

GROUNDLINE HEAT LESIONS ON TREE SEEDLINGS

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Trees and other plant species are susceptible to a variety of sometimes subtle and sometimes dramatic injuries when exposed to excessively high or low temperatures. The specific types and severity of injuries sustained vary with tree species, age, and relative acclimation (i.e., physiological readiness or preparedness for temperature

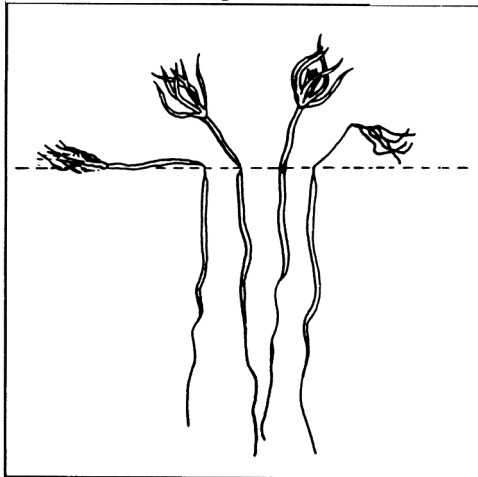


Figure 1. Schematic of developing groundline heat lesions on young pine seedlings.



Figure 2. Heat lesions on stems of "older" (i.e., mid-summer) loblolly pine seedlings from a Florida forest tree nursery. Note constrictions on stems (arrows). (DPI Photo No. 850074-A-6).



Figure 3. Severe heat lesions (arrows) on stems of container-grown eucalyptus seedlings from a South Florida nursery. Note swelling of stem above lesions resulting from obstructed flow of carbohydrates through damaged phloem.

extremes induced by gradual changes in environmental surroundings). Also important are the type (high or low), magnitude, and timing (time of year, duration, etc.) of the temperature extremes (1, 5, 6, 7, 9, 10). Some heat-induced injuries are difficult to identify with precision and accuracy due to their similarity in appearance and/or relatedness to injuries induced by other factors (e.g., tissue dehydration) (10). Others are quite distinctive and therefore easily recognized. Groundline heat lesions or "heat cankers" (5) are one type of readily identifiable heat-induced injury on young tree seedlings. This type of injury has been documented in Florida tree nurseries.

DEVELOPMENT & RECOGNITION OF HEAT LESIONS:

Heat lesions develop at the groundline on the stems of seedlings in response to solar heat buildup at the soil surface (3, 4, 8, 10, 12). Some lesions (perhaps early stage) appear as superficial white spots or streaks on the sides of stems facing the sunlight (4, 12). Severe or advanced-stage heat lesions appear as water-soaked areas, often associated with variable stem shrinkage and/or wrinkling, and deep constrictions (Figs. 1-3) on hypocotyls at or near the groundline (4, 12). Lesions may be restricted to only the insulated sides of seedling stems or completely encircle and girdle the stems. Very young and/or tender seedlings often lean or

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collapse entirely as lesions develop (Fig. 1). Older seedlings with ample secondary xylem may remain erect and alive for some time. These seedlings typically die slowly as the girdling effect of the heat lesions restricts the flow of carbohydrate to the roots, resulting in eventual starvation. In this latter case, seedling stems often swell above the lesions due to the accumulation of carbohydrates at the blockage (Fig. 3).

Although reports in the literature (1, 4, 6, 7, 9, 10) vary, it is generally accepted that groundline temperatures of >52-54°C are injurious to young seedling stems, and groundline temperatures of this magnitude are not uncommon in tree nurseries (1, 4, 8). The degree of injury and/or level of seedling mortality sustained is directly related to the length of time such temperatures are maintained; seedling mortality may result from exposures of 30 minutes or less. Dark nursery soils pose more risk of high temperature buildup than light soils as dark soils absorb more solar radiation (1, 9).

DIAGNOSTIC CAUTIONS: Heat lesions are sometimes confused with damping-off infections of very young seedlings, the feeding wounds of certain lepidopterous insect larvae, and/or the effects of certain pesticides (1, 2, 9, 10). Care should be exercised to note associated environmental conditions, the pattern of occurrence within nursery seedbeds, and specific differentiating features. Damping-off typically occurs in excessively moist soils and develops in expanding patches of seedlings. Heat lesions are more apt to develop on scattered seedlings, reflecting patterns of insolation, shade, and localized heat buildup. In addition, damping-off lesions are often less well defined than heat lesions, and damping-off lesions often extend well below ground whereas heat lesions are typically restricted to near or slightly above the groundline. The presence of insects and/or insect signs such as silken tunnels or webbing may be helpful in identifying certain types of insects or insect injury (2).

CONTROL: Prevention of heat-induced stem lesions may be achieved by providing adequate shade for young trees during periods of vulnerability, and frequently irrigating seedling crops to provide groundline cooling. Avoid sudden transfer of young seedling crops from shaded to full sun areas as shade-grown seedlings may be more vulnerable to heat injury than those grown in open sunlight. Favor light colored soil for seedbeds as these soils do not heat up as readily as darker soils.

SURVEY AND DETECTION: Look for scattered, leaning or collapsed young seedlings with well defined mild to severe lesions at or near the groundline. On older seedlings stem constrictions, often with swollen phloem tissues above, are generally diagnostic, especially where insects and/or pesticides can be ruled out as causal agents.

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