

Turfgrass Diseases and Their Relationship to Insect Management

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Many kinds of plant-parasitic microorganisms have been identified in turfgrasses, including fungi, nematodes, bacteria, mycoplasma-like organisms, and viruses. Of these, fungi and nematodes are the most common and important causal agents of turfgrass diseases. The other types of pathogens are less frequently observed and cause only a few economically important diseases.

Bacteria, Mycoplasma-like Organisms (MLOs), and Viruses. Bacterial wilt, caused by various pathogens of *Xanthomonas campestris* (Pammel) Dowson, has been observed occasionally on a few species and cultivars of turfgrass. Because bacteria are easily dispersed to wounds created by routine mowing, management of this disease is extremely difficult and expensive. Therefore, infected turf should be replaced with resistant species or cultivars.

The aster yellows MLO has been identified in several turfgrass species. It is vectored by a leafhopper and causes stunting, yellowing, and witches'-brooms of turfgrass shoots. MLOs are not mechanically transmitted, so control of the insect vector may reduce infection of new plants.

A number of viruses have been detected in turfgrass species, however St. Augustine decline, caused by *Panicum* mosaic virus, is apparently the only virus disease of economic importance in turf. Aphids, beetles, leafhoppers, mites, and planthoppers have been identified as vectors of viruses that infect turfgrasses. In addition, a few soilborne fungi and some nematodes vector turfgrass viruses, and a few viruses, including *Panicum* mosaic virus, are mechanically transmitted in the mowing process. Because there is no treatment once virus infection has occurred, infected turf areas must be replaced. Mites, plantbugs, and thrips have been implicated in one inflorescence disease of turfgrass known as silvertop in North America. The silvertop symptom is caused in

part by the puncture wounds made by these arthropods.

Nematodes. Nematodes are roundworms that are usually less than 0.04 in (1 mm) long. They are numerous in nearly all environments and are an important component of the soil microfauna. In turfgrass, populations of plant-parasitic nematodes may increase to levels that cause substantial injury. Nematode injury may result in distortion or inhibition of root growth, necrotic root lesions, and increased susceptibility to other pathogens, particularly fungi.

Determination of economic injury thresholds is difficult, especially for those nematode species that do not actually enter the root tissue. The presence of several species of plant-parasitic nematodes is common in and around turfgrass roots and may further complicate threshold determinations. Temporal and spatial variations in nematode populations occur in most turfgrass areas. As a result, high nematode population densities or "hot spots" may be detected.

In general, nematode injury is more common in sandy soils, warm environments, and where other stresses, such as compaction, low mowing height, fungal root diseases, and root-feeding insects, injure roots or reduce root growth. Substantial injury caused by plant parasitic nematodes in northern regions is more likely to occur on putting greens and other turf maintained at very low mowing heights.

Fungi and Environmental Conditions That Enhance Fungal Disease Development. Fungi cause the most common and economically important turfgrass diseases. Fungi are eukaryotic organisms that exist as threadlike mycelium or hyphae. They produce spores that enhance their ability to disperse and survive. Water is essential for spore germination and for infection of turfgrass plants. Fungi infect all parts of turfgrass plants and can be divided into two groups: (1) species that infect the turfgrass blades and cause leaf spots, foliar blights, and, sometimes, crown and root rots, and (2) soilborne species that infect roots and crowns and cause cortical and vascular decay.

The fact that diseases occur intermittently and seasonally illustrates the extremely important role that environment plays in disease development and severity. Unless the turf area is being reestablished or overseeded with a new species or cultivar, disease management of turfgrasses must emphasize modification of the environment. The key environmental factors that affect the development of foliar diseases are water and temperature. Spore germination and fungal infection require free water and very high relative humidity. Many cultural prac-