



Psyllid / Liberibacter / Phytoplasma complex

A range of symptoms is associated with the presence of the potato psyllid *Bactericera cockerelli* in potato crops. Some of these are caused by the psyllid alone, some by the bacteria-like disease Liberibacter which is transmitted by the psyllid, and some seem to be associated with the presence of another bacteria-like organism - Phytoplasma - in the crop. It is not yet certain whether Phytoplasma is the sole cause of symptoms seen in some crops (see the section of Phytoplasma later in this fact sheet). The

interaction of the psyllid and the two diseases is complex, and a lot is still unknown. This update is intended to provide as much information as is currently available. Further updates will be produced as the research programme answers the many questions.

The potato psyllid (also known as the tomato / potato psyllid, or TPP) transmits Liberibacter, and may transmit Phytoplasma but this is not yet proven. The psyllid, Liberibacter, and Phytoplasma all cause damage.



Potato psyllid adults. Image courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org



Zebra chip in a Rua potato. Image courtesy of Lia Liefing, MAF IDC.

Key issues

- The potato psyllid *Bactericera cockerelli*, the plant disease *Candidatus Liberibacter solanacearum*, and the phytoplasma *Candidatus Phytoplasma australiense* all cause similar symptoms in potato plants and can occur at the same time in a crop
- The adult psyllid looks like a 3 mm long cicada, and has a wide host range
- The psyllid causes "psyllid yellows" and transmits Liberibacter, and may also spread Phytoplasma.
- Liberibacter causes a range of foliar symptoms which are similar to *Fusarium* wilt, as well reducing yields by up to 50% and causing Zebra chip in tubers
- Infected seed tubers can pass Liberibacter to the next generation
- Phytoplasma causes foliar symptoms similar to the Liberibacter and also causes tuber discolouration, but this is different to Zebra chip

Potato psyllid *Bactericera cockerelli*

The potato psyllid is a small insect that looks like a 3 mm long cicada. All life stages - eggs, nymphs, and adults - can be found on potato leaves and stems. Nymphs and adults feed on the phloem which is how they transmit *Liberibacter* from plant to plant.

Psyllid eggs are less than 1 mm long, are attached to the plant by a short upright stalk, and are a yellow-orange colour. They are usually laid on the undersides of leaves or along the stalk, and hatch in around seven days. The nymphs look like 2 mm long yellow or green scale insects and their colour may make it difficult to see them on the plant. Nymphs may move slightly when disturbed. The adults are pale yellow when they first hatch but become brown, green, or black with white bands as they mature (though note that these colours may fade over time on a sticky trap). Adult psyllids will jump if disturbed. Growers should use a magnifying glass when scouting for psyllid eggs, nymphs, and adults.

Little is known about the psyllid's lifecycle in New Zealand so the following is based on data from the USA. The potato psyllid thrives in mild temperatures. Below 7°C the development of eggs and larvae will stop, while the survival of nymphs and adults is much reduced above 30°C. A life cycle is generally completed in 15 to 20 days, with up

to five generations per year in a potato crop. Females can lay 1000 eggs so populations can build up very quickly. Feeding psyllids cause a leaf yellowing known as "psyllid yellows", which is believed to be caused by the psyllid injecting its saliva into the plant - it is not a disease, and plants recover in three weeks if the psyllids are killed.

The potato psyllid has been reported from over 150 different species of plant. Most of these plants are solanaceous (related to potatoes and tomatoes) such as black nightshade, but common weeds including cape gooseberry, common morning glory, and convolvulus are also hosts. For further information on hosts see the article "Weed hosts of the potato / tomato psyllid" in the December 2008 issue of *The Grower* (this can be downloaded from *The Grower's* website at http://thegrower.co.nz/magazine_pdf/112/Grower%20Dec%2008_Web.pdf), and fact sheet "Hosts of the potato psyllid".

Psyllid monitoring and control from an early growth stage are important aspects of managing / reducing the impact of the psyllid, *Liberibacter*, and *Phytoplasma* - please see the fact sheets "Potato psyllid monitoring" and "Potato psyllid control" for further information on these issues.



Potato psyllid nymph and adults. Image courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org



Potato psyllid nymphs. Image courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org

Candidatus *Liberibacter solanacearum*

The disease Candidatus *Liberibacter solanacearum* is acquired by the potato psyllid during feeding, and it is persistent in the psyllid - meaning that once infected the psyllid is capable of transmitting the disease for the rest of its life.

Once inside a potato plant *Liberibacter* causes foliar symptoms which are similar to *Fusarium* wilt - leaf yellowing, curling, and necrosis. The disease also causes tuber symptoms, including sunken, pink eyes and Zebra chip – dark streaks, flecks, or spots in tubers caused by *Liberibacter* interfering with sugar transport down into the tubers. Tubers with affected eyes may not sprout as well as uninfected tubers, and weak plants may develop as a result. *Liberibacter* infection can lead to a drop in the number of tubers produced, with losses of 20-50% reported in crops in the USA, and in severe cases infection can cause plant death.



Foliar symptoms of *Candidatus Liberibacter solanacearum* in a Moonlight potato. Image courtesy of Lia Liefing, MAF IDC.

Research in the USA shows that psyllids can become infected with *Liberibacter* within an hour of feeding on an infected plant, and once infected can transmit the disease to other plants within four hours. Foliar symptoms may be visible within 25 days of infection. Plants will not recover from *Liberibacter* if the psyllids are killed, so monitoring and well timed spray applications are critical to psyllid control and the prevention of *Liberibacter* infection.

Research from the USA suggests that seed potatoes infected with *Liberibacter* will not germinate but New Zealand experiments show good germination and high levels of disease transmission to the next generation. The relative importance of seed transmission versus psyllid transmission is unknown, but is the subject of ongoing research.



Zebra chip symptoms in a Rua potato. Image courtesy of Lia Liefing, MAF IDC.



Potato plants from a crop thought to be infected with *Liberibacter* - upper plants show advanced symptoms of leaf necrosis. Image courtesy of Lia Liefing, MAF IDC.

Candidatus *Phytoplasma australiense*

Candidatus *Phytoplasma australiense* has been reported to cause symptoms similar to those caused by the potato psyllid and *Liberibacter*. However it is not yet confirmed that *Phytoplasma* is the cause of these symptoms.

Phytoplasma has been in New Zealand for a long time and is the cause of cabbage tree decline, but has only recently been reported in potatoes. Leaf yellowing and purpling, leaf

and stem necrosis, aerial tubers, and tuber discolouration are all reported symptoms – though note that the tuber discolouration is different to Zebra chip.

Other species of *Phytoplasma* affect potatoes in other countries, where they are transmitted by leafhoppers. It is thought that the New Zealand *Phytoplasma* is transmitted by potato psyllid but this has not yet been proven.



Foliar symptoms of *Candidatus Phytoplasma australiense* in a Fianna potato. Image courtesy of Lia Liefing, MAF IDC.



An aerial tuber, a symptom of *Candidatus Phytoplasma australiense* infection. Image courtesy of Lia Liefing, MAF IDC.



Tuber discolouration symptoms of *Candidatus Phytoplasma australiense* infection. Image courtesy of Lia Liefing, MAF IDC.

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