CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Zaprionus tuberculatus Malloch: Vinegar fly

Diptera: Drosophilidae

Pest Rating: B

Comment Period: 11/12/2024 – 12/27/2024

Initiating Event:

Drosophila tuberculatus has been found in the environment in Orange County. It is currently Q-rated. A pest rating proposal is needed.

History & Status:

Background:

Most Drosophilidae are reported to feed on rotting or overripe fruit or fungus and their pest significance is generally limited to that of a nuisance. There are some, however, that are of greater agricultural concern. For example, *Drosophila suzukii* is an important pest of fruit in California, and *Zaprionus indianus* is reported to be a pest of figs (decreasing production by 40% in Brazil) (Stein et al., 2003). Morphological (the serrated ovipositor in the case of *D. suzukii*) or behavioral (laying eggs in the ostiole of figs in the case of *Z. indianus*) characteristics are usually significant factors in these pest species.

Zaprionus tuberculatus is reported to feed on fruits in the families Anacardiaceae (*Mangifera*), Apocynaceae (*Carissa*), Arecaceae (*Butia capitata*), Moraceae (*Ficus*), Myrtaceae (*Eugenia* and *Psidium*), Oxidalidaeae (*Averrhoa*), Phytolaccaceae (*Phytolacca*), Rosaceae (*Eriobotrya*), Rubiaceae (*Coffea*), Solanaceae (*Cyphomandra* and *Solanum*), and Zingiberaceae (*Aframomum*) and flowers in

the families Apocynaceae, Bignoniaceae, Leguminosae, Malvaceae, Moraceae, and Zingiberaceae (Buruga, 1976; Georges et al., 2024; Jobim et al., 2023; Kamel et al., 2020). Other than fig, the condition of the fruits and flowers was not noted. It has been intercepted on citrus from South Africa and lychee fruit from Reunion Island; presumably this was fruit and not plants, although it was not indicated (Balmès and Mouttet, 2019). This fly has been reared in the laboratory on "fresh undamaged fruit" of fig, pears, strawberries, and pomegranate. If "undamaged" means that the fruit was not cut, this appears to be evidence for pest potential (Kuyulu et al., 2019).

In general, field evidence (or lack thereof) suggests that *Z. tuberculatus* has low pest potential. This fly is reported to be associated with "fallen and decaying citrus fruits" and overripe fruit (e.g., Georges et al. (2024) sampled 100 ripe and 100 overripe figs from orchards; 23 *Z. tuberculatus* emerged from overripe figs, and none emerged from ripe figs) and it is described as a secondary pest (Ebejer, 2015; Özbek et al., 2019). Concern for the pest potential of *Z. tuberculatus* in figs is justified, however, based on its presence in figs in California and the reports of another species in the genus, *Z. indianus*, impacting fig production in Brazil. In addition, the physical characteristics of fig fruit make it susceptible to attack by pests that may otherwise not attack "sound" fruit. As mentioned above, *Z. indianus* lays eggs in the ostiole of the fig; the ostiole is an opening that allows access to the flesh inside. In addition, fig fruit is susceptible to cracking and splitting on the sides and around the ostiole, and this cracking is in part affected by orchard conditions. This damage allows access of fungi and insects. An experiment in California showed that reduced irrigation can reduce splitting and cracking (Kong et al., 2013). If *Z. tuberculatus* becomes a significant pest of figs in California, modifying irrigation could be an important management tool.

Regarding trapping, *Z. tuberculatus* has been trapped using plastic beverage bottles with grape vinegar or yeast. Red, yellow, and white were the most attractive colors (Akşit et al., 2024). The McPhail traps with yeast used for exotic fruit fly detection in California would presumably be at least somewhat attractive to this fly, although there is no field evidence to support this.

Worldwide Distribution: *Zaprionus tuberculatus* is probably native to tropical Africa. Distribution: **Africa** (widespread): Madagascar, Mauritius, Réunion, Seychelles, Tunisia, Uganda; **Asia:** Turkey; **Europe:** France, Italy, Malta, Romania; **North America:** United States (California); **South America:** Brazil (Buruga, 1976; Cavalcanti et al., 2021; Chassagnard and Kraaijeveld, 1991; Chireceanu et al., 2015; Ebejer, 2015; Georges et al., 2024; Jobim et al., 2023; Kamel et al., 2020; Özbek et al., 2019; USDA-APHIS, 2024; Raspi et al., 2014).

Official Control: *Zaprionus tuberculatus* is not known to be under official control.

California Distribution: The first (to our knowledge) report of *Zaprionus tuberculatus* in California was by David Gross, who trapped this species at Long Beach, California. Attempts to officially trap the fly in the vicinity failed. The first official find of *Z. tuberculatus* in California was made from one or more figs at a residence in Orange County in September 2024. This was likely from an apparently overripe fig on the tree, but may have been from partially dried fruit collected from the ground (California Department of Food and Agriculture, 2024; Karen Hernandez, Orange County, pers. comm.). "Research grade" citizen scientist reports on the web site iNaturalist that appear to be the species suggest that *Z. tuberculatus* is also present in Los Angeles, Riverside, and San Diego counties (iNaturalist).

California Interceptions: *Zaprionus tuberculatus* has not been intercepted in California (California Department of Food and Agriculture, 2024).

The risk *Zaprionus tuberculatus* poses to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** *Zaprionus tuberculatus* is widespread in distribution and is found in areas with tropical and Mediterranean climates. It feeds on a wide variety of fruit. Therefore, *Z. tuberculatus* 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:** *Zaprionus tuberculatus* has been reported from a wide variety of fruits. 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:** *Zaprionus tuberculatus* can fly. It could also be dispersed via movement of infested fruit, although if it primarily infests overripe fruit, this may be less likely. 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**. *Zaprionus tuberculatus* could, like *Z. indianus*, become a pest of fig, thought this has not been reported. Modification of irrigation practices could be an important management tool, because cracking in fig fruit is related to water availability and cracking would likely allow infestation of figs by this fly. Therefore, it receives a **High (3)** in this category.

Economic Impact: A, B, D

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**. *Zaprionus tuberculatus* appears could be a pest of figs and possibly other fruits in home gardens, and this could trigger treatments. It seems unlikely that this fly would have significant impacts on native plants, as it presumably is mainly limited to overripe/damaged fruit. Therefore, *Z. tuberculatus* receives a **High (3)** in this category.

Environmental Impact: 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 *Zaprionus tuberculatus*: 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:** *Zaprionus tuberculatus* is established in Orange County. 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:

There is uncertainty regarding the current distribution of this fly in California. There is also uncertainty regarding its pest potential for fig and other fruit in the state. Literature does not support pest status. However, figs, with their ostiole and propensity for cracking, may be susceptible to attack by this fly and this susceptibility may be different under California conditions.

Conclusion and Rating Justification:

Zaprionus tuberculatus is generally considered to have little pest significance. However, the potential for this fly to be a pest of figs in California has not been ruled out and a cautious approach is taken here. For these reasons, a "B" rating is justified.

References:

Akşit, T., Kesici, M. A., Kiss, B., Deutsch, F., and Başpinar, H. 2024. Effect of trap bait and colours, and number of entry holes in monitoring of Drosophilidae (Diptera) species in a fig orchard. Bitki Koruma Bülteni 64:20-27.

Balmès, V. and Mouttet, R. 2019. The drosophilid risk on imports. EPPO Bulletin 0:1-5.

Buruga, J. H. 1976. Breeding sites of some species of *Zaprionus* (Diptera) in Uganda. Journal of the East Africa Natural History Society and National Museum 31:1-6.

California Department of Food and Agriculture. Pest and damage record database. Accessed October 11, 2024:
https://pdr.cdfa.ca.gov/PDR/pdrmainmenu.aspx

Cavalcanti, F. A. G. S., Ribeiro, L. B., Marins, G., Tonelli, G. S. S. S., Báo, S. N., Yassin, A., Tidon, R. 2021. Geographic Expansion of an Invasive Fly: First Record of *Zaprionus tuberculatus* (Diptera: Drosophilidae) in the Americas. Annals of the Entomological Society of America 115:267-274.

Chassagnard, M. T., and Kraaijeveld, A. R. 1991. The occurrence of *Zaprionus* sensu stricto in the palearctic region. Annales de la Société Entomologique de France 27:495-496

Chireceanu, C., Teodoru, A., and Chiriloaie, A. 2015. The first detection of fruit fly *Zaprionus tuberculatus* Malloch (Diptera: Drosophilidae) in the eastern part of Europe (Romania). 16:377-382.

Ebejer, M. J. 2015. A short note on additional records of fruitfly (Diptera, Drosophilidae) from Malta. Bulletin of the Entomological Society of Malta 7:143.

Georges, R., Yassin, A., and Colinet, H. 2024. First record of *Zaprionus tuberculatus* (Diptera: Drosophilidae) in mainland France. Entomological Research 54:pp.e12725

iNaturalist. Accessed October 18, 2024: https://www.inaturalist.org

Jobim, K., Kaster, P. L., da Rosa, B. R., Tidon, R., and Garcia, F. R. M. 2023. Expansion of the area of occurrence of *Zaprionus tuberculatus* (Diptera: Drosophilidae) in the Americas and Registration of new host plants. Brazilian Journal of Biology https://doi.org/10.1590/1519-6984.273916

Kamel, M. B. H., Cheik, Z. B., Zouari, S., Mdellel, L., and Balmès, V. 2020. First report of *Zaprionus indianus* and *Z. tuberculatus*. EPPO Bulletin 50:307-310.

Kong, M., Lampinen, B., Shackel, K., and Cristoso, C. H. 2013. Fruit skin side cracking and ostiole-end splitting shorten postharvest life in fresh figs (*Ficus carica* L.), but are reduced by deficit irrigation. Postharvest Biology and technology 85:154-161.

Kuyulu, A., Yücel, S., and Genç, H. 2019. Molecular identification of invasive drosophilid *Zaprionus tuberculatus* Malloch (Diptera: Drosophilidae) in Çanakkale, Turkey. Turkish Journal of Zoology 43: 531-535.

Özbek Çatal B, Çalışkan Keçe AF, Ulusoy MR 2019. New invasive species in Turkey: *Zaprionus indianus* (Gupta) (Diptera: Drosophilidae). KSU Journal of Agriculture and Nature 22(Suppl 1): 109-112.

USDA-APHIS. PestLens. May 23, 2024 notification.

Raspi, A., Grassi, A., and Benelli, G. 2014. Zaprionus tuberculatus (Diptera Drosophilidae): First records from the European mainland. Bulletin of Insectology 67:157-160.

Stein, C. P., Teixeira, E. P., and Novo, J. P. S. 2003. Aspectos biológicos da mosca do figo, *Zaprionus indianus* Gupta, 1970 (Diptera: Drosophilidae). Entomotropica 18:219-221.

Responsible Party:

Kyle Beucke (see comment regarding authorship above, in Background), 1220 N Street, Sacramento, CA 95814, 916-698-3034, permits[@]cdfa.ca.gov

***Comment Period: 11/12/2024 – 12/27/2024**

***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: B