

## California Pest Rating Proposal for

### Potato Virus X

#### Potato interveinal mosaic

**Current Pest Rating: C**

**Proposed Pest Rating: C**

Kingdom: Viruses and viroids; Category: Riboviria

Order: Tymovirales; Family: Alphaflexiviridae

Genus: Potexvirus

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**Comment Period: 7/17/2020 through 8/31/2020**

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#### Initiating Event:

On August 9, 2019, USDA-APHIS published a list of “Native and Naturalized Plant Pests Permitted by Regulation”. Interstate movement of these plant pests is no longer federally regulated within the 48 contiguous United States. There are 49 plant pathogens (bacteria, fungi, viruses, and nematodes) on this list. California may choose to continue to regulate movement of some or all these pathogens into and within the state. In order to assess the needs and potential requirements to issue a state permit, a formal risk analysis for Potato virus X is given herein and a permanent pest rating is proposed.

#### History & Status:

##### Background:

Potato virus X is the type member of the genus, potexvirus. Potexvirus virions are a single particle flexuous filament and their genome is a positive sense single-stranded RNA. The RNA codes for five proteins, including the virus RNA polymerase, the coat protein, and cell-to-cell movement proteins (triple gene block). Large numbers of potexvirus particles are produced in the cytoplasm of infected plant cells. The particles form large, amorphous aggregates that are visible with a light microscope (Agrios, 2005). Potato virus X has been important in the study of the viral interactions with cells, and

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has contributed significantly to understanding the mechanisms underlying plant-pathogen interactions, gene silencing and gene expression regulation (Lico et al., 2015).

Potexviruses affect numerous crops worldwide. Cymbidium mosaic virus is a potexvirus and the most important virus of orchids, causing significant losses. Generally, diseases caused by potexviruses are mosaics with varying degrees of stunting and reduced yield. Potexviruses do not have vectors, but they are transmitted easily with infected sap through contact between healthy and infected plants, from mothers to daughters during vegetative propagation, and while handling plants during cultivation (CABI-CPC, 2020).

*Hosts:* *Actinidia deliciosa* (kiwifruit), *Amaranthus retroflexus* (redroot pigweed), *Brassica rapa* subsp. *rapa* (turnip), *Capsicum annuum* (bell pepper), *Capsicum frutescens* (chilli), *Chenopodium album* (fat hen), *Cynara cardunculus* var. *scolymus* (globe artichoke), *Liparis loeselii* (yellow widelip orchid), *Nicotiana tabacum* (tobacco), *Solanum laciniatum* (kangaroo apple), *Solanum lycopersicum* (tomato), *Solanum tuberosum* (potato), *Trifolium pretense* (red clover), and *Vitis vinifera* (grapevine) (CABI- CPC, 2020; French, 1989; Zhou et al., 2019).

*Symptoms:* Some strains of Potato virus X are latent and produce no visible foliage symptoms or yield reductions. Other strains can cause a range of symptoms from a mild mottle or mosaic with slight leaf crinkling, to severe or rugose mosaic with plant dwarfing and reduced leaflet size. Some combinations of severe strains with susceptible genotypes cause extensive top necrosis, killing part of the plants or even entire plants with tuber necrosis. Symptom expression is stronger under periods of low light intensity and low temperature (60° to 68°F).

The presence of additional viruses in a plant can affect the types of symptoms and often increases symptom severity. The most striking of such synergistic diseases is the Potato virus X/potyviral synergistic disease, a condition that occurs when potato plants are infected with both Potato virus X and a potyvirus such as Potato virus A or Potato virus Y (MacLachlan et al., 1954; Nie and Singh, 2013). Potato crinkle disease caused by the mixed infection of Potato virus X and Potato virus A is the best-known example of synergistic disease (MacLachlan et al., 1954). Potato crinkle is significantly more severe than disease caused by infections with either virus alone. Mixed infection Potato virus X and Potato virus Y NTN (necrotic tuber strains) results in premature plant death, whereas single infection with either virus alone only causes mosaic on the plants (Nie and Singh, 2013).

*Transmission:* Potato virus X was ubiquitous in commercial potato varieties until testing for the virus and planting virus-free material became the standard last century. There is no known insect vector, but Potato virus X is carried in tubers and can be transmitted mechanically by machinery, spray equipment, root-to-root contact, sprout-to-sprout contact, or seed cutting equipment. Control is by the use of certified seed and avoiding mechanical transmission by strict sanitation of equipment that handles the tubers (Nuñez, and Aegerter, 2019; Stevenson et al., 2001).

*Damage Potential:* Potato virus X is one of the most common and economically important viruses affecting potato production worldwide. Some strains of Potato virus X produce no visible symptoms, although yields may be reduced 15 percent or more when compared to virus-free plants, and when

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symbiotic co-infections occur with other viruses, losses increase (Nuñez, and Aegerter, 2019). It causes symptoms ranging from latent to mild mosaic, and occasionally severe top necrosis depending on strains and potato cultivars (Nie et al., 2018).

**Worldwide Distribution:** Algeria, Argentina, Australia, Brazil, China, Czechia, Egypt, Ethiopia, France, Greenland, Hungary, India, Iran, Japan, Lebanon, Pakistan, Tanzania, Tunisia, Turkey, and United States (CABI-CPC, 2020).

**Official Control:** According to the European Plant Protection Organization, Potato virus X is a quarantine pest in Mexico and Norway and is on the A1 list for the European Union and the A2 list for Argentina, Bahrain, Jordan, and Turkey. USDA PCIT has it on the harmful organism list for Albania, Egypt, Georgia, Japan, Jordan, Mexico, Republic of Moldova, Morocco, and Norway.

**California Distribution:** CDFA records from the 20<sup>th</sup> century include the following counties: Imperial, Kern, Madera, Merced, Modoc, Sacramento, San Bernardino, San Diego, San Joaquin, Santa Clara, Shasta, Siskiyou, Stanislaus, Ventura, and Yolo. There have been no detections in California in the last 20 years.

**California Interceptions:** None

The risk Potato virus X would pose to California is evaluated below.

## Consequences of Introduction:

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

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

**Score: 3**

- 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:** Most of the hosts are Solanaceous plants but the list includes other families. Even though this is a well-studied virus, new hosts are still being added.

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.
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- 3) Pest Reproductive Potential:** This virus multiplies only within a living host. It may survive a short time in plant sap. It does not have any insect vectors.

Evaluate the natural and artificial dispersal potential of the pest.

**Score: 1**

- **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:** Potato virus X is mechanically transmitted and can be spread readily in the field through plant contact and crop management operations. Management mainly relies on phytosanitary measures, flush-through seed multiplication schemes, and the use of resistant cultivars (Nie et al., 2018).

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

**Economic Impact: A, 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: 2**

- 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:** Potato virus X can infect several species of weeds, but there are no direct reports of environmental impact

**Environmental Impact:**

- 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: 1**

- **Low (1) causes none of the above to occur.**
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- 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 Potato virus X is Medium:**

Add up the total score and include it here. **9**

-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 'high'.** Records in the CDFA database show this virus detected widely throughout the potato growing regions, mostly on potato and peppers (French, 1989).

**Score: -3**

-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 = 6*

### **Uncertainty:**

None.

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

Based on the evidence provided above the proposed rating for Potato virus X is C.

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## References:

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## Responsible Party:

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**\*Comment Period: 7/17/2020 through 8/31/2020**

**\*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).

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**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: C**

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