

California Pest Rating Proposal for

Canna yellow mottle virus

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Viruses and viroids, Category: Riboviria,
Category: Pararnavirae, Phylum: Artverviricota,
Class: Revtraviricetes, Order: Ortervirales,
Family: Caulimoviridae, Genus: Badnavirus

Comment Period: 05/31/2022 through 07/15/2022

Initiating Event:

Canna yellow mottle virus (CaYMV) was assigned a C-rating in 2007 by the California Department of Food and Agriculture (CDFA), Plant Health and Pest Prevention Services, but it has not gone through the current pest rating procedure. The risk to California from Canna yellow mottle virus is described herein and a permanent rating is proposed.

History & Status:

Background: Canna lilies (genus *Canna*) are herbaceous flowering plants. They are not true lilies; they are in the order Zingiberales and are the only genus in the family Cannaceae. Their closest relatives are ginger, banana, heliconia and strelitzia (Tanaka, 2001). Although they are tropical, cultivars have been developed for temperate climates. They are tall and grown mainly for the ornamental value of their flowers and foliage. The flowers are usually red, orange, yellow or combinations of these colors. The leaves are broad, like banana leaves, and are solid green, bronze, deep burgundy or green and can be variegated with white, yellow or red. They are also a source of starch for human and animal consumption (Maas-Van de Kamer and Mass, 2008). Cannas can be grown from seed, but nursery production is generally started from dormant rhizomes which produce clones of named cultivars (Verchot and Webb, 2015). This type of clonal production is high risk for the spread of viral diseases.

CaYMV was first described infecting *Canna* spp. in Japan by Yamashita et al. in 1979, with a first report in North America by Lockhart in 1998 in Minnesota. The disease is now found worldwide including in Italy, the Netherlands (Marino et al., 2008), India (Kumarietal, 2014), and Kenya (Agneroh et al., 2015).

CaYMV infects *Canna spp.* in several states in addition to Minnesota, including California (CDFA PDR database, 2022), Florida (Momol et al., 2004), and Washington (Pappu et al., 2008). There is a report of CaYMV infecting flowering ginger, *Alpinia purpurata*, in Hawaii (Zhang et al., 2017).

Plant pararetroviruses (Family: Caulimoviridae) contain a double-stranded DNA genome and replicate through an RNA intermediate, like retroviruses. However, in contrast to those, for pararetroviruses, genome integration is not part of the standard replication cycle. Instead, they accumulate as minichromosomes in the host nucleus. *Badnavirus* is one of eight genera in the family Caulimoviridae and contains more than thirty-two species. They infect a broad range of economically important crop plants all over the world. Virions are found in the host cytoplasm and sometimes in vacuoles. The genome consists of a single circular molecule of double-stranded open circular DNA.

Badnaviruses are also known to be present as integrated sequences in some host plant genomes and are then referred to as endogenous badnaviruses. The integration takes place by illegitimate recombination into host genomes, and their presence is not always associated with disease. In some cases, these copies can give rise to systemic virus infection by recombination events; this can be induced by abiotic stress, for example, that associated with *in vitro* tissue culture process and interspecific crosses. This tendency to become endogenous makes disease diagnosis and management more difficult (Bhat et al., 2016).

Hosts: Alpinia purpurata (red ginger), *Canna flaccida*, *Canna indica*, *Piper betel* (betel vine) (Larrea-Sarimento et al., 2020; Kumari et al., 2014; Kumari and Raj, 2015).

Symptoms: Symptoms are variable depending on the host, cultivar, and environmental conditions and can include foliar chlorotic and necrotic mottles, venial streaking, deformation of leaves, reduced internode length leading to stunting, leaf shredding, and flower color breaks (Momol et al., 2004; Yamashita et al., 1985; Lockhart, 1988). In most cases symptoms are mild to moderate and at times, they can be asymptomatic. Symptoms can re-emerge and severity can increase when plants are subjected to abiotic stress, temperature shifts and or under low levels of nutrients (Bhat et al., 2016).

Transmission: A majority of badnaviruses infect perennial hosts that are propagated vegetatively, and the primary spread of CaYMV occurs through vegetative propagation of infected rhizomes for *Canna* spp. (Chauhan et al., 2015) or vine cuttings for *Pepal betel* (Kumari et al., 2015). Some badnaviruses can be spread by mealybugs, or are transmitted semi-persistently by aphids, but there is no known vector for CaYMV (Momol et al., 2003). Seed transmission has not been documented.

Damage Potential: The incidence of symptomatic canna in one Florida nursery survey was more than 60% of approx. 18,000 plants (Momol et al., 2004). Since symptoms can be mild, or at times an infected block can appear asymptomatic, many infected plants are sold only to relapse into more severe symptoms of stunting, with a lack of flowers, and leaf shredding. There are no treatments for this virus and current management requires the destruction of the plants and using only virus-free rhizomes for propagation (Agneroh et al., 2015).

Worldwide Distribution: Australia, China, Kenya, India, Italy, Japan, United States (California, Hawaii, Minnesota, Washington) (CABI- CPC).

Official Control: CaYMV is on the USDA PCIT harmful organisms list for Georgia, Japan, and Taiwan. There are authorized mitigating regulatory actions for California nursery stock that require that all nursery stock shall be kept “commercially clean” in respect to established pests of general distribution. “Commercially clean” is defined as the pests being under effective control and present only to a light degree; only a few of the plants in any lot or block of nursery stock can show any infection, and none can show more than a few individual infestations of any plant disease. Applying this standard to plants that are infected with a systemic virus requires crop destruction as they cannot be lightly infected, the number of individual virions cannot be enumerated, and the virus cannot be eliminated post infection.

California Distribution: CaYMV is widespread in the California nursery trades. More than 135 official samples have been tested and found positive by the CDFA Plant Pest Diagnostics Center. The samples have come from Humboldt, Orange, San Diego, Santa Barbara, and Ventura counties.

California Interceptions: None

The risk Canna yellow mottle virus would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** The disease is likely to be found in any climate where its hosts can grow. In colder parts of the state, cannas are grown as annuals where rhizomes need to be lifted and protected over the winter. But in frost free areas, they grow and flower year-round.

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 genus *Canna* is the main host. There are also reports from red ginger and betel vine.

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.
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- 3) Pest Reproductive Potential:** No vectors have been identified for this virus, but mealybugs or aphids are possible vectors for Badnaviruses. CaYMV spread by propagation from infected mother plants. This virus could be eliminated by clean nursery stock programs with indexing.

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:** Plants are stunted, flower production is reduced, and leaves are damaged by this virus. It is a quarantine disease in three countries.

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.
- Medium (2) causes 2 of these impacts.
- **High (3) causes 3 or more of these impacts.**

- 5) Environmental Impact:** This pest impacts ornamental nurseries and landscape plantings

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

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 Canna yellow mottle 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.

This virus was first detected in Santa Barbara County in 2004 where it was already common in nursery stock. From 2004 to 2006 it was Q-rated and eradicated when found in nursery blocks, but there were no detection surveys or trace backs. It is found in many popular cultivars including 'Durban', 'Tropicana', 'Panache', 'Pretoria', 'Transvaal Beauty', 'Tropical Sunrise' and 'Zulu pink'.

Evaluation is 'high'.

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 = 7*

Uncertainty:

Multiple viruses infect canna and the symptoms are not diagnostic. Canna yellow streak virus is present in other parts of the United States and may also be in California.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for **Canna yellow mottle virus is C.**

References:

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Responsible Party:

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***Comment Period: 05/31/2022 through 07/15/2022**

*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](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.
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❖ 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
