cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Alfalfa mosaic alfamovirus

Current Pest Rating: C

Proposed Pest Rating: C

Comment Period: 3/19/2020 through 5/3/2020

Initiating Event:

On August 9, 2019, USDA-APHIS published a list of "Native and Naturalized Plant Pests Permitted by Regulation". Interstate movement of these plant pests is no longer federally regulated within the 48 contiguous United States. There are 49 plant pathogens (bacteria, fungi, viruses, and nematodes) on this list. California may choose to continue to regulate movement of some or all these pathogens into and within the state. In order to assess the needs and potential requirements to issue a state permit, a formal risk analysis for Alfalfa mosaic virus is given herein and a permanent pest rating is proposed.

History & Status:

Background: Many plant viruses have split genomes, consisting of two or more distinct nucleic acid strands encapsidated in different-sized particles made of protein subunits. Alfalfa mosaic virus (AMV) contains three genomic and one subgenomic single stranded RNAs, giving four components of different sizes. AMV is the type species of the monotypic genus Alfamovirus. AMV is unique from other members of the family Bromoviridae in that it has bacilliform rather than isometric particles. In Europe, the virus was previously known as Lucerne mosaic virus but the name Alfalfa mosaic virus now has precedence (Agrios, 2005).

AMV was first reported in alfalfa (*Medicago sativa*) in the United States by Weimer in 1931.

Hosts: AMV has a very wide host range and is reported to infect at least 697 species in 167 genera of 71 families (Edwardson and Christie, 1997; CABI-CPC, 2020; Gibbs, 1987).

Symptoms: Symptoms of AMV may differ according to the strain of virus, genotype of host, and/or time of year. In general AMV causes various mosaic, mottles, and flecking of leaves. Symptoms can range from a very mild yellow and green mottle to a bright yellow mottle to necrosis and death of the

plant. There can also be dwarfing and leaf distortion and infected plants are predisposed to drought or freeze injury. Imporant hosts in California include tomatoes where leaf symptoms include bright yellow blotches with some mottle, and with leaves eventually developing a bronze discoloration. Internal phloem tissue becomes necrotic, including the phloem in the roots. There can be necrotic rings and spots on the fruit and some fruit may develop a solid brown necrosis over the surface (Davis et al., 2013). On peppers, typical symptoms a distinct yellow or whitish mosaic on leaves. Fruits may be stunted and misshapen (Koike et al., 2016). On alfalfa, virus infection may cause yellow mottling or streaking on leaves, but at other times the symptoms are masked and leaves appear normal (Davis et al., 2017). On potato, the disease is called “calico”. Calico symptoms are pale to bright yellow blotches on leaves. Some strains cause severe stunting and necrosis of stems and tubers. Dry, corky areas or rusty brown patches develop within tubers (Nunez and Aegeter, 2019). On lettuce, symptoms include bright yellow mosaic or calico pattern on leaves. Older leaves develop a yellow mottle with enlarged veins (Koike and Turini, 2017).

Transmission: Transmitted by aphids; *Myzus persicae* and *Acyrthosiphon pisum* are the main vectors, but many other aphid species can transmit the virus. AMV is transmitted in a non-persistent manner. It can also be transmitted by mechanical inoculation and by grafting, but it is not transmitted by contact between plants. Seed transmission can reach 50% in alfalfa seeds, plus it can be transmitted by pollen to new seeds.

Transmission of the virus is most likely to occur when aphids migrate into potato, tomato, or pepper fields from nearby alfalfa or clover fields. Infection often occurs on edges of fields located near alfalfa. Little or no secondary spread occurs within the potato or vegetable fields. Seed transmission has been demonstrated in alfalfa but not in lettuce. AMV survives in infected seed or plant hosts; it does not persist in stubble or soil (CABI-CPC, 2020).

Damage Potential: Damage to individual alfalfa plants may be severe but AMV rarely causes field-wide or economic losses for plants. Detection of the virus in mother plants or seed tests can prevent the export of alfalfa seed from infected fields to trading partners who have phytosanitary standards to exclude it. When aphids that feed on alfalfa move to other crops, they can transmit AMV to economically important crops. For example, AMV can cause economic losses in tomatoes where it causes plant death and potatoes where the tubers are disfigured. AMV is considered a minor disease on lettuce but infected plants may be stunted (Davis et al., 2013, 2017; Koike and Turini, 2017; Nunez and Aegeter, 2019).

Worldwide Distribution: widespread worldwide

Official Control: Alfalfa mosaic virus is on the Harmful Organism list for Bangladesh, Egypt, French Polynesia, Georgia, Guatemala, Honduras, Indonesia, Japan, Madagascar, Nicaragua, Panama, Philippines, Syrian Arab Republic, Taiwan, Thailand, Timor-Leste, and Viet Nam (USDA-PCIT, 2020). In the CDFA Phytosanitary field inspection manual, it is a pest of concern for alfalfa as many trading partners request that alfalfa seed be certified on phytosanitary certificates as free-from Alfalfa mosaic virus.

California Distribution: Central Valley, Imperial Valley, south and central coastal counties (French, 1989).

California Interceptions: None.

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

Consequences of Introduction:

1) **Climate/Host Interaction:** This virus can survive in a range of climates statewide, including hot deserts, especially where the host is alfalfa. There have also been many hundreds of detections in the central valley on alfalfa and on vegetables and ornamentals on the south and central coasts.

   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 very large, including herbacious and woody hosts, crop plants and weeds.

   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.

3) **Pest Dispersal Potential:** Alfalfa mosaic virus has a wide host range including many common weed species. It is vectored by multiple species of aphids and moves with infected seed.

   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:** The economic impacts are the loss of yield and the loss of seed export markets. Alfalfa mosic 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:** Alfalfa mosaic has hosts that are woody ornamentals. If they are installed in landscapes, they are a persistent source of inoculum to annual crops.

Environmental Impact: 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: 2
- 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 Alfalfa mosaic 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.

Evaluation is 'high': Alfalfa mosaic is widespread in California on multiple hosts.

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* **= 11**

Uncertainty:

None.

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for Alfalfa mosaic virus is C.**

References:

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Responsible Party:

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*Comment Period: 3/19/2020 through 5/3/2020

*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: [C]