



Landcare Research
Manaaki Whenua

Broom gall mite update

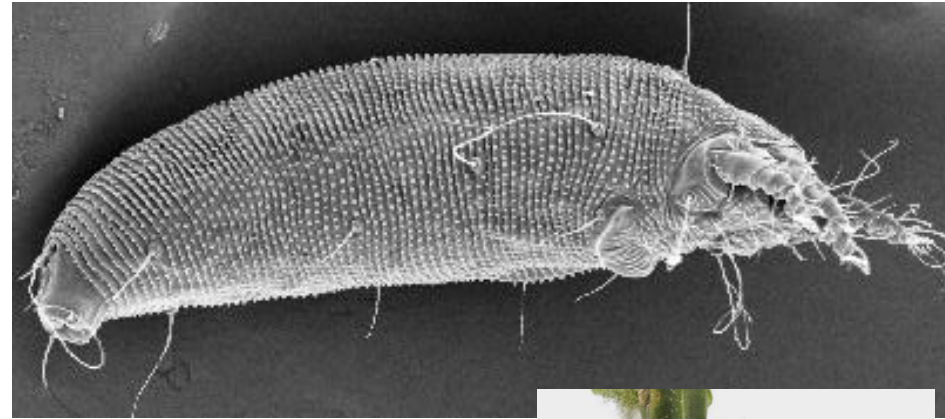
Quentin Paynter

(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 Europe¹



¹Syrett P et al. 1999. Biocontrol News and Information 20: 17N-34N.

Specificity testing



- Host records from several Fabaceae tribe Genisteae 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 exists².
- Imported into Australia & extensive host-specificity testing completed during the early 2000s confirmed adequate specificity for release in Australia, NZ.

¹Davis R et al (1982) Catalogue of eriophyid mites (Acari: Eriophyoidea) Warsaw Agricult. Univ. Press

²Paynter, Q., & Shaw, R.H. (1997). European work for the New Zealand broom biocontrol programme. Report for 1997. Unpublished report, CABI Bioscience, BPM-Weeds, Ascot, UK.

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 gorse¹.

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).

¹Manson, DCM. (1989) New species and records of eriophyid mites from New Zealand. *New Zealand Journal of Zoology* 16, 37-49.

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...



...and dying

Dispersal

Leslie Hills Station 1

Leslie Hill Station 2

Twin Bridges

Landsdowne Valley

4 early release sites
in Canterbury
surveyed 26-27 April
2012 & transects
from the original
release plants set up



Site 1 Release site

E172°46'55.2"

© 2012 Whereis® Sensis Pty Ltd
Image © 2012 DigitalGlobe

Google earth

122 m



Gall mites abundant & damaging at 3/4 release sites



Dispersal

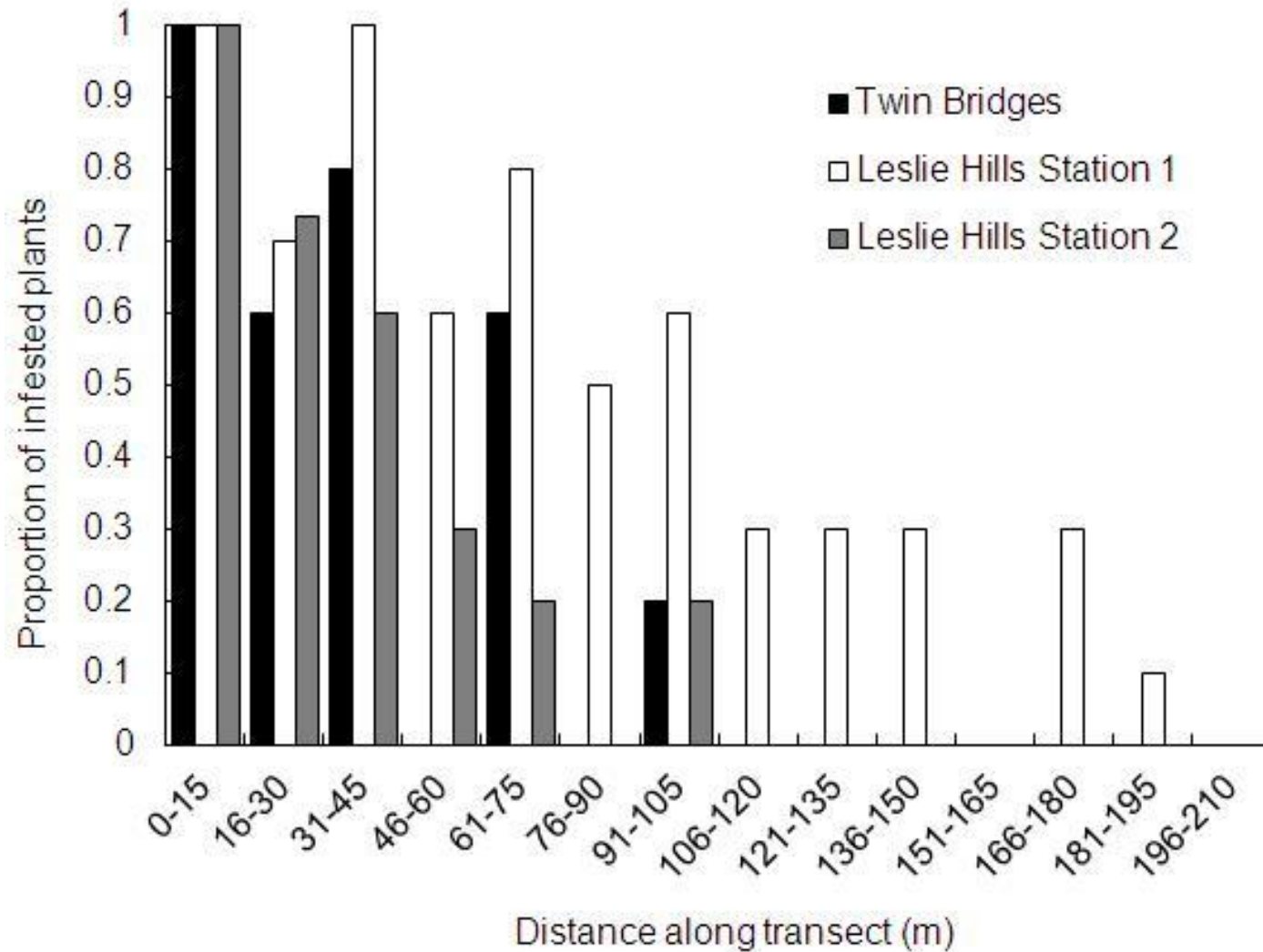


Release site name	Location	Distance dispersed (m)	Time since release (months)	Distance dispersed per year (m)
Leslie Hills Station 1	42°38'20.10"S, 172°46'49.62"E	187.5	27	83.3
Leslie Hills Station 2	42°38'41.28"S, 172°46'55.72"E	91.2	41	26.7
Twin Bridges	42°41'24.54"S, 172°48'00.84"E	92.6	50	21.9
Lansdowne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

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

High infestation rates lag dispersal front

Dispersal



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



Controlled burning of broom, Washington, USA
http://www.army.mil/article/64855/Rebuilding_an_ecosystem/

Early Predictions - forestry plantations

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

Early Predictions - forestry plantations

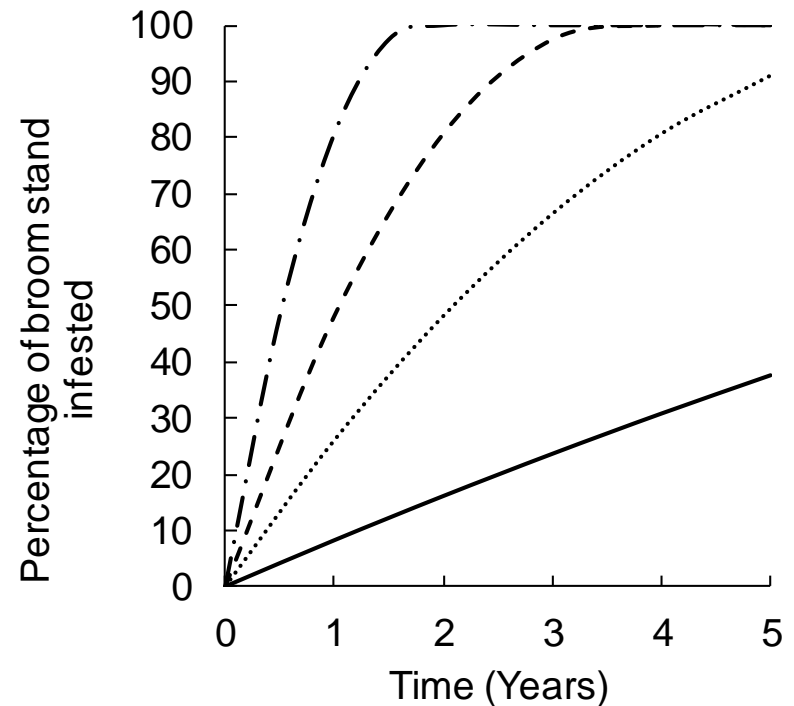


Predicted colonisation of a hypothetical circular 40 ha broom patch in 5 yrs, assuming dispersal from the edge at rates of:

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.

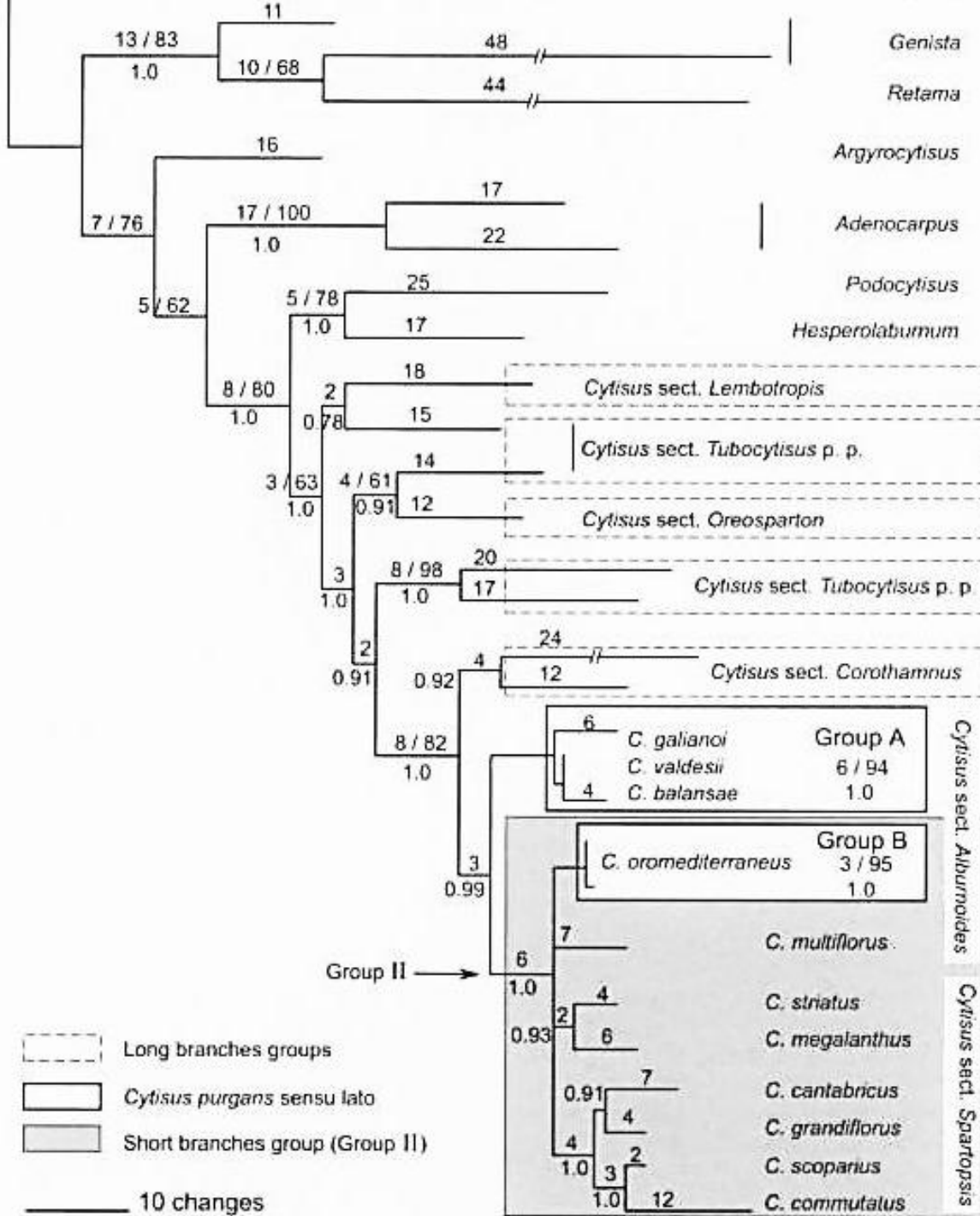
Gorse *Ulex europaeus* & Kowhai *Sophora spp.* also present.

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.



×TF *Genista, Ulex, Spartium*



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

×TF *Cytisus* sect. *tubocytisus* (tagasaste)

✓F

✓F

Group II = *Cytisus* sect. *spartopsis* & sect. *alburnoides*

✓F

✓TF

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 (*Zetzellia maori*)

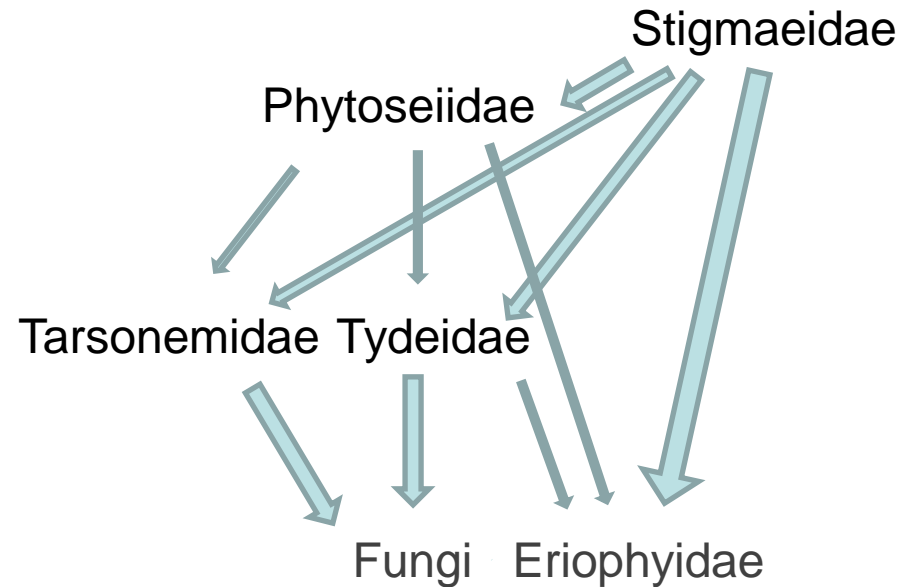


Links in multi-trophic system



- 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?