Broom gall mite update

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(Zhi-Qiang Zhang; Hugh Gourlay; Daniel Than; Simon Connell; Sarah Dodd; Carol Rolando; Mike Watt etc…)
Broom gall mite

- *Aceria genistae* Nalepa
- Belongs to family Eriophyidae
- Native to Europe
- High priority for introduction because it induces galls associated with stem dieback, even plant death in Europe\(^1\)

\(^1\)Syrett P et al. 1999. Biocontrol News and Information 20: 17N-34N.
Specificity testing

- Host records from several Fabaceae tribe Genistaeae spp. e.g. *Cytisus*, *Ulex*, *Genista* spp.\(^1\)

- Initial host-specificity testing in France: *A. genistae* from broom did not form galls on *Ulex* & *Genista*, indicating a complex of specific forms/sibling species exists\(^2\).

- Imported into Australia & extensive host-specificity testing completed during the early 2000s confirmed adequate specificity for release in Australia, NZ.

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Importation into NZ

With Sustainable Farming Fund $$, imported to Lincoln Quarantine from the foothills of the Cévennes mountains of France in July 2006
Release in NZ

Environmental Risk Management Authority (ERMA) approval to release the broom form was not required because ‘A. genistae’ was already present in NZ on gorse\(^1\).

Nevertheless, testing of the broom form from Europe was conducted as if it was a new organism to NZ.

MAF approval to release A. genistae from containment was granted in November 2007, when first release was made (at Lincoln).

Establishment

Released by tying cut stems with galls directly on to broom plants

As the galls dry out, mites exit them & crawl to developing buds where they initiate new galls
Proliferation

At Lincoln, heavily galled plants common within a few years…

Feb 2012

…and dying
Dispersal

4 early release sites in Canterbury surveyed 26-27 April 2012 & transects from the original release plants set up
At ~10 m intervals:

GPS coordinates recorded

broom plants randomly sampled for the presence of galls

Transect continued until zero galled plants found on successive observations.
Gall mites abundant & damaging at 3/4 release sites
## Dispersal

<table>
<thead>
<tr>
<th>Release site name</th>
<th>Location</th>
<th>Distance dispersed (m)</th>
<th>Time since release (months)</th>
<th>Distance dispersed per year (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leslie Hills Station 1</td>
<td>42°38'20.10&quot;S, 172°46'49.62&quot;E</td>
<td>187.5</td>
<td>27</td>
<td>83.3</td>
</tr>
<tr>
<td>Leslie Hills Station 2</td>
<td>42°38'41.28&quot;S, 172°46'55.72&quot;E</td>
<td>91.2</td>
<td>41</td>
<td>26.7</td>
</tr>
<tr>
<td>Twin Bridges</td>
<td>42°41'24.54&quot;S, 172°48'00.84&quot;E</td>
<td>92.6</td>
<td>50</td>
<td>21.9</td>
</tr>
<tr>
<td>Lansdowne Valley</td>
<td>43°36'58.68&quot;S, 172°34'57.78&quot;E</td>
<td>3.00</td>
<td>24</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Dispersal variable – but fairly slow, even at the fastest site

High infestation rates lag dispersal front
Dispersal

The graph shows the proportion of infested plants at different distances along a transect. The distances are measured in meters, ranging from 0 to 210 meters. The data is categorized by different stations:

- Twin Bridges
- Leslie Hills Station 1
- Leslie Hills Station 2

The y-axis represents the proportion of infested plants, ranging from 0 to 1.0.
Early Predictions

*Aceria genistae* damage is very encouraging – it looks like a winner! BUT

We predict that slow dispersal may limit impacts in disturbed areas for example:
Early Predictions - burning

If fire clears large broom stands, it will eliminate mites, which might take years to reinvade any broom regenerating from the seed bank.
Broom seedlings regenerate from seeds bank following clear-felling.

Impact on plantation growth over a 5-6 year time frame before becoming overtopped.

*A. genistae* must disperse onto regenerating broom & reduce broom’s competitive ability within 2-5 years.

Jack’s Pass, Hanmer
Predicted colonisation of a hypothetical circular 40 ha broom patch in 5 yrs, assuming dispersal from the edge at rates of:

- 15 m/yr (solid line);
- 50 m/yr (dotted line);
- 100 m/yr (dashed line);
- 200 m/yr (dot & dash line).

To reduce broom’s competitive ability within 2-5 years, *A. genistae* must disperse ~200 m/year

i.e. much faster than we have measured: inundative releases may be required to achieve this
Safety – direct non-target impacts

Haines (2004) planted white Spanish broom *Cytisus multiflorus*; Tagasaste *C. proliferus*; Spanish broom *Spartium junceum* at Lincoln to monitor potential broom seed beetle *Bruchidius villosus* non-target attack.

Gorse *Ulex europaeus* & Kowhai *Sophora spp.* also present.

Galls only found on Scotch broom & white Spanish broom (a minor, but potentially serious weed in NZ)

As predicted from host-range tests, no other spp. attacked, including Tagasaste.

Cytisus sect. tubocytisus (tagasaste)

Cubas et al. 2006.
Taxon 55(3) 695-704

Group II = Cytisus sect. spartopsis & sect. alburnoides
Safety – food web effects?

Monitoring work indicates the galls provide a habitat for a diverse array of organisms:

- Fungi – especially *Phoma* spp.
- Other mites from families Tydeidae, Tarsonemidae, Phytoseiidae (*Typhlodromus caudiglans*) & Stigmaeidea (*Zetztellia maori*)
Links in multi-trophic system

• Interesting interactions:
  – Tarsonemids are fungivorous
  – Tydeid mites typically feed on fungi & may feed facultatively on gall mites.
  – Phytoseiidae can feed both on gall mites & tydeids.
  – Stigmaeidae can feed on gall mites & phytoseids.
Food web effects?

Galls are distorted vegetative buds (not closed tissue). Due to size differences, eriophyids are protected from predators in narrow innermost parts of the galls

- Galls = refugia for *A. genistae*, so predators unable to prevent damaging levels of attack

- Dispersing mites exiting galls very vulnerable to predatory mites - predation may explain slow mite dispersal

- Unclear whether *A. genistae* will have knock on effects e.g. on native NZ Eriophyid spp. by augmenting predatory mites numbers
Summary

Early indications that *Aceria genistae* may have a major impact on Scotch broom, particularly in relatively undisturbed habitats.

Inundative releases may be required in forestry habitats or after fire.

Interesting ecological questions regarding the gall mite food webs being investigated (Landcare Research Capability Funding)
Thank you

Questions?