyas postvittana</td>
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<td>Acropolitis rudisana</td>
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<td>Merophyas divulsana</td>
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**BLAST search results**

**Study 2**
Confirming the presence of leafroller species in grapevine canopies

First time Acropolitis and Merophyas have been described in vineyard canopies in season 2014/15 and 2015/16 (n=407)

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Significance of these studies

1. Identified native insectary plants that can provide the provisioning requirements of key predators.

2. Determined which Tortricidae (leaf roller species) are present in grapevine canopies for the first time.

Acknowledgements

Scholarships:
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- SARDI Science Bursary

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- Australian Grape and Wine Authority (AGWA)

Supervisors:
- Principal Supervisor: Prof. Michael A. Keller (Adelaide University)
- Independent Advisor: Assoc. Prof. Duncan Mackay (Flinders University)
- External Advisor: Dr Linda Thomson (Melbourne University)