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THE PIÑON IPS BARK BEETLE

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Figure 1. Extensive piñon mortality from piñon ips induced by drought conditions, Flagstaff, Arizona September, 2003.

Within the woodlands of 4,500′ to 7,000′ elevations in the Southwest, piñon pine occurs in association with juniper (*Juniperus* spp.) at the lower and ponderosa pine (*Pinus ponderosa*) at the higher elevations. Piñon are commonly utilized by a small bark beetle – piñon ips, *Ips confusus*. Since these beetles are from the *Ips* genus of bark beetles they are also known as engraver beetles. Piñon ips will utilize, Colorado piñon (*P. edulis*) and single leaf piñon (*P. monophylla*) and occasionally other pines in the Southwest. Juniper and ponderosa species that are generally associated with piñon are not affected by piñon ips. Junipers in these woodlands are attacked by cedar, cypress, or juniper bark beetles in the *Phloeosinus* genus and woodborers. Ponderosa pine is attacked by pine bark beetles in the genus *Ips* and *Dendroctonus.* For information on these insects refer to University of Arizona publications AZ1316 "Cypress Bark Beetles" and AZ1300 "Pine Bark Beetles".

Twig beetles (*Pityophthorus* spp. and *Pityogenes knechteli* [Furniss and Carolin 2002]) are related to ips engraver beetles but they feed only on twigs and small branches. (For more information on twig beetles see: http://www.wci.colostate.edu/Assets/pdf/TwigBeetle.pdf). They feed under the bark in a similar fashion as *Ips* spp. of engraver beetles. Another insect that feeds on piñon are "pitch mass" borers (*Dioryctria ponderosae*), they cause copious amounts of pitch to flow from wounds and should not be confused with piñon ips.

Piñon ips is a native bark beetle that utilizes piñon pine inner bark and outer sapwood for food and to rear offspring, spending most of their lives underneath the bark of the tree. When a new generation of adults emerge from an infested tree they may re-infest the same tree or fly short distances

AT A GLANCE

- Hosts, Description and Life Cycle of Piñon Ips
- Signs of Infestation
- Management
- Thinning for Increasing Resistance
- Ecological Factors

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Figure 2. Adult piñon *ips.*

(one to two miles maximum) seeking a susceptible tree. These bark beetles normally infest stressed, damaged and dying trees. They will also infest recently cut piñons and the slash associated with firewood harvesting or thinning practices during spring, summer, and fall. If enough beetles are produced by these practices, they can infest green standing trees. Once the wood has dried sufficiently and the bark is easy to pry off, it is no longer suitable for bark beetle colonization.

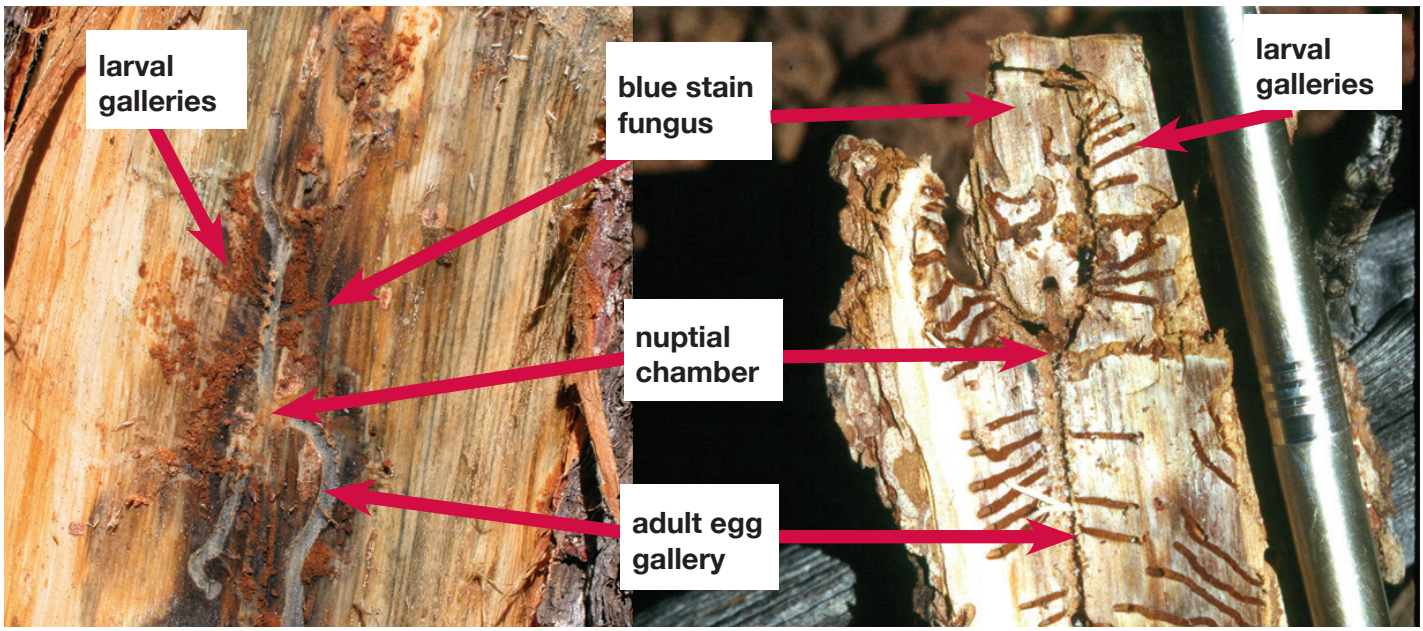
Population buildups tend to occur during extended drought periods causing widespread tree mortality. Significant landscape-level piñon mortality was noted in the mid 1950's and again in the late 1990's and early 2000's when tens of millions of dead piñon trees were found to be infested with piñon ips (Figure 1). Other localized piñon mortality events have occurred throughout the Southwest resulting in hundreds to thousands of piñon killed.

Description

Piñon ips are cylindrical, about 5 mm (¼") in length and shiny black to dark brown in color (Figure 2). A distinguishing feature of this beetle and other Ips species is a noticeable depression at the rear end that is bordered on each side with tooth-like spines. The piñon ips has five of these spines at the posterior end of their hardened forewings (elytra).

Life cycle

Male beetles initiate the infestation in spring by boring into the inner bark of the tree excavating a small (nuptial) chamber. Once the chamber is complete he releases chemical attractants that lure 2-4 females to the small chamber. Following mating, the adult females begin their tunneling in the inner bark and outer sapwood, forming their characteristic Y- or H-shaped galleries (Figure 3). Reddish boring dust is pushed out of the galleries through holes in the bark created by the adults, utilizing the depression found on their rear ends. Females lay eggs in niches along the side of the gallery. After the eggs hatch, the larvae (Figure 4) tunnel away from the egg galleries. The life cycle of the piñon ips is not fully understood. Most bark beetle larvae spend several weeks feeding on the inner bark. The mature larvae excavate oval shaped cells at the ends of their tunnels, where they pupate. Shortly after pupating they transform into the new adults completing their life cycle. It is believed that two or more generations are completed between March and late October. Adults overwinter underneath the bark, principally at the base of the tree in large groups. The first flight of the emerging adults the next spring occurs when the daytime temperatures begin averaging about 60 degrees F (16 degrees C) and will vary with elevation, slope and aspect.



Tom DeGomez, left; Bob Celaya right

Figure 3. Adult egg galleries, larval feeding galleries, and nuptial chamber on the outer sapwood (left) on the inner bark (right). Blue stain fungus surrounding the galleries.

Figure 4. Larva inside gallery.


Figure 5. Rust-colored pitch tubes indicating a successful attack by bark beetles.

Signs that a piñon is infested by ips beetles include:

- **Pitch tubes** (Fig. 5) (multiple small, reddish, popcorn-shaped masses of pitch) scattered up and down the trunk and branches that ooze out where the beetles enter the tree. These are usually rust-colored but yellow with time. The pitch is mixed with boring dust, or frass (see below). Pitch from physical wounds or "pitch mass" borers will be cream or amber colored.
- **Frass or boring dust,** that resembles fine sawdust (usually rust-colored but can be lighter) that collects in bark crevices, branch crotches, and on the ground around the base of the tree
- **Fading of foliage** from green to straw-color, later turning red and then brown (beetles are probably no longer in the tree by this time). The tree will usually drop the dead needles one year after infestation.
- **Blue-gray staining of sapwood** under the bark by bluestain fungi introduced by the beetles (will not be evident on trees that were just recently attacked).
- **Woodpeckers chipping away the bark** to feed on the beetles beneath — does not always occur. Woodpecker activity will give the tree trunk and branches a reddish appearance due to the removal of the outer bark. The chipped off bark tends to pile up around the base of the tree.
- **Live adults, pupae and/or larvae and their galleries** (tunneling) can be found on the inner bark and lightly scoring the surface of the sapwood. Callow or immature adult beetles are tan to brown, while adults are brown to black, pupae are white, and larvae are white with brown heads.

Management

Prevention is the best way to reduce losses due to piñon ips. Healthy, vigorous trees, growing on good sites usually are not attacked, unless there is a localized or widespread population buildup in the area. Trees affected by drought stress, disease, physical damage or are dying from other causes are typically the first piñon attacked. Piñons stressed and damaged by building construction activities are also very attractive to these beetles. Excavation for foundations, earth fills, paving, soil compaction and trunk wounds are some examples of tree stress and damage that attract these insects. This can be minimized or avoided if proper measures are employed before, during and after construction to reduce impact on the trees. Felled green trees left on the construction site also provide breeding material for the insect. Beetles may then proceed to infest adjacent live trees. For information on trees and construction refer to Colorado State University publication no. 7.420 "Protecting Trees During Construction".

To prevent further spread of the insect, infested tree(s) should be removed promptly and the material treated properly. This is especially critical from March to October during the beetle's most active period. Any technique that destroys infested material — piling and burning (where safe and legal), chipping away from the base of live trees, floating or submerging in water, burial at a landfill, removal to a site at least one mile from piñon pine, or complete removal of the bark — will kill any developing brood.

Bark beetles will usually inhabit a tree during the warmer months for 6 to 8 weeks. Round black exit holes indicate that the piñon ips has exited the tree. Other insects

Figure 6. Firewood placed in the full sun and covered with plastic sealed along the ground.

(woodborers — large white segmented larvae or large beetles, some with long antennae) are commonly found in dead trees but they are generally not a threat to live trees.

Infested pines should be treated as soon as possible while the beetles are still within the tree. Trees from which the beetles have already exited do not need to be treated, but can be cut down and removed as time permits for use as firewood or to reduce wildfire and structural hazard. Consider leaving some of the dead and down wood on the property to provide for a number of forest organisms critical to a healthy forest ecosystem. Material should be placed away from structures and trees, and downwind whenever possible.

If the wood is to be utilized for firewood it can be stacked two logs high in prolonged open sun, loosely wrapped with thick (>5mm), *clear* plastic to prevent beetles from easily chewing through and with the edges sealed in trenches with soil (Figure 6). This process creates a solar oven, this technique is only practical during the hottest months of the year, usually April through September. High temperatures produced in this enclosed space will kill many insects, including bark beetles, inside the wood. Additional information is available in University of Arizona publication AZ1370, "Firewood and Bark Beetles in the Southwest".

Under existing pines, avoid planting vegetation that requires frequent irrigation and fertilization, such as lawns, which is harmful to piñons. Consider slow, deep and infrequent (every 3 to 4 weeks) watering of stressed or damaged trees nearest your home. Start watering in May, or earlier at lower elevations, and continue until the monsoon season is well established.

Preventive spraying is only recommended for selected, high value trees around homes, businesses, recreation areas and other key areas during localized or widespread bark beetle activity, or if the tree(s) were disturbed during construction or other site disturbance activities. The insecticide label should indicate use for bark beetle prevention. These include varieties of **carbaryl** (trade name: Sevin® SL, Sevin® XLR) and **permethrin** (trade names: Astro™, Masterline® Permethrin Plus C, etc.). Landowners can purchase and apply preventive insecticides themselves, or hire a certified pesticide applicator. Ideally, spraying should be done in March *before* the first beetles emerge to attack new trees but it can be done during any time beetles are actively attacking live trees (March-October). Be sure to read all instructions on the product label. Spray each year that is at risk of piñon ips attack, and spray only those trees which are uninfested. Preventive spraying *will not* save trees already infested or under attack by ips. Currently there is no proven pesticides *to cure already infested trees* this includes systemic injections that claim to kill beetles that are currently feeding in the tree. Additional information is available in University of Arizona publication AZ1380, "Using Insecticides to Prevent Bark Beetle Attacks on Conifers".

Thinning

Thinning piñon-juniper woodlands can have substantial benefits. Thinning reduces competition for sunlight, nutrients, and moisture, hence enhancing the vigor of the remaining trees and making them more resistant to bark beetle attack. Reducing tree density will also significantly lower wildfire hazard, especially if the resulting slash (branches and tops less than 3" in diameter) is lopped and scattered (cut into short pieces and exposed to full sunlight), burned, or chipped and hauled away. When possible, thin or prune piñon during late fall, or winter, since ips are inactive at this time. If thinning or pruning must be done during the warmer months, high value piñon trees nearby may be preventively sprayed before starting and watered before and after thinning, and removal of the fresh slash away from the site is encouraged. Thinning is only effective in preventing future attack, thinning during an outbreak is an in-effective method of control.

Ecology

The main reason for increased activity by piñon ips may be due to the poor health of piñon-juniper woodlands. Negron and Wilson (2003) found that overly dense piñon stands led to reduced individual tree vigor and subsequently increased susceptibility to piñon ips. Many factors may have influenced increased stand density of piñon in the Southwest. These include favorable climatic conditions, and grazing by introduced ungulates which by removal of herbaceous plants would have improved conditions for trees and shrubs. There is some evidence that historical fire patterns were interrupted due to removal of fine fuels by ungulates thus further favoring trees and shrubs (Gottfried et al. 1995, West and Young 2000).

During periods of endemic populations, piñon ips normally act as natural thinning agents infesting widely scattered trees that have been weakened or recently killed by other factors. They are an important ecological component in the recycling of nutrients back into the system for the utilization by other organisms. In addition, piñon ips can be a food source for

woodpeckers and predatory beetles. Woodpeckers also create nesting cavities in the dead and dying piñons for themselves and secondary cavity nesting. And finally, wood-decaying fungi are provided a nutrient source for their survival and the decomposition of the trees.

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