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Cooperative Extension

TOMATO/POTATO LATE BLIGHT IN THE HOME GARDEN

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Introduction

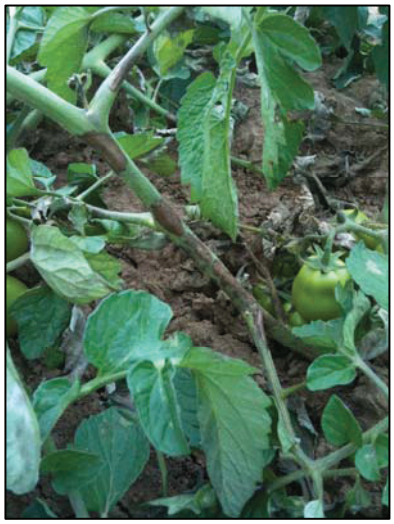
The causal pathogen from potatoes was first described in 1845 by Montagne and from tomato in 1947 by Payen in France. However, it was 1863 before deBary established beyond doubt that this organism, *Phytophthora infestans*, was the cause of late blight. The disease occurs worldwide where tomatoes are grown. Late blight is thought to have originated in Central America and to have appeared almost simultaneously in Europe and North America about 1830. It occurred in France in 1840, was destructive in Germany in 1841, and occurred in North America in 1843. Then, from 1844 to 1847, it occurred in epidemic and catastrophic proportions throughout Europe and North America. It was directly responsible for the Irish Potato Famine of 1845 and 1846. Since that time, epidemics have occurred periodically when weather and other conditions favored disease development. Some of these epidemics occurred in 1878 in England when entire plantings were destroyed; 1906, 1927 and 1928 in California; 1940 in Ontario; 1946 and 1947 throughout the eastern half of North America when 80 to 90% of early seedbeds in Florida were a complete loss, over 50% of the crop was lost in eastern states from New York to Florida, and 25% of the crop was lost in Midwestern states; 1960 in Ontario; and 1976 in southern Georgia and some northern states where infected transplants were used. Heavy losses can occur in transit; symptoms can occur on infected but symptomless tomato fruit within 5 days of harvest. In addition to tomato and potato, the late blight pathogen has also been reported to infect eggplant and pepper however, there have been no recently reported cases. The pathogen may infect solanaceous weeds, such as bittersweet nightshade, as well as, other plants in the same botanical (Solanaceae) family including petunias, Chinese lantern and tomatillos. Similar to the human seasonal flu, different isolates (genotypes) of the late blight pathogen exist and infect different hosts so it is highly unlikely that a given isolate of the pathogen would be capable of infecting and causing disease on all known host plants. The genotypes most common in Pennsylvania and the Northeast can cause disease on either potato or tomato or both. In 2009, the majority of losses for tomato and some potato losses were due to the relatively new US22 genotype. Other losses for potato were due to the US8 genotype that is widespread and commonly seen on potato annually.

Late blight is not uncommon in Pennsylvania. Each year there are several confirmed outbreaks on potato and/or tomato in commercial fields. The occurrence of late blight in 2009 is different for several reasons. One is that this was the earliest that the disease has been reported over such a broad region of the country (Northeast). By mid-June late blight had been confirmed in several states in the Northeast including Pennsylvania. Another reason was the distribution of infected transplants through local retail stores from Ohio to Maine. Never before had such an extensive distribution of late blight infected plants occurred. In addition, the

cool and wet conditions that favor disease develop persisted through the growing season. Keep in mind that in order for the disease to develop, the pathogen (*Phytophthora infestans*) must be present in combination with a susceptible host (primarily tomato, potato) and environmental conditions favorable for the pathogen to develop and cause disease. If any one or more of these components is absent, then late blight will not develop. In 2009, all three components were present throughout the growing season.

Symptoms

Late blight symptoms can develop on leaves, stems, branches and both green and ripe fruit and are very obvious to the naked eye. On leaves, pale green to brown spots appear on the upper surface of leaves. Leaf spot margins often are pale green or water soaked. The spots may enlarge rapidly until entire leaflets are killed. In moist conditions, a downy white growth usually develops near the margin of leaf spots on the underside of leaves. This white growth contains the spores that are easily blown around in the wind. When petioles and stems are affected, portions of plants beyond blight lesions may dry up rapidly and collapse. Lesions can expand rapidly and result in extensive, if not complete defoliation within 14 days. In dry weather, affected foliar parts may appear dry and shriveled. Stem lesions are typically brown to almost black in color.



Tomato fruit can become infected when foliage is affected. On tomato fruit, greenish-brown greasy-appearing spots may enlarge until the entire fruit is involved. The fruit tissue remains firm at first with varying depths of discolored tissue below the skin. In moist weather, a white downy growth may appear on the affected fruit rot surface. Secondary organisms may invade affected fruit and cause a soft-rot. Infected fruit can develop directly on the plant or a few days after they are sitting on a kitchen counter.

Potato tubers can become infected from spores splashing down into the soil. Late blight spots on tubers are reddish brown, dry, and granular. These spots often become infected with secondary pathogens such as bacteria, which can cause the entire tuber to rot and turn soft.

Although the unaffected parts of the tomato fruit are probably safe to eat, no published scientific study on this specific issue was found to confirm this conclusion. Therefore consumers need to make their own decision on food safety. The conclusion that unaffected tissue is safe to consume is based on several points. This pathogen does not produce a toxin that can make people sick, as a few plant pathogens can do. Plant pathogens cannot infect people. No food safety issues have been found with other diseases that affect tomato fruit or potato tubers. Late blight appears to be like other more common diseases, e.g. anthracnose on tomato fruit and pink rot of potato (which incidentally is caused by *Phytophthora erythroseptica*, a pathogen related to that causing late blight), in that these do not appear to affect plant tissue beyond the area of infection. Many home gardeners often cut off diseased tissue rather than throw out the entire fruit or tuber having found the healthy appearing part of these to taste fine. Keep in mind, however, that infection can create conditions where other potentially harmful secondary organisms can also invade tissue and grow. Diseases like late blight and anthracnose are not considered a

health concern for commercial tomato processing because the fruit are carefully sorted to remove diseases ones before being processed. Similarly, for home canning, only disease-free, preferably vine-ripened, firm tomatoes are recommended in the USDA Complete Guide to Home Canning because fungal pathogens may raise tissue pH and thereby allow growth of potentially harmful microorganisms.

Other diseases that are common to see on tomatoes this time of year include Septoria leaf spot and early blight. Early blight also occurs on potatoes. Symptoms of both diseases initially appear on the oldest leaves near the ground. Early blight initially appears as irregular lesions that develop concentric black rings giving the lesion a target-like appearance. The lesions may or may not have a chlorotic area surrounding the lesion. Septoria leaf spot starts as a small circular water-soaked spots that develop black to brown borders with a tan to gray center and are speckled with small black fruiting bodies.

Disease Cycle and Development

The most important sources of the late blight pathogen early in the season are infected potato tubers and infected tomato transplants. Infected potato tubers may survive in fields or storage. When infected potatoes sprout, the pathogen can grow into the sprout and produce spores on the sprout surface during favorable environmental conditions. Spore production by the pathogen is favored by temperatures between 65 and 70°F and relative humidity near 100%. The spores can travel by wind, up to 30 or 40 miles, or over short distances in dew and splashing rain. Survival of the spores is greatly reduced when the relative humidity is below 95%; at 80% RH they can survive only 5 hours.

Once the spores land on a tomato (or other plant host) leaf, a film of water must be present until the infection has established; otherwise, infection will not occur. Infection can occur in a matter of hours under ideal conditions and symptoms are evident in the field about 5 to 7 days after infection. Soon after symptoms appear, more spores are produced and the cycle continues. The ideal conditions which favor epidemic disease development, such as we saw in the 2009 season, include periods when the temperature drops to 70°F and the relative humidity rises to 100% early during the night, then slowly falling temperatures for the next 8 hours lead to the formation of dew which persists for several hours. If temperatures reach above 95°F, the pathogen can survive inside the living plant tissue, however, the disease will stop progressing until the conditions become cool and moist again.

Disease Management for Late Blight

Examine your tomato plants daily. You are more likely to save plants in a garden when only a few foliar symptoms are initially observed, the weather conditions are forecasted to be hot with no rain or a lengthy dew period (least favorable for the pathogen), and late blight outbreaks are not nearby (sources of spores). Further late blight development will be slowed by regularly removing affected tissue (daily cut-off and bag, preferably during a dry sunny day) and applying fungicides. Realize that when symptoms are first seen, all points of infection are not yet visible and it may be several days before they are.

Create a less favorable environment for the pathogen, by avoiding wetting the leaves with overhead irrigation or water mid-morning so the leaves dry quickly. Eliminate weeds from the garden to improve air circulation, as well as, remove extra branches. This will also help with managing other foliar tomato and potato diseases.

If the plants are severely infected be prepared to destroy them. Remove the entire plant and discard in a garbage bag. If a large number of plants need to be destroyed, they can be gathered together and placed under a tarp in the sun to “bake” (preferably on a hot and sunny day when any spores released into the air are less likely to survive). They could also being burned. Once the plant tissue is dead, the pathogen can no longer survive.

Commercial growers have a number of fungicides that if applied early and often, can reduce the spread of late blight. They would choose not to spray if they could, but this destructive disease does not give them any other option. Homeowners do have a few products that are registered for use; the most effective ones have the common name of chlorothalonil which will be on the product label. These products are only effective if used before the disease appears and should be reapplied every 5 to 7 days if cool, wet weather persists. Fungicides applied on a plant disappear over time due to being broken down biologically or by sunlight and/or being washed off by rain or irrigation. Chlorothalonil is a protectant fungicide, with no systemic movement in the plant, so thorough coverage is necessary. Fungicides cannot 'cure' a spot/lesion that has already developed. Copper applications are generally not as effective as chlorothalonil, however, several formulations are approved for use in organic production systems. Always read the label to determine what protective equipment is required prior to use (respirator, waterproof gloves, protective eyewear, shoes plus socks, long sleeve shirt and long pants). If you choose not to spray your plants, monitor them closely and destroy infected tissue that can be a source of spores for your neighboring gardens and commercial fields. Fruit may be harvested early and ripened off the vine in a warm dry location. Check the fruit frequently and discard those that develop symptoms. Spores that develop on infected fruit can spread and infect neighboring fruit.

Late Blight Management after Harvest

The late blight pathogen is an obligate pathogen and the spores can only survive in living plant tissue. However, the pathogen can produce a specialized survival structure (oospore) that would enable it to survive without living plant tissue. This requires that the pathogen reproduce sexually which involves two "mating types". This is the term used for the pathogen's equivalent of male/female. Previously both mating types were found in Florida but not in the Northeastern US. Last season both mating types were detected in Pennsylvania and Virginia. This could potentially make managing late blight more difficult since there is the chance that the pathogen can form oospores that stay in the soil. In Florida, although both mating types are present, oospores have not been found yet.

Treating the soil is not an effective control for late blight; the best control measures involve managing the sources of disease spread. Destroy any potato cull piles. Cut up infected potatoes and spread them across the garden surface so they freeze overwinter or dispose of them in the trash. Also, prevent the growth of volunteer potatoes and tomatoes, which may be a source of the pathogen. Carefully inspect any transplants purchased for any disease symptoms. Always select the healthiest and most vigorously growing transplants. There are no tomato or potato varieties that have complete resistance to late blight. There are some varieties that are known to have tolerance to late blight and disease can develop much slower on these varieties and sometimes not at all. It may be difficult to find seed of some of these varieties. Potato varieties with tolerance to late blight include Kennebec, Sebago, Allegany, and Jacqueline Lee. Tomato varieties with tolerance to late blight include Legend, Ferline, and Fantasio. Many new varieties with late blight resistance are under development and will hopefully be available for home gardeners in the near future.

Diagnostic Services

If you suspect late blight please contact your local county Penn State Cooperative Extension office. They can either help confirm the diagnosis and/or help you submit a sample to the Penn State Plant Disease Diagnostic Clinic at University Park, PA.

For More Information

Please visit http://www.ppath.cas.psu.edu/

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