Integrated pest management of passionvine hopper in kiwifruit orchards – year two findings

By Zespri and Plant and Food Research

Passionvine hopper (PVH), *Scolypopa australis* (Walker) is a significant production pest of kiwifruit and estimated to cost the industry at least $77M per annum.

In 2021, Zespri and Plant and Food Research began a four year research to develop an integrated pest management plan for PVH. The research focused on reducing PVH populations at the source, minimising PVH migration into orchard blocks and managing PVH within orchard blocks. Two components of this research were funded by A Lighter Touch, specifically the biological control agent search in Australia and testing of a smart monitoring technology.

The second year of research is now complete and the key findings of interest to ALT stakeholders are summarised below.

Field surveys to assess the effect of border and shelter management on PVH numbers in kiwifruit vines

A second season of survey was carried on 31 sites to measure the effect of different border management practices and shelter types on the numbers of PVH on kiwifruit vines. The border management practices include border clearing and insecticide application to the border vegetation; and the shelter types include dense, porous, artificial and no shelter.

Key findings:

- The strongest trend observed was that PVH numbers in kiwifruit were lowest where more of the adjoining areas were cleared of vegetation. Unless disturbed, PVH typically use short flights between plants to disperse. Large open spaces with few host plants may thus inhibit dispersal.
- Dense or artificial shelter between the gully and kiwifruit block tended to be a more effective barrier to PVH dispersal into kiwifruit blocks than porous shelter, but shelter design is important as PVH exploit gaps in the shelter to access kiwifruit blocks. Evidence of this came from a study at one site where significantly fewer PVH accessed the kiwifruit block when the gap between shelter cloth panels was closed versus open.
- A comparison of PVH densities at the gully border versus an adjacent kiwifruit block at six sites supported these trends. When border clearing and/or an effective shelter barrier was included as part of the PVH management plan significantly more PVH were captured at the gully edge compared to the adjacent kiwifruit block.
- The effect of insecticide applications against PVH nymphs at the border was unclear. PVH counts in kiwifruit blocks were higher when the adjacent border had been sprayed, however growers may be spraying in response to high PVH pressure and spraying may have prevented higher counts.

These results have been consistent between two years of survey which is very encouraging. The findings support the current industry messaging to growers around border management practices.

Semi-field trial and field surveys to evaluate host status of native plant species to PVH

Bay of Plenty kiwifruit orchards are often bordered by naturalised gullies containing a mix of native and exotic vegetation which are the key source of PVH in kiwifruit blocks. Some growers have been replanting these gullies with native plants claimed to be poor or intermediate hosts of PVH. A semi-field cage study to test the development of PVH caged on different plant species and a field survey were completed to verify the host plant status of plants used in replant projects.

Key findings:

- Several plant species were confirmed as poor or intermediate hosts of PVH and therefore suitable for replant projects. These include kōwhai, putaputawētā, karo, lemonwood, *Pittosporum tenuifolium*, rewarewa as well as plants with needle like leaves such as totara, mānuka, kānuka and kauri.
- Four plant species recommended for use in replant sites, namely *Coprosma robusta, Pittosporum colensoi*, akeake, and hebe may be intermediate or good hosts of PVH. A change to the host status classification of these plants may be warranted based on the development of large numbers of PVH on these species, observed infestations of PVH on plants in the field, and the frequency of use in replant areas.
- A comparison of PVH trap catches at replant sites versus those with a naturalised gully showed replanting gully areas on kiwifruit orchards with plant species that are poor or intermediate hosts of PVH appears to be effective at reducing PVH pressure in kiwifruit blocks.

Efficacy of sprays against PVH nymphs for border management

There are several products growers can apply to manage PVH on the orchard boundaries in late spring to early summer, but the relative efficacy of these products was unknown.

An initial laboratory screening assay was carried out in Year 1 on a range of spray products and product combinations for activity against PVH nymphs. The study found the combination of 1% oil with PyGanic® (an organic pyrethrum product) had similar contact efficacy as the chemicals bifenthrin and thiacloprid when applied against PVH nymphs (approximately 90% mortality rate).

To confirm the results, a second semi-field cage experiment was completed using PVH nymphs on mahoe plants. PyGanic (100 mL/100 L) was tested in combination with two Excel® Organic oil concentrations (0.5% or 1.0%).

Key findings:

- The results showed PyGanic has excellent contact activity against PVH nymphs when applied in combination with 0.5% or 1.0% oil.
- Moderate contact activity was apparent when PyGanic was applied alone.
- The two concentrations of oil tested (0.5 and 1.0%) were similarly effective at enhancing the efficacy of PyGanic, indicating that 0.5% should be adequate for use in border applications against PVH nymphs.
- Evening sprays are more efficacious than morning sprays, probably because of the slower drying time and reduced potential for breakdown of PyGanic by sunlight.

Efficacy of sprays against PVH eggs

Passionvine hopper populations in orchards mostly originate from adjacent areas with host plants, but some growers are reporting the establishment of within-block resident populations because of high numbers of PVH eggs being laid in fruit stalks. If a resident population of PVH is present within the orchard block, winter and early spring is a good time to intervene as there is no crop on the vines.

A survey of commercial kiwifruit blocks was completed to determine the efficacy of bifenthrin (Assail® or Venom®), with or without a penetrant (Engulf® or Wetcit), applied during the dormant period and/or spring against PVH eggs laid in kiwifruit fruit stalks.

Key findings:

- A single application of bifenthrin plus penetrant applied during dormancy is effective against PVH eggs laid in fruit stalks. Although the eggs are well hidden inside the fruit stalk over winter, both Engulf and Wetcit appear to be highly effective at aiding bifenthrin to enter the stalk and contact the eggs.
- An application of bifenthrin alone in spring was also effective at preventing PVH egg hatch. Penetrants are not recommended for use in spring, but the results suggest the eggs are close enough to the surface of the fruit stalk in spring for chemical contact to occur.
- Two sprays, one applied during the dormant period and one in spring, offered no advantage over a single spring spray.

Smart monitoring of PVH

Smart monitoring technology offers an alternative to traditional insect pest monitoring methods, enabling efficient detection of and response to pest infestations. Technology company, Trapview, has developed an intelligent monitoring system that enables growers to monitor pest activity in real-time by combining cutting-edge AI, sensors, GPS tracking, cloud-based analysis, and a mobile application that provides growers with precise and up-to-date information on pest activity.

The Trapview monitoring system was tested on adult PVH in two commercial kiwifruit orchards in Te Puke, comparing its effectiveness to standard yellow sticky traps. In late January 2023 five Trapview monitoring units were installed using standardised parameters, and critical telemetry checks deemed three of the five units operational. Monitoring commenced from 23 February 2023, all PVH caught were photographed and manually marked within the Trapview application.

Key findings

- A total of 42 adult PVH were caught in the three operating units from 23 February to 8 March 2023.
- The number of adult PVH captured on yellow sticky traps during this period ranged from 0.35 to 0.58 per sticky trap per day, fewer than those caught in the Trapview units, 0.7 to 1.7 PVH per unit per day.
- The current study demonstrated the ability of the Trapview monitoring system to identify adult PVH, autonomously marking ideally positioned PVH with moderate accuracy.
- With the inclusion of sticky traps from the wider PVH trapping programme for the purposes of machine learning, greater than 90% of adult PVH photographed were marked autonomously from late March 2023.

Given the technical and environmental factors that limited PVH capture this season, Trapview's machine-learning algorithm will require refinement throughout next season where PVH dispersal into a block will be measured alongside PVH captured on standard sticky traps.

Search for biological control agent of PVH

A search for biological control agent for PVH was carried out in south eastern Australia where PVH originated from. An Australian research organization based in Melbourne, Cesar Australia, was contracted to survey PVH populations in and near Melbourne for natural enemies during 2021 to 2023. Melbourne was selected because PVH and their nymphal parasitoids are known to be present and it has a similar temperature range to the Bay of Plenty.

Key findings:

- CESAR Australia reported finding a more diverse range of parasitoids in Melbourne than are present in New Zealand. There were two nymphal parasitoids and seven egg parasitoids.
- One nymphal parasitoid (*Neodryinus koebelei*) is already present in New Zealand but has not been recorded from PVH here.
- One of the egg parasitoids (*Ablerus* sp.) is already present in New Zealand and parasitises PVH at a low rate.
- Parasitism rates in Melbourne were low, and similar to those found in New Zealand.
- Egg parasitism occurred at only 7.6% of sites with PVH, while nymphal parasitism occurred at 23.4% of sites.
- Only 1.8% of all nymphs collected were parasitised.
- Egg parasitism was also low: 1.9% of all dissected eggs and 3.9% of all reared eggs were parasitised.
- Factors other than parasitism are likely to be important in limiting populations of PVH in Melbourne.

Given the low egg and nymphal parasitism rate (about 2–4%, and 2% respectively), this research component will not continue. There is insufficient evidence to invest in assessing non-target effects of parasitoids and engaging with the Environmental Protection Authoritiy to introduce one or more parasitoids into New Zealand quarantine.

Acknowledgement

Zespri and Plant and Food Research would like to thank all growers, orchard managers and packhouse entities who have been involved and provided support to this research.