Psa-V symptoms on non-host plants

10 April 2013

Since November 2010 there have been multiple reports of Psa-V like symptoms on non-host species, particularly when the species are adjacent to infected kiwifruit blocks with visible Psa-V symptoms.

Concerns have also been raised about the potential for Psa-V to survive on non-host species over a period of time. These species have covered various families and include shrubs, blueberry (*Vaccinium* spp Ericaceae), trees, *Idesia polycarpa* (Salicaciae), magnolia, (Magnoliaceae) banana(Musaceae) and understory weeds below the canopy.

The information in this case study report is a summary of non-host species that have been tested for Psa-V in the last two years. Between 9 November 2011 and 19 January 2012, four blueberry plant samples from Kerikeri were submitted for testing. Seedlings had been grown in potting mix in Katikati and went through Auckland for two weeks before arriving in Kerikeri. As a biosecurity precaution, on arrival in Kerikeri, blueberry leaves were swabbed and PCR tests undertaken through Verified Lab Services (VLS). Test results came back not detected for Psa-V.

Figure 1: Magnolia leaves with leaf-spot

Figure 2: Magnolia tree near to Hayward block

Figure 3: *Idesia polycarpa* yellow leaf spots

Figure 4: *Idesia polycarpa* stem dieback

In December 2012, Psa-V like symptoms were also reported on a magnolia tree in Oropi, and an *Idesia polycarpa* tree in Te Awamutu. Photographs of the symptoms were sent to KVH (Figures 1, 3 and 4 above). In the magnolia, leaf spots were black, of an irregular shape and with a yellow halo around the edge of the spots. Leaves varied in number of spots seen, and where leaf spot was in high proportion,

there also tended to be some leaf edge senescence and death. The Psa-V like symptoms reported from the *Idesia polycarpa* included yellow irregular-shaped halos and stem dieback. These symptoms were much less clearly Psa-V like than the symptoms seen in magnolia.

Leaf samples were taken from the magnolia tree in Oropi on 1 March 2013 (Figure 2) and tested at VLS. The real time PCR rapid test for the presence of Psa-V came back with a not detected result. The *Idesia polycarpa* was not sampled.

In March 2013 Psa-V like symptoms were reported on banana leaves with yellowing and mottled appearance in Omokoroa. A sample was taken on 25 March. The plants had shown leaf mottling and severe dieback. Again, symptoms were not as clearly Psa-V like as the Magnolia samples. Results came back not detected for Psa-V.

Previous research on non-hosts

Previous research has been conducted to determine Psa-V's ability to survive on shelter belts and weed species growing on the orchard floor. The following information is a summary of those experiments and results. The epiphytic growth of the bacteria on kiwifruit plants or non-host species, could provide the inoculum for further spread of the disease. Therefore, it is important to understand the risks of Psa-V dispersal and survival.

A Plant and Food Research (P&FR) study involved the collection of samples in infected orchards, from surveyed plants near kiwifruit vines. *Cryptomeria japonica*, *Pinus radiata*, *Casuarina cunninghamiana*, *Salix* sp. and *Populas* sp, and plants found on the orchard floor *Crepis* sp and *Carex* sp. were tested and analysed in the laboratory for presence of Psa-V. Psa-V was only found on one pine tree which was in direct contact with an infected kiwifruit vine. Potted plants of these same species were also trialled using either streptomycin resistant derivative Psa-V or a streptomycin and rifampicin resistant derivative of Psa-V (Horner et al. 2011).

All plants were inoculated by spraying with a hand-held sprayer bacterial suspensions ranging from 7.3 x 10^8 to 4.6 x 10^6 colony forming units/mL. They were monitored regularly for the presence of the pathogen. Washings were made of leaves, and then plated onto agar medium.

The conclusions on the survival of Psa-V on non-host plants were similar for all the evergreen shelterbelts, deciduous shelterbelts or weed species tested in this study. The bacteria survived from a few hours to several days (up to seven for Carex sp. inoculated in the laboratory). However, it does not seem to multiply. The length of survival time is related to the initial inoculum concentration on the plant (Horner et al. 2011).

As the presence of Psa-V on non-host plants might only be temporary, it is possible that a much larger sample, under natural conditions, in the same area at different times during the season might be needed to find it (Horner et al. 2011).

VLS also undertook a study on the survival of Psa-V on weeds and mulched shelter species under laboratory conditions after inoculation with a high concentration of Psa (1 x 10^7 to 2 x 10^7 colony forming units/mL). Different weed species, including *Crepis* sp. *Spurgela* sp. and *Euphorbia* sp. were collected from infected orchards (Figures 5-9 below) and potted in containers. Sprigs of *Cryptomeria* shelter were also collected, inoculated and placed in containers. Both sprigs and potted plants were put in a greenhouse with high humidity conditions (Figures 10-13 below).

Prior to inoculation, the weeds and mulched shelter were tested and no Psa-V was detected on them. Post inoculation, samples were taken and tested in PCR and cultured for viable colonies if positive in PCR on a weekly basis. Out of the five weed species tested, only one showed presence of viable colonies at week three, Weed 12 *Euphorbia sp*. For the mulched shelter, survival of Psa-V lasted for at least four to six weeks post inoculation.

Figures 5-9: Weed spp. inoculated and tested for presence/absence of viable bacteria (VLS trials).

Figures 10-13: Shelter sprigs pre-spiking, after 3 weeks and after 5 weeks (VLS trials)

From the various research undertaken, KVH concludes that Psa-V can survive on non-host plant species. It is unclear exactly how long survival is, but certain plant species retain inoculum longer than others. However, the pathogenicity of Psa-V on non-host plant species remains unclear.

Pseudomonas species in other plants

Worldwide the genus *Pseudomonas* contains over 130 species and pathovars. Of those, there are over 50 pathovars of *Pseudomonas syringae*. Many of which attack cultivated crops and tree species. In North America *Pseudomonas syringae* pv. *syringae* affects a large number of woody species. The most severely, and commonly, affected are maple (*Acer* spp), dogwood (*Cornus* spp), filbert (*Corylus* spp), blueberry (*Vaccinium* spp.), magnolia, lilac (*Syringa vulgaris*, Oleaceae), oriental pear (*Pyrus pyrifolia* or *Pyrus ussuriensis)*, aspen (Salicaceae) and linden (Malvaceae) (Moore 1988)**.** *Pseudomonas syringae* is named after the lilac tree (*Syringa vulgaris*) from which it was first isolated.

Other Pseudomonas species in kiwifruit orchards

There are a large number of Pseudomonads found in New Zealand. *Pseudomonas syringae* pv. *syringae* (Pss) also affects kiwifruit, and is known to cause budrot in vines. It also causes leaf spot which can be similar in appearance to spots seen in Psa-V affected vines. From the test results, and our understanding of the epidemiology and host specificity of Psa-V, it is thought unlikely that symptoms on magnolia, or banana, are caused by a host switch in Psa-V. It is more likely that the magnolia has been infected by either *Pseudomonas syringae* pv. *syringae* or another pathogen with similar symptomology. The banana is most likely affected by a disease specific to bananas.

Biosecurity risks and grower observations

Since the advent of Psa-V, kiwifruit growers have noticed more disease and pest effects in other plant species within, and around, their orchards. Observational skills have been honed through monitoring for Psa-V symptoms. A growing awareness of the patterns and symptoms of disease infection means orchardists are now more able to pick up trouble spots that could be of future biosecurity concern.

Host switching, horizontal gene transfer, and new virulent strains of Psa are all future biosecurity concerns. Industry observations, monitoring and research play an important role in understanding new and emerging risks.

For all unusual pest and disease symptoms on kiwifruit plants please contact KVH on 0800 665 825. For information and testing of other plant species, with pest and pathogenic symptoms, please call the Ministry for Primary Industries (MPI) exotic disease and pest emergency hotline 0800 809 966.

Bibliography:

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