

California Pest Rating Proposal for

Clover yellow vein virus

Current Pest Rating: None

Proposed Pest Rating: C

Kingdom: Viruses and viroids, Category: Riboviria,
Category: Orthornavirae, Phylum: Pisuviricota,
Class: Stelpaviricetes, Order: Patatavirales,
Family: Potyviridae, Genus: Potyvirus

Comment Period: 04/13/2022 through 05/28/2022

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from Clover yellow vein virus is described herein and a permanent rating is proposed.

History & Status:

Background: As early as the 1950s, plant pathologists recognized a sap transmissible virus that could infect both common bean and Ladino white clover plants, causing mosaic symptoms in the field, in California. At that time, it was thought to be a strain of Bean yellow mosaic virus (BYMV) (Houston and Oswald, 1953). Clover yellow vein virus (CYVV) was first described as a distinct species from white clover (*Trifolium repens*) in England by Hollings and Nariani (1965). CYVV is a member of the bean yellow mosaic subgroup of the genus *Potyvirus*, which includes bean yellow mosaic virus, pea mosaic virus, sweet pea mosaic virus, and white lupin mosaic virus (Barnett et al., 1987).

The taxonomy of bean yellow mosaic subgroup viruses has been challenging because their properties are very similar to one another. At one time, virologists considered CYVV a strain of BYMV because they had overlapping host ranges, they produced morphologically similar pinwheel cytoplasmic inclusions, and antisera against CYVV strongly interreacts with BYMV. The confusion regarding their taxonomic relations was resolved by nucleotide sequencing, which showed they are two distinct *Potyvirus* species (Uyeda et al., 1991). Today CYVV is distributed worldwide and causes severe disease in multiple types of leguminous and ornamental plants (CABI-CPC, 2022).

Most of the concern about the impact of CYVV has focused on clovers, particularly white clover (*Trifolium repens*), that are grown as perennials in grass-legume pastures. More than a dozen viruses have been detected in white clover, and fields are often simultaneously infected with more than one virus, and mixed infection of single plants is prevalent. Therefore, it can be hard to quantify the effect of CYVV alone (Barnett and Gibson, 1975). In 1999, a severe viral disease outbreak with 100% incidence was observed in a single field of common bean in Colusa County, CA. The symptoms included a yellow mosaic, leaf epinasty and, in some plants, a systemic necrosis. This field was adjacent to a clover field that had been harvested early in the development of the bean plants. RT-PCR with direct-sequencing and sequence comparisons revealed a close identity to known sequences of CYVV (Crnov and Gilbertson, 2001).

Hosts: *Alysicarpus vaginalis* (alyce clover), *Ammi majus* (Bishop's-weed), *Borago officinalis* (borage), *Coriandrum sativum* (coriander), *Crotalaria micans*, *Cucurbita pepo* (marrow), *Daucus carota* (carrot), *Dendrobium*, *Gentiana* (gentians), *Gladiolus hybrids* (sword lily), *Glycine max* (soybean), *Impatiens walleriana* (busy lizzy), *Iris* (irises), *Lamium amplexicaule* (henbit deadnettle), *Lathyrus odoratus* (sweet pea), *Lens culinaris* (lentil), *L. culinaris* subsp. *culinaris* (lentil), *Limonium sinuatum* (sea pink), *Lupinus* (lupins) *L. albus* (white lupine), *L. angustifolius* (narrow-leaf lupin), *L. luteus* (yellow lupin), *Medicago lupulina* (black medick), *M. sativa* (lucerne), *Melilotus officinalis* (yellow sweet clover), *Phaseolus* (beans), *P. vulgaris* (common bean), *Pisum sativum* (pea), *Plantago major* (broad-leaved plantain), *Psophocarpus tetragonolobus* (winged bean), *Trifolium* (clovers), *T. hybridum* (alsike clover), *T. incarnatum* (crimson clover), *T. pratense* (red clover), *T. repens* (white clover), *T. subterraneum* (subterranean clover), *T. vesiculosum* (arrowleaf clover), *Veronica persica* (creeping speedwell), *Vicia faba* (faba bean), *Viola odorata* (English violet) (CABI-CPC, 2022; Yoon et al., 2022).

Symptoms: Symptoms are variable and may be easily confused with those caused by other viruses. In several hosts, symptoms include spotting and mosaics associated with various degrees of necrosis, often leading to the death of leaves, and premature plant death. Symptoms from CYVV usually include more necrosis than symptoms from BYMV, but there can be highly necrotic strains of BYMV (Bos et al., 1974).

Symptoms on beans are leaf and stem necrosis, with premature dropping of leaves and pods (Lisa and Dellavalle, 1983) or severe vein necrosis (Okuda et al., 1992). On clovers, symptoms are mosaic, and chlorotic, occasionally necrotic, sectoring of leaves but obvious symptoms may also be absent (Barnett and Diachun, 1984).

Transmission: CYVV can be transmitted by various aphids in a non-persistent manner (Hollings and Stone, 1974). It is not seed borne or transmitted mechanically. The aphid vector is *Myzus persicae* (green peach aphid), is an important vector and a widespread, C-rated pest in California. CYVV can also be spread in vegetative planting material such as rooted stolons or cuttings (CABI-CPC, 2022).

Damage Potential: There is little information on the impact of CYVV on crops other than clovers where it reduces yield and lifespan of infected plants. In northwestern Italy in 1976 the virus was present at different locations in up to 50% of the plants and symptoms were severe (Lisa and Dellavalle, 1983). On common bean there have been reports of damage, but some varieties of legumes are known to be

resistant (Sato et al., 2007). Reports on the occurrence in non-legume crops such as orchids, *Gentiana* and *Limonium* have been incidental only; however, necrotic streaking on leaves and stems of ornamentals are considered significant defects (CABI-CPC, 2022).

Worldwide Distribution: **Asia:** *Japan, South Korea, Yemen.* **Europe:** *Bulgaria, Czechia, France, Germany, Hungary, Italy, Netherlands, Poland, Spain, Sweden, United Kingdom.* **North America:** *Canada, United States (Alabama, Alaska California, Connecticut, Florida, Georgia, Idaho, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Nebraska, New Jersey, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington).* **Oceania:** *Australia, New Zealand.* **South America:** *Colombia* (CABI-CPC, 2022).

Official Control: Clover yellow vein virus is on the USDA PCIT's harmful organism list for Brazil, Ecuador, Georgia, Guatemala, Honduras, India, Japan, Nicaragua, and Taiwan (USDA, 2022). It is on the EPPO's A1 list for Brazil (EPPO, 2022).

California Distribution: This virus has been present in California, not under regulatory control, at least since the 1950s. Outbreaks in this state occasionally occur on common bean (Frate et al., 2018).

California Interceptions: None

The risk Clover yellow vein mosaic virus would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** This virus has a large host range but is dependent on its insect vector to spread as it is not spread with seed. It is likely to establish in areas where its vector is present.

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 of this virus is large including plants in diverse families. California records include *Cicer arietinum* (garbanzo bean), and *Phaseolus vulgaris* (kidney bean)

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.**
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- 3) Pest Reproductive Potential:** The virus reproduces in its host and moves in a non-persistent manner with aphids. It does not spread 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:** There are economic impacts to perennial clovers, beans, and ornamental hosts. It is a quarantine pest in several countries. It is vectored by aphids.

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

Economic Impact: A, B, 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.

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 plants that are in the same genera as known hosts. However, this virus has been in California with aphid vectors for decades and no impact has been reported.

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.
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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.

Consequences of Introduction to California for Clover yellow vein 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 '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 = 8

Uncertainty:

Plants weakened by virus infection are probably more susceptible to damage by other pathogens and environmental stress than uninfected plants, which further contributes to the phenomenon of clover decline.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Clover yellow vein virus is C.

References:

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Responsible Party:

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***Comment Period: 04/13/2022 through 05/28/2022**

*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.
 - ❖ 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
