

Management of Giant Willow Aphid in New Zealand

An update on the concluding Sustainable Farming Fund Project

Stephanie Sopow, Barry Foster, Trevor Jones, John McLean, Toni Withers
Apiculture New Zealand Conference, 27 June 2019



Project aim: to identify solutions for long term sustainable management of giant willow aphid



1. Biological control (Scion)

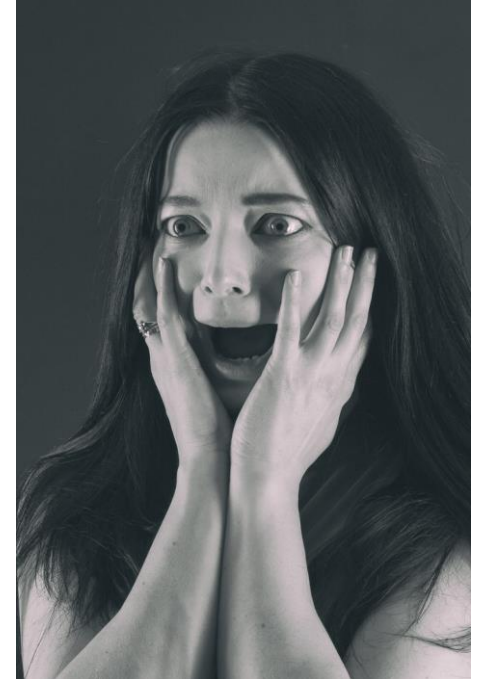
- Identified of a candidate biological control agent
- Assessed its safety for use in New Zealand
- Application for release to Environmental Protection Authority (EPA)

2. Willow resistance / quantifying GWA damage (Plant & Food)



Key messages

1. Giant willow aphid is bad news.



2. We have identified a promising solution.



Let me at 'em!

3. We need your help.

BEE REAL HONEY



July 2019

Dear Environmental Protection Authority,

Giant willow aphid is the bane of my existence. I support releasing the parasitoid that Scion has tested...

Biology of giant willow aphid

- *Tuberolachnus salignus* (GWA)
- First found in New Zealand in December 2013, now widespread
- Host are willows, poplars, apples, pears...
- Feeds on plant sap and secretes honeydew
- Interesting facts:
 - Largest known aphid (6 mm)
 - Only females are known
 - Live birth (no eggs)
 - Can live for up to 3 months (cool temps)
 - Scarce in spring



Photo: 'shineybeetleman'

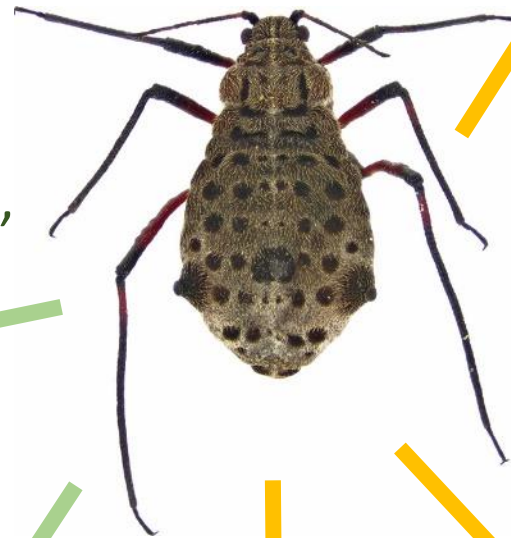
Impacts of giant willow aphid

1. Direct feeding harms willows

Affects land stabilisation, flood protection, willow growers



Less willow pollen and nectar for bees



Sooty mould a nuisance, degrades fruit



2. Honeydew deposits cause many issues

More pest wasps

Week long battle against wasp nest as big as a car in Rotorua

Benn Bathgate · 16:18, Mar 21 2019



Believe it or not, that wasp nest is the same size as a Mini.

A pest controller with 30 years experience has described his battle against a wasp nest the size of a car – home to at least a million of the aggressive German Wasps.

Bees make cement honey



Beekeeper survey results



Economic losses related to GWA estimated at \$300 million per year

- Damage to willows & poplars (reduced root production and overall biomass) – \$145.8 m
 - Reduction in mitigated erosion
 - Carbon losses
- Honey losses – \$84.2 m
 - Wasp impacts on production
 - Wasp management costs
 - Cement honey
- Other wasp impacts – \$64.4 m
 - Reduced clover nitrogen fixation – wasps disrupting pollination by interfering with bees
 - Health costs and traffic accidents
- Sooty mould – \$5.5 m
 - Kiwifruit losses





Finding a candidate biological control agent

- Parasitoid better option than predator or disease
 - More host specific
 - Easier to work with
- Collected GWA in Japan and California to look for parasitism
- Imported *Pauesia nigrovaria* from California in December 2017



Rearing in Scion's containment facility

- GWA reared on willow cuttings
- *P. nigrovaria* reared on GWA
- No protocol!



Pauesia attack behaviour:


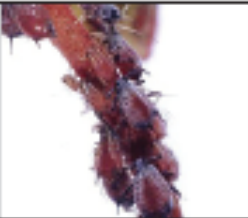





Non-target aphids & host specificity testing

- Species selection - closely related species and representatives of all phylogenetic groups containing native species
- Mated females caged with test species for 24 hours, then further tested to ensure viability
- Regularly checked for mummies

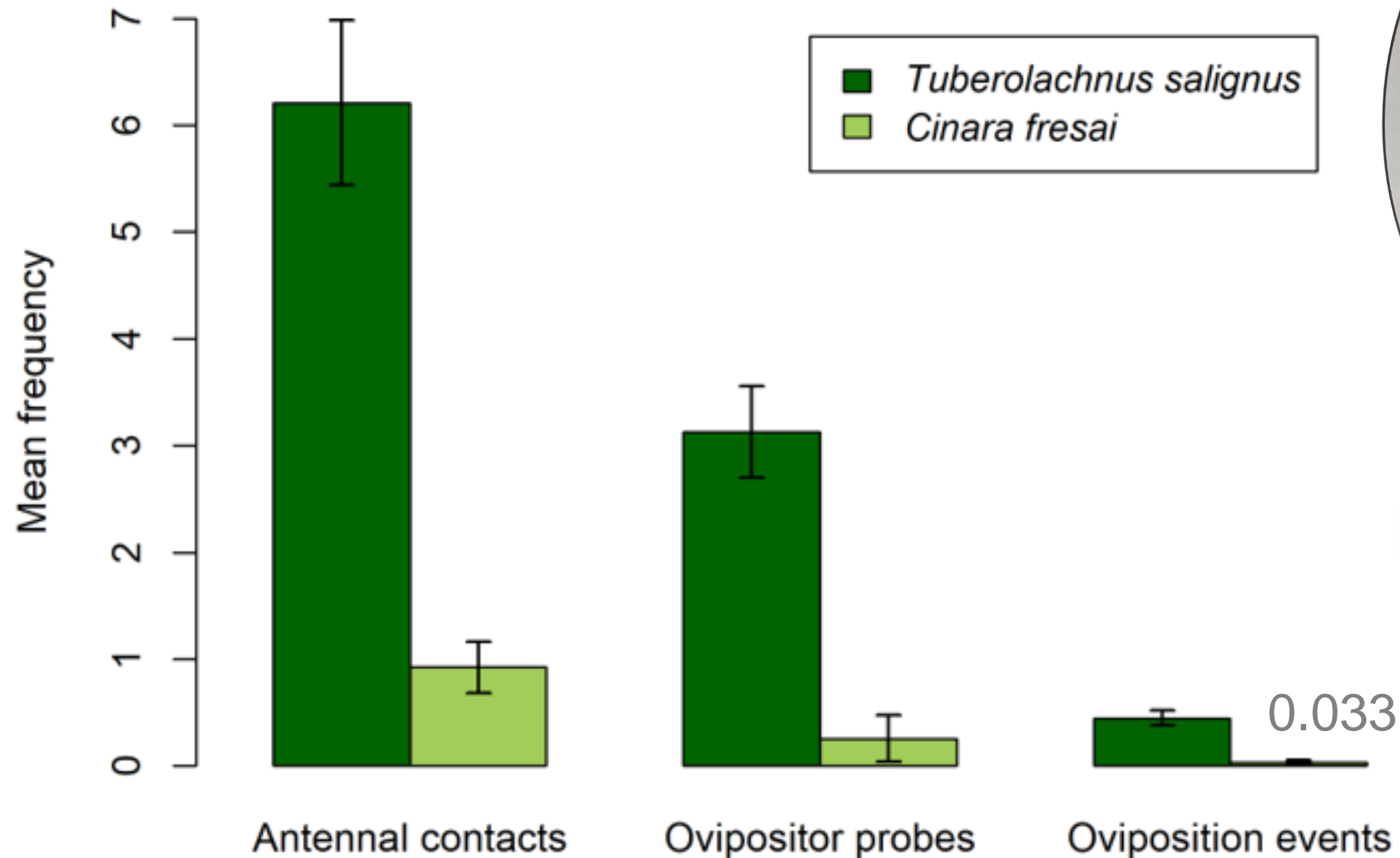


Pauesia nigrovaria host specificity testing results

Aphid species		Subfamily/Tribe	Host plants	Results
Most closely related (same subfamily)				
<i>Cinara fresai</i> Exotic pest		Lachninae	Various Cupressaceae, <i>Cryptomeria japonica</i> (Taxodiaceae)	No evidence of parasitism
Less closely related (different subfamily, same family)				
<i>Aphis cottieri</i> Native		Aphidinae: Aphidini	<i>Muehlenbeckia</i> spp.	No evidence of parasitism
<i>Brachycaudus persicae</i> Exotic pest		Aphidinae: Macrosiphini	<i>Prunus</i> spp.	No evidence of parasitism
<i>Neophyllaphis totarae</i> Native		Neophyllaphidinae	<i>Podocarpus</i> spp.	No evidence of parasitism
<i>Sensoriaphis nothofagi</i> Native		Taiwanaphidinae	<i>Fuscospora</i> spp.	No evidence of parasitism

Additional testing: behavioural assays

Mated female *Pauesia nigrovaria* exposed to GWA or *Cinara fresai*, one at a time for 5 minutes

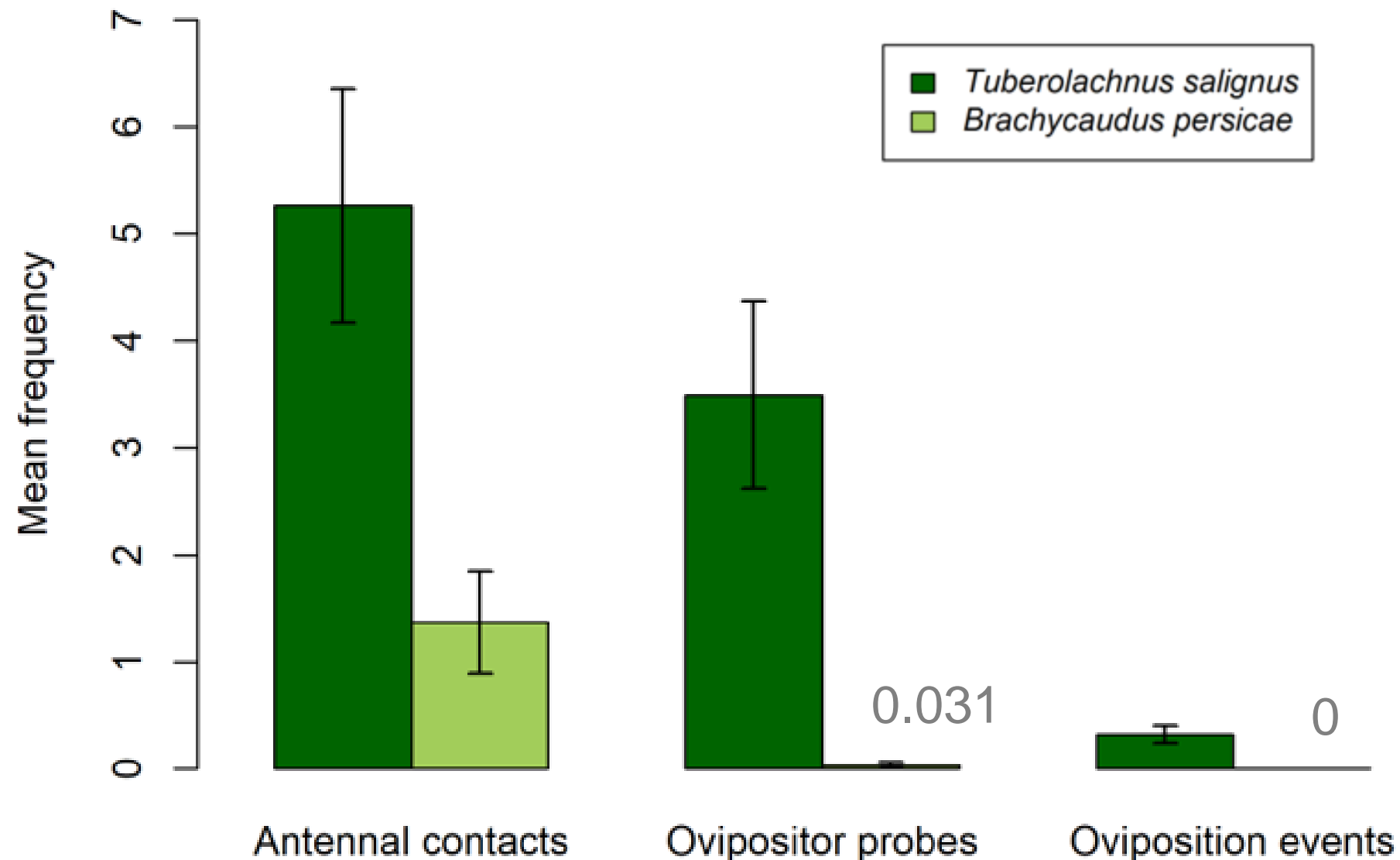


Pauesia nigrovaria behaviour



Additional testing: behavioural assays

Mated female *Pauesia nigrovaria* exposed to GWA or *Brachycaudus persicae*, one at a time for 5 minutes



Pauesia nigrovaria behaviour



Conclusions

- *Pauesia nigrovaria* appears highly host-specific – unlikely to parasitize any other aphids in New Zealand.
- The greatest risk would be to close relatives of GWA. In NZ all of these are exotic pests – could be considered an added benefit.
- *P. nigrovaria* is expected to have the indirect effect of lowering numbers of pest wasps, and potentially harlequin ladybirds



What's next?

- Lodging EPA release application now – we need your support
 - Poster session
 - Email (stephanie.sopow@scionresearch.com)
 - Formal submission on EPA website:
<https://www.epa.govt.nz/public-consultations/open-consultations/>

- Applying for a grant from Sustainable Food & Fibre Futures for a one-year project:
 - Colony maintenance
 - Mass rearing & release in summer/autumn 2020
 - First season monitoring

Acknowledgements



WASP TACTICAL GROUP



www.scionresearch.com



Prosperity from trees *Mai i te ngahere oranga*

Scion is the trading name of the New Zealand Forest Research Institute Limited

Harlequin ladybird beetle, *Harmonia axyridis*

- Eats GWA but also a voracious predator of small native insects (aphids, scales, psyllids... and other ladybirds), also outcompetes native ladybirds and transmits a fungal disease
- Feeds on fruit when other food becomes scarce
- Can taint wine and cause allergic reactions

Reducing numbers of GWA is expected to help to reduce numbers of harlequin ladybird



Photo: Mike Majerus

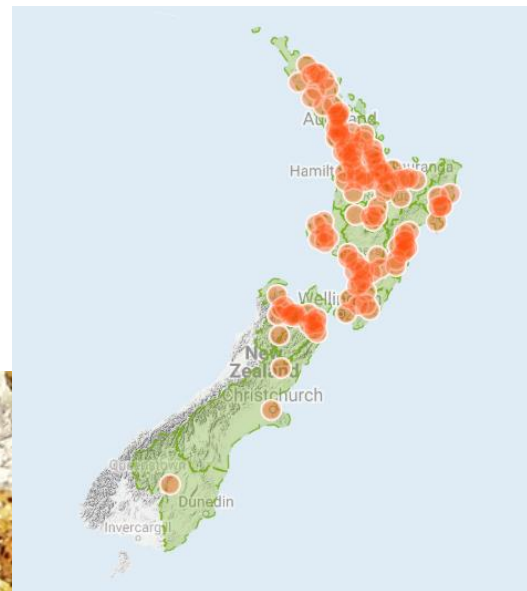
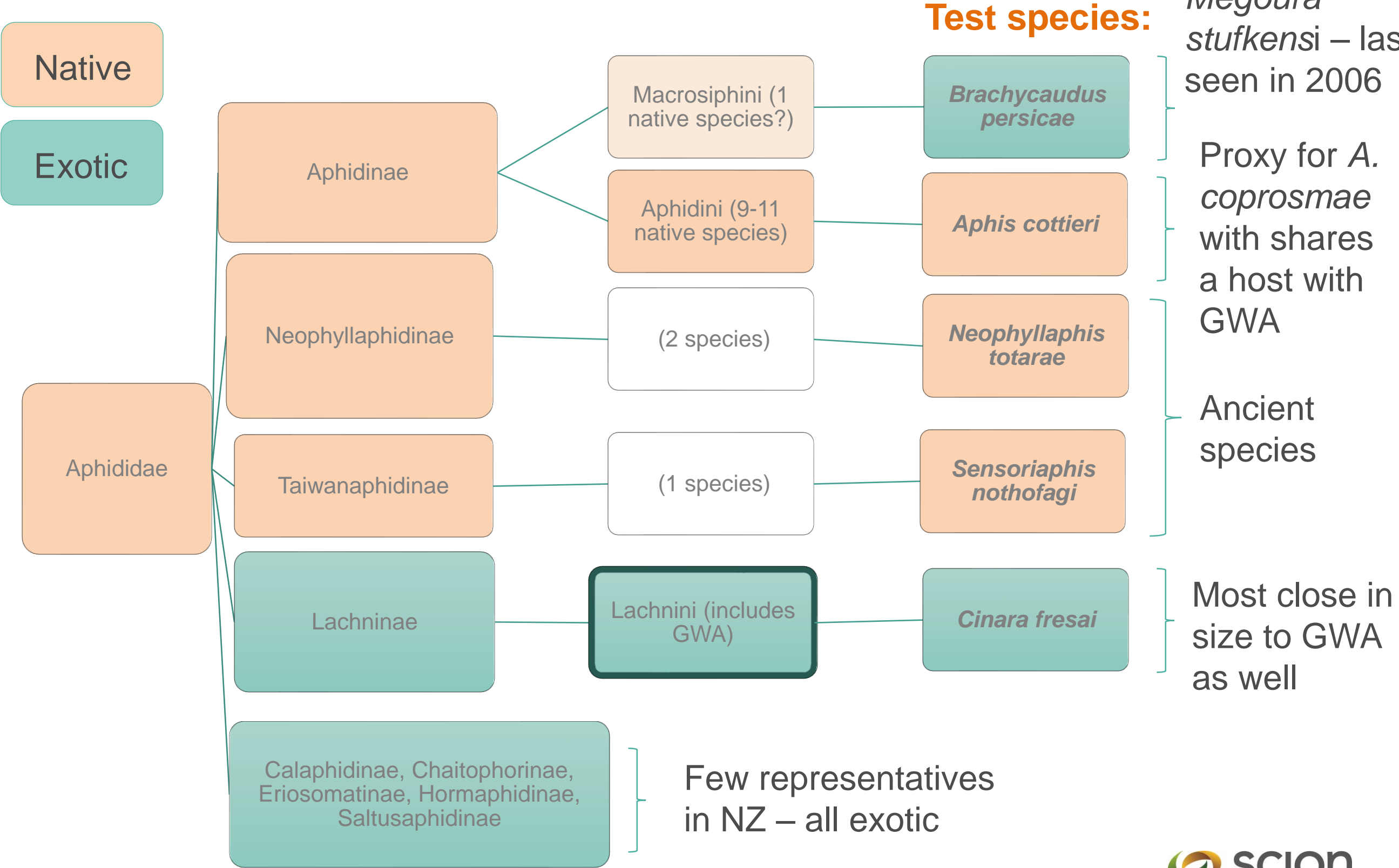


Photo: William Mettey

Phylogenetic relationships between GWA and other aphids present in NZ (90% are exotic)



Other supporters

Cash and in-kind support from:

Plant & Food Research

University of Otago

Gisborne Branch of ApiNZ

Waikato Branch of ApiNZ

Southern North Island Branch of ApiNZ

Bay of Plenty Branch of ApiNZ

Nelson Branch of ApiNZ

Trees for Bees

Wasp Tactical Group

Arataki Honey

Ingleby NZ LP

Ricki Leahy

Golden Grove Apiaries

USDA Forest Service/University of California Davis

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Acknowledgements

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Plant & Food Research
ApiNZ - Gisborne
ApiNZ - Waikato
ApiNZ - Southern North Island
ApiNZ - Bay of Plenty
ApiNZ - Nelson
Pipfruit NZ
Trees for Bees
Wasp Tactical Group
Arataki Honey
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