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White-Pine Cone Beetle

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The white-pine cone beetle (*Conophthorus coniperda* (Schwarz)) is one of the most destructive pests associated with loss of white pine seed in Eastern North America. This native insect is found throughout most of the natural range of eastern white pine (*Pinus strobus* L.) (fig. 1). Its only known host is eastern white pine.

An attack by the cone beetle is often so severe that it impairs the natural regeneration of eastern white pine. For example, in the Massabesic Experimental Forest in southwestern Maine, beetle damage to seed crops has largely prevented the natural reestablishment of white pine on an area burned by a forest fire in 1947. Similar destruction of cone crops in Durham, N.H., during the period 1956–60 has hampered a research project on seed of white pine.

Observations in 1960 indicated that the cone beetle had destroyed the cone crop in many pine stands throughout Maine, New Hampshire, Massachusetts, Vermont, and Connecticut. Damage by the white-pine cone beetle has also been reported in Michigan, Virginia, New York, Pennsylvania, Rhode Island, Wisconsin, New Jersey, North Carolina, Delaware, Maryland, and West Virginia, and in the Canadian Provinces of Quebec and Nova Scotia.

Damage

Most damage done by the cone beetle occurs in late April and May. At this time the adult beetles emerge from their overwintering habitat and attack the maturing second-year cones of nearby white pine trees. The vital damage is done within 1 hour. The beetle bores into the cone at its junction with the petiole, effectively girdling and killing the cone (fig. 2). A single beetle may attack and injure four cones; the average is two.

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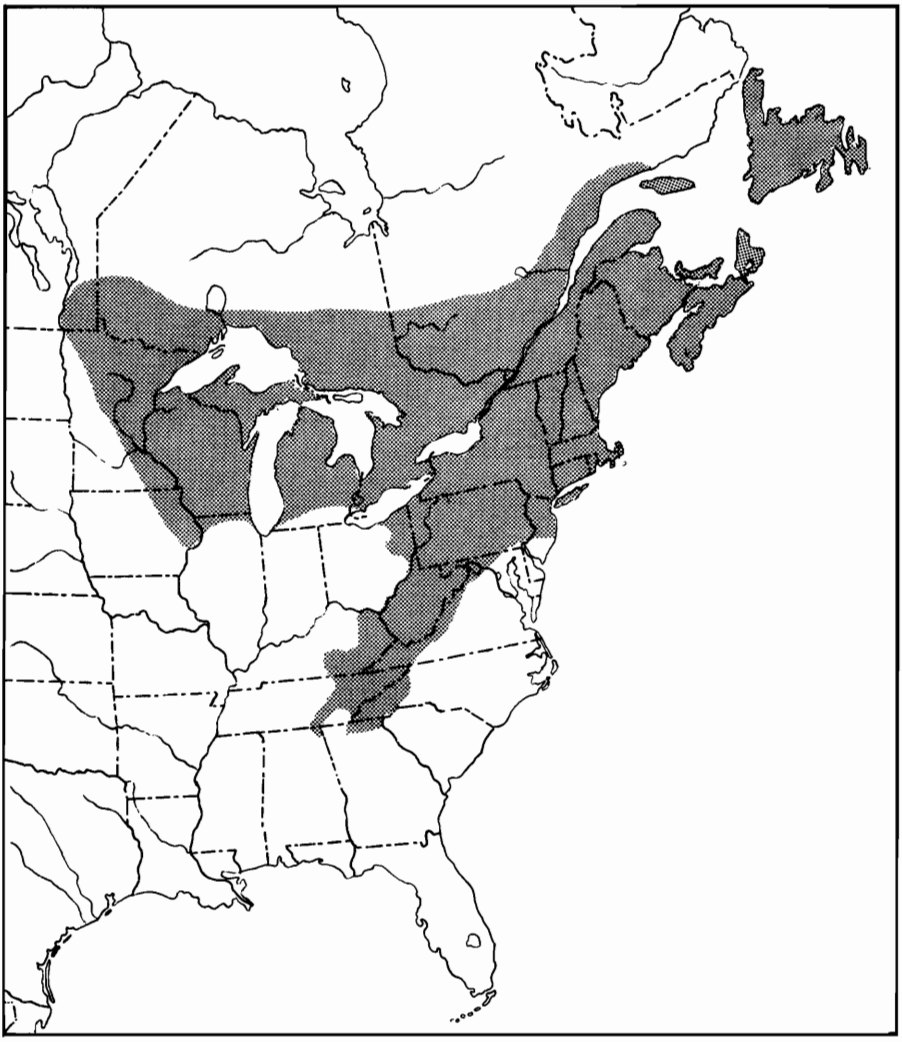

Figure 1.—The distribution of the white-pine cone beetle.

Although the white-pine cone beetle damages mainly the second-year cones, first-year conelets and new shoots are also attacked (fig. 3). The severity of these secondary attacks apparently depends on the number of second-year cones available and the size of the attacking beetle population. At times the beetles will attack the male flowers and the buds.

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Figure 2.—Part of a white pine cone, showing typical gallery construction by the white-pine cone beetle adult.

Evidence of Infestation

From the middle of May until autumn, the infested cones may be found littering the duff beneath the white pines. These cones are characterized by a small exudation at the junction of the cone and petiole, a mixture of pitch, frass, and cone borings.

The infested second-year cones generally drop to the ground within 6 weeks after attack. However, a heavy rain 1 or 2 weeks after a beetle attack may cause the cones to break away and drop. The break occurs at the junction of the petiole and the twig, presumably as a result of the formation of an abscission layer. Larger cones (those attacked later in the season) break away almost immediately, the break occurring between the cone and petiole.

Description

The white-pine cone beetle egg is pearl white. Average size is 0.75 mm. long and 0.05 mm. wide. The larva is legless, soft and fleshy, white or cream colored, and it has a pale amber head. Two larval instars develop, which do not differ greatly except in size. The mean width of head capsule is 0.33 mm. in the first instar and 0.49 mm. in the second.

The pupa is white when first formed. After 4 or 5 days the mouth parts, eye areas, and the ends of the elytra become darkened.

The adult is a small, stout beetle 2.8 mm. to 4.2 mm. long, shiny black, and covered with moderately long, erect hairs. The males and females can be distinguished by

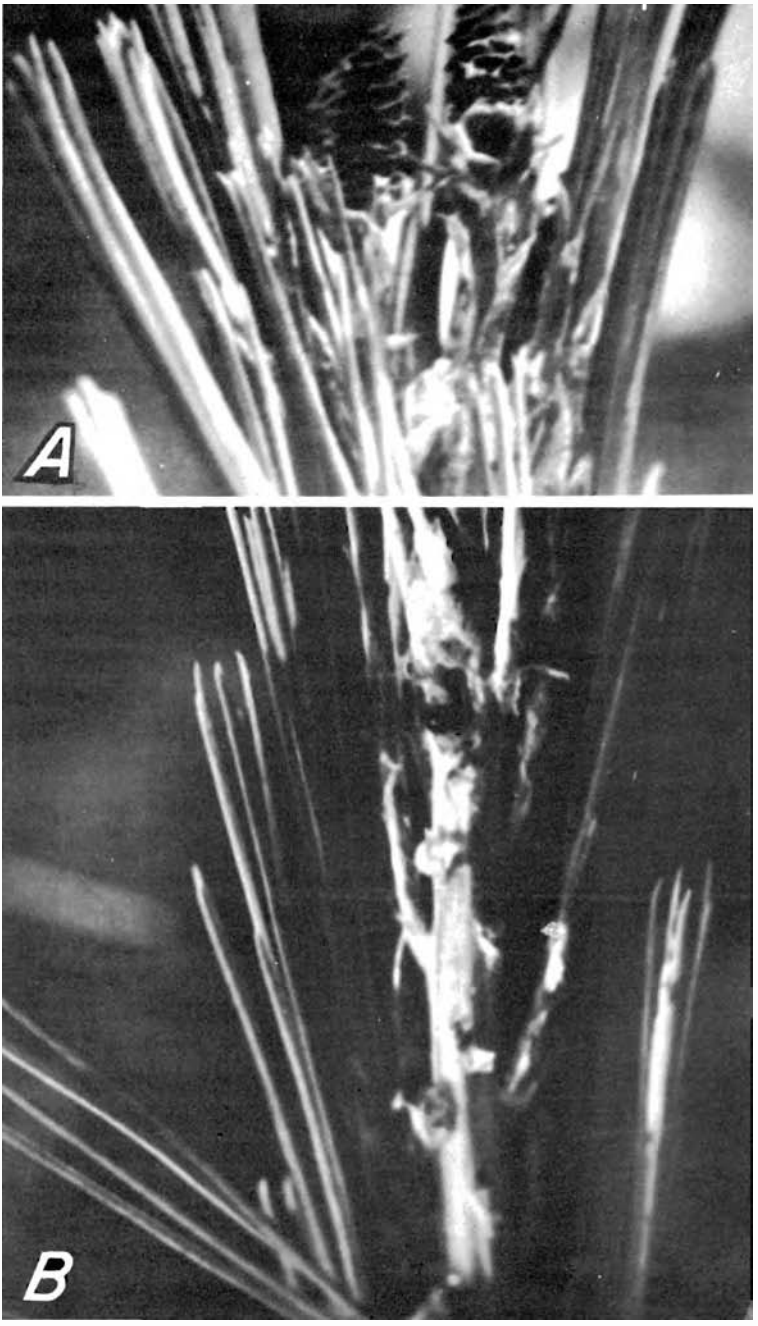

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Figure 3.—*A*, First-year white pine conelet attacked by white-pine cone beetle; *B*, cone beetle attacking new growth of white pine.

differences in the dorsal genital plate. In the male the dorsal plate is split laterally by a suture that divides it into two sclerites. The female genital plate is not so divided. The adult males and females are approximately equal in number.

Life History and Habits

In the Eastern United States there is one generation of the white-pine cone beetle a year. Seasonal activity begins in late April when the adult beetles emerge from their overwintering habitat and fly to the crowns of nearby white pines. The female beetle initiates the attack on the cone, boring in and constructing a tunnel across the cone axis, thus cutting off the vessels and killing the cone. She then turns and bores along the cone axis, constructing an enlarged chamber just inside the entrance (fig. 2).

The male beetle does not participate in the initial attack and does little to help in gallery construction. He enters the cone either through the female's entrance or by boring in adjacent to it. Within the cone he is usually found behind the female, widening the gallery and packing frass into the proximal chamber.

The type of gallery formed apparently depends on the presence or absence of the male. If no male enters the cone, the female bores out through the side of the cone or leaves through the entrance, to try again in another cone. But if a male finds and enters the cone, the female stays and extends the gallery the full length of the cone axis and emerges at or near the apex (fig. 4). The male either follows or detours from the main gallery, to bore out through the side of the cone.

Egg-laying usually begins in the second cone attacked. This is 10 to 12 days after the adults emerge from their overwintering cones. Egg niches are constructed along the sides of the gallery. The eggs are deposited singly, and each niche is filled with fresh frass.

The eggs hatch in 7 days. Newly hatched larvae begin feeding on the seed embryo and cone tissue. As

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Figure 4.—White-pine cone with cone beetle gallery extending full length of the cone axis.

they develop, they continue to devour the cone contents, feeding indiscriminately in no particular pattern (fig. 5). The larval period is about 4 weeks.

Pupation takes place in a small frass-filled chamber at the end of the larval gallery. One week later callow adults may be observed. Immature stages may occur as late as September, but the insects overwinter only as adults.

Some adults may emerge from the brood cones. However, most of the new adults remain in the brood cones to overwinter. The new beetles that do leave the brood cone migrate to the tree crown and attack the current year's conelets or remain on the ground to bore into other infested cones. At this time the males initiate as many attacks as the females.

In the fall, the activity of the beetle differs in attacking conelets. There are two characteristic patterns: (1) The beetle bores distally, stopping just short of the apex, then retreats and tunnels into the petiole; or (2) the beetle bores directly into the petiole. Rarely is more than one beetle found in these conelets.

Natural Control

The white-pine cone beetle is attacked by a number of parasites and predators. Several lepidopterous insects—including *Dioryctria abietella*, *Eucosma monitorana*, *E. tocullionara*, and two species of Blastobasidae—feed in the deteriorating cones and occasionally prey on the cone beetle in its various stages. Hymenopterous eggs, larvae, and pupae have been found in, on, or near cone beetle larvae; but only one species—*Cephalonomia hyalinipennis*—has been reared successfully and identified.

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Figure 5.—White-pine cone beetle larvae feeding on cone tissue.

Adult *Spathius* sp. have been observed emerging from cones infested by the cone beetle. The exact relationship of these insects to the cone beetle is not known, but certain species of *Spathius* are parasites of other Scolytidae. Various other beetles and flies have been found in white pine cones. These are mostly scavengers, but some no doubt compete with the cone beetles for space and food.

Nematodes (*Aphelenchoides* sp.) have been found in cone beetles taken from overwintering cones. These have not been determined positively as parasites, but other species of the same genus are reported to be parasitic on Scolytidae.

The failure of a number of cone beetle broods to develop has been attributed to pathogenic organisms. A white fungus, abundant in most cones lying in the duff, may develop so rapidly that the copious mycelium engulfs the cone beetle larva and callow adult, preventing them from feeding and eventually causing their death. *Aspergillus nigrans* has been cultured from tissue extracted from apparently paralyzed cone beetle larvae.

Chemical Control

Various chemical insecticides have been tried without success against this pest.

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