



Potato Wart Disease

Synchytrium endobioticum



Figure 1. Severe infection of potato tuber with potato wart disease. © Crown copyright, courtesy of Fera Science Ltd

Background

Potato wart disease is caused by the soil-borne fungus *Synchytrium endobioticum* which is a regulated quarantine pathogen of potato in the UK. It used to be considered as one of the most serious diseases of potato worldwide but has now been controlled by statutory measures and the development of 'immune' (resistant) potato cultivars. However, it still poses a significant threat to potato production because the spores of the fungus can remain viable in soil for many years. New pathotypes (varieties) of the fungus, capable of attacking potato cultivars that were previously resistant, have evolved in several European countries. Preventing the introduction of these pathotypes to the UK is especially important.

Geographical Distribution

Originating in the Andes in South America, *S. endobioticum* was first recorded in the UK in 1876 and is thought to have been introduced with new breeding material imported in the aftermath of the famine in Ireland in 1840-50 when potato blight devastated potato crops. Potato wart disease is now present in nearly all potato growing countries in Europe, but statutory measures have restricted its spread. In most European countries, including most of the UK, it is now found only locally. The disease was declared eradicated in Northern Ireland in 2012 after an extensive sampling and testing programme. It has a limited distribution in other parts of the world, with some occurrences reported in Bhutan, Canada, China, India, Nepal, New Zealand, and South Africa. It was previously found in the USA but was successfully eradicated in 1994 and has not been detected since.

Host Plants

Potato wart disease mainly affects cultivated potato plants (*Solanum tuberosum*) but can also be associated with a range of other wild *Solanaceae* species including *Datura metel* (horn-of-plenty) and *Nicandra physalodes* (shoo-fly plant). Tomato (*Solanum lycopersicum*) has also been recorded as a host, though this has only been demonstrated experimentally, not observed in a naturally occurring situation.

Description

The symptoms of potato wart disease are usually only found on tubers and stolons (underground stems), appearing as warty cauliflower-like growths. True roots are never affected. Because it is mainly the underground parts of the plant that are affected, the disease is often not noticed until the tubers are lifted. However, infected plants may occasionally produce symptoms above ground including a reduction in vigour with small, greenish-yellow warty growths at the stem base. On infected tubers, the eyes develop into the characteristic warty, cauliflower-like swellings. When formed underground, they are the same colour as the potato skin, but gradually darken with age, later decaying. If exposed to light, they turn green. Tubers may bear more than one warty outgrowth, and, in some cases, the whole tuber can be covered. When infected early, tubers can become so distorted and spongy that they are almost unrecognisable. Warts on stolons are similar to those on tubers and may be visible if the stolon is exposed above ground. Symptoms of powdery scab and bud proliferation can be similar to those of wart disease and are frequently mistaken for it. Full confirmation of wart disease requires a scientific laboratory diagnosis.



Figure 2. Darkened warty outgrowths from the eyes on potato tubers. Photo: © Crown copyright, courtesy of Fera Science Ltd



Figure 3. Green warty outgrowth at base of potato plant stem. Photo: © Crown copyright, courtesy of Fera Science Ltd



Figure 4. Warty outgrowths on potato plant. Photo: © Crown copyright, courtesy of Fera Science Ltd

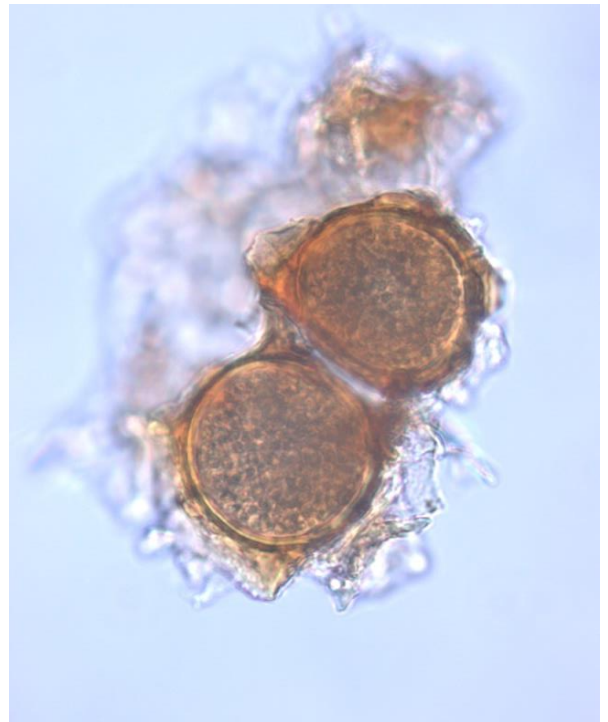


Figure 5. Two visible resting spores as found in soil. Photo: © Crown copyright, courtesy of Fera Science Ltd

Biology

Synchytrium endobioticum is an obligate parasite which means it needs a suitable living host to complete its life cycle. The warty growths on tubers eventually rot down in the soil during the winter months and release thick-walled spores into the soil. These 'resting' spores can remain viable for at least 30-40 years, surviving between potato crop rotations, and up to depths of 50 cm in soil. In the spring, given favourable conditions with temperatures over 8°C and sufficient moisture, these spores germinate. The released zoospores (a mobile spore involved in asexual reproduction) can move short distances through the soil to reach a living host, with the aid of a tail-like structure (a flagellum). Once they've reached a suitable host, the zoospores penetrate host cells. The host cell becomes enlarged and the fungus within quickly reproduces and discharges 'summer' spores into neighbouring host cells. Cycles of this over the summer allow the fungus to spread across the host and the characteristic warty growths ensue. Some of these summer spores give rise to the resting spores that will be released when the warts rot down in the winter and the whole cycle begins again. The disease is favoured by cool summers with temperatures averaging 18°C or lower, and wet soils during tuber development, but it is not limited by these conditions.

There are thought to be over 40 different pathotypes of the fungus worldwide, and these are defined by how effectively they infect potato cultivars. Pathotype 1 (European race 1) is the most common in Europe and is the only pathotype so far found in the UK. Other pathotypes have been reported by several European countries, including Poland, Germany, Greece and the Netherlands. These include four that are currently regarded to be the most widespread and of major importance (which includes European race 1).

Dispersal and Detection

The main means of spread of potato wart disease is via infected seed potatoes. Especially after a dry season, the warts may be extremely small and can be overlooked. However, the disease may develop further whilst the potatoes are in storage and may be seen at this stage. It can also be carried in contaminated soil on tools and machinery, on soil attached to plants and potatoes grown in infested fields, and spores may be carried in windblown soil or via the spreading of manure from animals that have been fed on infected potatoes, as the spores resist digestion.

The disease is favoured by cool, wet soils and most of the UK outbreaks have been found in the West Midlands and the Northwest of England. The severity of the attack depends on soil conditions during tuber development and the cultivar of potato being grown. For instance, the cultivar King Edward is highly susceptible whilst others, such as Maris Piper, are resistant to the pathotype of *Synchytrium endobioticum* found in the UK.

To help prevent spread of the disease in the UK, whenever an outbreak is found on agricultural land, the infested field is scheduled under notice by the relevant authority. Scheduling means that testing, treatment and cleanup regimes must be applied to an area to help eradicate a pest or pathogen. On land scheduled due to potato wart, potato

production is prohibited, as is production of any plants that would be transplanted, and only immune (resistant) potato cultivars can be grown in a safety zone around the scheduled fields. The last outbreak of the disease in the UK in a commercial field was in 1985, with findings since then mainly in small private holdings, reported by members of the public. The last confirmed finding in England was in a non-commercial situation, in 2008. Some fields have now been de-scheduled because they have been found free of the disease after a lengthy period of restrictions (lasting at least 20 years). As *Synchytrium endobioticum* is listed under GB Plant Health legislation as a quarantine organism, there are freedom requirements for seed potatoes and other planting material. There is therefore a nil tolerance for wart disease in the seed potato classification schemes in the UK, and marketing of an affected ware crop would be strictly controlled. New cultivars are all tested for resistance to wart disease.

Economic Impact

For over 100 years, quarantine and domestic legislation has been in place worldwide to prevent the spread of potato wart disease. If detected in a potato crop, it may be determined that a whole crop is unmarketable. Due to the long-term viability of the spores in the soil, potatoes cannot be grown again in the field for many years, and any other crops grown on that land may not be exported to other countries. The actual direct losses from the disease are minimal, largely due to the availability of resistant potato cultivars, although the introduction of a new pathotype of the fungus to a region could lead to locally grown resistant cultivars becoming infested and subsequent economic losses.

Pest Management and Reporting

Suspected outbreaks of **potato wart disease** or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, York.

Tel: 0300 1000 313

Email: planthealth.info@apha.gov.uk

For **Scotland**, contact the local **RPID officer**:

Agricultural crops Email:

<http://www.gov.scot/Topics/farmingrural/Agriculture/AOcontacts/contacts>

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch**:

Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

Web: <https://www.daera-ni.gov.uk/topics/plant-and-tree-health>

For additional information on UK Plant Health please see:

<https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/>

<https://planthealthportal.defra.gov.uk/>

<https://www.gov.uk/plant-health-controls>

<http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases>

<https://www.daera-ni.gov.uk>

[The Seed Potato Classification Scheme - GOV.UK \(www.gov.uk\)](#)

[Seed & Ware Potatoes | SASA \(Science & Advice for Scottish Agriculture\)](#)

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