



County of Santa Cruz

BOARD OF SUPERVISORS

701 OCEAN STREET, SUITE 500, SANTA CRUZ, CA 95060-4069

(831) 454-2200 FAX: (831) 454-3262 TDD: (831) 454-2123

JANET K. BEAUTZ
FIRST DISTRICT

WALTER J. SYMONS
SECOND DISTRICT

MARDI WORMHOUDT
THIRD DISTRICT

TONY CAMPOS
FOURTH DISTRICT

JEFF ALMQUIST
FIFTH DISTRICT

AGENDA: 9/28/99

September 21, 1999

BOARD OF SUPERVISORS
County of Santa Cruz
701 Ocean Street
Santa Cruz, CA 95060

RE: OAK INFESTATION

Dear Members of the Board:

Tan Oaks have been dying rapidly in the Santa Cruz Mountains. In addition, live oaks may be jeopardized by this blight as well. The California Department of Forestry and Fire Protection (CDF), the Department of Food and Agriculture, and the University Cooperative Extension have collected samples from dying trees. So far, standard diagnostic tests have not identified the cause. Potential outcomes of this epidemic include increased fire hazards, adverse effects on wildlife, and an increase in the populations of oak bark beetle. The beetles are considered the secondary cause of mortality.

Tan Oaks appear to have limited economic value, other than as firewood, and can be expected to regenerate quickly and vigorously. Attached are copies of articles published by the University of California regarding this problem. On the other hand, live oaks, which play an important role in suppressing growth of Chapparal and other more flammable vegetation, grow far more slowly. Their loss may be a significant detriment.

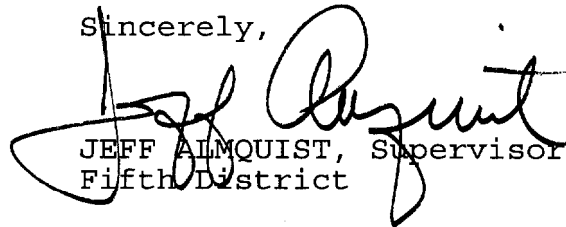
One of the great shortfalls we presently face is a lack of reliable information on the cause of the blight and the extent to which it has already taken hold in our forest lands.

28.1

September 22, 1999
Page 2

Given the extreme conditions existing in our community, I recommend that the Board direct the Agricultural Commissioner and the County Fire Chief to assemble a Scientific Task Force that includes representatives of UC Cooperative Extension, a representative from CDF and the Agricultural Commissioner's Office, researchers from local University programs, and representatives of the community with knowledge of the causes and threats to the woodlands. The Task Force would return to the Board of Supervisors on or before December 14, 1999, with a status report and recommendations on what the County can or should do to respond to the epidemic, and with suggestions of environmentally sound measures that are available to property owners who wish to attack this problem on their land.

Sincerely,



JEFF ALMQUIST, Supervisor
Fifth District

JA:lg
Attachments

cc: Chief Wert, CDF/County Fire
Dave Moeller, Agricultural Commissioner
UC Cooperative Extension

1957C5

Sep-20-99 09:20AM

P.2/5 P.02



UNIVERSITY OF
CALIFORNIA
Cooperative Extension En Maria County

Pest Alert #3
June 1999

Western Oak Bark Beetles and Ambrosia Beetles, Killers of Live Oaks

by Pavel Švihra, University of California Cooperative Extension

Oak bark beetles and ambrosia beetles are 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 and heartwood. Three species are common throughout California: the Western Oak Bark Beetle, *Pseudopityophthorus pubipennis*, the Oak Ambrosia Beetle, *Monarthrum scutellare*, and the Minor Oak Ambrosia Beetle, *M. Detinger*. These beetles have appeared very suddenly, and seasonally later than usual after the very cold spring of 1999, wreaking havoc among the California live oaks, *Quercus agrifolia*, in the landscape and natural forests of Marin County.

Western oak bark beetles and ambrosia beetles

attack wounded and stressed trees. If environmental conditions contribute to stress oaks in areas where bark beetle populations have reached epidemic proportion, the beetles may attack and kill trees that appear to be healthy. Such a situation has developed during the last four years, when apparently healthy oaks in the gardens and natural forest have been killed in large numbers as far south as Sausalito and north to Novato. Timely removal of infested trees may reduce further tree losses, but there is little that can be done directly to stop bark beetle and ambrosia beetle epidemics in the natural forest. The best defense that arborists, pest control advisors and homeowners have against such losses is to learn about oak health care and the beetles' habits.

Life History and Habits

Western Oak Bark Beetle, *P. pubipennis*. These beetles usually attack severely injured, dying or dead trees. They reproduce in great numbers

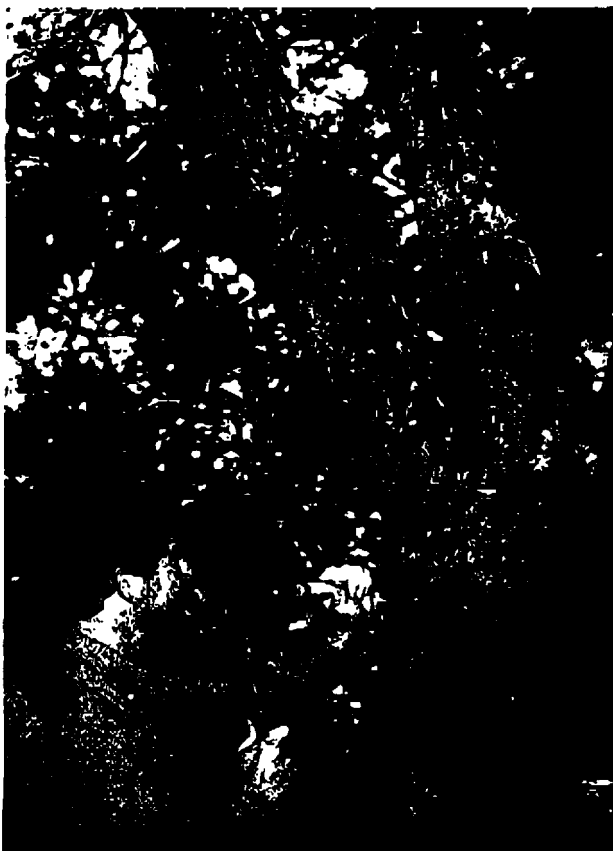


Fig.1. Tree heavily infested by ambrosia beetles. Only when their population is high, these beetles attack stems so high. Foliage was still green, yet this tree was killed before ambrosia beetles arrived.



Fig.2. Initiation of egg galleries by the western oak bark beetle. The transversely excavated egg galleries are marked deep in the sapwood. This oak had no sign of ambrosia beetles, which arrived 10 days later.

primarily in oak firewood, emerging to attack oaks and tan-bark oaks in the landscape. Adults emerge

Sep - SEP 20 '99 09:20AM

P.3/5 P. 03

near the trunk base. Reddish-brown boring dust appears on the lower bark surface near the tree base.

Sap flow and bark beetle borings attract oak ambrosia beetles and other associated insects to the same tree. They also bore in extremely high numbers into bark already occupied by oak bark beetles. However, the ambrosia beetles penetrate through the bark deep into the heartwood and fine white sawdust appears on the tree trunk (Fig. 4.). The amount of their feeding depends on the wood's moisture and surrounding temperature. Large trees, more than 10 inches in diameter are mostly attacked near ground level and succumb rather quickly. The foliage of an attacked live oak becomes pale green and then rather quickly changes into red.

Proper Oak Health Care Prevents Bark Beetle and Ambrosia Beetle Attack

There is no historical record about such rapid and massive dieback of live oaks as we are now experiencing in Marin County. The adage that "an ounce of prevention is worth a pound of cure" is certainly true with regard to the protection of landscape oaks. Epidemics of these beetles originated in naturally growing tan-bark oaks, *Lithocarpus densiflorus*. In 1995 massive deaths of tan-bark oaks from unknown causes began in the Mt. Tamalpais-Mill Valley region. These dead trees served as a staging base for new brood beetles to emerge and attack nearby live oaks in the natural forest and landscape. Tan-bark oak and California live oak diebacks in forest stands cannot be controlled with chemicals at reasonable costs and for environmental reasons. Once these beetles have completed their attack, there are no chemical controls that will save the tree (Fig. 5). We do not have complete biological information on these pests. It is difficult to predict how long the epidemics in natural forests will last. Therefore it is important to act promptly to reduce their impact in the landscape by:

- ◆ Promptly cutting down infested trees with the symptomatic brown foliage, chipping the smaller branches and splitting the wood for firewood. Firewood must immediately be covered with clear plastic for six months to prevent new brood emergence and subsequent attack of oaks in the vicinity.
- Removing dying, dead and damaged branches to maintain healthy and vigorous oaks.
- ◆ Avoiding heavy intermediate pruning cuts that open the oak canopy to physiological stress.

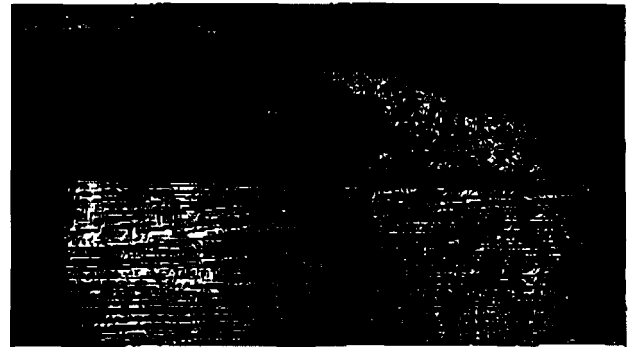


Fig. 5. The cross- and longitudinal section of a live oak trunk killed by ambrosia beetles. Or was it? Ambrosia beetles were blamed for the death of this tree but once the bark was removed, phloem and xylem were found to be girdled by oak bark beetles. Also notice the growth of *Monilia fungus* that caused black discoloring of tunnels and invaded the conductive system. Compare the infested section with the noninfested one on the left. It is clear that chemicals injected to the system cannot reach and kill the feeding larvae, because water-conductive vessels are plugged.

- ◆ Grinding the stump after the oak is removed.
- ◆ Preventing damage by insect defoliators such as oakworm and tent caterpillars, which are on the rise.
- ◆ Irrigating drought stressed oaks during summer to reduce drought damage to roots and improve tree vitality. 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

Sep - SEP 20 '99 09:21AM

P.4/5 P.04

in the spring and fly to dead or dying oak material, where they bore through the bark and construct two transverse egg galleries in the phloem and xylem tissues (Fig.2.). Females lay eggs along both sides of galleries. As beetles continue to bore through the bark, they introduce a symbiotic fungus (not yet identified) that stains and kills the inner bark and sapwood around the egg galleries excavated perpendicular to the grain. The construction of egg galleries and the growth of symbiotic fungus girdle and plug the tree's vascular system (the vessels that transport water and nutrients to the tree). After eggs hatch, the larvae make fine threadlike tunnels through the phloem into the inner bark where they pupate. Newly formed adults make their own exit holes through the bark and fly to attack oaks in the vicinity or far away. This beetle has two or more generations a year.

Oak Ambrosia Beetle, *M. scutellare*. These beetles attack dying, weakened, or diseased trees, but most prefer just-killed trees or parts of trees. In March, the male penetrates the sapwood to a depth of 2 1/2 inches. The female joins the male, mates

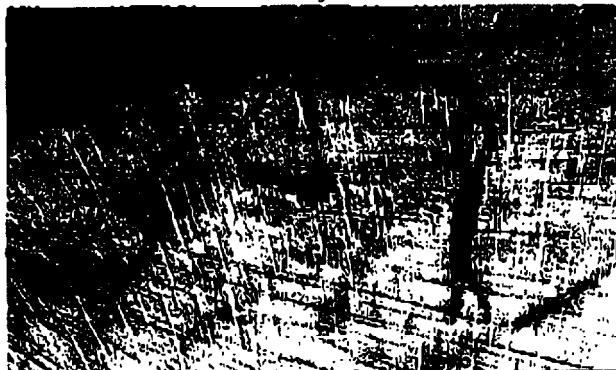


Fig. 5. Cross section of a California live oak showing egg tunnels made by the oak ambrosia beetle, *Monothrum scutellare*.

and introduces the symbiotic fungus, *Monilia brunnea*. Both sexes excavate two to four diverging galleries deep into the heartwood, each 2 to 6 inches long (Fig.3). The female excavates egg niches in the sidewalls of the galleries, which the larvae extend into "larval cradles." The ambrosia fungus grows into the cradles and serves as a food source. Excavation of egg galleries lasts

2 to 4 months; larval development, 6 to 8 weeks; and pupation, 2 to 3 weeks. After a total 3 to 4 months, new brood 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 October. However, the beetles may fly almost every day through the growing season because the different developmental stages overlap.

Minor Oak Ambrosia Beetle, *M. deninger*. The biology of this beetle is unknown but is probably similar to *M. scutellare*.

Look for Symptoms

The first step in dealing with potential bark beetle and ambrosia beetle problems is to learn to identify symptoms of their attack. In apparently healthy California live oaks dark brown- to black-colored granules and stained bark surface below the entrance holes of western oak bark beetles are the first signs of fresh infestation



Fig. 4. Beginning in March regularly check oaks for appearance of dark brown to black granules and stains on the bark surface, brown frass, and fine white sawdust streams on the lower trunk.

5

28.1²

Sep - SEP 20 '99 09:22AM

P.5/5 P. 0 5



Fig. 5. Firewood, cut from an oak that appeared healthy in April but was dead by mid-May, was immediately covered with clear plastic. Ambrosia beetles were thought to be the cause of death. Two days after cutting and covering, the inside of the plastic was "black" from beetles trapped and drowned in condensed pools of water (insert). They were the new brood adults of western oak bark beetles. This environmentally sound system is much more effective than any chemical treatment.

area caused by frequent irrigation. Too much supplemental water or water applied too often deny oxygen to the roots, reduce tree vigor, predispose trees to beetle attack, and favors certain serious diseases.

- ♦ Minimizing soil compaction to prevent root diseases such as oak root fungus and *Phytophthora* fungus.

- Spraying the trunks (up to 4 ft. above ground) twice with insecticide permethrin (Astro) (in March and the end of September) especially high-valued ornamental oaks, oaks whose root system was disturbed by any construction or soil compaction, and oaks with the initial beetle attacks. However, these chemicals do not kill beetles already in the ate and, at best, are only mildly successful as preventatives.

Acknowledgments: This research study has been supported by many public, private organizations and private citizens: Marin County Stormwater Pollution Prevention Program (MCSTOPPP)—for information on protecting local creeks call 499-6528; Drs. Paul and Geraldine Alpert; Bartlett Tree Service; Gardeners' Guild; Gardenworks; Garden West; City of San Rafael; and City of Novato.

28.1

6

4



UNIVERSITY OF
CALIFORNIA
Cooperative Extension in Marin County

Pest Alert #1
June 1999

Sudden Death of Tanoak, *Lithocarpus densiflorus*

Pavel Švihra, University of California Cooperative Extension



Fig. 1. Tanoak forest showing different stages of dieback. Wilted, faded and brown foliage clinging to entire crown since mid-spring draws the attention of concerned residents. More than 100 trees have been killed by a mysterious disease in the area shown.

Tanoak, tanbark-oak or chestnut-oak, *Lithocarpus densiflorus* is a large tree (some varieties are shrubby) that grows naturally in Marin County and many other areas of the state. It is rarely planted as an ornamental but if the tree begins to grow from seed in the garden, our residents favor it because this tree grows rapidly and in the past has not suffered significant dieback from biotic or abiotic agents. In the summer of 1995, the first serious episode of spontaneous tanoak death was reported in Mill Valley. Homeowners residing in the urban forest interface observed death of tanoaks in the forest close to their properties. I visited these sites and found several large trees with brown foliage scattered among apparently healthy trees. I checked the root system of one brown tree and found well-developed oak root fungus, which led me to the conclusion that *Armillaria mellea* was the cause. By early spring of 1996 the tanoak death rate reached epidemic proportions (Fig. 1).

Symptoms of this unusual tanoak dieback

From a distance, the first prominent symptoms are drooped (wilted) new shoots (Fig. 2A). Shoot wilting

is spontaneous and occurs throughout the crown. Older leaves become pale green. Approximately two-three weeks later the foliage turns brown but remains clinging to branches, visibly announcing the death of tanoak.

Chisel cuts into the inner bark and sapwood at breast height of affected trees, reveal saturated tissue that drips burgundy-red sap. Samples of the symptomatic branches, whether at the time of drooping or later when all foliage becomes brown, have ROT shown staining in vascular tissues. Close inspection of a lower trunk may show an exudation of dark-brown sap that stains a few squares inches of the bark surface (Fig. 2B). Samples of the bark, inner bark and phloem-xylem tissues beneath stains were cultured in different laboratories several times without revealing pathogens. However, the western oak bark beetle was found beneath the bark.

In the summer, the bark splits and breaks as a result of drying. Gum often exudes from these splits, and is then occupied with prominent clusters of *Daldinia* spp. fruit bodies (Fig. 2C). Long striations of a different tan to pinkish discoloration become visible on the bark surface. Examination of the root-crown

near the trunk base. Reddish-brown boring dust appears on the lower bark surface near the tree base.

Sap flow and bark beetle borings attract oak ambrosia beetles and other associated insects to the same tree. They also bore in extremely high numbers into bark already occupied by oak bark beetles. However, the ambrosia beetles penetrate through the bark deep into the heartwood and fine white sawdust appears on the tree trunk (Fig. 4.). The amount of their feeding depends on the wood's moisture and surrounding temperature. Large trees, more than 10 inches in diameter are mostly attacked near ground level and succumb rather quickly. The foliage of an attacked live oak becomes pale green and then rather quickly changes into red.

Proper Oak Health Cure Prevents Bark Beetle and Ambrosia Beetle Attack

There is no historical record about such rapid and massive dieback of live oaks as we are now experiencing in Marin County. The adage that "an ounce of prevention is worth a pound of cure" is certainly true with regard to the protection of landscape oaks. Epidemics of these beetles originated in naturally growing tan-bark oaks, *Lithocarpus densiflorus*. In 1995 massive deaths of tan-bark oaks from unknown causes began in the Mt. Tamalpais-Mill Valley region. These dead trees served as a staging bass for new brood beetles to emerge and attack nearby live oaks in the natural forest and landscape. Tan-bark oak and California live oak diebacks in forest stands cannot be controlled with chemicals at reasonable costs and for environmental reasons. Once these beetles have completed their attack, there are no chemical controls that will save the tree (Fig. 5). We do not have complete biological information on these pests. It is difficult to predict how long the epidemics in natural forests will last. Therefore it is important to act promptly to reduce their impact in the landscape by:

- Promptly cutting down infested trees with the symptomatic brown foliage, chipping the smaller branches and splitting the wood for firewood. Firewood must immediately be covered with clear plastic for six months to prevent new brood emergence and subsequent attack of oaks in the vicinity.
- Removing dying, dead and damaged branches to maintain healthy and vigorous oaks.
- ♦ Avoiding heavy intermediate pruning cuts that open the oak canopy to physiological stress.



Fig.5. The cross- and longitudinal section of a live oak trunk killed by ambrosia beetles. Or was it? Ambrosia beetles were blamed for the death of this tree but once the bark was removed, phloem and xylem were found to be girdled by oak bark beetles. Also notice the growth of *Monilia* fungus that caused black discoloring of tunnels and invaded the conductive system. Compare the infested section with the noninfested one on the left. It is clear that chemicals injected to the system cannot reach and kill the feeding larvae, because water-conductive vessels are plugged.

- ♦ Grinding the stump after the oak is removed.
- Preventing damage by insect defoliators such as oakworm and tent caterpillars, which are on the rise.
- ♦ Irrigating drought stressed oaks during summer to reduce drought damage to roots and improve tree vitality. 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

28.1

8



Fig. 5. Firewood, cut from an oak that appeared healthy in April but was dead by mid-May, was immediately covered with clear plastic. Ambrosia beetles were thought to be the cause of death. Two days after cutting and covering, the inside of the plastic was "black" from beetles trapped and drowned in condensed pools of water (insert). They were the new brood adults of western oak bark beetles. This environmentally sound system is much more effective than any chemical treatment.

- area caused by frequent irrigation. Too much supplemental water or water applied too often deny oxygen to the roots, reduce tree vigor, predispose trees to beetle attack, and favors certain serious diseases.
- ♦ Minimizing soil compaction to prevent root diseases such as oak root fungus and *Phytophthora* fungus.
- ♦ Spraying the trunks (up to 4 ft. above ground) twice with insecticide permethrin (Astro) (in March and the end of September) especially high-valued ornamental oaks, oaks whose root system was disturbed by any construction or soil compaction, and oaks with the initial beetle attacks. However, these chemicals do not kill beetles already in the tree and, at best, are only mildly successful as preventatives.

Acknowledgments: This research study has been supported by many public, private organizations and private citizens: Marin County Stormwater Pollution Prevention Program (MCSTOPPP)--for information on protecting local creeks call 499-6528; Drs. Paul and Geraldine Alpert; Bartlett Tree Service; Gardener's Guild, Gardenworks; Garden 'Nest; City of San Rafael; and City of Novato.

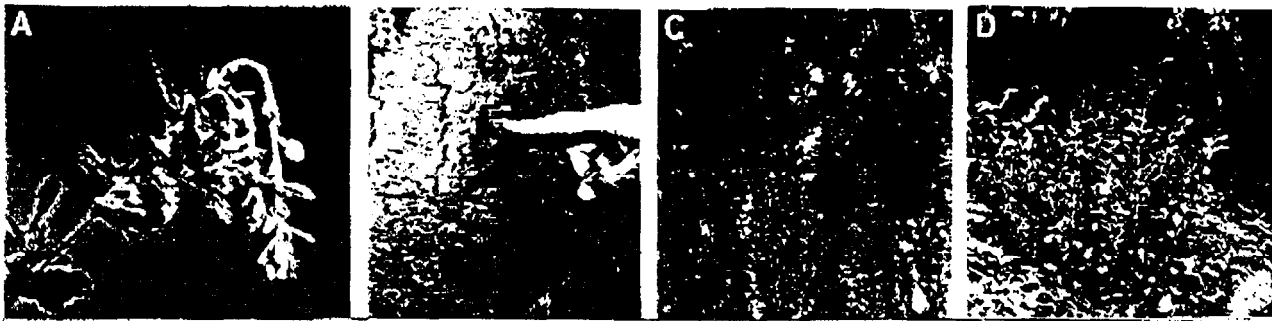


Fig. 2. Wilted shoots (A) signal the sudden death. None of the tree recovered after the wilt appeared. (B) Oozing near the base of tree stem. (C) *Daktaria*'s fruiting bodies. (D) Suckers display dieback resembling treatment with phenoxy herbicides.

area has not revealed development of oak root fungus nor *Phytophthora* disease on most dying trees. Roots of tanoaks undergoing above ground symptoms often have a pungent alcoholic odor, but appear sound. The following year after the tree dies, suckers sprout near the base. Soon their tips bend, become chlorotic and die (Fig. 2D).

A very noticeable feature of the dead tanoaks is massive infestation of the whole stem with ambrosia beetles in mid summer

Sampling, and information from experts

Samples of dying tanoaks were sent to State Laboratories and University of California Plant Pathology Departments at Berkeley, Davis and Riverside on the five separate occasions. In the beginning I suspected that tanoaks were infected with chestnut blight fungus, *Cryphonectria parasitica*, mainly because the initial symptoms closely resembled those caused by chestnut blight, which occasionally infects, without killing, some oak species in the east. Besides selecting branch-twig samples with different stages of wilted, dying and dead tissues, I also focused on abnormalities (swellings at the tree base) to collect samples of inner bark. No pathogens were ever isolated from the branches or stem sections, and no *Armillaria* or *Phytophthora* was cultured from the roots. In each of three separate samples *Hypoxylon* sp., *Pseudomonas tolaensis* and *Diplodia quercina* were found.

Speculations about causes of the dieback

Sudden death of tanoaks is localized in the Mill

Valley-Mount **Tamalpais** region and Inverness.

Differences of opinion exist among plant pathologists and tree experts as to whether the cause of dieback is a single pathogen or if this species has been locally predisposed to physiological weakening by drought or other environmental factors that have caused damage. Opinions may have merit but with one recent exception: very young trees have been killed as though they were treated with a systemic herbicide. It seems probable that drought was an important factor in placing the mature trees under stress that triggered their death. However, the same hypothesis does not hold for young trees that are dying now.

There is no question, that after these trees have gone through the progressive stages of the above-described symptoms, their vigor rapidly declines and they become vulnerable to secondary insect pests such as bark beetles *Pseudopityophthorus pubipennis*, which produce a pile of fine red boring dust near tiny holes, and ambrosia beetles *Monartum* spp., which produce a pile of fine white boring dust near tiny holes. While *Pseudopityophthorus* occupies the phloem-xylem portion of the tree, ambrosia beetles penetrate deeper to the heartwood region. These insects are not capable of invading healthy trees but are very destructive to weakened ones. Since several hundred tanoaks have died since 1995 these trees have become an especially favorable target for building up bark beetle and ambrosia beetle epidemics.

Recommendation: Prompt removal of dead trees is the only control that can be advised at this time. Cut logs and stored firewood should be covered with clear plastic sheeting to prevent beetle emergence and infestation...

Acknowledgments: This research study has been supported by many public, private organizations and private citizens: Marin County Stormwater Pollution Prevention Program (MCSOPPPP) for information on protecting local creeks call 499-6528 Bartlett Tree Service; Gardenworks Garden West; Drs. Paul and Geraldine Alpert; City of San Rafael; and City of Novato.

28.1

10



UNIVERSITY OF
CALIFORNIA
Cooperative Extension in Marin County

Pest Alert #3
June 1999

Western Oak Bark Beetles and Ambrosia Beetles, Killers of Live Oaks

by Pavel Švihra, University of California Cooperative Extension

Oak bark beetles and ambrosia beetles are 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 and heartwood. Three species are common throughout California: the Western Oak Bark Beetle, *Pseudopityophthorus pubipennis*, the Oak Ambrosia Beetle, *Monarthrum scutellare*, and the Minor Oak Ambrosia Beetle, *M. Detinger*. These beetles have appeared very suddenly, and seasonally later than usual after the very cold spring of 1999, wreaking havoc among the California live oaks, *Quercus agrifolia*, in the landscape and natural forests of Marin County.

Western oak bark beetles and ambrosia beetles

attack wounded and stressed trees. If environmental conditions contribute to stress oaks in areas where bark beetle populations have reached epidemic proportion, the beetles may attack and kill trees that appear to be healthy. Such a situation has developed during the last four years, when apparently healthy oaks in the gardens and natural forest have been killed in large numbers as far south as Sausalito and north to Novato. Timely removal of infested trees may reduce further tree losses, but there is little that can be done directly to stop bark beetle and ambrosia beetle epidemics in the natural forest. The best defense that arborists, pest control advisors and homeowners have against such losses is to learn about oak health care and the beetles' habits.

Life History and Habits

Western Oak Bark Beetle, *P. pubipennis*. These beetles usually attack severely injured, dying or dead trees. They reproduce in great numbers



Fig.1. Tree heavily infested by ambrosia beetles. Only when their population is high, these beetles attack stems so high. Foliage was still green, yet this tree was killed before ambrosia beetles arrived.

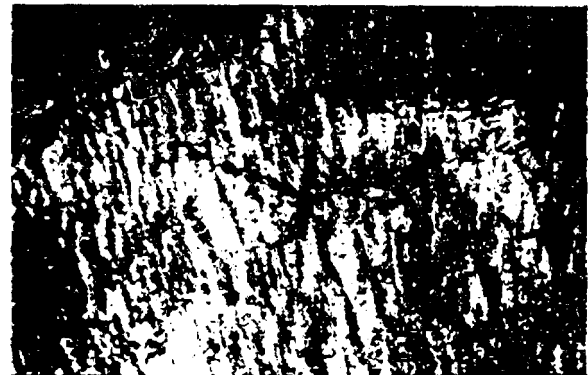


Fig.2. Initiation of egg galleries by the western oak bark beetle. The transversely excavated egg galleries are marked deep in the sapwood. This oak had no sign of ambrosia beetles, which arrived 10 days later.

primarily in oak firewood, emerging to attack oaks and tan-bark oaks in the landscape. Adults emerge

in the spring and fly to dead or dying oak material, where they bore through the bark and construct two transverse egg galleries in the phloem and xylem tissues (Fig. 2.). Females lay eggs along both sides of galleries. As beetles continue to bore through the bark, they introduce a symbiotic fungus (not yet identified) that stains and kills the inner bark and sapwood around the egg galleries excavated perpendicular to the grain. The construction of egg galleries and the growth of symbiotic fungus girdle and plug the tree's vascular system (the vessels that transport water and nutrients to the tree). After eggs hatch, the larvae make fine threadlike tunnels through the phloem into the inner bark where they pupate. Newly formed adults make their own exit holes through the bark and fly to attack oaks in the vicinity or far away. This beetle has two or more generations a year,

Oak Ambrosia Beetle, *M. scutellare*. These beetles attack dying, weakened, or diseased trees, but most prefer just-killed trees or parts of nets. In March, the male penetrates the sapwood to a depth of 2 1/4 inches. The female joins the male, mates

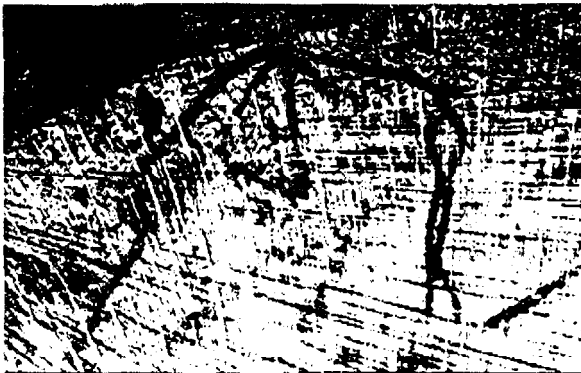


Fig. 3. Cross section of a California live oak showing egg tunnels made by the oak ambrosia beetle, *Monothrum scutellare*.

and introduces the symbiotic fungus, *Monilia brunnea*. Both sexes excavate two to four diverging galleries deep into the heartwood, each 2 to 6 inches long (Fig. 3). The female excavates egg niches in the sidewalls of the galleries, which the larvae extend into "larval cradles." The ambrosia fungus grows into the cradles and serves as a food source. Excavation of egg galleries lasts

2 to 4 months; larval development, 6 to 8 weeks; and pupation, 2 to 3 weeks. After a total of 3 to 4 months, new brood 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 October. However, the beetles may fly almost every day through the growing season because the different developmental stages overlap.

Minor Oak Ambrosia Beetle, *M. detinger*. The biology of this beetle is unknown but is probably similar to *M. scutellare*.

Look for symptoms

The first step in dealing with potential bark beetle and ambrosia beetle problems is to learn to identify symptoms of their attack. In apparently healthy California live oaks dark brown- to black-colored granules and stained bark surface below the entrance holes of western oak bark beetles are the first signs of fresh infestation



Fig. 4. Beginning in March regularly check oaks for appearance of dark brown to black granules and stains on the bark surface, brown frass, and fine white sawdust streams on the lower trunk

**DEPARTMENT OF FORESTRY
AND FIRE PROTECTION**

6059 Highway 9 . P.O. Drawer F-2
Felton, CA 95018
(831) 335-6742



August 5, 1999

Tan oak (*Lithocarpus densiflorus*) in the Santa Cruz Mountains are dying in unprecedented numbers, but thus far experts have been unable to determine the cause. Increased fire hazard, adverse effects on wildlife, and an increase in oak bark beetle populations are potential outcomes of the die-off.

Experts from the California Department of Forestry and Fire Protection (CDF), Department of Food and Agriculture, and University of California Cooperative Extension have collected samples from dying trees in hopes of identifying a pathogen, but standard diagnostic procedures have not yielded a culprit. **Tanoaks** that are weakened by the unidentified disease become susceptible to attacks by oak bark beetles and ambrosia beetles. The beetles are thought to be a secondary cause of mortality. The beetles typically attack weakened and freshly killed oak trees. An increase in dead or diseased oak trees in the Santa Cruz Mountains will most likely result in higher beetle populations. When beetle populations reach epidemic proportions, they potentially can threaten healthy oaks.

The public can express their concerns to Scott Johnson, Chairman of the California Forest Pest Council and encourage additional research into the problem. His address is: Scott Johnson, c/o Wilber Ellis Co., 13771 South Prescott Road, Manteca, CA 95336.

In order to control secondary insects, it is recommended that dying and recently dead oaks be cut down; the stem and branches cut into manageable **lengths**, stacked into piles, and covered completely with clear plastic that is sealed at ground level (with dirt or similar anchoring material). It is very important that the wood piles be sealed to prevent insects from escaping. This will help slow the spread and growth of insect populations. The wood can be used by the property owner for firewood after a recommended cure time of 6 months under the plastic. Movement of **tanoak** wood outside the area is not recommended since this may spread the disease further.