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## Downy Mildew Confirmed in Ohio Cucumbers

by Sally Miller and Ron Becker

Downy mildew was confirmed in a small cucumber field near West Salem, Wayne County, OH on July 5, 2006. The 0.25 acre field had not been sprayed with fungicides yet this season. Leaves had yellow areas typical of downy mildew on the upper surface and sporulation of the downy mildew pathogen on the lower surface. About 65% of the field was affected. Please see the Cucurbit Downy Mildew Photo Gallery in the NCSU North American Plant Disease Forecast Center website

(<http://www.ces.ncsu.edu/depts/pp/cucurbit/images.php>)  
for good pictures of symptoms. Also, see below:



Yellow spots on cucumber leaves due to downy mildew. Photos Courtesy of M.T. McGrath, Long Island Horticultural Research and Extension Center, Cornell University

Downy mildew symptoms can be confused with those of other diseases, environmental damage and chemical burns. If you find what looks like downy mildew in cucurbit fields, send a sample (overnight delivery) for confirmation to Sally Miller or Melanie Ivey, Department of Plant Pathology, The Ohio State University, OARDC, 1680 Madison Ave., Wooster, OH 44691, ph. 330-263-3838, or to the C. Wayne Ellett Plant and Pest Diagnostic Clinic, OSU, Kottman Hall, 2021 Coffey Road, Columbus, OH 43210, ph. 614-292-5006 (c/o Nancy Taylor).

The predicted risk of downy mildew the past few days has been moderate to strongly moderate (<http://www.ces.ncsu.edu/depts/pp/cucurbit/forecasts/c060704.php>). Scouting efforts in cucurbit fields should be stepped up at this point and protectant fungicide (such as chlorothalanil (Bravo, Equus, etc.) or EBDC (maneb, mancozeb) applications should be made or continued in northern Ohio. Growers may consider additional fungicides if the disease progresses and rainy conditions occur. Research conducted at Michigan State University suggests that Previcur Flex (1.2 pt.) + protectant alternated with Tanos 50 DF (8 oz.) + protectant provides good control of downy mildew in cucurbits. Please see <http://www.ipm.msu.edu/cat06veg/v06-14-06.htm#1> for current recommendations.

**Bacterial diseases in tomatoes.** Several bacterial diseases have shown up in tomatoes over the past 10–14 days. Refer to the fact sheet below for additional information:

**Bacterial Spot, Speck, and Canker of Tomatoes HYG–3120–96** by Sally A. Miller Randall C. Rowe and Richard M. Riedel  
Bacterial spot, bacterial speck, and bacterial canker are widespread diseases of tomato that can cause localized epidemics during warm (spot and canker) or cool (speck), moist conditions. Bacterial spot can cause moderate to severe defoliation, blossom blight, and lesions on developing fruit. Bacterial speck also causes these symptoms but is usually not as severe in Ohio as bacterial spot. Bacterial canker causes wilt, vascular discoloration, scorching of leaf margins, and lesions on fruit.



Symptoms: Foliar symptoms of bacterial spot and speck are identical (Figure 1. Symptoms of bacterial spot on tomato. Note lesions on fruit, leaves and stems. Symptoms of bacterial spot on tomato. Note lesions on fruit, leaves and stems.). Small, water-soaked, greasy spots about 1/8 inch in diameter appear on infected leaflets. After a few days, these

lesions are often surrounded by yellow halos and the centers dry out and frequently tear. Lesions may coalesce to form large, irregular dead spots. In mature plants, leaflet infection is most concentrated on fully-expanded and older leaves and some defoliation may occur. Spots may also appear on seedling stems and fruit pedicels. In some cases, blossom blight may occur, causing flower abortion. This is more severe with bacterial spot and may result in a split fruit set which is especially troublesome with determinate cultivars intended for mechanical harvest.

Bacterial spot and speck can usually be differentiated by symptoms on immature fruits. Bacterial spot lesions (Figure 1) are small water-soaked spots that become slightly raised and enlarged until they are about 1/4 inch in diameter. The centers of these spots later become irregular, light brown, slightly sunken with a rough, scabby surface. In the early stages of infection, a white halo may surround each lesion at which time it resembles the fruit spot of bacterial canker. Small lesions which have not yet become scabby are often confused with lesions of bacterial speck. Bacterial speck appears on immature fruit as a black, slightly sunken stippling, eventually causing lesions less than 1/16 inch in diameter (Figure 2. Fruit symptoms of bacterial speck on fresh market tomato.). Fruit lesions are not initiated on mature fruit in either disease.



Primary or systemic symptoms of bacterial canker (from infections originating in seeds or young seedlings) include stunting, wilting, vascular discoloration, development of open stem cankers, and fruit lesions. When affected stems are split open lengthwise, a thin, reddish-brown discoloration of the vascular tissue is observed, especially at the base of the plant. On young seedlings in the greenhouse, lesions may appear as raised pustules on leaves and stems. These plants rarely survive the season in the field. Secondary symptoms in the field include leaf "firing" (necrotic marginal leaf tissue adjacent to a thin band of chlorotic tissue; Figure 3. Leaf marginal necrosis or firing symptom of bacterial canker. Photo courtesy of S. Johnston, Rutgers University.) and fruit lesions. Spots on fruit are relatively small ( $1/32$  to  $1/16$  inch) surrounded by a white halo ("bird's-eye" spots; Figure 4. Birds-eye spots of bacterial canker on tomato fruit.). Canker bacteria may also invade internal fruit tissues, causing a yellow to brown breakdown.

Causal Organisms

Bacterial spot is caused by the bacterium, *Xanthomonas campestris* pv. *vesicatoria*, which can be carried as a contaminant on the surface of infested seed and has been found to overwinter in soil associated with plant debris. Bacterial speck is caused by another bacterium, *Pseudomonas syringae* pv. *tomato*. This bacterium may also be seedborne and can overwinter on plant debris in soil and on the roots of many perennial plants. Bacterial canker is caused by *Clavibacter michiganensis* subsp. *michiganensis*, which, unlike the spot and speck pathogens, has the ability to infect tomato plants systemically. It is seedborne and can survive on infested plant debris in soil.



All three organisms may exist at low populations on leaf surfaces of symptomless plants. At the onset of favorable conditions, these low populations can increase rapidly and bacteria can then enter plants through stomata or small wounds and begin infection. Bacteria can spread rapidly with spattering rain and widespread epidemics may develop. Penetration of tomato fruit occurs through wounds created by windblown sand, breaking of hairs, or by insect punctures. Optimal conditions for bacterial spot and canker are high moisture, high relative humidity and warm temperatures (75 to 90 degrees F). Bacterial speck is more likely to occur under cool (64 to 75 degrees F), moist conditions.

## Management

Rotate tomatoes with non-solanaceous crops with at least 2 to 3 years between tomato crops. Avoid rotation with peppers, which are also susceptible to bacterial spot.

Plant only seed from disease-free plants or seed treated to reduce any bacterial populations. Treatments include:



- a. fermentation of tomato pulp and seeds at room temperature for 45 days;
- b. soaking seeds in 0.60.8% acetic acid for 24 hr at 70 degrees F;
- c. soaking seeds 510 hr in 5% hydrochloric acid;
- d. hot water treatment of seeds (122 degrees F for 25 minutes); or
- e. sodium hypochlorite (bleach) treatment [2040 minute soak of seeds in 1% sodium hypochlorite (20% bleach)]. Some decrease in germination may be expected from these treatments.

Use only transplants free of disease symptoms.

Carry out proper sanitation of transplant production greenhouses. Remove all weeds and plant debris, clean all tools with disinfectant solution, and wash hands thoroughly before and after handling plants. Water plants early in the day to reduce the amount of time

foliage is wet. Do not handle plants when they are wet. After each crop, clean greenhouse walls, benches, etc., with hot soapy water, followed by thorough rinsing and treatment with a disinfectant. If possible, close up greenhouse after transplant production is completed to allow natural heating during the summer. Use only new plug trays and pathogen-free planting mixes. Avoid growing peppers and tomatoes in the same greenhouse unless pepper seed has also been treated as in step 2.

In the field, control irrigation to minimize the time foliage is wet and avoid working among wet plants to minimize spread of disease. Applications of mancozeb plus copper soon after transplanting may help retard development and spread of bacterial spot and speck. This practice is not particularly effective for management of bacterial canker. Many tomato processors will not accept tomatoes treated with mancozeb or other EBDC fungicides. Check with your processor before applying one of these fungicides. Consult the Ohio Vegetable Production Guide (OSU Extension Bulletin No. 672) for current recommendations.