Integrated pest management of passionvine hopper in kiwifruit orchards – year three 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 project to develop an effective integrated pest management plan (IPM) for PVH. The research focused on border management practices reducing PVH populations at the source, e.g. gullies with host plants, having effective barriers to minimise PVH migration into orchard blocks and managing PVH within orchard blocks through well-timed sprays and cultural control. Two components of this research are co-funded by A Lighter Touch in Year 3, which includes the evaluation of Trapview as a smart monitoring system to recognise and detect PVH on kiwifruit orchards, and evaluation of native plant species for use in replanting.

The third season of data collection is now complete and the key findings of interest to ALT stakeholders are summarised below.

Border spraying against PVH nymphs

Pyrethrin + 0.5% mineral oil combination has been shown to be highly effective against PVH nymphs in laboratory and semi-field studies, especially when applied in the evening. In Year 3, a study was carried out to test the efficacy of this combination in the field. Sprays were applied by growers between late December to early January using cannon, airblast sprayer or handgun, and PVH nymphs were monitored from November to mid-January.

Key findings:

- A single spray of pyrethrin + 0.5% mineral oil can be highly effective against PVH nymphs at the gully border.
- Application is most effective if applied when nymphal emergence is complete and the insects are aggregating on plant shoots – typically late December to early January.
- Re-infestation can be prevented or minimised by applying another spray when a second wave of PVH adults are observed – typically late January to first week of February.
- Good spray coverage of the trees and shrubs along a gully edge can be achieved using an air-blast sprayer, cannon or handgun.
- Product storage conditions may be an important factor influencing pyrethrin efficacy.

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

A third season of data collection was completed on the same 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 general trend shows PVH population may be starting to recover from the cyclone 2023 but most sites which actively manage PVH were able to keep PVH numbers low.
- Clearing of border vegetation is associated with reduced numbers of PVH in adjacent kiwifruit blocks.
- Wide open areas beside kiwifruit blocks inhibit PVH dispersal from the gully source as PVH typically use short flights between plants to disperse.
- Dense or artificial shelter between the gully and kiwifruit block is a more effective barrier to PVH dispersal into kiwifruit blocks than porous or no shelter, especially when the shelter is designed or modified to have few gaps.
- Well-timed spray(s) of efficacious products can help reduce PVH densities at the border and/or delay migration of PVH adults into the block. There were no differences in PVH counts between sprayed and unsprayed sites this season as opposed to the previous two seasons (higher PVH counts at sprayed sites). This is likely due to the growers choice of spray, more than 75% of sprayed sites used an effective product this year, namely pyrethrin + 0.5% mineral oil, leading to reduced PVH counts.

Most changes to management practices on the survey sites are grower-initiated. The findings demonstrate that having well considered border management practice(s) can be effective as part of an integrated pest management plan for PVH.

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 to manage PVH, as well as improve orchard biodiversity and pollination resources. In Year 3, the research focused on verifying the host status of plants by assessing direct impact of selected plant species on nymph development, identifying additional poor PVH host plants (good for replanting) and assessing impact of replanting on PVH populations.

Key findings:

- Cage trials and field observations have been used to classify 26 native plant species as poor, intermediate or good hosts for PVH.
- Twelve plant species were identified as poor PVH hosts plants and are unsuitable for nymph development, including rewarewa (*Knightia excelsa*), mānuka (*Leptospermum scorparium*) and kānuka (*Kunzea ericoides*).
- Some of the most common plants selected for replanting are intermediate hosts for PVH, such as *Coprosma robusta*, akeake (*Dodonaea viscosa*) and lemonwood (*Pittosporum eugenioides*).
- The results also indicate the PVH host plant status of previously unknown plants – horopito (*Pseudowintera colorata*), shore hebe (*Veronica elliptica*) and *Olearia albida* are good PVH hosts
- Host status change to some species in the Plants with Purpose guide may be warranted based on the new data in the survey, for example:
    - Akeake, koromiko (*Veronica stricta*) and lacebark (*Hoheria sexstylosa*) has been raised to intermediate or good host plants

    - *Coprosma robusta*, karo (*Pittosporum crassifolium*), kānuka and kōwhai (*Sophora microphylla*) has been reduced to intermediate or poor host plants.
- Trap catches data showed replant sites initially had lower PVH numbers than sites with a naturalised gully, indicating replanting gully areas with plant species that are poor or intermediate hosts of PVH can help reduce PVH pressure in kiwifruit blocks. The difference in PVH trap catches between replant and non-replant sites have also reduced over time, likely due to the decrease in PVH pressure and growers' proactive PVH management practices.

The information generated from this survey can help inform the selection of plant species for inclusion in various planting projects from border re-planting orchards to greenfield development and riparian planting. If planting from afresh , it might be good to avoid plants which are good PVH hosts. For those who have planted, the information will help inform PVH risk and a reminder to keep up with management.

Evaluating feasibility of Trapview for 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. Trapview is a commercial smart monitoring system for real-time insect pest monitoring and surveillance. A second season of data gathering was completed to evaluate the feasibility of Trapview for monitoring insect pests on kiwifruit orchard using PVH as a model organism.

Key findings

- Two seasons of trialling demonstrated the ability of Trapview to autonomously detect and identify PVH with good level of accuracy.
- Trapview was as effective at trapping PVH as the manual yellow sticky trap method.
- The pros and cons of Trapview for PVH monitoring are summarised as below:

Pros	Cons
Easy to use and accurate, very intuitive	Very expensive $2000 per unit (relative to monitoring nymphs using trap plants)
Good technical support from provider	Ongoing subscription cost $600 per year (includes access to all other insect pests on the system)

- While easy to operate in a kiwifruit orchard, the high price per unit can be a barrier for growers to adopt it on orchard. The system may be more suited as a surveillance tool for biosecurity pests. Furthermore, at the project commencement, monitoring PVH adult was thought to be useful as part of the IPM programme. As the project progressed, it has become evident that monitoring PVH nymphs would be more useful to inform spraying.
- As part of this project, a few other smart monitoring systems were also reviewed. Based on cost, functionality and ease of use, iScout and Farmsense are considered to have the most suitable application to kiwifruit.

Monitoring PVH egg hatch

This component is part of a bigger research programme at Plant and Food Research to understand the hatching phenology of PVH. Plant and Food Research has been collecting PVH hatching phenology data at Te Puke and Auckland for 23 and 11 years, respectively. The data informs long-term egg-hatch trends crucial in the development of an IPM plan for PVH. There is an indication that PVH egg hatch is trending earlier, likely due to the gradual increase in temperature over time. An earlier hatching date may lead to the early appearance of PVH adults and a longer risk period of the development of sooty mould on the crop, and therefore good PVH management is important.

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.