

Bipolaris Leaf Spot on Switchgrass: *Bipolaris* species

Introduction

Bipolaris leaf spot is caused by a number of species in the fungal genus *Bipolaris*, most notably *B. oryzae*. It has been shown to reduce both seed germination and biomass yield in switchgrass (*Panicum virgatum* L.). The disease occurs throughout the range of switchgrass in North America and is prevalent in high humidity areas. The pathogen is soil and seed-borne so potential control measures include developing resistant cultivars and fungicidal seed treatments.

Symptoms and Signs

The main *Bipolaris* infection comes from fungal infection within seeds. Germination is often reduced in infected seed, which can drop by 70% compared to non-infected seeds. Once infected seeds have germinated, seedlings can show brown lesions on the leaves within one week and some infected seedlings wilt and die. As the surviving seedlings grow, the lesions can continue spreading or show up later in the favorable condition of high humidity (86 – 100%) and hot days (96– 140°F); generally, between June and August in New York. Brown to black oval lesions range in size from 5 – 14 mm. A couple small lesions appear at the beginning of the infection and if hot and humid weather conditions are extended, the lesions will expand to more area of the leaf.



Figure 1 Switchgrass leaf with *Bipolaris* infection. Lesions are typically a 5-14 mm oval and are brown to black, with a central chlorotic circle.

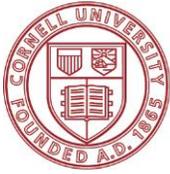
The disease can lead to leaf chlorosis, wilting and early senescence.

Since the same conditions favor both *Bipolaris* and anthracnose (*Colletotrichum navitas*) infections in switchgrass, these diseases can occur at the same time.

Bipolaris leaf spots are small and brown, whereas anthracnose lesions are large with white centers.

Disease Cycle

Bipolaris oryzae can survive as mycelium in soil for many years without a host and is also seed-borne. Infected seeds usually provide the primary inoculum. In a favorable environment, conidia are produced in brown portions of the lesions and



dispersed aerially. The conidia (Figure 2.) germinate and form penetration structures. Hyphae enter the switchgrass leaf cell and induce host cell death from which *B. oryzae* can utilize the nutrients.

Bipolaris oryzae conidia have a short incubation period (less than 24 hours). The disease can develop within 3-4 days and the pathogen sporulates approximately 6 days after the infection, providing secondary inoculum. Thus, the sources of *Bipolaris* are soil, infected seeds, and plant residues in the field and nearby infected fields.

Management Strategies

Since *Bipolaris* leaf spot is a soil- and seed-borne disease and switchgrass is perennial, disease management beginning at planting is critical. Seed applied fungicides may reduce initial disease incidence. Observations of the 'poor man's disease' of rice caused by *B. oryzae* and associated with the 1943 famine in Bengal, India suggested that under-fertilized soil leads to higher disease incidence. Thus, soil tests to monitor soil



Figure 2 Microscopic view of the conidia of *Bipolaris oryzae*. Photo by K. Songsomboon.

nutrients every one or two years is recommended for sufficient nutrient applications. Moreover, silicon amendment has proven effective against leaf spot in rice, although there is no direct research supporting this in switchgrass. When switchgrass is planted on marginal lands with inadequate nutrient and low maintenance, nutritional approaches to control *Bipolaris* are not likely to be economical. Thus, one economical option is to use resistant cultivars. Cornell University, University of Tennessee and others are working to develop switchgrass cultivars with resistance to *Bipolaris* leaf spot.

References:

- Van Bockhaven, J. (2014). Silicon-induced resistance in rice (*Oryza sativa* L.) against the brown spot pathogen *Cochliobolus miyabeanus* (Doctoral dissertation, PhD thesis, Ghent University, Belgium).
- Fajolu, O.L. 2012. Characterization of *Bipolaris* species, their effects on switchgrass biomass yield and chemical components. (Doctoral dissertation, PhD thesis, University of Tennessee, USA).

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