CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Citrus tatter leaf virus

(a strain of Apple stem grooving virus)

Current Pest Rating: C

Proposed Pest Rating: C

Realm: Riboviria, Kingdom: Orthornavirae,
Phylum: Kitrinoviricota, Class: Alsuviricetes, Order: Tymovirales
Family: Betaflexiviridae, Subfamily: Trivirinae, Genus: Capillovirus

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Comment Period: 08/26/2021 through 10/10/2021

Initiating Event:

A pest rating has not been written for this pathogen. The risk to California from Citrus tatter leaf virus is described herein and a permanent rating is proposed.

History & Status:

Background: Citrus tatter leaf virus (CiTLV) was first described in California in Meyer lemon orchards (*Citrus limon* × *C. sinensis*) in 1908 (Wallace and Drake 1962). Meyer lemon was introduced into the United States from China in 1906, and it is assumed that China is the origin point for this virus (Miyakawa and Ito, 2000). Garnsey reported the virus in Meyer lemons in Florida in 1964, and it is also found in Texas (Herron and Skaria 2000). To date it has been reported in many citrus growing countries including Australia, Cyprus, Korea, Nigeria, Japan, India, Turkey, South Africa, and China (Altas et al., 2019).

The Capillovirus genus includes species that infect pome fruits, stone fruit, citrus, currents, and pear. They have non-enveloped, flexuous, filamentous, linear ssRNA (+) genomes. Apple stem grooving virus (ASGV) is the type member of the group and there are three other recognized species: Cherry virus A, Currant virus A, and Mume virus A. ASGV naturally infects pears, but different strains have been reported from kiwi, apple, Japanese apricot, lily, and citrus. Evidence based upon serology and genome sequencing suggests that ASGV and CiTLV are very closely related, and some consider CTLV to be a strain of ASGV (Ohira et al., 1994).

Disease symptoms associated with the Capilloviruses are primarily abnormal graft unions, stem pitting, chlorotic leaf spots or patterns, and sometimes a black necrotic leaf spot disease. Citrus tatter leaf virus isolated from Meyer lemons from California induces bud union incompatibility of citrus trees when grafted on trifoliate and trifoliate hybrid rootstocks (Tatineni et al., 2009). CiTLV can be transmitted through sap experimentally to at least 19 non-citrus hosts and is mechanically transmissible to citrus with knife blades used in pruning or grafting, or by leaf abrasions (Garnsey, 1974). There are no reports of seed or vector transmission, and little is known about the role of latent and herbaceous hosts (Harron and Skaria, 2000).

Hosts: Almost all citrus plants can be hosts, but the majority are symptomless. Trifoliate orange, (*Poncirus trifoliata)* is immune or highly resistant, but its hybrids can show symptoms after infection from diseased scions or budwood (Wallace and Drake, 1963)

Symptoms: Susceptible citrus trees include *Citrus excelsa*, Troyer citranges (*Poncirus trifoliata x C. sinensis)*, citrumelos (*P. trifoliata x C. paradisi*) and other *P. trifoliata* hybrids. These develop chlorotic leaf symptoms and deformed leaf shapes (so-called tatter leaf), but plants often recover. Stems of citrange plants may be deformed and have a zigzag growth pattern with chlorotic areas on the stem. Citranges and citrange hybrids are show internal stem pitting. Infected latent hosts that are grafted on rootstocks of *P. trifoliata* or its hybrids can develop a bud-union crease, seen as a yellow to brown line, observed 1 year after grafting when the bark is removed. Affected plants become stunted, chlorotic and can experience over blooming, along with early maturing of fruit. Often the scion dies, with rootstock suckers then taking over (Altas et al., 2019; CAB-EPPO, 2021)

Transmission: This virus is mainly transmitted from citrus to citrus is by grafting. Mechanical transmission with sap on knives used for grafting or leaf abrasion has been shown from citron to citron (Roistacher et al., 1980) and from Etrog citron to *Citrus excelsa* (Garnsey, 1974). Seed transmission has been observed in *Chenopodium*, quinoa, cowpeas and soyabeans but not in kumquats (*Fortunella japonica*) (Nishio et al., 1982). No natural vector is known, and natural transmission occurs only at a very low rate. CiTLV has moved around the world with infected budwood.

Damage Potential: Almost all citrus plants can be infected by this virus but are symptomless if they don't have a susceptible graft union, either because they are growing on their own roots, or on a CiTLV tolerant rootstock. Trifoliate orange, *Poncirus trifoliata,* on its own is immune or highly resistant to CiTLV. However, when infected latent hosts are grafted on rootstock of *P. trifoliata* or its hybrids, a bud union crease can occur, after which the tree becomes stunted or often dies (Calavan et al., 1963). Mandarins (*Citrus reticulata*) infected with CiTLV and grafted on *P. trifoliata* rootstock, showed a 25% yield reduction over CiTLV-free trees (Takahara et al., 1988).

Worldwide Distribution: Australia, China, Cyprus, Japan, Korea, Nigeria, Taiwan, South Africa, and the United States (California, Florida, Texas) (Altas et al., 2019).

Official Control: Citrus tatter leaf virus is on the USDA's harmful organism list for: Chile, Georgia, Egypt, Israel, Japan, Mexico, Morocco, Oman, Thailand, Turkey, United Arab Emirates, and Uruguay (USDA PCIT, 2021). It is on the EPPO's A1 list for Argentina, Bahrain, Chile, Egypt, European plant protection

organization, Georgia, Jordan, Turkey, Uruguay, and it is a quarantine pest in Morocco, Tunisia, and Israel (EPPO, 2021).

California Distribution: CiTLV was first described in California at UC Riverside more than a century ago. Since it is asymptomatic in most citrus, its likely widespread in the state in older trees and orchards, particularly in Meyer lemons. Modern programs such as those run by the Citrus Clonal Protection Program and the National Clean Plant Network for Citrus have eliminated this pathogen from commercial budwood.

California Interceptions: None

The risk **Citrus tatter leaf virus** would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen is entirely dependent on a living host and is likely to occur wherever citrus is grown in California.

   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 natural host range is limited to *Citrus* and close relatives

   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 pathogen reproduces in all types of citrus without causing disease. However, it can only spread through movement of infected sap either mechanically, or through budwood. There are no vectors.

   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:

In the past, this pathogen seriously impacted citrus varieties grafted on to trifoliate orange hybrid rootstocks, causing bud union crease, leaf mottles and tatters and even death of scions. Today it is very effectively controlled by certified nurseries and clean stock programs. It is a quarantine pest in various countries, however, international trade in citrus propagative material is highly regulated and under strict phytosanitary control, reducing the chance of moving this virus.

Evaluate the economic impact of the pest to California using the criteria below.

Economic Impact:

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: **2**

- 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. Home gardeners using non-commercial budwood could experience symptoms if they use infected budwood sources for propagation, especially old Meyer lemons.

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 Citrus tatter leaf virus*:* Medium

Add up the total score and include it here. **9**
-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'.

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* ***= 6***

Uncertainty:

There is uncertainty in the taxonomic placement of this virus. It is sometimes classified as a unique and separate virus, sometimes as an isolate of Apple stem grooving virus. It is clear from serology and sequence analysis that they are highly homologous to one another.

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for Citrus tatter leaf virus is C.

References:

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Responsible Party:

Heather J. Scheck, Primary Plant Pathologist/Nematologist, CDFA/PHPPS ECOPERS, 2800 Gateway Oaks Suite 200, Sacramento, CA 95833 Phone: (916) 654-1017, permits[@]cdfa.ca.gov.

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*Comment Period: 08/26/2021 through 10/10/2021

*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: C
