PYTHIUM ROOT ROT - ANOTHER NEW DISEASE

Eric B. Nelson
Cornell University, Ithaca, NY

Over the past few years, Pythium root and crown rot has become more of an increasing problem on highly managed turfgrasses nationwide. This disease complex is characterized by a root and crown decay leading to a thinning or eventual loss of an established turfgrass stand. Although the occurrence of this disease has been most frequently associated with established highly maintained bentgrass/annual bluegrass putting greens on golf courses, it can also be a serious problem on highly managed home lawns and newly seeded areas. Although most turfgrass species are susceptible to Pythium root rot damage, some turfgrasses vary in their tolerance to infection. Bluegrasses (*Poa annua* and *P. pratensis*), ryegrasses, and bentgrasses are particularly susceptible to infection. Among the bentgrasses, colonial bentgrasses are more tolerant than creeping bentgrasses to Pythium root rot damage.

Pythium species can be isolated readily from healthy as well as diseased turfgrass roots and crowns; a number of different species can be pathogenic. Some strains of *Pythium aphanidermatum, P. graminicola, P. myriotylum, P. aristosporum, P. periplocum, P. vanterpoolii* and *P. arrhenomanes* are pathogenic to turfgrass roots under warm (75-85°F) conditions whereas strains of *P. graminicola, P. vanterpoolii, P. torulosum, P. aphanidermatum* and *P. aristosporum* are pathogenic under cool (45-60°F) conditions. All species require prolonged wet periods to induce severe disease development. Based on frequency of isolation and degree of pathogenicity to creeping bentgrass and perennial ryegrass, it appears that *Pythium graminicola* is the principal *Pythium* species involved in Pythium root and crown rot diseases on golf course turf.

Currently, little is known about the biology and ecology of the major *Pythium* species causing Phytium root rot. The most thorough understanding of any of these species on turfgrasses has come from studies of the soil ecology *P. aphanidermatum*, the primary cause of cottony blight, and. to a limited extent, *P. graminicola*. However, the extrapolation of this information to other root-rotting *Pythium* species is uncertain. Certainly much of the biology of *P. torulosum* and *P. vanterpoolii* are unknown and the limited information available on *P. graminicola* and *P. aristosporum* has come from annual crops such as wheat, corn and barley. Research is just beginning to address the biology, ecology and epidemiology of root-infecting *Pythium* species in established turfgrasses.

Early symptoms of Pythium root and crown rot may be visible in the spring immediately after snow melt but are most common in the early spring (Mar - May). Symptoms, however, may be evident

at any time throughout the growing season and disease activity may continue into late autumn. From observations of the disease in the Northeastern U.S. over the past several years, it appears that particular sites are more prone to Pythium root rot damage in early spring and late autumn, while other areas experience the problem primarily in warmer parts of the season with little or no damage at other times of the year. This is perhaps related not only to variation in the native complex of pathogenic *Pythium* species associated with different sites, but also to the management practices unique to particular areas that may limit the activity of certain species and favor the activity of others.

Under the cool wet conditions typical of early spring (Mar - May) and late autumn (Oct - Nov), symptoms may first appear as small diffuse yellow or reddish brown patches of turf approximately two to three inches in diameter. Symptoms often closely resemble the early stages of pink snow mold (*Microdochium nivale*) damage. In the spring, plants may be slow to come out of dormancy and growth may be less vigorous than in uninfected plants. Under severe conditions, patches of infected turf may coalesce and large areas may appear yellow and in a general weakened condition. Commonly, affected turf responds poorly to the application of fertilizers. As the season progresses and temperatures warm, large areas of turf may wilt, turn yellow to brown and then die.

Under warm wet conditions of mid-summer (Jun - Aug), initial symptoms appear as small tan to brown or bronze patches of turf very similar in appearance to dollar spot patches. These patches may converge on one another and affect large areas of turf where extensive stands of plants rapidly wilt and die. With severe infections, plants may wilt rapidly under heat stress and thinning may be so extensive that large areas of turf may become devoid of plants. Recovery of these severely affected areas may take an entire season.

Roots remain infected with *Pythium* species throughout the entire year, making it difficult to eradicate infestations from problem sites. The frequency of root infections increases in the early spring and reaches maximum levels in early summer. From studies on golf course putting greens, these periods of peak root infection typically coincide with Pythium root rot outbreaks. Following heavy infection periods, roots and crowns may contain abundant oospores of several of the pathogenic *Pythium* species, providing sufficient inoculum for the infection of newly developing roots in the fall and spring. These spores allow the fungus to survive unfavorable environmental conditions in a dormant state and as a result are insensitive to many control measures, including most fungicidal treatments.

Unlike Pythium blight, no foliar mycelium is evident during periods favorable for infection and rarely can Pythium root rot be diagnosed from field symptoms alone. Only upon microscopic examination of roots and crowns can one effectively determine whether root and crown damage from *Pythium* species has occurred. Typically, damage is first evident in the crown with the roots largely unaffected. However, on severely infected plants, root systems are greatly reduced in volume and vigor and may be extensively discolored. Crown areas may also appear water-soaked and greatly discolored. If root systems are not well developed prior to infection by *Pythium* species, the level of damage that a root system can sustain and still function becomes dramatically reduced and severe plant decline can occur.

From observations of Pythium root rot in the laboratory and in the field, it is clear that above-ground symptoms are not suitable diagnostic features for this disease. Typically diagnosticians have relied on the observation of oospores in root tips, the root cortex and crowns as indicative of Pythium root rot damage. Although oospores are frequently observed in root and crown tissues, much of the root and crown damage can occur as a result of *Pythium* growth inside the plant in the absence of oospore production. This can affect diagnoses based strictly on oospore observations. It is likely that a large number of Pythium root rot occurrences are overlooked by relying strictly on the presence of oospores in roots for disease diagnosis. It is critical, therefore, that turfgrasses, suspected of being affected by Pythium root rot, be diagnosed by a qualified diagnostician.

Severity of Pythium root rot damage can apparently be avoided by adjusting cultural practices to minimize plant stress. Maintaining an extensive and vigorous plant root system as well as the effective management of water are key elements in minimizing environmental stresses conducive to Pythium root rot. Biological control of Pythium root rot also appears promising. Recent studies have

shown that the application of topdressings amended with certain composts and organic fertilizers will reduce the symptoms of Pythium root rot on golf course putting greens. Unlike fungicide applications, applications of composts and organic fertilizers may also reduce populations of *Pythium* species in soil.

If conditions warrant the application of fungicides, it is recommended that a currently-labelled fungicide be carefully chosen and thoroughly watered-in. Although turfgrasses affected with Pythium root rot respond to drenches with Pythium-selective fungicides, symptoms may frequently recur, particularly as temperature and precipitation change, since pathogen inoculum levels in soil are rarely suppressed following fungicide applications.

The currently available *Pythium* fungicides and application recommendations are listed in the table below. Of the systemic fungicides, Banol® or Aliette® have been most effective in controlling Pythium root rot in the Northeastern U.S. Subdue® has been effective in some locations but has failed in others. The granular formulations of Subdue® have been more effective than the liquid formulation. Koban® and Terrazole® are contact fungicides that have also been effective in some locations for the control of Pythium root rot and are probably the only fungicides effective in reducing soil inoculum of *Pythium*. For those sites with a history of early spring Pythium root rot problems, a fall application (mid October - mid November) of an appropriate Pythium fungicide (usually Banol®) is most effective in suppressing disease development early in the spring. This should be followed-up with another application in the spring. In order for control to be effective at any time during the season, the fungicide must reach the root zone. We therefore recommend that all fungicides be thoroughly watered-in at the time of application. It is also advisable to avoid continuous application of any one fungicide on the same site since this practice may enhance the development of fungicide-resistant *Pythium* populations.

Damage from Pythium root rot has also been observed to be enhanced following applications of high rates of broad-spectrum systemic fungicides such as triadimefon (Bayleton®) and propiconazole (Banner®). It is therefore recommended that these types of fungicides be used sparingly on sites with a history of Pythium root rot and during periods favorable for *Pythium* infection.

Fungicides for the Control of Root-Rotting *Pythium* Diseases of Turfgrasses

Fungicide	Trade Name(s)	Formulation(s)	Application Rates (per 1000 ft^2)*
Chloroneb	Teremec SP®	65W	Not Recommended
	Tersan SP®	65W	Not Recommended
	Scott's ProTurf Fungicide II®	6.3G	Not Recommended
Ethazole	Koban®	30W	7-9 oz
		1.3G	8 lb
	Terrazole®	35W	8 oz
Mancozeb	Fore®	80W	Not Recommended
	Lesco 4®	80W	Not Recommended
	Lesco Mancozeb DG®		Not Recommended
	Manzate 200®	37F	Not Recommended
		75DF	Not Recommended
	Tersan LSR®	80W	Not Recommended
Metalaxyl	Subdue®	2E	2 oz
		2G	1.5 lb
		5G	10 oz
	Scott's Pythium Control®	1.2G	2.5 lb
(+triadimefon)	Scott's Fluid Fungicide II®	16AS	Not Recommended
(+mancozeb)	Pace®	7+14S	Not Recommended
Fosetyl-Al	Aliette®	80W	4-8 oz
Propamocarb	Banol®	6S	2-4 oz

* All fungicides must be thoroughly watered-in to get effective Pythium root rot control. Only Aliette® can be applied as a spray an still maintain control of Pythium root rot.