UNIVERSITY OF ILLINOIS EXTENSION
College of Agricultural, Consumer and Environmental Sciences

report on
PLANT DISEASE

RPD No. 925
December 2023

DEPARTMENT OF CROP SCIENCES
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

BACTERIAL SPOT OF CUCURBITS

Bacterial spot, caused by *Xanthomonas cucurbitae*, has become one of the most important diseases of cucurbits, especially pumpkin and winter squash crops in Illinois and worldwide. The disease was first reported as bacterial leaf spot on 'Hubbard' squash in New York in 1926. Since then, the disease has been reported from other cucurbit growing areas in Asia, Australia, Europe, and North America on cucumber, pumpkin, squash, and watermelon. The pathogen infects leaves and fruits of cucurbits crops anytime during the growing season. Outbreaks of bacterial spot in commercial pumpkin and winter squash fields in Illinois, and other states the United States (US), especially in Midwestern states. Yield losses caused by this disease in pumpkin and winter squash fields exceed 50% in moist conditions.

Illinois with approximately 20,000 acres of pumpkin and more than 5,000 acres of winter squash production requires effective management of bacterial spot, caused by *X. cucurbitae*. Bacterial spot was not a serious disease in Illinois until 2005. Since then, it has become one the most important diseases of pumpkins and winter squashes in this state.

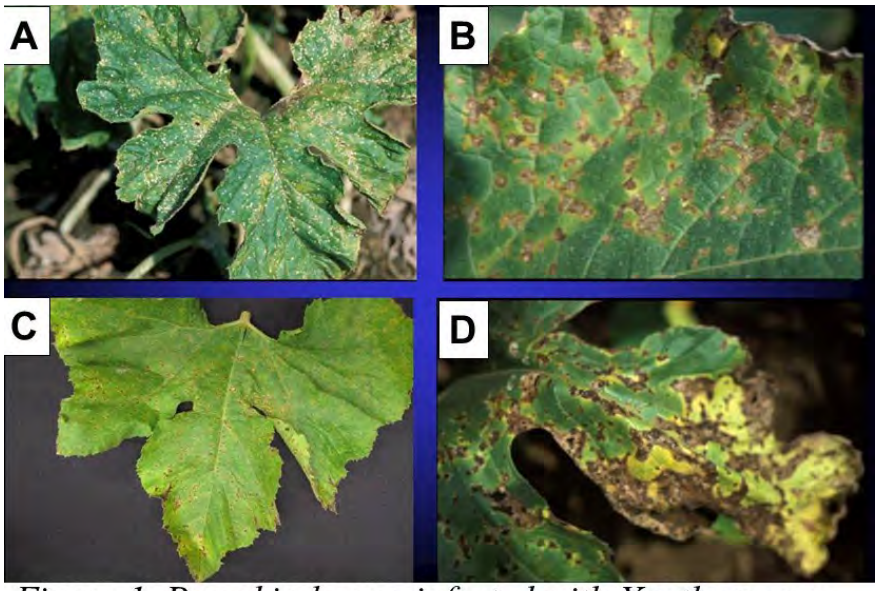

Figure 1. Pumpkin leaves infected with Xanthomonas cucurbitae. A, a leaf with translucent lesions; B, a leaf with angular spots; C, a leaf with dark lesions with yellow margins; D, a severely infected old leaf.

X. cucurbitae leaves and fruits. Leaf infection by *X. cucurbitae* does not significantly affect yields, as pumpkins and winter squashes have large leaf areas, and rarely the bacterium cause complete losses of leaves. Infected leaves, however, provide inoculum for fruit infection, which is very important in production, as even a single lesion on a fruit may result in fruit rot. For developing effective strategies for managing *X. cucurbitae* on cucurbits, we began our research in 2008 and still continues .

So far, we have conducted following studies: (1) assessed the incidence of infected fruits by *X. cucurbitae* in commercial fields of gourd, pumpkin, and winter squash in the Midwestern states,

For further information contact ***Mohammad Babadoost****, Extension Specialist in Fruit and Vegetable Pathology, Department of Crop Sciences, University of Illinois, at Urbana-Champaign.* (***Phone: 217-333-1523; email:*** ***babadoos@illinois.edu***).

Kansas, and Nebraska; (2) investigated disease development and symptoms caused by *X. cucurbitae* on leaves and fruits on different cultivars of pumpkins and winter squashes in commercial fields; (3) collected infected fruits from all visiting states, isolated the pathogen, and determined differences in virulence and genetic variation among the *X. cucurbitae* isolates; (4) determined stages of susceptibility of leaves and fruits of pumpkins and winter squash to *X. cucurbitae*; (5) studied survival of the pathogen in infected pumpkin leaves and fruits of different pumpkin cultivars in the field; (6) determined survival of *X. cucurbitae* in infected and artificially infested pumpkin seeds at different temperature; (7) studied survival of *X. cucurbitae* on weeds and nonhost crops; (8) determined host range of *X. cucurbitae*; (9) investigated seedborne aspect of *X. cucurbitae*; (10) developed methods for eradication of *X. cucurbitae* in the seeds; (11) tested more than 12 biocontrol agents, that were either commercially available or we isolated from infected fruits, to control *X. cucurbitae* in the laboratory and commercial fields; (12), tested more than potential chemicals in the laboratory and commercial fields for managing the disease; (13) evaluated available chemicals for inducing resistance in plants in commercial fields; (14) developed methods for inoculating cucurbit leaves and fruits in greenhouse with *X. cucurbitae* to screen plants for resistance to the pathogen; and (15) screened all available more than 3000 cucurbit accessions and 81 cultivars for resistance to *X. cucurbitae*. Results of these investigations provided reliable information for developing management of *X. cucurbitae* on cucurbits.

Figure 2. An infected pumpkin fruit with Xanthomonas cucurbitae.

Symptoms

Symptoms of the disease on leaves appear as small (1-2 mm) and dark lesions, with indefinite yellow margin (Figure 1, C). The lesions may coalesce to form larger necrotic areas, usually on leaf margins (Figure 1, D). In Illinois, different lesions have been characterized on leaves of different pumpkin cultivars (Figure 1, A-C),

Figure 3. Infected winter squash fruit with Xanthomonas cucurbitae.

which vary in color and size. The most readily identifiable symptoms occur on fruit. The appearance and size of fruit lesions can vary, depending on rind maturity and the presence of moisture. Initial lesions are small, slightly sunken, circular spots, 1/16 to 1/4 inch in diameter, with a beige center and a dark-brown halo (Figures 2-4). Later the cuticle and epidermis crack, and the lesions enlarge, reaching up to 1/2 inch in diameter (Figure 3, C). The large lesions may have scab-like appearance and give rise to tan, raised blisters. On mature fruit, saprophytic fungi often colonize the dead, tan tissue at the center of the lesion (Figures 2 & 4). Penetration of the bacteria into the flesh can lead to fruit rot in the field (Figure 4, C & D) or later in storage.

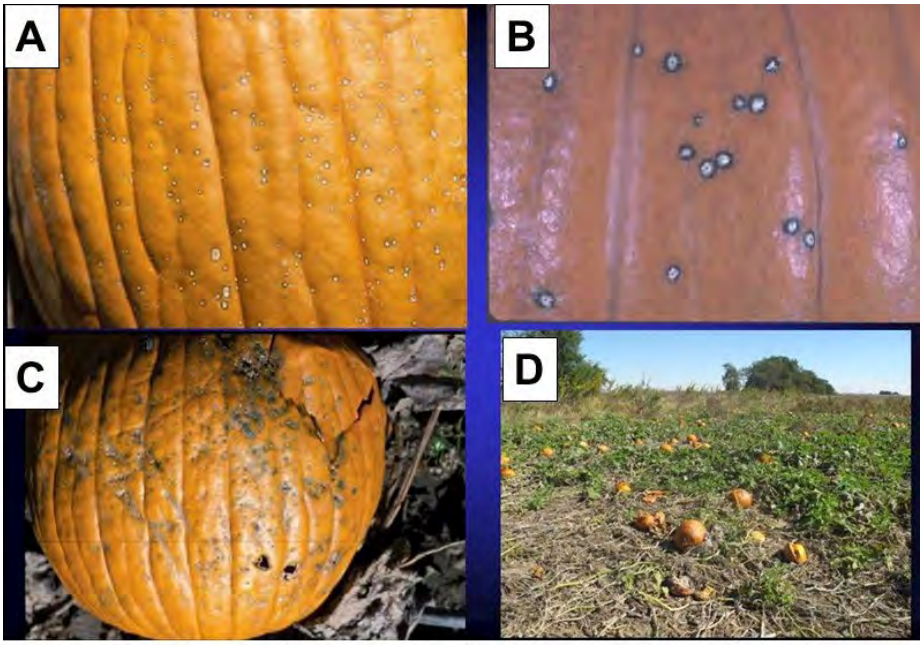

Figure 4. Pumpkin fruit infected with Xanthomonas cucurbitae. A, a fruit with small lesions; B, a fruit with most common lesions; C, an infected, collapsing fruit; D, rotting fruit in a commercial field.

Disease Cycle

The bacterium has been reported to be a seed-borne pathogen. However, we have not been able to document infection of cucurbit seedling from naturally infected or artificially infested seeds. Also, the bacteria can survive in crop residue in the field. The disease appears during the summer months when temperatures are high, and most commonly after heavy rain, dew, or overhead irrigation. Fruit infection occurs through natural opening or wound in young, rapidly expanding fruit prior to the development of thick, waxy cuticle. The bacteria are splash-spread in the field. Spread of the bacteria within fields can be very rapid. Long distance dispersal of the pathogen is believed to be by contaminated seed. We have documented infection of leaves from 4-leaf stage until harvest. Fruit infection in Illinois begin when fruit are about baseball size until beginning of fruit maturity. When fruits start maturing (changing surface color to orange), they become less susceptible or resistant to *X. cucurbitae*.

Disease Management

After the 15 years of intensive investigations, we are not able to effectively control *X. cucurbitae* in cucurbit fields. Although we are able to eradicate *X. cucurbitae* carried in/on the seed by treating seeds in hot-water [151°F (55°C) for 15 min], or in 0.5% HCl for 40 minutes, but the disease still develops in the fields sown with treated seeds. The inoculum likely comes from the infected plant debris from previous years or surviving bacteria on asymptomatic weeds and non-host crops.

Crop rotation with non-host crops (i.e., corn or soybean) for 3 years delayed development of bacterial spot for 2 weeks but did not prevent development of the disease.

Using chemicals (i.e., Actigard) did induce resistance (or at least not enough resistance) to protect cucurbit plants against *X. cucurbitae*. Spray applications of biocontrol agents did not affect development of bacterial spot on cucurbits. Of more 20 chemicals tested in the fields, only copper (Kocide-3000), mancozeb (Manzate PRO Stick), Regalia, and Quintec reduced the incidence and severity of bacterial spot in the field, but failed to provide effective protection to plants against *X. cucurbitae*.

None of test 81 commercial cultivars of gourds, pumpkins, and squashes was resistant against *X. cucurbitae*. Of more than 300 cucurbit accessions tested in the greenhouse and field, only 9 and 21 accessions were found as resistant and less-resistant to *X. cucurbitae*, respectively. Resistant and less-resistant accessions belong to *Cucurbita maxima*, *C. maxima* subsp. *maxima*, *C. maxima* subsp. *andreana*, and *C. okeechobeensis* subsp. *martinezii*. The information has been published, and also has been provided to cucurbit specialists, with a hope that breeders will develop acceptable commercial cultivars of pumpkins and winter squashes resistant to *X. cucurbitae*.

At present, following practices are recommended to reduce damages caused by *X. cucurbitae* to cucurbit crops: (1) use pathogen-free seed and disease-free transplants; (2) consider ≥ 3 years of crop rotation with non-cucurbits; (3) spray plants, at 7-day interval, from vine-spread stage until maturing fruits with a copper compound mixt with mancozeb, Quintec, or Regalia; (4) do not work in the fields when plant are wet; and (5) harvest matured fruits and keep them in dry area. We believe that without developing resistant commercial cultivars, effective management of *X. cucurbitae* in pumpkin and winter squash fields may not be possible. For additional information on management of bacterial spot of cucurbits, refer to the “Midwest Vegetable Production Guide for Commercial Growers.”