

Mediterranean Oak Borer

(*Xyleborus monographus*)



Mediterranean oak borer (MOB) is a tiny brown woodboring insect called an “ambrosia” beetle. Female beetles tunnel into many species of oaks and have recently been found in Oregon infesting Oregon white oak (*Quercus garryana*). Despite being a woodboring beetle, they do not eat wood. These beetles carry fungi (such as *Raffaelea montetyi* and *Fusarium solani*) with which they inoculate their tunnels to feed their young. These fungi clog water-conducting tissues and cause a wilting disease in susceptible trees. Over several years, large numbers of adult beetles infest and reinfest the trees, often killing whole branches, large portions of the tree crown, and later whole trees.



Crown dieback from MOB and associated fungi (Christine Buhl, ODF).

Current distribution

MOB is native to Europe, western Asia (Iran, Israel, Russia, and Turkey), and northern Africa (Algeria and Morocco). It has spread long distances to Korea and the United States (California and Oregon). In its native range it infests weakened or dying oak and beech tree species that are already suffering from drought, other pests, or disease. However outside of its range it has been killing relatively healthy oaks in California and Oregon.



MOB females are the size of a pencil lead. Males (inset) are slightly smaller, have a rhino horn-like structure, and are flightless (Curtis Ewing, CAL Fire).

Based on related ambrosia beetles, MOB is likely well-suited to oak habitats throughout much of western and southern Oregon, and especially at elevations $\leq 2,000$ feet above sea level where Oregon’s oak species grow.

In California, widespread reports of dying valley oak (*Quercus lobata*) came from Napa and Sonoma counties in 2019. Large populations of MOB have likely been present there and killing trees since at least the early 2010s. MOB infestations have spread to adjacent Lake and nearby Sacramento counties. Blue oak (*Q. douglasii*) is also a known host. In California, a single attack was found in a severely distressed California black oak (*Q. kelloggii*) and another attack in Oregon white oak. California officials found that MOB is already established and too widespread to be eradicated from central California.

In Oregon a single beetle was first captured in a trap in 2018 at Chinook Landing near Troutdale. Another beetle was captured in a trap in 2021 near Woodburn. In 2022 across seven sites and four counties in the northern Willamette Valley, there were 21 beetles captured, 14 of which were in Troutdale. In 2022, two Oregon white oak trees (*Quercus garryana*) were found to be positive for MOB, one near Troutdale and another in

Wilsonville. In 2023, approximately 30 infested trees were found in Wilsonville.

A multiagency effort is underway to monitor population spread and determine effective management strategies to prevent and slow the spread of this insect. Map of current MOB infestations found in Oregon:

<https://oda.fyi/MOBMap>



Oak canopy dieback (Christine Buhl, ODF).

Hosts

The primary hosts of MOB are oak (*Quercus*) species. **Reported from California and Oregon:** Section *Quercus* (white oaks): *Q. lobata*, *Q. douglasii*, *Q. garryana*; Section *Lobatae* (red oaks): *Q. kelloggii*.

Reported from Europe, Asia & literature records: Section *Quercus* (white oaks): *Q. boissieri*; *Q. lustanica*; *Q. petraea*; *Q. pubescens*; *Q. robur*. Section *Lobatae* (red oaks): *Q. rubra*. Section *Mesobalanus*: *Q. canariensis*; *Q. frainetto*; *Q. pyrenaica*. Section *Cerris*: *Q. castaneifolia* var. *incana*; *Q. calliprinos*; *Q. cerris*; *Q. coccifera*; *Q. ilex*; *Q. suber*. Section *Ponticae*: *Q. pontica*.

In its native range, MOB has been reported to attack non-oak species such as maple, walnut, beech, elm, cherry, chestnut, hornbeam

Pathway

The invasion pathways by which MOB came to California and Oregon from Europe are unknown. Genetic analyses show that multiple introductions of MOB have occurred from Europe to the West Coast of the U.S. The likely culprit is untreated and MOB-infested oak wood, such as: raw oak timber, pallets, crates, packing materials, hobby wood, and firewood. There could also be an association with oak wine barrel staves imported from Europe. The nursery industry may also be a potential pathway for this pest as many ambrosia beetles are pests of nursery trees worldwide.

Signs and symptoms of infestation

Infested oak trees may have obvious canopy dieback including: brown leaves on a whole branch, a section, or the entire crown. This wilting or browning of leaves in the canopy is easily seen in mid-summer when other nearby oak crowns are healthy and green. The leaves at first are wilted or droopy, but then turn red. Leaves eventually fall off leaving bare, dead branches. It is not uncommon for older oak trees to lose a branch occasionally, however, infestation from this insect usually continues to spread from one location to another in the crown. Branch death moves from the top down, toward the main trunk, as the local beetle populations increase.

The insect pushes out pale boring dust (frass) which accumulates in mounds in bark crevices or around the base.



Pale boring dust (frass) visible on the exterior or around the base of a tree (Christine Buhl, ODF).

Beetles also create perfectly round 1/16th of an inch (1.3-1.5 mm) entrance and exit holes. These holes are hard to spot due to their size and may be hidden in bark cracks.



Hole created by MOB (Christine Buhl, ODF).



Mob galleries in transverse view (top) and tangential view (bottom) (Curtis Ewing, CAL FIRE).

Individual tunnels are about 1/16th of an inch (1.2-1.5 mm) wide and networks of these tunnels (galleries) are branched, black-stained, overlapping, and located primarily in sapwood. Broken branches may be checked for galleries to avoid destructive sampling.

Tiny brown beetles may be seen crawling around the outside of the tree or within their galleries nearly all year long. Females average 1/8th of an inch (3.1 mm long). Males are smaller at 1/10th of an inch (2.3 mm long) and have a rhino horn-like structure, and are flightless. Females far outnumber males. Eggs, small white larvae, and pupae are also

present inside galleries. MOB can produce 2-3 generations a year.

Similar damage

Thinning crowns, stunted foliage growth, and branch dieback in oaks can also be caused by other stressors. These include: drought, storm damage, wood-rotting fungi, gall-making or foliage-attacking insects and squirrels, and various other bark beetles and woodboring insects.



Scattered leaf and twig dieback from oak galls and squirrel damage (Christine Buhl, ODF).

Many other non-pest, native and exotic ambrosia beetles create boring dust, galleries, and holes in oak and may be confused with MOB, however, none of these beetles are known to cause major crown dieback. Typically, other ambrosia beetles known in Oregon attack already dead or dying oaks. When reporting a suspected MOB infestation, ensure that the tree is an oak (any species) and look specifically for portions of crown dieback and pale boring dust as indicators of MOB attack. See images of damage from other oak pests to differentiate from MOB attacks:

<https://www.oregon.gov/odf/Documents/forestbenefits/oak-pests.pdf>

Control strategies

At this time, few control strategies for MOB have been proven as effective, although methods are currently being tested and guidance will be updated as we learn more. The guidance below lists our currently known best practices as well as some strategies that may be attempted for control.

Prevention

Healthy trees are more defended trees. Improving tree health may help trees resist or tolerate MOB and associated fungi.

- Drought stress is one of the most common primary causes of tree stress that reduces defenses against pests. Even drought-tolerant trees such as oaks can benefit from slow, deep watering, even a single watering during the hot summer months:
<https://www.oregon.gov/odf/Documents/forestbenefits/watering-fact-sheet.pdf>
- Avoid activities near oaks that may cause root compaction.
- Large, unsupported branches can break during storms and allow harmful fungi or insect pest attacks. Preventive pruning of large and unsupported branches *may* avoid further damage and encourage better wound healing.
- Systemic injection of insecticide (e.g., emamectin benzoate) + fungicide (e.g., propiconazole) *may* be effective in preventing MOB attack and disease transmission, although more testing is necessary. Repellants are also being tested.
- Forest insects and diseases are moved through firewood. Please adopt and support the Don't Move Firewood educational campaign.
<https://www.dontmovefirewood.org>

Control

Ensure that infestation by MOB is correctly identified and use control strategies before infestations spread to nearby trees.

- It is optimal to burn infested trees on site. This is the only method confirmed to kill all MOB in infested wood material.
- Chip infested material to 1"x1" and leave on site.

Other less favorable options *may* include:

- Transport of covered infested material to a disposal facility that can implement one of the above methods. It is best to transport material during colder months when beetles are less active (December-February) to avoid spreading MOB in transit.
- Bury infested material at a depth where light cannot penetrate because beetles will crawl towards light. More testing is needed to determine optimal burial depth.

- Infested material *may* be covered by thick, clear tarps to prevent beetles from exiting. However, currently there is limited evidence of the effectiveness or duration required by this strategy. Infested material may have to remain covered for the better part of a year.
- If dieback is caught early, and signs and symptoms appear to be isolated in one part of the tree, that infested portion *may* be removed to attempt control. However, this action may not eradicate beetles or disease elsewhere in the tree and will not prevent future attacks but *may* buy time to implement other preventive actions or treatments.
- Scattering chips or cut firewood from infested oaks near uninfested trees is not advised because we do not yet know if the fungal wilt pathogens can be vectored from this material. Sterilization of equipment such as saws, with 70% ethanol, 5% bleach, oxidate (hydrogen peroxide), or Lysol is advised.

Report an Invader!

If you observe signs or symptoms of possible MOB infestation, report it! Describe the location and your observations and submit photos and your contact information through the Oregon Invasive Species Council's website:

<https://oregoninvasiveshotline.org/reports/create>

Current efforts

The Oregon Department of Agriculture and Oregon Department of Forestry are trapping for MOB, monitoring and mapping active infestations, and testing efficacy of multiple management strategies. Oregon state and federal agencies and universities are working with their counterparts in California to research additional strategies.

Other Resources

University of California Agriculture and Natural Resources MOB page:

<https://ucanr.edu/sites/mobpc/>

University of California Agriculture and Natural Resources pest alert:

<https://static1.squarespace.com/static/58740d57579fb3b4fa5ce66f/t/5f46ccb55bbec03869a9206e/1598475452109/MOBPC+Pest+Alert+Aug+2020.pdf>