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Turfgrass Disease Profiles

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Identifying Turf Diseases

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Effective and efficient disease control always begins with an accurate diagnosis of the problem. Turf diseases are particularly difficult to identify because, unlike weed and insect pests, turf pathogens are primarily microscopic. Most often, we observe only the results of infection, rather than the pathogens (fungal pests) themselves.

Those of us who examine leaves and roots with microscopes spend a lot of time trying to identify elusive turf pathogens — especially root pathogens. These fungi are stealthy. They often conceal their identity and hide among the other microorganisms that inhabit turf. Moreover, even when we are able to confirm the presence of fungal pathogens, uncertainty remains — environmental stress plays a large role in determining the extent of turf damage.

Some turf diseases spread quickly, which adds a sense of urgency to applying a remedy. To implement an effective treatment, the identification must be both accurate and timely. Although diagnostic labs around the country are very competent, the process of collecting and shipping samples consumes valuable time. If you can recognize the initial stages of an outbreak in the field, you can immediately consider a remedial treatment, thereby increasing the likelihood you can halt disease progress and promote turf recovery.

This publication is intended to help turf managers diagnose infectious turf diseases on the course and on the field. Readers will be introduced to the concept of the disease triangle (host, pathogen, environment), which forms the basis for a systematic approach to turf disease identification.

Identifying turf disease is a combination of art and science. It is often not exact — but even differentiating between turf damage caused by infectious vs. noninfectious agents can save time and money. Furthermore, by

using a process of elimination, you can often narrow the nature of the problem to a few possible causes, thereby shrinking the "gray area" of uncertainty that allows you to focus your attention on a few likely culprits.

The Disease Triangle

In order for a disease to become a problem in a plant, there are three components that must be met. It's helpful to think of these components as the three sides of a triangle — if one side is missing, then the triangle cannot be completed and the disease will not pose a problem.

The components (or sides) of the plant disease triangle are:

1. **The host component** — the plant (host) must be susceptible to the disease. Not every plant is a potential host for every disease.
2. **The pathogen component** — the disease pathogen must be present.
3. **The environmental component** — conditions must be favorable for a successful infection.

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The Host Component

In this publication, we will limit our discussion of host plants to species and cultivars of cool-season turfgrasses. These include creeping bentgrass (*Agrostis stolonifera*), annual bluegrass (*Poa annua*), Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), and tall fescue (*Festuca arundinacae*). From a diagnostic perspective, it's important to know the turf species you are dealing with — this will help narrow the number of possible diseases that could infect that species.

Table 1 summarizes the advantages and disadvantages of turf species in terms of susceptibility to disease (pathology) and agronomic characteristics.

Turfgrass species and cultivars vary in their susceptibility to diseases. For example, perennial ryegrass is very susceptible to Pythium blight and gray leaf spot, yet it is unaffected by summer patch. Kentucky bluegrass, on the other hand, is susceptible to summer patch, but it is not affected by gray leaf spot or Pythium blight. Even different cultivars within a species can vary widely in their susceptibility to a disease.

Table 2 summarizes the relative severity of selected diseases on cool-season turf species.

The Pathogen Component

The pathogen component of the disease triangle involves the expression of disease and the appearance of damaged turf — up close and from a distance. Turf disease damage can be described with three characteristics: field patterns, symptoms, and signs.

Field Patterns

Field patterns are what you can observe from a distance (roughly 10 feet or more), and include:

- Well-defined circular patches
- Frogeyes, arcs, and rings
- Linear patterns
- Diffuse areas of affected turf

Circular patches are easy to describe. Since fungi grow in a radial pattern, the damage they cause tends to be expressed in circular patterns. Many diseases — such as brown patch (Figure 1) — exhibit this type of field pattern.

Figure 1. *Many fungi grow in a radial pattern, which results in well-defined, circular patches of damaged turf.*

Table 1. The pathology and agronomic advantages and disadvantages of five cool-season turf species.

Turf Species	Perspective	Advantages	Disadvantages
annual bluegrass	Pathology	Recuperates well from disease damage during spring and fall	Susceptible to many diseases (anthracnose, summer patch, dollar spot, etc.)
	Agronomic	Tolerates low mowing	Extremely susceptible to summer stress
creeping bentgrass	Pathology	Recuperates well, not susceptible to summer patch	Prone to dollar spot, brown patch, Pythium blight
	Agronomic	Tolerates low mowing and cold weather	Requires high fertilizer inputs
Kentucky bluegrass	Pathology	Not susceptible to Pythium blight, reduced susceptibility to most diseases	Susceptible to root diseases (summer patch, necrotic ring spot)
	Agronomic	Good quality, good recuperative characteristics, tolerates drought better than perennial ryegrass	Somewhat tolerates low mowing, establishes slowly from seed
perennial ryegrass	Pathology	Not susceptible to root diseases	Susceptible to many foliar diseases (Pythium blight, gray leaf spot, leaf spot, brown patch)
	Agronomic	Stand establishes rapidly, tolerates low mowing well	Does not tolerate summer stress
tall fescue	Pathology	Less susceptible to most diseases, not susceptible to root diseases	Seems more susceptible to red thread, juvenile turf (less than 2 years old) is quite susceptible to gray leaf spot and brown patch
	Agronomic	Tolerates heat and drought well, requires lower fertility	Somewhat tolerant of low mowing

Table 2. Relative severity of selected diseases on five cool-season turf species.

Disease	Turfgrass Species				
	Kentucky bluegrass	perennial ryegrass	tall fescue	creeping bentgrass	annual bluegrass
gray snow mold	++	++	+	++	++
pink snow mold	++	++	+	+++[2]	+++
yellow patch	—	+	—	++	++
melting out	++	++	—	—	++
red thread	++	++	++	+	+
pink patch	+	+	+	+	+
dollar spot	++	+++	+	+++[3]	++++
necrotic ring spot	++	—	—	—	++
take all patch	—	—	—	+++	—
brown ring patch	—	—	—	—	++
anthracnose	—	—	—	+	+++[4]
leaf spot	++	++	—	+	+
brown patch	+	++	++	++	++
Pythium blight	—	+++	+	++	++
summer patch	+++	—	—	—	+++
gray leaf spot	—	+++	++	—	—
rust diseases	++	++	—	—	—
powdery mildew	++	—	—	—	—

[1]Key:
— = rare; no symptoms, not susceptible.
+ = sporadic; damage is mostly cosmetic and has a short duration.
++ = sporadic; cosmetic damage is of major concern, and structural injury will lead to thin, poor quality turf.
+++ = sporadic; cosmetic damage and serious structural injury to turf depending on the extent and duration of the outbreak.
++++ = chronic; potential for severe structural injury that will affect appearance and playability for unacceptable periods.
[2] J uvenile (1-2 years old) creeping bentgrass is most susceptible to pink snow mold.
[3] Modern creeping bentgrass cultivars (Declaration, T1, 007, and others) are relatively resistant to dollar spot. Infection and symptoms still occur, but they are not as severe as they are with cultivars such as Penncross under similar environmental conditions.
[4] S erious damage occurs on annual bluegrass maintained at putting green height.

Frogeyes, arcs, and rings also are expressions of the radial growth of some fungi. When you see a frogeye pattern, the turf has recovered at the site of the initial outbreak and begins to overgrow the damaged area. Meanwhile, the pathogen continues to grow in a radial pattern away from the center. Therefore, some diseases (such as summer patch) exhibit well-defined patches in addition to frogeyes (Figure 2).

Linear patterns have three possible causes. First, the damage is abiotic (not infectious) and related to a mechanical operation. Second, the damage is the result of an implement (usually a mower) moving infectious inoculum. And third, the damage is the result of the inoculum moving down a slope with surface water.

Most often, mechanical operations cause linear patterns (Figure 3). However, there are a couple of instances (Pythium blight and pink snow mold) when infectious diseases are involved.

Figure 2. *Frogeyes are essentially circular patches that have some grass growing in the center of the patch.*

Figure 3. Linear patterns are usually caused by mechanical operations.

Figure 4. Diffuse areas of damaged turf are characterized by a gradient of damage away from the site of the initial outbreak. They are most often associated with pathogens that spread via airborne spores.

Figure 5. Leaf spots often have tan or gray centers with brown borders.

Diffuse areas of affected turf are most often associated with pathogens that spread via airborne spores. Although there may be areas of concentrated turf damage, they normally do not have a well-defined circular pattern. Instead, the level of damage follows a gradient away from the site of the initial outbreak. Damage becomes less severe and more sparse the further away it is from the concentrated area of damage (Figure 4).

Symptoms

Symptoms represent the plant's response to infection. To see symptoms you have to get very close (inches) to the damaged turf — in some cases, you may need a hand lens to see symptoms.

Symptoms include:

- Leaf spots
- Blight
- Dieback
- Root rot

Leaf spots are the most readily recognized symptom (Figure 5). As the name suggests, the symptoms involve discolored spots on the leaf.

Blight describes the collapse and deterioration of plant tissues without some other identifiable characteristic — such as a leaf spot (Figure 6).

Dieback describes a condition where affected leaves appear to be dying backward, from the tips to the crowns. Therefore, the base of the leaf may appear green and

Figure 6. Blight is a general collapse and deterioration of leaves and stems.

healthy, but becomes progressively more chlorotic (yellow) and necrotic (brown) towards the leaf tip (Figure 7). Dieback is common for root diseases as well as abiotic issues that affect root function and/or nutrient uptake.

Root rot describes the appearance of dark, necrotic roots (Figure 8) — a common feature with root diseases.

Figure 7. *Dieback describes a condition where leaves die from the tips backward. Individual leaves are necrotic (brown) and chlorotic (yellow) at the tips and green at the base.*

Signs

Signs represent parts of the actual pathogen that causes the disease. Recognizing signs also may involve close inspection of plants.

Four signs of turf diseases are:

- Mycelium
- Sclerotia
- Setae
- Spore masses

Figure 8. *Root rot describes the appearance of necrotic root and crown tissues. The plant on the left shows symptoms of root rot.*

We are most familiar with **mycelium** (Figure 9), which is associated with a variety of diseases. Mycelium is a mass of white or gray fungal threads. **Sclerotia** are survival structures produced by turf pathogens such as Typhula blight (gray snow mold) and red thread (Figure 10). They are hardened masses of mycelium. **Setae** are bristlelike structures produced by the anthracnose pathogen (Figure 11). Some turf pathogens (such as powdery mildew) produce **spore masses** on infected leaves (Figure 12).

Figure 9. *Mycelium is a mass of white or gray fungal threads.*

Figure 10. *Sclerotia are hardened masses of mycelium that usually are survival structures.*

Figure 11. *Setae are bristlelike structures associated with anthracnose infections. To be seen, they must be observed under magnification.*

The Environmental Component

The third side of the disease triangle is the environmental component. For turf disease identification, the environment includes all the factors that are not related to the host genetics (species and cultivar) or pathogen (field patterns, signs, and symptoms).

The three major elements of the environmental component are:

- Temperature
- Moisture
- Soil fertility and pH

Figure 12. *Spore masses occur within lesions associated with rusts, powdery mildew, smuts, and gray leaf spot.*

Temperature

Temperature influences disease development by affecting both the pathogen and the host. Pathogens are active within fairly well-defined temperature ranges. For example, gray snow mold pathogens are most active when it is cold (32°F to 36°F), the take all patch fungus is active at moderate soil temperatures (50°F to 60°F), and the Pythium blight pathogen requires very warm temperatures (70°F to 75°F).

Figure 13 shows the seasonal activity of turfgrass pathogens based on monthly average temperatures for the lower Midwest. *Pathogen activity and symptom expression may not occur at the same time, especially for root diseases.*

Temperature also may influence disease symptom severity. For example, under high temperature stress (usually combined with drought stress), infection-impaired roots are unable to acquire sufficient water to support the plant. That results in wilt, leaf collapse, and plant death with little or no turf recovery.

The take all patch pathogen is active in spring and fall when soil temperatures are moderate; however, symptoms may continue throughout the summer in areas where turf is

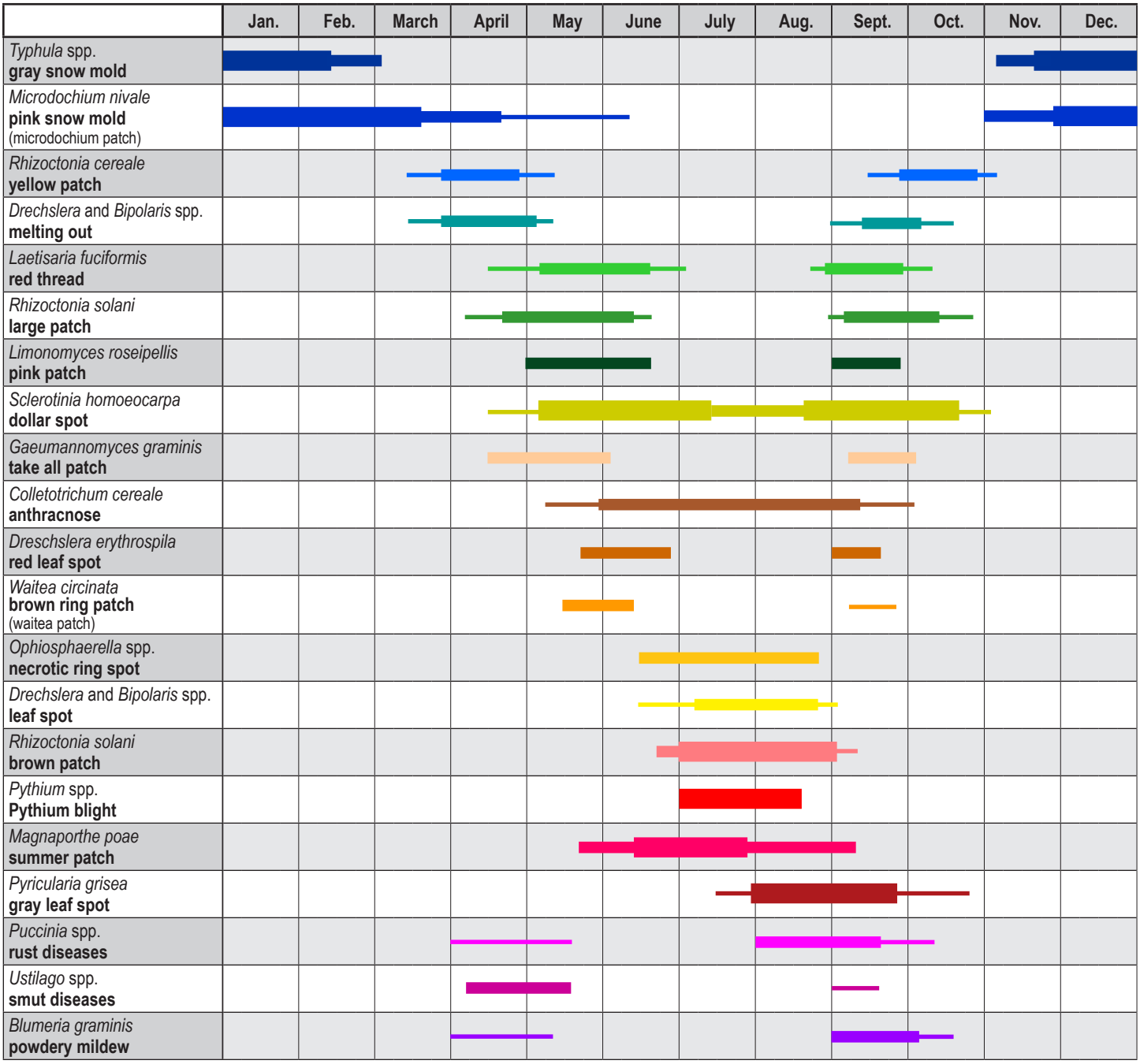

Figure 13. *Seasonal activity of turfgrass on cool-season turf species in the Midwest. The lengths of the bars represent the months when pathogens are active. Thicker bars indicate greater activity. In root diseases (take all patch, necrotic ring spot, and summer patch), symptoms express after periods of pathogen activity when turf suffers summer stress.*

subjected to a variety of summer stresses. It is important to understand that remedial treatments are effective only when pathogens are active, and that pathogen activity does not always coincide with symptom expression.

Moisture

Moisture directly and indirectly affects disease development and symptom expression. Moisture is a critical component of the infection environment because almost all fungal pathogens require free water on plant surfaces for growth and infection. Moisture occurs in a variety of forms including precipitation, irrigation, relative humidity, leaf wetness, and dew. Soil moisture affects symptom expression for root diseases and soil moisture deficits can further stress plants with root infections.

Temperature and moisture combinations are critical to foliar disease development. The most important

combination of factors (for foliar diseases) is the duration of the wet period and the temperature when leaves are wet.

Soil Fertility and pH

Nitrogen fertility is an important factor for several diseases. In some cases (brown patch and Pythium blight), an excess of nitrogen seems to result in more severe outbreaks. In other cases (dollar spot and red thread), a deficiency of nitrogen seems to make plants more prone to infection and plants recover more slowly, often prolonging the duration of symptom expression. Other nutrients (such as phosphorus and potassium) also influence disease development, but their individual effects are not as significant as nitrogen.

Soil pH is an important factor with the take all patch pathogen (and to a lesser extent, the summer patch pathogen). Other diseases are favored by alkaline soil conditions, but take all patch represents the clearest example of the effect of pH on disease development.

The Bottom Line on Turf Disease Identification

There is no substitute for experience when it comes to identifying turf diseases in a timely manner in the field and on the course. However, by taking a systematic approach that considers host, pathogen, and environmental factors, even less experienced turf managers can narrow the range of possibilities to a manageable few.

Details about identifying specific turf diseases are the subject of other publications in the Turfgrass Diseases Profiles series — visit www.agry.purdue.edu/turf/publicat.htm#BP, or the Purdue Extension Education Store, www.the-education-store.com.

All photos by Richard Latin.

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