Detecting Rhizoctonia solani pathogen in turfgrass

Traditional plant disease diagnosis often depends on visual symptoms of necrotic plant tissue, visual signs or evidence of the fungal pathogen and the environmental conditions observed during disease development. This method relies on the principles represented by the "plant disease triangle" in figure 1.

In order for a plant disease to occur, the pathogen must be present and have a viable host to infect and colonize, and the environmental conditions must favor the growth and development of the pathogen over the host. The plant pathologist must rely on "detective-like" skills to piece the pathogen-host environment information together and properly diagnose the plant disease.

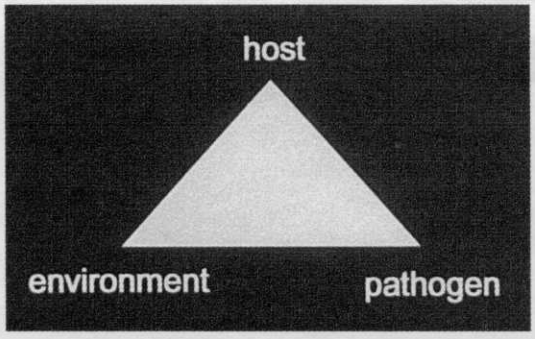

Fig.1 Plant disease triangle represents the plant host/pathogen/environment relationship and its importance in disease development.

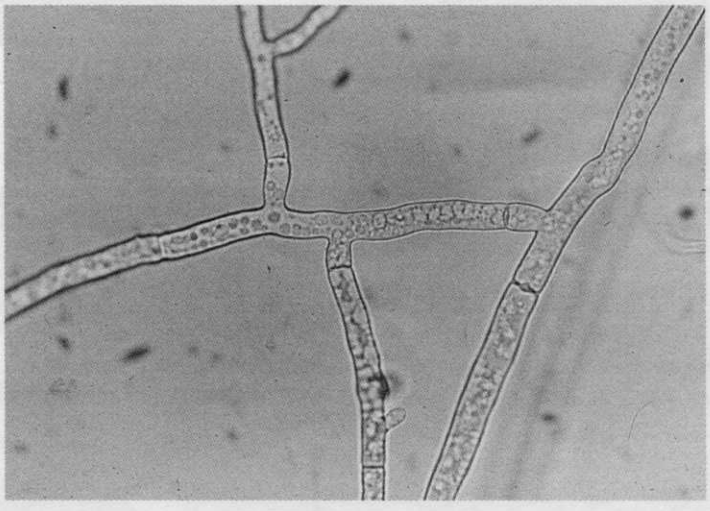

Fig.2 Rhizoctonica solani, the causal agent for Rhizoctonia blight, shown under 400x magnification. Notice the "right angle" branching useful in distinguishing this pathogen from others that cause diseases among turfgrasses.

Ideally, the best way to identify Rhizoctonia solani, the causal agent of Rhizoctonia blight (formerly called "brown patch") in turfgrasses, is with the aid of a microscope. Through a microscope lens, R. solani is differentiated from other turfgrass fungal pathogens by many traits, including characteristic "right angle" branching of the hyphae (Fig. 2). In this decade, advances in molecular biology have led to the identification and development of antibodies that are useful for detecting specific proteins or nucleic acids of plant pathogens. As a result, enzyme-linked immunosorbent assay (ELISA) methods were developed for plant pathogen detection and plant disease diagnosis (1,3,4). Currently, ELISA-based turfgrass disease detection kits are commercially available for identifying Rhizoctonia solani, Sclerotinia homoecarpa (causal agent for dollar spot) and Pythium spp. (causal agent for Pythium blight). In turfgrasses, diseased or necrotic tissue is sampled and processed in only a few minutes with an ELISA test-kit, then confirmation of the pathogen can be quickly determined. This procedure is fast and easy, and can be conducted on the back of a golf cart, or diseased samples can be taken back to the greenkeeper's office for an ELISA test.

A recent field study conducted in Massachusetts on Rhizoctonia blight showed that the number of fungicide applications could be reduced and acceptable disease control achieved by combining weather - based disease forecasts with ELISA-based confirmation of the pathogen. (5)

In a Maryland study, perennial ryegrass was assayed specifically for *R. solani* (2). In that study, the pathogen detection was influenced by the sampling time-of-day and mowing height. The *R. solani* populations assayed from the leaf tissues were detected

LIST OF FUNGICIDES COMMONLY USED FOR RHIZOCTONIA BLIGHT (FORMERLY CALLED "BROWN PATCH") MANAGEMENT IN TURFGRASSES[1,2]

Chemical Class	Contact[3] / Penetrant[4]	Common Name	Trade Name
Benzamide (also referred to as Carboximide)	penetrant[4a]	flutalonil	ProStar
Benzimidazole	penetrant[4a]	thiophanate-ethyl thiophanate-methyl	Cleary's 3336 Fungo 50
Dicarboximide	penetrant[4b]	iprodione vinclozolin	Chipco 26019 Curalan, Touche
Ergosterol Inhibitors (also referred to as 'DMI' or demethylation inhibitors)	penetrant[4c] mycobutanil	propiconazole cyproconazole Eagle	Banner Sentinel
Ethylenebis-dithiocarbamate	contact	mancozeb	Fore, Dithane M-45
Strobilurin (also referred to as Beta-methoxyacrylates)	penetrant[4a]	azoxystrobin	Heritage
Substituted Aromatic Hydrocarbon	contact	chlorothalonil quintozene	Daconil, Thalonil PCNB, Terraclor

[1]No endorsement of named products is intended, nor is criticism for products that are not mentioned.

[2]List compiled from the following sources:

- Couch, H.B. 1995. Diseases of turfgrasses, Kreiger Publishing Company, Malabar, FL.
- Vargas, J.M. 1994. Management of turfgrass diseases. CRC Press, Boca Raton, FL
- Watschke, T.L., P.H. Dernoeden, and D.J. Shetlar. 1995. Managing turfgrass pests. CRC Press, Boca Raton, FL.

[3]Contact: fungicide active on leaf and sheath surfaces.

[4]Penetrant: fungicide is absorbed and can provide activity both on the outside and inside of plant tissues.
(4a – movement in plants is primarily upward)
(4b – limited movement in plants, considered a local penetrant)
(4c – movement in plants is primarily upward, with limited downward movement)

at greater intensity when sampled in the early morning compared to the late afternoon. Also, higher *R. solani* populations assayed from the leaf tissues were detected at greater intensity when sampled in the early morning compared to the late afternoon. Finally, higher *R. solani* population levels were detected from turfgrass mowed at a height of 2.0 inches compared to 0.66 inches.

The ELISA method is a helpful tool that turfgrass managers can use for determining if infected leaf tissue is colonized by the fungal pathogens *R. solani*, *Pythium spp.* or *Sclerotinia homoeocarpa* (2,6). This is particularly helpful in the hot and humid summer months, when diseased turfgrass can exhibit similar symptoms between Rhizoctonia blight (Fig. 3) and Pythium blight, and even dollar spot.

Fig.3 Symptoms of Rhizoctonia blight: necrotic and blighted tall fescue leaf tissue.

Proper diagnosis is critical to turfgrass disease management, especially when considering the use of a fungicide. For example, if a turfgrass manager misidentifies Pythium blight as Rhizoctonia blight, and then applies ProStar (a fungicide specifically targeted to the Basidiomycete fungal group, to which the *Rhizoctonia spp*. belong), the Pythium blight actually infecting the turfgrass will not be controlled.

Also, the fungal mycelium that is observed colonizing the leaf tissue can help in identifying which fungal pathogen is responsible for causing the disease. when environmental conditions are conducive to disease development, the best time to see the mycelium infecting turfgrass is in the early morning hours in the presence of dew or high relative humidity conditions. Even the best plant pathologist will not diagnose the fungal mycelium from a visual observation with the naked eye, but will want to confirm the identity of the fungus under the microscope. For example, the color of the mycelium infecting the turfgrass of Rhizoctonia can range from gray to white (Fig. 4) and Pythium and Sclerotinia can range from white to a "cottony-white" appearance. Therefore, testing an infected turfgrass sample with the ELISA method will help confirm which pathogen is causing the disease.

Fig.4 The actual sign of the fungal pathogen—mycelium of Rhizoctonia solani—colonizing and infecting perennial ryegrass.

References:

1. Clark, M.F. 1981. Immunosorbent assays in plant pathology. Annual Review of Phytopathology 19:83-106

2. Fidanza, M.A. and P.H. Dernoeden. 1995. Evaluation of an enzyme-linked immunosorbent assay method for predicting brown patch infection in turf. HortScience 30:1263-1265

3. Miller, S.A. and R.R. Martin. 1988. Molecular diagnosis of plant disease. Annual Review of Phytopathology 26:409-432

4. Rittenberg, J.H., F.P. Petersen, G.D. Grothans, and S.A. Miller. 1988.

Development of a rapid field-usable immunoassay format for detection and quantification of Pythium, Rhizoctonia, and Sclerotina spp. in plant tissue. Phytopathology 78:1516

5. Schumann, G.L., B.B. Clarke, L.V. Rowley and L.L. Burpee. 1994 Use of environmental parameters and immunoassays to predict Rhizoctonia blight and schedule fungicide applications on creeping bentgrass. Crop Protection 12:211-218

6. Shane, W.W. 1991. Prospects for early detection of Pythium blight epidemics on turfgrass by antibody-aided monitoring. Plant Disease 75:921-925

7. Zadoks, J.C. and R.D. Schein. 1979. Epidemiology and plant disease management. Oxford Press, N.Y.