Red Turpentine Beetle

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The red turpentine beetle (*Dendroctonus valens* LeConte) is the largest and most widely distributed bark beetle in North America. It belongs to a group of beetles that characteristically mine between the bark and the wood of trees.

The red turpentine beetle is a common pest of forest, shade, and park trees of pole size or larger. It has been recorded from at least 40 species of domestic and foreign conifers. Yet, despite the abundance and wide distribution of this beetle, outbreaks have not been extensive or severe. The beetle has been found most frequently in individual trees or in groups of trees in localized areas. Pines are the most common host by far.

The insect usually attacks trees of reduced vigor or those infested with other bark beetles, but it can attack apparently healthy trees. It is especially destructive to Monterey pine; it has attacked as much as 15 percent of the Monterey pines in some park areas in California. At times the insect is destructive in areas disturbed by fire, logging, or land clearing. Soon after logging, up to 3 percent of the remaining pines in some stands have been attacked. On construction sites, injured trees or those adjacent to fresh lumber frequently become infested.

Range and Hosts

Except in the southern Atlantic Coast and Gulf Coast States, the red turpentine beetle may be found in all the coniferous forest areas of the continental United States, southern Canada, and Mexico (fig. 1). It may extend farther north in Canada and into Alaska, and there is one record of its occurrence in Guatemala. Its range is quite similar to the range of ponderosa pine in the West and of eastern white pine in the East.

In the extreme Southeastern United States, this insect is replaced by a very closely related species, the black turpentine beetle. Where their ranges touch or overlap, the identity of the two species is often confused.

All serious damage by the beetle has been to pines. The trees in which it is most frequently found are red, lodgepole, and jack pines in the North; white, pitch, and shortleaf pines in the East; and Monterey, ponderosa, and sugar pines in the West. Monterey pine is the tree most frequently

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U.S. DEPARTMENT OF AGRICULTURE

Forest Service

Revised May 1971

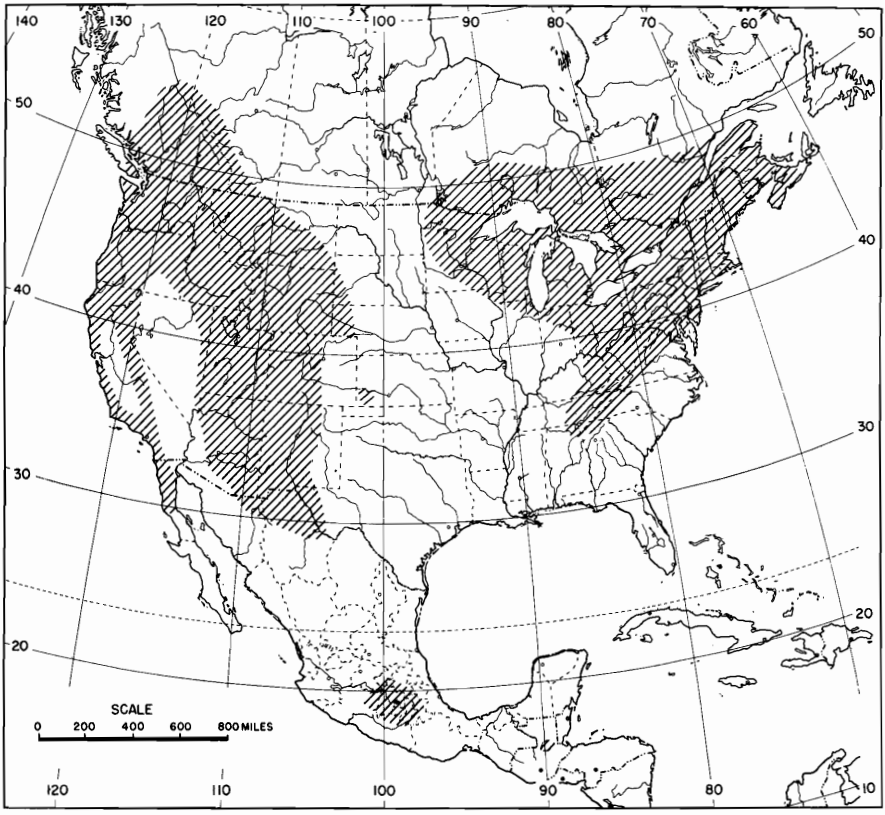

Figure 1.—General range of the red turpentine beetle.

killed and ponderosa pine is the tree most frequently attacked, according to existing records. Attacks on the other genera of conifers—spruce, larch, true fir, and Douglas-fir—are infrequent and have never led to serious losses.

Evidence of Attack

Attacks by the red turpentine beetle are concentrated in the basal 6 feet of the tree, but occasionally an attack may be made above a height of 12 feet. Indicators of an attack are a pitch tube on the outer surface of the bark (fig. 2), boring particles either in bark crevices or on the ground at the base of the tree, or pitch pellets on the ground.

Resin that flows from the wood, the insect's frass, and bark borings are mixed in the beetle's gallery (tunnel) and pushed outside the entrance hole by the insect. The mixture either adheres to the bark surface, forming a pitch tube, or it falls to the ground in pitch pellets of various sizes.

The pitch tubes vary in size, texture, and color, depending on the kind of tree and the relative amounts of bark borings and frass embedded in the resin. The resin is usually white to yellow, and the borings are red. On pines the tubes may be as large as 2 inches across. On other species of trees, such as fir or spruce, which produce little resin, the tubes may be small or absent, but boring dust or small pitch pellets can be found on the ground around the base of the tree.

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Figure 2.—Pitch tubes of the red turpentine beetle at base of a pine.

Galleries, always located between the bark and the wood of the tree, are the internal evidence of attack. They are generally vertical and may be partially packed with granular, reddish, pitchy borings or frass. The galleries vary in width from one-half inch to more than 1 inch and in length from a few inches to several feet.

Often it is a dying tree (fig. 3) that focuses attention on an attack. As the tree dies, the needles fade to yellowish green and then through shades of yellow and sorrel to red. In most cases this fading of the needles is associated with attacks by other insects, primarily bark beetles.

Description

The egg is shiny, opaque white, ovoid cylindrical, and a little over 1 millimeter long (fig. 4, *A*).

The larva, which hatches from the egg, is grublike, legless, and white, except for a brown head capsule and a small brown area at the hind end. With growth, a row of small, pale-brown tubercles becomes evident along each side of the body. The larva may attain a length of 10 to 12 mm. when fully grown (fig. 4, *B*).

The larva changes into a pupa (fig. 4, *C*), slightly shorter than the larva but still white. In the pupal or resting stage, the wings, legs, and antennae are held against the body.

The pupa changes to a beetle, typically 6 to 10 mm. long and quite stout. At first the beetle (fig. 4, *D*) is tan and is called a callow adult, but it rapidly darkens to a reddish brown.

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Figure 3.—Ponderosa pine, adjacent to a freshly cut stump, dying after being attacked by the red turpentine beetle.

Life History

Peak flight and attack activity usually occur in the spring. Beetles emerging from recently cut stumps and dying trees attack trees, exposed roots, or freshly cut stumps. The female beetle bores inward through the outer corky bark and inner, spongy, white bark to the surface of the wood. There she is soon joined by a male. They generally bore downward, although at first the gallery usually has a lateral or even slightly upward direction. Where attacks are made just above the ground line, the gallery may extend below the ground line and along the larger roots. The boring may exceed an inch a day. Most of the time one pair of beetles is found in an individual gallery; occasionally there may be one, three, or four beetles present.

Most of the resin that flows into the gallery comes from the sapwood, but a small amount comes from the inner bark. This resin, mixed with boring particles and frass, is pushed to the outer surface of the bark and forms a pitch tube there or drops in pellet form to the base of the tree.

Eggs are laid in an elongate mass along the side of the egg gallery (fig. 5) and are partitioned off from the adult gallery by a wall of pitchy borings. The egg mass can extend from 1 inch to several inches along the gallery; the number of eggs in it varies from a few to more than a hundred. A single female may deposit one or more groups of eggs farther along the gallery, usually several inches or more below the previous group. The parent beetles continue to feed in the gallery for several weeks. Then they may bore out through the bark and make additional attacks or they may die within the gallery.

In vigorous trees the flow of resin apparently prevents egg laying. Beetles may remain in these trees for several months, enlarging their galleries laterally or vertically but seldom depositing eggs. Two factors directly associated with the insect's action are sometimes assumed to enhance its success by decreasing the flow of resin from the sapwood of the tree. One is the introduction or invasion of blue-stain fungi and yeasts, which grow in the sap-

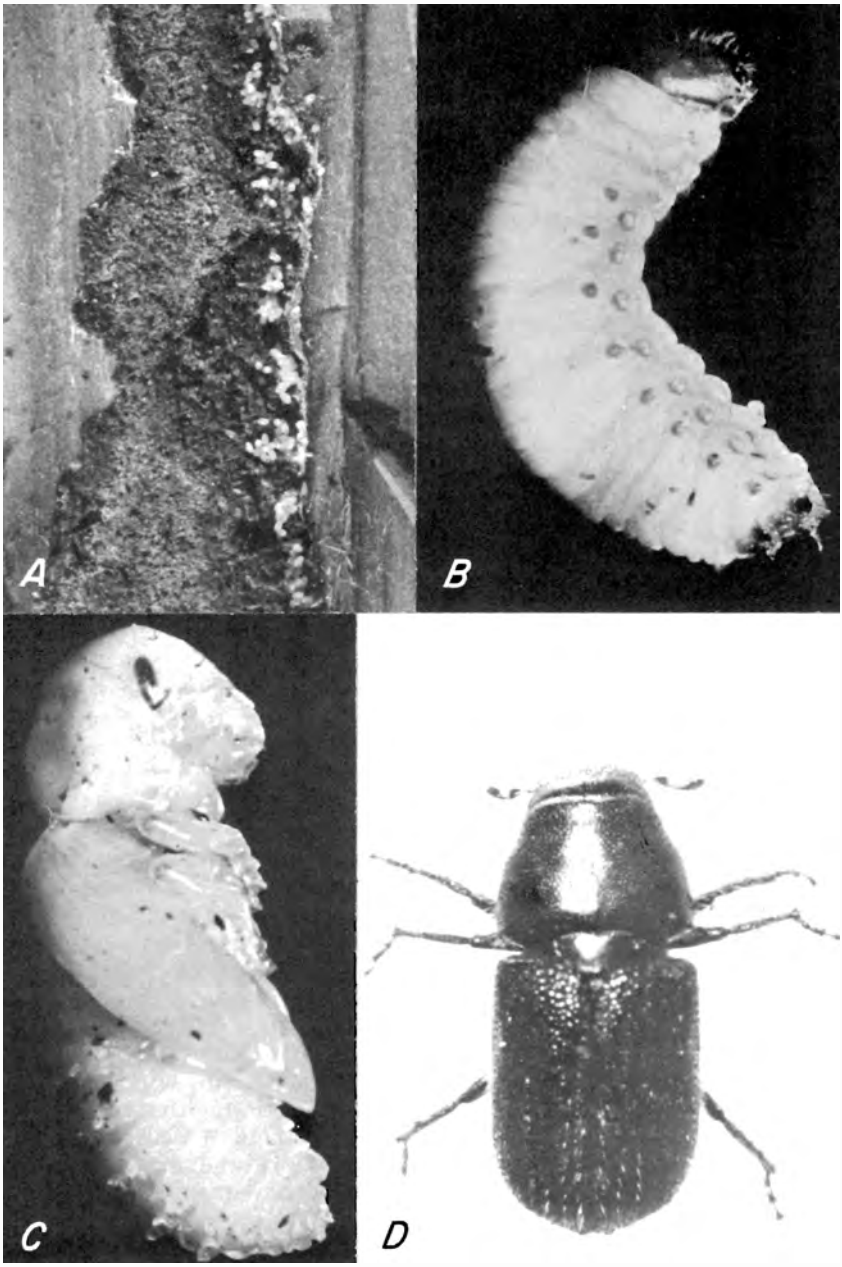

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Figure 4.—Life stages of the red turpentine beetle: *A*, Pencil pointing to mass of eggs along gallery; *B*, larva; *C*, pupa; *D*, adult. (*A* is 1.5 times normal size; *B*, *C*, and *D* each are eight times normal size.)

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Figure 5.—Adult gallery and eggs of the red turpentine beetle in the inner bark of ponderosa pine.

wood surface of the gallery. The other is the lowering of the moisture content of the sapwood as a result of the beetle's feeding activity.

In summer the eggs hatch in 1 to 3 weeks. The small larvae, which emerge from the eggs, feed gregariously away from the adult gallery, always feeding in the inner bark tissue between the outer dry bark and the wood (fig. 6, *A*). As they grow, they feed more extensively and make an irregularly margined, fan-shaped gallery (fig. 6, *B*).

The larvae feed side by side in an irregular line, steadily moving forward into fresh tissue. If a well-developed gallery is exposed at its margin, one may often find a large number of larvae within a few square inches. Their feeding kills a patch of inner bark which may vary from a few inches to more than a foot wide.

As the larvae complete their feeding, they make separate cells in which to change to pupae. In constructing these cells, they may scoop out bits of wood or bark. The cells are located between the bark and the wood, either in the area of the gallery (fig. 6, *C*) or a short distance forward in the fresh inner bark. Here the larvae change to pupae, which in turn change to adults.

The new adults move about in the gallery area for a few days to several months. In warm weather they soon bore outward through the bark and fly away to new host material. Several may use the same exit hole. The beetles are capable of flying more than 10 miles.

The rate of development of a generation and the number of generations per year are largely dependent on temperature. In the Sierra Nevada of California, the usual developmental periods in summer are about 2 weeks for the egg, 8 weeks for the larvae, 1 week for the pupa, and 1 week for the young adult. In most areas there is at least one generation a year. In northern areas at high elevations, 2 years may be required for a single generation. In southern areas at low elevations, there may be as many as three generations per year.

In the warmer parts of their range, the beetles' flight may occur during intermittent warm periods in the winter. In the colder parts, the winter is passed in hibernation, chiefly in the adult stage and to a lesser extent in the larval stage. Pupae and eggs rarely overwinter.

Attack Habits

The primary places of the insect's attack are freshly cut stumps or the bases of trees that are dying, often from attacks by other insects. In these places it may multiply and threaten nearby trees. Freshly cut logs with thick bark may be attacked, but they

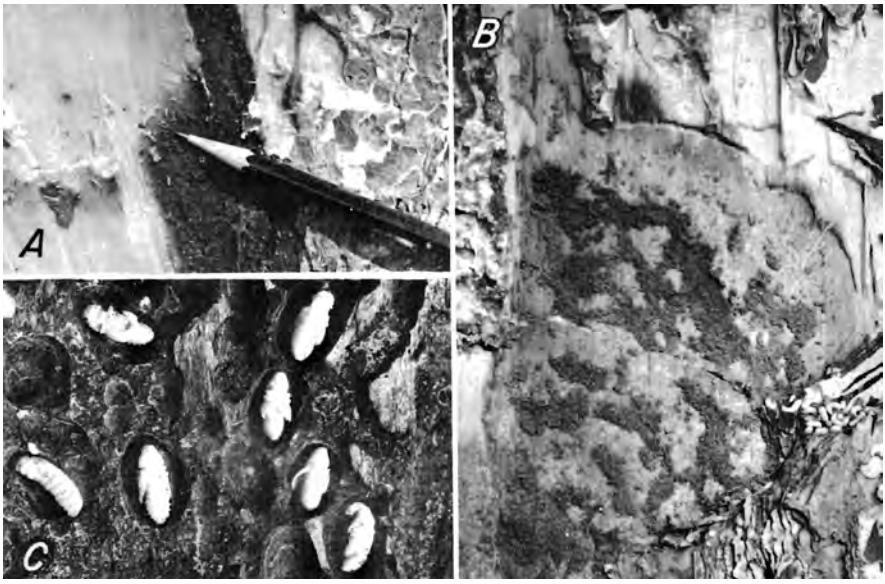

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Figure 6.—Development of galleries: *A*, Young larvae feeding away from adult gallery; *B*, fan-shaped gallery and three-fourths-grown larvae (lower right); *C*, pupae and a full-grown larva in cells between bark and wood.

will not produce large numbers of beetles.

The next-most-frequent places of attack are the exposed roots and the bases of trees that are weakened by roadbuilding, home construction, logging, land clearing, drought, fire, lightning, or the activity of other insects. In these places the beetles often produce broods that infest and kill other weakened trees. The beetles may persist in such places for more than one season.

The beetles are also attracted to healthy trees near freshly cut logs and lumber and to stands attacked by other species of bark beetles. Many attacks on apparently healthy Monterey pines are successful, while those on other species are not. In attacking healthy trees, the beetles usually excavate irregular galleries without laying eggs. Such attacks do not kill the trees but apparently predispose them to subsequent infestation by other bark beetles at higher points on the trees.

In the Western United States, the red turpentine beetle is most frequently associated with the pine engraver beetle (*Ips* spp.) and the western pine beetle (*Dendroctonus brevicomis* LeConte), which often attack trees before the red turpentine beetle does.

Attacks, especially on vigorous trees, may extend over a period of 2 years or more.

Indirect Control

There is very little information on the biological or natural control of the red turpentine beetle. Occasionally an insect parasite or predator has been observed destroying some stage of the beetle beneath the bark. Many beetles die in their attempt to attack healthy trees. Woodpeckers feed on the larvae and pupae. The competition for food within and between broods may result in re-

ducing beetle populations. However, none of these natural or biological means can be counted on to control the beetle.

Control Through Management

Damage to stands or individual trees should be minimized through improved logging, construction, and management practices. Trees infested with other insects should be selectively removed to limit places where the red turpentine beetle might breed.

Chemical Control

Lindane is effective in preventing attacks and in killing insects already beneath the bark. It is especially useful in controlling infestations in trees of high value, such as shade and park trees.

A 1.5-percent fuel oil solution of lindane may be sprayed on the lower part of a tree. This will prevent attacks on a weakened or threatened tree for several months. For those trees that have already been attacked, the same solution should be sprayed on the trunks to a height of 1 foot above the highest point of attack. The spray is prepared by mixing 1 gallon of a 20-percent lindane emulsifiable concentrate in 14 gallons of No. 2 fuel oil. Apply it at the rate of 1 gallon for every 50 square feet of bark surface or until the bark is thoroughly wet. Use a low-pressure sprayer.

Pesticide Precautions

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or when they may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. If a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

WARNING: Recommendations for use of pesticides are reviewed regularly. The registrations on all suggested uses of pesticides in this publication were in effect at press time. Check with your county agricultural agent, State agricultural experiment station, or local forester to determine if these recommendations are still current.

U.S. GOVERNMENT PRINTING OFFICE: 1971 O—416-023