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Roundheaded Pine Beetle

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The roundheaded pine beetle *(Dendroctonus adjunctus* Blandford) kills pine trees in the Southwestern United States and Mexico. Periodic outbreaks have killed large numbers of ponderosa pines *(Pinus ponderosa* Lawson) in southern New Mexico during the last three decades. In 1950, 16,000 pole- and sawtimber-sized trees were infested on 2,500 acres (1,012 ha) near Cloudcroft (fig. 1) . A smaller outbreak killed several hundred trees near Ruidoso in the early 1960's. In 1971, a survey estimated 400,000 infested pole-sized ponderosa pines on 150,000 acres (60,700 ha) from Mayhill to Ruidoso. On a high-use recreation area of the Toiyabe National Forest, Nev., several hundred trees per year were lost during the periods from 1938 to 1941, 1953 to 1959, and 1968 to 1970.

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Outbreaks seem to develop on poorer sites and ridgetops. During outbreaks in New Mexico, trees in all crown and diameter classes were killed in groups ranging from 3 to in excess of 100 (fig. 2). In one New Mexico area, 60 percent of the infested trees were of intermediate crown class. Infestations in Nevada, however, were restricted primarily to trees over 20 in (50.8 cm) in diameter at

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Figure 1. - Ponderosa pines infested by the roundheaded pine beetle.

breast height (d.b.h.); only occasionally did beetles attack trees less than 12 in (30.5 cm) in diameter. The Nevada infestations were usually in single trees or groups that seldom exceeded 15 trees.

Trees that are not attacked around the entire circumference or that are not attacked above 7 ft (2.1 m) may survive. As many as 15 percent of all trees attacked may not receive a lethal number of attacks.

In the Southwest, the roundheaded pine beetle often works in conjunction with the western pine beetle *(D. brevicomis* LeConte), the mountain pine beetle *(D. ponderosae* Hopkins), and several species of *Ips.* In trees larger than 18 in (46 cm) d.b.h., the roundheaded pine beetle may attack the bole below 12 ft (3.7 m) while the other *Dendroctonus* beetles attack the bole above 12 It (3.7m). When the mountain pine beetle is present in large numbers, the roundheaded pine beetle may be restricted to the first few feet of the bole. In smaller trees, the roundheaded beetle may work entirely alone. In the most recent outbreak in southern New Mexico, the roundheaded pine beetle initially attacked the trees; as many as three species of *Ips* attacked simultaneously or filled in later.

The beetle may kill up to 50 percent of the trees in pure stands of ponderosa pine, including both small- and large-diameter trees.

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Figure 2.—Group of ponderosa pines killed by the roundheaded pine beetle.

In mixed conifer stands, the beetle may also kill up to 50 percent of the pine, thereby leaving Douglasfir—*Pseudotsuga menziesii* (Mirb.) Franco—as the dominant species. On southern aspects where Douglas-fir may have formerly predominated, some sites have been converted to predominantly ponderosa pine through fire and logging. These sites may eventually revert to predominantly Douglas-fir as the beetles kill the ponderosa pine and release the understory Douglas-fir seedlings.

Hosts

In the United States, the beetles principally attack ponderosa pine but have also been collected from limber pine (*P. flexilis* James). From Mexico southward, it infests several pines, including Mexican white pine *(Pinus ayacahuite* Ehr.), Chihuahua pine (P. *chihuahuana* Engelm.) Montezuma pine (*P. montezumae Lamb.),* and Nicaragua pine (*P. pseudostrobus* Lindl.).

Evidences of Infestation

Resin mixed with boring dust may exude from the entrance holes in the first trees attacked by the roundheaded pine beetle. On most trees, boring dust collects in the bark crevices and accumulates around the base of the tree. This dust ranges in color from a brownish red to almost white. Pitch tubes (fig. 3) are usually formed on the surface of the tree trunk when the resin solidifies. On trees with relatively few attacks, pitch tubes are larger than those on trees with many attacks. Boring dust and pitch tubes are freshest and most noticeable during the attack period of late September to early November.

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Figure 3.—Pitch tubes formed after attack by the roundheaded pine beetle.

Foliage on the trees attacked by the beetle begins to fade to a light green as early as May of the year following attack; by midJuly, the foliage is straw brown. By December, 14 months after attack, most of the trees have dropped their needles. A few trees may remain green for 12 to 16 months despite the presence of boring dust and pitch tubes on the bark.

Life Stages

Newly emerged adult beetles are a shiny dark brown to black, about 1/4 in long (0.6 cm) and 1/8 in (0.3 cm) wide. Females are slightly larger than males. Eggs are oblong and pearly white, less than 1/16 in (0.15 cm) in length and width. Larvae are grublike, legless, and more or less translucent, although the contents of the abdomen may impart a reddish-brown hue. Depending on the instar, the size of the larvae may range from the dimensions of the egg to those of the adult. The pupae are white and bear adult characteristics such as antennae, wing covers, and legs (fig. 4).

Most roundheaded pine beetles in the United States complete their life cycle in 1 year, although

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Figure 4.—Stages in development of roundheaded pine beetle: top left, adult; top right, eggs; bottom left, larvae; bottom right, larvae and pupae in outer bark.

about 10 percent of the brood may take 2 years. In Nevada, a larger percentage may take more than 1 year to complete development. Adults emerge and fly from infested trees from late September to late November; they attack green trees within a few days of emergence. The greatest daily numbers of beetles emerge in late October and early November. The females bore through the outer bark into the phloem, where the egg gallery is constructed; the outer wood (xylem) is also lightly scored. The egg gallery usually

meanders upward, with the eggs deposited in small niches alternately on either side of the gallery. The egg gallery is initially kept clean of boring dust, but as the gallery lengthens, the male packs the first few inches with boring dust.

Galleries are usually about 12 in (30.5 cm) long (fig. 5), although they may extend to 4 ft (1.2 m). Beetles that attack trees early in the flight period will have their galleries essentially completed by early December; galleries in trees attacked in November will be only

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Fisrure 5.—Galleries of the roundheaded Pine beetle.

partly completed by December. Between December and February, gallery construction is limited to times when bark temperatures are favorable. A minor amount of gallery construction resumes in March and April.

The youngest larvae form small feeding galleries in the phloem. Older larvae bore into the drier outer bark, broadening the feeding tunnels that eventually end in pupal chambers.

Brood densities are highly variable between aspects and heights on the tree. In one study, brood densities were significantly higher on the north sides of trees than on the south sides in the spring, but as the time of emergence neared, the densities were quite similar. In another study, south sides produced more beetles on the average than north sides. Beetle production was also greater at 10 feet aboveground than at 1.5 feet.

Egg hatch generally begins in mid-March and is essentially complete by late April. A few eggs from the early attacks will hatch before winter but many of these die during that period. Larvae develop rapidly through the third instar. Fourth-instar larvae develop more slowly and do not pupate until late July and early August; in exceptional cases, pupae may be found as early as June and as late as mid-September. Adult beetles are present after the middle of August and remain in the tree for a period of 2 to 3 months.

The life history of the roundheaded pine beetle is unique for the genus *Dendroctonus*. It is the only species in the United States that overwinters predominantly in the egg stage and flies and attacks so late in the year. This uniqueness is probably brought about by its development at the extreme limits of its northern range. Optimum development appears to occur from central Mexico south, where the insect may have two generations per year.

Control

The red-bellied cleric *(Enoclerus sphegeus* Fab.) is the most important predator of the roundheaded pine beetle in New Mexico and plays an important role in regulating beetle populations. The red-bellied cleric larvae consume the larvae, pupae, and callow adults of the roundheaded beetle. A predaceous ostomid beetle *(Temnochila virescens* Fab.) commonly feeds on roundheaded pine beetle eggs and larvae. A braconid wasp *(Coeloides sp.) is* the most abundant insect parasite. Numerous other arthropods are associated with the roundheaded pine beetle, but little is known of their relationships.

Two common internal nematode parasites, *Parasitylenchus stipatus* Massey and *Parasitaphelenchus dendroctoni* Massey, frequently reduce egg production of infested females by 50 percent.

Woodpeckers may reduce populations of the beetle during spring and summer on individual trees. Woodpeckers have consumed over 90 percent of the brood of other *Dendroctonus* beetles on individual trees, so it is

probable that they do the same with the roundheaded beetle.

Low winter temperatures appear to have little effect on the insect. The overwintering eggs survive temperatures as low as minus 25° F. (minus 32° C). These temperatures do, however, cause high mortality among the larvae that hatch before the low temperatures occur.

Management

Private landowners can minimize the number of trees killed on their property and protect especially high-value trees by (1) thinning their stands, (2) eliminating infested trees by felling and then burning or treating chemically, and (3) spraying noninfested trees with a protective spray. Trap trees felled in late September may be effective but the technique needs more study. For recommendations and procedures, contact your regional Forest Service or State Forest Service pest control office for information on thinning methods, registered chemicals, formulations, rates of application, and method of treatment.

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