

California Pest Rating Proposal for Red clover vein mosaic virus

Current Pest Rating: none

Proposed Pest Rating: B

Kingdom: Viruses and viroids, Category: Riboviria,
Category: Orthornavirae, Phylum: Kitrinoviricota,
Class: Alsuviricetes, Order: Tymovirales,
Family: Betaflexiviridae, Genus: Carlavirus

Comment Period: 06/13/2023 through 07/28/2023

Initiating Event:

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

History & Status:

Background:

Red clover vein mosaic virus (RCVMV) is an important virus of leguminous crops that can cause significant losses to seed. RCVMV was first reported from red clover in the United States by Osborn (1937) but has since been found in several other countries. *Carlavirus*, formerly known as the "Carnation latent virus group", is a genus of viruses in the order Tymovirales, in the family Betaflexiviridae. There are more than 50 species in this genus. Some are serious pathogens, including Pea streak virus and Poplar mosaic virus, causing mosaics and ringspots. Others are mild or symptomless. They can act synergistically with other viruses, worsening disease severity. Carlaviruses are commonly spread by aphids but also can be spread by contact of infected and healthy plants, and by handling of such plants; some are spread by whiteflies; and some including RCVMV are occasionally transmitted by seed (Agrios, 2005). Several aphid species can transmit RCVMV in a nonpersistent manner, including some aphids that are common in California (Pers. comm. Dr. Beucke, Primary State Entomologist, CDFA).

Hosts: Cicer arietinum (chickpea), *Lens culinaris* (lentil), *Medicago sativa* (alfalfa), *Nicotiana glutinosa*, *Phaseolus vulgaris* (common bean), *Pisum sativum* (pea), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), *Vigna unguiculata* (cowpea) (CABI, 2023).

Symptoms: On alfalfa in Saudi Arabia, the symptoms of RCVMV include crinkling, interveinal mosaic, small leaves, yellowing, stunting, vein mosaic or vein chlorosis and mottling (Al-Shahwan et al., 2015). On pea, chickpea, faba bean, and lentil in the Pacific Northwest of the United States, symptoms ranged from mild systemic mosaic symptoms to moderate to severe stunting, axillary bud proliferation and malformed leaves and branches. (Larsen et al., 1996; Larsen and Myers, 1998). Symptoms on peas can range from asymptomatic to necrotic stem streaking, depending on the virus strain or isolate involved (Bos et al., 1972).

Transmission: RCVMV is transmitted in sap in a non-persistent manor by aphids including 3 species that are common and widespread in California: *Acyrtosiphon pisum* (pea aphid), *Myzus persicae* (green peach aphid), and *Cavariella aegopodii* (carrot-willow aphid). Two additional aphid vector species, *Therioaphis ononidis* and *Cavariella theobaldi*, are not known to be in California (CABI, 2023; CDFA PDR Database, 2023). Mechanical transmission and seed transmission have also been reported (Sander, 1959).

Damage Potential: Economic losses caused by RCVMV infection have been up to 88% of the grain weight of moderately diseased pea (Khan and Singh, 1997) but yield losses in chickpea have been up to 100% depending on time of infection (Larsen and Miklas, 2001). Detection of RCVMV in seed fields may disqualify them for export. Alfalfa losses have also been reported from loss of forage biomass and quality (CABI, 2023).

Worldwide Distribution: Asia: *Saudi Arabia*. Europe: *Germany, Lithuania, Netherlands*. North America: *Canada, United States* (Mississippi, Washington). Oceania: *New Zealand* (Fletcher et al., 2016; CABI 2023).

Official Control: RCVMV is on the EPPO's A1 list for Brazil and Bahrain, on the A1 list for Egypt and a Quarantine pest in Mexico (EPPO, 2023). It is on the USDA PCIT's harmful organism list for Colombia, Georgia, Oman, Syrian Arab Republic, and United Arab Emirates (PCIT, 2023).

California Distribution: none

California Interceptions: none

The risk Red clover vein mosaic virus would pose to California is evaluated below.

Consequences of Introduction:

1) Climate/Host Interaction:

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.**

Risk is High (3) – This virus is likely to be found anywhere in the state that its hosts can grow.

2) Known Pest Host Range:

Evaluate the host range of the pest.

Score: 1

- **Low (1) has a very limited host range.**
- Medium (2) has a moderate host range.
- High (3) has a wide host range.

Risk is low (1) – The host range is limited to plants in one family.

3) Pest Reproductive Potential:

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.**

Risk is High (3) – The virus spreads multiple ways, with aphid species that are common in California, seed, and mechanically.

4) Economic Impact:

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

Economic Impact: A, C, E

- 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.
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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.**

Risk is High (3) – This virus is documented to cause yield loss, it is a quarantine pest and a pest of concern for export seed markets, and it has aphid vectors

5) Environmental Impact:

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: 1

- **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.

Risk is low (1) – No environmental impacts have been reported.

Consequences of Introduction to California for Red clover vein mosaic virus: Medium

Add up the total score and include it here. **11**

-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.

-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:

In other places, it is not uncommon for fields of annual and perennial pasture plants to have co-infections of RCVMV and other viruses including Alfalfa mosaic virus, Cucumber mosaic virus, Bean yellow mosaic virus, Pea seed-borne mosaic virus, Soybean dwarf virus and Turnip yellows virus (Fletcher et al., 2016). Fields may have no visible symptoms making visual detection unreliable. Symptoms may be worse when viruses co-occur, making the measurement of disease severity from RCVMV more difficult.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Red clover vein mosaic virus is B.

References:

Al-Shahwan, I.M., Farooq, T., Al-Saleh, M.A., Abdalla, O.A. and Amer, M.A., 2016. First report of Red clover vein mosaic virus infecting alfalfa in Saudi Arabia. *Plant Disease*, 100(2), pp.539-539.

Bos, L., Maat, D.Z. and Markov, M., 1972. A biologically highly deviating strain of red clover vein mosaic virus, usually latent in pea (*Pisum sativum*), and its differentiation from pea streak virus. *Netherlands Journal of Plant Pathology*, 78, pp.125-152.

CABI 2023. Red clover vein mosaic virus

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Fletcher, J., Tang, J., Blouin, A., Ward, L., MacDiarmid, R., Ziebell, H. 2016. Red clover vein mosaic virus-A Novel Virus to New Zealand that is Widespread in Legumes. Plant Dis. 2016 May;100(5):890-895.

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Larsen, R.C. and Myers, J.R., 1998. First report of red clover vein mosaic carlavirus naturally infecting lentil. Plant Disease, 82(9), pp.1064-1064.

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Osborn, H. T. 1937. Vein-mosaic virus of red clover. Phytopathology 27:1051-1058.

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Responsible Party:

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***Comment Period: 06/13/2023 through 07/28/2023**

***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.

Proposed Pest Rating: B
