

**FUNGAL DISEASES OF TOMATOES**

**Early blight (*Alternaria solani*)** occurs on the foliage, stem, and fruit of tomato as well as potato. In tomato, the disease first appears as small brown to black lesions with yellow haloes on older foliage. Entire leaves may become chlorotic (yellow) where many lesions coalesce. As the lesions enlarge, they often develop concentric rings giving them a 'bull's eye' or 'target-spot' appearance. Plants can become defoliated, reducing fruit quantity and quality. Fruit can become infected either in the green or ripe stage. Infections usually occur through the stem. Fruit lesions appear leathery and may also have concentric rings. Fruit lesions can become quite large, encompassing the whole fruit. Infected fruit often drop prematurely, resulting in losses of 30-50% of immature fruit. The fungus overwinters on infected crop debris in the soil and can survive there several years. High humidity and warm temperatures (75-85°F) favor infection and disease development. Spores are dispersed mainly by wind but also by splashing water and overhead irrigation. Some varieties with early blight resistance or tolerance are available.



**Septoria leaf spot (*Septoria lycopersici*)** causes circular, tan to grey lesions with a dark brown margin that appear. Symptoms develop first on lower leaves, after the first fruit set. If conditions are favorable, lesions can enlarge rapidly, turning infected leaves yellow, then brown. *S. lycopersici* forms pycnidia (structures where asexual spores are formed) in the center of expanding lesions which can be seen with a 10X hand lens as tiny black dots. Fruit infection is rare, but lesions occur on foliage, stems, petioles, and calyces. The pathogen overwinters on infected tomato debris or infected solanaceous weed hosts (jimsonweed, horsenettle, groundcherry and black nightshade), and can also survive on stakes and other equipment. High humidity, long periods of leaf wetness, and temperatures between 60 and 80°F are conducive to disease development. Some varieties with resistance or tolerance are available.



**Leaf Mold (*Fulvia fulva*)** can occur in the field, but is most common in greenhouses. Infections begin on older leaves and cause pale-green to yellow spots visible on the upper leaf surface, with olive-green to grayish-purple fuzzy sporulation on the underside of the leaf. Heavily infected leaves turn yellow, then brown and may wither and drop. Occasionally petioles, stems, and fruit may be affected. Infected flowers wither without setting fruit and infected fruit has leathery, black, irregularly shaped lesions. The fungus overwinters in soil on crop residue and as sclerotia (hard, black, long-lived resting structures) and may be introduced on infested seed. Disease development is favored by warm, moist conditions with relative humidity over 85% and optimum temperatures of 71-75°F. The disease can spread rapidly as spores disperse throughout a greenhouse on air currents, water, rainsplash, insects, and workers. Improve air circulation and reduce relative humidity in greenhouses by a combination of heating and venting, especially at night.



**Powdery mildew (*Oidium neolycopersici*)** of tomato is emerging as an important disease of greenhouse crops. Light-green to bright yellow lesions on the upper leaf surface. The spots enlarge and become necrotic. Lesions may exhibit concentric rings similar to early blight. A light, powdery coating may be seen on leaf undersides, or a dense, white layer of growth may develop on both leaf surfaces if conditions are right. Entire leaves wither and die, but remain attached to the stem. There are no symptoms on fruit or stems, but loss of foliage may result in sunscald. Disease is favored by low light and cool temperatures and the pathogen does not require free water to germinate and cause disease.



**Gray mold (*Botrytis cinerea*)** appears on young plants as gray-brown velvety mold covering stems or leaves. Infections that girdle the stem cause wilting above the infected area. *Botrytis cinerea* is a weak pathogen, so senescent flowers, calyces or leaf tips are often starting points for infections. Infections spread from flowers or fruit back toward the stem, which turns white and develops a canker that may girdle it. Green fruit decays and turns light brown or gray, starting at the point where it touches other infected plant parts. Small green fruit infected directly by airborne spores develops white, circular rings called "ghost spots."



## **BACTERIAL DISEASES OF TOMATO**

**Bacterial spot** caused by *Xanthomonas campestris* pv. *vesicatora* (*Xcv*) is present wherever tomato and peppers are grown. *Xcv* consists of different strains that vary in their pathogenicity to tomato, pepper, and solanaceous weeds. *Xcv* affects all aboveground plant parts. On leaves, the spots are generally brown, circular, and water-soaked. Bacterial spot lesions do not have concentric zones or a prominent halo. When conditions are optimal for disease development, spots can coalesce to form long, dark streaks. A general yellowing may appear on foliage with many lesions giving the plants a scorched appearance, and the plants may exhibit severe bending and twisting. Only green tomato fruit is susceptible to infection, and lesions are quite distinct, beginning as minute, slightly raised blisters with a halo that resemble the birds-eye spot caused by bacterial canker. As lesions enlarge, they lose their halo and become brown, raised, and scab-like on ripe fruit. Lesions on ripe pepper fruit may be scab-like or sunken. Disease development is favored by temperatures between 80° and 90° F and by heavy rainfall.

**Bacterial speck** (*Pseudomonas syringae* pv. *tomato*) causes a fruit spot and foliar blight on tomato only, not pepper. It is a cosmopolitan disease, though is generally of minor concern. Disease development is favored by low temperatures and high moisture. The pathogen can be seed-borne, and may persist in weed species. Secondary disease spread within fields occurs by wind-driven rain, workers, farm machinery, and by aerosols in humid air. Lesions on leaves are round and dark brown to black with a halo that develops with time. Spots may coalesce, killing large areas of tissue. On fruit, small (1/16 inch), dark spots or specks develop with the tissue around them often more intensely green than unaffected areas.

**Bacterial canker** (*Clavibacter michiganensis* pv. *michiganensis*) is one of the most destructive tomato diseases. Initial symptoms are the result of primary, systemic, infections. The lower leaves are affected first, exhibiting leaf curling, wilting, yellowing, and shriveling. In advanced stages, the pathogen spreads throughout the plant and causes poor growth, wilt, and plant death. Foliage throughout the canopy wilts, yellows, turns brown, and collapses. Stems can split resulting in open breaks or cankers and stems break easily. Secondary infections occur from rain splash onto foliage, stems, and fruit. Spots occur on green fruit and are very characteristic: white to yellow spots, 3-4 mm with raised brown centers known as “bird’s eye spots”.

**Tomato Pith Necrosis** is caused by *Pseudomonas corrugata* and other soil-borne species of *Pseudomonas*. While high tunnels and greenhouses provide ideal conditions for the growth of early season tomatoes, this environment also provides ideal conditions for this emerging disease. Pith necrosis generally occurs on early planted tomatoes growing when night temperatures are cool, the humidity is high, and the plants are growing vigorously because of excessive levels of nitrogen. The disease is also associated with prolonged periods of cloudy, cool weather. Initial symptoms often appear just as the first fruit clusters reach the mature, green stage, and consist of yellowing and wilting of young leaves. Serious infections can result in yellowing and wilting of upper portions of plants, with brown to black lesions on infected stems and petioles. When stems are cut longitudinally, the center of the stem (pith) may be extensively discolored, hollow, and/or degraded. Stems may be swollen, numerous adventitious roots can form, and infected stems may shrink, crack, or collapse. The epidemiology of this disease is not well understood; it is possible that the bacteria are seed-borne and most certainly survive in the soil in association with infected tomato debris.



Upper left-Canker, Upper Right-Spot, Lower-Speck. Photos R. Wick



Bacterial Spot. R. Wick



Bacterial Speck. OMAFRA



Canker. S. Scheufele



Pith Necrosis. S. Scheufele

