

Identifying the Southern Pine Beetle

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There are five primary pests that attack the stems of southern pine trees in South Carolina. They are the (A) Black Turpentine Beetle (*Dendroctonus terebrans*), three species of Engraver beetles (collectively called the Ips beetles, (B) *Ips avulsus*, (C) *I. calligraphus*, and (D) *I. grandicollis*), and the (E) Southern Pine Beetle (*Dendroctonus frontalis*) See Figure 1.

Of the five pine bark beetles in South Carolina, the southern pine beetle, is the pest of greatest concern because:

- 1) it can attack and kill healthy trees,
- 2) large numbers of beetles can attack a tree in a short time frame and cause rapid death,
- 3) the beetle introduces a bluestain fungus into the tree which further accelerates the decline of the tree, and
- 4) they can spread from the first tree that was attacked to surrounding trees, potentially causing damage to large areas of pine forest.

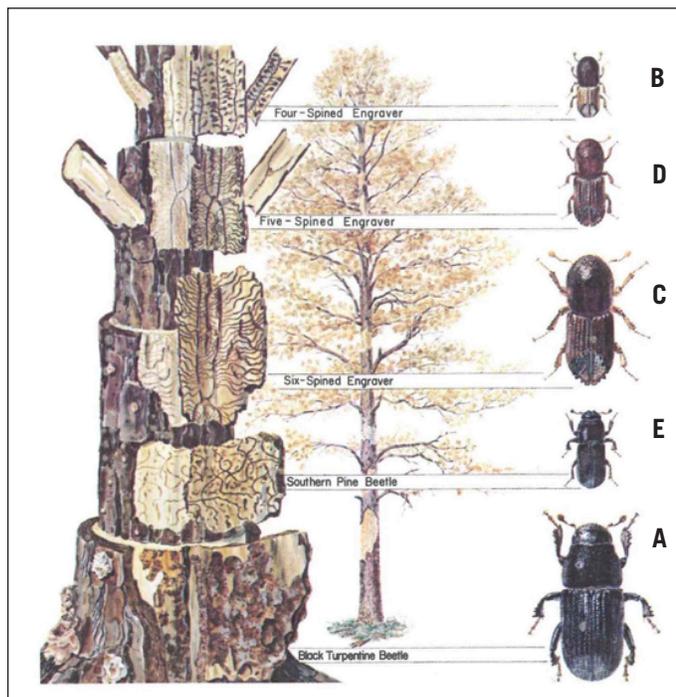


Figure 1. Pine bark beetles of the southern US

Periodically, massive population explosions of southern pine beetle occur in the southern United States, causing widespread damage and economical loss of pine timber. These population explosions are cyclical (typically every 6 to 10 years)



and last for two to three years. Outbreaks often follow periods of stress such as droughts, floods, or tropical storms when trees are weakened and more susceptible to attack. The greatest level of damage recorded in South Carolina occurred in 1995-1996 when approximately \$125 million worth of pine timber was lost to the southern pine beetle. The most recent recorded outbreak peaked in 2002. Fortunately, major timber losses can be minimized by using preventative forest management strategies, and there are actions a landowner/forester can take to stop the spread of an infestation when it is underway.

Symptoms of Infected Trees

Understanding the symptoms presented by infected trees is essential for identifying infestations early and reducing the amount of damage southern pine beetle attacks will cause. All species of southern pines can be attacked, but some are more susceptible than others. Shortleaf pines are the most susceptible, followed by Virginia and loblolly pines. Longleaf and slash pine are the least susceptible, but they can be attacked if they are stressed or weakened by other factors. Ordinarily, unhealthy, weakened pines are the most susceptible to beetle attack, but as the beetle population increases, even healthy, fast-growing pines will be attacked.

Crown Condition

The most obvious symptom of a southern pine beetle infestation is the discoloration of the needles throughout the entire crown of the tree. The excavation of feeding galleries under the bark and infection of the tree with



Figure 2. Progression of a SPB infestation

bluestain fungus disrupt the flow of fluids and nutrients to the crown of the tree. As a result, the needles over the entire crown begin to fade and eventually die (Figure 2).

Needles fade from green to pale green, then yellow, and finally turn reddish-brown before falling. The entire crown of the tree is affected, not just one branch or section. In figure 2, the dead, grey trees near the top were the first attacked, and the infestation has spread down toward the bottom of the photo. In the middle of the spot there are dead trees that are still brown because they have not yet lost their needles. The most recently attacked trees are those with the light green and yellow crowns in the lower part of the photo.

Pitch Tubes

The presence of pitch tubes on the trunk is another critical symptom of a bark beetle infestation. Pitch tubes are formed by the sap that leaks out of the hole made when a bark beetle bores into the tree (Figure 3). Pitch tubes tend to look like crusty popcorn attached to the trunk, usually in the grooves of the bark (Figure 5). All bark beetles form them, but trees infested with southern pine beetle will have dozens of pitch tubes that form anywhere on the stem of the tree. Turpentine beetles tend to attack the base of the tree. They rarely attack in great numbers so they normally do not form more than a few pitch tubes at a time. Ips beetles tend to attack the middle and upper sections of the tree and can be numerous in extreme circumstances.

Bark Condition

Bark beetles excavate feeding galleries under the bark, and these galleries are unique to each species. Over time the bark will become loose and will flake off of the tree. The Ips beetles are referred to as “engravers” because their galleries have distinct patterns and symmetry. They tend to form “Y” or “H” shaped channels with a latticework of



Figure 3. Pitch tubes

feeding channels radiating out. (See Figure 1) Turpentine beetles tend to excavate large, irregular cavities with only a few identifiable channels, which are much wider than the channels of other bark beetles. The southern pine beetle is distinct because it excavates irregular, very narrow channels that seem to have no pattern or symmetry at all. They are typically “S” shaped and overlap randomly.

Exit Holes and Saw Dust

Once exit holes and sawdust start to form on the surface of the bark, then the tree has been overwhelmed and will die. These are signs that the beetle larvae have matured and adults are leaving the tree. It also is a sign that the tree is no longer conducting fluids and has been compromised. Saw dust also may be formed by a wide array of secondary invaders that decompose dead wood (powderpost beetles, longhorned sawyer beetles, bess beetles, termites, etc.) These other insects only take advantage of dead or dying trees and are not the reason the tree died.

Often, when trees become weakened, they are attacked by multiple species. Several or all of these bark beetle species might be present in a tree that is showing symptoms of attack. The Ips and turpentine beetles can damage or kill pines, but they rarely affect more than a few trees at a time, they do not normally spread to neighboring trees rapidly, and they tend to attack trees that are already declining for some other reason such as mechanical damage during thinning or environmental stress like

Table 1. Progression of Symptoms after SPB attack

Tree Stage	Symptom				
	Foliage	Pitch Tubes	Bark	Exit Holes	Ambrosia Beetle Dust
Freshly Infested	Green	Soft, white, light pink	Tight, hard to remove	None	None
Infested With Developing Brood	Green trees, with larvae; fade to yellow before brood emerges	White hardened	Loose, peels easily	Few, associated with attacking adult reemergence	White, localized areas around base of trees
Vacated, Dead Tree	Red, needles falling	Hard, yellow, crumbles easily	Very loose, easily removed	Numerous	Abundant at base of trees

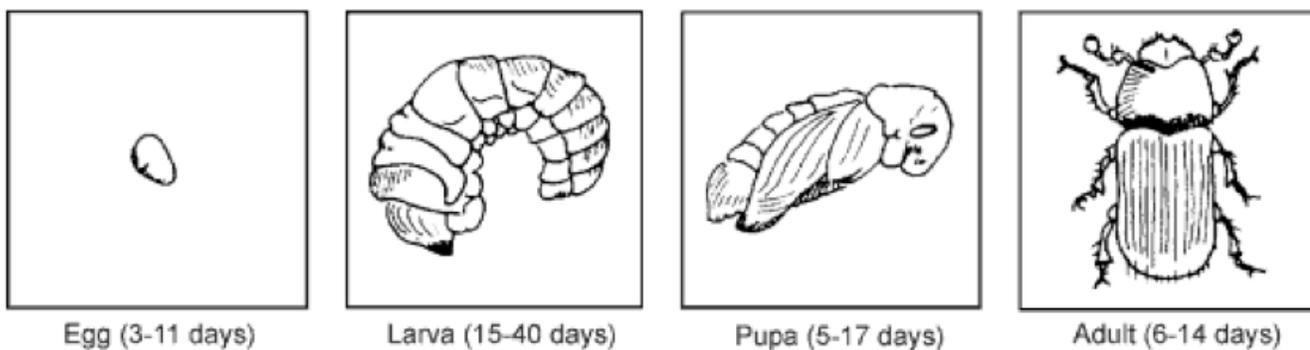


Figure 4. The four life stages of SPB

drought or lightning strikes. If southern pine beetles are present, then the potential for spread is greater than with other beetles, so action may need to be taken to prevent additional losses.

Table 1 describes symptoms associated with various stages of SPB attack.

Southern Pine Beetle Life Cycle

The southern pine beetle may have up to eight generations per year. Each generation has complete metamorphosis with four life stages: egg, larva, pupa and adult. Development of all stages continues throughout the year, slowing considerably in the winter and accelerating in the spring and summer. One life cycle or generation from egg to adult may take from 26 to 54 days depending on the season. Over a temperature range of approximately 60 to 85 degrees F, the length of time for each stage varies as indicated in Figure 4. Adults reach an ultimate length of only 1/8 of an inch, similar in size to a grain of rice.

Host Attack - Initially, a few adult "pioneer" beetles attack the midtrunk of susceptible host trees. After the pioneer beetles successfully colonize a susceptible host tree, the beetles and the host tree produce chemicals that attract additional flying adult beetles. Attacks spread up and down the trunk over the course of three to five days.



Figure 6. Blue-stain fungus

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Figure 5. Freshly formed pitch tube

Small, light yellow to white pitch tubes usually form where the beetles enter the tree. These masses of pitch are about the shape and color of popcorn, and can be the same size or slightly smaller. Especially weak trees may not produce pitch tubes, but reddish boring dust in bark crevices.

Attacking adults construct winding S-shaped egg galleries in the cambium layer between the bark and wood, and lay eggs. During gallery construction, the adult beetles introduce a blue-stain fungus. Along with the girdling effect of gallery excavation, the fungus contributes to the death of the tree by eventually plugging the tree's water-conducting tissue.

Reemergence - Attacking adults begin to reemerge one to three days after the mass attack, mating and egg laying, and continue to do so for 10 to 14 days. Reemerged adults may attack additional pines and contribute to infestation spreading.

Brood Development - Small C-shaped larvae hatch from the eggs and feed in the cambium and then in the inner bark. Near the end of the larval stage, the larvae move into the outer bark and pupate. The pupae develop into

immature yellowish-white (callow) adults about one week before becoming dark in color. Upon full development, the adult constructs an exit or emergence hole through the outer bark.

New Adult Emergence - Emergence is temperature related, and the adults may remain under the bark for a period of time if conditions are not favorable. Usually colder air temperatures delay emergence. In addition, emergence does not take place all at once. A few beetles leave the tree initially, followed by a larger number, and then a declining number over an extended period of time. The dispersal of emerging adult beetles is also affected by environmental conditions. During the winter, emerging beetles may not disperse, but re-attack the same tree instead. Usually, however, emerged adult beetles leave the host tree and, depending on the time of year, either aggregate on adjacent trees under attack or fly off to find a suitable new host tree elsewhere.

Additional Information

Keeping your pine timber stands healthy and vigorous and having a good knowledge of the southern pine beetle habits and symptoms is essential to effectively deal with this destructive pest. Professional advice and assistance is available through the South Carolina Forestry Commission, Clemson University Cooperative Extension Service, U.S.D.A. Forest Service, forest industry personnel, and private consulting foresters.

SC Forestry Commission Forest Health

<http://www.state.sc.us/forest/id.htm>

Southern Pine Beetle Internet Control Center

<http://web2.ento.vt.edu/servlet/sf/spbicc/topic.html?topic=home>

Southern Pine Beetle Literature Review and Research

<http://www.barkbeetles.org/spb/spbbook/Index.html>

Acknowledgement: USDA Agriculture Handbook Nos. 575 and 226.

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