

Late Blight of Potato & Tomato

The oomycete *Phytophthora infestans* causes Late Blight of Potato and Tomato, a disease with a special place in history.



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Pathogen Description

Late blight of potato is a devastating disease caused by an oomycete, *Phytophthora infestans*. It requires living plant tissue for growth, but can survive on dead plant material for a time.

In the 1990s it was shown that *P. infestans* is not a fungus, but more closely related to algae. It was reclassified as a member of the protists. *P. infestans* also causes late blight of tomato attacking both leaves and fruit. This sheet focusses on potato late blight given its huge economic and historic importance.

Mode of Infection

Spores (sporangia or zoospores) germinate on the leaf surface, producing germ tubes which penetrate epidermal cells; tubers are infected through eyes, lenticels or wounds. *P. infestans* initially lives off the plant tissue without killing it. Later, it switches to necrotrophic growth, resulting in cell death and the appearance of necrotic lesions (dead tissue) on the infected tissues (see Ref. 1).

Symptoms

Leaves, stems and tubers may all be infected. Small black/brown lesions, sometimes with pale green margins, expand quickly. In humid conditions, hyphae bearing sporangia emerge from the tissue, visible as white growth on the underside of leaves. An entire plant can be destroyed within a week. Infected potato tubers develop rusty brown markings in the flesh, visible through the skin. Secondary bacterial infections often follow turning the tuber into a soft, smelly mush.

Disease Spread

Sporangia are spread by wind and water-splash and when washed down into the soil can infect tubers. They can germinate directly, but below 15°C, their contents differentiate into a number of motile zoospores, which can swim for several hours before encysting on potato tissue and infecting it.

Control

Farmers rely mainly on fungicides to control the disease as well as growing potato varieties with resistance to blight. The pathogen has a highly variable genome able to respond to selection pressures. It has developed resistance to some fungicides (the phenylamides) and has also proved able to overcome resistance genes in the host plant. Due to the influence of environmental conditions upon disease development, forecasting is used to aid the timing of fungicide applications.

No potato cultivar has proved completely and durably resistant to the disease, some are more resistant than others. The development of plants resistant to the disease, carrying multiple resistance genes, remains the long-term goal, but it is not easy to combine these with agronomic characters such as good flavour & high yield.

Detection

DNA-based methods have been developed to support visual ID and can allow rapid genotyping direct from infected tissue.

Interesting Facts

In Greek, its scientific name *Phytophthora* means Plant Destroyer (*Phyto* – plant; *phthora* – destroyer). The disease is notorious for causing the Irish Potato Famine of 1845 shortly after its arrival in Europe. Its centre of origin is in the Americas, but whether in central Mexico or the South American Andes remains controversial. It was the first plant disease for which a microbial pathogen was proved to be the causal agent, leading to the birth of plant pathology as a science. Late blight remains a major constraint to the production of potato.

Further reading

Extended pathogen description: <http://tinyurl.com/hwnugcl>

General report (ADHB): <http://tinyurl.com/zzawob6>

Modern technology to learn more about the Famine:

<http://dx.doi.org/10.1371/journal.ppat.1004028>