



Pine Engraver Beetles in the Low Elevation Sonoran Desert in Tucson

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Introduction

Pine engraver beetle refers to 11 species of insects (in the *Ips* genus) living in the inner bark of Arizona's conifers that can cause rapid decline and tree death. Typically, the beetles are found at higher elevations (4200 feet to 9000 feet), but have recently been detected at about 2400 feet, in Tucson. The six-spined engraver (*Ips calligraphus ponderosae*) has been the only species detected, so far, in Tucson. This is the first time these native bark beetles have been found in non-native pines in the Sonoran Desert.

Typically, these beetles infest and kill weakened or stressed trees compromised by drought, lightning strikes, or windfall. In the Tucson area, they have generally been seen in non-native Aleppo (*Pinus halepensis*) and Afghan (*P. eldarica*) pines that have been poorly irrigated, struck by lightning, or weakened by other abiotic factors. Presumably, the beetles have been introduced to Tucson through the movement of infested, green ponderosa pine firewood from higher elevations. Once the firewood is no longer suitable, the beetles leave, flying to other susceptible green firewood or live pine trees.

In the following section, a description of the beetle, its life cycle at higher elevations, and some management tips on dead tree disposal, and management of live trees to limit further spread of the beetle are presented. Currently the life cycle of the beetles in their new, low elevation habitat is not known, and, therefore, effective management practices are still under development.

Beetle Description and Life Cycle

The six-spined engraver is the largest beetle of its genus in the southwest at just under a quarter inch in length. One of the most telling characteristics of pine engravers is the deep "scoop" (called declivity) on the rear of the beetle. The edge of the declivity is where the spines exist (six pairs, in this case), giving the beetle its name (Figure 1). This declivity is used to push the boring dust out of the exit holes so the adult beetles can move easily through the inner bark.

Generally, the six-spined engraver infests the thicker barked, and deeply fissured main trunk of trees, but



Figure 1: *Ips calligraphus*. Notice “scoop” (elytral declivity) with spines in rear of beetle. Photo courtesy of Arizona Dept. of Agriculture.



Figure 2: Galleries of *Ips calligraphus* in an Aleppo pine bark collected in Tucson, Arizona.

can be found in larger branches further up the tree. At higher elevations, the beetles begin flying in the spring as temperatures begin to increase, looking to infest new trees. Initially, a male beetle enters the inner bark of the tree, and releases a chemical attractant to attract multiple females. After the beetles mate, the females create galleries often exhibiting an “X” or “Y” shape. The galleries will generally follow the grain of the wood. As she goes, the female lays eggs along the edges of the gallery. After the eggs hatch, larvae emerge, creating galleries that branch horizontally from the female gallery (Figure 2). Eventually, these larvae will pupate and emerge from the tree, and look to find a new host in which to produce offspring. Engraver beetles have the ability to create multiple generations per year at higher elevations from spring through fall. With warmer temperatures in Tucson, beetles may produce new generations year-round.

Beetle Damage and Signs of Infestation

As noted, the six-spined engraver usually infests ponderosa pine. But, in Tucson, hosts include Aleppo and Eldarica pines. Other potential hosts may include Chir (*P. roxburghii*) and Canary Island (*P. canariensis*) pines. The beetles usually colonize trees stressed by lack of water, lightning, soil compaction, construction, or other mechanical damage. The effects of drought, soil compaction and root damage often progress slowly over years. Since trees develop symptoms gradually, diagnosis is often overlooked until other secondary problems develop. Signs of stress in pines include a thinner crown as older needles are shed, and branches have fewer green needles compared to healthy trees. Sometimes brown, dead needles are visible before they fall off. In some cases an entire branch can die.

Colonized trees exhibit several signs and symptoms that can be observed. The most common sign is a discolored crown. Needles fade from green, to a straw color, to a reddish orange as they die (Figure 3A). Often, one also sees some green needles hanging on. Unfortunately, this tree is already lost if



Figure 3: A. Fading crown of an Aleppo pine after bark beetle infestation; B. Boring dust on an Aleppo pine after successful beetle attack; C. Exit holes on an Aleppo pine after beetles completed their life cycle in the inner bark.

the whole crown has turned color. In some cases, individual large branches may die, and the progression of needle color will be the same. Another sign of beetle infestation is boring dust (Figure 3B). This is dust created by beetle activity in the tree, and will be red. It can be found in bark fissures, at the tree's base, or on branch crotches. The next sign of beetle infestation lies under the bark. Peeling off the bark, one sees the galleries (Figure 2), and there is no doubt that beetles are, or have been, present. Beetles will also leave exit holes on the surface of the outer bark (Figure 3C). These are small holes (about 1/8 inch to 1/4 inch) that go through the entire bark from the galleries to the outside.

Management Options

In the case of bark beetles in Tucson, management options are limited. At higher elevations, timing of treatments can be targeted for pre- or post-flight in the spring or fall. If the beetles are flying year-round in Tucson, targeting actions may be more complicated. Further, the species affected in Tucson are unsuitable for chemical foliar sprays as they are large in size, on small urban sites, and have broad canopies making overspray likely and creating a hazard nearby.

Prevention

The best treatment is prevention of beetle attacks by employing best management practices for tree care. Unless there are local water restrictions, apply water slowly, deeply, and infrequently (1-2 times per month) to the pines around your residence or commercial property. Do this with a properly installed and maintained drip system, or with a soaker hose placed around the drip line of the tree. The soil around the drip line of the tree should be soaked to a depth of 2-3 feet. Pines are evergreens requiring water year-round. Pines originating from Mediterranean climates are especially dependent on winter irrigation. Watering can be reduced after significant rainfall, as heavy rain may supply the necessary moisture as described above. Well-watered pines will be healthy, long-lived and less susceptible to insects or diseases including beetle colonization (Figure 4). Unfortunately, if your tree has already turned straw or red colored throughout the crown, irrigation will no longer help.

Removing and disposal of dying or dead trees

A pine tree that is dying or has been killed by the pine engraver beetles should be removed as soon as possible. Complete removal of green wood can prevent further spread of the beetles into neighboring trees or throughout the community. The entire tree should be disposed of in a landfill rather than chipping and reusing the wood chips. If chipping is the most practical method of disposal, take the chips to a landfill, but do not reuse them.

Dealing with firewood

Additionally, proper selection and storage of pine firewood is important. If you harvest firewood from the forest, collect dry (over 1 year old) wood. If you do collect green firewood, do not place it against or at the base of pines in your yard. Cover the firewood with clear, heavy plastic, completely, to



Figure 4: Healthy pines, such as this *Pinus halepensis* (Aleppo pine), have bright green, dense needles, and a full rounded canopy. Photo courtesy of the University of Arizona Campus Arboretum.

prevent any beetles from escaping the wood until it is dry. If possible, split the firewood before you stack and cover it. Pine trees growing near infested green firewood or growing near infested trees with a high population of beetles can become potential targets.

Chemical treatments

In ponderosa pine forests at higher elevations there are chemical options for spraying trees *before* a beetle infestation, however, the cost, effectiveness, and exposure to non-target organisms must be considered in urban areas, thus making spraying impractical. Insecticides used improperly can be injurious to humans, animals, and plants.

The bark beetles will not infest all or even most of the pines in Tucson, but will likely target pines stressed by drought or other factors, or damaged by construction. Planting pines in Tucson is not advisable, especially in small residential settings, and where irrigation is inadequate, due to the potential for beetle infestation. However, planting pines susceptible to the pine engraver beetle should only be done if the tree will be properly maintained over the life of the tree. There are many tree species that provide shade, screening, and character, but require less water and space at maturity, and are less vulnerable to disease. Please see the attached list of potential replacement trees for the Tucson area.

This fact sheet only addresses basic information about these beetles in a new environment. For additional information about this complex subject check out the following links:

For proper watering techniques, refer to the University of Arizona Cooperative Extension brochure:

<http://cals.arizona.edu/pubs/water/az1298.pdf>

Forest Pest Insects in North America: A Photographic guide

<http://forestpests.org/vd/42.html>

Six-Spined Engraver Beetle

http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5187551.pdf

http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_043451.pdf

<https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1449-2014.pdf>

How to Hire a Tree Expert

<http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1003.pdf>

Construction and Tree Protection

<http://www.ces.ncsu.edu/forestry/pdf/ag/ag685.pdf>

Pines of Arizona

<http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1584.pdf>

For further assistance with this insect, contact

Peter Warren, Urban Horticulture Agent, Pima County Extension in Tucson (520) 626-5161, plwarren@cals.arizona.edu; Chris Erickson, Forest Program Specialist, Arizona State Forestry Division, (602) 771-1407, ChrisErickson@azsf.gov; Mayra Moreno, (520) 628-5480, MayraMoreno@azsf.gov; or Bob Celaya, Forest Health Specialist, Arizona State Forestry Division, (602) 771-1415, BobCelaya@azsf.gov.

Alternative Tree Species to Consider When Replacing Pines

Plants that are well suited to site conditions will thrive with little maintenance and provide a greater return on your landscape investment. Tree size should be proportionate to the site to ensure adequate irrigation is applied. The lists provided here present trees, organized by size, and selected for both their low water use and cold hardiness to at least the mid-teens (F).

Small (8-15' Tall), Low Water Use Trees		Medium (15-30' tall), Low Water Use Trees		Large (30-60' tall), Low Water Use Trees	
Leatherleaf Acacia	<i>Acacia craspedocarpa</i>	Sweet Acacia	<i>Acacia greggii</i>	Arizona Cypress	<i>Cupressus arizonica</i>
Palo Blanco	<i>Acacia willardiana</i>	Weeping Acacia	<i>Acacia pendula</i>	Smooth Bark Cypress	<i>Cupressus glabra</i>
Anacacho Orchid	<i>Bauhinia lunaroides</i>	Shoestring Acacia	<i>Acacia stenophylla</i>	Coolibah	<i>Eucalyptus microtheca</i>
Thornless Cascalote	<i>Caesalpinia cacalaco</i> 'Smoothie'	Bottle Tree	<i>Brachychiton populneus</i>	Silver Dollar Gum	<i>Eucalyptus polyanthemus</i>
Desert Hackberry	<i>Celtis pallida</i>	Desert Willow	<i>Chilopsis linearis</i>	Chinese Pistache	<i>Pistacia chinensis</i>
Texas Olive	<i>Cordia boissieri</i>	Texas Ebony	<i>Ebanopsis ebanum</i>	Mt. Atlas Pistache	<i>Pistacia atlantica</i>
Little Leaf Ash	<i>Fraxinus greggii</i>	Little Leaf Ash	<i>Fraxinus greggii</i>	Red Push Pistache	<i>Pistacia 'Red Push'</i>
Mastic Tree	<i>Pistacia lentiscus</i>	Desert Ironwood	<i>Olneya tesota</i>		
Evergreen Sumac	<i>Rhus virens var. choriophylla</i>	Blue Palo Verde	<i>Parkinsonia florida</i>		
Texas Mountain Laurel	<i>Sophora secundiflora</i> 'Silver Peso'	Foothills Palo Verde	<i>Parkinsonia microphylla</i>		
Mexican Buckeye	<i>Ungnadia speciosa</i>	Mexican Palo Verde	<i>Parkinsonia x sonora</i>		
Arizona Rosewood	<i>Vanquelinia californica</i>	Red Push Pistache	<i>Pistacia x 'Red Push'</i>		
Kidneywood	<i>Eysenhardtia orthocarpa</i>	Velvet Mesquite	<i>Prosopis velutina</i>		
Evergreen Sumac	<i>Rhus virens</i>	Texas Honey Mesquite	<i>Prosopis glandulosa</i>		



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extension.arizona.edu/pubs/az1689-2015.pdf

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