cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Pseudomonas syringae pv. *tomato* (Okabe) Young, Dye & Wilkie 1978

Bacterial speck of tomato

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Bacteria; Phylum: Proteobacteria
Class: Gamma Proteobacteria; Order: Pseudomonadales
Family: Pseudomonadaceae

Comment Period: 04/16/2020 through 05/31/2020

Initiating Event:

On August 9, 2019, USDA-APHIS published a list of "Native and Naturalized Plant Pests Permitted by Regulation". Interstate movement of these plant pests is no longer federally regulated 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 movement of some or all these pathogens into and within the state. In order to assess the needs and potential requirements to issue a state permit, a formal risk analysis for *Pseudomonas syringae* pv. *tomato* is given herein, and a permanent pest rating is proposed.

History & Status:

Background:

Pseudomonas syringae pv. *tomato* causes a disease called bacterial speck. This name describes the main symptom, which is generally very small but often numerous leaf and fruit spots. Like other *Pseudomonas syringae* pathovars, pv. *tomato* can be found growing epiphytically on a wide range of plants outside of its hosts that it parasitizes. Serious disease outbreaks are relatively infrequent in California as they are favored by heavy leaf wetness, cool temperatures, and cultural practices like handling wet plants that allow bacteria multiply and to be disseminated. The use of clean seed also greatly limits epidemics.

There is a high level of scientific interest in this pathogen as it is easy to grow and ideal for a wide range of molecular genetics and cell biology research. Its primary host, tomato, is amenable to transformation and genetic analysis, which has allowed researchers to isolate and characterize plant genes involved in host responses to this pathogen. Also, it is pathogenic on the model plant *Arabidopsis thaliana* and this combination has provided a robust model pathosystem for studying both compatible and incompatible host–pathogen interactions. This relationship has increased our understanding of bacterial pathogenesis and plant responses to bacterial infection, especially through studies of pathogenicity and virulence factors and functional genomics (Preston, 2000; Yan et al., 2008).

Hosts: Arabidopsis thaliana (thale cress)*, Brassica oleracea* var. *botrytis* (cauliflower), *Brassica oleracea* var*. viridis* (collards), *Solanum lycopersicum* (tomato) (CABI-CPC, 2020)

Symptoms: Young leaves, stems, flowers, and fruits are susceptible to this pathogen. Plants become less susceptible with age. Symptoms on fruit can be presumptively diagnostic for this disease. Lesions on immature fruit can slightly raised or sunken and are generally small, varying in size from tiny flecks that are barely visible to areas 0.125 inch (3 mm) in diameter. They are dark brown and superficial, seldom penetrating more than a few cells deep. Only green fruit are susceptible to infection. (Davis et al., 2013; Jones et al., 2016; Agrios, 2005). On leaves, symptoms can be confused with those of a different disease, bacterial spot, caused by *Xanthomonas campestris* pv. *vesicatoria* (Davis et al., 2013). Often symptoms first appear on more susceptible younger leaves then spread to stems. Bacterial speck causes dark brown to black lesions of various sizes and shapes on leaves and stems. The tissues may show water soaking initially, and the areas adjacent to the lesions can initially be yellow before becoming darker brown. Leaf lesions are frequently concentrated near the leaf margins and can cause extensive marginal necrosis and necrosis of the leaf tips (Jones et al. 2016).

Transmission: Pseudomonas syringae pv. *tomato* is spread from overwintering sites including volunteer tomatoes, crop debris, and asymptomatic weeds to new plants and from plant to plant with rain, runoff, rain splash, windblown rain; with insects such as flies, bees, and ants; with people who are handling plants; and with unsanitary tools. Penetration takes place through stomates, hydathodes, and injuries. Water soaking of tissues during heavy rains greatly favors subsequent penetration and invasion by bacteria. The disease can also be seedborne with seeds and weed hosts being the most important sources of primary inoculum (McCarter et al., 1983).

Damage Potential: Plants can be stunted and suffer yield loss, particularly if young plants are infected. Speckled fruit has a reduced value in the fresh market. Seed fields with any detectible level of disease may be prohibited from international movement. Infected seed is a major source of inoculum causing disease in new areas (Davis et al., 2013; Jones et al., 2016).

Worldwide Distribution: Worldwide in all tomato growing areas (CABI, 2020).

Official Control: *Pseudomonas syringae* pv. *tomato* is on USDA's harmful organism list for China, Colombia, Egypt, French Polynesia, Honduras, India, Israel, Jordan, Korea, Mexico, Nicaragua, Panama,

Peru, and Thailand (USDA-PCIT, 2020). From the EPPO, it is on the A1 list for Egypt, the A2 list for Jordan and on the quarantine list for Mexico (EPPO, 2020). It is a pest of concern for tomato and tomatillo seeds grown for export (CDFA Phytosanitary field inspection manual)

California Distribution: Statewide (French, 1989).

California Interceptions: None.

The risk *Pseudomonas syringae* pv. *tomato* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen is highly dependent on water to infect, reproduce, and move. Drier parts of the state are unfavorable for the disease but transplant greenhouses and areas near the coast are more likely to be affected.

   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 narrow but includes members of two plant 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:** Under favorable conditions, foliar bacterial pathogens have an exponential rate of increase.

   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:** Fresh market tomato fruit have very low tolerances for damage from bacterial speck. High levels of disease can significantly impact leaves and stems. Because the disease can be seed borne, many countries impose phytosanitary standards on tomato seed fields for export.

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 pathogen can survive as an epiphyte and could become resident in weeds or other plants growing in proximity to infected hosts.

Environmental Impact:

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 *Pseudomonas syringae* pv. *tomato:* Medium

Add up the total score and include it here. **11**
-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'. From CDFA records and publications from UCCE Farm Advisors, this pathogen is already widespread in California tomato-growing areas.

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* **= 8**

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Pseudomonas syringae* pv. *tomato* is C.**

References:

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Responsible Party:

Heather J. Scheck, Primary Plant Pathologist/Nematologist, California Department of Food and Agriculture, 204 West Oak Ave, Lompoc, CA. Phone: 805-736-8050, permits[@]cdfa.ca.gov.

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*Comment Period: 04/16/2019 through 05/31/2020

*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 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
