

Potato spindle tuber viroid

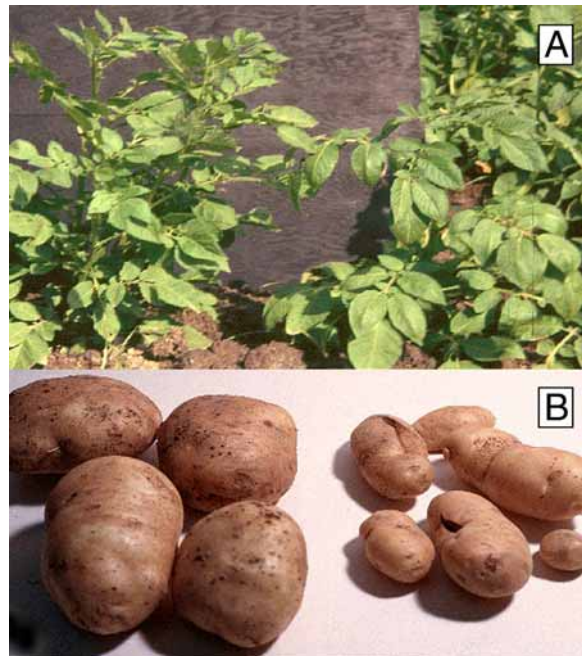


FIGURE 1. Symptoms of PSTVD A. foliar (left) B. tuber (right) (R.P. Singh, Agriculture and Agri Food Canada)

– a new disease risk for New Zealand potato crops

Potato spindle tuber viroid (or PSTVd) is a new disease of New Zealand glasshouse tomato and capsicum crops that is normally associated with potatoes in other countries. Currently it is confined to a few glasshouses and is under control. So far PSTVd has not been detected in New Zealand potato crops, but it is possible that infection may occur if growers do not take care. With this in mind this broadsheet describes viroids, including how they spread and can be controlled and the damage and symptoms they cause in potatoes.

What are viroids?

Viroids are the smallest agents known to cause serious diseases in plants. They are a single strand of genetic material (i.e. RNA), but unlike viruses they do not have a protein coat. While they are not common plant pathogens in New Zealand, three viroids do cause problems in their respective hosts: chrysanthemum stunt, citrus exocortis and avocado sunblotch viroids.

How do they damage plants?

Pathogens such as viruses and viroids take over cell division and biochemistry in the host plant in order to reproduce. In so doing they disrupt the host's metabolism and manner of growth. For example, symptoms of PSTVd observed on glasshouse tomatoes include leaf yellowing and mottling, with slower growth and, eventually, plant collapse. Fruits are smaller, sometimes slightly misshapen, with yellowing on the top of the fruit.

In potato plants symptoms of PSTVd infection in the field may be difficult to recognise before plants mature. Potato plants infected with

a severe infection of spindle tuber viroid are upright, stunted and much thinner than normal plants (FIG. 2). Leaves are smaller, may be grey and twisted or distorted. The stems are often more branched and branches may form very sharp angles where they join the stem. Milder PSTVd infections may not produce foliar symptoms.

Once potato plants are mature, symptoms can be more obvious on tubers. Affected tubers of some varieties are small, narrow and spindle-like (FIG. 3). In other varieties tubers develop knobs and swellings. In some varieties eyes are numerous, shallow and more prominent, and tubers are often cracked (FIGS. 1 & 4).

Yield losses of up to 64% have been recorded in potato crops infected by PSTVd. Interactions between PSTVd and other viruses may also occur. For instance, severe necrosis has been observed in plants that are also infected with potato virus Y (PVY).

Other economically important crops that host PSTVd include sweet potato and aubergine. Wild hosts include nightshade (*Solanum* sp.) and black nightshade.



FIGURE 1. Foliar infection of potato spindle tuber viroid (PSTVd) showing stiff upright growth habit.



FIGURE 2. Tuber infection of potato spindle tuber viroid (PSTVd) showing spindle shaped tubers (right).



FIGURE 3. Tuber infection of potato spindle tuber viroid (PSTVd) showing cracked tubers.

How are viroids spread?

CONTACT: PSTVd is easily mechanically transmitted. An infection may be introduced by sowing infected true potato seed or seed tubers or by planting infected plants. Mechanical plant-to-plant movement is the most common way disease spreads through a crop after its introduction. Contaminated skin, clothing or equipment can also spread the disease.

INSECTS: Experience overseas shows that PSTVd spread may occur mechanically from the activities of insects such as aphids, grasshoppers, Colorado potato beetles and flea beetles. Insects may play a part in spread, particularly if numbers are allowed to increase. In other countries evidence suggests an association between the aphid transmission of potato leafroll virus (PLRV) and transmission of PSTVd. In New Zealand there is a strain of leafroll virus called tomato yellow top virus (TYTV) that sometimes infects both glasshouse and field tomato crops. Green peach aphid (*Myzus persicae*) and potato aphid (*Macrosiphum euphorbiae*), both common in New Zealand, transmit both PSTVd and PLRV in crops overseas.

NEMATODES: Overseas experience shows that nematode larvae may transmit PSTVd infection after feeding on a PSTVd infected host.

POLLEN: PSTVd is transmitted in the pollen of potato and tomato plants. True potato seed produced by a PSTVd infected plant may be up to 100% infected with PSTVd.

How can viroids be controlled?

The most effective means of control is not to introduce infected plants into the field.

In New Zealand **movement of personnel, equipment or plant materials into potato crops from glasshouse tomato or capsicum premises should be avoided.** It is expected that efforts to contain PSTVd to affected properties will eventually lead to its elimination.

PSTVd infections have been successfully eliminated from potatoes in the USA, Canada and Australia. Similar outbreaks of PSTVd-like infections in Dutch, Canadian and Belgian tomato crops have also been successfully controlled.

TO SUCCESSFULLY CONTROL PSTVD:

- Ensure seed tubers are derived from certified seed that has been tested and is free of PSTVd.
- Plant whole seed tubers rather than cut pieces.
- Avoid contact with leaves (either by staff or equipment) during field operations.
- Control insects, especially aphids and chewing species.
- Inspect and remove diseased plants. Carefully remove, bag and burn plants that are suspected of being infected well away from production areas. Adjacent plants may also need to be removed and destroyed.
- Monitor the crop carefully. PSTVd symptoms may be confused with nutrient imbalance, herbicide damage, or virus infection. Careful

monitoring of any crop is important and if any disease symptoms are observed it is useful to have a **confirmatory diagnosis of an infection** before time and resources are committed.

- Apply stringent hygiene procedures if there has been an outbreak of PSTVd. Wash equipment (knives, cutters, sprayers, cultivators) with sanitisers before moving to another field or sowing another seed-line.

Sanitising equipment

Viroids are fairly resistant to heat sterilisation so sometimes freezing or chemical treatments are more effective. Equipment, surfaces and tools can be effectively disinfected with fresh solutions of sodium or calcium hypochloride (bleach) (0.25% or stronger), and 2% sodium hydroxide. Chemicals such as Virkon (FruitFed Supplies) and quaternary compounds such as Dermasan (Ecolab) can also be used.

If you suspect you have PSTVd in your crop contact one of the following to arrange a diagnosis :

MAF (National Plant Pest Reference Laboratory)

PO Box 295 Auckland
Tel. 09 626 6026

MAF (National Plant Pest Reference Laboratory)

PO Box 24 Lincoln
Tel. 03 325 3900

John Fletcher, Crop & Food Research

Private Bag 4704
Christchurch
Tel. 03 325 6400

Acknowledgements

Dr Rudra P Singh, Agriculture and Agri Food Canada. Fredericton, NB, Canada for reviewing the text.

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