Exotic Pest Alert: Potato Spindle Tuber Viroid (PSTVd) in tomatoes

Plant Biosecurity Orange

Potato Spindle Tuber Viroid (PSTVd) is an exotic plant pest
PSTVd is a serious threat to Australia’s tomato and potato crops
If symptoms are seen it must be reported promptly to the Exotic Plant Pest Hotline 1800 084 881

Symptoms

PSTVd symptoms (Figure 1) can be variable. The severity of symptoms depends on the strain of the viroid (both mild and severe strains exist), the host, the host cultivar and environmental conditions. The disease is difficult to diagnose in tomatoes because mild strains generally cause no obvious symptoms or symptoms can be similar to those caused by nutrient deficiency, root disease or spray drift damage from hormone weedkillers.

Leaf symptoms

In a mature plant, symptoms are usually first seen in the plant head (Figure 2). Leaves become yellowed and have a purplish tinge while the main veins remain bright green. Leaves are smaller than normal, bunched together, often down-curved, distorted and brittle (Figure 3). Internodes are shortened so that affected shoots appear stunted. In the most severe cases dieback may develop along the veins and the leaves die.

Fruit symptoms and yield

PSTVd is often not obvious in a tomato crop until around 2-3 months after planting, after the fifth flowering truss has developed. Flowers often abort. Infected fruit may appear small, dark green and hard and ripen irregularly. The yield of marketable tomatoes from affected plants can be significantly reduced, but varies with plant age, age when infected and disease severity. Losses of 10-60% have been reported.

Infection and severity

Tomato plants are unlikely to recover from infection with PSTVd because the infection is systemic. If the head is removed the disease can move downwards in the phloem and into the laterals. Temperature affects viroid levels and symptom severity, with greater amounts of viroid in the plant and more severe symptoms at high temperatures (25-37 °C). Some reports indicate that high light intensity increases symptom severity.
What is a viroid?

Viroids are extremely simple virus-like microorganisms. They are the smallest agents known to cause serious diseases in plants. Like viruses, viroids multiply only in living plant cells. A characteristic feature of viroids is that they can survive in sap and crop debris after the plant has died. Viroid diseases are especially common in solanaceous and asteraceae hosts and in most cases are not host-specific. PSTVd is one of about 30 viroids that have been described, several of which cause diseases in tomato (for example, tomato apical stunt viroid).

Disease spread

Mechanically

PSTVd is highly transmissible and is easily spread from infected to healthy tomato plants. The viroid spreads in tomato sap through natural plant to plant leaf contact, when plants are handled and on greenhouse equipment including knives, support string, clips, trolleys and crates. PSTVd can be transferred in whole fruit but this is more likely when the fruit has been damaged. Local spread occurs down rows in the direction of work and clusters of several affected plants are likely to occur together. Viroid transfer by root contact between plants in the same slab or container is considered unlikely.

In seed

Sporadic outbreaks of PSTVd in greenhouse tomatoes in Australia are believed to have arisen from infected seed. Seed infection is internal and levels of 10% infection have been recorded in tomato seed. Quarantine conditions apply to the importation of tomato seeds into Australia. It is possible that PSTVd also spreads in pollen and that the pollen carried by bees in greenhouse crop pollination could spread infection within the crop.

Vectors

There is a risk that aphids may spread PSTVd. This risk is probably low in commercial greenhouse tomato crops when pest insects are actively managed.

Debris

PSTVd can survive in dried tomato sap for more than eight weeks and in infected leaf debris for over six months. Thorough composting will kill the viroid.

Hosts

The principal hosts of PSTVd are tomatoes, potatoes, solanaceous ornamentals and solanaceous weeds. PSTVd is generally symptomless in ornamentals and weeds.

Figure 2 Tomato head yellowed and stunted

Figure 3 Tomato leaves purple-tinged, down-curved and brittle
Control measures

The NSW DPI factsheet ‘Keep it Clean: Reducing costs and losses in the management of pests and diseases in the greenhouse’ (2009) lists 10 essential practices to implement on your farm.

1. Regularly monitor and correctly identify pests and diseases (or have them identified for you) to ensure early detection and correct identification of problems.
2. Use action points and check pest and disease information for all your decision making including chemical, biological, whole-crop and hot-spot treatments.
3. Quarantine your greenhouse within a ‘clean’ zone separated from the ‘outside’ zone of the farm.
4. Use check and control points to manage the movement of people, vehicles, plants and materials into your ‘clean’ zone.
5. Make sure employees and visitors do not visit another greenhouse before entering your greenhouse.
6. Always thoroughly clean and disinfect your greenhouse and fixtures before planting a new crop.
7. Inspect all seedlings to ensure they are free from pests and diseases before they are planted out into a clean greenhouse.
8. Maintain a 5-10 metre wide plant free buffer around every greenhouse.
9. Keep your greenhouse and farm surrounds weed free.
10. Remove, stockpile and dispose of crop debris outside the ‘clean’ zone and away from the greenhouse.

Actions to minimise PSTVd risks

Although management controls cannot ensure that PSTVd will not become established the risks can be reduced. Examples of successful eradication of PSTVd from tomato greenhouses are linked to timely and strict implementation of a range of measures:

- Perform all plant handling tasks in the same direction along a row
- Regularly disinfect pruning tools and equipment
- Replace or disinfect support strings and clips between crops
- Avoid excessive temperatures in the greenhouse
- Control volunteer tomato seedlings and solanaceous weeds (eg nightshade) in and around tomato greenhouses

Reporting

If you suspect symptoms of Potato Spindle Tuber Viroid (PSTVd):

Call the Exotic Plant Pest Hotline 1800 084 881

Take photos not samples to minimise the risk of spreading the disease

Clearly mark suspect plants and isolate these and adjacent plants from your operations

Contact your local district horticulturalist


An exotic plant pest is a disease causing organism or invertebrate not present in Australia and which threatens agricultural production, forestry or native and amenity plants.

Resources

Horticultural Development Council Factsheet 09/06 Tomatoes Project No. PC212 ‘Potato spindle tuber viroid in tomato and new viroid reports’ (October 2006)

Horticulture New Zealand ‘PSTVd in greenhouse tomatoes’ poster

NSW Department of Primary Industries and Horticulture Australia Limited ‘Keep it Clean: Reducing costs and losses in the management of pests and diseases in the greenhouse’ (2009)

NSW Department of Primary Industries Primefact 1005 ‘On-farm hygiene and sanitation for greenhouse horticulture’ (April 2010)

New Zealand Vegetable & Potato Growers Federation. ‘New Zealand code of practice for the management of potato spindle tuber viroid (PSTVd) in greenhouse tomato and capsicum crops’ second edition (30 April 2003)
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ISSN 1832-6668

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Published by the Department of Primary Industries, a part of the Department of Trade and Investment, Regional Infrastructure and Services.

PUB12/15