Management of giant willow aphid

ANNUAL NEWSLETTER ■ JULY 2017 ■ **ISSUE 1**

Scion update

Stephanie Sopow, Scion

Year One kicked off with the formation of a diverse project team, including representatives from Scion (leading the project), Apiculture New Zealand, Plant & Food Research, the New Zealand Poplar and Willow Research Trust, regional councils, and Zespri. The broad range of interest groups reflects the breadth of impacts that giant willow aphid (GWA) is having in New Zealand. These range from detrimental impacts to willow trees and honey bees, to honey losses, rising vespulid wasp populations and risks to fruit exports.

The primary aims of the project are to investigate the potential for long term control of GWA with a biological control agent (Scion) and to identify willow cultivars exhibiting some degree of resistance so these willows can, over time, replace those that are more susceptible (see Plant & Food update).

Biological control is an environmentally sound and sustainable approach to managing GWA. However it requires significant investment to thoroughly investigate both the risks and the potential for success. Scion has undertaken scouting trips to Japan and California looking for a candidate biological control agent. In California we found a species of *Pauesia* (Hymenoptera: Braconidae: Aphidiinae) parasitising GWA (Figure 1). We are now planning to import this tiny parasitic wasp (about 2 mm) from California in September 2017. This process involves approval from the Environmental Protection Authority and the Ministry for Primary Industries.

The parasitoid is believed to be specific to GWA. It is highly unlikely that it will find any of New Zealand's native aphids palatable. However, once in New Zealand, the parasitoid will be transferred to Scion's PC2 invertebrate containment facility in Rotorua (Figure 2). Extensive testing to ensure the safety of our native aphid fauna will be carried out there. This is expected to take the better part of the next two years of this three year programme.

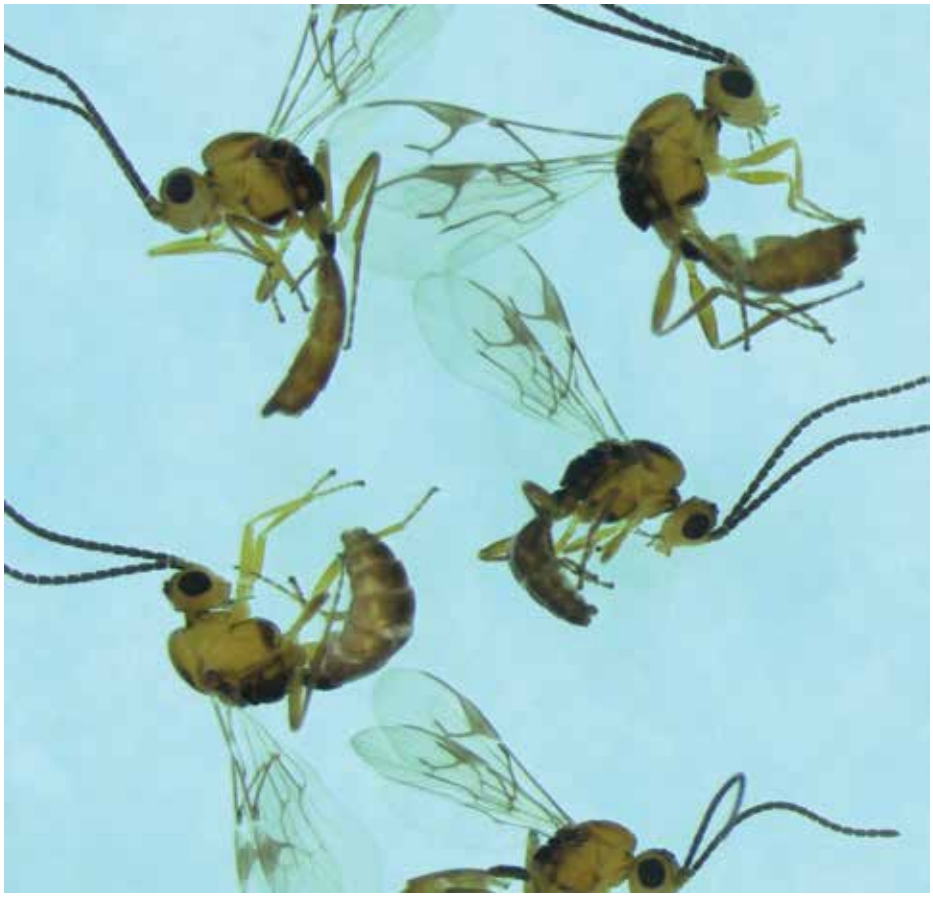

Figure 1. Pauesia *sp., a parasitic wasp that kills giant willow aphid by developing inside it – one wasp per aphid.*

Another aspect to this work is learning how best to rear GWA in the containment facility so the parasitoids will have a suitable environment in which to thrive upon arrival. Thus experiments are underway to optimize GWA rearing protocols under these artificial conditions. We have also begun our search for the non-target aphid species required for host specificity testing of the parasitoid, and we are obtaining host plant material for maintaining colonies of these aphid species as well.

Scion is also investigating RNA interference (RNAi) technology, in partnership with the University of Otago, as a short term mitigation strategy for control of GWA. RNAi acts by stopping the transfer of information from DNA by introducing target double-stranded RNA (dsRNA) to the insect. RNAi is designed to be highly specific to the target organism, and other arthropods such as bees would not be at risk. We have conducted proof of concept experiments to see whether we can get a proxy for dsRNA into the aphids via prior application to willow stems. The mode of entry for the dsRNA is through the gut of the insect, so this means we need to get the dsRNA first into the phloem of the willow. Results from this experiment are being analysed now (July 2017).

Figure 2. *Toni Withers inside Scion's PC2 invertebrate containment facility.*

Plant & Food Research update

Trevor Jones, Plant & Food Research

Field trials. On-farm field trials of willow trees have been established to look at the impact of giant willow aphid on willow tree health in the Hawke's Bay and Wairarapa regions. The trials are located on sheep and beef farms in erosion control plantings of willow trees in gullies on hillsides. They include newly planted poles and two and three year-old trees of *Salix matsudana*, and *S. matsudana* × *alba* 'Moutere' and 'Tangoio'.

The field trials were established in early summer and the trees allocated to sprayed and unsprayed treatments, with insecticide applied monthly when the trees were monitored for aphids. Initial findings showed a rapid increase in the numbers of trees infested with aphids from very low numbers in January to high numbers in February and March (Figure 3). The size of the aphid clusters on the tree stems increased rapidly in February, March and April, and then declined substantially, in both size and number, in May.

The sprayed trees were quickly re-infested by winged aphids in February, March and April, with the sprayed and unsprayed treatments having similar numbers of infested trees one month after spraying. However, the sprayed trees had smaller aphid clusters and much reduced stem blackening (mould) compared with the unsprayed trees (Figure 4). The re-infestation of willow trees declined substantially in May, with only a small number of winged aphids and small clusters seen on the sprayed trees.

The field trials will be monitored for two years. The growth and survival of the willow trees will be assessed at the end of the growth seasons.

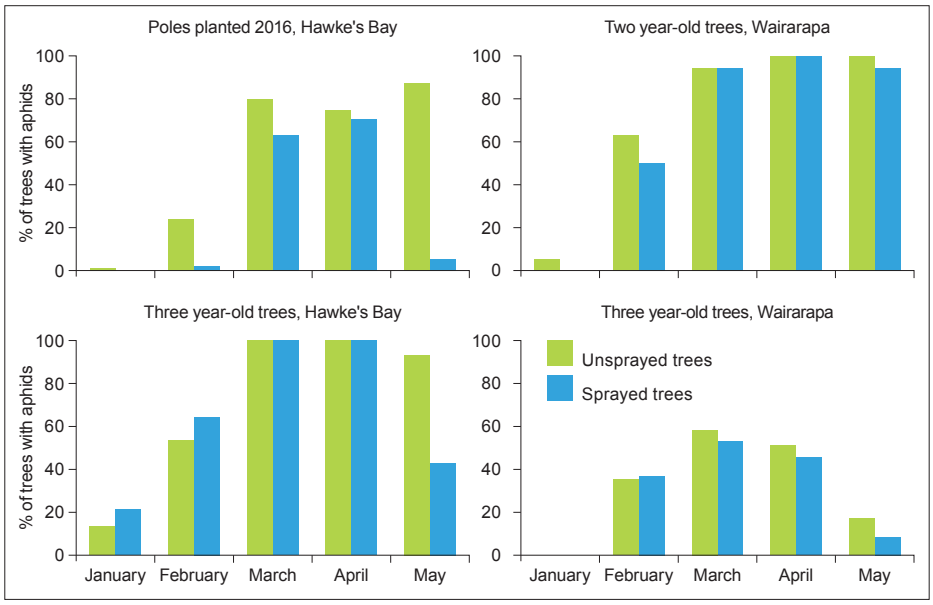

Figure 3. *The percentage of sprayed and unsprayed willow trees infested with giant willow aphids in the Hawke's Bay and Wairarapa field trials.*

Tolerance of willows to the giant willow aphid. Observations of tree and shrub willows in the collection at Plant & Food Research in Palmerston North have shown that *Salix matsudana* cultivars are the most tolerant of the tree willows to the giant willow aphid. The clusters of aphids on cultivars of this species are smaller and the stems of the trees show less stem blackening from the growth of mould on the honeydew, compared with other tree willows. The *S. matsudana* × *alba* cultivars, such as 'Tangoio' and 'Moutere', also have good tolerance of the giant willow aphid, but have larger clusters of aphids and more stem blackening. The *S. alba* and *S.* × *fragilis* (crack willow) cultivars are generally tolerant of the giant willow aphid, but have shown larger numbers of aphids, and more stem blackening, as well as some branch dieback in younger trees during drought conditions in summer.

Figure 4. *The blackened stem of an unsprayed 'Tangoio' willow tree (left) and the adjacent sprayed tree (right), in May.*

The *S. purpurea* cultivars such as 'Booth', 'Holland', 'Irette', are among the more tolerant of the shrub willows to the giant willow aphid. The *S. viminalis* cultivars, such as 'Gigantea', and the *S. schwerinii* cultivar 'Kinuyanagi' are susceptible to the giant willow aphid, with large numbers of aphids on the stems, branch dieback and the death of younger, and some older trees, observed during drought conditions in summer.

Apiculture NZ conference

We will be hosting a workshop on giant willow aphid on 11 July 2017 at 1:00 pm at this year's Apiculture NZ conference in Rotorua for anyone interested in learning more about the project.

This project is supported by MPI's Sustainable Farming Fund No. 404830. Further details on this project and a full list of supporters can be found at: giantwillowaphid.co.nz.

For more information contact Lisa Stanbra, Project Coordinator, at lisa.stanbra@scionresearch.com