

## California Pest Rating Proposal for *Pseudomonas viridiflava* (Burkholder 1930) Dowson 1939

### Bacterial leaf blight of tomato

**Current Pest Rating: Z**

**Proposed Pest Rating: C**

Domain: Bacteria, Phylum: Proteobacteria,  
Class: Gammaproteobacteria, Order: Pseudomonadales,  
Family: Pseudomonadaceae

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**Comment Period: 05/24/2023 through 07/08/2023**

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### Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from *Pseudomonas viridiflava* is described herein and a permanent rating is proposed.

### History & Status:

#### **Background:**

Traditionally, the phytopathogenic oxidase-negative fluorescent Pseudomonads have been grouped into two species, *Pseudomonas syringae* and *P. viridiflava* (Palleroni, 1984). Today *P. viridiflava* is described as a distinct species within the *P. syringae* species complex with distinct characteristics, including pectate lyase as a virulence factor, atypical pathogenicity islands, and phenotypic phase variation (Liao et al., 1988; Lipps, and Samac, 2022). It has a wide host range and causes a variety of symptoms in different plant parts, including stems, leaves, and blossoms, and is likely to have a worldwide distribution. *Pseudomonas viridiflava* is a ubiquitous weak pathogen and there is probably no basis for phytosanitary action against this pathogen, although it is frequently requested on phytosanitary certificates. *Pseudomonas viridiflava* also lives as an endophyte, epiphyte, and saprophyte and has been isolated from a variety of environmental sources, including asymptomatic wild plants, snow, epilithic biofilms, and icepacks (Balestra, 2020; Lipps and Samac, 2022).

*Pseudomonas viridiflava* produces symptoms similar to other necrosis-inducing pseudomonads, and in many hosts, and can co-occur with *P. syringae* and *P. tomato*. *Pseudomonas viridiflava* tends to

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produce larger, more irregular leaf and fruit spots than the other species. Lesions are pale to mid-brown and have a discrete margin. They may exhibit a chlorotic halo. Although the pathogen has marked pectolytic activity, tissue damage has the appearance caused by necrotizing rather than soft-rotting *Pseudomonas*. *Pseudomonas viridiflava* may be present as a secondary pathogen to other primary pathogens. Care is needed to ensure that symptoms are not confused, and that this pathogen does not mask activities of a primary pathogen (Balestra, 2020).

**Hosts:** *Pseudomonas viridiflava* has been reported from more than 50 host plants including both monocots and dicots. Important economic hosts in California include alfalfa, artichokes, brassicas, citrus, cucurbits, grapes, leafy greens, pome fruits, stone fruits, and tomatoes.

**Symptoms:** causes a variety of disease symptoms, including spots, streaks, necrosis, rots, and more in above-and below-ground plant parts. *Pseudomonas viridiflava* produces symptoms like other necrosis-inducing pseudomonads, such as *P. syringae* pv. *phaseolicola* in bean, *P. syringae* pv. *pisi* in pea, and *P. syringae* pv. *syringae* in many hosts. *Pseudomonas viridiflava* tends to produce larger, more irregular leaf and fruit spots. Lesions are pale to mid-brown and have a discrete margin. They may exhibit a chlorotic halo. *Pseudomonas viridiflava* may be present as a secondary pathogen.

**Transmission:** Members of the *Pseudomonas syringae* complex, which include *P. viridiflava*, are often epiphytic members of the phyllosphere of healthy plants. Bacteria are spread by wind, rain, rain splash, windblown rain, direct contact with the host, insects such as flies and bees, and hands, handling of plants and tools, and movement of infected nursery stock. Under favorable conditions, they enter the plant through wounds or natural openings such as stomata and multiply rapidly within the apoplast. Water soaking of tissues during heavy rains greatly favors penetration and invasion. Bacteria multiply on the walls of host cells, which collapse after disruption of the cell membranes (Agrios, 2005).

*Pseudomonas viridiflava* 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. This bacterium can be seedborne, but weed hosts are also important sources of primary inoculum (Mariano and McCarter, 1992). It can be spread long distances on plants or parts of plants (Balestra, 2020).

**Damage Potential:** *Pseudomonas viridiflava* can act as an endophyte, saprophyte, and pathogen, which supports the idea that *P. viridiflava*, like many other members of the *P. syringae* complex, is a generalist rather than a specialist. Its ability to infect a wide range of hosts corroborates with this idea (Lamichhane, and Venturi, 2015). *Pseudomonas viridiflava* may occasionally cause measurable crop damage, though it is commonly isolated as a sub-population with more vigorous pathogens. It sporadically causes minor damage to vegetative plant tissue under conditions favorable for pathogenesis. In California, it causes leaf spots on *Cuphea hyssopifolia* nursery stock (Albu et al., 2018), and stem blight of alfalfa (Lipps et al., 2019).

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Some strains of *P. viridiflava* are ice nucleation-active, i.e., they serve as nuclei for ice formation and cause frost injury to plants at relatively high freezing temperatures. The wounding from ice crystal formation increases bacterial infection (Lipps and Samac, 2022). Bacterial leaf blight of tomato is less common when clean seed is planted, but epidemics can occur when environmental conditions are favorable, and if there are populations in the area associated with weeds. It is a phytosanitary issue for seed grown for export.

**Worldwide Distribution:** Africa: *Algeria, Egypt, Kenya, Morocco, Tanzania, and Uganda*. Asia: *China, Iran, Japan, Jordan, Nepal, Saudi Arabia, South Korea, and Turkey*. Europe: *Belgium, Bulgaria, Czechia, France, Germany, Greece, Hungary, Italy, Netherlands, North Macedonia, Poland, Portugal, Russia, Serbia and Montenegro, Slovakia, Spain, Switzerland, and United Kingdom*. North America: *Mexico and United States (California, Florida, Georgia, Illinois, New York, Oklahoma, Oregon, Utah, Washington)*. Oceania: *Australia, New Zealand*. South America: *Argentina, Brazil, Uruguay, and Venezuela* (Balestra, 2020).

**Official Control:** *Pseudomonas viridiflava* is a quarantine pest in Mexico, and a regulated non-quarantine pest in Switzerland and the United Kingdom (EPPO, 2023). It is on the USDA PCIT's harmful organisms list for Argentina, Australia, Colombia, Dominican Republic, Ecuador, French Polynesia, Guatemala, Honduras, India, Mexico, Namibia, Nicaragua, Panama, Paraguay, Peru, Philippines, South Africa, Taiwan, Thailand, and Viet Nam (USDA PCIT, 2023)

**California Distribution:** There are official records from Colusa, Madera, Orange, Placer, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, and Tehama counties, from vegetables, ornamentals, and small fruits (CDFA PDR database, 2023).

**California Interceptions:** There was one interception made by San Bernadino County agricultural officials on *Laurus nobilis* 'Emerald wave' containerized nursery stock from Yamhill County, Oregon in 2017 (CDFA PDR database, 2023).

The risk *Pseudomonas viridiflava* would pose to California is evaluated below.

## Consequences of Introduction:

- 1) **Climate/Host Interaction:** *Pseudomonas viridiflava* has been isolated from a wide range of environments, associated with plants in many stages of growth. Epidemics are more frequent and more severe in wetter climates as water is needed for bacterial dissemination and infection.

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.
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**2) Known Pest Host Range:** The host range is very broad, including important agronomic crops.

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:** *Pseudomonas viridiflava* can live as an epiphyte on the surface of healthy plants. Under favorable environmental conditions, they can invade and reproduce at an exponential rate.

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:** Detection of this pathogen on mother plants grown for seed impacts export markets. There are some reports of crop damage.

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

**Economic Impact: A, 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: 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:**

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

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No direct environmental effects have been reported, but home/urban gardening or ornamental plantings could be affected

**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 *Pseudomonas viridaflava*: Medium**

Add up the total score and include it here. 12

- 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)
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**Final Score:** *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 9*

**Uncertainty:**

none

**Conclusion and Rating Justification:**

Based on the evidence provided above the proposed rating for *Pseudomonas viridiflava* is C.

**References:**

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### Responsible Party:

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**\*Comment Period: 05/24/2023 through 07/08/2023**

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

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### 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:
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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**

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