

Black Rot of Brassica Crops

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Overview

Black rot (*Xanthomonas campestris* pv. *campestris*, Xcc) is uncommon but can be a devastating bacterial disease in South Dakota. Typically, South Dakota's climate is not conducive to development of this disease, but when periods of hot and wet weather are sustained, it can lead to rapid and widespread crop loss. Black rot can develop at any stage of growth, though it is more commonly seen either in the spring on new transplants or late summer following several days of high humidity and temperatures. When the environment is less suitable, progression and spread of this disease will slow, though symptoms will rapidly worsen when conditions are suitable again. It is most severe on broccoli, cabbage, kale and cauliflower, but can infect all members of the brassica family, including brussels sprouts, bok choy, turnips, kohlrabi, radishes, mustards, and others, including forage, weeds and ornamental brassica. Bacteria enter through large pores on the leaf margins, called hydathodes, through water droplets via splashing, dew, rain or irrigation water. They can also enter through sites of damage from insect feeding, hail, or other mechanical damage to the plant. Black rot can be spread through infected plant residue from the current season or from previous years. It can also be seed-borne. Once a plant is infected, large yellowing and dying lesions will spread down the leaf and eventually result in severe damage or plant death.



Figure 1: Early symptoms of Black Rot on broccoli. Note the characteristic triangular or wedged-shaped dying areas surrounded by yellow halos along the leaf edge. Photo credit C. Molnar and N. Volesky

Symptoms

Black rot symptoms can present differently on various crops. In cauliflower, broccoli, and cabbage and other members of *Brassica oleracea*, it begins as yellowing wedges on the leaf margins that spread down the leaf (Figure 1). Veins within the affected area will turn brown or black, with leaf tissue surrounding the affected areas turning yellow. Eventually, large portions of the leaf necrose as the disease progresses into the stalk, which will cause head or stalk rot and death of the entire plant (Figure 2). At this stage, stems and stalks will often have black discoloration in the vascular tissue (Figure 3). In bok choy, turnips, and other members of *Brassica rapa*, black rot can appear as necrotic speckles on the leaves, which can resemble some leaf spot diseases, but will eventually resemble symptoms on other brassicas and cause head rot and plant collapse as well. Many other soft rots, fungi, and opportunistic pathogens will often colonize the dying plant as well, which can make recognizing this disease difficult later in the growing season.

If infected through seed transmission, black rot will typically first appear on the cotyledons or seed leaves that first emerge during germination. Leaves will quickly wilt and drop. Plants generally cannot recover as the stem is likely already infected. Infected seedlings typically die within two weeks of germination.



Figure 2: Advanced symptoms of Black Rot on cabbage. Entire sections of the leaf have begun to die and break down. Leaf veins have collapsed and appear black in necrotic areas of the leaf (near center). Photo credit M. Shires



Figure 3: Advanced symptoms of black rot in cauliflower stem. As the disease progresses, it will begin causing collapse of the vascular tissue in the stalk, which will lead to complete death of the plant. Vascular damage is seen as the black spots on the left and upper left of the stalk. Photo credit M. Shires

Identification and Diagnostics

Black rot is easily identified by the characteristic triangular brown lesions with yellow halos that form on leaf margins (Figure 1). Where and when black rot develops depends on the route of introduction to the field. When transmitted by seed, black rot will generally develop symptoms within two weeks after germination and begin on the cotyledons and stem. Black rot is heavily influenced by weather. Disease spread and progression will be slow in cool and dry weather but can rapidly progress during hot, humid weather (above 80° F/80% humidity). When transmitted from infested soil or other infected plants, the disease can start on any age of leaf/plant and location but will typically develop on leaves within splashing height of water, either from rain, dew, or irrigation.

As the disease progresses, many other opportunistic pathogens can begin growing on decaying material and thus black rot can be confused for soft rot (*Pseudomonas spp.*), white mold (*Sclerotinia spp.*), or other bacterial and fungal rots. Early symptoms can be mistaken for Fusarium wilt and Verticillium wilt (Figure 4A and B). Fusarium wilt (Fusarium yellows, 4A) will extend from the stalk outward, affecting half or the entire leaf, typically affects the lower leaves first and tends to curl leaves along the midrib. Verticillium wilt (4B) can produce yellowed leaves but similarly tends to show symptoms first on lower leaves with

symptoms progressing from the stalk outward, typically only produces symptoms on half or a portion of the leaf, and will produce noticeable black dots on dead tissue, particularly on the stalk. Both of the previously described diseases will typically affect only one side of a plant, at least initially. Black rot can be distinguished from these by the presence of black veins in dead portions of leaves (Figure 4D). Black rot will occur on any portion of the plant with no distinct bias for sides or leaves. Black rot will also almost exclusively begin at the leaf edge (Figure 4C), while other leaf spots and wilts can begin on the stalk or central parts of leaves, though this can be difficult to distinguish as the disease progresses. Black rot of brassica is not related to other black rots.



Figure 4. Other similar diseases to black rot. Fusarium wilt (a) and Verticillium wilt (b) can be mistaken for black rot, as they also cause plants to yellow and wilt. However, they tend to lack key symptoms such as marginal yellowing (c) and blackened veins in dead portions of leaves (d). Key symptoms are marked by orange circles. Photo credit of Fusarium wilt to Margaret Tuttle McGrath, Cornell; photo credit of Verticillium wilt on tomato to Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.

Management

Black rot is difficult to manage once it is established. Xcc can be transmitted by seed into new plantings and can rapidly spread once conditions are favorable. Xcc can survive on decaying plant material and residue for up to 3 years, as well as persist on several weeds in the brassica family, such as shepherd's purse (*Capsella bursa-pastoris*) or wild mustards. Most management practices focus on minimizing potential introduction of Xcc or by reducing Xcc inoculum.

Use Credible Suppliers and Clean Seed

Purchase certified clean seeds or heat treat seeds to prevent seed transmission of Xcc. "Use temperatures and times of 122o F for 25 minutes for brussels sprouts

and cabbage, 122o F for 15 minutes for mustard greens, and 122o F cole crops and brassica leafy greens, 109o F for 20 minutes for other brassicas" (Phillips et al, 2026, page 108-109). If plugs or transplants are purchased, purchase from a reputable source and inspect plants for early signs of black rot, in particular yellowing spots on the edges of young leaves or cotyledons.

Select and Plant Resistant Varieties

Resistant varieties of many brassica crops are available. Xcc has been observed to overcome resistance with abundant disease pressure, so it is still important to manage black rot outbreaks even with resistant varieties. See table 1 for a list of resistant varieties of brassica crops. A field trial in MN found that Wolfman, Green Magic, and Eastern Crown for early planted broccoli, and Belstar and Covina for late planted broccoli had the most disease resistance to Xcc. Many growers also ranked Gypsy and Monty very highly for performance in high-disease pressure conditions.

Field and Residue Management to Prevent Spread of Disease

Promptly removed infected plant material from the field. If harvesting from an infected field, till under or remove plants as quickly as possible. Clean tools after working with diseased plants and before handling uninfected plants. Increasing spacing between plants can also slow the spread of many diseases, including black rot. If possible, use drip irrigation or soaker hoses to minimize splashing and avoid overhead watering as much as possible. Avoid working in fields when wet (after rain or early in mornings when dew is present).

As Xcc can remain in decaying soil material, rotate infested fields out of any brassica crops for 2 to 3 years to allow inoculum to break down, especially if incorporating residues after harvest. Do not compost infected plants unless similar precautions are taken.

Copper-based sprays or products containing the active ingredient acibenzolar-S-methyl can be used as a preventative but have limited effectiveness. Sprays will not affect the disease once it establishes on a plant. If used, sprays should be timed to prior to and during high-risk conditions of prolonged high humidity and temperature to prevent disease introduction or spread. Avoid excessive use of any copper-based spray to limit the development of resistance in Xcc. Always follow the label of any pesticide and only use products registered for use in South Dakota for approved crops.

For questions and to submit a sample for disease confirmation:

Please send plant disease questions to SDSU Extension Plant Pathology Specialist Dr. [Madalyn Shires](#), SDSU Extension Horticulture Plant Pathology Field Specialist [Cody Molnar](#) or SDSU Extension Diagnostician, [Connie Tande](#).

Samples can also be sent to the SDSU Plant Diagnostic Clinic for fee-based diagnostics. The clinic's mailing address is Berg Ag Hall 203, Box 2207D, 1451 Stadium Road, Brookings, SD 57007-1090. For more information, visit the [SDSU Plant Diagnostic Clinic website](#). The physical address for sample drop off is Berg Ag Hall Room 203 (business hours) or Room 001 (after hours). When collecting and mailing samples, select leaves and plants that include yellowing leaves and mail as quickly as reasonable. Include as much of the plant as possible. Try to keep samples cool but dry; excessive moisture can cause samples to rot while in transit. Samples should be wrapped in a dry paper towel and placed in a closed plastic bag. Please do not send heavily rotting plants.

Sources

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Table 1: Black Rot resistant cultivars of brassica crops. This list was compiled from Cornell University and the Pacific Northwest Disease Management Handbook. Most resistance with Black Rot is variable and not complete; plants can still become infected if disease pressure is high enough.

Crop	Cultivar
Green Cabbages	Altria
	Capture
	Bartolo
	Bellicose
	Benelli
	Blue Dynasty
	Blue Vantage
	Bobcat
	Botran
	Bravo
	Burno
	Celebrate
	Cheers
	Chun Yeon Gold
	Defender
	Early Thunder
	Excalibur
	Guardian
	Green Presto
	Green Winter
	Gunma
	Hinova
	January King
	Krautking
	Krautpacker
	King Cole
	Lennox
	Little Rock
	Lucky Ball
	Monterrey
	Multikeeper
	Pacifica
	Passat
	Polinius
	Platinum Dynasty
	Protector
	Rodolfo
	Roundup
	Satie
	Stellar Vantage
Stonehead	
SuperStar	

Crop	Cultivar	
Green Cabbages	Superelite	
	Superdane	
	Superkraut	
	Taurus	
	Tribute	
	Titanic 90	
	Tropicana	
	Vantage Point	
	Viceroy	
	Xtreme Vantage	
	Red Cabbages	Red Dynasty
		Scarlet
Chinese Cabbages	Li Ren Choi	
	Toy Choy	
Napa Cabbage	Blues	
Broccoli	Asteroid	
	Abrams	
	Belstar	
	Bonarda	
	Burney	
	Covina	
	Diplomat	
	Eastern Crown	
	Fiesta	
	Gemini	
	Green Magic	
	Greenpak 28	
	Gypsy	
	Imperial	
	Luna	
	Marathon	
	Millennium	
	Monty	
Tendergreen		
Wolfman		
Brussel Sprouts	Attis	
	Doric	
	Nautic	
	Silva	
Cauliflower	No notable cultivars show resistance	