

California Pest Rating Proposal for

Tobacco streak virus

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Viruses and viroids, Category: Riboviria,
Category: Orthornavirae, Phylum: Kitrinoviricota,
Class: Alsuviricetes, Order: Martellivirales,
Family: Bromoviridae, Genus: Ilarvirus

Comment Period: 12/01/2021 through 01/15/2022

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from Tobacco streak virus is described herein and a permanent pest rating is proposed.

History & Status:

Background: The family *Bromoviridae* contains six genera of viruses: *Bromovirus*, *Cucumovirus*, *Ilarvirus*, *Alfavirus*, *Anulavirus*, and *Oleavirus*. There are 22 described ilarviruses and they have been found primarily in woody plants. Notable members of the genus and their hosts include Apple mosaic virus (pome fruits and roses), Prunus necrotic ring spot virus and Prune dwarf virus (stone fruits and roses), and Citrus leaf rugose virus and Citrus variegation virus (citrus) (Bujarski et al., 2019; Agrios, 2005).

Ilarviruses are named after their description as “isometric labile ringspot viruses,” although they are not truly isometric and many cause symptoms other than ringspots. Tobacco streak virus (TSV) is the type species of Ilarvirus. TSV is a nonenveloped, quasi-spherical virion with tripartite (RNA1, RNA2, and RNA3) segmented linear (+) sense RNA genome (Bag et al., 2008). Several Ilarviruses can be transmitted by thrips, but some are seed and/or pollen transmitted in some hosts. Ilarviruses occur wherever their hosts are grown, and many are distributed worldwide having been spread with infected nursery stock, budwood, or seed. Because ilarviruses are very labile (unstable), they have been more difficult to isolate and characterize. Therefore, the identity of many and relationships with one another have been difficult to establish definitively.

TSV was first reported in *Nicotiana tabacum* from Wisconsin by Johnson (1936). Important natural hosts of TSV include asparagus, beans, clover, cowpea, and soybeans. The first report on tomato was

made in California by Cupertino et al., in 1984 from necrotic plants and fruit. At one time, it was thought that *Fragaria* (strawberry) and *Rubus* (blackberry, wild blackberry, red raspberry, and black raspberry) species were infected with distinct isolates of Tobacco streak virus (TSV). Employing serology and nucleic acid hybridization, it was shown by Tzanetakis et al. in 2004 that these isolates belong to a distinct virus species (in the same genus) now named Strawberry necrotic shock virus (SNSV). In strawberry, both TSV and SNSV were confirmed to be present and in *Rubus*, however, only SNSV was detected (Martin et al. 2013).

Hosts: The host range of TSV includes at least 200 species in more than 31 monocotyledonous and dicotyledonous families, both weeds and other crops. There are many weed hosts; a few examples are Jimson weed (*Datura stramonium*), field bindweed (*Convolvulus arvensis*), black nightshade (*Solanum nigrum*) and several other *Solanum* species (CABI-CPC, 2021; EPPO- 2021).

Symptoms: Infected tobacco plants show yellowing and veinal necrosis of leaves (Tomaru et al., 1985) On beans, chlorotic mottling and/or mosaic symptoms are accompanied by black streaks on stems and leaf petioles. In some varieties, severe leaf chlorosis subsequently develops into browning and blackening of the entire leaf), resulting in plant death (Ali et al, 2009). On honeysuckle, there are chlorotic leaves on some shoot tips and a mild veinal chlorosis (Waterworth, 2007). In tomato, downward curling of leaf blades is common. Leaf veins become necrotic, which can lead to necrotic blotches, especially on young leaves. Fruit may develop necrotic ringspots. Necrotic streaks on young stems extend to flowers and leads to flower drop. On summer squash, foliar symptoms such as mosaic and greening in leaves, and fruit symptoms of large green sunken spots that coalesce to form green islands that are necrotic with water-soaked spots, are observed (Bag et al., 2019). Zucchini squash show symptoms primarily on top young leaves and include mosaic, leaf curling, yellowing, and stunting. Young leaves can be unusually small and distorted showing narrow and pointed “fern leaf” symptoms (Zhang and Ling, 2014; Padmanabhan et al., 2014)

Transmission: TSV is efficiently transmitted by thrips, *Frankliniella occidentalis* and *Thrips tabaci*. Both species are widespread in California. The virus is also transmitted by seed, pollen, and mechanical injury (Davis et al., 2013).

Damage Potential: Tobacco streak is a widespread disease of tomato, but it generally does not cause major losses in California (Davis et al., 2013). Severe outbreaks of TSV are favored by climatic conditions that enable high thrips populations to develop and large amounts of infective pollen to be produced by host plants. In Australia, losses on sunflowers have exceeded 20% and yield reduction of mung bean can be up to 70% (Sharman et al., 2009)

Worldwide Distribution: Africa: *South Africa*, America: *Argentina, Brazil, Canada, Chile, Mexico, Peru USA* (California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Washington, Wisconsin), *Venezuela*. Asia: *China, India, Iran, Israel, Japan*, Europe: *Denmark, France, Italy, Netherlands, Russia, Serbia, Slovenia, United Kingdom*, Oceania: *Australia New Zealand* (EPPO, 2021)

Official Control: USDA PCIT's harmful organism lists Tobacco streak virus for Australia, Colombia, Cuba, Dominican Republic, Ecuador, French Polynesia, Georgia, Guatemala, Honduras, Indonesia, Israel, Japan, Korea (Republic of), Mexico, Namibia, Nauru, New Caledonia, Nicaragua, Panama, Sri Lanka, South Africa, Syrian Arab Republic, Taiwan, Thailand, and Turkey (USDA, 2021). Tobacco streak virus is on the EPPO A1 list for Jordan, Turkey and Paraguay and a quarantine pest for Israel and Mexico (EPPO, 2021). In CDFA's Phytosanitary field inspection manual for certifying export seed, TSV is listed as a pest of concern for common, adzuki and mung beans, plus sunflower and tomato.

California Distribution: Glenn, Imperial, Sacramento, and Yolo counties. Likely widely distributed in California on tomatoes

California Interceptions: None

The risk Tobacco streak virus would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** This pathogen lives entirely inside of its hosts and vectors, and can establish everywhere its hosts are grown

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:** This virus has a very wide host range

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 reproduces in its plant host and is spread by thrips which can fly. It also spreads with pollen and seed, and mechanically.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 3

- 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.**
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- 4) Economic Impact:** This virus can decrease plant yield. It is a quarantine pest in many countries and as a concern for export seed. It is vectored by thrips

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

Economic Impact:

- 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:** No environmental impacts have been reported in California, but with a large host range it can infect non-crop plants

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

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: 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 Tobacco streak virus: High

Add up the total score and include it here. **14**

-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.

This pathogen has been in California for decades. It has a large host range, and it is not under regulatory control. It is spread by a flying vector which is also widespread in the state.

Evaluation is 'high'.

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 = 11*

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Tobacco streak virus is C .

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***Comment Period: 12/01/2021 through 01/15/2022**

***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.
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- ❖ 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
