

## California Pest Rating Proposal for

### Blueberry leaf mottle virus

**Current Pest Rating: none**

**Proposed Pest Rating: A**

Kingdom: Viruses and viroids, Category: Riboviria,  
Category: Orthornavirae, Phylum: Pisuviricota,  
Class: Pisoniviricetes, Order: Picornavirales,  
Family: Secoviridae, Genus: *Nepovirus*

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**Comment Period: 07/05/2023 through 08/19/2023**

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#### Initiating Event:

This pathogen has not been through the pest rating process. Attestation of freedom from this virus is frequently requested on phytosanitary certificates for the export of host plants. The risk to California from Blueberry leaf mottle virus is described herein and a permanent pest rating is proposed.

#### History & Status:

##### Background:

California is the nation's sixth largest blueberry producer, accounting for over 20% of U.S. production. Blueberries are grown on ~7,300 acres in California and had a total value of \$223M in 2021 ([https://www.cdfa.ca.gov/Statistics/PDFs/2022\\_Ag\\_Stats\\_Review.pdf](https://www.cdfa.ca.gov/Statistics/PDFs/2022_Ag_Stats_Review.pdf)). Virus diseases of blueberry have become a major problem in recent years not only because of the expansion of the industry and the change in climate patterns, but also because of disease problems that can emerge when propagating non-certified material (Martin et al., 2012). In the U.S., certified planting stocks come through the National Clean Plant Network (NCPN) in one of four places: University of Arkansas, Fayetteville, North Carolina State University, Raleigh, Horticultural Crops Research Unit, USDA/ARS, Corvallis, OR, or Foundation Plant Services, University of California, Davis, CA.

*Nepovirus* is a large genus and its members cause a range of symptoms from none (asymptomatic) to foliar patterns, leaf necrosis, severe shock, stunting and even death in annual or perennial plants including vegetables, flowering ornamentals, fruit trees and vines. Some *Nepovirus* spp. are transmitted from plant to plant by longidorid nematodes, especially the American dagger nematode,

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*Xiphinema americanum* sensu lato. These nematodes acquire the virus by feeding and can transmit it for several months.

Blueberry leaf mottle virus (BLMoV) is a polyhedral (isometric) virus, with single-stranded, positive-sense RNA, likely indigenous to North America (Jaswal, 1990). It was first described in the 1970s in Michigan by Ramsdell and Stace-Smith (1979) and its presence in North America is limited to a few eastern states and parts of eastern Canada. Partial sequence of the genome placed BLMoV in subgroup C of the genus *Nepovirus* (Bacher et al., 1994). Other important viruses in this subgroup include Tomato ringspot virus and Cherry leaf roll virus. It is very closely related to Grapevine Bulgarian latent virus (GBLV), but they are different species (Elbeaino et al., 2011). Although BLMoV belongs to the genus *Nepovirus*, where members are often nematode or aphid transmitted, vector transmission studies with this species have been unsuccessful, and no vectors have been identified. It is readily transmissible between blueberries by pollen, primarily via honeybee movement, and with seed (Childress and Ramsdell, 1987).

Affected blueberry bushes develop severe stem dieback and are stunted with leaf mottling and often only a fraction of plants remains healthy. It is absent from the European Union, making it a pest of concern for the European Plant Protection Organization. American grape, *Vitis labrusca*, some cultivars of *V. vinifera*, and some French American *Vitis* spp. hybrids have tested positive for this virus. However, the risk of BLMoV for grapevine seems to be limited (EPPO, 2023).

The cost of virus diseases is massive in perennial fruit crops such as blueberry. BLMoV is thus far only found in North America and South Korea, and it has obvious implications in quarantine and certification programs in other blueberry growing countries (Martin et al., 2012). Often there is limited information on the distribution of blueberry viruses other than where the viruses were first discovered and characterized. A survey for blueberry viruses was carried out in the U.S. in 2015–2017 by Martin and Tzanetakis (2018). No detections of BLMoV were made in California blueberries, and it has not been found in California grapevines (CDFA PDR Database, 2023).

**Hosts:** The principal host is highbush blueberry (*Vaccinium corymbosum*). The lowbush blueberry species *V. angustifolium* and *V. myrtilloides* have been found to be infected adjacent to commercial highbush crops, but they were asymptomatic (Sandoval, 1992). Other reported hosts are *Vaccinium corymbosum* (cranberry), *Vaccinium hybrids*, *Vitis labrusca* (fox grape), and *Vitis vinifera* (grape).

**Symptoms:** On some cultivars of highbush blueberry, the main shoots of the bush are killed, and new regrowth occurs from the crown. On others, leaves are malformed and mottled but there is no shoot dieback. If a leaf from an infected bush is held up to the light, translucent spots will be visible. Bushes can be stunted. New growth exhibits rosetted leaves, which is a result of shortened internodes with leaves appearing to be piled on top of one another. Leaves on infected bushes are smaller than normal and are pale yellow green (Martin et al., 2012; Martin and Tzanetakis, 2018).

Leaf malformation and shortening of internodes, along with delayed bud break, irregular elongation of fruits, pale green foliage, and straggly fruit clusters has been reported in *Vitis labrusca* cv. Concord (Uyemoto et al., 1977). Kwak et al. (2016) detected BLMoV by RT-PCR both in symptomatic leaves

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showing yellowing and mottling and in asymptomatic leaves of grapevine (*V. vinifera*) cultivars where it was described as a latent infection.

**Transmission:** Movement and trade of infected planting material is the most significant mode of long-distance spread of BLMoV. It is pollen-borne in highbush blueberry and spread by bees (Childress and Ramsdell, 1987). Nematode vector spread has not been documented in BLMoV, although it is taxonomically related to other Nepoviruses that are nematode or aphid transmitted. This may be because blueberries are grown in a low pH, high organic matter soil, conditions that are not conducive to longidorus nematodes (Martin et al., 2012). The virus is also seedborne in blueberry infecting 1.5% of blueberry seedlings originating from an infected bush (Childress and Ramsdell, 1986) and *Vitis labrusca* affecting 5% of seedlings (BLMoV-NY strain) (Uyemoto et al., 1977).

**Damage Potential:** In blueberries, there is a latent period of approximately four years between initial infection and the onset of symptoms. BLMoV is extremely damaging to *Vaccinium* spp. (Martin and Tzanetakis, 2018). Blueberry crop yields in Michigan can reduced to nil by this virus (Ramsdell and Stace-Smith, 1979). On grapevines in Korea, survey results indicate that BLMoV was widely distributed, though with no damage observed by Kwak et al. (2016).

**Worldwide Distribution:** Canada, South Korea, and the United States (*Connecticut, Michigan, New Jersey, New York, Pennsylvania*) (EPPO, 2023).

**Official Control:** Blueberry leaf mottle virus is on the EPPO's A1 list for Argentina, Bahrain, Brazil, Chile, Egypt, Jordan, Switzerland, Turkey, United Kingdom, the European Plant Protection Organization, and the European Union. It is on the A2 list for the Comité Regional de Sanidad Vegetal del Cono Sur, and a quarantine pest in Israel, Mexico, Moldova, Morocco, and Norway (EPPO, 2023). It is on the USDA PCIT's Harmful Organism list for: Albania, Argentina, Brazil, Canada, Chile, Colombia, Ecuador, Egypt, European Union, Georgia, Holy See (Vatican City State), India, Indonesia, Israel, Japan, Mexico, Monaco, Morocco, Norway, Oman, Peru, Republic of North Macedonia, San Marino, Serbia, Taiwan, The Republic of Korea, The Republic of Moldova, The Republic of Turkey, United Arab Emirates and Uruguay (USDA, 2023).

**California Distribution:** none.

**California Interceptions:** none

The risk Blueberry leaf mottle virus would pose to California is evaluated below.

## Consequences of Introduction:

- 1) Climate/Host Interaction:** Blueberries and grapes are widely planted in California, and it is likely this virus could be found wherever its hosts can grow.

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

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**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:** The host range is *Vaccinium* and *Vitis*.

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.

**3) Pest Reproductive Potential:** With the ability to transmit with pollen, this virus has the potential to become widespread.

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.**

**4) Economic Impact:** There are records of total crop loss on highly susceptible blueberry cultivars. Bushes have become damaged to the point that they must be removed and replaced. It is an important quarantine pest for the European Union and other trading partners.

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

**Economic Impact: A, B, 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.
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- Medium (2) causes 2 of these impacts.
- **High (3) causes 3 or more of these impacts.**

**5) Environmental Impact:** There are multiple native *Vaccinium* spp., some listed as rare (Calflora.org). Their susceptibility to BLMoV is unknown. Infected shrubs in plantings may suffer serious yield loss and need to be removed.

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

**Environmental Impact: A, 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: 3**

- 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 Blueberry leaf mottle virus: High**

Add up the total score and include it here. **13**

- 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).
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-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 = 13*

**Uncertainty:** None

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

Based on the evidence provided above the proposed rating for Blueberry leaf mottle virus is A.

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### **Responsible Party:**

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**\*Comment Period: 07/05/2023 through 08/19/2023**

### **\*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).

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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:**

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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**

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