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Foliar and Head Diseases of Sorghum in Florida

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Sorghum is not a major crop in Florida but its potential for growth is good if problems related to markets, perceived nutritional value for livestock, and diseases can be solved. Solving plant disease problems begins with accurate identification of the causal agents. In Florida-produced sorghum, several diseases caused by fungi and one bacterial disease occur. The purpose of this publication is to provide information on the field diagnosis and control of diseases that occur in leaves and seed heads of sorghum in Florida. Root and stem diseases (e.g. Fusarium and Pythium root rots) also occur but information relating to these soilborne diseases is limited at this time.

ANTHRACNOSE

Anthracnose is caused by the fungus *Colletotrichum graminicola*. Anthracnose is the most common disease of sorghum in Florida and has caused yield decreases in excess of 50%. This fungus can cause seedling blight, foliar leaf spots, root rot and stalk rot. Foliar leaf spots represent the most predominate phase in Florida. In drier production areas, the stalk rot phase (red rot) may be more important than the foliar phase.

Leaf symptoms of anthracnose appear as elliptical small reddish-purple to tan (depending on the variety) spots that expand to lengths of 1/8 to 7/8". Commonly, lesions appear first in the midvein (Fig. 1) and as the epidemic proceeds, abundant lesions occur in the leaf blades and sheaths (Fig. 2). Full-sized spots are usually tan in the center with a distinct reddish-purple to brown border. Within the tan center, fruiting structures (acervuli) of the fungus are visible through a hand lens. The fruiting structures contain a gelatinous mass of white spores. Interspersed among the spores are dark spines (setae). With an increase in lesions in leaf blades, more lesions will be found in leaf sheaths, peduncles (stem between uppermost leaf and the head), and flower parts (e.g. glumes).

Lodging can be more severe if the foliar phase of anthracnose is severe. Anthracnose causes lodging indirectly because the leaf phase reduces the amount of nutrients translocated to the stem or directly by the infection of the stalk, causing a disease called red rot.

In addition to the anthracnose fungus, other fungi are likely to be associated with stalk rotting and lodging. Important sources of inoculum (spores) to initiate the leaf phase of anthracnose include susceptible crops or weeds or crop refuse from those susceptible plants. The anthracnose fungus also causes disease in grass species such as Johnsongrass, Sudangrass, sorghum-Sudan hybrids, broomcorn, corn, rye, sugarcane, and other grasses. Thus, inoculum for a sorghum crop may originate from these

other plant species or their residues associated with the soil, particularly if the crop refuse is near the soil surface. However, in some studies, anthracnose was less severe in no-till plantings compared to conventionally tilled plantings.

Seed transmission of the anthracnose fungus has been demonstrated. However, this source of inoculum is not likely to be as important as that from the field unless the inoculum associated with the seed is a new or different pathogenic race for sorghum or the planting site is initially void of inoculum.

Isolates of the anthracnose fungus from one grass species may or may not infect another grass species. Within those isolates that infect sorghum, pathogenic races of this fungus exist. Thus, varieties that are resistant to the isolates in one location may be more susceptible to other isolates in another situation. For example, in Florida, some varieties have been highly resistant to anthracnose (Fig. 3.) in some tests but in tests conducted in later years, those same, varieties were more susceptible. Presumably shifts in pathogenic races occurred. Interestingly, in Florida, forage sorghum types tend to be more resistant to anthracnose than grain sorghum types.

Frequent rains or irrigation during the summer months in north Florida, when night temperatures are warm, provide optimum conditions for infection, symptom development and disease spread. Leaves of susceptible varieties with numerous lesions turn brown prematurely and significant yield losses result (Fig. 3).

Control of anthracnose includes: 1) crop rotation 2) use of resistant varieties; 3) suppression of grass weeds and volunteer sorghum in and around the field; 4) burial of old sorghum debris by plowing (the need for this is conjecturable); 5) planting in mid April to early May in northern Florida usually result in less damage from anthracnose than later plantings, and 6) avoidance of field operations when leaves are wet.

ZONATE LEAF SPOT

Zonate leaf spot is caused by the fungus *Gloeocercospora sorghi*. It has not been a major problem in Florida but in variety evaluation tests, some varieties were clearly more susceptible to zonate leaf spot than other varieties. Young lesions or small lesions may appear similar to those caused by the anthracnose fungus. However, large lesions are distinctive with their circular alternating bands of white or tan with bands of reds, purples, or browns (Fig. 4).

Frequent rains or irrigation coupled with warm nights, such as those during the summer in north Florida, are conducive for development and spread of target spot. Equipment moving through the field can also serve as a mechanism for spread, particularly when the leaves are wet. Spores are produced in a gelatinous matrix on the surface of the leaf lesions and on overwintering sclerotia (an aggregation of fungal hyphae into a cushion-like structure with a firm outer rind). When leaves are wet, spores germinate by forming filament-like structures which penetrate the leaf surface. Tiny dark, pinpoint lesions may be seen in the leaf 24 hours after the infection begins.

Other host plants for the fungus that causes zonate leaf spot include corn, Sudangrass, sorghum-Sudangrass hybrids, Johnsongrass, broomcorn, napiergrass, sugarcane, bentgrass, bermudagrass, and possibly other grasses. The fungus survives in old crop refuse or in the soil as black sclerotia formed in infected leaf tissue. Crop rotation, use of resistant varieties, burial of old crop debris by plowing, and avoiding field tasks when the leaves are wet should reduce this disease.

ROUGH SPOT

Rough spot is caused by the fungi *Ascochyta sorghina* and *A. sorghi*. The former species is thought to predominate in Florida. Most varieties are not highly susceptible to rough spot but occasionally susceptible varieties appear in Florida. Rough spot could be as damaging as anthracnose in Florida if susceptible varieties were grown. Old crop residues and seed are reported to be sources of inocula. Spores of this fungus are produced within flask-shaped structures (pycnidia) and are spread primarily by rain or irrigation splash. However, physical contact with field equipment could serve as another method of spread, particularly when the leaves are wet. Little is known about the life cycle of this disease. Rough spot has occurred in Johnsongrass, Sudangrass, and wild sorghum types.

Symptoms of rough spot occur in leaf blades and sheaths, peduncles, stalks and certain flower parts (e.g. glumes). Leaf symptoms from other geographical areas have been described as beginning as small circular to oblong lesions that are tan-colored in the center with a distinctive or well-defined border. Then, the spots enlarge to oval to elliptical blotches that are 1/2 to 1" long and are gray, red-purple, yellow-brown in color. In Florida, rough spot appears similarly except the color of the lesions tended to be dark brown to black and the tan center during early lesion formation is not apparent (Fig. 5). A mild irregular yellow area around the blotch may also be present (Figs. 5 & 6). Also, in Florida, the margins of lesions are somewhat feathered (Figs. 5 & 6). The most distinctive feature of rough spot is the sandpapery feel of the lesion because of the numerous spore-bearing structures (pycnidia) on the leaf surface (Fig. 6).

Control of rough spot includes the use of 1) crop rotation, 2) deep plowing of old crop residues, 3) use of resistant varieties, and 4) avoiding field operations when leaves are wet.

NORTHERN CORN LEAF BLIGHT (LEAF BLIGHT)

Northern corn leaf blight (NCLB) is caused by the fungus *Exerohilum turcicum* (*Helminthosporium turcicum*). This fungus can cause a major foliar disease in corn (field and sweet), but it has been seen only on occasion in sorghum in Florida. Johnsongrass, Sudangrass, teosinte, and gamagrass are also hosts for this fungus. In other geographical areas, losses near 45% have occurred from NCLB in sorghum. Pathogenic races occur but they have not been classified for isolates that infect sorghum. Aggressiveness of those races that infect corn or other grasses has not been determined in sorghum.

This fungus produces spores (conidia) on leaf lesions and crop refuse. When wind disseminates these spores to susceptible leaves, infection of the leaves occurs when a filament from the germinating spore penetrates the leaf surface. Leaf moisture is required for spore germination and infection. Within three to six days after infection, lesions appear and between six and 14 days, a new crop of spores are formed on the lesions. Spore production and lesion development occur between 50 to 94° F but optimum temperatures for disease development are near or slightly below 61° F for a minimum daily temperature when the average daily temperature is near 72° F. This fungus can also produce thick walled spores called chlamydospores which lengthens the survival time of the organism in soil.

Mature lesions vary in size but may be from 1 to 6" long and up to 1/2" wide (Fig. 7). Lesions tend to be cigar-shaped, tan to brown in the center. Sometimes lesions are multiple-pointed at the tips. A lesion may or may not be surrounded by a dark brown-reddish purple border or a narrow band of water soaking (Fig. 7).

If control is needed, use resistant varieties, crop rotation with non grass crops, and bury old sorghum crop debris. Also, destroy Johnsongrass and volunteers of susceptible crops in the vicinity.

BACTERIAL LEAF STRIPE

Bacterial leaf stripe (bacterial stripe) is caused by the bacterium *Pseudomonas andropogonis*. It occurs in Florida and elsewhere but is not a major problem. Other hosts include corn, Johnsongrass, Sudangrass, teosinte, sugarcane, clover, velvet bean, and other Sorghum spp. Sorghum varieties differ as to susceptibility but apparently most are resistant.

This bacterium can grow from 40° F to 100°, but the optimum for growth is near 72 to 86° F. Rain, irrigation water, or contact are the main methods for its spread. Bacterial cells enter the leaves through breathing pores (stomates) and can live in old crop debris. Infection of the kernel, peduncle, rachis, and inner stalk tissue can occur. Apparently, this bacterium can be seedborne.

Lesions often first appear as reddish-purple to tanbrown somewhat linear spots less than 1/2 " long. Lesions tend to be interveinal and may attain lengths of 8" with the lesion color being fairly uniform throughout (Fig. 8).

Control methods include: 1) crop rotation, 2) resistant varieties, 3) plowing down old crop debris, and not working in the field when it is wet.

SORGHUM RUST

Sorghum rust, caused by the fungus *Puccinia purpurea*, has not been a major problem in Florida. Sorghum rust produces slightly elongated raised pustules in leaves and in the outer tissue of the peduncle (head stem). The pustules in leaves are typically not more than 1/8" long in leaves, and often surrounded by a reddish-brown to tan halo. Pustules in the peduncle may be longer and linear in appearance or within oval red to brown lesions.

Within the raised pustule, a red to orange brown mass of spores (urediospores) will be exposed if the peridium (covering) of the pustule has ruptured. If the peridium has not ruptured, it can be cut with the tip of a pocket knife to expose the urediospore masses. These spores are dispersed primarily by wind. Spores will germinate on wet leaves by forming a small filament that penetrates the leaf. Approximately 10 to 14 days after infection, new pustules with spores are formed. Later, teliospores, a different spore type, may form within these pustules or new pustules. In mass, the teliospores are dark brown to black.

This rust fungus also infects *Oxalis comiculata*, a type of sorrel, where a third type of spore (aeciospore) is produced. The importance of this latter spore stage in the field for sorghum rust is not known.

Little is known about this rust fungus, but some indications suggest that it is more likely to cause disease during cool, wet conditions. Some have suggested that forage sorghums tend to be more susceptible than grain sorghum types. If this disease becomes a problem, resistant varieties would be the primary control.

SORGHUM DOWNY MILDEW

Sorghum downy mildew is caused by the fungus *Peronosclerospora sorghi*. In Florida, it has occurred in sweet corn and an inter-specifically derived sorghum related weed (*Sorghum almum*) in central Florida. It has not occurred in commercial grain or forage sorghum up to this time.

HEAD MOLD

Head mold is caused by many fungi. *Fusarium* spp. (e.g. *F. moniliforme*, Fig. 9), *Curvularia* spp., *Colletotrichum* spp., *Alternaria*

spp., *Helminthosporium* spp. and other fungi have been associated with head mold in Florida. These fungi can survive in old crop debris and in association with other crops. This complex disease has been severe in some plantings, particularly in varieties with tight panicles (heads) or some non-bird resistant types. Varieties with white to yellow to bronze seed coats tend to be more susceptible to head mold than those with red seed coats. Florida's warm and wet summer weather is conducive to head mold. Infection begins during flowering and continues throughout grain filling. Feed value for livestock is reduced significantly and some of these fungi (e.g. *Fusarium* spp.) may produce toxins that poison livestock.

Head mold is evident by the abnormal colorations and moldy growths on the head. *Fusarium* spp. typically cause a white to pink coloration on the outside of the flower and seed parts (Fig. 9). Also, inner tissues of the flower branches and head stalk may be discolored with shades of red to dark brown.

Controls include: 1) planting so that flowering is initiated during drier months, 2) reducing insects such as the sorghum midge, and 3) using resistant varieties.

Figure 1. A lesions of anthracnose in the midvein of a leaf.

Figure 2. Multiple lesions of anthracnose in leaves.

Figure 3. Resistant (left) and susceptible (right) varieties to anthracnnose.

Figure 4. Zonate leaf spot.

Figure 5. Rough spot in leaves.

Figure 6. Rough spot with pycnidia in leaf.

Figure 7. Northern corn leaf blight (leaf blight).

Figure 8. Bacterial stripe.

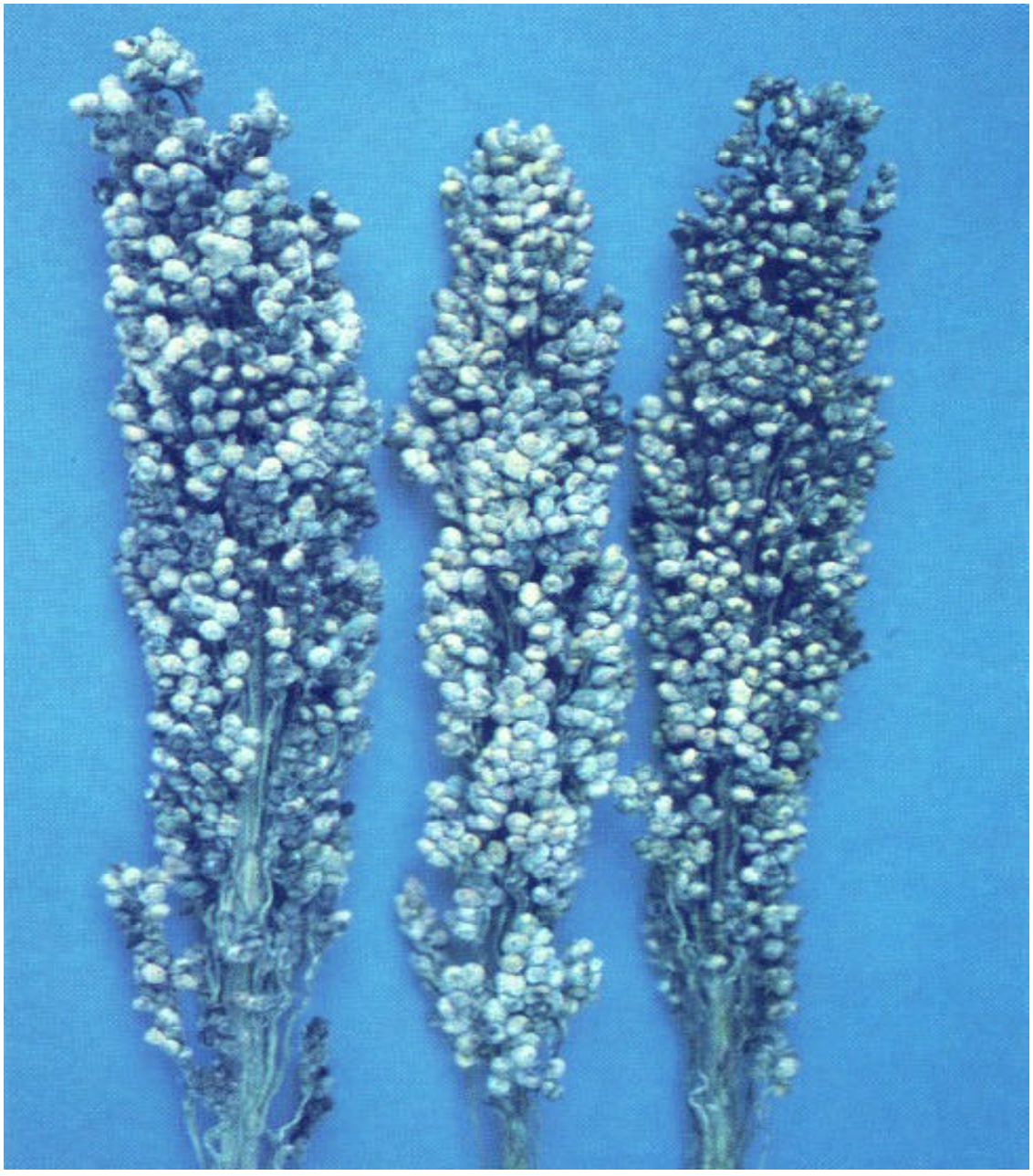

Figure 9. Head mold caused by *Fusarium moniliforme (F.subglutinans).*