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The Sugar Pine Cone Beetle

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The sugar pine cone beetle, *Conophthorus lambertianae* Hopk., is a native pest of sugar pine (*Pinus lambertiana* Dougl.) cones in California, Nevada, and Oregon (fig. 1). The adult beetles attack and kill second-year cones before they mature, thus preventing the production of viable seed. Cone loss often exceeds 90 percent of the crop in local areas. At times such heavy losses have created critical problems in the regeneration of sugar pine.

Evidence of Infestation

Dead cones, stunted and darkened, are the most obvious signs of infestation (figs. 2 and 3) in June through August, and fall to the ground in July and August when dry and hard.

The cones are killed by the beetles during cone elongation. They vary in length from 2 to 17 inches, are usually 3 to 9 inches, and have a pitch tube on the stem (fig. 2). If the stem is missing, the cone can still be recognized by a frass-filled gallery leading into the cone along one side of its axis.

Two other types of cones may fall during this period: normal cones of the previous year and squirrel-cut cones of the current season. The normal cones are full sized and open when they fall. The squirrel-cut cones may not be full sized and are usually closed. They bear toothmarks and are often associated with the remains of cones taken apart by squirrels.

Faded twig tips are another sign of infestation. The adult cone beetles kill sugar pine twig tips by boring into them and mining the current year's growth. The needles of this mined area droop and fade to a reddish brown (fig. 4). These faded twig tips can be seen in the tree crowns and are most common in late summer and fall. Some loss of needles or falling of twigs occurs in winter, and in some years in any season. At close range beetle-mined twig tips are easily recognized but at longer distances become impossible to distinguish from those dead from other causes.

Infestations are most accurately assessed in September because the fallen cones more accurately indicate population size than do faded twig tips. Infestations are usually "spotty"; one tree may lose most of its cones, whereas other trees only 50 yards away may escape loss.

Description of Life Stages

The adults are cylindrical, shiny black, and $\frac{1}{8}$ to $\frac{3}{16}$ inch long (fig. 5, *A*). Their posterior end indents slightly, sloping from the dorsal surface. Eggs are $\frac{1}{25}$ inch long, ovoid cylindrical, and—depending on age—near transparent to white opaque (fig. 5, *B*). Larvae (fig. 5, *C*) are white legless grubs with small, light brown heads and variable in size. Pupae are similar to adults in size and shape but are fragile and white (fig. 5, *D*). The

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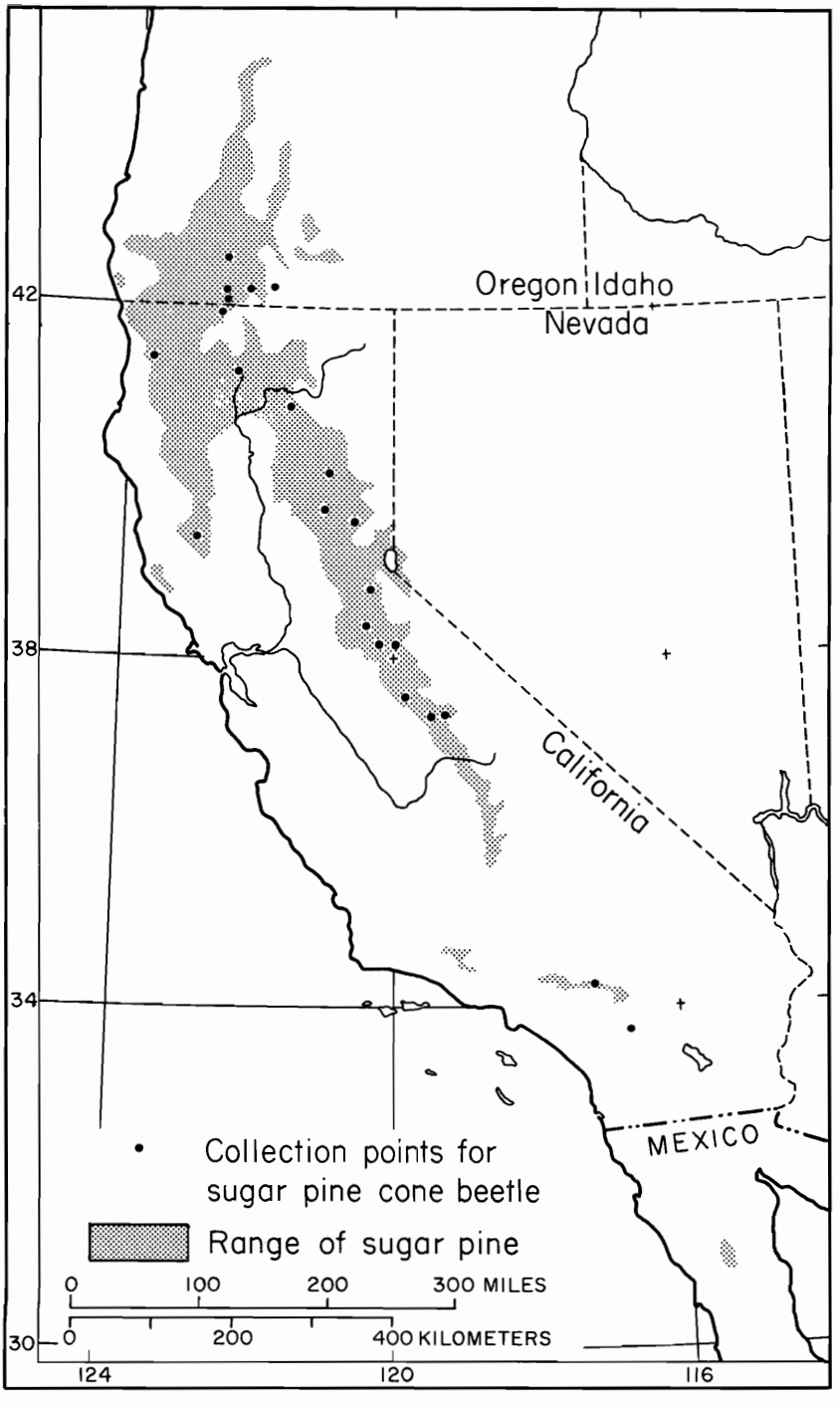

Figure 1.—Localities where sugar pine cone beetles have been collected, and distribution of its host, sugar pine.

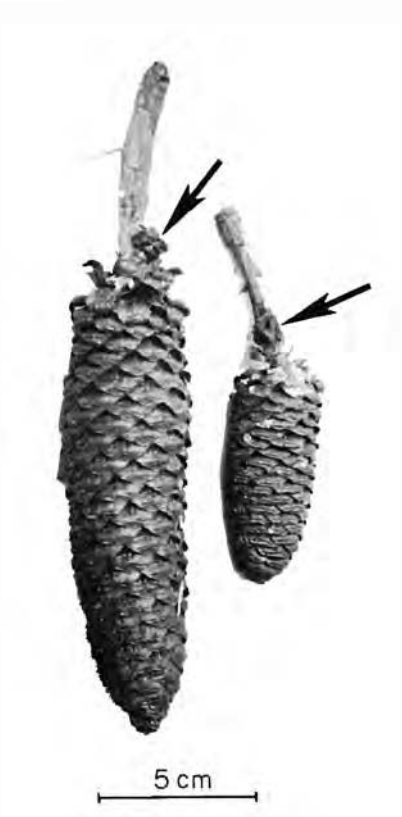

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Figure 2.—Sugar pine cones killed by the sugar pine cone beetle. Note pitch tubes on stems.

new adults are light yellowish brown but darken progressively until they reach their normal black color.

Life History and Habits

The sugar pine cone beetle has several broods each year but only one generation. The beetles overwinter as adults in either cones or mined twig tips that have fallen, or in mined twig tips on the trees. In late May or early June, during the first warm week or more, the adults emerge to attack the second-year cones just as they start the season's growth. A female beetle attacks the stem of the cone. Upon entering she completely severs the woody water-conducting tissue but leaves enough other tissues to support the cone mechanically. Then she mines down into the cone along one side of its axis (fig. 3, *A*). Her attack is followed by the entrance of one or more males and possibly other females through the same route. Mating takes place in the cone. Eggs are laid in a niche cut into a developing seed, usually one per seed, as the female progresses along the axis of the cone. In some small cones females do not lay eggs. Often they die before laying. Thus broods are not established in about one-third of the attacked cones.

Commonly the parent adults emerge from the cone within 10 days to attack another cone. The peak of attack is in June, but limited attack may continue through most of July.

Larvae feed within the dying cones and pupate mostly during late June and July. The adult stage begins during July and August, and the new adults feed within the cones for at least a month before emerging. Emergence starts during August and continues into the fall. Emerged beetles mine singly in twig tips. Apparently, a single beetle mines several tips between emergence and cone attack. The proportion of beetles that overwinter in twig tips instead of cones varies from year to year and from one locality to another.

Natural Control

The irregular food supply provided by the typically intermittent cone crops of sugar pine is probably dominant in limiting the abundance of the beetle. Also important is mortality from high temperature. Many cones fall in sunny spots and are heated to temperatures lethal to the broods inside.

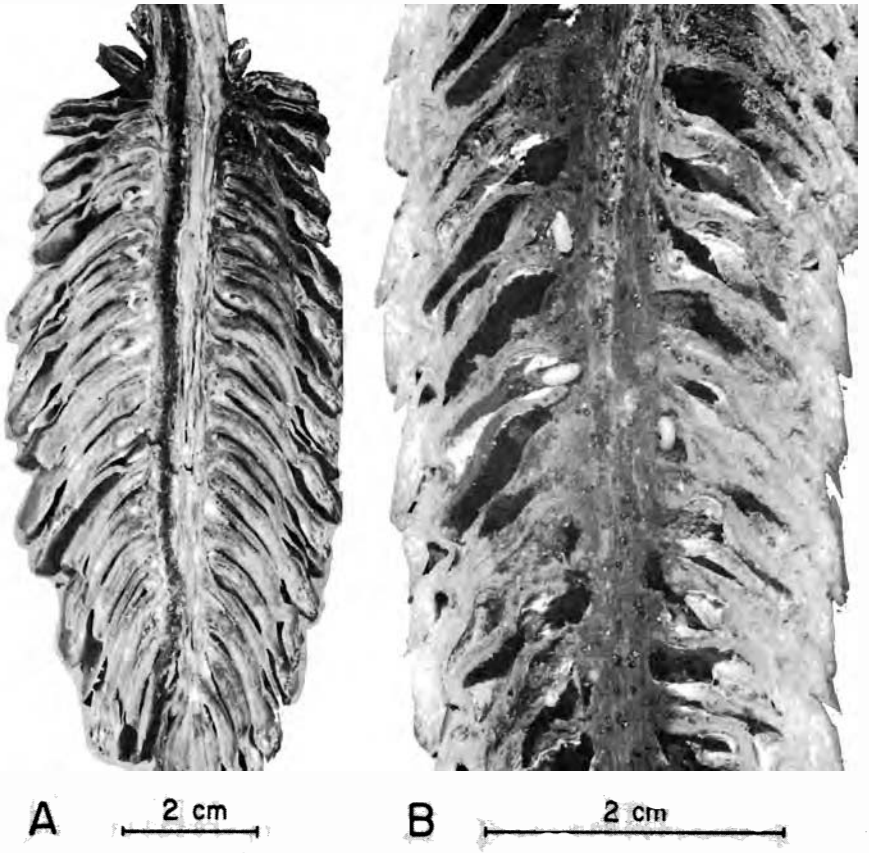

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Figure 3.—Longitudinal sections of cones killed by the sugar pine cone beetle: *A*, 10 days after attack, parent gallery; *B*, 40 days after attack, dried condition and immature stages of the beetle.

Little is known about insect enemies of the sugar pine cone beetle. The wasp *Cephalonomia utahensis* Brues parasitizes cone beetle larvae. And the larvae of an unidentified clerid beetle destroy both larvae and pupae of the cone beetles. The clerid *Enoclerus lecontei* Wolcott may devour attacking cone beetle adults. Adults are also parasitized by the wasp *Tomicobia tibialis* Ashmead. Larvae of several species of the beetle *Ernobius* and of the moth *Dioryctria abietella* (D. & S.) feed in cones killed by the cone beetle and destroy cone beetle larvae and pupae even though not obligate predators. Parasitic wasps reared from beetle-infested cones but not directly observed parasitizing the cone beetle include the braconids *Eubadizon strigitergum* (Cushman) and *Spathius californicus* Ashmead and the pteromalid *Rhopalicus pulchripennis* (Crawford). Undoubtedly more natural enemies await discovery.

Applied Control

Several control methods have been advocated and aerial spraying has been attempted, but no control method has been practiced and

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Figure 4.—Faded twig tip caused by mining of sugar pine cone beetle adults.

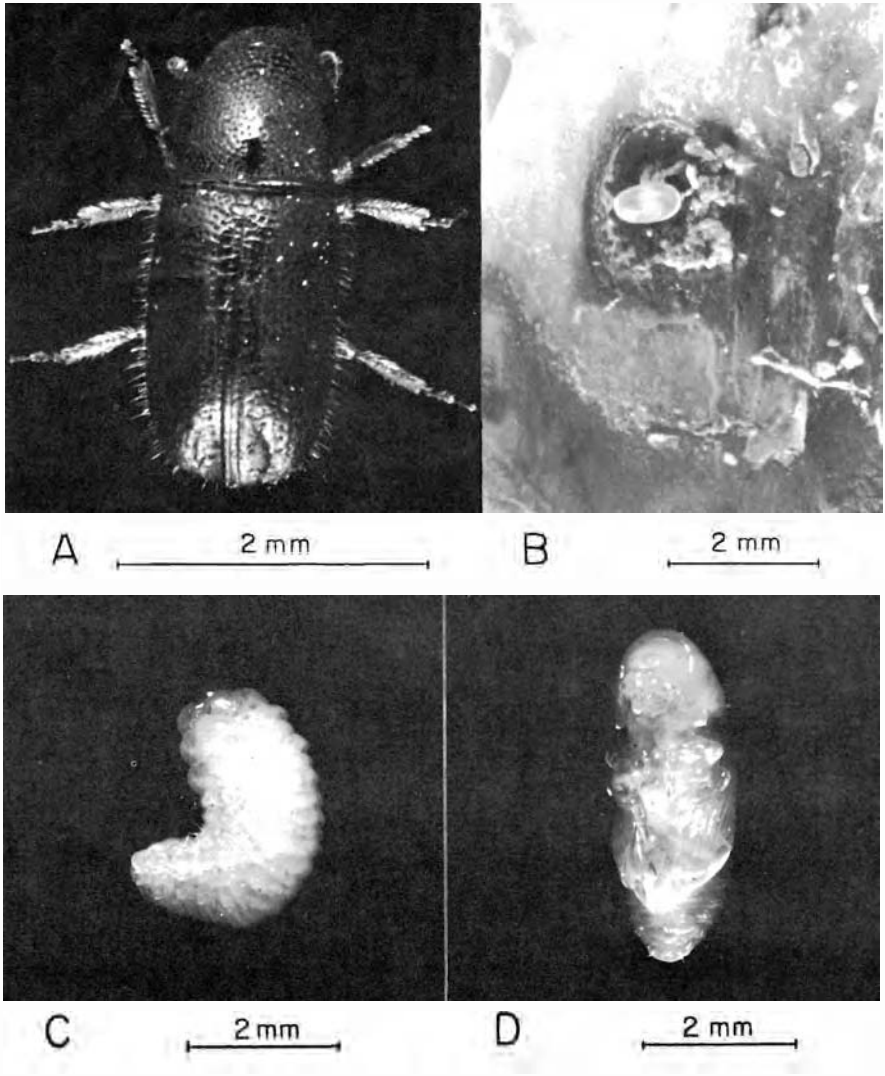

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Figure 5.—Life stages of the sugar pine cone beetle: *A*, Adult; *B*, egg in niche; *C*, larvae; *D*, pupa.

evaluated enough to be considered dependable.

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