

COLLEGE OF FOOD, AGRICULTURE, AND ENVIRONMENTAL SCIENCES

Bacterial Blight and Bacterial Pustule of Soybean

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Bacterial diseases of soybean have become more common in Ohio. When compared with fungal, virus and nematode pathogens, bacterial diseases do not cause significant yield reductions. The most predominant bacterial diseases in Ohio are bacterial blight and bacterial pustule. Symptoms sometimes can be confused with those caused by fungal pathogens, meaning a more detail examination should be conducted if bacterial infection is suspected and prior to any fungicide sprays as these are not effective towards this type of pathogen.

Bacterial Blight of Soybean

Bacterial blight is the most common bacterial disease of soybean in Ohio. Symptoms related to this disease are often observed early season, allowing the plant to recover as it puts on new growth throughout the season. For this reason, yield losses are minimal when the disease occurs. However, highly susceptible older varieties, and highly favorable conditions can cause yield losses of up to 40 % have been noted.

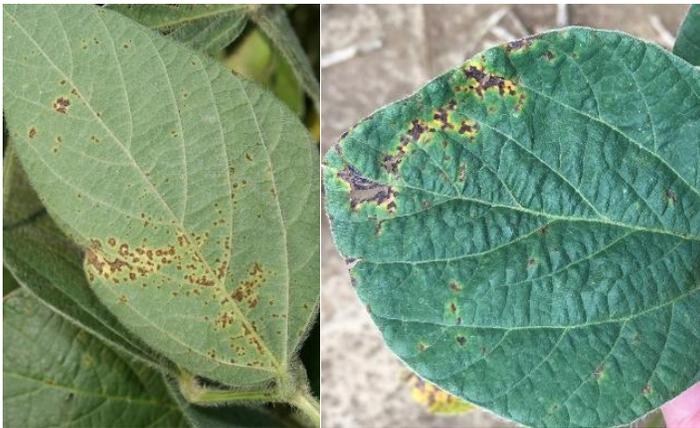


Figure 1. Left, the underside of a leaf showing symptoms of bacterial pustule; Right, a leaf with irregular lesions caused by the bacterial blight pathogen.

Causal Agent

This disease is caused by the bacteria *Pseudomonas savastanoi* pv. *glycinea*. There are at least 9 known races of the pathogen. The most frequently isolated is race 4, which is known to be pathogenic on almost all soybean cultivars. Several avirulence genes have been identified since the first was discovered in 1984. The pathogen grows well on King's B medium and will produce a weak glow under a blacklight. In culture, colonies will be white, circular, smooth, and may produce mucus.

Symptoms and Signs

Symptoms caused by *P. savastanoi* pv. *glycinea* can be observed on the leaves, pods, and stems of the plant, with the greatest disease pressure in the mid to upper canopy. At early stages, cotyledons may have brown spots on the leaf margin and die prematurely if infection reaches the apex. As the plant matures, infection will appear on the young leaves, as these are the most susceptible. The most common symptoms on leaves are brown, angular lesions with chlorotic halos. Necrotic spots will merge together and form a large patch that will make the foliage appear broken-down. Pods that are infected will have small and water-soaked lesions that will later turn necrotic. Infected seeds will be discolored and may have a slimy coating due to the bacteria creating a film on the seed surface.

Disease Cycle

The bacterium that causes bacterial blight, overwinters in dried crop residue and seeds. Rain and high winds disperse the inoculum onto plant tissues where bacterial cells are introduced into the plant through natural wounds or stomata (Figure 1). Water must be present in order for the bacteria to disperse and infect the leaves. Necrotic lesions appear 3-7 days after infection occurs, when the bacteria produces toxins that prevent chlorophyll production. Wet and cool temperatures (70-80°F) can promote faster disease development. Pathogen transmission from a sick plant to a healthy plant can occur when the two plants make contact in high winds, or from human field activity (such as spraying), which can move water droplets containing bacterial cells from plant to plant.



Figure 2. A common diagnostic test for diseases caused by bacteria. A cross section of a lesion is submerged in water and observed under the microscope. The dark cloud emerging from the leaf tissue contains millions of bacterial cells, commonly referred to as bacterial streaming.

Bacterial Pustule of Soybean

Bacterial pustule has been reported in Ohio, but at lower incidence than bacterial blight. It is prevalent when warm and wet conditions are present and symptoms may appear later in the growing season. Symptoms can appear very similar to those of bacterial blight and soybean rust, so knowing the differences between these two diseases is critical for accurate diagnosis.

Causal Agent

Bacterial Pustule is caused by the bacteria *Xanthomonas axonopodis* (syn. *campestris*) pv *glycines*. In culture, this bacteria is gram negative and forms small, deep yellow, circular colonies on rich media.

Symptoms and Signs

Symptoms related to bacterial pustule are often confused with soybean rust due to the lesion color and pattern. Pustules caused by *X. axonopodis* pv *glycines* first appear as pale green spots on leaves. The spots, which are commonly observed in the main veins, can develop in either the upper or lower surface of the leaf. Pustules or small craters on the underside of a leaf can merge together to form large lesions with irregular patterns. A distinct feature to differentiate bacterial pustules from soybean rust are the raised necrotic centers and the lack of spores when observed under a microscope.

Disease Cycle

Similar to bacterial blight, the pathogen that causes bacterial pustule overwinters in crop debris. Wind-driven rain and water droplets can disperse the inoculum from one place to another. This bacterium uses natural openings, stomates, or wounds to enter the plant and colonize. It can also be spread when performing other agricultural practices. Optimal temperatures for growth range from 86-92 °F.

Bacterial Disease Management

Although, bacterial diseases are often less prevalent than other diseases, growers should consider the following management techniques if a bacterial disease is present in soybean fields.

Resistant Varieties: The use of a resistant varieties should always be used.

Pathogen-free Seed: The pathogen can be seedborne, so it is important to use seed that is certified to be pathogen-free. Do not use seed from infected plants.

Cultural Practices: Avoid any cultivation practice when plants are wet, since this will spread the inoculum in the field.

Chemical Control: To date, no field in Ohio has warranted sprays, but there are Copper-based sprays that can be used to control bacterial diseases of soybean.

Crop Rotation: This will significantly reduce the amount of inoculum present in the field.

Tillage: This will help eliminate the inoculum present in crop residue where the bacteria usually overwinters. This is only necessary if disease severity was high in the previous growing season.

Useful References

Crop Protection Network

<https://cropprotectionnetwork.org/encyclopedia/soybeans/foliar-diseases/bacterial-blight/>

<https://cropprotectionnetwork.org/encyclopedia/soybeans/foliar-diseases/bacterial-pustule/>