Cylindrocladium Black Rot (CBR) of Peanut, Soybean, and Forage Legumes in Florida

Tom Kucharek, Professor and Extension Plant Pathologist, Plant Pathology Department, University of Florida, Gainesville FL 32611. 1995; Revised, February, 2000.

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CAUSE

The fungal disease Cylindrocladium black rot (CBR) was first found in 1965 in peanut in southwest Georgia. It was not until 1975 and 1976 that CBR was first found in peanut in Florida, in Alachua and Columbia counties. In the mid 1980s CBR was found in peanut in the panhandle section of Florida. Since 1975, CBR has been found in alfalfa, clovers, and soybean. Also, CBR has been found in hairy indigo, coffeeweed, and beggarweed in Florida. Among the weed species in the central Florida area, hairy indigo is the weed that is most commonly seen with CBR. In soybean, this disease is sometimes called red crown rot. Other crops reported to be susceptible to CBR are cowpea, bean, blueberry, and tobacco but in Florida CBR has not been found in these four crops. However, in blueberry, a related fungus has caused disease in Florida.

Yield losses from CBR in some infested fields of peanut in Florida have exceeded 50%. Cylindrocladium black rot has become a limiting factor for the production of peanut in some fields in the panhandle area, particularly in Santa Rosa County. In general, CBR appears to be gradually increasing in severity in peanut throughout the peanut-producing areas of Florida. Additionally in Florida, Cylindrocladium black rot has caused significant damage to plantings of alfalfa but levels of damage from CBR in soybean have been minimal. However, in Louisiana severe damage to soybean from CBR has been reported.

The fungus that causes CBR is *Cylindrocladium parasiticum* (*Cylindrocladium crotalariae)*. The sexual stage, *Calonectria ilicicola* (*Calonectria crotalari*ae), produces spores called ascospores. They are produced within bright red spherical structures called perithecia which sometimes can be seen on lower stems or peanut pods. The asexual stage produces spores known as conidia, which are formed externally on infected tissue. Neither spore type is considered to be important in the causation of this disease. However, ascospores are likely to function as sources of genetic variation within the species. Other species of *Cylindrocladium* have been reported to infect soybean.

Temperatures near 77° F are optimal for fungal growth, formation of ascospores and perithecia, and development of symptoms. The severity of CBR is reduced as soil temperatures deviate from 68° F to 86° F. Fungal growth and production of ascospores and perithecia can occur from 58° F to 91° F.

Ascospores can be produced more than one time within the same perithecium. Ascospores are discharged within a mucilaginous ooze from the perithecium during periods of reduced humidity. However, ascospores lose their germinability rapidly after discharge into reduced humidities. Spread of ascospores is primarily by physical contact with rain drops or other mechanical means. High soil moisture and abundant rainfall are favorable for infection and development of CBR.

The fungus, *C. parasiticum*, produces microsclerotia. (small aggregates of hyphae with a hardened exterior) within infected tissue, particularly in roots. Microsclerotia serve as inoculum for CBR by germinating to form fungal strands (hyphae) in the soil. These hyphae penetrate root, pod (for peanut), or lower stem tissue. Roots of peanut are commonly infected via hyphae through nitrification nodules.

Microsclerotia are distributed for long distances by wind which blows crop debris and infested soil, and by equipment and livestock which moves soil from field to field. Additional spread of the fungus within a field occurs with tillage of soil and harvest operations. Microsclerotia in soil and infected weeds during rotation periods provide mechanisms for long term survival of *C. parasiticum.* A five-year interval of bahiagrass between peanut plantings was inadequate to reduce CBR in one situation.

Soils that remain at 40° F or less for four weeks or longer during the winter have fewer sclerotia than warmer soils. Thus, winters in Florida are not cold enough to reduce inoculum (microsclerotia) for CBR. Microsclerotia survive better when buried with tillage operations than when left on the surface of the soil after harvest.

Some additional factors can influence the severity of CBR. For example, nematode damage can increase levels of CBR in some peanut varieties. Damage to root systems from cultivation is also likely to enhance CBR.

SYMPTOMS

In peanuts, symptoms generally appear during July or August in Florida. However, in forage legumes, symptoms have been observed in May to June in Florida. Cylindrocladium black rot tends to be more severe during seasons with excessive rains, particularly on heavier (less sandy) soils. The greater severity of CBR in Santa Rosa County and a few other areas in the panhandle area, when compared to the central peanut-producing area from Ocala to Live Oak, is likely caused by the presence of heavier soil in the panhandle area. Sandier soils allow better drainage of excess moisture.

Like many other soilborne diseases, CBR does not occur in a random pattern in fields. Rather, CBR occurs in non-random patches (Fig. 1). After the disease becomes distributed within a field across many years, the patchy occurrence becomes less obvious. Often the more severely affected areas in the field are in the wetter sites. Symptoms include wilting (Figs. 1 & 2) and eventually death of entire vines or plants (Fig. 1).

When the fungus invades plant tissues, discolored plant tissues result. Initially, infected tissue may be brown, but usually such infected tissue becomes black (Figs. 3 & 4). Such discoloration is common in lower stems, pegs, and pods (Figs. 3 & 4). Additionally, red perithecia can often be seen on lower stems (Fig. 3) or pods. The presence of perithecia is useful in distinguishing CBR from other soilborne diseases, such as white mold (caused by *Sclerotium rolfsii*), Rhizoctonia-induced diseases, nematode damage, or other diseases. The soilborne disease white mold and other soilborne problems can occur at the same time as CBR in the same field. Occasionally in Florida, a related fungus, *Nectria* spp., produces red perithecia seen on lower stems of peanut. The importance of *Nectria* spp. in relation to causation of disease in peanut has not been determined. Another fungus that produces reddish perithecia on peanut is *Neocosmospora sp.* Its causal relationship to disease in peanut is imperfectly understood at this time, but it can be pathogenic.

Symptoms and signs of CBR in other legume crops, such as soybean (Fig. 5) and alfalfa (Fig. 6), are similar to those in peanut. Infected hairy indigo generally produces an abundance of perithecia on the lower blackened stem. The initial wilting associated with CBR in peanut, soybean, alfalfa, or clovers from CBR tends to be associated with bright yellow to red leaf discoloration (Figs. 2 & 6). Browning of leaves occurs later. Initial leaf discoloration associated with white mold tends to be dull green to silvery. Confirmation of field diagnoses with laboratory tests is recommended if any doubt exists.

CONTROL

At this time, tactics that are likely to elicit total control for CBR are not available for any susceptible crop. The best control available is to utilize as many of the control tactics as possible for each field. If possible, avoid planting susceptible crops in infested fields. Crop rotations of peanut with four to five years of bahiagrass have not been adequate for suppression of CBR in some situations. However, because higher levels of CBR are directly related to higher levels of microsclerotia in soil, crop rotation with non-susceptible crops is likely to be useful to some degree. Susceptible weeds such as hairy indigo, beggarweed, and coffeeweed should be reduced or eliminated. Such weed control should be done when the susceptible crop is being grown and during rotational years when the susceptible crop is not being grown.

Plantings should be in fields that are well drained. Soil and plant debris should be removed from tractor tires and implements before moving from an infested to a non-infested field. Later planting of peanut has resulted in reduced levels of CBR. Because peanut is typically planted earlier than soybean in Florida, the later planting of soybean may be why CBR typically occurs less frequently in soybeans when compared to peanut.

Resistance to CBR in alfalfa has been pursued in Florida and elsewhere, but resistant varieties are not currently available. Some varieties of peanut (e.g., NC 10C) have low levels of resistance to CBR for use in Virginia and North Carolina. Comparisons of varieties in Florida and elsewhere have resulted in less CBR in Florunner, a commonly grown variety, when compared to NC 10C, Florigiant, and some other varieties. However, severe cases of CBR in Florunner in commercial plantings in Florida override any consideration that Florunner possesses any useful level of resistance to this disease. Some Spanish-type varieties possess slight resistance to CBR. The peanut varieties NC 12C, Georgia Green, Florida MDR 98, and Southern Runner incur less damage than Florunner and other susceptible varieties.

Chemical control for CBR in peanut has provided some control. In Virginia, North Carolina, and to a limited extent in Georgia, preplant fumigation with metam-sodium has been used successfully, particularly if fumigation is coupled with use of a resistant variety. The fumigant must be applied two to three weeks prior to planting. Typically, the fumigant is applied behind a chisel set 10 to 12" deep along the intended center of the row followed by hilling with coulters (ripping & bedding, ripping & hipping).

In Florida, CBR has been suppressed in peanut by means of post-plant sprays of select sprayable fungicides (e.g. Folicur) at mid-season. Control from sprays has been slightly erratic, but usually wilt and black pods have been reduced and higher yields occurred. In some situations the initial yellowing of leaves, is not dramatically reduced but pod blemish is reduced dramatically. More than two tons of peanut have been harvested per acre in some situations after midseason sprays were employed, even though widespread yellowing of plants occurred. However, if plants turn brown in the latter stage of discoloration, i.e., turn brown after the initial yellowing, yield losses increase drastically. Because information about chemicals and varieties is likely to change, acquire current recommendations from the University of Florida.

Some studies show that applications of nitrogen reduce CBR in peanut. This tactic should be avoided because applications of nitrogen to peanut have reduced yields. Reduced nodulation and delayed pod formation occur with increases in applied nitrogen.

Figure 1. Field view of Cylindrocladium black rot in a peanut crop.

Figure 2. Wilting and yellowing of peanut with Cylindrocladium black rot.

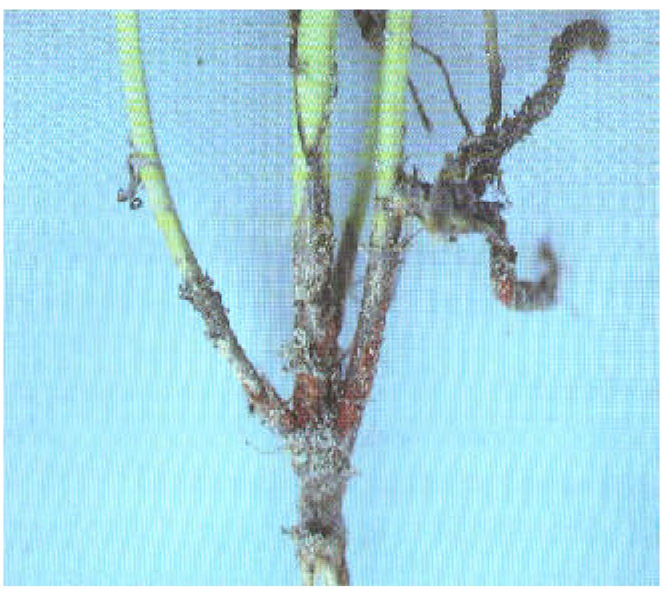

Figure 3. Blackened lower stems of peanut with red perithecia.

Figure 4. Symptoms of Cylindrocladium black rot in pods and pegs of peanut.

Figure 5. Lower stem symptoms of Cylindrocladium black rot in soybean.

Figure 6. Wilting and yellowing of alfalfa with Cylindrocladium black rot.