

33. Damping-Off

Robert L. James

Hosts

Damping-off is a generic term that refers to the disease and mortality of recently germinated seeds and emerging seedlings. Several fungi and Oomycetes commonly cause damping-off in both bareroot and container nurseries, including *Fusarium*, *Rhizoctonia*, *Phytophthora*, and *Pythium* species. Most conifer and hardwood plant species are susceptible to damping-off, although junipers are an exception.

Distribution

Nurseries throughout tropical and temperate areas are prone to damping-off losses. Because damping-off is caused by a variety of pathogenic organisms with different environmental requirements, most nurseries experience some level of this disease.

Damage

Damping-off affects seeds and seedlings during germination and emergence. Pre-emergence damping-off occurs when germinating seeds are affected before their hypocotyls break through the soil surface. Post-emergence damping-off occurs shortly after seedling emergence when tissues are still succulent. Infection usually results in seed or seedling death.

Diagnosis

Losses from pre-emergence damping-off are often subtle and difficult to detect. Poor emergence in scattered pockets within bareroot beds or few or no emerging seedlings within containers, however, is a good indication that damping-off has occurred. Hardwood and conifer post-emergence damping-off symptoms

are different. Post-emergence damping-off on hardwood seedlings appears as necrotic areas at or below the groundline. Infected seedlings wilt and die, but they often remain upright. Dead seedlings are brittle and break off easily just above the groundline. Post-emergence damping-off of conifers occurs between emergence and primary needle development. Infections also occur at or slightly below the groundline and result in water-soaked, discolored (usually brownish) areas that rapidly become sunken or constricted (fig. 33.1). Affected seedlings fall over (damp-off) (fig. 33.2). Seedlings that have fallen over are often green distal to the affected area until they dry out. The specific pathogen causing damping-off cannot be determined on the basis of symptoms. Identification usually requires infected tissue culturing and microscopic examination of associated organisms. Such identification is usually necessary before specific control recommendations can be made.

Biology

Most damping-off pathogens survive in soil, within plant debris, or on seeds

(fig. 33.3), usually as viable dormant spores. They tend to increase when seedbeds are used continuously for seedling production without fallowing or preplanting soil fumigation. Damping-off organisms are not necessarily very aggressive pathogens. Pathogens may cause serious damage, however, when environmental conditions are conducive to their proliferation, especially when such conditions are detrimental to early seedling establishment. The principal environmental factors influencing disease development are soil pH, moisture, nutrition, and temperature; effects of these factors vary with the predominant pathogen and seedling species. All damping-off pathogens grow and reproduce best when the soil or growth medium pH is above the optimum for seedling growth. Cool, wet conditions slow germination and extend the time seeds and germinating seedlings are exposed to pathogens, increasing damping-off losses. Excessive soil moisture at moderate temperature favors *Pythium* and *Phytophthora* development. Soil texture, organic amendments, and nutrients can also influence disease severity. Fine-textured soils with high clay content retain water and warm



Figure 33.1—Conifer seedling with typical foliar symptoms of post-emergence damping-off. Photo by Robert L. James, USDA Forest Service.



Figure 33.2—Newly emerged conifer seedling killed by post-emergence damping-off. Note discolored, constricted area of stem just above the groundline. Photo by Robert L. James, USDA Forest Service.

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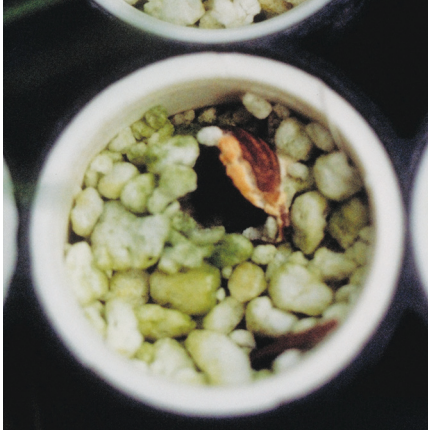


Figure 33.3—Fungal growth on seedcoat attached to an emerging seedling is a sign of damping-off. Photo by Robert L. James, USDA Forest Service.

slowly in the spring. Organic amendments may improve soil drainage, but may also provide substrates of potential damping-off pathogens. Nitrogen fertilizers applied when seedlings are emerging often increase seedling losses. Severe damping-off in bareroot nurseries is often associated with impeded surface or subsurface soil drainage. Damping-off in container nurseries is most often related to container reuse and seed contamination by potential pathogens.

Control

Cultural

Cultural practices can be modified to remedy conditions conducive to damping-off and can reduce potential damping-off organism inoculum. Soil pH can be lowered by adding sulfur compounds (granular sulfur or ammonium sulfate) or inorganic acids (sulfuric acid). Soil drainage can be improved in bareroot nurseries by leveling soil, installing subsurface drainage tiles, and adjusting irrigation frequency—which must be carefully controlled in

container nurseries. Treating seeds and reused containers to reduce contamination by potential damping-off pathogens will greatly reduce losses. Also, minimize seed exposure to damping-off pathogens by delaying sowing until soil temperatures have risen to near optimum for rapid germination.

Chemical

Soil fumigation is the most effective way to control damping-off in bareroot nurseries. Soils should be fumigated when temperature, moisture, and physical condition are optimum for proper fumigant distribution. Pathogen-contaminated seeds should not be sown in fumigated soil because potential pathogen antagonists are usually eliminated by fumigation. Soil fungicide drenches are usually effective against damping-off in both bareroot and container nurseries. Pathogens causing disease, however, must be correctly identified because many modern fungicides are effective only against certain groups of related fungi.

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