

California Pest Rating Proposal for

Pelargonium zonate spot virus

Current Pest Rating: none

Proposed Pest Rating: A

Realm: Riboviria, Kingdom: Orthornavirae,
Phylum: Kitrinoviricota, Class: Alsuviricetes,
Order: Martellivirales, Family: Bromoviridae,
Genus: Anulavirus

Comment Period: 12/05/2022 through 01/19/2023

Initiating Event:

In 2007, Plant Virologists Hsin-Yeh Liu and John Sears, USDA-ARS Salinas, published a first report of Pelargonium zonate spot virus from tomato in the United States. They observed more than 100 tomato (*Solanum lycopersicum*, syn *Lycopersicon esculentum*) plants with symptoms in a seven-acre tomato field in Yolo County in 2006. It has not been found since, but is this is a pest of concern in the seed export programs. This pathogen has not been through the current pest rating process. The risk to California from Pelargonium zonate spot virus is described herein and a permanent rating is proposed.

History & Status:

Background:

Pelargonium zonate spot virus was first isolated from *Pelargonium zonale* (Geraniaceae) in Italy (Quacquarelli and Gallitelli, 1979), and has since been shown to have a broader host range, notably as a pathogen of pepper and tomato (Solanaceae), sunflower and globe artichoke (Asteraceae), kiwifruit (Actinidiaceae), and several weeds from the family Brassicaceae. It is best known as the cause of disease on tomato, characterized by concentric chlorotic/necrotic rings and line patterns of leaves, stems, and fruits, that has been reported in Italy, Spain, and France (CABI-ISC, 2022). PZSV is the type strain of the viral genus *Anulavirus*. It has a segmented, tripartite linear ssRNA (+) genome, and forms quasi-spherical virions. Its position is well supported in the Bromoviridae (Finetti-Sialer and Gallitelli, 2003).

Hosts: *Actinidia chinensis* (kiwifruit), *Anthocercis ilicifolia* subsp. *ilicifolia* (red-striped tailflower), *Capsella bursa-pastoris* (shepherd's purse), *Cakile maritima* (European sea rocket), *Capsicum annuum* (pepper), *Cynara scolymus* (artichoke), *Diplotaxis eruroides* (white rocket), *Glebionis coronaria* (crown daisy), *Helianthus annuus* (sunflower), *Helminthotheca echioides* (bristly ox tongue), *Pelargonium* (geranium), *Solanum lycopersicum* (tomato), and *Sonchus oleraceus* (sow thistle) (EPPO database, 2022).

Symptoms: In Europe, PZSV induces severe disease symptoms in tomato plants characterized by chlorotic and necrotic ring and line patterns on the leaves and fruit together with plant stunting, leaf malformation, and reduced fruit set, which often result in plant death (Gallitelli, 1982). Infected tomato plants from the one field found in California showed stunting, malformation, yellow rings and line patterns on the leaves, and concentric chlorotic ringspots on the stems (Liu and Sears, 2007).

Sunflower plants show chlorotic concentric rings and line patterns on the leaves (Giolitti et al., 2014). On kiwifruit, infected plants usually show chlorotic and necrotic rings on leaves and depressed areas on the fruit, sometimes major symptoms were observed, including leaf spots, fruit malformation, bark cracking and cane wilting (Blouin et al., 2013). Artichokes show moderate stunting and leaf chlorotic mottling with chlorotic spots and line patterns (Spanò et al., 2018).

Transmission: This virus is transmitted mechanically with sap. It is pollen and seed transmitted in some hosts. For tomatoes, seed collected from infected plants, was found to contain PZSV by RT-PCR, and the virus was able to infect the seedlings that developed from these infected seeds. Pollen grains collected from flowers of infected plants were used to hand pollinate healthy mother tomato plants. Although none of the pollinated mother plants became infected with PZSV, 29% of the seedlings produced from seed harvested from these plants were found to be infected (Lapidot et al., 2010).

There are no known vectors of PZSV, however, it has been transmitted to tomatoes in association with pollen grains carried on the bodies of flower feeding thrips (Vovlas et al., 1989). Long distance transport is likely with seed. Weeds can be infected and serve as a source of inoculum in a local area, but without a vector, spread is limited.

Damage Potential: For tomatoes and peppers, PZSV can cause stunting of the plants, fruits with lines or rings, and reduced yield (Lapidot et al., 2010). Poor fruit set and reduced yields have been reported for kiwifruit along with bark cracking and cane wilting. PZSV infection decreases vigor year by year and then productivity of perennial kiwifruit plants. Cuttings taken from symptomatic plants developed infected but asymptomatic leaves (Blouin et al., 2013; Biccheri et al., 2012.)

Worldwide Distribution: PZSV has been detected in Argentina, Australia, France, Israel, Italy, and Spain. There has been one detection in the United States (California), made in 2006.

Official Control: PZSV is on the USDA PCIT's harmful organisms list for Brazil, Colombia, Georgia, Honduras, India, Japan, Peru, The Republic of Korea, and is on the EPPO's A1 list for Brazil.

California Distribution: There was one detection in Yolo County in 2006 (see 'initiating events') but it has not been found elsewhere or since.

California Interceptions: none

The risk *Pelargonium zonate spot virus* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** This pathogen is likely to survive wherever its hosts can grow.

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 establish 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 plants in multiple families.

Evaluate the host range of the pest.

Score: 3

- 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:** This virus only reproduces inside the plant hosts. There are no known vectors other than thrips which can move infected pollen. Spread is with seed or mechanically with sap.

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:** Severe disease losses have been reported in Southern Europe on tomatoes. This virus also causes economic loss in kiwifruit in Argentina. It is a pest of concern for export seed.

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

Economic Impact: A, C

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: 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:** This virus can infect multiple species of weeds. Although not easily transmitted, it could remain in fields after crop destruction requiring additional weed control programs. For infected kiwifruit, there are no treatments other than roguing infected vines.

Evaluate the environmental impact of the pest to California using the criteria below

Environmental Impact: 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: 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 Pelargonium zonate spot virus: 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
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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.

There has only been one published report from California in 2007. This is one of the pathogens on CDFA's survey list for PQ export seed, and it has not been found anywhere in the state in the subsequent 15 years. It's likely the source of the virus in the 2007 was infected seed used for planting, and it did not survive or persist in California after that field was harvested.

Evaluation is 'not established'.

Score: 0

-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.

7) The final score is the consequences of 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:

This virus can co-infect, and its symptoms can appear like those caused by other viruses. Diagnosis should always be done by a qualified diagnostician.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Pelargonium zonate spot virus is A.

References:

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Responsible Party:

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***Comment Period: 12/05/2022 through 01/19/2023**

***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: A
