

## Disease Update

# The Long List of Diseases Affecting Tomatoes and Peppers in a Wet Growing Season

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### Introduction

The 2000 growing season will be remembered for the large number of diseases that could be found on both tomatoes and peppers. Some of these diseases are common to both crops, and include bacterial leaf spot, *Phytophthora* blight, and white mold. In this report, we will focus on the main fungal (late blight, early blight, *Septoria* leaf blight, *Phytophthora* blight), and bacterial (spot, speck and canker) diseases of tomato/pepper.

### Tomato Late Blight

Tomato growers should be aware that late blight infections of this crop are not new in New York, but occurrence of the disease has definitely increased during the 1990s with the arrival of new immigrant strains of *Phytophthora infestans*.

In 1993, U.S.-7 caused widespread losses in home gardens in rural upstate New York, with the disease eventually spreading into four counties (Oneida, Herkimer, Madison and Oswego).

In 1996, late blight samples confirmed in the Plant Disease Diagnostic Lab were submitted from six counties (Chautaupqua, Ontario, Tioga, Orange, Schenectady and Clinton), consisting of U.S.-1, U.S.-8 and U.S.-17. Once again, the infections for the most part were limited to home gardens or tomato plantings used for nearby roadside stands.

In 1997, both commercial and homeowners suffered the greatest losses to late blight previously recorded. Tomato late blight was verified by the Diagnostic Lab from samples submitted from 12 counties from western, central and eastern New York. Most damage resulted from a relatively new genotype of late blight called U.S.-17, which, for tomato, is particularly pathogenic. Several other genotypes infecting tomato were recovered (U.S.-8, U.S.-7 or 11, U.S.-1, and some unidentified strains), but none were as destructive as U.S.-17.

In 2000, yet another new strain of late blight was found in eastern New York, causing heavy infections in commercial and homeowner settings in Albany, Columbia, Greene, Schenectady, Schoharie and Rensselaer counties (Fig. 1). Other occurrences on tomato were noted in Genesee, Niagara and Orleans counties. Of equal importance to the occurrence of a new strain was the possible linkage with petunias as a source of the initial inoculum. Petunias brought into the area from southern states could be carriers of the unwanted inoculum. It is unclear where the inoculum is coming from in each yearly incident. Infection may originate from infected potato tubers located in the same or nearby home garden setting, from windborne spores, from infected tomato transplants, as well as the possibility now from petunias.



Figure 1. Late Blight infection on the underneath and upper leaf surface and on tomato fruit (L-R)

### Tomato Early Blight

This disease occurs every season because the causal fungus, *Alternaria solani*, can overwinter in the soil on infected debris. Primary infection is generally caused by the fungus in the soil, and can occur as early as mid-July in upstate locations. Older leaves are infected first, and the younger leaves are infected later, after they attain a certain physiological maturity. A close linkage occurs between the days to maturity and susceptibility to early blight, with early maturing varieties generally being quite susceptible. Following fruit set and development, plants become progressively more susceptible (Fig. 2). Long rotations of two or more years out of susceptible crops, including potato, are necessary to reduce the amount of overwintering inoculum.



Figure 2. *Alternaria solani* affects the leaves, stems and fruit of tomato

## Septoria Leaf Spot of Tomato

This disease occurs sporadically in New York, but it is particularly severe in years when wet weather conditions persist for extended periods, as occurred in the Capital District and surrounding counties during the 2000-growing season. The disease is particularly destructive to tomato foliage, but the fungus can also infect stems, petioles, and the calyx (Fig. 3). Fruit infections are rare. Initially, lesions may be as small (about 2 mm in diameter) as those caused by bacterial speck and could also be confused with bacterial spot. However, as Septoria lesions mature, they develop dark brown margins and tan-to-gray centers dotted with black, speck-like fruiting bodies called pycnidia. When conditions are appropriate and the tissue is succulent, the lesions are about 5 mm or 0.2 inch in diameter. The disease spreads upward from the oldest to the youngest growth, and if left uncontrolled, can almost defoliate a plant. *Septoria lycopersici* overwinters on infected tomato debris and certain solanaceous weeds such as horsenettle. Rotations of two years between tomato crops are recommended.



Figure 3. General appearance of lesions caused by *Septoria lycopersici* may suggest bacterial speck or spot, but closer examination reveals lesions with the speck-like fruiting bodies (pycnidia). Fruit are not infected, unlike infections resulting from bacterial speck or spot.

## Phytophthora Blight of Pepper and Buckeye Rot of Tomato

Even though solanaceous and cucurbitaceous crops are in very different plant families, tomatoes, peppers, pumpkins and squashes are all susceptible to infection by Phytophthora blight caused by the fungus *Phytophthora capsici*. *P. capsici* is a member of the oomycete group of fungi, are also known as the “water molds” because they generally grow best under high moisture conditions. In fact, the disease is most commonly found in low areas of the field or in poorly drained areas where soils remain saturated for extended periods of time. The stems of tomato, pepper, and eggplant plants are usually infected near the soil line (Fig.4). At first the lesions are dark green in color and appear water-soaked. With time the lesions dry and become brown in color. Symptoms also can spread to the upper stems, leaves and fruit. When infections occur at ground level the plants can be girdled. These plants will become gray-green in color and severely wilted. The fungus can also infect the upper stems and fruit (Buckeye rot) without affecting the lower stems, resulting in some wilted leaves and shriveled fruit on an otherwise healthy looking plant (Fig. 4.). The fungus survives in the soil and on infested seed. It becomes active and infects during warm, wet periods. Recommended control procedures include avoiding fields with a history of the disease, planting on well-drained soils, deep plowing to breakup hardpans, following crop rotation schedules that avoid other susceptible crops (peppers,



tomatoes, eggplant, and all cucurbit crops), and the application of fungicides. Raised beds and plastic mulch help improve drainage and reduce the amount of spores splashing from the soil onto the plant.



Figure 4. Phytophthora blight affects many crops including pepper, tomato and cucurbits.

### Bacterial Leaf Spot of Pepper and Tomato

Bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*) remains a problem in pepper and tomato fields (Fig. 5). In both instances, starting with clean seed and healthy transplants is required. Currently there are eleven races of the pathogen that have been identified. Tomato growers must rely upon fungicide sprays (fixed copper mixed with mancozeb) for control. Pepper growers should select resistant varieties, which are currently available. Commercial pepper varieties are available with resistance to three particular races. Named varieties with resistance to races 1, 2, 3, 7, 8 and 9 are: Lafayette, Brigadier and Commandant (Syngenta); Aladdin and Red Knight (Petoseed/Seminis); Enterprise, Yorktown, Mambo, Intrepid and Corvette (Asgrow/Seminis); Bravo, Orion and Diego (Enza Zaden); Boynton Bell (Harris Moran); and Summer Sweet 830 and 890 (Abbott and Cobb).

Pageant (Syngenta), a sweet banana type, and Ironsides (Petoseed/Seminis), a bell type, had fairly good resistance. Many of these varieties may have some spots on the leaves and fruit if disease pressure is high, but defoliation is unlikely and yields will not be affected significantly. Fungicides used on pepper for BLS control include fixed coppers or a mixture of fixed copper and maneb. Following a two-year rotation out of pepper and tomato breaks the cycle of bacterial leaf spot carryover on plant debris.

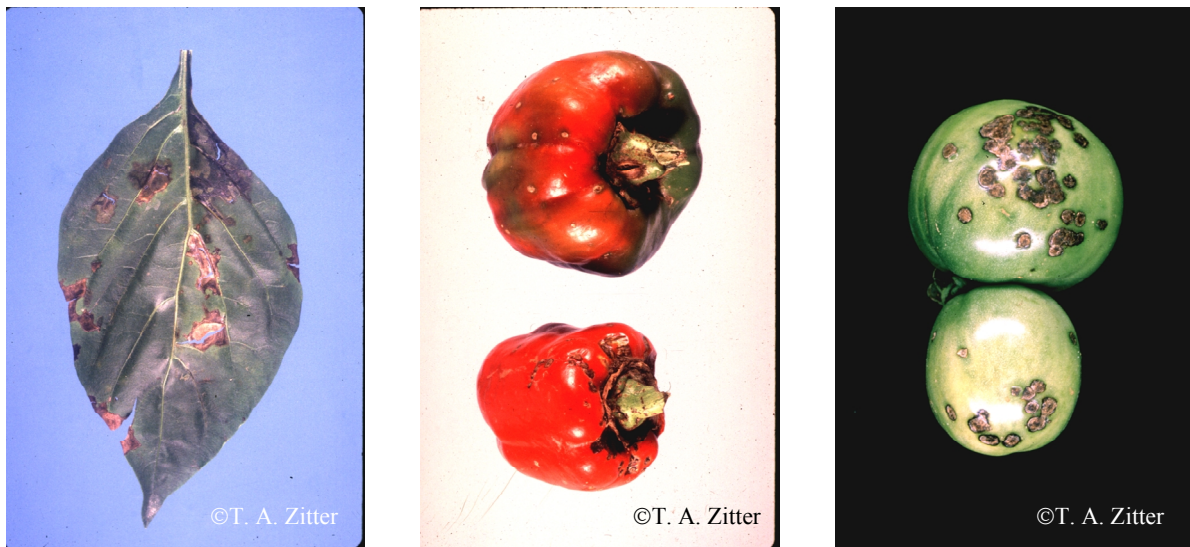


Figure 5. Bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*) causes damage to both foliage and fruit.

## Bacterial Canker of Tomato

Bacterial canker, caused by the bacterium *Clavibacter michiganensis* subsp. *michiganensis*, is one of the most serious diseases attacking tomatoes wherever they are grown. The disease has also been found on pepper in New York during the past two seasons, but losses on pepper are not as severe as on tomato. Symptoms of canker are first obvious on tomato foliage as a marginal necrosis (Fig. 6). A chlorotic area may be seen between the marginal necrosis and healthy leaf tissue. Stem cankers may also appear and are commonly found at the nodes along the stem. Cutting longitudinally through the stem reveals that the center pith is discolored and becomes “mealy.” Fruit symptoms appear as small white lesions with raised brown centers giving the appearance of a “bird’s eye spot.”

The initial source of inoculum is from tomato seed, or if it has occurred previously on the farm, from overwintering tomato debris, weed hosts, volunteer plants, and especially from contaminated wooden stakes. It has also been reported from greenhouse transplant production areas.

Sanitation is extremely important, since once the plants are infected, it is very difficult to control the disease in the field. All tomato seed should be treated with chlorine either by the seed provider or by the grower. During transplant production, seedlings can be treated with streptomycin before transplanting. Begin sprays once the first true leaves appear. If yellowing of the foliage occurs, reduce the rate of streptomycin. In the field, select an area that has been free of tomato for two to three years. Shortly after transplanting and once plants have recovered, apply a foliar spray of fixed copper and mancozeb several times at 7-day intervals.



Figure 6. Symptoms of bacterial canker appear on tomato foliage, stems, and fruit.

## Bacterial Speck of Tomato

Bacterial speck, caused by the bacterium *Pseudomonas syringae* pv. *tomato*, was common in the Capital District and surrounding counties in 2000. Cool temperatures and high moisture favor the disease. Small brown-to-black lesions appear on the foliage, and, with time, a yellow halo will develop (Fig. 7). Stems and petioles are also infected, along with the calyx and fruit. On fruit the specks are black and rarely larger than 1 mm in diameter, but this is sufficient to make them unmarketable. Like bacterial spot and canker, the bacterium responsible for speck

is seedborne. Follow the precautions given in the Bacterial canker of Tomato section. Avoid planting in the same field for two successive years.



Figure 7. Bacterial speck infections appear on tomato leaves, stem and fruit. Compare with Septoria leaf spot.

**Editor's Note:** Dr. Thomas A. Zitter is a professor, Department of Plant Pathology, Cornell University, Ithaca, N.Y. This presentation was given Feb. 15 as part of the 2001 New York State Vegetable Conference Tomato and Pepper Session, held in Liverpool, N.Y.