cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Dasheen mosaic virus

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Viruses and viroids

Category: Riboviria, Category: Orthornavirae,
Phylum: Pisuviricota, Class: Stelpaviricetes,
Order: Patatavirales, Family: Potyviridae,
Genus: *Potyvirus*

Comment Period: 07/27/2022 through 09/10/2022

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from Dasheen mosaic virus (DsMV) is described herein and a permanent rating is proposed.

History & Status:

Background: Dasheen mosaic virus (DsMV) was first described as a member of the viral genus *Potyvirus* from dasheen (*Colocasia esculenta*) and related plants in Florida (Zettler et al., 1970). This genus is in the family Potyviridae, a family of positive-strand RNA viruses. Members are notable for forming cylindrical inclusion bodies in infected cells that can be seen with light microscopy, and the genus Potyvirus contains many important plant pathogens. Named after Potato virus Y, "Pot-y-virus" particles are flexuous and filamentous and composed of ssRNA and a protein coat (Murphy et al., 2012). Most diseases caused by potyviruses appear primarily as mosaics, mottling, chlorotic rings, or color break on foliage, flowers, fruits, and stems. Many cause severe stunting of young plants and drastically reduce yields with leaf, fruit, and stem malformations, fruit drop, and necrosis (Brunt et al., 1996). The disease was first reported in California by Stoner (1964) on *Philodendron selloum* (split leaf philodendron).

Hosts for Dasheen mosaic virus are mainly in the family Araceae, which holds monocotyledonous flowering plants in which flowers are borne on a type of inflorescence called a spadix. The spadix is

usually accompanied by, and sometimes partially enclosed in, a spathe or leaf-like bract. Also known as the arum family, members are often colloquially known as aroids. Although dasheen mosaic potyvirus has been reported from all regions of the world in which members of the Araceae are cultivated as crops or ornamentals, the phytosanitary risk seems to be low (Zettler et al., 1986, 1989).

Members of the Araceae are widespread throughout the world but are most abundant in the tropics. This family has close to 3000 species distributed in over 100 genera (Mabberley 1989). Edible members of the family Araceae include *Amorphophallus paeoniifolius* (elephant foot yam), *Colocasia esculenta* (kochu, taro, or dasheen), *Xanthosoma* (cocoyam, tannia), *Typhonium trilobatum* (Bengal arum) and *Monstera deliciosa* (Mexican breadfruit). The main edible part is the corm, which is high in starch; sometimes leaves and flowers also have culinary use. Many more species are grown as ornamental foliage plants and they are vegetatively propagated. The edible aroids are tremendously important to tropical people as staple starch-food crops that can withstand tidal waves and hurricanes. Popular ornamentals grown as house or garden plants are *Aglaonema, Caladium, Dieffenbachia, Philodendron*, and *Zantedeschia*.

Hosts: Aglaonema spp., *Alocasia* spp., *Amorphophallus* spp., *Anthurium* spp., *Caladium* spp., *Colocasia* spp., *Colocasia esculenta* (taro), *Cyrtosperma merkusii* (giant swamp taro), *Dieffenbachia* spp. (dumbcanes), *Nelumbo nucifera* (sacred lotus), *Philodendron* spp., *Scilla* spp., *Spathiphyllum* spp., *Typhonium trilobatum*, *Vanilla tahitensis, Xanthosoma* spp. (cocoyam), *Xanthosoma sagittifolium* (elephant ear), and *Zantedeschia* spp. (calla-lilies)

Symptoms: Expression of symptoms is often intermittent or seasonal. *Dieffenbachia* spp. show symptoms most often during spring and autumn (Zettler and Hartman, 1987). Young *Philodendron selloum* seedlings develop systemic vein chlorosis 2-3 weeks after inoculation. Seedlings grew slowly, and the parenchyma and chlorenchyma of diseased leaves possessed fewer starch grains. Hypertrophy and hyperplasia of chlorenchyma, collenchyma and parenchyma occurred in rugose areas of infected leaves. This was described as severe mosaic and deformation of leaves (Stoner, 1964).

Foliar mosaic symptoms often appearing as localized "feathering" patterns along the veins are observed on *Caladium hortulanum, Colocasia esculenta, Philodendron* spp., or *Xanthosoma* spp. (Zettler et al., 1978). A single plant may have leaves with striking pale or whitish calico feathering, some with severe or slight vein banding, and others with no visible symptoms. It is not a lethal disease but reduces growth and corm yields. Infected corms do not show symptoms (Nelson, 2008).

Transmission: This virus is aphid-transmitted in a non-persistent manner by the green peach aphid (*Myzus persicae*) and the cowpea aphid (*Aphis craccivora*) (Buddenhagen et al., 1970). Both aphids are widespread in California. DsMV does not seem to be transmitted by the banana aphid (*Pentalonia nigronervosa*), which often colonizes and feeds on members of the Araceae (Morales and Zettler, 1977), or the bird cherry-oat aphid (*Rhopalosiphum padi*) (Nelson, 2008). DsMV is not known to be seed or pollen transmitted (Zettler et al. 1970) but is spread from mother plant to daughter plant by vegetative propagation (Zettler et al., 1970; Zettler and Hartman, 1987). The virus can be spread mechanically by plant sap during any cutting operation.

Damage Potential: The pathogen infects leaves, stems, and petioles. The disease results in reduced photosynthesis, reduced corm size or yield. The reduction in leaf number or size, the deformation of leaves, and stunting of plants can render ornamental hosts unmarketable. DsMV is especially threatening to aroid nurseries where plants are grown vegetatively from cuttings or corms. Disease control is achieved through the production of virus-free planting materials derived from tissue culture. The majority of taro plants in Hawai'i are probably infected with DsMV. In a survey in the early 1990s, DsMV was detected in 14 of 15 commercial taro fields, in all 9 commercial taro cultivars surveyed, and in 163 of 186 taro accessions indexed. The green peach aphid (*Myzus persicae*) was identified as the vector in Hawai'i (Nelson, 2008).

Worldwide Distribution: Africa: *Egypt, Ethiopia, Nigeria, South Africa*. Asia: *China, India, Japan, Philippines, Taiwan, Vietnam*. Europe: *Belgium, Bosnia and Herzegovina, Denmark, Italy, Netherlands, United Kingdom*. North America: *Costa Rica, Cuba, Dominican Republic, Jamaica, Martinique, Nicaragua, Puerto Rico, Trinidad and Tobago, United States* (California, Florida, Hawaii, Kansas, Louisiana, Nebraska, South Carolina). Oceania: *American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu*. South America: *Brazil, Venezuela* (CABI-CPC, 2022).

Official Control: Dasheen mosaic is on the USDA PCIT's harmful organisms list for Ecuador, French Polynesia, Georgia, Guatemala, Honduras, Israel, Japan, Mexico, Nicaragua, Panama, and Peru. It is a quarantine pest in Mexico (EPPO, 2022; USDA PCIT, 2022).

California Distribution: Since 2005, the virus has been found multiple times in Monterey and Santa Cruz in calla lily bulbs during phytosanitary testing prior to international export. It has also been detected on *Amorphophallus paeoniifolius* from a botanical collection in San Diego County. Older records are from Orange, Shasta, and San Diego counties on *Dieffenbachia* spp., *Philodendron* spp., *Scilla* spp., and *Zantedeschia* spp. (French, 1989).

California Interceptions: None

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

Consequences of Introduction:

1) **Climate/Host Interaction:** DsMV survives as viable virus particles within living plant tissues, or for short periods of time in association with the mouthparts of aphid species or as infested sap on tools. It is likely to be found in any climate that supports the growth of its hosts, most notably in California it is found in Calla lilies growing in Monterey and Santa Cruz counties.

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 is mainly ariods but can infected plants in several families

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:** DsMV is transmitted by several species of aphids in a non-persistent manner. It spreads mainly by using suckers, corms, or infected cuttings used for propagation.

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:** Infected plants should be destroyed as there is no curative treatment for the virus. It is vectored by aphids and a quarantine pest in several countries.

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:** No environmental impacts have been reported

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

Environmental Impact: 1

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 Dasheen 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 'medium'.

Score: -2
-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:

None

Conclusion and Rating Justification:

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

References:

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***Comment Period: 07/27/2022 through 09/10/2022**

***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.

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