



Forest Insect & Disease Leaflet 60

Revised April 2012

U.S. Department of Agriculture • Forest Service

Silver Fir Beetle & Fir Root Bark Beetle

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Two species of native bark beetles in the genus *Pseudohylesinus*; the silver fir beetle, *P. sericeus* (Mannerheim), and the fir root bark beetle, *P. granulatus* (LeConte), (Figure 1) are known to kill true firs along the Pacific coast and inland Pacific Northwest. These beetles usually attack windthrown, felled or injured trees. Pole and sapling size trees in dense stands and suppressed understory trees are most susceptible to attack. They are active every year causing scattered mortality in individual trees or small groups of trees, and are often found together or in conjunction with other true fir bark beetles.

Outbreaks are rare; however a large outbreak of these two species occurred between 1947 and 1955 with Oregon and Washington bearing the brunt of the infestation. By 1955, when the outbreak concluded, more than 528 million board feet of Pacific silver fir (*Abies amabilis*) had been killed on more than a million acres. More recently, from 1994-1997, an outbreak of fir root bark beetles (possibly in

conjunction with silver fir beetles) near Vancouver, BC, killed a few hundred silver firs after a blowdown event.

Range

Silver fir beetle has been confirmed in BC, AK, WA, OR, ID, and CA. The range of the silver fir beetle extends from the southern portion of the Alaskan peninsula (near Sitka) and western British Columbia (as far west



Figure 1. *Pseudohylesinus granulatus*, the fir root bark beetle (top) and *Pseudohylesinus sericeus*, the silver fir beetle (bottom).

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as the island of Haida Gwaii), south to the Santa Cruz Mountains in central California, and east to the Cascade Mountains.

Fir root bark beetle has been confirmed in BC, AK, WA, OR, ID, MT, and CA. The range of the fir root bark beetle extends from the southern Alaskan peninsula (near Juneau) and western British Columbia to the Giant Forest in Sequoia National Park in south central California, and as far east as the western edge of Montana.

Host Trees

Pacific silver fir is the most common host, and the only species so far to host serious epidemics (Figure 2); however, both beetle species have also been recorded on grand fir (*Abies grandis*), white fir (*Abies concolor*), California red fir (*Abies magnifica*),

subalpine fir (*Abies lasiocarpa*), noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), and western hemlock (*Tsuga heterophylla*). Fir root bark beetle has been collected from ponderosa pine (*Pinus ponderosae*) and silver fir beetle has been collected from Sitka spruce (*Picea sitchensis*).

Evidence of Attack

The entrance holes made by these beetles are inconspicuous because they normally occur in bark crevices and under bark scales, mosses, or lichens. Close inspection will reveal small amounts of reddish boring dust beneath fresh attack sites. Most attacks occur between May and August. Abundant attacks by these beetles can cause a ring of boring dust to accumulate around the base of the tree. This ring of boring dust can be



Figure 2. Pacific silver fir mortality attributed to *Pseudohylesinus* species on the Mt. Hood National Forest, Oregon.

seen from a distance of 10-15 feet, but can be washed away by the first rain.

The most noticeable evidence of a successful beetle attack is a change in foliage color. The foliage of trees killed by these beetles usually first turns yellow, then bright red-orange, finally fading to a dull red-brown. These dead needles often remain on the tree for up to two years after death. However, during periods of unseasonable warm weather, the needles sometimes die and fall quickly without noticeably changing color. Yellow and bright red-orange crowns indicate freshly killed trees that often contain larvae (Figure 3). Dull red-brown trees are older, and usually only contain galleries as evidence of beetle attack.

Physical Description

The two species are very similar in appearance, differing mainly in their size. On average, fir root bark beetle is 4.0-6.5 mm long (.16-.26 in), compared to about 2.4-3.9 mm (.09-.15 in) for silver fir beetle (Figures 1 and 4). Both species are stout, oval beetles covered with brown and gray scales that give them a patchy appearance (see top beetle in Figure 4). When the scales are rubbed off the beetles have a minutely roughened, shinier, dark reddish-brown to black appearance. The pronotums are distinctly narrower



Figure 3. Bright red needles of freshly killed grand fir with silver fir beetle brood still present near Blewett Pass in Washington.

Figure 4. Dorsal view of the fir root bark beetle (top) and the silver fir beetle (bottom).



than the elytra, which have shallow, irregular punctures on the surfaces. The elytra are strongly rounded at the base with narrow striae (lines) along the length.

Life History & Habits

The life cycles of the two beetles are very similar. In northwestern Washington both beetles require approximately 24 months to complete their life cycle. In warmer climates at a lower elevation, they may reach adulthood within a year. Adult beetles bore into living phloem between the bark and sapwood.

There are two types of attacks. New adult beetles emerge between August and early September and make “feeding attacks” on host trees. At this time they do not construct galleries (tunnels in the phloem) or lay eggs (Figure 5). From late September

until the end of October the beetles concentrate their boring and feeding at the bases of host trees, where they hibernate through the winter. In late May to early June of the following year, these overwintering beetles emerge and make “brood attacks” by constructing galleries and laying eggs in niches along the galleries (Figure 6). In late July or early August, some of these overwintering adults reemerge, construct more galleries, and lay a second batch of eggs. Externally, the feeding attacks and the brood attacks appear the same. The only way to tell them apart is to remove a section of the bark to determine whether galleries are present or not.

The egg galleries of both species cut transversely across the grain of the wood (Figure 6). In successful attacks the length of the gallery ranges from 1–7 inches for both



Figure 5. Bark removed to reveal feeding attack (arrow) on inner bark – no brood produced.

beetles, with an average of 2.6 inches. As the adults construct the gallery, eggs are laid in niches along the sides. In 10-14 days larvae hatch and begin larval galleries perpendicular to the parental gallery, along the grain of the wood. In the beginning larval galleries are parallel to each other, but as the larvae grow the paths begin to wander, especially when the population is dense. The larval stage (Figure 7A) lasts 12-14 months, depending on when the eggs were laid. Larval development stops during cold weather. Both the larval stage and the overlapping generation of adults hibernate through the winter and resume activities in the spring.

The following July, when larvae have matured, they construct pupal cells within the inner bark. If the bark is thin the cells may extend slightly into the wood. Larvae that have transformed into pupae (Figure 7B) emerge as adults 2-3 weeks later. When they emerge in August, the two year life cycle is complete.

Each of the two species attacks a different portion of the tree. The smaller silver fir beetle attacks all along the bole, but primarily occurs in the upper portion of the bole and the branches. It has been found attacking branches that are only 1 inch in diameter.

The larger fir root bark beetle usually attacks the basal portion of the bole

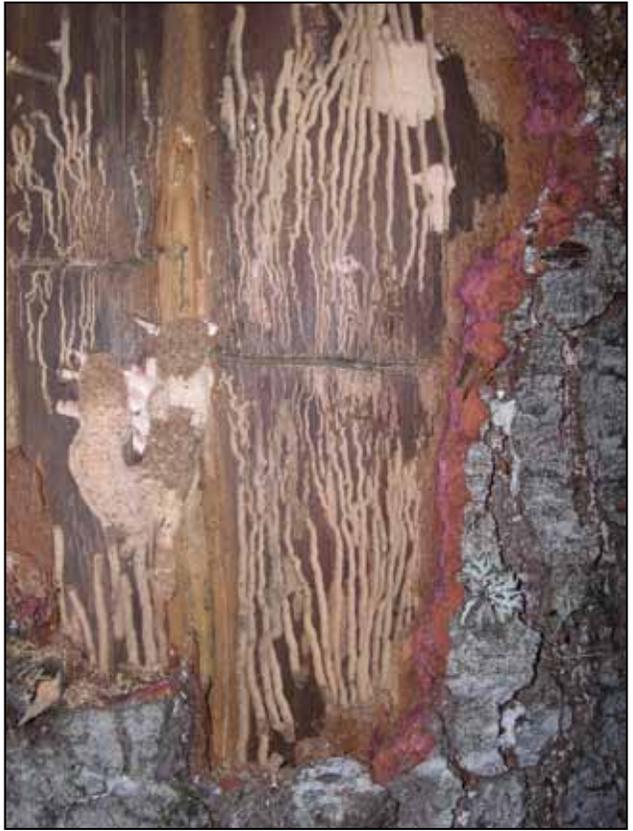


Figure 6. Transverse egg galleries and vertical larval mines from a successful brood attack by Pseudohylesinus species.

and the roots of the tree. It has been observed from a few inches below the ground line up to a height of 15 feet on the bole.

Usually more than a year is required for a mature tree to be killed. A tree can experience top-kill in one year, and additional sections of the tree can be killed in subsequent years. Strip or patch-killing often occurs so that the tree is not girdled in a single year. In some cases, strip attacks heal over completely, leaving scars that can later be identified. However, recurrent attacks over a period of years usually overcome the tree.

Infection by fungi often accompanies beetle attack. A brown-staining



Figure 7. Fir root bark beetle larva (A) and pupa (B).

fungus, *Ophiostoma subannulatum* (Livingston & Davidson), is often found in association with the silver fir beetle and fir root bark beetle, and is believed to aid in killing the tree. Bark beetle feeding scars on live trees may allow other fungi, such as the root rotting fungi *Armillaria ostoyae* (Romagnes) Herink and *Phellinus werii* (Murrill) Gilbertson, to infect live grand fir roots and spread these diseases. *Armillaria* was present to some degree at the base of all the beetle-killed silver fir trees in a 1954 study in a Skagit County, WA, outbreak. *Armillaria* root disease and silver fir beetles were linked to the damage and mortality of silver fir trees on 650,000 acres in 1955.

The large outbreak that occurred from 1947-1955 was associated with drought. Weather records show that average temperatures were higher than normal, and precipitation was below normal, from 1942 through 1954. It was determined that unseasonably hot, dry summers initiated the outbreak.

Silver fir beetles and fir root bark beetles have also been associated with tree-killing in areas defoliated by sawflies (*Neodiprion* sp.). A study

near Kelsey Bay, BC, found that trees that were severely defoliated by sawflies were highly susceptible to successful attack by bark beetles. *Pseudohylesinus* species have also been linked to balsam woolly adelgid damaged trees over a 146,000 acre area in the Pacific Northwest. A study in coastal Oregon found that silver fir beetles will attack fresh western hemlock logging slash in recently thinned areas.

Management

Both beetles are associated with windthrown, injured, or weakened trees. However, on occasion, they can cause significant mortality. Young, vigorous trees appear to be resistant. Forest management practices that maintain tree vigor could minimize impacts from these beetles. When feasible, removing windthrown trees can minimize the impact from these bark beetles.

Assistance

Private landowners can get more information from county extension agents, state forestry departments, or state agriculture departments. Federal resource managers should

contact Forest Health Protection, USDA Forest Service (www.fs.usda.gov/goto/foresthealth/). This publication and other Forest Insect and Disease Leaflets can be found at www.fs.usda.gov/goto/fhp/fidls.

Acknowledgements

This publication is a revision of the original Silver Fir Beetles Forest Pest Leaflet 60 by G.M. Thomas and K.H. Wright. We thank Malcolm Furniss, Robert Rabaglia, and Donald Bright for reviewing and providing input to the manuscript.

Figures 1 and 4 were taken by Steve Valley, Oregon Dept. of Agriculture. Figure 2 was taken by Beth Willhite, USDA Forest Service, and Figures 3, 5, 6, and 7 were taken by Darci Carlson, USDA Forest Service.

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