



TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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NUMBER: 28

JANUARY 2004

Ips Beetles in California Pines

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There are a number of bark beetle species that attack and kill pines in California. Foremost among these are species of *Dendroctonus* and *Ips*. Although species of *Dendroctonus* are considered to be the most aggressive tree killers, species of *Ips* can be significant pests under certain circumstances and/or on certain hosts. Nearly all of California's native pines are attacked by one or more species of *Ips*. Some species of *Ips* also attack spruce, but are not considered to be significant pests in California.

While numerous bark beetles colonize pines, only a handful are capable of killing live trees. The majority of bark beetles, including species of *Ips*, are secondary invaders that colonize recently dead, dying, or weakened trees. Those species of *Ips* that kill trees, do so opportunistically and typically only kill trees under stress. Many *Ips* species prefer to attack freshly cut or downed wood, such as logging slash, blowdown or firewood. In contrast, *Dendroctonus* beetles seldom attack cut or downed material, instead preferring standing live trees. *Ips* attacks on live trees can result in top-kill or death of the entire tree. Such attacks on live trees are frequently preceded by a population increase that resulted from beetles reproducing in cut or downed material. Most tree killing occurs during drought years.

Life Cycle and Identification

Like other bark beetles, *Ips* beetles initiate their attack by tunneling into the inner bark of a host tree where they mate, lay eggs, and their offspring feed. When the offspring mature to adult beetles, they leave the tree and search out new host material to colonize. Only the fresh inner bark of a live or recently dead tree is suitable for colonization and only one generation is produced in a given piece of host material. Bark that has deteriorated due to drying or attack by other organisms will not be colonized. Depending upon beetle

species, climate, and other factors, *Ips* may complete from one to many generations per year. Under ideal conditions, a single generation may be completed in about 45 days.

Ips are shiny black to reddish brown, cylindrical beetles, ranging in size from about 3 - 6.5 cm. A feature which readily distinguishes them from *Dendroctonus* beetles is the presence of spines on the posterior end of the wing covers. There may be between 3-6 pairs of spines, the size, number and arrangement of which are unique for each



Figure 1. Adult *Ips paraconfusus*

species of *Ips* (figure 1).

The adult male initiates attack. After boring through the outer bark, he constructs a small chamber (nuptial chamber) in the inner bark where he is joined by a number of females with whom he mates. Each female constructs an individual tunnel that radiates out from the chamber. Eggs are laid along the sides of these tunnels. The number of radiating tunnels indicates the number of females; three or four are common, although there may be more (figure 2). There are two distinct differences between the tunnels (or galleries) of *Ips* and those of *Dendroctonus*. *Dendroctonus* beetles are monogamous and produce an un-branched gallery. They also pack their tunnels with a fine granular material, whereas *Ips* keep their tunnels open.



Figure 2. *Ips* gallery with 3 branches

Bark beetle eggs are white and about the size of a pinhead. Eggs hatch into larvae, the immature stage that feeds on the inner bark of the tree. These are small, cream-colored, legless grubs with a dark head. The feeding of each larva is marked by a fine, thread-like tunnel which runs perpendicular to the parent egg gallery and increases in size as the larva grows. Successful completion of larval development is followed by the

pupal stage in which the transformation to the adult beetle takes place. Pupae can be found in small, circular chambers at the end of the larval tunnels. Pupae are soft-bodied like larvae, but show the beginnings of the adult form. Initially cream-colored, they darken to a reddish brown as they undergo the transformation to adult. Newly formed or callow adult beetles can be found in pupal chambers before they emerge from the tree.

Characteristics of Attack

Ips beetles are particularly efficient at locating and colonizing freshly downed or cut stems and large branches of trees. It has been shown that some species are attracted to odors released from this material and will themselves produce additional odors called pheromones that attract more beetles to the site. If there are sufficient beetles available to respond to these attractant odors, the result is a rapid and thorough colonization of the host material.

Ips also attack standing live trees, but typically do this only if their populations are



Figure 3. Slash and attacked nearby pine trees

high, the trees are under stress, and there is no other suitable host material available. *Ips* may shift attack to live trees after building up their numbers in downed or cut material (figure 3). Populations may also build-up in dying trees, such as trees that are dying from attack by other types of bark beetles. Even though *Ips* may attack and kill live trees, their success will be poor in trees that are vigorous (healthy) enough to mount an active defense against the attacking beetles. Thus, tree-killing outbreaks are typically limited in duration and size. Severe drought or disease conditions, however, can lead to more persistent outbreaks.

The first sign of *Ips* attack is the presence of boring dust in the cracks and crevices of the bark. This is a yellowish or reddish brown material that is pushed out by the beetles as they construct their galleries (figure 4). *Dendroctonus* attacks on a live tree often result in the formation of pitch tubes, which are a

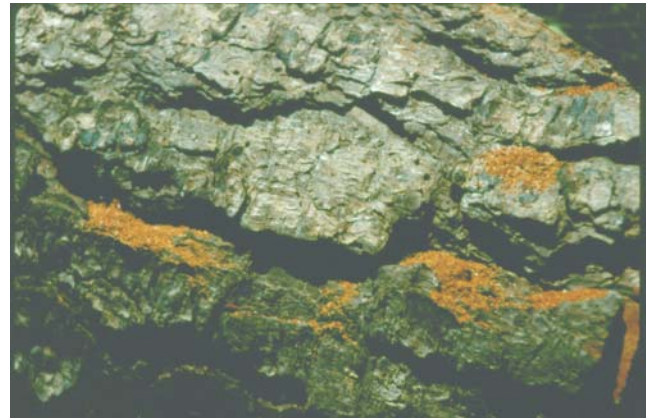


Figure 4. *Ips* boring dust

mixture of resin and boring material that accumulates at the attack site. *Ips* attacks rarely produce pitch tubes.

When a pine is successfully attacked by *Ips*, its foliage fades from green to yellow to reddish brown. If the tree is top-killed, this color change will be restricted to the upper part of the crown. If the entire tree is killed, this change will take place uniformly throughout the crown. This change in color can take many months and usually the bark beetle brood will have finished developing and emerged by the time the tree is brown.

The nature of attack on live trees varies depending upon the species of pine and the beetle(s) attacking it. *Ips* and *Dendroctonus* attacks often can be found on the same dying tree — experience helps us to identify which beetle is the likely cause of death. For pines such as ponderosa, sugar, and Jeffrey, *Ips* will kill smaller, pole-size trees or the tops of mature trees, but larger trees are typically killed by species of *Dendroctonus*. For some

other pines, *Ips* will kill mature trees, as is the case for Monterey pine.

Management Considerations

The keyword for management of bark beetles is prevention. This is especially true for *Ips* beetles whose tree-killing attacks are often short-lived and may have a clearly identifiable cause.

Ips beetle populations can build-up whenever fresh, recently cut or downed stems or large branches of pine (greater than 3 inches in diameter) are available for the beetles to breed in (hereafter referred to as brood material). However, the creation of this material does not necessarily mean that *Ips* populations will build-up in the material or that nearby live trees will be attacked and killed by *Ips*. Many factors influence the outcome of such a situation and, in fact, more often than not no live trees are killed. Relevant factors include the pre-existing beetle population, the condition of live trees, and various attributes of the brood material. The following activities may promote the build-up of *Ips* populations and/or *Ips* attacks on live trees and should be avoided when possible:

- » Piling or stacking brood material adjacent to live pine trees
- » Creating large quantities of brood material during late winter and spring (February through June), particularly
 - during periods of drought
 - when recently dead and dying pines are present, indicating a beetle outbreak is already in progress
- » Creating large quantities of brood material anytime high value pines are nearby

If avoiding these activities is not possible, there are treatments that will reduce the suitability of brood material as a breeding site for *Ips*.



Figure 5. Lopped stem of ponderosa pine

- **Lop and scatter** is a common practice used in logging operations where large amounts of brood material are generated. It involves removal of branches from pine stems greater than 3 inches in diameter and

scattering the stems in a sunny location (figure 5). The purpose is to subject the brood material to maximum solar radiation, which heats it and promotes drying, both of which discourage beetle colonization. This treatment also reduces fire hazard.

- For small quantities of brood material, an alternative treatment is **covering with plastic**. In this case, the material is stacked and covered with clear plastic sheeting that is a minimum of 6 mil thick. Stack in a sunny location if possible. The covering should completely seal the pile so that there are no openings to the outside and should remain in place for a minimum of several months during the summer or longer during cooler weather.
- Other treatments include removal of the material from the site, piling and burning, chipping, and debarking. See Tree Note # 3 for a more complete discussion of the various treatments.

Following the above guidelines will help prevent a large percentage of pine mortality and top-kill that is caused by *Ips*. Still, there are other situations that may justify additional management actions in order to protect your pine trees. Disease and drought conditions are of particular concern. In order to formulate an appropriate response to a disease situation, it is important to have an accurate diagnosis, preferably from a professional, such as a certified or registered arborist, or a registered professional forester. These professionals should also be able to recommend a course of action, if warranted. Management of some of the more common tree diseases are discussed in other CDF TREE NOTES, as well as in publications available from universities and other governmental agencies. Many publications can be accessed on the Internet.

Drought is a reoccurring phenomenon in California that invariably leads to bark beetle outbreaks and tree mortality. There are both long-term and short-term actions that can be taken to protect your trees. **These actions are not aimed specifically at *Ips*, but rather at any of the bark beetles that might attack and kill pine trees.** Maintaining tree health is a basic objective and maintaining adequate spacing between trees is one of the most important means of achieving this. Many California forests are overstocked with trees – more trees are present than can be sustained through repeated episodes of drought. When bark beetles kill trees during drought, they help reduce tree density to a more sustainable level. This “natural thinning” by bark beetles, however, can be quite variable and unpredictable. Alternatively, landowners can be proactive and thin trees before the beetles do. The recommended time to thin is during

non-drought years when trees are best able to respond to and take advantage of the added space. Consult with a registered professional forester for advice on thinning and tree harvesting.

Short-term responses to drought include irrigation and pesticide treatment. Periodic, deep irrigation during the later part of spring and summer can help compensate for water deficits brought on by drought. Pesticides formulated to protect trees from bark beetle attack are appropriate for use on trees that are experiencing an acute, temporary stress, such as is caused by drought. They generally are not appropriate for use on trees that are not under stress or on trees that are suffering from chronic, long-term stress. For a more detailed discussion of thinning, irrigation, and pesticide use, refer to TREE NOTE # 13, The Western Pine Beetle.

Further Reading

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