Epidemiology of Gray Leaf Spot of Perennial Ryegrass

Philip Harmon and Richard Latin, Botany & Plant Pathology

Objective

The objective of this research is to investigate environmental factors that influence the overwinter survival of *Magnaporthe grisea* and to determine the role of primary inoculum in the development of gray leaf spot epidemics.

Rationale

Gray leaf spot, caused by *M. grisea*, is a potentially devastating disease of perennial ryegrass that was recently identified as a threat to golf, sports, and landscape turf in the Midwest. The disease was initially identified on perennial ryegrass in 1985 in eastern Maryland. Outbreaks were reported from various other eastern states since 1991. The initial report of gray leaf spot in Indiana was confirmed in 1999.

The epidemiology of gray leaf spot on perennial ryegrass is not well understood. Disease development is associated with hot, humid weather in mid-late summer in northeastern and mid-Atlantic states. Although disease favorable weather occurs each year, outbreaks of gray leaf spot are sporadic, suggesting that factors other than summer time temperatures and moisture conditions influence disease incidence and severity.

The gray leaf spot pathogen spreads during summer months by airborne conidia (spores) that are produced within lesions on infected plants. It is presumed that the conidia that initiate an epidemic are produced on infested ryegrass debris within the turf canopy. This research is designed to determine the extent of overwinter survival and the environmental factors that trigger sporulation at the beginning phase of the epidemic. Knowledge of the amount of inoculum that survives the winter may be critical for predicting disease outbreaks the following summers.

Procedure

Survival experiments were conducted at an established experimental field site and in laboratory facilities. Overwinter survival was addressed by exposing infested perennial ryegrass debris to three environmental regimes, then sampling the debris periodically to assess the viability of the pathogen. Two of the environmental regimes involved sampling of dry tissue stored at different temperatures in controlled environment facilities. For the third regime, the infested debris was sampled from the experimental field site at the Daniel Turfgrass Research Center.

In order to study initial gray leaf spot outbreaks during the summer, *M. grisea* was established at the Daniel Turfgrass Research Center in a three-meter square plot that was inoculated with infested perennial ryegrass debris in July, 2000. In 2001 the disease was allowed to develop from naturally surviving inoculum. Pathogen activity during summer months was monitored by trapping conidia with a continuous volumetric air sampler located at the experimental field site. During each year, the sampler collected airborne conidia (and other particles) directly into small plastic vials from late June through the end of September. Vials were retrieved and replaced every few days and their contents were examined microscopically for the characteristic, pear shaped, three celled spores of *M. grisea*.

Results

Pathogen populations recovered from dry residue showed no significant decrease after exposure to a range of temperatures from -20 C to 4 C as shown in Figure 1 (LAB and VAR treatments). However, when infested debris was hydrated (wet) and **exposed to** ambient winter conditions, survival was decreased significantly (Fig. 1, DAN treatment). Results show that the pathogen will survive the winter in infested debris and that temperature and moisture conditions interact to influence survival.

During the summer of 2000 airborne conidia were detected approximately one week after inoculation with infested residue. The numbers of observed conidia were initially very low, then gradually increased and peaked in early September (Fig. 2). Symptoms of gray leaf spot at the Daniel Turfgrass Research Center were not apparent until mid-August. Disease symptoms were most severe following the peak in spore capture. Gray leaf spot outbreaks throughout Indiana also peaked in severity in early September in 2000. The experimental site was not inoculated in the summer of 2001, and disease was allowed to develop from naturally overwintered inoculum. Airborne conidia were again detected in early July, however, the numbers of spores remained low through the entire summer and disease symptoms were not apparent. Gray leaf spot development was very mild across the Midwest in 2001, and only two reported outbreaks of gray leaf spot were confirmed in Indiana.

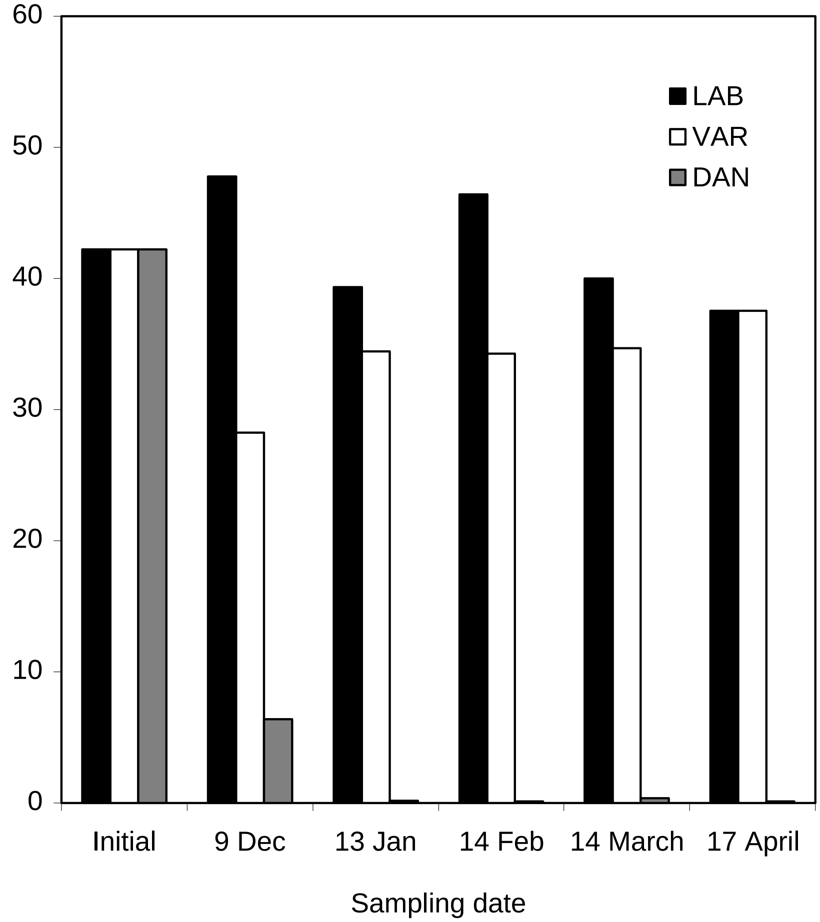

Fig. 1. Recovery of conidia of *M. grisea* from infested residue after exposure to three environmental regimes on five sample dates. The Initial column is an average value of the original dried residue. The LAB regime involved storage at a constant 23 C on a laboratory bench throughout the sampling period. In the VAR regime, residue was maintained in an incubator where exposure temperatures varied and were intended to mimic ground temperatures in the Midwest during a typical period from Nov to May. Residue was stored dry in the LAB and VAR regimes. Infested residue in the DAN treatment was exposed to ambient weather conditions at the Daniel Turfgrass Research Center (DAN) on the Purdue University campus in West Lafayette, IN.

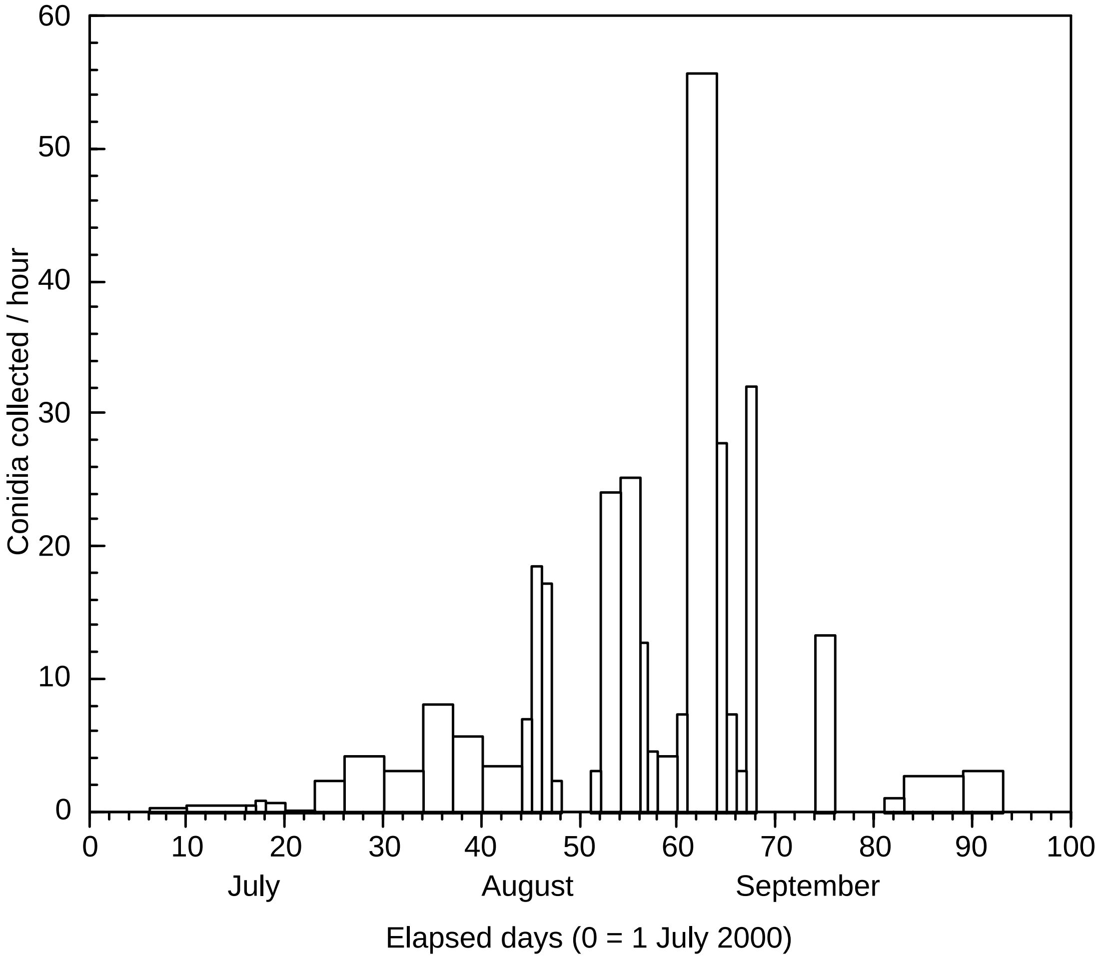

Fig. 2. Conidia of *M. grisea* were collected with a Burkard volumetric air sampling devise during the summer of 2000. Samples were collected at 1-5 day intervals. Width of individual bars indicate sampling interval. The time of peak pathogen activity corresponded with disease outbreaks at the Daniel Turfgrass Research Center.