Some Common Soybean Leaf and Stem Diseases

Tom Kucharek, Professor, Plant Pathology Department, IFAS, University of Florida, Gainesville. 1981; Revised February 2001

Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / Christine Waddill, Dean

Introduction

Soybeans are susceptible to dozens of parasitic organisms. In Florida, fungal parasites predominate, but bacterial and viral diseases occur to some extent. If total control of fungal diseases could be achieved in Florida, soybean yields would increase by more than 50 percent. This publication will discuss some common fungal diseases that occur on leaves and stems of soybean plants in Florida. These diseases have never been observed by this author to kill a plant; rather they cause yield loss by continual debilitation of the plant. All eleven disease-causing organisms discussed in this publication can remain in soybean residue in the soil from one year to the next. Except for the web blight organism, all can be carried in or on the seed.

Fungi are organisms without chlorophyll, with microscopic spores and with microscopic threads called hyphae. Some types of spores are survival structures while other types are disseminated by wind or rain, land upon a leaf, and germinate with the germ tube penetrating (infecting) the tissue. A downy mildew spore (conidium) is about 1/1000 of an inch long.

Bacteria are single-celled organisms that multiply rapidly by fission. Those that cause plant diseases lack chlorophyll and generally are about 1/12,000 of an inch long.

Viruses are noncellular, being composed of protein and nucleic acids only. They reproduce in living plant cells by redirecting cellular functions of the plant. A typical soybean mosaic particle is about 1/35,000 of an inch long.

Brown Spot

Brown spot is caused by the fungus, *Septoria glycines*. This disease may occur in plants any time during the season. It is primarily a leaf disease, but seeds, stems, and pods can be infected. Primary inocula comes from infected seed or old plant debris in the field. Brown spot is more apt to be severe in low, wet fields or after periods of heavy rains.

Brown spot (Figs. 1 & 2), old downy mildew lesions (brown spot in upper center of Fig. 3) and bacterial pustule (Fig. 10) produce similar appearing leaf lesions. Brown spot lesions vary from pinpoint in size up to 5 mm. Leaf spots are angular or somewhat circular with irregular edges. They are brown in color and leaf spots are usually aggregated as opposed to being randomly dispersed.

A yellow halo may surround individual spots with leaves becoming prematurely yellow and falling off, usually from the lower part of the plant first. Field identification can be done with the aid of a hand lens. Embedded in the dead tissue within the lesion are tiny (1/10 mm), black, pimple-like structures (pycnidia). If the tissue is dry the leaf may have to be remoistened to swell these structures. Microscopic diagnosis may be necessary in some situations.

Downy Mildew

Downy mildew is caused by the fungus, *Peronospora manshurica.* In Florida, downy mildew usually appears in abundance at flowering time or somewhat later. Distinct light yellow spots appear on the upper leaflet surfaces. Later these spots become bright yellow and eventually turn brown with a yellow margin (Fig. 3). At this stage of symptom development, it can be confused with brown spot (Figs. 1 & 2) and bacterial pustule (Fig. 10). On the lower leaf surface tufts of a grey-purple, downy growth may be seen associated with the lesions. These tufts are spores and spore stalks of the fungus. Spores are dispersed primarily by wind. Spores are produced from 50 to 86°F. Older leaves, or younger leaves exposed to high temperatures prior to infection become resistant to the fungus. This fungus can exist in seeds or as thick-walled resting spores in soybean crop debris. Numerous races of this fungus exist, and some varieties may be more susceptible than others. At this time, downy mildew does not appear consequential in relation to yield. However, seed from plants infected severely might be less vigorous in germination.

Frogeye Leaf spot

Frogeye leaf spot is caused by the fungus, *Cercospora sojina* In Florida, frogeye leaf spot occurs from the time soybeans are flowering until the leaves mature. Frogeye leaf spot occurs primarily on the leaves and petioles, but stems, pods, and seeds are infected also. Leaf spots are 1 to 5 mm in size, usually circular, but occasionally angular. The spot begins as a pinpoint reddish-brown area that expands with a reddish-brown-purple ring on the outside, with the center of the spot being tan to grey to white. No yellow halo surrounds these spots (Fig. 4). The fungus survives between seasons in seeds and old soybean debris. Young leaves are more susceptible than older leaves. Frogeye leaf spot reduces yield directly by reducing active photosynthetic tissue and by the secretion of toxins by the fungus.

Anthracnose

Anthracnose is caused by the fungi, *Colletotrichum truncatum, Glomerella glycines, G.cingulata, G. graminicola* and possibly other related fungi. Anthracnose is a major yield-reducing disease on soybeans in Florida. This disease is generally a late season (pod set to harvest) disease but it can occur earlier. Anthracnose can be associated with seedling blights or early to mid season petiole blemishes. Leaves, petioles, stems, pods, and pedicels (flower and pod stalks), are susceptible. Pod infection can occur by the fungus alone, but stinkbug injury predisposes the plant to more severe infections. Anthracnose will be reduced in severity during “dry” seasons. These fungi carry over from one season to the next in seed and old soybean debris. The anthracnose fungi can infect lima bean, clover, alfalfa and other forage legume crops. Symptoms of anthracnose are variable. The seeding blight phase of this disease has not been observed in Florida. Leaf petioles may become infected, resulting in elongated (2 “ or more), reddish brown lesions. Other diseases such as pod and stem blight or web blight may cause similar symptoms on petioles. Stem and pod symptoms include blotchy areas of discoloration which are usually grey but nay be reddish-brown (Fig. 5). Often stems may not have the blotchy discoloration, but rather small lack cushion-like structures (Fig. 6). With a magnifying glass you can see black spines growing from he spore bearing cushions (acervuli).

Pod and Stem Blight

Pod and stem blight is caused by the fungus *Diaporthe phaseolorum* var. *sojae.* The imperfect (conidial) stage is *Phomopsis phaseoli.*This fungus along with other species of *Diaporthe* and *Phomopsis* causes significant yield loss and

is commonly associated with low quality, poor germinating seed. Leaves, petioles, stems, pods, seeds, and roots are susceptible. Seeds may be infected with no visible symptoms. However, seeds that are shriveled, cracked, or small in size should be suspected of being infected with this fungus or other fungi. The pod and stem blight fungus can also infect other plants such as lima bean, cowpea, snap beans, peanuts, lespedeza, lupine, pepper, tomato, okra, onion, and garlic.

Signs and symptoms of pod and stem blight usually appear late in the season, but the fungus can be in the plant earlier without expressing symptoms. Then, late in the season, black, pimple-like, spore-bearing structures (pycnidia) suddenly appear. They are arranged in a linear fashion on the stem (Fig. 7). Shaving the skin or bark off of a soybean stem often will reveal black stroma (matrix of fungus mycelium) growing throughout the inner part of the stem (Fig. 8). This stroma or matrix can be present without the pycnidia mentioned earlier. A related fungus, *Diaporthe phaseolorum* var. *caulivora,* caused a major epidemic in the southeastern U.S. in 1983. The name of that disease is stem canker.

Aerial Blight (Web Blight)

Aerial blight is caused by the fungus *Rhizoctonia solani* This disease is caused by the same fungus that causes seedling blight and root rot (See Plant Pathology Fact Sheet No. 1). Aerial blight may be present at low levels without being noticed, but when the plants are mature with a closed canopy of leaves across the field and when frequent rains occur, aerial blight will spread fast. Within one week or less an entire field will appear scorched. Small fields bordered by trees or poorly drained fields are more apt to have severe aerial blight. This fungus has an extremely wide host range.

Symptoms are variable but often diagnostic in the field. Microscopic examinations can confirm the presence of this fungus. Stems, flowers, pods, petioles, and leaves are susceptible. Root tissue is also susceptible but such an infection may occur without causing aerial blight. Lesions in leaflets can range in size from a single pinpoint to coverage of the entire leaflet. Usually the lesion is brown to pale green in color. If the lesion is fresh it may have a greasy appearance. Lesions do not have a distinct shape; lesion shape is determined by tissue colonized by the fungus (Fig. 9). Fungal hyphae can be seen on infected tissue; it will appear as a brown spider-like web and is most apt to be seen early in the day or when the canopy is still moist. Pods and stem tissue that are infected will be greasy, brown, and shriveled.

Bacterial Pustule

Bacterial pustule is caused by the bacterium *Xanthomonas campestris* pv. *glycines.* The bacterium is common in nature, but because of the presence of a single recessive gene in most commercially available varieties, this disease is not a major problem. Without this resistance it would be difficult to grow soybeans in the Southern U.S.A. The bacterium enters leaves or other plant parts through natural openings (stomata) or via wounds. Once inside the plant, the bacterium multiplies and lesions are produced. Spread of the bacterium occurs primarily by wind-blown rain and cultivation when the plant is wet. The bacterium can multiply from 50 to 100° F. Optimum conditions are from 86 to 91°F. The bacterium can live from one season to the next in seed and soybean litter in the field. The incubation period may vary depending on numerous weather variables and varieties, but a 5-7 day incubation period is standard. Young leaves are more susceptible than older leaves. Leaf symptoms of bacterial pustule are similar to brown spot and old downy mildew. Pinpoint spots expand into brown, angular lesions with or without a yellow halo. Small raised pustules in the center of the lesion are conspicuous on some lesions (Fig. 10).

Bacterial Blight

Bacterial blight (Fig.11) is caused by the bacterium *Pseudomonas syringae* pv. *glycinea.* This disease was found for the first time in Florida in 1982 in Madison County. It was limited to the variety "Centennial'. It occurred for a couple more years in nearby counties but then ceased to be a problem. The bacterium enters tissue in leaves through stomata. Optimal temperatures for growth of this bacterium are from 76-80°F. With the advent of hot temperatures in July and August, the progress of this disease was suppressed. Control of bacterial blight is easily accomplished with resistant varieties. Many strains or races of this bacterium exist around the world.

Powdery Mildew

Powdery mildew is caused by the fungus *Microsphaera diffusa.* It is an uncommon disease of soybeans in Florida. It is favored by temperature from 64-75°F. Powdery mildew is not active at 86°F or above. Symptoms in the field are diagnostic. A white powdery growth is seen on the -upper leaf surface (Fig. 12). This fungus can infect other legumes and some solanaceous plant species.

Target Spot

Target spot is caused by the fungus *Corynespora cassiicola* This fungus has a wide host range including: cotton, cowpea, cucumber, beans, lima beans, lupine, okra, pepper, sicklepod, tomato, and watermelon. Leaf infection occurs only when the relative humidity is above 80% or when free water is present on the leaves. This is not a common disease on soybeans in Florida, but it is capable of reducing yield. The fungus can overseason on old soybean debris in the field or in seeds. Many varieties are resistant to the disease, which accounts for its infrequent occurrence. Leaves, petioles, stems, pods, seeds, and roots are susceptible. Lesions in leaves are brown, somewhat round, and begin as pinpoint spots which can expand up to 1/2 inch across. A thin yellow halo may surround the spot (Fig. 13).

Leaf Bronzing and Purple Seed Stain (Cercospora Leaf Blight)

Leaf bronzing and purple seed stain are caused by the fungus *Cercospora kikuchii.* Leaves, petioles, stems, pods and seeds can be infected. This disease can cause yield reduction and downgrading in seed quality. The fungus survives in soybean debris in the field and in seeds. Infected seeds will have a reduced and low vigor germination. Seeds can be infected either through the flower or through the pod after seed formation. Often the upper-most leaves on a full grown plant are infected whereas lower leaves may or may not have some degree of infection.

Symptoms on leaves include, spots 2-3 mm across, reddish brown and angular. Spots are often small but aggregated and appearing as a purple to red to bronze crust (Fig. 14). Seeds may be infected without expressing symptoms, but a pink to purple coloration on the seed coat is diagnostic. (Fig. 15).

Control

Diseases of soybeans are numerous, and therefore, numerous controls must be used in a sequence to reduce damage. Specific recommendations are available from your county Extension office, and these are subject to change each year. However, briefly, the following controls are basic and essential to control all diseases described in this publication:

(1) Use disease-free seed. Most soybean diseases are seedborne. (2) Use crop rotation with grass crops. (3) Use a moldboard plow to bury old stubble. (4) Control weeds because they increase moisture retention on leaves and interfere with fungicide sprays. (5) Use a seed

treatment as it can reduce inoculum of several seedborne diseases. (6) Use resistant varieties where available. (7) Fungicide recommendations are recommended for certain situations. (8) Harvest soybeans as soon as they mature. Leaving soybeans in the field beyond maturity results in a poorer quality bean or seed and can be counterproductive to other control measures used earlier.

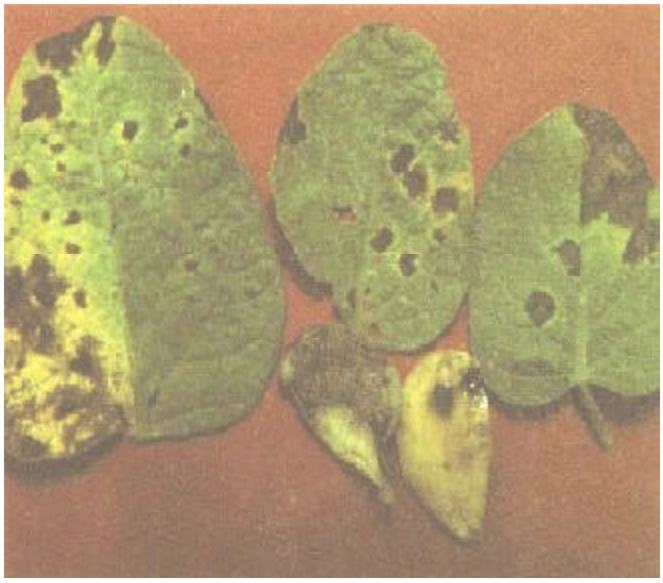

Figure 1. Brown spot in cotyledons and soybean leaves.

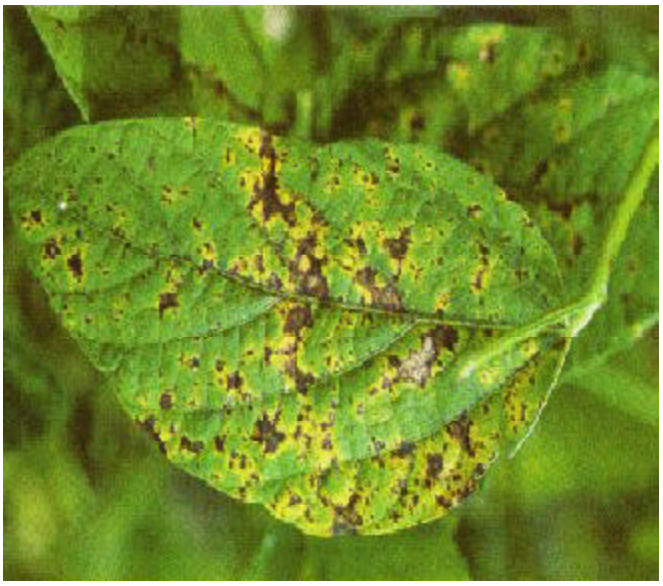

Figure 2. Brown spot in soybean leaves.

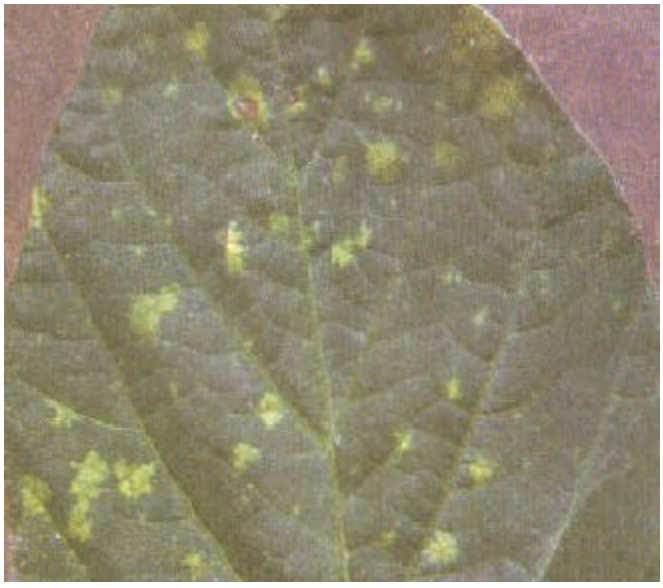

Figure 3. Downy mildew.

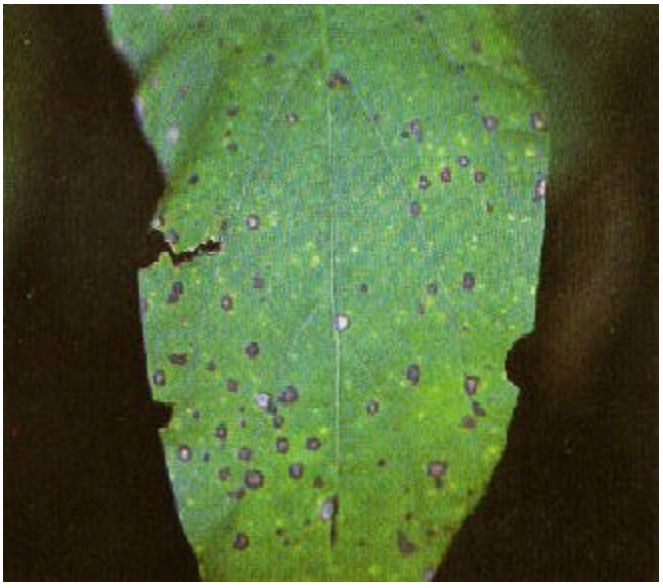

Figure 4. Forgeye leaf spot.

Figure 5. Anthracnose.

Figure 6. Anthracnose.

Figure 7. Pod and stem blight (Photo courtesy of Clemson Extension Service).

Figure 8. Pod and stem blight fungus stroma in inner stem tissue.

Figure 9. Aerial blight (web blight).

Figure 10. Bacterial pustule.

Figure 11. Bacterial blight.

Figure 12. Powdery mildew.

Figure 13. Target spot.

Figure 14. Leaf bronzing (Cercospora blight).

Figure 15. Purple seed stain (Cercospora blight).