What is the problem?

Potato spindle tuber viroid (PSTVd) is an important pathogen of solanaceous crops, causing the diseases 'spindle tuber' in potato and 'bunchy top' in tomato. Yield losses can be up to 65% in potato and as much as 50% in tomato. It has been found in many countries around the world, including parts of North and South America, Asia and Oceania. The disease is not endemic to western Europe and has previously only been identified on intercepted material and within controlled situations such as germplasm collections. However, in recent years outbreaks have been reported in both France (in potato) and the Netherlands (in tomato). In addition, the disease is established in eastern Europe, including certain countries that are planning to join the EU, e.g. Poland. These recent developments have heightened awareness of PSTVd and raised concerns about the possibility of an outbreak in the UK.

What is it?

PSTVd is a EU A1 listed quarantine pathogen. It exists as a small, circular RNA molecule that, unlike viruses, is not associated with any proteins. It is closely related to Chrysanthemum stunt viroid, which is relatively common in the UK but only naturally occurs on chrysanthemum. One highly significant feature of viroids is that their structure makes them exceptionally stable, allowing them to survive in sap or leaf litter for some considerable time.

What crops care affected?

The primary natural hosts of PSTVd are potato (Solanum tuberosum) and tomato (Lycopersicon esculentum). All varieties appear to be susceptible, with no natural resistance to PSTVd available in either host. Natural infections of PSTVd have also been reported on pepino (Solanum muricatum) and avocados (Persea americana), in addition to a range of wild Solanum spp. hosts. Most other solanaceous species (e.g. Solanum, Nicotiana and Petunia spp.) have been infected under experimental conditions and could theoretically become naturally infected.
**What are the symptoms?**

PSTVd symptoms can be quite variable, especially as both mild and severe strains exist. Mild strains generally cause no obvious symptoms on either potato or tomato. For severe strains, symptoms very much depend on the cultivar infected and environmental conditions, becoming more pronounced in warm conditions and under high light intensity.

In potatoes, symptoms are often not visible during the first season when infection occurs, but become progressively more severe in the following generations. Infected plants are stunted and have an upright or erect appearance. The foliage may change colour, becoming either lighter or darker than normal and have smaller, distorted leaflets. Tuber symptoms are more obvious but do take several generations to appear. Affected tubers are small and deformed, becoming cylindrical and elongate (‘spindle’). They are often pointed and can show growth cracking on larger tubers. Eyes will often become more prominent and sprouting is slower than with healthy tubers.

In tomatoes, symptoms can take some time to develop, often not becoming apparent until four to five weeks after infection. Overall plants become stunted and show ‘bunchy top’, where the foliage becomes crowded, due to a shortening of the internodes. Spindly shoots can sometimes be formed. Leaf symptoms include yellowing and purple blotches, along with considerable leaf distortion including downward curling of the leaflets (‘epinasty’), curling and twisting (‘rugosity’). Severe necrosis along the veins develops later in the lower and middle leaves and these will eventually die. The younger leaves at the top of the plant will remain but are reduced in size. Flowers often abort and fruit ripening becomes erratic. The fruit becomes small and hard and can turn dark green. Overall yields are significantly reduced.

**How is it spread?**

The long distance spread of PSTVd, between different sites, mainly occurs via infected seed stocks (both tubers and true seed) or young plants. The viroid can also be spread by aphids (*Myzus persicae*), but this only occurs in the presence of *Potato leaf roll virus* (PLRV) and is unlikely to be a major problem in the UK.

Symptoms of tubers of potato cv. Nicola. Infected tubers become elongated and distorted (middle and right), compared with a healthy tuber (left). Symptoms can take several generations to appear.>>

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Once PSTVd has been introduced onto a farm or nursery, it can be rapidly spread from plant-to-plant by mechanical means. This can occur through the use of contaminated cutting tools, on machinery, by handling or simply by direct plant-to-plant contact. PSTVd can also be transmitted via infected pollen.
Leaf symptoms in potato cv. Nicola (right). The leaflets are smaller and paler than the healthy ones (left). In addition, the foliage appears more erect than normal. >>

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**How is it controlled?**

The best means of controlling PSTVd is to ensure that viroid-free seed and plants are used. Material sourced from the UK and other EU countries should be PSTVd-free. If possible always find out from which countries seed originated. Solanaceous plant material imported from non-EU countries will need to pass through the UK quarantine station based at the Scottish Agricultural Science Agency in Edinburgh.

To prevent spread within growers' premises, good hygiene practices are necessary to prevent contact with potentially infected plants and avoid subsequent spread of the viroid. Contaminated benches, tools, etc. should be disinfected. 2-3% hypochlorite has been shown to be effective.

**This is a notifiable disease.**

If you suspect the presence of this disease you must immediately inform your local DEFRA Plant Health and Seeds Inspector or the PHSI HQ, York (Tel: 01904 455174, Fax: 01904 455197. Email: planthealth.info@defra.gsi.gov.uk).

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