CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal

***Xyleborus monographus* (Fabricius): Ambrosia beetle**

Coleoptera: Curculionidae

Current Rating: Q

Proposed Rating: A

Comment Period: 1/21/2020 through 3/6/2020

Initiating Event:

Xyleborus monographus was found infesting several valley oak (*Quercus lobata*) trees in Calistoga, Napa County, California in 2019. This beetle has not yet been rated. A pest rating proposal is needed.

History & Status:

Background: Adult *X. monographus* range from 1.8 to 3.6 mm in length. Adults tunnel into trees that are often reported to be recently dead or stressed. Host trees include chestnut (including *Castanea sativa*), beech (including *Fagus orientalis*), and oak (including *Quercus frainetto*, *Q. lobata*, *Q. pyrenaica*, *Q. rober*, *Q. rubra*, and *Q. suber*) species (Lombardero, 1995; Sarikaya and Kavakli, 2018). Additional genera of deciduous trees are mentioned by Schedl (1964), but he states that oaks are the most important hosts. Adult females tunnel into trunks, usually at points where the bark is thin or cracked. The entrance holes measure 1.3-1.5 mm in diameter (Schedl, 1964). Adult females carry with them fungal spores in structures called mycangia that are located (in this species) on their mandibles. These spores inoculate the branching tunnels made by the beetles. Beetle larvae feed on the fungus "garden." Besides being the primary food of the beetle larvae and adults, the fungi may be pathogenic to living trees. One of the fungal species associated with *X. monographus* in Europe and in the 2019 Calistoga infestation is *Raffaelea montetyi* (A. Eskalen, pers. comm.; Gebhardt et al.,

2004). This fungus is reported to be pathogenic to cork oak and in experiments it killed inoculated seedlings within two months (Inácio et al., 2012). The trees associated with the 2019 finds of *X. monographus* in Calistoga showed symptoms including wilting, defoliation, and broken branches, and the infested wood was discolored, presumably by the fungus (A. Eskalen, pers. comm.). *Raffaelea montetyi* (but not *X. monographus*, although it was likely present but appears to have been misidentified as another scolytine species) was reported a year earlier in 2018 in Calistoga infesting *Q. lobata* (California Forest Pest Council). This appears to be the first report of this fungus in North America.

In addition to injuring or killing living trees, *X. monographus* is reported to damage cut oak wood (Franjević et al., 2016).

Xyleborus species have sibling mating. Therefore, females can mate with their brothers prior to leaving the gallery (with fungus in their mycangia) and flying to a new tree to initiate gallery construction. Males have reduced wings, cannot fly, and are not involved with the construction of new galleries (Schedl, 1964). In addition, *Xyleborus* species are parthenogenic. An unmated female can lay unfertilized eggs that develop into males that the female can then mate with to produce fertilized eggs (Gohli et al., 2016).

Worldwide Distribution: *Xyleborus monographus* is reported from Europe (including France, Italy, Norway, Slovenia, and Spain) and Palearctic Asia (including Korea and Turkey) (Choo and Woo, 1985; Freeman and Grancher, 2014; Hardersen et al., 2014; Hauptman et al., 2019; Lombardero, 1995; Olberg, 2007; Sarikaya and Kavakli, 2018). The Calistoga, California finds in 2019 appear to be the first known establishment of the species in the United States. One specimen was trapped in Portland, Oregon in 2018, but no further specimens appear to have been found there, suggesting this find may not have represented an infestation (Oregon Department of Agriculture).

Official Control: *Xyleborus monographus* is listed as a quarantine pest by Japan and it is considered reportable by the United States Department of Agriculture (Food and Agriculture Organization of the United Nations; USDA-APHIS).

California Distribution: *Xyleborus monographus* was found infesting several *Q. lobata* trees in Calistoga in 2019. See Uncertainty, below.

California Interceptions: *Xyleborus monographus* has not been intercepted in California.

The risk *Xyleborus monographus* poses to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Although *X. monographus* feeds on its symbiotic fungi, it attacks a variety of oaks and other trees in the family Fagaceae. One confirmed host is *Q. lobata*, which is widespread in California. *Xyleborus monographus* is found in a variety of climates, including Mediterranean. It is likely capable of establishing over much of California. Therefore, it receives a **High (3)** in this category.

   – Low (1) Not likely to establish in California; or likely to establish in very limited areas.

   – Medium (2) may be able to establish in a larger but limited part of California.

   – High (3) likely to establish a widespread distribution in California.

2) **Known Pest Host Range:** *Xyleborus monographus* feeds on symbiotic fungi, but for the purpose of this proposal, the trees it attacks and establishes galleries in will be considered hosts. These trees include several genera in the family Fagaceae (but see Uncertainty, below). Therefore, it receives a **Medium (2)** in this category.

   – Low (1) has a very limited host range.

   – Medium (2) has a moderate host range.

– High (3) has a wide host range.

3) **Pest Reproductive and Dispersal Potential:** Like others in the genus, female *Xyleborus monographus* are presumed to mate with their siblings and be parthenogenetic. A single mated or unmated female is therefore capable of establishing a new infestation. Ambrosia beetles can be moved in infested wood and the females can fly. Therefore, it receives a **High (3)** in this category.

– Low (1) does not have high reproductive or dispersal potential.

– Medium (2) has either high reproductive or dispersal potential.

– High (3) has both high reproduction and dispersal potential.

4) **Economic Impact**. Other species of *Xyleborus* are known to be capable of attacking and sometimes killing host trees, at least in their introduced ranges. Such species include *X. dispar* and *X. glabratus*. *Xyleborus monographus* and its fungal symbiont are known to attack living oak trees and symptoms of dieback were reported in the Calistoga infestation. It is possible that this mutualism could impact production of oaks in California nurseries. This beetle is reportable and could trigger quarantines. Therefore, it receives a **High (3)** in this category.

Economic Impact: A, C, E

A. The pest could lower crop yield.

B. The pest could lower crop value (includes increasing crop production costs).

C. The pest could trigger the loss of markets (includes quarantines).

D. The pest could negatively change normal cultural practices.

E. The pest can vector, or is vectored, by another pestiferous organism.

F. The organism is injurious or poisonous to agriculturally important animals.

G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact Score: High

– Low (1) causes 0 or 1 of these impacts.

– Medium (2) causes 2 of these impacts.

– High (3) causes 3 or more of these impacts.

5) **Environmental Impact**. *Xyleborus monographus* and its fungal symbiont are known to attack living oak trees. In California, this beetle-fungus mutualism will be exposed to species of oaks that it has not previously been exposed to and damage to some of these species could be more severe than that observed in the beetle's native range. Oaks are important components of forests and woodlands in California and valley oak (*Q. lobata*), which is already known to be attacked, is widely distributed in California and an important component of oak woodlands. Some species of oaks in this state are rare. Oaks (including *Q. lobata*) provide habitat for threatened species (Beckman and Jerome, 2017). Oak trees in California, including *Q. lobata*, have historically been used by Native Americans for food and other purposes. Oaks, especially the large heritage oaks, are important landscape trees and add to the value of property. Therefore, *X. monographus* receives a **High (3)** in this category.

Evaluate the environmental impact of the pest on California using the criteria below.

Environmental Impact: A, B, C, E

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.

B. The pest could directly affect threatened or endangered species.

C. The pest could impact threatened or endangered species by disrupting critical habitats.

D. The pest could trigger additional official or private treatment programs.

E. The pest significantly impacts cultural practices, home/urban gardening or ornamental plantings.

Environmental Impact Score: High (3)

– Low (1) causes none of the above to occur.

– Medium (2) causes one of the above to occur.

– High (3) causes two or more of the above to occur.

Consequences of Introduction to California for *Xyleborus monographus:* High (14)

Add up the total score and include it here.

–Low = 5-8 points

–Medium = 9-12 points

–High = 13-15 points

6) **Post Entry Distribution and Survey Information:** *Xyleborus monographus* was found infesting several oak trees in Calistoga. It receives a **Low (-1)** in this category.

–Not established (0) Pest never detected in California, or known only from incursions.

–Low (-1) Pest has a localized distribution in California, or is established in one suitable climate/host area (region).

–Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.

–High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

Final Score:

7) The final score is the consequences of introduction score minus the post entry distribution and survey information score: High (13)

Uncertainty:

It is possible that *X. monographus* is more widely distributed in California. Traps for exotic wood boring beetles are used in certain California counties as part of a CAPS (Cooperative Agricultural Pest Survey) project. Although *X. monographus* is not a specific target of the California survey, the traps used include Lindgren funnels with ethanol lures, which are known to attract *X. monographus* (Galko et al., 2014). Over the past two years, these traps have been placed in Alameda, Contra Costa, Monterey, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, and Santa Cruz counties. No traps were located in Napa or Sonoma counties. The trap catches are reviewed by qualified personnel who would likely recognize exotic species of ambrosia beetles. Therefore, there is significant uncertainty regarding the extent of the distribution of *X. monographus* in Napa County, but less uncertainty regarding its presence in the counties included in the survey, including the San Francisco Bay area, where 16 sites were trapped with ethanol lures in 2018-2019 (C. Takahashi, pers. comm.).

Research by McPherson et al. (2008) showed that ambrosia beetles in California (including a different *Xyleborus* species) are preferentially attracted to oak trees infected with the causative agent of sudden oak death, *Phytophthora ramorum*. Beetle attack allows infection with another fungus that structurally weakens trees and it appears to hasten the death of the tree. Therefore, *X. monographus* could have a synergistic impact (with sudden oak death) on California oaks. Remnant oak trees serve as habitat for

bats (and likely other animals) in California vineyards (Polyakov et al., 2019). Infestation and death of such trees could therefore impact animals associated with these oak trees, which could in turn impact ecosystem services, such as pest control, provided by these animals.

The host range of *Xyleborus monographus* could be much narrower or broader in California than has been observed in Europe. If so, it's impact in the state could be over- or underestimated in this proposal. It may not be a competent attacker of oak trees other than the species already found to be infested here and in Europe. In that case, it's impact could be minor in this state.

Conclusion and Rating Justification:

Xyleborus monographus is an ambrosia beetle that was recently found in Calistoga. It vectors a pathogenic fungus that is capable of killing oak trees. Ambrosia beetles, including *Xyleborus* species, can attack stressed trees. California forests are periodically under stress from drought, fire, and disease, so they may be especially vulnerable to this beetle. Therefore, *X. monographus* may add to the compounding threat of climate and other pests and diseases (including sudden oak death) to California oaks. For these reasons, an "A" rating is justified.

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CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Responsible Party:

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***Comment Period: 1/21/2020 through 3/6/2020**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at permits[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

Example Comment:
Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.
- Comments may not be posted if they:

Contain inappropriate language which is not germane to the pest rating proposal;

Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.
- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Proposed Pest Rating: A