

## California Pest Rating Proposal

### *Trissolcus japonicus* (Ashmead): Samurai wasp

Hymenoptera: Scelionidae

Current Rating: Q

Proposed Rating: D

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Comment Period: **11/29/2021 – 01/13/2022**

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#### Initiating Event:

The parasitoid wasp *Trissolcus japonicus* has spread to multiple locations across the United States. There is interest in *T. japonicus* as a potential biological control agent against brown marmorated stink bug (*Halyomorpha halys*), an invasive agricultural pest in North and South America and Europe. *Trissolcus japonicus* has been reported to be established in Los Angeles County, California. This wasp has not been rated. A permanent pest rating proposal is required to support an official pest rating in California.

#### History & Status:

**Background:** *Trissolcus japonicus* is a tiny (1-2 mm in length), black wasp that is known to parasitize host eggs of some members of the Pentatomoidea, a superfamily in the Order Hemiptera (USDA-ARS, 2016). A female wasp lays a single egg into a host egg. The developmental rate of *T. japonicus* is dependent on temperature; the time required for development from egg to adult is reported to range from five to 21 days (Qiu et al., 2007).

*Trissolcus japonicus* has been studied in the United States since 2007 as a potential biological control agent against the brown marmorated stink bug, *H. halys* (Buffington et al., 2018; Milnes et al., 2016). *Halyomorpha halys* is a polyphagous pest that is now widely distributed in California and continues to spread. It has the potential to impact a wide variety of specialty crops in the state. For

example, it was found causing damage to almonds and peaches in the San Joaquin Valley (Rijal and Gyawaly, 2018) and has also been reported in pear orchards in Lake and Mendocino County (C. Kron, pers comm.).

The interest in *T. japonicus* as a biological control agent began with the recognition that this wasp was an important parasitoid of *H. halys* in its native range (Buffington et al., 2018). Host specificity studies for *T. japonicus* have been done in the United States by Pickett et al. (2019), Milnes et al. (2017), and others, in China (part of its native range) by Zhang et al. (2017), in New Zealand by Charles et al. (2019), and in Switzerland by Haye et al. (2020). Of the ten species of pentatomids studied by Pickett et al. (2019) in California, including seven native species, six were parasitized to some degree by *T. japonicus* under laboratory no-choice conditions, which provide maximum non-target exposure. Eggs of two native California species, *Banasa dimidiata* and *Podisus maculiventris*, were parasitized at rates lower than, but not statistically significantly different from that of *H. halys*. In Washington state, Milnes et al. (2017) tested three native pentatomid species in three genera in the field; their eggs were paired in all cases with those of *H. halys*. The three native species were parasitized at much lower rates compared to *H. halys*. In China, Zhang et al. (2017) found *T. japonicus* to parasitize seven genera of pentatomids in no-choice tests and rearings from field-collected and sentinel eggs (i.e., laboratory-reared eggs placed in the field). In the sentinel egg studies, *T. japonicus* was the most important egg parasitoid for several species of pentatomids. It should be noted that *H. halys* eggs were parasitized at very high rates compared to many of the other pentatomid species from the native range of *T. japonicus* that were tested. In Switzerland, Haye et al. (2019) found *T. japonicus* parasitized 12 of 13 species of non-target Hemiptera under no-choice tests; 11 species from Pentatomidae and one species from Scutelleridae were parasitized and one species from Coreidae was not parasitized. *Trissolcus japonicus* was able to successfully develop on 11 pentatomid species, and four of the pentatomid species were accepted at rates not significantly different from that of *H. halys* under laboratory conditions. In paired choice tests, one of the non-target species, *Palomena prasina*, was parasitized at a level not significantly different from that of *H. halys*. In New Zealand, Charles et al. (2019) found *T. japonicus* was able to parasitize seven of the eight pentatomid species under no-choice laboratory conditions. In most choice tests, *H. halys* eggs were preferred to those of other species tested.

Malek et al. (2021) found that *T. japonicus* showed foraging behavior that was significantly stronger when associated with *H. halys* compared to one other species of pentatomid, further supporting that *H. halys* is preferred by *T. japonicus* over at least some other species and that this preference is based on chemical cues.

Outside of California, *T. japonicus* is being reared and redistributed in at least 9 states, i.e., Delaware, Maryland, Michigan, New Jersey, New York, Ohio, Oregon, Virginia and Washington for control of *H. halys* populations (Kaser et al., 2021). In New Zealand, the Decision-Making Committee for the Environmental Protection Authority proactively approved the field release of *Trissolcus japonicus*, should *H. halys* arrive in that country (Environmental Protection Authority, 2018).

**Worldwide Distribution:** *Trissolcus japonicus* is native to Asia and is reported from China, Japan, Russian Federation, South Korea, and Taiwan. It has been introduced to (through unknown means) and become established in Canada (British Columbia), Europe (including Italy and Switzerland), and the United States (Abram et al., 2019; Peverieri et al., 2018; Stahl et al., 2019; Talamas et al., 2017). It was first found in the United States in 2015 in Maryland and was later found in Virginia, Washington D.C., New York, Pennsylvania, New Jersey, Utah, Michigan, and on the west coast, Oregon and Washington (Buffington et al., 2018; Hedstrom et al., 2017; Milne et al., 2017; Stop BMSB). It was found in California in 2017 (California Department of Food and Agriculture; Lara et al., 2019). As of October 2021, adventive populations of *T. japonicus* have been reported in 15 U.S. states: California, Delaware, Idaho, Ohio, Oregon, Maryland, Michigan, North Carolina, New Jersey, New York, Pennsylvania, Utah, Virginia, Washington, and West Virginia (Stop BMSB, 2021).

**Official Control:** *Trissolcus japonicus* is not known to be under official control anywhere.

**California Distribution:** *Trissolcus japonicus* was found in Los Angeles in 2018 and 2020 and in Pomona in 2017; both of these locations are in Los Angeles County (California Department of Food and Agriculture; Lara et al., 2019). Sentinel egg cards (a total of 1,276 egg cards with 25,363 eggs) were placed and wild *H. halys* eggs (a total of 67 egg masses) were collected from Los Angeles,

Mendocino, Merced, Sacramento, San Joaquin, Santa Clara, Siskiyou, Stanislaus, and Yolo counties from 2019-2021, but additional *T. japonicus* were not found.

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

The risk *Trissolcus japonicus* poses to California is evaluated below.

### **Consequences of Introduction:**

1) **Climate/Host Interaction:** The current distribution of *T. japonicus* represents a range of climates. A CLIMEX model suggested that the climate of the west coast of the United States, including much of California, is marginally suitable for *T. japonicus* (Avila and Charles, 2018; Yonow et al., 2021). The wasp is established in the Northeast and Pacific Northwest of the United States and in Los Angeles, California as well. Reported hosts from laboratory studies include a variety of pentatomids, including *H. halys*, which is widely distributed in California. Suitable hosts are presumed to be present over much of the state. Therefore, *T. japonicus* 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:** *Trissolcus japonicus* is reported to feed on multiple genera of Pentatomoidea, almost all of which are in the family Pentatomidae. Therefore, it receives a **Low (1)** 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:** *Trissolcus japonicus* is presumed to be capable of flight. 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.** *Trissolcus japonicus* is reported to parasitize a variety of pentatomids, including a predatory genus, in field and laboratory studies. Any impact to predatory pentatomids could in turn impact agriculture by reducing pest control exerted by these natural enemies. Therefore, it receives a **Low (1)** in this category.

#### **Economic Impact: 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: Low**

– **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.** *Trissolcus japonicus* can parasitize a variety of pentatomids. Although there are no threatened or endangered pentatomids in California, this wasp could impact natural communities. Therefore, it receives a **Medium (2)** in this category.

**Environmental Impact: A**

- 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: Medium (2)**

- 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 *Trissolcus japonicus*: Medium (9)**

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:** *Trissolcus japonicus* is established in Los Angeles County, California. 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: Low (8)

### **Uncertainty:**

There is uncertainty regarding what non-target pentatomid species are likely to be parasitized by *T. japonicus* in significant numbers in California. No-choice experiments cited in this proposal may give an unrealistic impression of the degree to which these non-target species would be parasitized in a field setting. Various ecological “filters,” including habitat preference, plant associations, chemicals associated with the eggs, etc. may limit parasitism of non-targets in the field (C. Pickett and R. Lara, pers. comm.).

### **Conclusion and Rating Justification:**

*Trissolcus japonicus* appears to pose some level of risk of parasitizing native and beneficial pentatomids in California. However, it is already established in the state and it is the most promising candidate as a biological control agent against the brown marmorated stink bug, *H. halys*, a serious pest that continues to spread in California. Potential benefits of the control of this pest include reduced pest damage, pesticide use, and environmental impacts. For these reasons, a D rating is justified.

## References:

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### Responsible Party:

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**\*Comment Period: 11/29/2021 – 01/13/2022**

### \*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.

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**Proposed Pest Rating: D**