Tomato late blight (261)

Photo 1. Rapid destruction of tomato plants by late blight, *Phytophthora infestans.*

Photo 2. Large irregular-shaped spots on the leaves, and rots on the fruit, of tomato caused by late blight, *Phytophthora infestans.*

Photo 3. Close-up of leaf spots caused by late blight, *Phytophthora infestans.*

Photo 4. Symptoms of late blight on potato, *Phytophthora infestans.*

Photo 5. Tomato trial uniformly attacked and destroyed by late blight, *Phytophthora infestans.*

Photo 6. Close-up of Photo 1 to show the destruction caused by late blight, *Phytophthora infestans.*

Common Name

Tomato late blight, potato late blight

Scientific Name

Phytophthora infestans

Distribution

Worldwide. Wherever tomatoes are grown. Asia, North, South and Central America, Caribbean, Europe, Oceania. It is recorded on tomato from American Samoa, Australia, Cook Islands, New Zealand, and Papua New Guinea. It is recorded on "Solanaceae" from American Samoa.

Hosts

Tomato, potato (**see Fact Sheet no. 265**) and wild species in the potato (*Solanum*) family, e.g., nightshade (*Solanum nigrum*). There is

evidence of strains attacking different hosts.

Symptoms & Life Cycle

Phytophthora infestans is not a fungus, but an oomycete or a water mould, related to algae. The life cycle, however, has many fungal-like characteristics.

Symptoms on tomato and potato leaves and stems are similar. On the young leaves, black or brown irregular-shaped spots occur; they expand rapidly, forming a white cottony growth on the underside, and within a few days the leaves turn yellow, shrivel and die (Photos 1-4). Dark brown, firm, rots occur on the fruit of tomatoes (Photo 2). Spores from the leaves of potato wash into the soil and infect the tubers and cause rots. Late blight has two ways of reproducing; (i) it produces spores without going through a sexual process or (ii) two strains come together and mate. In the first method, spores called 'sporangia' are produced on leaves, stems and fruit, and these germinate and produce more spores of the same kind. In the second method, the mating strains produce a spore called an 'oospore', which is thick walled. It is also called a 'resting spore' as it can survive for some time in plant remains or in the soil. Oospores germinate to produce sporangia.

Spores of the oomycete on the leaves, stems and fruit are spread by wind or water splash. If the spores land on a tomato, and the surface is wet, they germinate. There are two ways of germinating: (i) in warmer conditions (21-26°C), the spores germinate like seeds and infect the plant directly, or (ii) in cooler conditions (18-22°C) each spore produces about 6-8 smaller spores (called 'zoospores') which burst out of the larger spore and swim short distances over the plant surface before germinating and infecting.

Spread by wind or wind-driven rain can occur as far as 15-20 km. Long distance spread is possible on seed. It can be present in the gel around them, and also in the seed coat. Epidemics of late blight occur when night temperatures are cool, followed by warm days with mists and rains. Under those conditions, zoospores spread the disease rapidly and entire planting are destroyed in a few days (Photos 5&6).

Impact

Late blight is one of the world's worst plant diseases, despite efforts to control it for 150 years. It causes large losses in yields of tomatoes (and potatoes), and requires the application of expensive fungicides to maintain control. Since the 1990s, a second strain (A2) has appeared in Europe, presumably and introduction from Mexico. Previously only one strain (A1) was known in Europe. There is now the potential for new strains of the oomycete through sexual reproduction, and these may be more aggressive, and/or tolerant to fungicides than those present previously. The A2 strain has spread to many countries, with the result that there are new strains that are more aggressive, produce more spores and have increased tolerance to fungicides.

Detection & inspection

Look for spots and patches on the leaves which grow rapidly and produce a furry white growth on the underside. Look for the white growth after putting the leaves in a plastic bag overnight. Check tomato plants regularly for infections, especially when the days are cool and wet, or overcast with heavy dews or mists.

Management

Late blight can be a devastating disease of tomato. There are several factors making it a particularly difficult problem: (i) there is very little resistance available in commercial tomatoes; (ii) management relies on the use of fungicides; (iii) fungicides have to be applied up till harvest, and that creates residue problems; and (iv) and there is some evidence that separate tomato and potato strains exist so managing the two diseases may need to be different.

QUARANTINE
Until recently the movement of tubers from countries where the A2 strain existed was regulated, but with the wide distribution of that strain in recent year, the policy has been reassessed.

CULTURAL CONTROL

Before planting:

- Check plants in the nursery for late blight infections before taking them to the field. Destroy diseased plants.
- If unsure of symptoms, spray plants with a fungicide before transplanting in the field.
- Do not plant tomatoes next to older plantings of either tomatoes or potatoes, otherwise spores will spread by wind or wind-blown rain.

- Use a spacing between plants that allows air movement through the planting so that foliage dries as quickly as possible after morning dews or rains. For the same reason, orientate plantings parallel to the direction of wind.
- If using your own seed and the crop which the seed was taken had late blight, dry the seed for 3 days at 22°C.

During growth:

- Do not use overhead irrigation; otherwise, it will create conditions for spore production and infection.
- Remove a few branches from the lower part of the plants to allow better airflow at the base.
- Prune any diseased leaves from the bottom of the plants as they become infected.
- If practical, grow tomatoes intercropped with non-hosts, e.g., beans, maize, papaya, *bele*; this will increase the spacing between plants, and reduce the spread of spores.
- Stake the plants to keep the foliage off the ground; it will improve air movement around the plants.
- Remove self-grown tomatoes, potatoes and *Solanum* weeds (i.e., volunteer plants) as they may have late blight infections.

After harvest:

- Rotate crops. Do not plant successive crops of tomatoes on the same land.

RESISTANT VARIETIES

Late blight tolerant varieties are available, so check if they are available in your country.

CHEMICAL CONTROL

Ideally, use a preventative spray before symptoms are seen, e.g, a copper product, chlorothalonil, or mancozeb. If using a systemic product, e.g., metalaxyl, cymoxanil, or dimethomorth, or a strobilurin, alternate single sprays with two sprays of a preventative product. Also, note that in some countries mancozeb is not used on fruit if growers harvest two or more times a week as the preharvest interval is 5 days (i.e., the time between the last spray and harvest).

In addition, phosphorous acid has a direct and indirect effect on oomycetes, and should be tested. The indirect effect comes from its ability to stimulate plants' nautural defense response against attacks by pathogens.

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