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## BACTERIAL SPOT OF PEPPER

Bacterial spot, caused by *Xanthomonas campestris* pv. *vesicatoria*, is the most common foliar disease of pepper (*Capsicum* spp.). The disease can cause early defoliation, yield losses, and poor fruit quality. The pathogen also infects tomato, and many Solanaceae family weeds.

### SYMPTOMS AND DIAGNOSTICS

The typical symptoms of bacterial spot are necrotic lesions on leaves, stems, and fruit. The symptoms on leaves first appear as small, water-soaked spots that expand into angular or irregular necrotic lesions 1/16 to 1/4 inch. These lesions have light gray centers and dark brown margins surrounded by narrow yellow haloes. Tissue in the center of a lesion can dry

and break away, giving a "shot-hole" appearance (Figure 1). Under continuous rain and wet conditions, lesions expand fast and remain dark-green and water-soaked without necrotic and dried (Figure 2). Several lesions may coalesce and result in large necrotic lesions. Eventually the leaves turn yellow and drop off prematurely. Spots on fruit begin as pale-green and water-soaked areas, which eventually become raised and scab-like lesions (1/16 to 1/8 inch) that render fruit unmarketable (Figure 3).

### DISEASE DEVELOPMENT

The pathogen is seedborne, being present within the seed or on its surface. The pathogen also is considered to be soilborne,



Figure 1. Brown angular lesions with gray centers and yellow halos on a pepper leaf.



Figure 2. Dark green, water-soaked lesions on a pepper leaf



Figure 3. Dark-brown, raised necrotic lesions of bacterial spot on a pepper fruit.

but survival is always associated with the presence of susceptible crop debris.

Contaminated seed and diseased transplants serve as key avenues of long distance spread of the pathogen and serve as primary inoculum in fields. Once initial infections occur, the disease can spread rapidly from a few infected plants to an entire seedbed or field. During very humid conditions, bacteria may ooze out from lesions and may spread from plant to plant by overhead irrigation, rain splashing, and by touching and handling diseased plants. Bacterial spot is favored by long periods of high relative humidity and free water on leaf surfaces.

## MANAGEMENT

Resistance of pepper to bacterial leaf spot is race-specific. Several races with differing levels of pathogenicity have been identified in the pathogen. Therefore, effective use of resistant varieties requires knowing which races of the pathogen are likely to be present in a certain area. Races 1 and 3 have been found in the northern U.S. Sweet bell pepper varieties Patriot, Boynton Bell, Commandant, Brigadier, and Socrates are resistant to both races 1 and 3.

Seed treatment should be used to reduce possible transmission of the pathogen. Two types of seed treatment have been found effective for bacterial spot. Seed may be

treated in a household bleach solution (2 parts bleach and 8 parts water). Seed wrapped in a cheesecloth bag are soaked in the bleach solution, and continuously agitated for 40 minutes. After the treatment, rinse seed in running water for 5 minutes, and dry seed thoroughly on a paper towel. Seed treatment with bleach solution is effective for contamination of pathogens on the seed surface only. Hot-water treatment can kill bacteria inside as well as on the outside of seed. But, it is critical to pre-warm wrapped seed in the 100° F water bath for 10 min, and then treat seed at 125° F for 30 minutes. It is very important to continually monitor the temperature of the water bath with a good thermometer. After treatment, dip the bag in cold water to stop the heat treatment, and dry seed, as described above.

For a preventative purpose, use pathogen-free seed and transplants. Rotate with non-host plants to avoid carryover of the pathogen on volunteers and crop residue. Do not rotate pepper with tomato, eggplant, or potato, and do not grow these crops together. Avoid overhead irrigation. Do not work on wet plants in fields. Control nightshade, horsenettle, jimsonweed, and all other solanaceous weeds.

A spray program should be initiated before or early stage of disease development. The products registered for use in Connecticut are copper-containing compounds (such as copper hydroxide and copper sulfate). Maneb can be mixed with copper products to enhance control of bacterial spot. Applications of Serenade® ASO (*Bacillus subtilis* QST 713) is another option for organic production.

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