

California Pest Rating Proposal for Southern bean mosaic virus

Current Pest Rating: Z

Proposed Pest Rating: B

Realm: Riboviria; Kingdom: Orthornavirae;
Phylum: Pisuviricota; Class: Pisoniviricetes;
Order: Sobelivirales; Family: Sobemoviridae;
Genus: Sobemovirus

Comment Period: 03/16/2021 through 04/30/2021

Initiating Event:

In August 2018, a Monterey County agricultural inspector submitted an official sample of bean plants grown for seed as part of CDFA's phytosanitary field inspection program that certifies seed for export. Using ELISA, CDFA plant pathologist Tongyan Tian detected Southern bean mosaic virus (SBMV). Although there are historical records of SBMV in California dating back to the 1940's (Zaumeyer and Harter, 1943), this was the first modern detection. It was assigned a temporary Z rating. The risk to California from Southern bean mosaic virus is described herein and a permanent rating is proposed.

History & Status:

Background: The genus Sobemovirus contains 14 species of viruses that are transmitted by various insect vectors and seed and are readily transmitted mechanically with infected plant sap. **Southern bean mosaic** is the type species of the genus and is vectored by bean beetles. The genome is linear, single-stranded, plus-oriented, single-component RNA encapsidated in small icosahedral particles (Somera et al., 2015). Subcellularly, particles of sobemoviruses have been detected in the cytoplasm and vacuoles of infected cells and they form crystalline arrays in the cytoplasm (Tamm and Truve, 2020). The first sobemovirus to be described was SBMV from beans in Louisiana and California (Zaumeyer and Harter, 1943). Since then it has been observed that sobemoviruses occur worldwide. For most, their natural host range is quite narrow. For SBMV, the natural host range is limited to beans. The two most important vectors, Mexican bean beetles, *Epilachna varivestis*, and bean leaf beetles, *Cerotoma trifurcata*, are not known to be in California.

Hosts: *Glycine max* (soybean), *Phaseolus vulgaris* (common bean), *Vigna mungo* (black gram), *Vigna unguiculata* (cowpea) (CABI-CPC, 2021).

Symptoms: The symptoms of sobemoviral infections varies from mild to severe chlorosis, mosaic, and mottling. In addition, stunting, leaf rolling, leaf narrowing, necrotic lesions, vein clearing, and/or sterility have been documented (Mulenga et al., 2020). However, some infections have been reported to be symptomless (Foster and Jones, 1979).

Transmission: Initial infections in new areas are usually due to transmission of the virus from seeds, with subsequent spread by beetles. The main transmission mechanism of sobemoviruses is mechanical wounding of host plants. When bean beetles feed on the leaves of virus-infected bean plants, virus enters their midgut. The virus is stored in the caeca of the midgut and enters the hemolymph, which acts as a reservoir for virus. During feeding, the beetles cause wounds to the leaves and regurgitate large amounts of virus into those wounds (Kopek and Scott, 1983). SBMV can also be passed from the mother plant into the seed coats, and to a lesser degree, into the embryos (Uyemoto and Grogan, 1977). In experimental conditions, sobemoviruses are easily transmitted by sap-inoculation. Their particles are typically very stable and with a high thermal inactivation point. SBMV can be transmitted by soil-borne bean plant debris (Teakle and Morris, 1981).

Damage Potential: Infection causes leaf symptoms and reduced bean yields. Incidence in fields can reach 100% (Mulenga et al., 2020). Seeds from infected plants produce lower numbers of seed and they are lighter weight. An average of 17.4% of the pods from infected plants did not produce seed (Morales and Castano, 1985). SMMV is a pest of quarantine significance for trading partners and on CDFA's list of diseases for phytosanitary field inspection.

Worldwide Distribution: Africa: *Benin, Côte d'Ivoire, Ghana, Morocco, Nigeria, Senegal, Togo* and *Zambia*. Asia: *China, India, Iran, and Pakistan*. Europe: *France and Spain*. North America: *Costa Rica, Mexico, Nicaragua, and United States* (Arkansas, California, Florida, Georgia, Louisiana, Maryland, Michigan, South Carolina, Tennessee, Texas, Virginia), South America: *Brazil, Colombia, and Venezuela* (CABI- CPC, 2021; Mulenga et al., 2020).

Official Control: USDA-PCIT's harmful organism list for Argentina, China, Georgia, Japan, Republic of Korea, New Zealand, Paraguay, Uruguay. The EPPO has it on their A1 list for Argentina, Paraguay, and Jordan; and the A2 list for China. Bean southern mosaic virus is a pest of concern for beans (common, adzuki and mung) in CDFA's Phytosanitary field inspection manual (USDA-PCIT, 2021; EPPO, 2021; CDFA Phytosanitary field inspection manual, 2021).

California Distribution: There has been one recent detection in Monterey County (see 'initiating event').

California Interceptions: None.

The risk Southern bean mosaic virus would pose to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** Since the virus lives inside its host plants and seeds, it is likely to survive everywhere its host are grown in the state.

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 natural host range is limited to *Phaseolus* spp.

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:** This virus multiplies in its hosts and is spread through infected sap. It can also be seed borne. It survives inside its beetle vectors, but those vectors are not known to be in California.

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:** Significant yield losses have been reported from SBMV. It is also a pest of quarantine significance. It is vectored by leaf feeding beetles.

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.
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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 no reported environmental impacts

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.

Consequences of Introduction to California for Southern bean mosaic virus: Medium

Add up the total score and include it here. **10**

- 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 'low'. This virus has been found recently in only one bean field in Monterey County. Older literature lists occurrence in California but does not delimit by counties or regions.

Score: -1

- 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 = 9*

Uncertainty:

SBMV seems to be relatively uncommon in California despite it was first described here in 1943. Accidental introduction and establishment of leaf feeding beetle vectors could increase its incidence and severity. Additional vectors could also be identified in the future.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for **Southern bean mosaic virus** is **B**.

References:

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Responsible Party:

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***Comment Period: 03/16/2021 through 04/30/2021**

***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](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
