CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Citrus yellow vein clearing virus

Current Pest Rating: None

Proposed Pest Rating: A

Kingdom: Viruses and viroids, Category: Riboviria,
Order: Tymovirales, Family: Alphaflexiviridae,
Genus: *Mandarivirus*

Comment Period: 09/24/2021 through 11/08/2021

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from Citrus yellow vein clearing virus (CYVCV) is described herein and a permanent pest rating is proposed.

History & Status:

Background: A yellow vein clearing disease of citrus was first reported in lemons and sour oranges from Pakistan in 1988 (Catara et al., 1993). Yellow vein clearing disease is caused by Citrus yellow vein clearing virus (CYVCV), which is a positive-sense RNA virus and a putative member of the family Alphaflexiviridae, genus *Mandaraivirus*, (Loconsole et al., 2012). There are three known Mandariviruses, all primarily pathogens of citrus.

Citrus is the main host of CYVCV. Infected plants can be symptomless depending on the citrus species, cultivar or hybrid, but symptoms of severe yellow vein clearing and leaf distortion, occasionally with ringspots and veinal necrosis, are expressed in lemon and sour orange (Chen et al., 2014; Zhou et al., 2017; Loconsole et al., 2012). In addition to Pakistan, it has been detected in Turkey, India, Iran and China. CYVCV was first found in China in 2009 on lemons and has spread rapidly; it is now widely distributed and considered to be the most serious disease affecting lemon production in that country (Zhou et al., 2016; Liu et al., 2020). The disease is spread in citrus through vegetative propagation of infected scion buds, or infected rootstocks, but also by mechanical inoculation with sap extracts (Alshami et al., 2003). A new report from Turkey (Afloukou and Önelge, 2020) describes natural infection of wild grapevine (*Vitis vinifera*) by CYVCV. The grapevines exhibited leaf necrosis, small leaves, and shorten internodes, and were found climbing citrus trees that tested positive for CYVCV.

Transmission of the virus from citrus-to-citrus, by the citrus whitefly, *Dialeurodes citri*, has been described in China (Zhang et al, 2019). This whitefly is widespread in California on citrus, gardenia, ash, fig, and pomegranate. Spirea aphid (*Aphis spiraecola),* cowpea aphid (*A. craccivora),* and melon aphid*, (A. gossypii)*, have also been proven to be vectors under controlled conditions (Zhang et al., 2018; Afloukou et al., 2021). These aphids are widespread on citrus, ornamentals, and stone fruit. All four known insect vectors have a C-rating in California (CDFA PDR database).

Hosts: The disease primarily affects citrus, including *Citrus aurantium* (sour orange), *C. latifolia* (Tahitian lime), *C. limon* (lemon), *C. maxima* (pomelo), *C. medica* (citron), *C. reticulata* (mandarin), *C. sinensis* (orange), *C. x paradisi* (grapefruit), *C. takan* (takan), *C. unshiu* (satsuma), *C. x limonia* (mandarin lime), *C. x nobilis* (tangor), and *P. trifoliata* (trifoliate orange). Herbaceous and weed hosts include *Chenopodium quinoa* (quinoa),*Malva sylvestris* (common mallow), *Phaseolus vulgaris* (common bean), *Ranunculus arvensis* (Corn buttercup), *Sinapis arvensis* (wild mustard), *Solanum americanum* (American black nightshade), and *Solanum nigrum* (black nightshade). *Vitis vinifera* (grapevine) is a recently reported host (CABI-CPC, 2021).

Symptoms: Symptoms from CYVCV include yellowing of the veins and veinlets, and water soaking of the veins on ventral side of leaves. Symptoms in susceptible varieties including lemons are strong yellow vein clearing, leaf distortion, and occasionally ringspots and veinal necrosis (Loconsole et al., 2012). Affected trees show poor growth and reduced fruit production (Alshami et al., 2003). CYVCV detections from weed species including *Malva sylvestris*, *Solanum nigrum*, *Sinapis arvensis*, and *Rananculus arvensis*, are largely symptomless (Önelge et al., 2016). The symptoms on *Vitis vinifera* are leaf necrosis, small leaves, and shortened internodes (Afloukou and Önelge, 2020).

Transmission: This disease can be graft transmitted, and mechanically inoculated with infected sap which can occur with pruning. It can also be transmitted citrus-to-citrus by citrus whiteflies (Zhang et al., 2019) and from citrus to other hosts by aphids (Zhang et al., 2018; Afloukou et al., 2021) and by mechanical inoculations of sap extracts onto herbaceous indicator hosts. Long distance spread is with the movement of infected planting material. CYVCV is frequently latent in most sweet orange, pummelo, tangerine, and mandarin varieties, and propagation of asymptomatic but infected plant material can exacerbate the dissemination of CYVCV.

Damage Potential: CYVCV is an emerging disease causing escalating economic losses in multiple citrus species and varieties, especially lemons. The disease seems to be spreading rapidly in Pakistan, India, Turkey, China, and Iran (Cui et al., 2018; Zhou et al., 2016). It can severely affect the growth and fruit yield of Eureka lemon (Chen et al., 2014). There is also potential to cause damage to grapevines. Three of the known vectors are already widespread in California.

Worldwide Distribution: China, India, Iran, Pakistan, and Turkey (CABI-CPC, 2021).

Official Control: USDA maintains a Federal Foreign Quarantine against citrus nursery stock. CDFA has a State Exterior Quarantine against citrus pests, and this includes any plant disease pest of citrus which does not occur or is not generally established in California (3250). Citrus yellow vein virus is on the USDA's harmful organism list for Georgia, Japan, and Taiwan (USDA PCIT, 2021).

California Distribution: None

California Interceptions: None

The risk Citrus yellow vein clearing virus would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This disease is likely to occur in any climate where its hosts can establish. This includes any part of California suitable for citrus or grapes.

   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 mainly citrus, but grapevines and some herbaceous hosts can also be infected. Their role in disease epidemiology is unknown.

   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 replicates inside its hosts. It can be dispersed with movement of infected planting material or with flying insect vectors.

   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 causes significant damage to citrus, including yield loss.

   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:** Weedy hosts including mallow, mustard and nightshades are widespread in California. Wild grapevines have been found infected with CYVCV in Turkey. There is no treatment for infected plants. CYVCV is a quarantine pest in the United States and if detected, would likely trigger treatments for vectors.

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

Environmental Impact: A, D, 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 Citrus yellow vein clearing 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.

There have been no detections or interceptions of this virus in California

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 =*

Uncertainty:

Four known vectors of this disease are already widespread and not under quarantine regulation in California. It is possible that additional vectors will be identified for spread from citrus to citrus, and from citrus to herbaceous hosts. It is also possible that more hosts will be identified in the future; grapevines were confirmed as hosts recently.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Citrus yellow vein clearing virus is A.

References:

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***Comment Period: 09/24/2021 through 11/08/2021**

***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
