

Black Rot of Crucifers

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Black rot is the most serious disease of crucifer crops world wide when environmental conditions (relatively high temperature and humidity) are favorable. The disease affects primarily aboveground parts of plants at any stage of growth and causes high yield and quality losses, especially in tropical and subtropical regions during the rainy season. All vegetables in the crucifer family, including broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, mustard, radish, rutabaga, and turnip, are susceptible to black rot. Many cruciferous weeds such as Shepherd's Purse, wild mustard, and yellow rocket may also be hosts of this pathogen.

Symptoms

The characteristic black rot symptom on most cultivated crucifer plants is the appearance of yellow, V-shaped lesions along the margins of leaves. The point of the V-shaped lesion is directed toward a vein (Figure 1). When lesions enlarge, wilted tissue expands toward the base of leaves. Eventually the diseased areas become necrotic and the veins turn black or brown. The infection may move down the vascular tissue of petioles and then spread up and down the stems. When stems and petioles of an infected plant are cut crosswise or lengthwise, the black-brown vascular tissue with yellowish bacterial slime



Figure 1. V-shaped black rot lesions on cabbage.

is observed (Figure 2). These symptoms may be confused with *Fusarium* yellows, except that *Fusarium* causes brown vein discoloration without bacterial slime. Moreover, symptoms of black rot may vary according to age of host, host genus, species, and cultivar and even environmental conditions. For example, symptoms on cauliflower may appear as numerous black or brown specks, scorched leaf margins, black veins, and discolored curds (Figure 3). Many cruciferous weed species do not exhibit any of these characteristic symptoms even when infected.

Causal Organism

Black rot of crucifer is caused by a bacterium, *Xanthomonas campestris* pv. *campestris* (Xcc). The bacteria can overwinter in plant debris, in and on seeds from diseased plants, and in and on weeds. The pathogen may survive in diseased crop residue buried in soil for up to 2 years, but not more than 60 days free in soil. The major source of these bacteria is infected seeds, which enable long-distance spread of the disease. The pathogen is spread within and between fields by splashing water, wind, insects, machinery, and irrigation or drainage waters. The bacteria infect the cotyledons and young leaves through natural plant openings (stomata, hydathodes) or wounds and then migrate between cells until they reach the xylem tissue where they spread throughout the plant. Free moisture is required for infection by the pathogen. After infection, symptoms may appear on plants within 7 to 14 days under optimum conditions (25 to 30 degrees C).

Management

Effective management of black rot of crucifers depends on the application of the following practices in combination:

1. Use black rot-tested, disease-free seed grown in an arid production area.
 - 1a. If the source of the seeds is unknown, or infested seedlots must be used, treat seed with hot water to eradicate pathogenic bacteria. Cabbage, broccoli, and Brussels sprouts can be treated at 50 degrees C for 25 minutes, while seeds of

cauliflower, kale, turnip, and rutabaga are treated for 15 minutes. However, this treatment may reduce the viability of seed. Therefore, some other chemical seed treatments, including, sodium hypochlorite, hydrogen peroxide, and hot acidified cupric acetate or zinc sulfate can be applied to eliminate the bacteria from crucifer plant seeds.



Figure 2. Discolored vascular tissue in cabbage stem and petiole.



Figure 3. Black rot symptoms on cabbage transplants.

2. Use certified disease-free transplants.
3. Practice crop rotation where crucifers are grown only every 3 to 4 years to eliminate the inoculum sources from diseased crop debris in the soil.
4. Good sanitation practices should be performed to prevent disease spread.
 - a. Eliminate all volunteer crucifer plants from previous crops and alternative wild host plants within and around the field.
 - b. Do not apply manure that may contain crucifer residues.
 - c. Do not use sprinkler irrigation.
 - d. Avoid working in the field when plants are wet.
 - e. Do not allow machinery and equipment movement from infested areas to non-infested fields.
 - f. Deep plow to bury all crucifer residues after harvest.
5. Application of fixed copper pesticides in the field may help to reduce spread of the disease. Consult the Ohio Vegetable Production Guide (OSU Extension Bulletin No. 672) for current recommendations.
6. A few black rot-resistant cultivars of cabbage and other crucifers are commercially available. These resistant cultivars should be used in crucifer growing regions where black rot is a common problem.

This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author, The Ohio State University and Ohio State University Extension assume no liability resulting from the use of these recommendations.

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