cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Blueberry scorch virus

Current Pest Rating: none

Proposed Pest Rating: A

Kingdom: Viruses and viroids,
Category: Riboviria, Order: Tymovirales,
Family: Betaflexiviridae, Genus: Carlavirus

Comment Period: 08/27/2021 through 10/11/2021

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from Blueberry scorch virus (BlScV) is described herein and a permanent pest rating is proposed.

History & Status:

Background: The name blueberry is applied to many species of *Vaccininum*. North American breeding programs have produced selections of the northern highbush blueberry (*V. corymbosum*) that are planted in very acid soils and require a northern temperate zone. These varieties are suited to grow in the Pacific Northwest, upper Midwest and in the North East. Work from the University of California Agricultural and Natural Resources programs has selected southern highbush blueberry (*V. virgatum*) and rabbit eye blueberry (*V. ashei*) cultivars that are more tolerant of hot, dry conditions and higher pH and are well adapted to Central and Southern California. California produces blueberries on approximately 7300 harvested acres, most of which are in Tulare, San Joaquin, Fresno, and Kern counties. The value of the crop was reported at $204 million in 2019 which is 25% of US national production (USDA, 2019).

A serious blight of highbush blueberry with no known cause was first observed in the early 1970s in Sheep Pen Hill area of New Jersey and named Sheep Pen Hill virus (Stretch, 1983). The symptoms were blighting of flowers and new vegetative growth just prior to full bloom. The symptoms actively spread to all cultivars grown in the area and could lead to total fruit loss. Spread through propagating from infected plants was suspected.

A disease with similar symptoms was described in 1980s affecting the blueberry cultivar 'Berkeley' in western Washington (Bristow and Martin, 1987). Within a year, it was shown to be caused by a previously undescribed, graft transmissible virus in the genus Carlavirus, and the name Blueberry scorch was proposed (Bristow and Martin, 1988). Subsequently it was shown that it was the same pathogen as that responsible for scorch disease in New Jersey (Martin et al., 1992).

Carlaviruses are flexuous rods encapsidating a monopartite, positive-sense, single-stranded RNA genome. The type strain is **Car**nation **la**tent virus. Some species cause very mild symptoms or are completely symptomless; BlScV is exceptional in the genus as it causes severe disease. Carlaviruses produce particles in the cytoplasm of plant cells, singly or in masses, without forming any virus-specific inclusions. Carlaviruses are primarily transmitted non-persistently by aphids or by vegetative propagative with infected plant material. Some transmission occurs by contact of infected and healthy plants and by handling of such plants (Agrios, 2005).

Hosts: Sambucus nigra (elder berry), *V. corymbosum* (blueberry), *V. macrocarpon* (American cranberry), *V. membranaceum* (wild black huckleberry), *V. virgatum* (rabbit-eye blueberry) (CABI-CPC, 2021).

Symptoms: Symptoms can be variable depending on virus strain and cultivar infected. Symptoms can range from none (asymptomatic) to severe blighting of flowers and young leaves with twig dieback. Leaves of infected bushes can show marginal chlorosis or a red line pattern in late summer and fall. The blighted flowers can remain on the bush throughout the season and through the next dormant season. Plants with severe blighting produce little or no fruit and can have a scorched appearance. Virus infections can be latent for many years, depending on cultivar, and severity of expression can vary from year to year (Martin et al., 2012).

Transmission: The virus is spread primarily by aphids in a non-persistent manner, and an aphid control program can help limit spread in the field. Aphids can also transmit the virus to weeds including *Chenopodium quinoa* and *C. amaranticolor* and *N. occidentalis* (Cavileer et al., 1994; Lowery et al., 2005). Mechanical transmission has been shown by Lawrence and Hillman (1994) using infectious transcripts. Long distance spread is with infected nursery stock, which can be asymptomatic (Oudemans et al., 2011). While tolerant cultivars remain productive once infected, they are a source of inoculum for further disease spread. Symptomless but infected bushes rapidly disperse of BlScV and aphid vectors to new sites, including from residential plants to commercial plants. The aphid *Fimbriaphis fimbriata* appears to be the main vector of BlScV between plants in Pacific Northwest blueberry fields, but other species have not been tested (Bristow et al., 2000). This aphid is not known to be in California (K. Beucke, CDFA, pers. comm.)

Damage Potential: All highbush blueberry cultivars are susceptible to BlScV. Cranberry, wild black huckleberry, and elderberry are natural and symptomless hosts. Affected bushes of some cultivars can be productive for many years, while others decline over a few years, becoming less productive, and eventually dying. This variation in symptom expression has made field diagnosis difficult and growers may delay removal of infected bushes if they are still bearing fruit (Martin et al., 2012; Kalinowska et al., 2013).

In field and nursery experiments, Bristow et al., 2000 showed the disease can spread rapidly and radially from foci of infection, equally infecting in symptomatic and asymptomatic varieties. In Western Washington, aphids were the important means of transmission of BlScV to healthy blueberry plants in commercial fields. Most symptomatic varieties showed symptoms the year after infection, with many cultivars developing severe blighting of flowers and young leaves, with dieback of twigs. Berry yield was reduced by more than 85% in the third year of symptom expression.

Worldwide Distribution: Canada, Italy, Netherlands, Poland, Switzerland, United States: *Connecticut, Massachusetts, Michigan, New Jersey, Oregon, Washington* (EPPO, 2021; Kalinowska et al., 2013)

Official Control: Blueberry scorch virus is on the EPPO's A2 list for Egypt, Argentina, Brazil, Chile, Jordan, and Turkey. It's on the A2 list for the European Plant Protection Organization and is a quarantine pest in Morocco (EPPO, 2021). Blueberry scorch virus is on the USDA PCIT's Harmful organism list for Brazil, Chile, Ecuador, Egypt, Georgia, Japan, Republic of Korea, Peru, Taiwan and United Kingdom (USDA-PCIT, 2021). Michigan, Georgia, Washington and Oregon have similar quarantines for *Vaccinium* from all states, territories, and districts of the United States, (including internally) where BlScV occurs (excluding fruit). This quarantine requires official testing and certification that plants are free-from virus, or that plants are from areas surveyed and found free-from the virus (National Plant Board, accessed 7/13/21).

California Distribution: None

California Interceptions: None

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

Consequences of Introduction:

1) **Climate/Host Interaction:** This virus survives inside its host and vectors. It's likely to survive anywhere 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:** The host range is limited to *Sambucus* and *Vaccinium*

   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.

3) **Pest Reproductive Potential:** The virus reproduces inside of its host plants and disperses with aphid vectors that can fly. It can be asymptomatic or latent in propagative material, increasing the risk of movement to new areas.

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:** This disease has a very serious impact on plant vigor and fruit production for *V. corymbosum*. Although this species is not widely planted in California, commonly planted types varieties are also known to be susceptible. It is a quarantine pest for nursery stock in other states and countries. Testing and certification of nursery stock are important methods for preventing the accidental introduction of this virus to California. Participating in clean stock programs and improved certification systems produces higher quality plants that benefit fruit producers and consumers alike, but these programs are not mandatory.

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.

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 several native species of *Vaccinium* and *Sambucus* in California. Their susceptibility to BlScV is unknown, however, there is the threat that novel virus can move from cultivated fields into native stands with potentially devastating effects. Another scenario could have tolerant and asymptomatic native plants as a source of inoculum to susceptible crop plants. There is no treatment for infected plants.

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 scorch 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.

Blueberry scorch virus is not known to occur in California. No official samples have been submitted through nursery or phytosanitary inspections. A survey conducted by Martin and Tzanetakis (2018) between 2015-2017 did not detect this virus in California fields or nurseries.

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* ***= 14***

Uncertainty:

Most epidemiological information on BlScV is from the Pacific Northwest. California is not known to have the aphid vector that is present in Washington, but other species may also be able to spread this virus. Also California blueberry varieties may differ in susceptibility from Pacific Northwest varieties.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Blueberry scorch virus is A

References:

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

Bristow, P.R.; Martin, R.R. 1987. A virus associated with a new blight disease of highbush blueberry. Phytopathology, 77, 1721–1722.

Bristow, P.R.; Martin, R.R.; Windom, G.E. 2000. Transmission, field spread, cultivar response, and impact on yield in highbush blueberry infected with blueberry scorch virus. Phytopathology, 90, 474–479.

CABI Crop Production Compendium 2021. Alfalfa mosaic virus. https://www.cabi.org/cpc/datasheet/4346 . Accessed 2/26/2021

Calflora Database. *Vaccinium and Sambucus*. Accessed 1/31/2021. Berkeley, CA. calflora.org

Cavileer, T.D.; Halpern, B.T.; Lawrence, D.M.; Podleckis, E.V.; Martin, R.R.; Hillman, B.I. Nucleotide sequence of the carlavirus associated with blueberry scorch and similar diseases. J. Gen. Virol. 1994, 75, 711–720.

EPPO Global Database. 2021. https://gd.eppo.int/taxon/BLSCV0. Accessed 7/12/2021

Kalinowska, E., Paduch-Cichal, E. and Chodorska, M., 2013. First report of Blueberry scorch virus in elderberry in Poland. Plant disease, 97(11), pp.1515-1515.

Lawrence, D.M.; Hillman, B.I. 1994. Synthesis of infectious transcripts of blueberry scorch carlavirus in vitro. J. Gen. Virol., 75, 2509–2512.

Lowery, D.T.; French, C.J.; Bernardy, M. 2005.Nicotiana occidentalis: A new herbaceous host for Blueberry scorch virus. Plant Dis., 89, 205.

Martin, R.R.; MacDonald, S.G.; Podleckis, E.V. 1992. Relationships between blueberry scorch and Sheep Pen Hill viruses of highbush blueberry. Acta Hortic. 1992, 308, 131–139.

Martin, R.R., Polashock, J.J. and Tzanetakis, I.E., 2012. New and emerging viruses of blueberry and cranberry. Viruses, 4(11), pp.2831-2852.

Martin, R.R. and Tzanetakis, I.E., 2018. High risk blueberry viruses by region in North America; implications for certification, nurseries, and fruit production. Viruses, 10(7), p.342.

Oudemans, P.V., Hillman, B.I., Linder-Basso, D. and Polashock, J.J., 2011. Visual inspections of nursery stock fail to protect new plantings from Blueberry scorch virus infection. Crop protection, 30(7), pp.871-875.

Stretch, A.W. A previously undescribed blight disease of highbush blueberry in New Jersey. Phytopathology 1983, 73, 375.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. Blueberry scorch virus. Accessed 7/12/2021

Responsible Party:

Heather J. Scheck, Primary Plant Pathologist/Nematologist, CDFA/PHPPS ECOPERS, 2800 Gateway Oaks Suite 200, Sacramento, CA 95833 Phone: (916) 654-1017, permits[@]cdfa.ca.gov.

---

*Comment Period: 08/27/2021 through 10/11/2021

*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.

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: A