DISPERSAL BY PASSIONVINE HOPPER (*SCOLYPOPA AUSTRALIS*) ADULTS

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ABSTRACT

Passionvine hopper (*Scolypopa australis*) (PVH) is a serious pest in some Bay of Plenty kiwifruit orchards, with large numbers of PVH adults flying in from adjacent scrub. A series of field experiments investigated their dispersal abilities. Adult PVH released into an open area, were recaptured on sticky traps up to 70 m downwind two hours later. When released inside a kiwifruit orchard, PVH gradually dispersed throughout a block of vines. Sticky traps at different heights along an orchard border caught PVH up to 2 m above ground. Different shaped (rectangle, square or triangle) traps caught similar numbers of PVH adults.

Keywords: *Scolypopa australis*, dispersal, kiwifruit.

INTRODUCTION

Since its arrival in New Zealand in the 1870s, passionvine hopper (PVH) (*Scolypopa australis* (Walker)) has become common in some parts of the country infesting a wide range of plants, including some fruit crops. In the 1970s during the early development of the kiwifruit industry, fruit rejection occurred due to sooty mould growing on honeydew produced by PVH (Sale 1974). Fruit affected by sooty mould are unsuitable for export. Over the following two decades, PVH was regarded as a minor pest and indirectly controlled by the sprays of broad-spectrum insecticides targeted against key pests (Steven 1990). However, widespread problems did occur in 1973/74 (Sale 1974) and serious crop losses (up to 31%) could occur if no insecticides were applied (Smith and Graham 1980). When broad-spectrum insecticide use was reduced following the introduction of KiwiGreen (Steven *et al*. 1994) and organic growing systems, the incidence of sooty mould increased on crops in parts of the Bay of Plenty (Sale 1996). In the 1995/96 season, some orchards suffered crop losses of up to 5%, with individual rows in badly affected blocks having up to 85% of fruit affected (Sale 1996).

Many leafhopper species (Waloff 1973) disperse readily and some cause problems when they fly into orchards from adjacent areas where they have overwintered (Purcell 1974). A similar situation occurs with PVH in some Bay of Plenty kiwifruit orchards. To overcome this problem some kiwifruit growers have tried to clear or treat scrub bordering their orchards. However, the success of this technique will be very dependent on the dispersal abilities of PVH. This paper reports on studies of the dispersal of PVH adults.

METHODS

To investigate PVH dispersal, four trapping experiments were conducted.

Flight distance

The potential dispersal distance of PVH adults was investigated by releasing PVH adults in an open field and recapturing them downwind. Several thousand PVH adults were released, within two hours of collection from heavily infested bracken (*Pteridium esculentum*) or privet (*Ligustrum sinense*) plants, at a single point in the middle of an open field in Hamilton on 27 February 1998. On the day of release, the maximum temperature was 24.5ºC and the windspeed ranged from 0.02-3.0 m/s nearby at the

Ruakura Research Centre meteorological station. To recapture the PVH adults, green-coloured corflute sheets (500 × 1000 mm) covered with sticky adhesive mounted on poles 300 mm above ground, were set up at 10 m intervals, from 10 to 70 m downwind. The trial was not replicated. Each sticky board was systematically staggered so they were all visible from the release point. On the day of release and 3, 4, 5, 6, 7 and 8 days later, PVH trapped on each sheet were counted and removed.

Within-block movement

A second trial investigated movement by PVH after they had entered a block of kiwifruit. The trial was conducted at HortResearch, Te Puke Research Centre inside a block of 92 unsprayed, T-bar trained kiwifruit with similar numbers of cv. Hayward and 16A vines, which had a very low existing PVH population. There were seven rows of vines in the block, with 7-15 vines per row. On 28 February 2000, approximately 4000 PVH adults were collected from a variety of host plants, primarily bracken and mahoe (*Melicytus ramiflorus*) from nearby areas. On the day of release, the maximum temperature was 24.8ºC and the wind run was 58 m/s at HortResearch, Te Puke Research Centre. The insects were released in several batches between 10 am and 2 pm at a single point beneath the canopy of a vine in the centre of the block (seventh vine in fourth row) within an hour of their collection. The range and rate of PVH dispersal within the kiwifruit block was determined by conducting 30 s searches of each vine quarter in the block on four occasions after releasing the insects.

Shape attractiveness

Observations of PVH adult behaviour during some previous experiments indicated that the shape of objects might affect their attractiveness. To test this hypothesis, a trial design similar to that in the flight distance trial was used, with several thousand PVH adults released upwind from sticky traps in an open field. Four trap designs were used: rectangle (500 × 2000 mm) on its end or side, a square (1000 × 1000 mm) or a triangle (1400 mm sides), all of which had a 1 m^2 surface area. Each trap was made from green-coloured corflute with the side closest to the release points coated in sticky adhesive. The traps were mounted on a pole 50 mm above the ground surface, with four replicates in a randomised block design with 4 m between and within rows. The PVH were released in a line staggered to compensate for the wind which was at an angle to the grid of sticky traps. On the day of release and 1, 2 or 6 days later, PVH trapped on each sheet were counted and removed. Two trials were conducted on 25 February and 15 March 1999, when the respective maximum temperatures were 21.9 and 26.0ºC and windspeeds ranged from 0.9-5.9 and 0-2.4 m/s at the Ruakura Research Centre meteorological station. Data were analysed by ANOVA after square transformation of the total (male and female) number of PVH caught per trap.

Flying height

The height at which PVH adults were flying into kiwifruit orchards was investigated. Sticky traps were placed at different heights on the end of rows of a block of a Waikato kiwifruit orchard which bordered a known source of PVH adults. Three trap heights (500, 1000 and 1500 mm above ground) were replicated four times using 600 × 1200 mm sticky traps consisting of green-coloured corflute with sticky adhesive on the side facing away from the vines. The traps were arranged in a randomised block design and fastened to kiwifruit vine support structures. Data were analysed by ANOVA after square root transformation of the total (male and female) number of PVH caught per trap.

RESULTS AND DISCUSSION

Flight distance

Within two hours of adult PVH being released in an open field, insects were being trapped up to 70 m downwind from the release point. The majority of the PVH caught (65%) were trapped within the first two hours after release, with insects still being caught up to five days later. After five days, 52% of the insects had been caught on the first sticky trap, 10 m from the release point with 3% caught on the most distant trap 70 m downwind (Fig. 1). This is further than the 13 m observed in a previous study by Siew (1960). Considerably longer distances (i.e. kilometres) have been recorded for some other species of leafhoppers (Waloff 1973). It is probable that over their adult

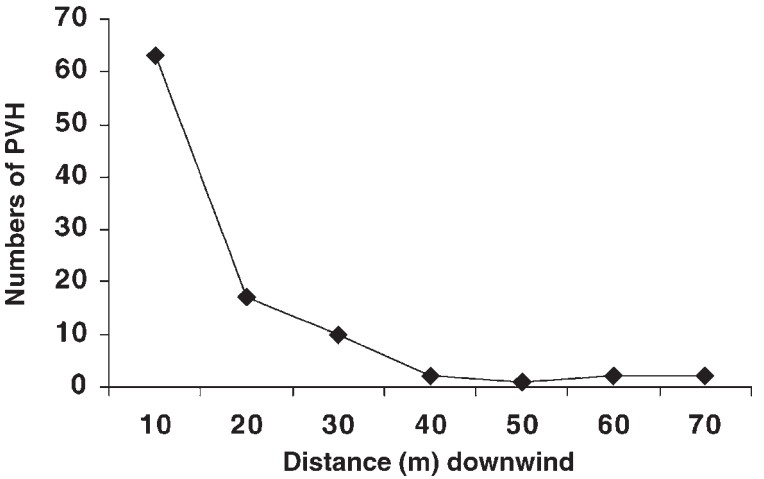

FIGURE 1: Numbers of PVH adults trapped at intervals downwind 5 days after release from a single release point on 27 February 1997.

lifespan, which can last up to 95 days (Gerard 1985), some PVH may fly much further than 70 m. This has significant implications for growers trying to trace and destroy sources of PVH flying into their orchard. For example, some growers have tried to prevent PVH flying into their orchards by creating a buffer strip several metres wide which is free of vegetation, along their orchard borders. This study indicates that to be effective any kind of buffer area would have to be much wider.

Within-block movement

A day after the release from a single point in the middle of a block of kiwifruit vines, most (62%) of the 1228 PVH found were still within two vines of the release point, but some were found throughout the block. Over the following eleven days, an increasing proportion of the PVH gradually dispersed from the release point but 20% still remained within two vines of the release point (Fig. 2). There was no indication

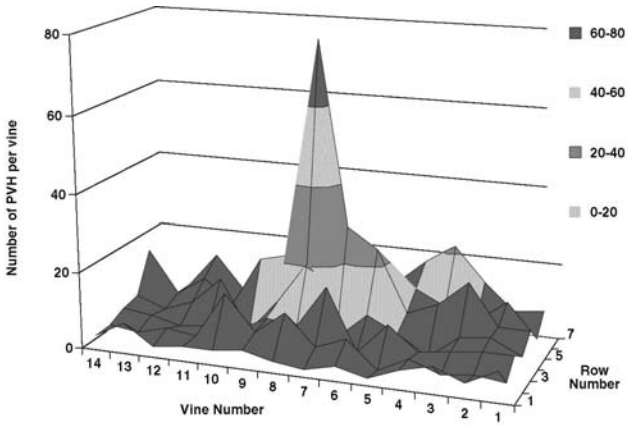

FIGURE 2: Numbers of PVH adults recorded during a 2 min examination of each vine in a kiwifruit block, 12 days after releasing insects at a central point in the block (row 4, vine 7) on 28 February 2000.

that PVH preferred to move within rows rather than between rows across the block. This appears to indicate that once in an orchard, PVH gradually move throughout the orchard.

Shape attractiveness

If PVH adults are attracted to tall objects, then insects emerging in scrub areas containing only low-growing plants would move towards the trees which shelter kiwifruit orchards. Therefore, trap catches should have been greatest on the end rectangle traps which were the tallest of the different-shaped traps compared. However, this was not found in either of the two trials (Table 1). Either the height of traps used in these trials was not high enough or there are other factors which are responsible for PVH adults moving into kiwifruit orchards.

TABLE 1: Mean number (± SEM) of PVH adults caught on 1 m^2 sticky traps of different shapes, downwind from a single release point, 25 February 1999. Data presented are the values obtained after square root transformation.

Trap shape	Mean number of PVH per trap	
	25 February 1999	15 March 2000
Square	2.7 (0.29)	4.0 (0.53)
Triangle	2.5 (0.29)	4.1 (0.49)
Side rectangle	2.5 (0.29)	4.3 (0.53)
End rectangle	1.5 (0.29)	3.6 (0.49)
SED (maximum)	0.40	0.69

Male and female PVH were trapped from the base of the lowest traps 500 mm above ground to the top of the highest traps which was 2100 mm above ground. The lowest (500 mm above ground) traps caught relatively fewer PVH than the traps hung 1000 or 1500 mm above ground. There was no indication that trap catches were declining with height within the range tested in this study, indicating that PVH may fly more than 2 m above ground.

TABLE 2: Mean number of PVH (male and female) adults caught per sticky trap placed at different heights along the border of a kiwifruit orchard 1999. Data presented are the values obtained after square root transformation.

Trap height above ground (mm)	Mean number of PVH caught per trap
500	9.5
1000	10.5
1500	10.5
SED	1.08

CONCLUSIONS

Passionvine hopper adults are capable of dispersing at least 70 m downwind within open areas. Any control measures applied to only a small buffer zone bordering orchards, are therefore unlikely to stop PVH adults entering. Once inside a kiwifruit orchard, PVH will gradually move throughout blocks, although a proportion may stay near their point of entry. This may partially explain why fruit contamination by sooty mould growing on honeydew produced by PVH, is usually highest in the several rows of vines along the border where insects have flown into an orchard. PVH may fly towards objects depending on their shape, but do not appear to fly preferentially towards relatively higher objects within the height range tested. PVH fly up to 2 m above ground and appear to be capable to flying even higher.

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