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Mangement Guide for

Roundheaded Pine Beetle

Dendroctonus adjunctus Blandford

Topics

The roundheaded pine beetle *Dendroctonus adjunctus* Blandford (= *convexifrons* Hopkins) (Chansler 1967, Stevens and Flake 1974, Wood 1963), occurs and kills pine trees in Colorado, Utah, Nevada, Arizona, New Mexico, and southward into Mexico. Periodic outbreaks, although sporadic and short-lived, have killed large numbers of ponderosa pines *(Pinus ponderosa* Lawson) in southern New Mexico and Nevada during the last three decades (Massey, 1977).

Hosts:
In the United States, roundheaded pine beetle principally attacks *P. ponderosa* 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.).

Key Points

- Roundheaded pine beetle is destructive in stands of overstocked, pole-sized ponderosa pines.
- In southern Nevada, mature and overmature ponderosa pines have been extensively killed by this beetle on high-use areas.
- Attacks by roundheaded pine beetle are made in the basal portion of the bole.

Damage

Attacks by roundheaded pine beetle are made in the basal portion of the bole, often in trees previously attacked by other species of *Dendroctonus* or by species of *Ips*. In dense young stands, trees usually are killed in groups of 3 to 15; sometimes up to 100 (figure 1). Recently felled trees are also commonly attacked. Roundheaded pine beetle may kill up to 50 percent of the trees in pure stands of ponderosa pine, including both small- and large-diameter trees. In mixed conifer stands, roundheaded pine beetle may also kill up to 50 percent of the pine, thereby leaving Douglas-fir (*Pseudotsuga menziesii* (Mirbel) Franco) as the dominant species.

Figure 1. Ponderosa pines infested by the roundheaded pine beetle (Massey, 1977).

Egg hatch generally begins in mid-March and is essentially complete by late April.

The larvae mine across the grain in the cambium region.

Figure 2. Long, vertical egg galleries with eggs deposited at intervals along their lengths

Life History

Most roundheaded pine beetle in the United States complete their life cycle in 1 year, although about 10 percent of the brood may take 2 years. In Nevada, a larger percentage may take more than 1 year to complete development. Attacks are made principally in October and November to green trees within a few days of emergence. The foliage of attacked trees fades the following May or June.

The females bore through the outer bark into the phloem, where the egg gallery is constructed; the outer wood (xylem) is also lightly scored. From this entrance hole, the egg gallery extends horizontally in the cambium region, either left or right, for 2.5 to 5 cm and then winds longitudinally with the grain an average distance of 30 cm (figure 2). Galleries of neighboring pairs often cross, but retain an overall longitudinal pattern. Eggs are laid individually in niches on alternate sides of the egg gallery (figures 2,5). 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 30.5 cm long, although they may extend to 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 only be 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 (figure 3). Older larvae bore into the drier outer bark, broadening the feeding tunnels that eventually end in pupal chambers (figure 4). Brood densities are highly variable between aspects and heights on the tree.

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.

Figure 3. Larval mines radiating horizontally (USDA, 2005)

Figure 4. Larvae mining in the bark of a ponderosa pine in the later stages of development.

The larvae mine across the grain in the cambium region until the third instar, then they bore into the outer bark to complete development. 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.

Identification

Figure 5. Pitch tubes formed after attack by the round-headed pine beetle (Massey, 1977).

Resin mixed with boring dust may exude from the entrance holes in the first trees attacked by 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 (figure 5) 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. 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 mid-July, 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.

Newly emerged adult beetles are a shiny dark brown to black, about 6 mm long and 3 mm wide (figure 6). Females are slightly larger than males.

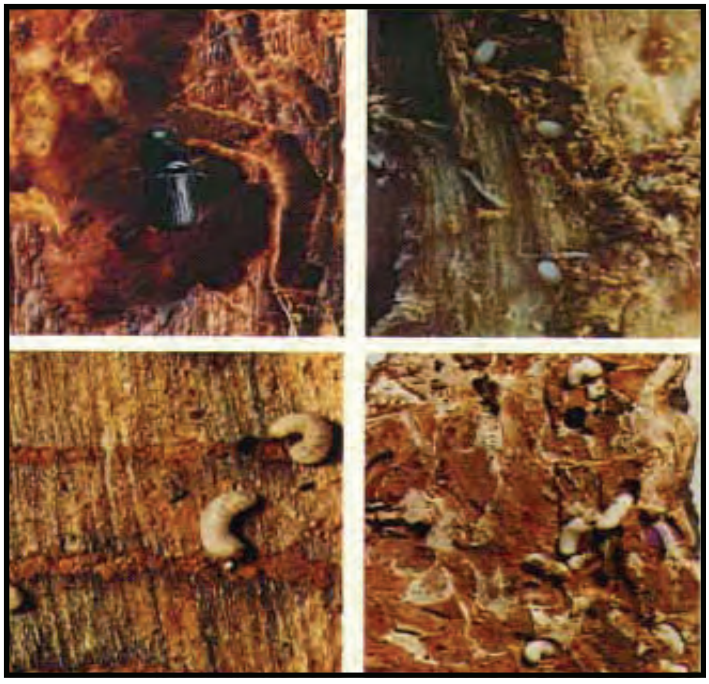

Figure 6. Stages in development of roundheaded pine beetles: top left, adult; top right, eggs; bottom left, larvae; bottom right, larvae and pupae in outer bark (Massey, 1977).

Eggs are oblong and pearly white, less than 1.5 mm in length and width (figure 6). Larvae are grublike, legless, and more or less translucent, although the contents of the abdomen may impart a reddish-brown hue (figure 6). 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 (figure 6).

Management

Management objectives should be directed toward preventing, or at least substantially mitigating, development of epidemic beetle infestations. Once populations increase to an epidemic status and outbreaks become large, management of beetle populations, as well as other resources, becomes more complicated.

Biological control:

- The red-bellied cleric *(Enoclerus sphegeus* Fab.) is the most important predator of 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 roundheaded pine 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 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 roundheaded pine 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

Cultural control: Thinning and control of dwarf mistletoe in dense young stands of commercial forest likely will minimize potential killing by this beetle. Private landowners can minimize the number of trees killed on their property and protect especially high-value trees by (1) thinning their stands, and (2) eliminating infested trees by felling and then burning or treating chemically. Trap trees felled in late September may be effective but the technique needs more study.

Chemical control: Direct control is expensive in time, effort, and resources and therefore usually applied to high value areas. The need for insecticidal control measures should be based upon environmental risk assessments and surveys of population abundance (egg band or post-hatch larval surveys).

Other Reading

Chansler, J.F. 1967. Biology and life history of *Dendroctonus adjunctus* (Coleoptera: Scolytidae). Ann. Entomol. Soc. Am. 60(4): 760-767.

Furniss, R.L. and V.M. Carolin. 1977. Western forest insects. Misc. Publ. 1339. Washington D.C.: U.S. Department of Agriculture, Forest Service. 346 p

Massey, C.L., Lucht, D.D., and J.M. Schmid. 1977. Roundheaded pine beetle. USDA Forest Service. Forest Insect and Disease Leaflet 155. 8p.

Stevens, R.E. and H.W. Flake. 1974. A roundheaded pine beetle outbreak in New Mexico. USDA For. Serv. Res. Note RM-259, Rocky Mt. For. And Range Exp. Stn., Fort Collins, Colo. 4 p.

USDA Forest Service. 2005. USDA Forest Service Archives, USDA Forest Service, www.ipmimages.org

Wood, S.L. 1973. On the taxonomic status of Platypodidae and Scolytidae (Coleoptera). Great Basin Nat. 33(2): 77-90.

Forest Health Protection and State Forestry Organizations

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