CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

***Agrilus planipennis* Fairmaire: Emerald ash borer**

Coleoptera: Buprestidae

Previous Pest Rating: None

Pest Rating: A as of 03/11/2021

Comment Period: 01/25/2021 – 03/11/2021

Initiating Event:

On January 14, 2021, the United States Department of Agriculture removed the federal domestic quarantine for emerald ash borer, a pest that is not known to be present in California. It was determined that the resources currently being used for this quarantine would be more effective if directed towards biological control. Emerald ash borer has not been rated. Therefore, a pest rating proposal is needed.

History & Status:

Background:

Adult emerald ash borers reach 14 mm in length and are narrow and metallic blue-green in color. The larvae are white and flattened and reach 32 mm in length (Center for Plant Health Science and Technology).

Adult emerald ash borers feed on leaves (including those of ash (*Fraxinus* spp.) and white fringetree (*Chionanthus virginicus*), although this is not reported to cause significant damage (Peterson, 2019). Eggs are laid on tree branches or trunks from 2.5 to more than 90 cm diameter (McCullough, 2019). The larvae tunnel into and feed on phloem and outer sapwood. The feeding damage causes dieback and eventual death (in as little as two years) of the tree (United States Department of Agriculture,

2018). Adult emergence holes have a characteristic D-shape (Center for Plant Health Science and Technology). Development requires one to two years depending on climate; the larva is the overwintering stage in both cases (Herms and McCullough, 2014).

Host trees include: **Juglandaceae**: *Juglans mandshurica*; *Pterocarya rhoifolia*. **Oleaceae**: *Chionanthus virginicus*; *Fraxinus* spp. (including *F. americana*, *F. chinensis*, *F. latifolia*, *F. mandshurica*, *F. nigra*, *F. pennsylvanica*, and *F. velutina*); *Olea europaea*. **Ulmaceae**: *Ulmus davidiana* (Herms, 2015). The original references for the *Juglans*, *Pterocarya*, and *Ulmus* host records are not available. Susceptibility of *Fraxinus* spp. is species-dependent. *Fraxinus* spp. from the native range of emerald ash borer are reported to be much less susceptible (than species in North America) to this beetle and experimental evidence suggests stress (including drought) increases their susceptibility (Rebek et al., 2008; Showalter et al., 2018). The only known field hosts in the United States are *Fraxinus* spp. and *Chionanthus virginicus*. Olive trees have been infested in experiments; development is reported to be slower than on *Fraxinus* spp. (Peterson and Cipollini, 2020). Limited experiments suggest suitability of (and impact on) olive trees is dependent on variety. For example, emerald ash borer completed development in branches more than 10 cm in diameter of the Manzanillo variety but another variety was not susceptible. When branches were less than 4 cm in diameter, neither variety was susceptible (Peterson and Cipollini, 2020).

Emerald ash borer is well-known to kill healthy trees on a large scale. It is estimated to have killed millions of ash trees in the eastern United States and is likely to have had ecosystem-level impacts there. For example, overstory ash trees have nearly disappeared from southeastern Michigan (Hoven et al., 2020; Ward et al., 2021). It is considered by some to be the most significant (in terms of cost and damage) forest pest to have ever invaded North America.

Much research has been done regarding control of emerald ash borer. Regarding chemical control, injections of systemic insecticides have been successful, but this is only practical for individual high-value trees (McCullough, 2019). Regarding biological control, several species of egg and larval parasitoid wasps were introduced to the United States in an effort to control emerald ash borer.

There is evidence of widespread establishment of some of these parasitoids, but widespread, significant control has not yet been shown. Interestingly, one of these parasitoids, *Tetrastichus planipennisi*, avoided emerald ash borer larvae in *Chionanthus virginicus* trees but parasitized larvae in *Fraxinus* spp. This suggests that, at least in some cases, biological control organisms respond to host-specific cues and therefore biological control of emerald ash borer may be more challenging on alternate hosts, such as *Chionanthus* or olive (if that proves to be a field host) (Olson and Rieske, 2019).

Worldwide Distribution:

Emerald ash borer is native to Asia, including China, Japan, North Korea, South Korea, Mongolia, the Russian Far East, and Taiwan (Center for Plant Health Science and Technology). It has been introduced to Canada (Manitoba, Ontario, Quebec, Nova Scotia, and New Brunswick), the United States (widespread in the eastern United States and also in Colorado), European Russia, and Ukraine (Government of Canada; Orlova-Bienkowskaja et al., 2020).

Official Control: *:* Emerald ash borer is considered a quarantine or A1 pest by Canada, Morocco, Kazakhstan, Georgia, Turkey, Ukraine, and the European Union. It is considered reportable by the United States Department of Agriculture, although this will presumably change at some point because the domestic quarantine has been lifted (EPPO Global Database; USDA-APHIS).

California Distribution: Emerald ash borer is not known to be present in California.

California Interceptions: Emerald ash borer is occasionally intercepted on aircraft and was intercepted once with firewood at a border station (California Department of Food and Agriculture).

The risk emerald ash borer poses to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Native species of ash (*Fraxinus*), including two that are reported hosts of emerald ash borer, are widely distributed in California. Eastern species may be planted in California, but do not appear to be common. Another likely host, olive, is also widely cultivated in California. Emerald ash borer is presently found primarily in temperate areas. Winter temperatures in California are not predicted to be low enough to limit the establishment of emerald ash borer (Cuddington et al., 2018). However, the Mediterranean climate with dry summers over much of California may limit its distribution, although the pest is now present in Boulder, Colorado, which has a semi-arid climate. For more discussion on uncertainty, see Uncertainty, below. Therefore, it receives a **Medium (2)** 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:** Emerald ash borer is reported to use trees in six genera in three families as hosts. 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:** Emerald ash borer can fly and it can be moved artificially with firewood. Therefore, it receives a **Medium (2)** 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**. The olive industry in California is worth tens of millions of dollars annually. Emerald ash borer has been shown to be capable of completing development on Manzanillo variety olive trees. This is the most commonly-grown variety in California (Lazicki and Geisseler, 2016). If emerald ash borer becomes established in California and attacked olive trees here, it could lower crop yield and increase crop production costs. Therefore, it receives a **Medium (2)** in this category.

Economic Impact: A, B

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: Medium

– 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**. Emerald ash borer is reported to attack two species of ash native to California, *Fraxinus latifolia* and *F. velutina*. The other species present may be attacked as well. One of the native California species known to be attacked, *Fraxinus latifolia* (Oregon ash), suffered decline and 100% mortality within five years in a common garden experiment in Michigan (Herms, 2015). This tree is widespread in California and is found along the entire length

of the state from the coast to the Sierra Nevada (CalFlora). Another native California ash, *Fraxinus velutina*, is reported to have suffered "heavy infestations," but the original source of this information is not available (Liu, 2017). Therefore, emerald ash borer receives a **High (3)** in this category.

Environmental Impact: A, 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 emerald ash borer: Medium (11)

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:** Emerald ash borer is not known to be present in California. It receives a **Not established (0)** 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: Medium (11)

Uncertainty:

The main uncertainty regarding the potential for emerald ash borer to become established in and impact California is climate. Most of the current known distribution of this pest is characterized by temperate climate. Boulder, Colorado is one exception because it has a semi-arid climate. Emerald ash borer has not yet spread far enough into Europe to demonstrate if it is capable of establishing in the Mediterranean. It has not yet spread far enough west in the United States to see if it can thrive in the climates present here.

There is some uncertainty regarding the potential presence of emerald ash borer in California. This pest is difficult to detect during the initial 3-5 years of an infestation because the symptoms of a low-level infestation are subtle and often limited to the upper branches (Buck; McCullough, 2019). In addition, no long-distance mating pheromone is known, so traps are not considered very effective.

Conclusion and Rating Justification:

Emerald ash borer is clearly a significant pest of forest and street trees. It is known to attack two species of native *Fraxinus* that are widespread in California, and limited experimental evidence

suggests it is a potential pest of olive, an important crop. It is not known to be present in California.

For these reasons, an "A" rating is justified.

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Responsible Party:

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***Comment Period: 01/25/2021 – 03/11/2021**

***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.

Pest Rating: A