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Southern Pine Beetle

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The southern pine beetle (*Dendroctonus frontalis* Zimmermann) is one of pine's most destructive insect enemies in the Southern United States, Mexico, and Central America. Because populations build rapidly to outbreak proportions and large numbers of trees are killed, this insect generates considerable concern among managers of southern pine forests.

The beetle occurs from Pennsylvania to Texas and from New Mexico and Arizona to Honduras (fig. 1). Periodic outbreaks commonly recur in fairly well-defined areas. During one outbreak in the Southern States in 1973–77, the southern pine beetle killed the equivalent of about 4.5 billion board feet of pine timber. Average annual tree mortality may exceed the equivalent of 100 million board feet of sawtimber and 20 million cubic feet of growing stock.

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Engraver beetles (*Ips* spp.) and the black turpentine beetle (*Dendroctonus terebrans* (Olivier)) are frequently associated with southern pine beetle outbreaks. Their interrelation in predisposing trees to southern pine beetle attack or in competing for the same food supply has not been fully explained.

Description

In the South, the southern pine beetle attacks all species of pines, but prefers loblolly, shortleaf, Virginia, pond, and pitch pines.

The first indication of beetle-caused mortality is discolored tree foliage (fig. 2). Needles become yellowish, then change to a red color, and within 1 to 2 months become brown. Typically, pines are killed in groups ranging from a few trees to those covering several hundred acres.

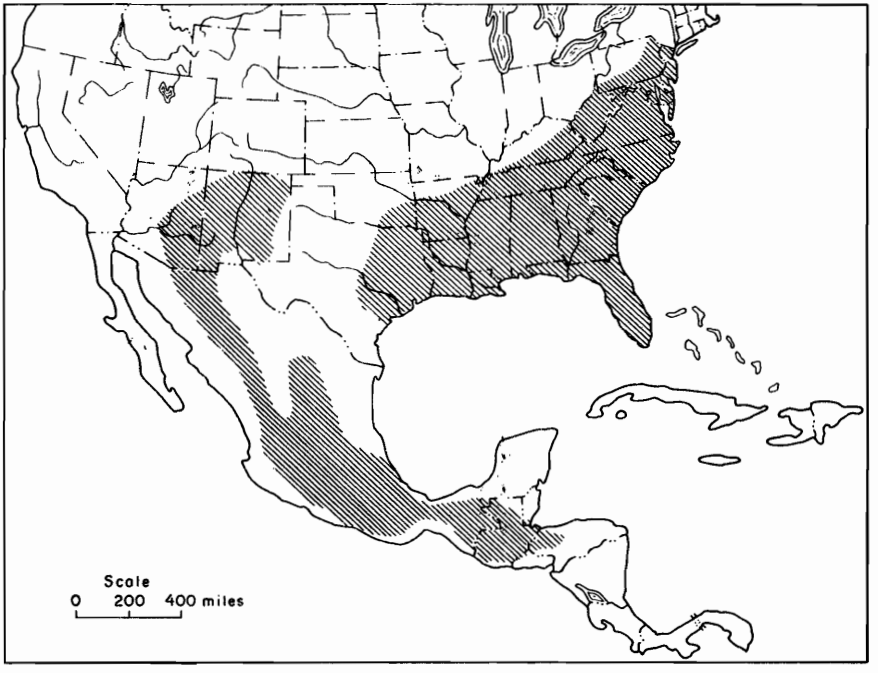


Figure 1.—*Range of the southern pine beetle in North and Central America.*

Figure 2.—*Needles on trees killed by beetles fade from green to yellow, red, and brown.* F-702852

Pitch tubes—small yellowish-white masses of resin, ¼ to ½ inch (6–13 mm) in diameter—mark the points of beetle attack (fig. 3). In unusually dry weather, drought-stressed host trees may produce no pitch tubes; and a reddish boring dust lodged in bark crevices or in

Figure 3.—*Pitch tubes, the first sign of southern pine beetle attack.* F-702853

spiderwebs and leaves of understory vegetation at the base of an infested tree may be the only indication of attack. Removal of bark from an infested pine will reveal *S*-shaped egg galleries that crisscross one another in the inner bark and on the wood surface (fig. 4). The *S*-shaped galleries distinguish the southern pine beetle from all other pine bark beetles in the South.

Figure 4.—*Galleries of southern pine beetle adults with developing larvae.* F-702854

Figure 5.—*Southern pine beetle larvae and pupae in shaved outer bark.* F-702855

Figure 6.—*Southern pine beetle pitch tubes and exit holes through bark.* F-702856

If the attack is recent, some living adult beetles may be observed in the galleries or very tiny, whitish larvae will be visible in threadlike mines that extend from the galleries. Later, most of the brood will be concealed within the bark, but may be exposed by chipping or shaving the bark with a machete or hatchet (fig. 5).

Beetle broods complete their development in about a month from April through September. The adults exit by tunneling through the bark. Their exit holes resemble those made by birdshot (fig. 6). From spring to late fall, adult emergence takes place about the time infested trees begin to fade; during mild periods in winter, emergence may occur from trees whose foliage ranges from green to red or from fully defoliated trees.

Life Cycle

The southern pine beetle is short-legged, stout, and about ⅛ inch (3 mm) long. (See cover.) The front of its head is notched, and the hind end of the body is rounded. Mature beetles are dark reddish brown to black. The newly emerged adult beetle is soft bodied

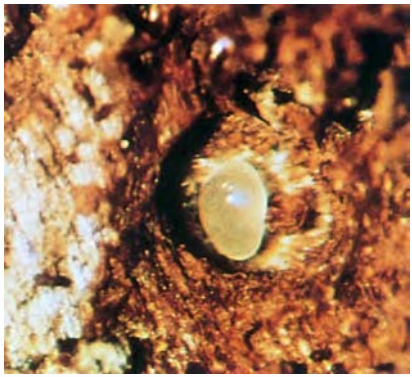
and amber colored, but quickly hardens and darkens.

Each attack involves one pair of beetles. When populations are large, thousands of beetles may invade individual trees. Each pair constructs a winding gallery in the inner bark and the female deposits pearly-white eggs in individual niches along the sides (fig. 7A). The galleries, which frequently meet or cut across one another, girdle the tree. Blue-stain fungi, carried by the beetles, hasten the death of the tree by plugging the water-conducting tissues.

The egg hatches into a whitish, crescent-shaped larva with a glossy, reddish-brown head. When fully developed, the larva is about ⅛ inch (3 mm) long (fig. 7B). Newly hatched larvae mine in the soft inner bark; older larvae mine outward into the corky bark. When fully grown, the larva changes to the resting stage or pupa (fig. 7C), which is pure white and very soft.

When pupation is complete, the newly formed adults chew individual exit holes through the bark and take flight. Emerging beetles may invade green trees in the vicinity or fly considerable distances to begin new infestations.

In the South, adults from overwintering broods emerge and begin to attack uninfested trees in early spring—about the time dogwood trees flower. Depending upon latitude and elevation, there may be three to seven generations each year. Often, all life stages are present in different trees in the same infestation. During outbreaks, beetle activity peaks in early summer in the Gulf States and in late summer and early fall farther north. Under ideal conditions, the number of beetles may increase



A F-702857

B F-702858

C F-702859

Figure 7.—*Preadult life stages of the southern pine beetle: (A) egg, (B) larva, and (C) pupa.*

tenfold in a single generation and sparse populations may reach epidemic proportions within a summer.

The southern pine beetle overwinters beneath or within the bark in the egg, larval, pupal, or adult stages. Adults emerging during warm winter periods may attack either the same trees in which they developed or nearby uninfested trees.

Control

Natural enemies, including diseases, parasites, and predators, can help maintain beetle populations at low levels. However, they seem to have little effect during epidemics. Very low or very high temperatures, on the other hand, do have a substantial effect upon beetle survival. When temperatures drop to 0° F and persist at this level for several days, brood mortality is high. Continuous daily temperatures in excess of 95° F tend to kill broods in the Gulf States. These natural factors seem to be very important in causing both seasonal and annual fluctuations in beetle activity.

Detection

In years when outbreaks occur, Federal, State, and industrial landowners conduct more frequent aerial detection surveys. Infestations can easily be spotted from low-flying aircraft. Groups of red and fading trees are then ground checked to confirm the cause of death. If populations are high enough to warrant control, a continuous program of ground surveillance and aerial surveys is initiated to insure timely action. Aerial surveys may be made at 3- to 4-week intervals from April through October. One early winter flight after leaf fall is also useful in the northern part of the beetle's range.

Suppression

The primary objectives of a suppression project are to reduce beetle populations to a low level as rapidly as possible and to prevent further tree mortality.

When a sufficient number of infested trees of merchantable size are available for salvage, they should be removed as quickly as possible. The first step is to cut a 40- to 70-foot-wide buffer strip of green trees in front of the most recently attacked trees. Newly attacked trees and trees containing larvae and pupae should be removed next. This approach will insure that further growth of the infestation is stopped and that all infested trees are removed.

Where trees cannot be salvaged, infestation spread may be controlled by felling and treating infested trees with lindane or chlorpyrifos. Follow mixing instructions on the insecticide container.

The entire bark surface should be soaked to the point of runoff with a coarse spray from a low-pressure sprayer. Logs must be turned so that the entire bark surface can be treated. The spray should be applied only when the bark is dry.

These chemicals are also registered for use in protecting trees from beetle attack. The same spray concentrations used for felled trees are applied to standing

trees, but with a hydraulic sprayer. Either spray mixture must be applied to the trunk of the tree until the bark is thoroughly wet. Such preventive control treatments will find greatest use in protecting trees in seed orchards, urban settings, and high-use areas.

The cut-and-leave method can be used to reduce the hazard of infestation spread into surrounding stands during the summer months from May to October. The method is generally limited to spots with 10 to 50 infested trees and has been used most extensively in east Texas. All actively infested trees are felled toward the center of the spot. A buffer strip of green, uninfested trees at the spreading edge or front of the spot is also felled toward the center of the spot. The width of the buffer strip is as wide as the average height of the infested trees. Spots with fewer than 10 infested trees may be treated. (They often die out naturally.) If there are many spots, control is focused on the larger ones where greater tree mortality occurs.

Preventive Measures

Many infestations occur in stands where trees have been planted off-site or are crowded and their vigor is low. Examination of infested trees invariably indicates a general decline in vigor as indicated by a recent reduction in diameter growth.

If pine stands are weakened by drought, flooding, or careless logging, they become more susceptible to attack by the beetle. Once heavy populations develop in weakened trees, the beetles may spread to healthy trees that normally would resist attack.

The most practical approach to minimizing timber losses and avoiding costly, short-term suppression projects is to maintain forests in a vigorous, healthy condition. Stands should be thinned before they become overdense and the normal growth rate declines. Trees struck by lightning and those showing obvious signs of weakness from whatever cause should be salvaged. On sites where flooding is a chronic problem, improvement of surface drainage may improve tree growth and survival.

Logging should be planned to avoid operations in outbreak areas during the summer and to minimize damage to the site and to the residual stand. Thinnings or other partial cuttings should be separated by intervals long enough to permit the stands to recover. Logging equipment should be operated carefully to minimize scarring the trunks of residual trees, compacting the soil, or crushing tree roots. Trees severely damaged by heavy equipment should be salvaged. Roads and trails should be carefully constructed to avoid erosion problems, flooding, or changes in the water table.

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

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

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case 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.

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