California Flatheaded Borer

Robert L. Lyon[1]

The California flatheaded borer (*Melanophila californica* Van Dyke) has been responsible for the death of many valuable Jeffrey and ponderosa pine trees in the West. The insect appears most commonly in Idaho, Oregon, and California but is also found in Nevada and Washington (fig. 1).

Most of what is known of the insect's biology has been learned from studies in California where it is the most destructive. Here conditions favorable to the insect are common in pine stands along the east slopes of the Sierra Nevada and the Cascade Range, in the foothills of the Sierra Nevada, in the Coast Ranges, and in the mountains of southern California. Most often the insect infests pines growing on shallow or rocky soils in stands at the fringe of forest areas where rainfall is light; it also attacks stands on better sites.

A serious pest, the flatheaded borer can kill a tree outright. Usually, though, the insect is found in trees along with other destructive pests: the western pine beetle (*Dendroctonus brevicomis* Le Conte), the Jeffrey pine beetle (*D. ponderosae* Hopkins), and pine engravers (*Ips confusus* (Le Conte) and *I. oregoni* (Eichhoff)). The borer often attacks a tree first and predisposes it to further attack by *Dendroctonus* beetles. A tree that survives borer attacks may subsequently be killed by bark beetles. Trees top-killed by pine engravers may be killed by supplementary attacks of the borer in the lower crown and bole.

Hosts

The California flatheaded borer primarily attacks ponderosa and Jeffrey pines. In stands composed of a mixture of these two species, the insect is more often found in Jeffrey pine. The borer also attacks sugar, Coulter, Monterey, Digger, and knobcone pines.

The flatheaded borer usually attacks living trees of all size classes above the sapling or pole stage. It is found more commonly in trees that are declining in vigor than in healthy vigorous trees. The borers may continue their development in trees when they are felled or when they are killed by bark beetles or other agents. They may also continue their development in tops and limbs left as slash after a logging operation. Although the borer may sometimes attack dead trees or slash, its survival in dead material varies.

[1] Research entomologist, Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture.

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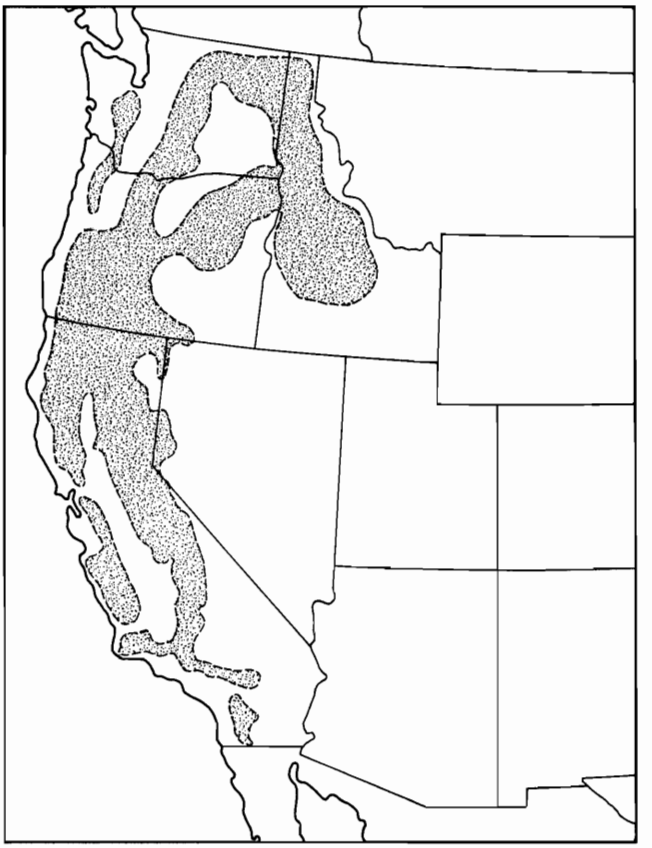

Figure 1.—Distribution of the California flatheaded borer.

The borer can attack the entire length of the bole of the host tree and the basal parts of heavier limbs. It can infest only a part of a tree, such as the top, the midbole, or a strip on one side.

Evidence of Attack

The general appearance of an infested tree is not always a reliable guide to the insect that has attacked it. Trees showing symptoms of poor vigor can be a suitable food source for bark beetles as well as for the borer. Some trees are attacked repeatedly by the borer and yet do not die. When trees are repeatedly attacked for several years, however, they show a progressive decline. Decline in vigor is usually expressed by thin crowns, shorter and fewer needles, dead limbs in the living crown, and yellowish-tinted foliage (fig. 2).

Concrete evidence of flatheaded borers in trees of poor vigor can be found by peeling off a section of bark. If the flatheaded borer has attacked a tree, the surface of the exposed wood will have winding, warty ridges 1 or more inches long (fig. 3, *B*). These narrow linelike ridges are formed when new wood grows over the tiny

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Figure 2.—Decline in vigor of ponderosa pine is often associated with repeated flatheaded borer attacks.

galleries produced by young borer larvae feeding on the innermost bark tissues lying next to the wood. The healed-over larval galleries may be numerous over the exposed wood, and their mirror image will be seen as an impression on the opposing bark surface.

When a tree dies from flatheaded borer attacks, its foliage first turns yellowish green. Later the foliage turns straw color, then reddish brown to brown. Usually the borers have matured and emerged from the tree before the foliage turns reddish brown; occasionally they emerge before the foliage turns straw color or when it is only beginning to show a yellowish cast. Small oval exit holes opening at the bark surface are evidence that the adult borers have abandoned the tree (fig. 3, *C*).

In dead or dying trees, the presence of flatheaded borers is shown by galleries on the inner surface of the bark. The galleries are made by the larger, maturing larvae. They wind about through the tissues lying next to the wood, at times occupying most of the inner bark surface. They are mostly 10 to 15 millimeters wide and are packed solid with larval excrement, which is deposited in a clearly defined, concentric, crescent-shaped pattern (fig. 3, *A*).

The work of the California flatheaded borer may be confused with that of the pine flatheaded borer (*Melanophila gentilis* Le Conte) since the two species have common hosts. The pine flatheaded borer does not attack living trees but develops in felled logs and slash or in windfalls and other dead or dying trees. There are no healed-over galleries since the host is dead or dying when attacked by the pine flatheaded borer.

Life States

The adult California flatheaded borer is 7 to 11 millimeters long and 3 to 4 millimeters wide. It is elliptical and is brownish black and bronzed above and brassy green below (fig. 4, *A*). About 60 percent of the adults have one to three yellow spots on each wing cover; 40 percent have none. The pine flatheaded borer, on the other hand, is bright blue green with unspotted wing covers.

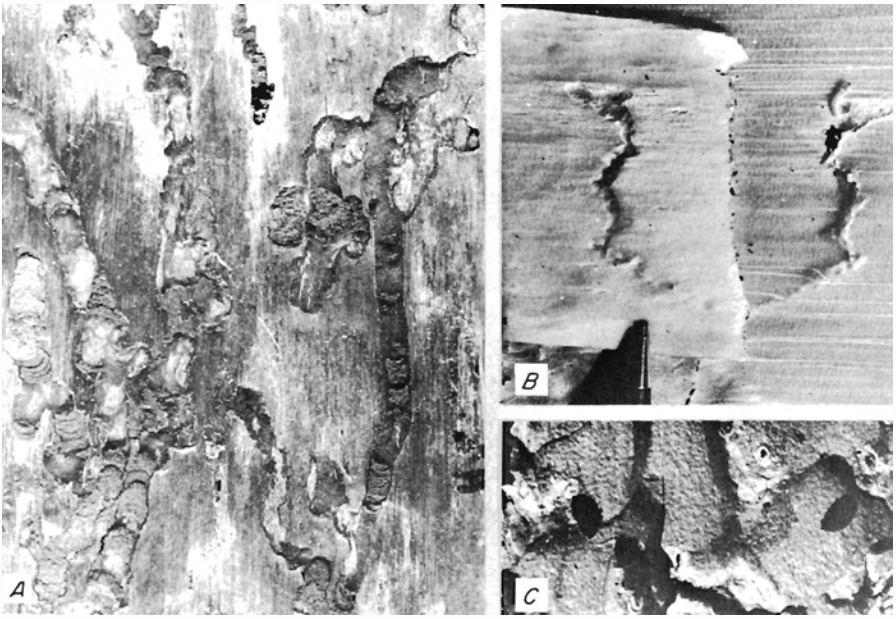

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Figure 3.—Evidence of attack by the California flatheaded borer: *A*, Galleries of maturing larvae on the inner surface (×⅓); B, left, exposed mine of a young larva showing the partially healed mine in the bark; right, the same mine in the wood with the larva at its terminus (×⅔); and *C*, exit holes in the outer bark made by the adult (×1⅓).

The eggs are creamy white when first laid and turn yellowish as they develop. They are generally flattened and oval in outline (fig. 4 *D*). Most of them are about 1 millimeter long and ⅔ millimeter wide.

The young larvae are creamy white with a tinge of brown. They blend with the wood and phloem of the infested tree and are difficult to see. The forepart of the larva's body is slightly enlarged laterally, having a "horseshoe-nail" shape characteristic of the family Buprestidae. The forepart of the body of the older larva is much enlarged. The full-grown larva (fig. 4, *E*) is creamy white and about 25 millimeters long. In the last instar (prepupal), the larva shortens, it thickens greatly, and its body bends double (fig. 4, *F*).

The pupa is the same size as the adult. It is translucent white at first, changing to the color of the adult as it develops. The antennae, wings, and upper surface of the abdomen remain a clear translucent white until just before the pupa become an adult (fig. 4, *B* and *C*).

Habits

The adult beetles emerge from May to August; the peak of emergence is usually in June or July. The peak and the spread of emergence, however, may vary in the different parts of the insect's range—especially from north to south and at various elevations.

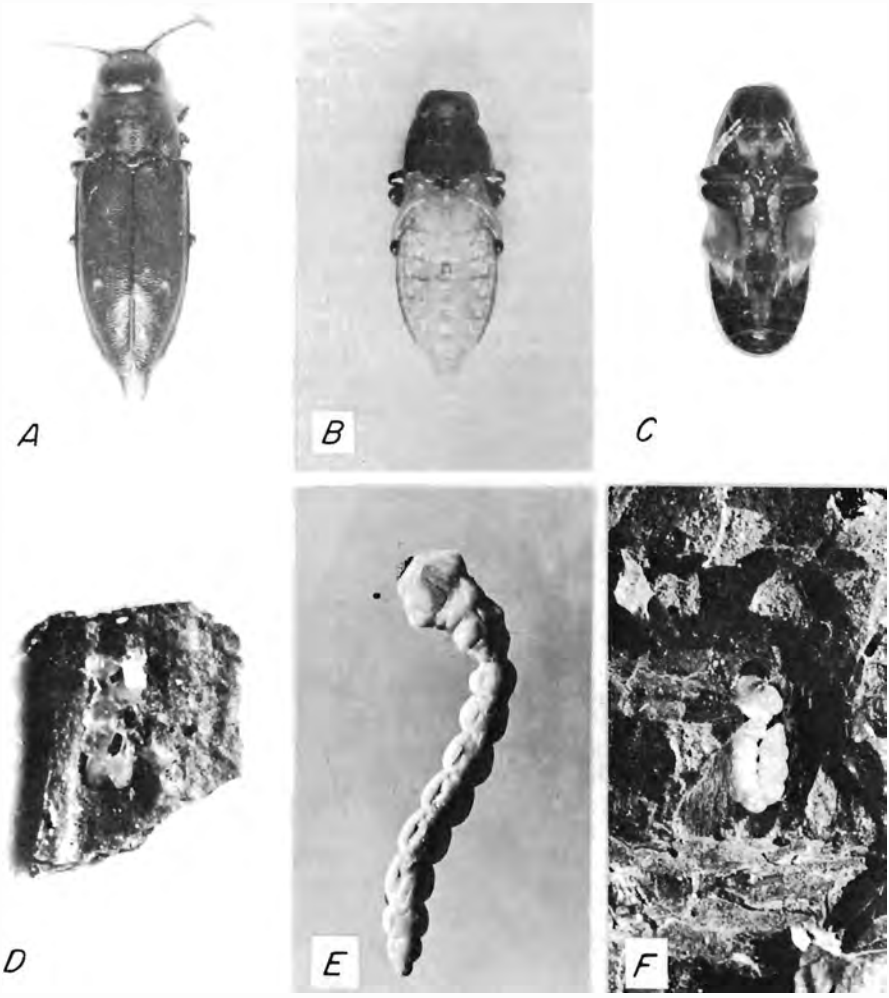

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Figure 4.—Life stages of the California flatheaded borer: *A*, Adult (×4); *B*, pupa, dorsal view (×3); *C*, pupa, ventral view (×3); *D*, eggs on underside of a bark scale (×4); *E*, full-grown larva (×3); *F*, prepupal larva in outer bark (×2).

Local weather conditions have a profound influence on adult emergence and may greatly delay or accelerate it.

When the adults emerge, they fly to green host trees and feed on the foliage. If the female is to develop viable eggs she must feed on foliage. The adult clings to the needle sheath, or just above it, and feeds on the exposed fascicle of needles, usually of the current season's' growth. Most feeding is confined to the lower inch of the exposed needle although feeding elsewhere along the edge of the

needle is known. Damage to the foliage is not great enough to injure the tree seriously.

The adult lays eggs from June through August. The eggs are placed under bark scales bordering on crevices. About 60 percent of the eggs are deposited singly or in pairs. The remainder are usually laid in groups of three to eight.

The eggs hatch in from 1 to 3 weeks. The newborn larva mines directly to the cambium, turns, and mines through the innermost phloem tissue next to the wood in an approximately horizontal direction. The mine of the very young larva is at first tiny and scarcely wider than the larva itself. As the larva progresses, it fills the mine behind it with a slender homogeneous thread of frass.

The life span of the California flatheaded borer varies. The larva may grow steadily larger and reach the prepupal instar in one season; or it may remain small, feeding and progressing slowly throughout the season, and overwinter in this form. When development is slow and the larva remains small, it is termed an "incipient larva"; the mine it makes is healed over by the tree, and the warty ridges typifying this species are thus formed. The tiny "incipients" may survive for 2 or even 3 or 4 years, but their mortality rate is high. Galleries of incipient larvae can be found imbedded in the wood of trees that have withstood repeated attacks by the borer over several years.

Incipient larvae that survive eventually enter a phase of development in which they grow rapidly. This phase, which usually starts in early June, does not begin until the tree is either dead or dying.

As the larva grows larger, its mine widens progressively, and it feeds more extensively, destroying much of the phloem tissue. The full-grown larva constructs a pupal cell in the outer bark or sometimes in the outer sapwood of thin-barked trees. It then stops feeding and becomes a prepupal larva. Generally this stage is reached before winter and can be found from July on. The insect usually overwinters as a prepupal larva within the pupal cell. Pupation takes place the following spring mostly in June or from May to July. The insect remains a pupa for about a month and then changes to an adult thus completing the life cycle.

Sometimes the insect does not become a prepupa before cold weather but passes the winter in the actively feeding stage. When this happens it becomes a prepupa in spring. Broods of this kind probably suffer heavy mortality. When the larvae do survive and become prepupae most of them undergo a diapause. They remain as prepupae throughout the summer and following winter; then they pupate and emerge as adults in the spring.

Biotic Control

Little is known about the climatic and biotic forces that hold populations of the borer in check or about which life stage is most affected. It is known, however, that at times a large part of a brood of larvae die when still very young.

Small hymenopterous parasites infest the eggs and larval stages of the borer. Also the black-bellied clerid (*Emoclerus lecontei* Wolcott) and the blue-green trogositid (*Temnochila virescens* (Fabricius)) have been observed attack-

ing the larvae. At times woodpeckers feed on the prepupal larvae by pecking through the bark to the pupal cell located close to the surface. The effectiveness of these agents in controlling the borer has not been determined.

Direct Control

Sanitation-salvage logging—a selective cutting of trees of poor vigor—is an effective method of controlling the flatheaded borer in stands of merchantable timber. The selective cutting of decadent trees helps reduce the borer population because such trees usually are most heavily infested. The partial cutting of timber stands may not be economical where most trees are small or unmerchantable. Other methods of control may need to be used in forests that are devoted to recreational use and where logging is not permitted.

The borer can also be controlled by cutting infested trees and peeling and burning the infested bark. This is done during the winter months while the borer is prepupal and in the outer bark.

The flatheaded borer can be controlled by applying water emulsions or penetrating oil sprays to the outer surface of the bark of felled trees while the insect is in the larval stage. A suggested spray mixture is 1 pint of 85-percent ethylene dibromide concentrate in 5 gallons of No. 2 fuel oil. Apply the spray liberally to the bark of the felled tree so that the solvent will carry the insecticide to the inner layers of bark tissue where the flathead larvae occur.

Lindane sprays are also effective. Water emulsions or solutions in No. 2 fuel oil of 1.5-percent lindane are applied until the bark is completely wet. To prepare the oil spray, mix 1 gallon of 20-percent lindane oil solution into 14 gallons of No. 2 fuel oil. Or, if a water emulsion spray is to be used, mix 1 gallon of 20-percent lindane emulsifiable concentrate with 14 gallons of water. Apply either spray until the bark is completely wet.

When using either a lindane or ethylene dibromide spray, the tree should be felled and all infested portions of the bark should be carefully treated.

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. 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.

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.

References

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