

California Pest Rating Proposal

Vespa mandarinia Smith: Northern giant hornet

Hymenoptera: Vespidae

Current Rating: Q

Proposed Rating: A

Comment Period: **08/08/2022 – 09/22/2022**

Initiating Event:

In 2019, *Vespa mandarinia* was found in Nanaimo, British Columbia, Canada and near Blaine, Washington, United States. This hornet is known to attack honeybees and also has a reputation for a painful (and sometimes dangerous) sting. It has not been rated and a pest rating proposal is needed.

History & Status:

Background: *Vespa mandarinia* (Northern giant hornet) is a large (up to approximately 5 cm in length) hornet native to Asia. It prefers forests. Mated queens emerge from hibernations sites in the spring and feed on oak tree sap. They establish a nest, usually underground in a cavity excavated around tree roots, in a burrow made by a small animal, or in an underground, hollow portion of a tree. The nest is delicate and constructed from wood fibers. The queen produces workers starting in July in Japan. A variety of insects are eaten by this hornet, including caterpillars and spiders. Honeybees become an important food source in August in Japan. *Vespa mandarinia* attacks on honeybees range from “hunting,” in which individual bees are taken as food (apparently, only the mesosoma is taken and the rest of the body is discarded), to “slaughter” and “occupation,” in which an organized attack is made on the nest, thousands of honeybees are killed (approximately 20-30 AGH are reported to be capable of destroying 5,000-25,000 honeybees), and the hornets go through the hive and remove larvae and pupae, bringing them to the hornet nest as food. The hornets are more aggressive to

humans during these attacks. Adult male reproductives and new queens of *V. mandarinia* start to emerge in September (Matsuura and Sakagami, 1973; Norderud et al., 2021).

Vespa mandarinia is considered a serious pest of honeybees in Japan. Control methods reported by Matsuura and Sakagami (1973) include poisoning or burning of nests, bait trapping, protective screens, and beating the hornets to death. Trapping and control techniques, including potential delimitation procedure are discussed in the USDA's New Pest Response Guidelines.

At least one other *Apis* species, *A. cerana*, has a specialized defense against attacking *V. mandarinia*. This bee swarms the hornet and kills it, apparently partly through production of heat by the cluster of bees around the hornet (Matsuura and Sakagami, 1973; Ono et al., 1995). *Apis mellifera cypria* is reported to have a similar defense against *Vespa orientalis* involving smothering, but asphyxiation appears to be involved in that case (Papachristoforou et al., 2007).

The sting of *V. mandarinia* is reported to have caused organ failure (including heart and kidney failure) and sometimes death in humans (Yanagawa et al., 2007).

Larvae of *Vespa* species, including *V. mandarinia*, are eaten in Asia, including China and India (Ghosh et al., 2021; Kiewhuo et al., 2022). Kiewhuo et al. (2022) describe the labor-intensive capturing and rearing process in India, a testament to the value placed on this food.

Worldwide Distribution: *Vespa mandarinia* is native to Asia and has been introduced to North America. Reported from **Asia:** Bhutan, China, Democratic People's Republic of Korea, Hong Kong, India, Japan, Laos, Nepal, Republic of Korea, Russian Federation, and Taiwan; **North America:** Canada (British Columbia) and the United States (Washington) (GBIF; Lee, 2010; Matsuura and Sakagami, 1973; Mattu and Sharma, 2017). The status and extent of the infestations in British Columbia and Washington state are unknown. In 2019, *V. mandarinia* was found in British Columbia (including a nest at Nanaimo that was destroyed) and near Blaine, in Washington state (Looney et al., 2020). The hornet was found in both areas again in 2020 and 2021 (Hornets). Molecular data indicates that the Nanaimo, British Columbia, Canada infestation and the finds in the Blaine, Washington, United States area originated from two separate queens (Wilson et al., 2020). Using niche modelling and other techniques, Moo-Llanes (2021), Norderud et al. (2021), and Nuñez-Penichet et al. (2021) found coastal British Columbia and coastal Washington state to have a high likelihood of occurrence based

on climate and habitat type. Moo-Llanes (2021) and Nuñez-Penichet et al. (2021) found the southeastern United States to be the other part of the Continental United States with a high likelihood of occurrence. It is uncertain how far *V. mandarinia* will spread if eradication efforts are not successful.

Official Control: *Vespa mandarinia* is a quarantine pest in the United States (New pest response guidelines).

California Distribution: *Vespa mandarinia* is not known to be present in California.

California Interceptions: *Vespa mandarinia* has not been intercepted in California (California Department of Food and Agriculture).

The risk *Vespa mandarinia* poses to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** Niche modelling using location data from its native distribution suggests that *V. mandarinia* could establish in northern coastal California, likely in forests. The reported foods of this hornet, including oak sap and various insects, including honeybees, are widespread in California. 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:** *Vespa mandarinia* is reported to feed on a wide variety of insects and plant materials, including oak tree sap and banana flowers (Lee, 2010). Therefore, it receives a **High (3)** 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:** *Vespa mandarinia* is unlikely to be moved accidentally, whether as an individual queen or nest, due to its large, fragile nests, nesting site preferences, and mobile, defensive nature (for example, overwintering queens, which could be present in such materials as heaps of straw or rotten logs, although underground is the preferred location, are likely to awake from dormancy if disturbed) (USDA-APHIS, 2020). According to USDA-APHIS (2020), *Vespa mandarinia* was not intercepted in international cargo at United States ports of entry during the period 2012-2020; federal policy during this period was to identify all intercepted *Vespa* to species. However, apparently after this data was collected, a package with live *V. mandarinia* larvae and pupae was intercepted (New pest response guidelines). Therefore, intentional movement for use as a human food clearly occurs, but it appears to be rare, likely because of low demand in the United States. This hornet can fly. 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:** *Vespa mandarinia* is a serious pest of honeybees that can destroy hives in a matter of hours. If it became established in California, it could impact honey production and pollination services provided by honeybees. The queen bee industry in California could be impacted. Farm workers could be stung and there could be serious medical consequences, including death. Although unintentional human-aided spread of this large hornet is unlikely, it is possible that other states or countries could impose quarantines on California products. Therefore, it receives a **High (3)** in this category.

Economic Impact: A, B, C, D, F

- 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:** *Vespa mandarinia* feeds on a variety of insects and spiders, and it could have an impact on native species, both prey directly through feeding as well as native Vespidae through competition. Infestations could trigger treatments with pesticides. The presence of this hornet in gardens could impact cultural practices. Therefore, *V. mandarinia* receives a **High (3)** in this category.

Environmental Impact: A, D, 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 *Vespa mandarinia*: High (13)

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: *Vespa mandarinia* is not known to be established 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: High (13)

Uncertainty:

Vespa mandarinia is a large hornet and attacks honeybees; these attacks result in large numbers of mutilated bees. These characteristics make it highly unlikely that it could establish and remain undetected for a significant amount of time in California. Therefore, there is low uncertainty regarding its absence from California. Niche modelling studies suggest this hornet may be limited to a small portion of northern California if it did become established in this state, so there is significant uncertainty regarding the potential for this hornet to spread over a significant portion of the state

Conclusion and Rating Justification:

Vespa mandarinia is considered a significant pest of honeybees, which are critical for California agriculture. It is capable of inflicting harmful (sometimes fatal) stings on humans. It may also impact native insects and beneficial species through predation. It is not known to be present in California. For these reasons, an “A” rating is justified.

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Responsible Party:

Kyle Beucke, 1220 N Street, Sacramento, CA 95814, 916-698-3034, [permits\[@\]cdfa.ca.gov](mailto:permits[@]cdfa.ca.gov)

***Comment Period: 08/08/2022 – 09/22/2022**

***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](mailto: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