



Protecting Live Oaks Against Bark Beetles and Ambrosia Beetles

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Oak bark beetles and ambrosia beetles are dark colored, very small insects (1.7 to 4 mm long) that attack and may kill oaks by boring beneath or through the bark into the sapwood. Three beetle species are common and widespread throughout California: the Western Oak Bark Beetle, *Pseudopityophthorus pubipennis*; the Oak Ambrosia Beetle, *Monarthrum scutellare* (Fig.1); and the Minor Oak Ambrosia Beetle, *M. detinger*. These beetles have reached epidemic proportions in California live oaks, *Quercus agrifolia*, in the landscape and natural forests from Mendocino to Santa Barbara Counties.

As a general rule these beetles are not aggressive, preferring to attack wounded and stressed trees. Yet if environmental conditions contribute to oak stress in areas where beetle populations have reached epidemic proportions, they may attack and kill trees that appear to be healthy. This has become self-evident during the last four years, when apparently healthy oaks in gardens and natural forests were killed in large

numbers. A complete problem diagnosis and timely removal of infested trees, if indicated, may reduce further attacks. In urban forests and landscapes all possible direct control treatments should be applied. **No single treatment is suitable in dealing with individual oaks attacked by bark or ambrosia beetles.** Therefore urban foresters, arborists, pest control advisors and homeowners should understand beetle life histories and habits in order to choose the most appropriate combination of treatments.



Fig.2. Beneath the bark, initiation of egg galleries excavated across the grain by the western oak bark beetle. This oak had no sign of ambrosia beetles; they arrived 10 days later.

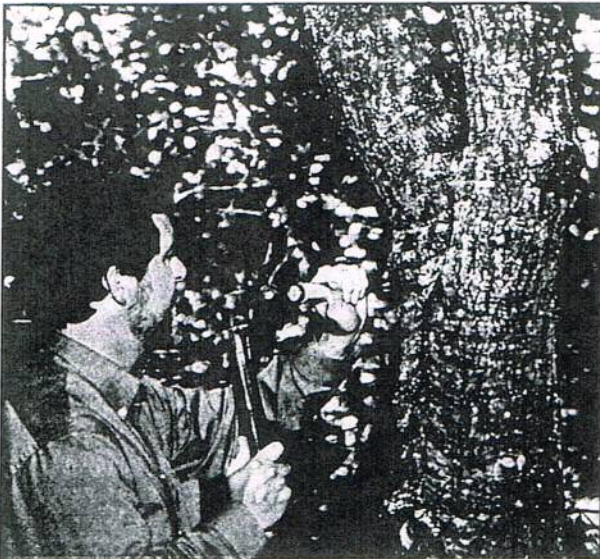


Fig.1. Tree heavily infested by ambrosia beetles. Only when their population is high do these beetles attack stems so high up. Foliage was still green, yet this tree's death was hastened by ambrosia beetle's arrival.

Beetle Life History and Habits

Western Oak Bark Beetle, *P. pubipennis*

These beetles reproduce in great numbers, primarily in oak firewood, emerging to attack live oaks and tanbark oaks, *Lithocarpus densiflorus*, in the landscape. They usually attack severely injured, dying or dead trees, but also may attack lower branches and trunks near the base of healthy oaks.

Adult beetles emerge in the spring and fly to host trees to feed and reproduce in dead or dying oaks. They bore through the bark and construct two transverse egg galleries in the bark and sapwood (Fig.2). Females lay eggs along both sides of galleries. As the beetles bore through the bark, they introduce a fungus (not yet identified) that stains and kills the inner bark and sapwood

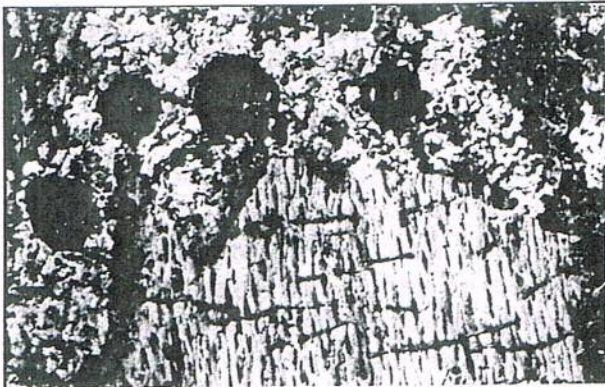


Fig.3. The growth of *Hypoxylon* fungus fruiting bodies almost always appears close to *P. pubipennis* attack, evidenced by horizontal engravings after the bark was removed.

around the egg galleries. The construction of egg galleries girdles and plugs the vessels in the outer sapwood that transport water and nutrients upward to the tree crown (Fig.3).

After eggs hatch, the larvae make fine, threadlike tunnels through the phloem into the inner bark where they later pupate. Newly formed adults make their own exit holes through the bark, emerge and fly to attack other oaks. The time it takes the oak bark beetle to grow from egg to adult varies seasonally. This beetle has two or more generations a year and, because successive generations overlap, the adults fly almost everyday during the growing season.

Oak Ambrosia Beetle, *M. scutellare*

These beetles attack dying, weakened, or diseased trees, but prefer very recently killed trees, stumps or parts of trees. In March, the male

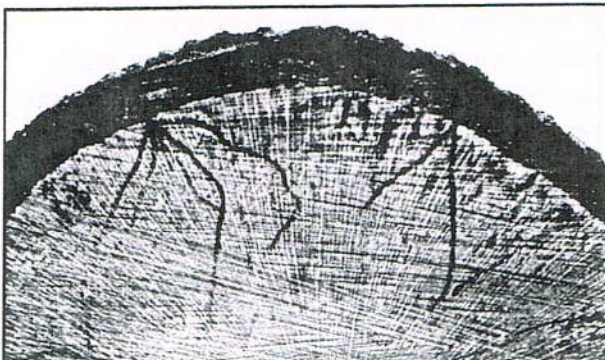


Fig. 4. Cross section of a California live oak showing egg tunnels made by the oak ambrosia beetle, *M. scutellare*.

beetles penetrate the sapwood to a depth of 5 cm (2 inches). The female joins the male, mates and introduces the fungus, *Monilia brunnea*. Both sexes excavate two to four diverging galleries deep into the heartwood, each 5 to 15 cm (2 to 6 inches) long (Fig.4). The female excavates egg niches in the sidewalls of the galleries. The hatched larvae extend the egg niches into "larval cradles." *M. brunnea* grows into the cradles and serves as a larval food source for the beetles. Excavation of egg galleries lasts for 2 to 4 months; larval development, 6 to 8 weeks; and pupation, 2 to 3 weeks. After 3 to 4 months, new adult beetles emerge through the same entrance holes made by parent beetles. There are two generations per year with two major flight periods; the first in March and the second in September. However, beetles may fly almost every day during the growing season because different developmental stages overlap.

Minor Oak Ambrosia Beetle, *M. detinger*

The biology of this beetle is not well known but is probably similar to that of *M. scutellare*.

Look for Symptoms

The first step in dealing with potential bark beetle and ambrosia beetle problems is to identify symptoms of their attack. In apparently healthy



Fig. 5. Beginning in March, regularly check oaks for appearance of dark brown to black globules and stains on the bark surface.

California live oaks the first signs of a new infestation are **dark brown- to black-colored globules and stained bark surfaces**, located near the trunk base to breast height (Fig.5) with **reddish-brown boring dust**.

Sap flow and bark beetle borings attract oak ambrosia beetles and other associated insects to the vicinity of oak bark beetle attacks. They may

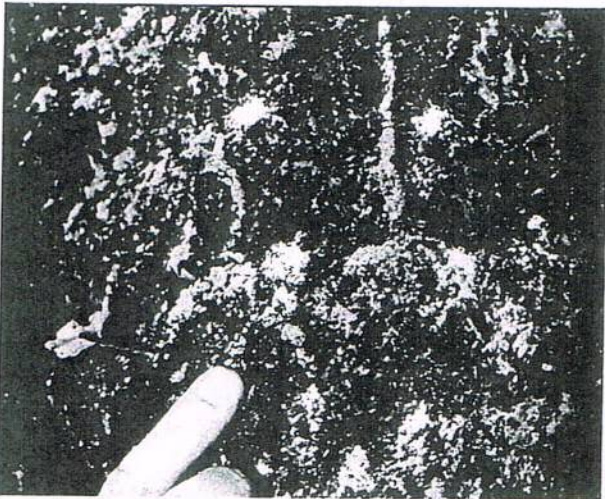


Fig. 6. Fine white sawdust streams on the lower and middle trunk indicates ambrosia beetle attack.

also bore into bark in extremely high numbers. However, ambrosia beetles penetrate through the bark deep into the heartwood and **fine white sawdust appears in bark crevices near entrance holes** (Fig. 6). The duration of their feeding and attack depend on the sapwood moisture content and temperature.

Adult Pacific flatheaded borers also lay their eggs in cracks near these attacks. Hatched larvae

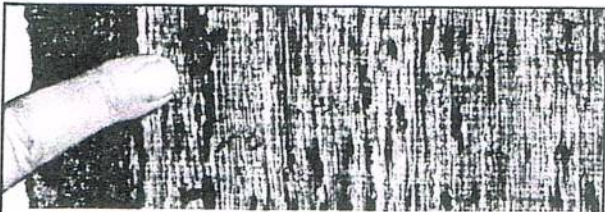


Fig.7. Crosscut of a live oak trunk section attacked by ambrosia beetles. Notice the growth of *Monilia* fungus that caused black discoloring of tunnels. Chemicals injected into the tree's system cannot reach and kill the feeding adults or larvae, because water-conductive vessels are plugged.

mine directly in the cambium, leaving **wet spots** on the bark.

Live oaks more than 10 inches in diameter, with healthy-appearing green foliage, are attacked mostly near ground level and succumb rather quickly. The foliage of an attacked live oak becomes pale green and then rapidly changes to red.

Very soon after gallery construction commences beneath the bark and in the sapwood, fruiting bodies of *Hypoxylon* sp. fungus appear on the bark's surface (Fig.3).

Proper Oak Health Care Prevents Bark Beetle and Ambrosia Beetle Attack

There is no historical record about the massive dieback of live oaks that we are now experiencing in coastal counties of northern and central California. In 1995 massive deaths of tanbark oaks from unknown causes began in the Mt. Tamalpais-Mill Valley region. These dead trees may have served as a source for attacking nearby live and tanbark oaks.

Tanbark oak and California live oak diebacks in forest stands cannot be controlled with chemicals. Once the beetles have completed their attack, there are no chemical controls that will save the tree (Fig.7). The adage "an ounce of prevention is worth a pound of cure" is certainly true in the protection of landscape oaks.

While these beetle species are native to California, they have never before reached pest status and thus very little biological information exists about their habits. In natural forests the success of chemical and silvicultural treatments is uncertain because it is difficult to predict how long the epidemics will last. In contrast, in urban forest situations oaks are often used as design elements. Whether they grow singly or in groups, homeowners insist that their oaks be protected

from infestation by these pests. To decrease the likelihood of oak death, pay attention to:

- ◆ Regularly checking coast live oaks and tanoaks from March to October for evidence of bleeding (Fig. 5) and reddish-brown boring dust. Immediately spray the infested trunk (up to 10 ft. above the ground) with the insecticide permethrin (Astro) to prevent further infestation.
- ◆ Promptly cutting down infested trees with symptomatic brown foliage, then chipping smaller branches and splitting the wood for firewood. **Firewood must immediately be covered with clear plastic for six months to prevent new beetle emergence and subsequent attack of oaks in the vicinity (Fig. 8).**
- ◆ Pruning oaks to achieve desired form and structure only from November to February when the beetles are not active. Avoid heavy (severe) pruning that opens the oak canopy to physiological stress.
- ◆ Removing dying, dead and damaged branches to maintain healthy, vigorous oaks.
- ◆ Grinding or covering the stump with plastic for 6 months after the oak is removed. **Stumps are very attractive to ambrosia beetles.**
- ◆ Preventing damage and physiological stress by insect defoliators such as oakworm and tent caterpillars.
- ◆ Irrigating **drought stressed** oaks during the summer to reduce drought damage to roots and increase tree vigor. Apply soaker hose to the area within the drip line of a tree once every six

weeks. Lay down soaker hose across (at right angles to) the slope.

- ◆ Reducing damage to roots and the root crown area caused by soil compaction and too frequent irrigation. Too much supplemental water denies oxygen to the roots, reduces tree vigor, predisposes trees to beetle attack, and favors attack by certain serious disease fungi such as the oak root fungus *Armillaria mellea* and *Phytophthora* fungus.

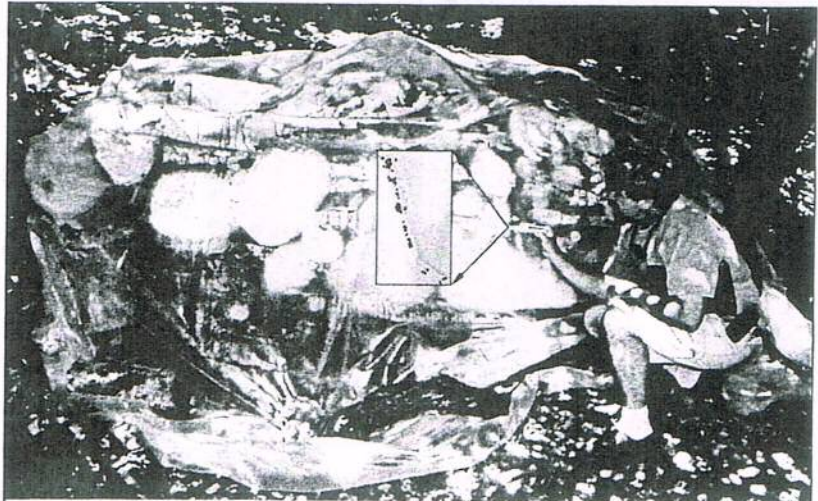


Fig. 8. Firewood, cut from an oak killed by western oak bark beetles and ambrosia beetles, was immediately covered with clear plastic. Two days after cutting and covering, the inside of the plastic was "black" with beetles trapped and drowned in condensed pools of water (insert). This environmentally sound system is much more effective than any chemical treatment.

- ◆ Protecting individual trees by spraying the trunks (up to 10 ft. above ground) twice a year with the insecticide permethrin (Astro) (in early March and at the beginning of August), especially over-aged high-valued landscape oaks and oaks whose root systems were disturbed by construction activity or soil compaction. If properly applied (bark soaked to runoff) this chemical acts as a successful preventative treatment.

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