

California Pest Rating Proposal for

Pepper chat fruit viroid
(syn. *Pospiviroid parvicapsici*)

Current Pest Rating: none

Proposed Pest Rating: A

Domain: Virus, Group: Viroids,
Family: Pospiviroidae, Genus: Pospiviroid

Comment Period: 05/01/2025 through 06/15/2025

Initiating Event:

This pathogen has not yet been evaluated through the pest rating process. It is considered a pest of concern for California's export seed programs. This document assesses the risk posed by *Pepper chat fruit viroid* (PCFVd) to California and proposes a permanent rating.

History & Status:

Background: Viroids are the smallest known plant pathogens, consisting of a short, circular, single-stranded RNA molecule. Unlike viruses, they do not encode proteins and lack a protein coat. All known viroids inhabit higher plants, with some causing disease while others remain asymptomatic.

Pepper chat fruit viroid (PCFVd) replicates using host RNA polymerase II, an enzyme typically involved in transcribing messenger RNA from plant DNA. In infected plants, this enzyme facilitates "rolling-circle" replication of the viroid's RNA. This replication mechanism is characteristic of viroids in the Pospiviroidae family, which replicate in the nucleus of host plant cells. In contrast, members of the Avsunviroidae family replicate in chloroplasts via nuclear-encoded polymerase (Agrios, 2005).

PCFVd primarily affects *Capsicum* species (peppers) and was first identified in the Netherlands in 2006 during investigations into unexplained fruit deformities. It was formally characterized in 2009 by Verhoeven et al. and confirmed as a Pospiviroidae member, capable of spreading via seeds and mechanical transmission (Verhoeven et al., 2020). Since then, PCFVd has been detected in multiple countries, including Thailand (Reanwarakorn et al., 2011) and Canada (Verhoeven et al., 2011).

Hosts: The major hosts of PCFVd are *Capsicum annuum* (bell pepper) and *Solanum lycopersicum* (tomato). Additional hosts, also in the Solanaceae family, are *Alkekengi officinarum* (Chinese lantern),

Datura metel (devil's trumpet), *D. stramonium* (Jimsonweed), *Nicotiana benthamiana* (benth), *N. glutinosa* (tobacco), *N. rustica* (indian tobacco), *N. tabacum* (tobacco), *Petunia* hybrids, *Solanum melongena* (eggplant), *S. muricatum* (pepino). *Solanum tuberosum* (potato) is an experimental host (Yanagisawa and Matsushita, 2017; EPPO, 2025).

Symptoms: Symptoms of PCFVd on pepper and tomato include curling of leaves, apical stunting, necrotic lesions, vein yellowing, deformation, and small fruit (Verhoeven et al., 2009). Symptoms are like those of other pospiviroid species, and molecular diagnostics are required to determine if the infection is caused by PCFVd, another viroid, or a virus (Yanagisawa and Matsushita, 2017). Woody ornamental hosts are asymptomatic.

Transmission: The international dissemination of this disease has been the result of the movement of infected seeds (Chambers et al., 2013).. Pathways for new introductions also include infected pepper and tomato seedlings, and ornamentals. Ornamental solanaceous plants, including petunias, which are widely grown and traded internationally, can be infected by this and other viroids but appear asymptomatic (Verhoeven et al., 2017). These plants can act as a reservoir for the spread of viroids in pepper and tomato production, especially in greenhouse conditions. PCFVd is spread easily through plant sap, e.g., during tomato or pepper pruning and propagation. Symptomless infected ornamental host plants may have been the source of infection of pepper plants in a Canadian greenhouse, as reported previously for the Potato spindle tuber viroid in tomato (Verhoeven et al., 2011).

Damage Potential: PCFVd has been reported in multiple countries across Asia, Africa, and Europe. Infection results in: stunted plant growth, reduced fruit size and deformation, and yield losses (though typically low). Although outbreaks are sporadic, quarantine measures have successfully eradicated the viroid in some areas through the destruction of infected plants (Chambers et al., 2013). However, asymptomatic ornamental hosts remain a major phytosanitary risk and should not be traded (Verhoeven et al., 2010; 2011).

Worldwide Distribution: Confirmed detections have often been treated as regulatory incidents. The exceptions are Canada and Thailand (EPPO, 2025).

Official Control: PCFVd is on the EPPO's A1 list for the United Kingdom and is a quarantine pest in China (EPPO, 2025). It is on the USDA PCIT's harmful organisms list for Antarctica, Australia, Brazil, Nauru, New Zealand, Taiwan, the Republic of Türkiye, and the United Kingdom (USDA-PCIT, 2025).

In California, Pospiviroid species are considered pests of concern in export seed programs for peppers and tomatoes. CDFA's Phytosanitary Field Inspection Manual requires that mother plants undergo two visual inspections: at late bloom/early fruit stage, and at 20–30% fruit maturity.

California Distribution: none

California Interceptions: none

The risk that Pepper chat fruit viroid would pose to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** This viroid is likely to survive wherever its hosts are grown. Tomatoes and peppers are frost-sensitive annuals, but some other solanaceous hosts are perennials that die back in the fall but regrow in the spring.

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: 2

- Low (1) Not likely to establish in California, or likely to establish in very limited areas.
- **Medium (2) may be able to be established in a larger but limited part of California.**
- High (3) likely to establish a widespread distribution in California.

- 2) **Known Pest Host Range:** The host range includes multiple species in the family Solanaceae

Evaluate the host range of the pest.

Score: 2

- 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 Potential:** Viroids are completely dependent on the cellular mechanisms of their hosts to be able to reproduce. They spread through infected sap and with seeds.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 2

- 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:** Yield losses and quarantine actions against infestations in pepper and tomato greenhouses can reach 100% crop loss. Seeds need to be screened for the presence of pospiviroids. Strict phytosanitary techniques in greenhouses are key to preventing the spread, for tomatoes, peppers and ornamental hosts.

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

Economic Impact: A, B, C, D

- A. The pest could lower crop yield.**
 - B. The pest could lower crop value (including increasing crop production costs).**
 - C. The pest could trigger the loss of markets (including quarantines).**
 - D. The pest could negatively change normal cultural practices.**
 - E. The pest can vector, or is vectored, by another pestiferous organism.
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- 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: 3

- 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:** There are many native and naturalized members of the family Solanaceae in California, including Jimson weed which is widely distributed. They could act as a reservoir for the viroid. Detections of PCFVd will likely trigger quarantine actions.

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

Environmental Impact: A, D

- 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: 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 Pepper chat fruit viroid: Medium

Add up the total score and include it here. **12**

- Low = 5-8 points
- Medium = 9-12 points**
- High = 13-15 points

- 6) Post-Entry Distribution and Survey Information:** Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication or have been delimited with no further detections should not be included.

Evaluation is 'not established'.

Score: 0

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

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

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 12*

Uncertainty:

Differentiation between Pospoviroids requires advanced laboratory techniques. Private diagnostics labs in California occasionally report detections of the Pospiviroid group from tomatoes. This group includes PCFVd and at least 9 other viroids, but the species are not determined. Thus, the status of specific viroids in California is unknown.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for **Pepper chat fruit viroid is A.**

References:

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

CABI Compendium. 202. Pepper chat fruit viroid.

<https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.118603#sec-5>

Accessed 4/4/2025.

Chambers, G.A., Seyb, A.M., Mackie, J., Constable, F.E., Rodoni, B.C., Letham, D., Davis, K. and Gibbs, M.J., 2013. First report of Pepper chat fruit viroid in traded tomato seed, an interception by Australian biosecurity. Plant Disease, 97(10), p.1386.

EPPO Database. *Pospiviroid parvicapsici*. <https://gd.eppo.int/taxon/PCFVD0> Accessed 4/3/2025

Reanwarakorn K, Klinkong S, Porsoongnurn J (2011) First report of natural infection of Pepper chat fruit viroid in tomato plants in Thailand. New Disease Reports 24, 6.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PEXD) Harmful Organisms Database Report. Pepper chat fruit viroid. Accessed 4/3/2025.

Verhoeven, J.T.J., Jansen, C.C.C., Roenhorst, J.W., Flores, R. and De la Peña, M., 2009. Pepper chat fruit viroid: biological and molecular properties of a proposed new species of the genus *Pospiviroid*. *Virus Research*, 144(1-2), pp. 209-214.

Verhoeven, J.T.J. and Roenhorst, J.W., 2010. High stability of original predominant pospiviroid genotypes upon mechanical inoculation from ornamentals to potato and tomato. *Archives of virology*, 155, pp.269-274.

Verhoeven, J.T.J., Botermans, M., Jansen, C.C.C. and Roenhorst, J.W., 2011. First report of Pepper chat fruit viroid in capsicum pepper in Canada. *New Disease Reports*, 23(15), pp.2044-0588.

Verhoeven, J.T.J., Hammond, R.W. and Stancanelli, G., 2017. Economic significance of viroids in ornamental crops. In *Viroids and satellites* (pp. 27-38). Academic Press.

Verhoeven, J.T.J., Koenraad, H.M.S., Jodłowska, A., Hüner, L. and Roenhorst, J.W., 2020. Pospiviroid infections in *Capsicum annuum*: disease symptoms and lack of seed transmission. *European Journal of Plant Pathology*, 156(1), pp.21-29.

Yanagisawa, H. and Matsushita, Y., 2017. Host ranges and seed transmission of Tomato planta macho viroid and Pepper chat fruit viroid. *European Journal of Plant Pathology*, 149, pp.211-217.

Responsible Party:

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***Comment Period: 05/01/2025 through 06/15/2025**

*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.
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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
