

California Pest Rating Proposal for

Pseudomonas syringae pv. *actinidifoliorum* (Van Hall, 1904) Cunty et al., 2014

Bacterial spot of Kiwifruit

Current Pest Rating: Q

Proposed Pest Rating: C

Domain: Bacteria; Phylum: Proteobacteria

Class: Gammaproteobacteria; Order: Pseudomonadales

Family: Pseudomonadaceae

Comment Period: 4/1/2020 through 5/16/2020

Initiating Event:

On 5/10/2019, agricultural inspectors in Stanislaus County submitted a magnolia sample (*Magnolia grandiflora*) with leaf spots from a wholesale nursery. On 6/19/2019, CDFA plant pathologist Sebastian Albu cultured *Pseudomonas syringae* pv. *actinidifoliorum* (Psaf) from the leaf spots and confirmed identity by PCR, followed by DNA sequencing and phylogenetic analysis. On 12/26/2019 he sent a culture to USDA APHIS in Beltsville, Maryland for confirmation. On 3/9/2020, USDA phytobacteriologist Mark Nakhla confirmed his identification through cPCR and sequencing. This was the first detection of this pathogen in North America and a first report on this host. The risk to California from this pathogen is described herein and a permanent rating is proposed.

History & Status:

Background: Kiwifruit bacterial canker, caused by *Pseudomonas syringae* pv. *actinidiae*, is currently the most destructive disease of kiwifruit worldwide. In contrast, the closely related pathovar *P. syringae* pv. *actinidifoliorum* only causes necrotic spots on kiwifruit leaves and flowers and is not associated with plant mortality. It is the latter that has been detected in California and is under review in this pest rating proposal.

Pseudomonas syringae pv. *actinidifoliorum* was once thought to be a low-virulence variant of *P. syringae* pv. *actinidiae* and was originally classified as a separate biovar, Psa4. In 2014, Cuntly et al. reclassified isolates from France as a new pathovar, *Pseudomonas syringae* pv. *actinidifoliorum* (Psaf) which describes its ability to attack kiwifruit (*Actinidia*) and leaves (*foliorum*). Psaf is non-systemic and is associated with spot symptoms only. It has shown low aggressiveness on kiwifruit (Butler et al., 2013, Chapman et al., 2012; Vanneste et al., 2013; Cuntly et al., 2014) and does not cause the more serious canker symptoms. Abelleira et al. (2015) describes additional detections from kiwifruit flowers in Spain.

Hosts: Kiwifruit (*Actinidia deliciosa* and *Actinidia chinensis*), southern magnolia (*Magnolia grandiflora*).

Symptoms: On kiwifruit, leaf and flower bacterial spots caused by Psaf (Cuntly et al., 2014; Abelleira et al., 2015) are associated with minor damage or no damage at all. Leaves show necrotic spots without a defined morphology and on flower buds, sepals develop necrotic areas. Symptoms are likely to occur during wet and cool weather conditions, during spring and autumn.

Transmission: Nothing specific is known about the transmission of Psaf. Assuming it is similar to Psa with the main mode of natural spread within and between orchards via passive transmission - bacterial exudates from kiwifruit cankers disseminate by rain-splash and wind driven rain (Serizawa et al., 1989). This pathovar could move over short distances with heavy rainfall, strong winds, and mechanically with grafting and pruning. Strong winds during rain may both injure the plants and disperse the bacterial exudate to the wounds and/or natural openings (Serizawa et al., 1989). Winter frost and late frost ('spring frost') as well as hail also favor disease development. Over long distances it could be spread by infected nursery stock. Infected fruit have not been observed and are not considered a pathway (CABI-CPC, 2019).

Damage Potential: For this pathovar, damage reports are very minimal. It is not a spore-forming bacterium and does not persist in the environment or in soil, although it can be isolated from detached plant material, including leaf litter and twigs, for up to 45 days after detachment from plants (Scortichini et al., 2012). It does not become air-borne without wind or rain splash.

Worldwide Distribution: It is reported from Australia, France, New Zealand and Spain (Cuntly et al., 2014; Abelleira et al., 2015), plus California (see initiating event)

Official Control: None.

California Distribution: There has been one detection in Stanislaus County

California Interceptions: None.

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

Consequences of Introduction:

- 1) Climate/Host Interaction:** This bacterial pathogen requires wind and rain to disperse and is favored by low temperatures and spring frosts. These conditions are possible in the California kiwifruit production counties of Butte, Sutter, and Yuba, but less likely in Fresno, Kern, Kings, or Tulare counties.

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 known host range is narrow, two species of kiwifruit plus this report from southern magnolia.

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:** Bacterial pathogens can multiply exponentially but are limited by their relatively high requirements for water. Under typical dry California summer weather, bacterial growth and spread would likely drop to sub-detectible levels. It has no mechanism for dispersal, it relies on wind and wind-driven rain.

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:** There are no significant reports of economic damage from this pathogen on its primary host, kiwifruit. It also leaf spots on magnolia.

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.
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- 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: 1

- 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:** The pathovar that causes bacterial canker on kiwifruit can survive on vineyard weeds, however, there is no information specific to Psaf.

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. *actinidifoliorum*: Low

Add up the total score and include it here. 7

- 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 'Low'. There has been one detection at a wholesale nursery in Stanislaus County.

Score: -1

- Not established (0) Pest never detected in California or known only from incursions.
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-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:

This is a fairly recently described pathogen, the host range may continue to expand. This is the first detection on Magnolia, and a second detection was made more recently on Arbutus. The pest rating is for the pathogen and is independent of the host on which it is detected.

Conclusion and Rating Justification:

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

References:

Abelleira, A., Ares, A., Aguin, O., Penalver, J., Morente, M. C., Lopez, M. M., Sainz, M. J. and Masilla J. P. 2015. Detection and characterization of *Pseudomonas syringae* pv. *actinidifoliorum* in kiwifruit in Spain. *J Appl Microbiol.* 2015 Dec;119(6):1659-71

Butler, M. I., Stockwell, P. A., Black, M. A., Day, R. C., Lamont, I. L., & Poulter, R. T. 2013. *Pseudomonas syringae* pv. *actinidiae* from recent outbreaks of kiwifruit bacterial canker belong to different clones that originated in China. *PloS one*, 8(2), e57464.

CABI Crop Production Compendium 2020. Bacterial canker of Kiwifruit.
<https://www.cabi.org/cpc/datasheet/45002>. Accessed 3/13/2020.

Chapman, J. R., Taylor, R. K., Weir, B. S., Romberg, M. K., Vanneste, J. L., Luck, J., and Alexander, B. J. R. 2012. Phylogenetic relationships among global populations of *Pseudomonas syringae* pv. *actinidiae*. *Phytopathology* 102:1034-1044.

Cunty, A., Poliakoff, F., Rivoal, C., Cesbron, S., Fischer-Le Saux, M., Lemaire, C., Jacques, M. A., Manceau, C., and Vanneste, J. L. 2014. Characterisation of *Pseudomonas syringae* pv. *actinidiae* (Psa) isolated from France and assignment of Psa biovar 4 to a de novo pathovar: *Pseudomonas syringae* pv. *actinidifoliorum* pv. nov. Plant Pathology, 64(3):582-596

Scortichini, M., Marcelletti, S., Ferrante, P., Petriccione, M., and Firrao, G. 2012. *Pseudomonas syringae* pv. *actinidiae*: a re-emerging, multi-faceted, pandemic pathogen. Molecular Plant Pathology, 13(7):631-640.

Serizawa, S., Ichikawa, T., Takikawa, Y., Tsuyumu, S., Goto, M. 1989. Occurrence of bacterial canker of kiwifruit in Japan: description of symptoms, isolation of the pathogen and screening of bactericides. Annals of the Phytopathological Society of Japan, 55(4):427-436

Vanneste, J. L., Yu, J., Cornish, D. A., Tanner, D. J., Windner, R., Chapman, J. R., Taylor, R. K., Mackay, J. F., and Dowlut, S. 2013. Identification, virulence, and distribution of two biovars of *Pseudomonas syringae* pv. *actinidiae* in New Zealand. Plant Dis. 97:708-719.

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[[@](mailto:permits@cdfa.ca.gov)]cdfa.ca.gov.

***Comment Period: 4/1/2020 through 5/16/2020**

*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[[@](mailto:permits@cdfa.ca.gov)]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.
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Proposed Pest Rating: C
