

Charcoal rot disease of soybean

YT Tewoldemedhin & SC Lamprecht

ARC-Plant Protection Research Institute, Private Bag X5017, Stellenbosch, 7599.

Charcoal rot is widely present in soil and has been reported to cause yield losses of 30 to 50% in the United States. It is also known as summer wilt or dry weather wilt. Charcoal rot occurs in many fields, some with scattered, infected plants in small patches or parts of rows and others with larger patches. The most seriously affected areas are often in the drier parts of fields. The disease is usually noted after midsummer and is considered a disease of the mature plant, however, seedlings and young plants are also attacked. Under favorable conditions, it causes seedling damping-off. Charcoal rot occurs primarily when dry, hot weather stresses soybeans.

The fungus

Charcoal rot is caused by *Macrophomina phaseolina*. This pathogen has a host range of more than 500 plant species worldwide. Under hot, dry environmental conditions, many economically important crops, including soybean, suffer significant yield losses from this disease. The fungus has been reported to attack soybean plants throughout the growing season and is reported to cause root and stem rot on soybean throughout the world. *Macrophomina phaseolina* overwinters in dry soil and residue of host tissues, and it can be spread by contaminated seed. Some reports suggest the fungus to be a weak pathogen and may cause only minimal damage when plants are not stressed, but can severely damage soybeans subjected to stress such as drought. In South Africa, in a recent survey conducted in major soybean production areas (Bethlehem, Bothaville, Brits, Cedara, Clocolan, Delmas, Dundee, Groblersdal, Kinross, Middelburg, Potchefstroom, Rustenburg and Vaalharts), *M. phaseolina* was found in all the localities surveyed, with the exception of Cedara.

Symptoms

Symptoms of charcoal rot most frequently begin in the driest areas of the field (such as sandy or compacted areas, or the tops of terraces). Usually the symptoms occur after mid-season in dry, hot conditions, but seedlings may also be affected in hot and dry soil conditions. On emerging seedlings, brown lesions may form on the hypocotyl. However, symptoms typically occur during or after flowering on mature plants. Infected plants wilt in the mid-day heat,

recovering at night until the permanent wilt point is reached (Fig. 1). Leaves of severely infected plants turn yellow and brown, wilt, and stay attached to the plant, but drop prematurely, which is usually mistaken for normal maturity.

A more solid diagnosis of the disease is based on the appearance of the root and lower stem. Beginning at flowering, a light gray discoloration develops on the epidermal and sub-epidermal tissues of both tap and secondary roots and lower stems. The distinctive characteristic of the disease can be revealed by scraping off the surface layer (epidermis) of the root and lower stem. Under the epidermis, plants infected with charcoal rot will have minute black dusty microsclerotia giving the stems and roots a charcoal-sprinkled appearance (Fig. 2). These microsclerotia are difficult to see without the help of a hand lens. Cutting the root and lower stem often reveals distinct gray to black discoloration inside the root and lower stem (Fig. 3).

Management:

1. Charcoal rot is a difficult disease to manage. No resistant cultivars are available, but some cultivars have been reported to be less affected by charcoal rot than others.
2. Manage fields to avoid drought stress. Implement practices to reduce drought stress such as early planting to avoid the worst drought conditions, plan an irrigation schedule that promotes good root growth and reduce plant populations in order to reduce competition for water.
3. Conservation tillage (minimum and no-tillage). Decreased disease has been reported with conservation tillage; this could be due to cooler soils and stubble retention resulting in less moisture stress.
4. Crop rotation, especially with cereal grains (non-host crops or with crops that support relatively reduced inoculum in the soil), for 1 to 3 years is recommended.



Figure 1. Soybean plants dying due to charcoal rot disease.

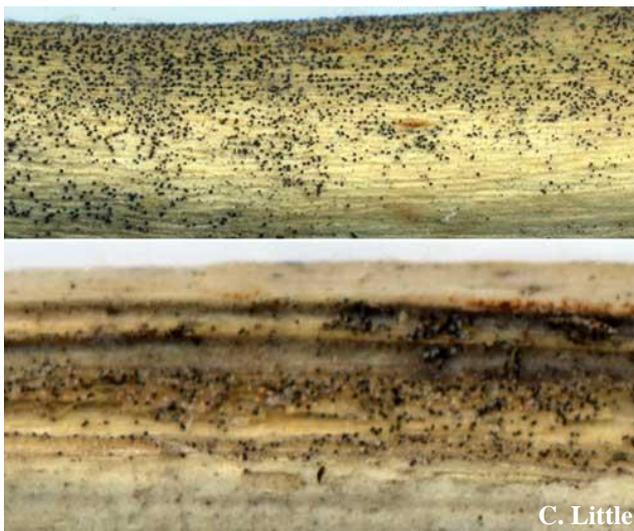


Figure 2. Microscopic image of soybean stem and root infected with charcoal rot showing minute black dusty microsclerotia.



Figure 3. Soybean pith with dark-gray discoloration due to microsclerotia of the charcoal rot fungus.

Sources:

1. Bissonnette, S. 2012. The Bulletin. Charcoal rot a hot disease in soybeans. Issue 19, article 2. Illinois University.
2. Malvick, D. 2003. Charcoal Rot of Soybeans in Illinois: Primary or Secondary Disease? <http://bulletin.ipm.illinois.edu/pastpest/articles/200323g.html>
3. Sinclair, J. B. & Backman, P. A. eds. 1989. *Compendium of Soybean Diseases*. 3rd ed. American Phytopathological Society. St. Paul. MN. 106 pp