46. Upper Stem Canker

Philip B. Hamm, Sally J. Campbell, and Everett M. Hansen

Hosts

The fungi that cause upper stem canker, *Phoma eupyrena* and *Fusarium roseum,* occur on a broad range of conifer and hardwood trees. However, damage has been reported only from 1-0 Douglas-fir, although true firs, spruce, hemlock, and western larch are susceptible in greenhouse inoculation tests.

Distribution

This disease has been found in almost all the bareroot nurseries in western Oregon and Washington. Although the fungi are present in nurseries outside this area, the disease is known to occur only in the Northwest.

Damage

Significant losses attributed to upper stem canker occur sporadically in Pacific Northwest nurseries. Although seedlings usually are not killed, many do not recover enough to meet packing standards.

Diagnose

Symptoms are first visible in late September or October of the first growing season. Look for seedling tops to turn chlorotic and then red-brown above girdling cankers on the middle to upper stem (fig. 46-1). Cankers initially appear as sunken areas centered on a bark fissure (fig. 46-2) or other infection courts such as lateral branchlets (fig. 46-3) or needles (fig. 46-4). The canker turns red-brown as it expands around the stem, and light scraping of the cortex clearly identifies the infected area. Cankers may elongate up the stem. Seedlings infected late in the fall may not show symptoms until the following spring. Damage is often concentrated in discrete areas of the nursery.

Figure 46-1—Foliage symptoms on Douglas-fir associated with upper stem canker. Note that only tops of seedlings have been killed.

Figure 46-2—Canker originating in the vicinity of bark fissure. The small black structures in the bark fissure are pycnidia produced by *P. eupyrena*.

Figure 46-3—Stem canker resulting from infection on small branchlet.

Figure 46-4—Stem canker resulting from needle infection.

Pycnidia of *Phoma eupyrena* may be present on the canker face.

Upper stem canker can be easily differentiated from lower stem canker (chapter 12) and phoma blight (chapter 13), two other diseases caused by *P. eupyrena.* Upper stem canker occurs primarily in the fall of the 1 + 0 year, kills only seedling tops, and is readily controlled by fungicides. Lower stem canker occurs only in the spring of the 2 + 0 year, kills the entire seedling with a groundline canker, and is not controlled by fungicides but by mulching seedbeds to limit the buildup of soil collars around seedlings. Phoma blight occurs in the spring of the 2 + 0 year, kills needles and buds without a stem canker, and is controlled most effectively by mulching.

Biology

The fungi that cause upper stem canker, *P. eupyrena* and, to a lesser extent, *F. roseum*, are common soil inhabitants associated with a number of other seedling diseases (see chapters 12 and 13). They are also commonly present on healthy seedlings.

The primary inoculum sources are most likely the thick-walled chlamydospores, which survive in the residue of previous crops, or conidia, which are produced in large quantities by both fungi. These fungus structures are brought into the nursery beds through the movement of contaminated soil, equipment, and seeds.

Infection occurs when spores land in bark fissures, which are naturally occurring splits in the epidermis on the upper stem. The fissures are caused by rapid seedling growth. Lateral branchlets and needles are also occasional infection courts.

Conidia of *P. eupyrena* are generally cylindrical or ellipsoid and 3-6 x 1.5-3 microns. They are formed in small, black, globose pycnidia on stem cankers and presumably act as secondary inoculum. Conidia of *F. roseum* are distinctly sickle shaped and vary in length. Infection occurs in late summer or fall.

Damage is related to the physiologic condition of the seedlings (whether actively growing or dormant) and the amount of rainfall. Succulent seedlings exposed to heavy fall rains are the most badly affected.

Control

Cultural—Avoid cultural practices that force growth into the fall, such as fertilization and irrigation. Historically, high-density seedlings have had greater damage, so some control may be obtained by growing seedlings at lower densities.

Chemical—Fungicides, such as benomyl and chlorothalonil, effectively control upper stem canker when applied at 2-week intervals from mid-July to bud set in the fall. The fungicides can be applied separately or mixed together. More frequent applications in the fall are necessary if heavy rains begin before bud set.

Selected References

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