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Forest Insect & Disease Leaflet

Pinyon Engraver Beetle (Pinyon *Ips* Beetle)

Pinyon-juniper forests occupy the driest forested sites in Utah and provide a wide range of important resources for people, wildlife, and plants. These forests cover approximately 9 million acres and comprise nearly 60% of Utah's forest cover. The pinyon engraver beetle (*Ips confusus* (LeConte)) is an important bark beetle in pinyon-juniper forests. Colorado and single-leaf pinyon pines (*Pinus edulis and monophylla*, respectively) are the primary hosts for this beetle in Utah. In a healthy pinyon forests, endemic levels of pinyon engraver in association with diseases serve to remove weakened and stressed trees, thus thinning the forest and reducing competition for light, water, and nutrients. However, population levels may build in fresh green material including pruned branches and recently broken, uprooted, or downed trees. Epidemic populations may kill groups of trees stressed by disease, damage or drought.

Drought has been considered a predisposing agent for engraver beetle outbreaks for many years. Moisture stress may increase tree susceptibility in two ways. The first way is by reducing the production of sap. Vigorous trees can produce enough sap to push or 'pitch' attacking beetles out of entrance holes. Often, beetles become trapped in the sap, and they die. The second way is by increasing the nutritional quality of the tree for the beetles. Moisture stress has been found to increase soluble nitrogenous compounds and sugars in living cells of trees. Both of these substances are important for the development of beetles.

Damage occurs when adult beetles colonize and reproduce in the conductive tissues of suitable host trees. Conductive tissues transport water and nutrients throughout the tree. Female beetles construct a tunnel just under the bark to lay eggs. After the eggs hatch, the larvae feed creating more tunnels that further destroy the conductive tissue. During the initial construction of the egg gallery, the bark beetle often introduces a fungus that invades the wood staining it a bluish color. This 'blue stain' fungus plugs up the conductive tissues of the tree further, prohibiting the transport of water and nutrients. Thus, the combined activity of both the beetle and the fungus eventually kills the tree.

Frass in bark crevices **Over-wintering adults** **Beetle galleries**

Beetle larvae pupate and overwinter at the base of infested trees, usually between November and March. Adult beetles emerge in the spring and re-attack uninfested portions of the same tree or attack another susceptible host tree. In Utah, pinyon engravers normally begin flight in mid-April. The life cycle of pinyon engraver beetles generally lasts from 6 - 8 weeks. Therefore, there may be up to 5 generations produced in one season, depending on climate and elevation. With more than one population in a given area, generations may overlap with host trees attacked throughout the season.

When a beetle chews through the bark, it produces red or orange boring dust. Successfully attacked trees will generally have this boring dust (frass) in bark crevices and/or around the base of the tree. Pinyon pine needles on branches or trees killed by the beetle will generally turn yellow (fade) to orange/red within a few days or weeks. Before long, the needles begin to fall.

Although stand density is a good predictor of susceptibility to pinyon engravers, the probability of beetle attack increases with increasing pinyon density, even when pinyon represents a minor portion of the stand (Negron and Wilson, *in press*). The most susceptible trees are relatively old with average diameter at root collar (DRC) between 7 and 11 inches. The beetle also favors

pinyons with heavy dwarf mistletoe infections (Wilson and Tkacz 1992; Negron and Wilson, *in press*). During intense drought years, pinyon pines may be susceptible to attack even at low densities and small diameter (2 inches DRC).

Management Options:
Thinning offers the best long-term management strategy for the pinyon engraver beetle. To maximize effectiveness, thinning should reduce the number of pinyons per acre to below 10% of the maximum stand density index (SDI), or the total stand basal area to less than 100ft^2 per acre. Select larger diameter trees and those heavily infested with dwarf mistletoe. Cut stumps close to the ground to avoid colonization by beetles. Use thinning techniques that minimize damage to residual trees, disruption of the soil profile and soil compaction. Improper techniques that result in injury to trunks and roots may create worse beetle problems.

Delay thinning until late July, and since beetles will also infest fresh green material, promptly burn or dispose of any logging slash. It would be also prudent to delay pruning or construction activities that may result in tree damage or slash production until late July to reduce the potential for population build-ups. Currently infested trees may not be easy to detect until the foliage begins to fade. Other signs of infestation include frass in bark crevices or around the base of trees, and possibly pitch tubes (frass mixed with sap) on the trunk. Currently infested trees should be removed and disposed of as soon as possible. Trees removed in the winter months should be treated or disposed of by the end of March, before the next beetle flight.

High value trees may be sprayed with a registered insecticide to protect them from attack. Insecticides with the active ingredient Carbaryl are quite effective and several brand names are registered in Utah for bark beetles. Some brand names include, but are not limited to Sevin SL, Sevin Brand 4F or Carbaryl 4L* (a complete list of registered insecticides in Utah is available through the Division of Forestry, Fire and State lands). The insecticide must cover all sides of the trunk and larger branches (1 inch diamter and larger). To effectively treat trees, apply to drip. If any portion of the trunk or susceptible branches are missed, then beetles can successfully attack the non-treated area. These sprays, when applied as a 2% (active ingredient) solution, should provide protection from attacking engraver beetles for 16 – 18 months.

Black stain root disease in pinyon pine is often associated with pinyon engraver activity. Black stain root disease often appears as a concentric, circular pattern of tree mortality with older dead trees near the center and declining and currently infested trees near the periphery. Black stain root disease is spread by root-to-root contact and a few root-feeding beetles. Infection centers on average enlarge at the margin at an average annual rate of 3.5 feet/year. This disease is non-persistent in infected root systems, remaining active usually no more than one year after its host dies.

There are a few guidelines to differentiate between black stain root disease and blue staining fungi introduced by the pinyon engraver beetle. Blue stain is more often found in the sapwood (outer half or third of the wood) throughout the bole and turns wood tissues more bluish in color. If only part of the tree's circumference is infected, the stain may appear wedge-shaped in cross-section. Black stain, however, may discolor entire sapwood circumference. Black stain usually appears as a dark brown to purple-black stain occurring within concentric arcs of the annual growth rings. Black stain may also occur in pockets throughout the wood. It is not confined to the sapwood wood like blue stain, but may extend into the heartwood (wood near the center of the tree trunk). Black stain is found in the roots, root collar, and base of the tree.

**Mention of products or companies by name does not constitute endorsement by the Division of Forestry, Fire and State Lands, nor does it imply approval of a product to the exclusion of others that may also be suitable*

References:
Negron, J. and J.L. Wilson. In Press. Attributes associated with probability of infestation by the Pinyon Ips, *Ips confuses*, (Coleoptera; Scolytidae) in pinyon pine, *Pinus edulis*.

Wilson, J.L. and B.M. Tkacz. 1992. Pinyon ips outbreak in pinyon juniper woodlands in northern Arizona: a case study. Pages 187-190 in Symposium on Ecology and Management of Oak and Associated Woodlands: Perspectives in the Southwestern United States and Northern Mexico. Sierra Vista, AZ. April 27-30, 1992.

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