Management of giant willow aphid

News

SCION

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Scion update

Stephanie Sopow, Scion

The Sustainable Farming Fund programme is now over half way through the research on long term sustainable management of giant willow aphid (GWA), *Tuberolachnus salignus*. We have made great progress in year two, with the successful importation of a potential biological control agent into our containment facility (Figure 1), and the initiation of host specificity trials to ensure the safety of New Zealand's native aphids, should the biological control agent be approved for release. Resistance of certain willow varieties to GWA is also becoming apparent in field trials (see Plant & Food Research update overleaf).

GWA has been causing a wide variety of problems throughout New Zealand, since it was first discovered in 2013.

The aphids feed on the sap of willows, causing branch dieback and occasionally death of the tree. Willows are widely used in New Zealand for slope stabilisation, flood protection and as vital pollen and nectar resources for honey bees in the early spring.

Feeding aphids secrete sticky honeydew that falls onto lower level foliage as well as any equipment or crops that are nearby. The honeydew is rapidly colonised by sooty moulds which can degrade the value of fruit crops. Kiwifruit growers are reporting 20-30% fruit losses caused by sooty moulds, which can be considered the second largest microbial challenge after PSA. Much of this has been attributed to passion vine hopper, but cicadas and GWA exacerbate the issue, the latter particularly when in close proximity to willow shelterbelts.

In the past, pest wasps have been estimated to cost New Zealand $133 million in economic losses from combined impacts such as the direct effect of wasps on apiculture and the indirect effect of lost pollination services[1]. Giant willow aphid honeydew is an abundant new resource gathered by pest wasps, which causes their populations to increase and contributes further to these economic losses.

Figure 1. *Roanne Sutherland (left) and Georgia Woodall (right) inside Scion's PC2 invertebrate containment facility.*

Honey bees also gather the aphid honeydew, which, if present in high enough quantities, leads to crystallisation of honey in the comb, difficulties with extraction, and a sour taste to the honey.

Pesticides are not an option for GWA control because they would be secreted in the honeydew of the feeding aphids. This would put nectar feeders such as honey bees, tui and bellbirds at risk. Thus, the primary focus of our research is to identify a biological control agent for GWA.

Parasitoid wasps like the one we found parasitising GWA in California, *Pauesia* sp., are ideal biological control agents. They search out and destroy their targets, multiplying and spreading on their own. The parasitoid wasp lays an egg in the aphid, a larva hatches, and then kills the aphid as it develops. In two to three weeks a new adult wasp emerges from the dead aphid (Figure 2).

Figure 2. *Adult female* Pauesia *sp., newly emerged from a GWA mummy inside a gel capsule.*

Both the risks and the potential for success must be thoroughly investigated to ensure that biological control will be an environmentally sound and sustainable approach to managing GWA. *Pauesia* sp. is believed to be specific to GWA, and it is highly unlikely that it will find any of New Zealand's native aphids palatable. Nonetheless, extensive testing must be undertaken to ensure the safety of our native aphid fauna. This research is underway, thus far, with three of the five non-target species carefully selected to represent the phylogenetic lineages of aphids present in New Zealand.

Host testing results to date are favourable, with no evidence of parasitism of the non-target species by *Pauesia* sp. If all continues to go well, we will initiate the process of applying to the Environmental Protection Authority for approval to release the parasitoid in late 2019 or 2020.

[1] MacIntyre P & Hellstrom, J. (2015). *An evaluation of the costs of pest wasps (*Vespula *species) in New Zealand*. Department of Conservation and Ministry for Primary Industries, Wellington. 44 p.

Plant & Food Research update

Trevor Jones, Plant & Food Research

Impact on willow tree survival and growth

Field trials on sheep and beef farms in Hawke's Bay and Wairarapa have been continued for a second season to quantify the impact of the giant willow aphid on willow tree survival and growth.

The trees were allocated to sprayed and unsprayed treatments (Figure 3). The willow trees were monitored for aphids from December 2017, and insecticide was applied to the sprayed trees at monthly intervals from January 2018.

Aphid numbers were low in December, but increased rapidly on the unsprayed trees during January, February and March. The size of the clusters of aphids on the stems of the unsprayed trees increased during January, February, March and April.

Figure 3. *A pair of unsprayed (left), and sprayed (right) trees in a three year-old stand in the Wairarapa. Note the black sooty mould on the stem and branches of the unsprayed tree.*

The sprayed trees showed high levels of re-infestation with winged aphids during the one month interval between spraying. The percentage of trees re-infested with winged aphids increased during January, February and March, and then declined in April. The percentage of trees re-infested with winged aphids increased with the age of the trees, which could be attributed to the larger size of the trees.

The monitoring of the aphid populations, and the control of the aphids on the sprayed trees, will continue until the end of June 2018, when the unsprayed and sprayed trees will be assessed for survival and growth.

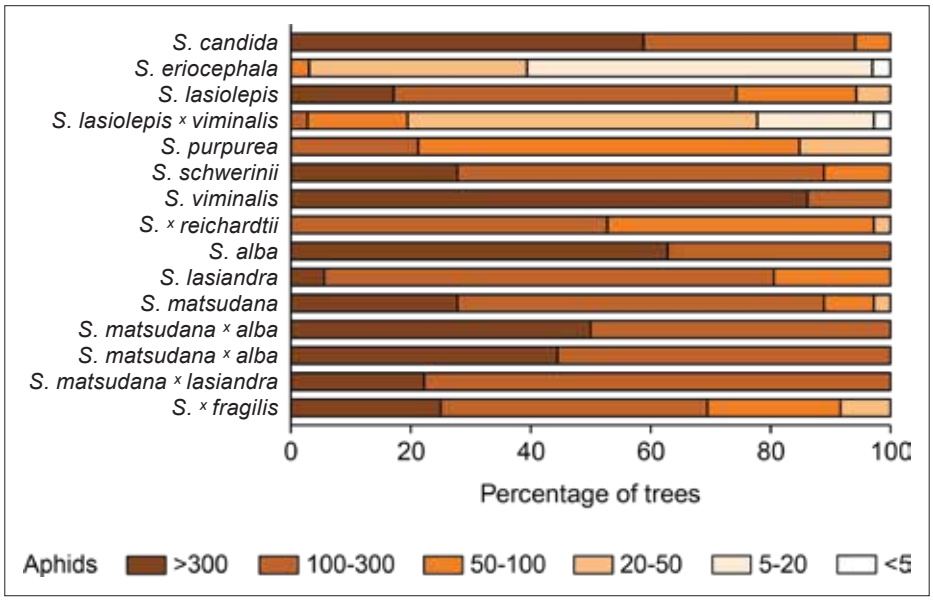

Figure 4. *The abundance of giant willow aphids on the different willow species and hybrids, as at April 2018.*

Susceptibility of willow species and hybrids

A nursery field trial was established at Massey University to look at the effect of the giant willow aphid on the survival and growth of young willow trees. Fifteen tree and shrub willow clones were planted as cuttings in June 2017. These included some commonly planted willows, and Trees for Bees selections of willows for bees. The trees were planted in paired rows, with one row sprayed with insecticide to control the aphids, and the other row inoculated with aphids. The number of aphids on the unsprayed trees was monitored from February 2018.

The numbers of aphids increased rapidly during February and March, and peaked in mid-late April (Figure 4). There was a more rapid increase in aphid numbers on some willow cultivars, with larger clusters of aphids forming on the stems. The willows that were susceptible to the aphids included: *Salix viminalis, S. candida, S. alba, S. matsudana × alba, S. matsudana, S. schwerinii, S. × fragilis, S. matsudana × lasiandra*. The most resistant willows were: *S. eriocephala and S. lasiolepis × viminalis*. Two early flowering male *S. lasiolepis × viminalis* clones with resistance to the aphids, have recently been released to regional council nurseries, so that plants can be made available for planting.

More about the project can be heard at this year's Apiculture NZ conference in Blenheim, 22-24 July 2018, and further details can be found at: www.giantwillowaphid.co.nz.

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