cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Tobacco ringspot nepovirus

Current Pest Rating: None

Proposed Pest Rating: A

Comment Period: 11/27/2019 through 1/11/2020

Initiating Event:

On August 9, 2019, USDA-APHIS published a list of "Native and Naturalized Plant Pests Permitted by Regulation". These plant pests are now allowed (permits not required) for *interstate* movement 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 some or all these pathogens with state plant pest permits. In order to assess the need for a state permit, a risk analysis for Tobacco ringspot virus (TRSV) is given herein and a permanent pest rating is proposed.

History & Status:

Background: Tobacco ringspot virus (TRSV) is the type species of the nepovirus genus in the family Secoviridae. Nepoviruses are named after two of their important characteristics: they are nematode transmitted and have icosahedral shaped particles. The primary vector of nepoviruses including TRSV are longidorid nematodes, especially the American dagger nematodes, *Xiphinema americanum* sensu lato (Brown et al., 1993).

TRSV has been reported occasionally on a very wide variety of crops and ornamentals causing ringspots and bud blights. Characterized by numerous strains, it has been reported to infect a large number of plant hosts in at least 30 different plant families (Hill, 2003). TRSV is known mainly from North America and is frequently found in the midwestern USA and Canada where it has a very large host range but is most damaging on soybeans and tobacco.

TRSV can cause significant disease on blueberries in Oregon and the northeastern United States and Canada. In the southeastern United States, the virus is found infecting a variety of cucurbits. Other important diseases caused by TRSV in the northeast occur on grapes, apples and other fruit trees

(CABI-CPC, 2019). *Xiphinema americanum* is endemic to North America and this nematode is already widespread in California with official records on dozens of hosts (Siddiqui et al., 1973). TRSV can also be vectored non-specifically at a very low rate by insects and mites. When vectored by nematodes, TRSV is lost when the nematode molts; it does not multiply in the nematode and is not transmitted to the eggs. It can also be transmitted by mechanical inoculation, by seed, and with pollen.

Hosts: Tobacco ringspot virus has a very wide natural host range including herbaceous and woody plants and trees in more than 30 families including important vegetables, fruit trees, vines, and ornamentals. The most important agronomic hosts in the United States are tobacco, soybeans, stone fruit, berries, and grapevines.

Symptoms: Symptoms vary depending on the plant affected. In general, symptoms are more severe on young plants at the beginning of the growing season and are less noticeable later in the season. TRSV causes a disease known as “bud blight” on soybeans. Plants infected in early growth stages are severely stunted. The most characteristic symptom is the “shepherd's crook” caused by the curving of the terminal bud to form a crook. Other buds on the plant become brown, necrotic, and brittle. Adventitious leaf and floral buds may proliferate excessively. Petioles of the youngest trifoliolate leaves are often shortened, thickened, and may be curved to distort the shoot tips. Leaflets are dwarfed and may cup or roll. Leaf blades become more or less rugose and bronzed. Pods are generally underdeveloped and often aborted. Those that do set often develop dark blotches, generally do not produce viable seeds, and drop off early (Hill and Whitham, 2014). In tobacco,TRSV infected plants are stunted, and a ring and line pattern appears on the leaves, which reduces the yield and quality (Stace-Smith, 1985). On blueberries, plants show decline and virus-like symptoms with a reduced vigor, shoot defoliation, and distorted and crinkled apical leaves with dark reddish lesions. Some plants show a top dieback with poor blossom development or necrotic flower buds (Fuchs et al., 2010). Grapevines in Texas show symptoms of leaf deformation, chlorotic specks, stunted shoots, and general decline when infected with TRSV (McBride et al., 2017). Grapevines in Eastern Washington showed severe leaf deformation and general decline with vein banding, chlorotic specks, and rings with mild mottling (Walker et al., 2015). Cucurbits including cucumber, cantelope, pumpkin, squash, and watermelon in Oklahoma showed mild to severe mosaic, mottling, and chlorotic spots.

Transmission: Tobacco ringspot is transmitted by infected sap but only when plants are wounded (e.g., with pruning and grafting or insect and mite feeding) and not simply from physical contact between plants (CABI-CPC). It is also vectored by the American dagger nematode. Global distribution of TRSV has probably occured with the accidental movement of infected seed and nursery stock. Although infection of field plants can reach close to 100%, the potential of harvesting seed fields with such high infection rates is unlikely because very little seed is produced by infected plants. In general, the arthropod vectors like aphids, mites and bees are not efficient vectors of TRSV. (Hill and Whitham, 2014).

Damage Potential: Of the many diseases caused by TRSV, bud blight of soybeans is the most severe and can cause the most significant yield loss. In general, most significant yield loss occurs when plants

become infected before flowering. Yield of early inoculated soybeans has been reported to be reduced by as much as 79% (Demski et al., 1971) and yield loss as a result of natural infection has been reported as greater than 50% (Crittenden and Moore, 1966). Fruit yield can be substancially reduced in highly susceptible blueberry varieties (Fuchs et al., 2010) and in grapevines (McBride et al., 2017). In Washington, grapevine shoots had shortened internodes leading to a stunting of the canopy with symptomatic vines producing a few small clusters with different size berries showing uneven ripening compared with clusters from healthy vines (Walker et al., 2015). The detection of TRSV in Kudzu (*Pueraria montana*) in Mississippi is a concern to soybean growers as it may represent a major reservoir of TRSV in the southeastern United States (Aboughanem-Sabanadzovic et al., 2014).

Worldwide Distribution: Africa: *Democratic Republic of the Congo, Egypt, Malawi, Morocco, Nigeria, Zambia;* South America: *Argentina, Brazil, Chile*, *Uruguay, Venezuela*; Asia: *China, India, Indonesia, Iran, Japan, Kyrgyzstan, Oman, Saudi Arabia, Sri Lanka, Taiwan*; Europe: *Georgia, Hungary, Italy, Lithuania, Poland, Russia, Serbia, Turkey, United Kingdom*; Oceana: *Australia, New Zealand, Papua New Guinea*; Caribbean: *Cuba, Dominican Republic;* North America: *Canada* (British Columbia, New Brunswick, Ontario, Québec), *Mexico*, *United States* (Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming)

Official Control: Tobacco ringspot virus is on the USDA-PCIT harmful organism list for the following countries: Albania, Argentina, Australia, Azerbaijan, Bangladesh, Canada, China, Colombia, Ecuador, Egypt, European Union, Eurasian Customs Union, French Polynesia, Georgia, Holy See (Vatican City State), Honduras, Israel, Japan, Republic of Korea, Madagascar, Mexico, Moldova, Republic of Monaco, Morocco, Namibia, Nauru, New Caledonia, Norway, Panama, San Marino, Serbia, South Africa, Switzerland, Syrian Arab Republic, Taiwan, Tajikistan, Turkey,Turkmenistan, Ukraine, Uzbekistan (USDA-PCIT, 2019). It is a quarantine pest in Morocco, Canada, Mexico, Israel, and Norway; on the A1 list for East Africa, Argentina, Paraguay, Kazakhstan, Turkey, Ukraine, and the A2 list for China, Jordan, and Russia.

California Distribution: Tobacco ringspot virus has been reported in El Dorado County on blueberries, in Glenn county on watermelon, in Sacramento county on spiderwort and geranium, and on the south coast in lettuce. All detections were made prior to 2000. The American dagger nematode is a C-rated pest in California and hundreds of detections in nurseries, orchards, vineyards and fields on fruit trees, vines, forage crops and ornamentals.

California Interceptions: none

The risk *Tobacco ringspot nepovirus* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Tobacco ringspot virus systemically infests its hosts. In California, is likely to establish in climates suitable for the growth of its host plants. Since these host plants are widespread within the state, it is likely for the virus to also be widespread Additionally it can survive with its vector, *Xiphenema americana*, in weeds and even when no host plants are available

   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:** Tobacco ringspot virus has a very large host range including many families of herbacious and woody plants, and many important crop species

   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 Reproductive Potential:** Tobacco ringspot virus has high reproductive potential within plants and is spread naturally mainly by the dagger nematode*, Xiphenema americana*, which is widespread in California. It is also spread through the movement of infested planting stock to non-infested sites and can be transmitted mechanically by inoculation and by 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:** Tobacco ringspot virus is a regulated pathogen and a target of phytosanitary field inspection for export bean, cucurbit, and tomato grown for seed.

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

   Economic Impact: A, 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**: Home, urban, private, and commercial ornamental, fruit, and vegetable gardens may be significantly impacted by Tobacco ringspot virus, which could trigger development of additional official or private treatment programs.

Environmental Impact: 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: D, E
- 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 *Tobacco ringspot virus:* High

Add up the total score and include it here. **15**
-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 'Not established'. Although multiple detections have been made in California, they were all prior to 2000.

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:

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* **= 15**

Uncertainty: None

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Tobacco ringspot nepovirus* is A.**

References:

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Responsible Party:

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***Comment Period: 11/27/2019 through 1/11/2020**

***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 plant.health[@]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