

Pythium Root Rot

Pythium root rot is a devastating disease that especially affects fine-amenity turfgrasses. Golf course putting greens are highly susceptible. While traditionally a problem in transition zones, Pythium root rot has become a major global concern due to climate warming. Diagnosis can be challenging, as it can be mistaken for Pythium root dysfunction. Factors like nematode feeding, heat stress, or traffic can worsen the disease. Effective management involves proper cultural practices, drainage maintenance, airflow promotion, and judicious fungicide use. Pythium root rot poses a significant threat to turfgrasses and demands comprehensive management approaches, particularly for golf course putting greens.

Causal agents

Pythium spp. are commonly isolated from turfgrass with Pythium root rot symptoms, however isolating them into pure culture is challenging due to the severe root rot it causes and subsequent colonization by faster-growing saprophytes. The exact cause of Pythium root rot remains unclear. Common species associated with Pythium root rot in turfgrass include:

- *P. aristosporum*
- *P. arrhenomanes*
- *P. catenulatum*
- *P. graminicola*
- *P. myriotylum*
- *P. tardicrescens*
- *P. vanterpoolii*
- *P. volutum*
- *Phytopythium vexans*
- *Globisporangium irregulare*
- *G. ultimum*

These species vary in aggressiveness towards *Agrostis stolonifera* seedlings. *P. torulosum* is often found with senescent tissue but does not cause seedling death in pathogenicity assays.

Primary Hosts

All turfgrass species can develop Pythium root rot, but the disease is most prevalent and severe on golf course putting greens.

Disease Cycle

The disease cycle of Pythium root rot in turfgrasses is not well understood. Pythium spp. are widespread in the environment and can be transported over long distances through water, soil, or infected plant tissue. Thick-walled oospores produced by *Pythium* can survive in the soil for extended periods, ranging from months to years. Hyphae and sporangia of *Pythium* can also persist in the soil or infected plant tissue but have a shorter survival time.

When environmental conditions such as temperature and moisture are favorable for disease development, oospores germinate and directly infect the host plant or give rise to sporangia. Sporangia can also germinate and directly infect the plant or release zoospores. Zoospores are small, flagellated spores that enable rapid spread of Pythium spp. in wet conditions. Upon encountering a suitable host, zoospores encyst and germinate, forming germ tubes that initiate infection in the host plant.

Pythium Root Rot Preview Clip



Credit: APS

Epidemiology

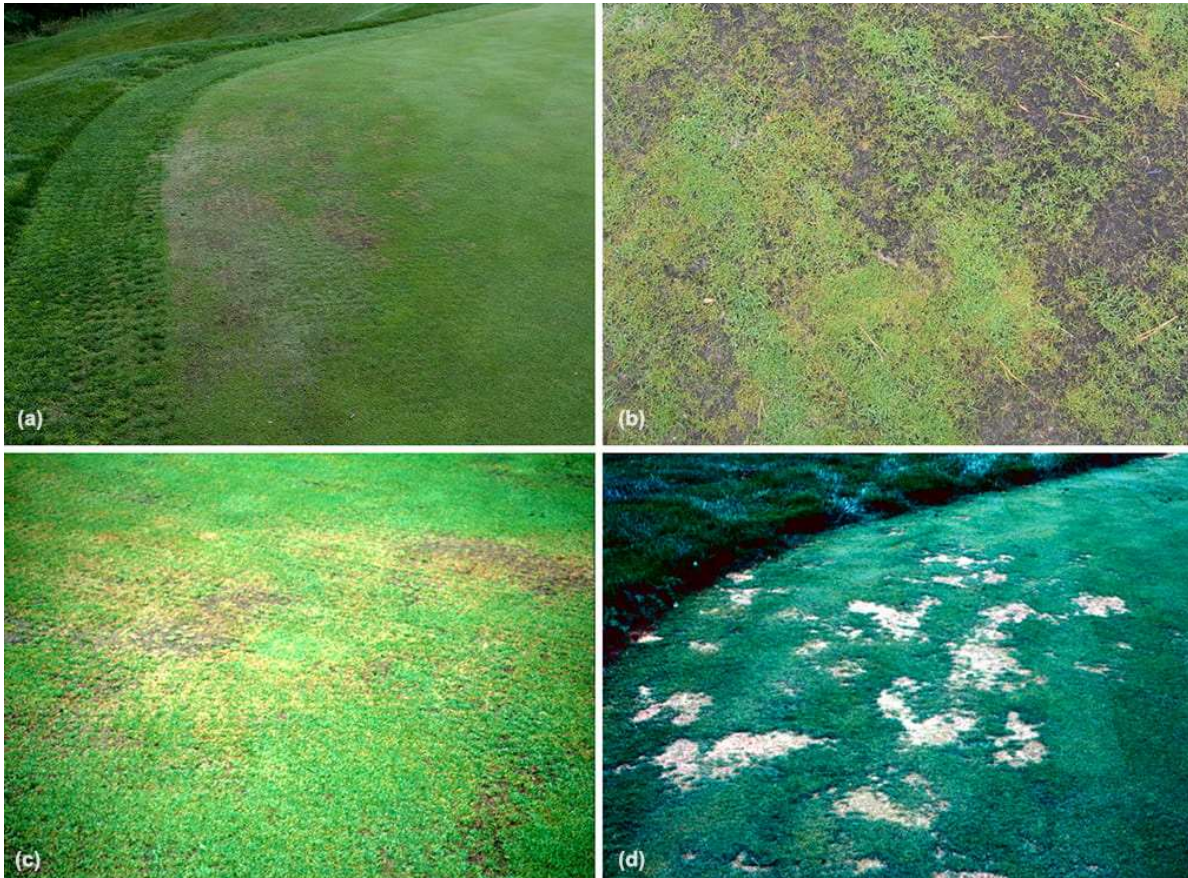
Pythium root rot of turfgrasses can be caused by various *Pythium* species, which are capable of growing and infecting turfgrass roots within a temperature range of 10 to

35°C (50 to 95°F). This means that Pythium root rot can occur at any time during the growing season if the soil remains saturated for extended periods. Factors such as poor surface or subsurface drainage, overirrigation, heavy rainfall, and excessive thatch and organic matter buildup contribute to the development of Pythium root rot. The symptoms of Pythium root rot are most severe when there is a combination of heat and/or drought stress following a prolonged wet period.

Symptoms

Pythium diseases in turfgrass can result in nonspecific symptoms, including thinning, off-color appearance, and slow growth. On cool-season grasses, symptoms manifest as small, diffuse, yellow patches in peripheral or high-traffic areas of golf greens. Infected plants may appear stunted, with narrow yellow leaves. Severely affected patches can merge into large areas of weakened and discolored turf.

On warm-season grasses, symptoms present as off-white to yellow patches that may coalesce and follow drainage patterns. Symptoms on warm-season grasses can occur year-round and may resemble other root diseases or nematode damage.

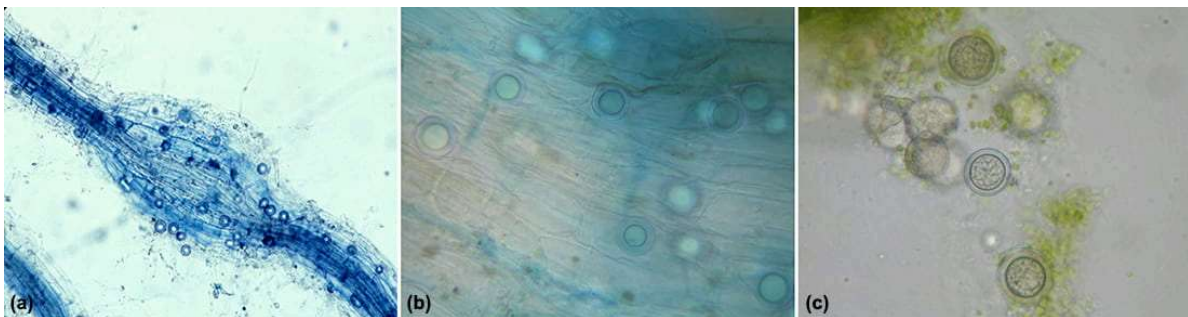


Credit: (a&b) John Kaminski/ Penn State University. (c&d) Peter Dernoeden/ University of Maryland

Figure 11.7.1: (a) Symptoms are usually more severe in areas of high traffic like the cleanup pass of a putting green. (b&c) Active disease symptoms appear yellow or reddish brown, but then (d) turn tan as the turfgrass dies.

Signs

Pythium spp. crown and root diseases in turfgrass do not produce visible mycelium on leaves. Diagnosis typically involves microscopic examination of roots and crowns. Severely infected plants may exhibit water-soaked crowns and discolored, reduced roots. Infected roots may appear water-soaked, slimy, and show degradation of cortical cells. Diagnosis usually requires microscopic examination of the morphology and abundance of oospores embedded within root and/or crown tissues.



Credit: John Kaminski/ Penn State University

Figure 11.7.2: (a-c) Signs of the *Pythium* species found in the roots include double-walled resting structures known as oospores (a, b, c). The presence of oospores in general doesn't necessarily mean that the plants have *Pythium* root rot, but high numbers of oospores is indicative of the disease.

Management

To effectively manage *Pythium* root rot in turfgrasses, a combination of cultural and chemical strategies is necessary. By avoiding poorly drained areas that remain saturated for extended periods, the establishment of *Pythium* can be prevented. Regular aerification and topdressing of golf course putting greens are crucial practices to control thatch accumulation and reduce organic matter. Increasing sunlight penetration and air movement through pruning or removing trees and installing high-powered fans can help minimize *Pythium* root rot activity by improving turfgrass conditions. In cases where

putting greens have poor internal drainage, reconstruction may be the most effective long-term solution for Pythium root rot. Chemical management through fungicide applications is also recommended.

Cultural

To effectively manage Pythium root rot in turfgrasses, it is important to **avoid establishing grasses in poorly drained areas** that remain saturated for extended periods. Regular **aerification and topdressing of golf course putting greens** help control thatch accumulation and **reduce organic matter**. Hollow-tine aerification should impact around 15 to 20% of the putting green surface annually, and approximately 5,000 lb (2,272 kg) of topdressing should be applied per 1,000 ft² (93 m²) each year.

Increasing sunlight penetration and air movement by pruning or removing trees around putting greens can help reduce Pythium root rot activity. Installation of **high-powered fans** can also improve air circulation in areas where airflow is restricted. For putting greens with poor internal drainage, **reconstruction may be the most effective long-term solution** for Pythium root rot.

Chemical

Fungicide applications are recommended to manage Pythium root rot.

Labeled **fungicides should be applied every 14 to 21 days during the growing season or when there are 2 to 3 consecutive days of rainfall**. **Ethazole** is recommended for curative applications, **followed by cyazofamid, mefenoxam, or propamocarb 2 to 3 days later**. **Ethazole should be watered-in immediately after application with at least 0.25" (6 mm) of water** to minimize potential foliar burn. Other fungicides should also be watered-in to ensure the active ingredient reaches the root zone where Pythium spp. are most active.

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