

**California Pest Rating Proposal for**  
***Pseudomonas cichorii* (Swingle 1925) Stapp 1928**

**Bacterial blight of endive**  
**Varnish spot of lettuce**

**Current Pest Rating: C**

**Proposed Pest Rating: C**

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

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**Comment Period: 07/19/2021 through 09/02/2021**

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**Initiating Event:**

The USDA's Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens (ITAP.gov) Subcommittee on Plant Pathogens has identified the worst plant pathogens that are either in the US and have potential for further spread or represent a new threat if introduced. *Pseudomonas cichorii* is on this list. In 2002, this pathogen was given a B rating that was later changed to an informal C rating. A pest risk assessment of this bacterium is presented here, and an official pest rating for California is proposed.

**History & Status:**

**Background:** Pseudomonads are ubiquitous bacteria in the environment. They have metabolic abilities that allow them to utilize a wide range of organic compounds and occupy important ecological niches. Some species are important pathogens of animals and plants. *Pseudomonas cichorii* has a wide host range which includes plant hosts of high economic importance, such as *Solanum lycopersici* (tomato), *Lactuca sativa* (lettuce), *Cichorium endivia* (endive), and *Helianthus annuus* (sunflower) (CABI-CPC, 2021; Stead et al., 2003).

*Pseudomonas cichorii* was initially described causing a center rot or wilt of endive by Swingle (1925), and later was found rotting head lettuce in New York (Burkholder 1954). In 1977, UC Davis plant pathologists described an epidemic of "varnish spot disease" caused by *P. cichorii* on sprinkler-irrigated

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head lettuce in the Salinas Valley. They were able to isolate the pathogen from soil samples collected from symptomatic and asymptomatic lettuce fields (Grogan et al., 1977).

Based on phylogenetic analysis using *gyrB* and *rpoD* genes, *P. cichorii* is grouped within the *P. syringae* pathogen complex (Yamamoto et al., 2000). Within this group, *P. cichorii* strains form a monophyletic group. *Pseudomonas cichorii* strains are oxidase-positive (as are most pseudomonads) which differs from *P. syringae*, which is oxidase-negative. It is hypothesized that the '*P. cichorii* lineage' branched at an early stage after the acquisition of phytopathogenicity from a common ancestor, and subsequently the ancestor of the '*P. syringae* lineage' lost the ability to produce oxidase (Yamamoto et al., 2000). The bacterium can be seed borne and is widely distributed around the world (CABI-ISC, 2021).

*Hosts:* *Pseudomonas cichorii* has a wide host range and can cause disease on hundreds of species of vegetables and ornamental plants in many plant families including Apiaceae, Asteraceae, Brassicaceae, Cucurbitaceae, Fabaceae, Rosaceae, and Solanaceae. Important hosts in California include *Apium graveolens* (celery), *Brassica oleracea* (cabbage, cauliflower), *Cichorium endivia* (endive, escarole) and *Lactuca sativa* (lettuce).

*Symptoms:* Symptoms can vary depending on the host and the infected part of the plant. Symptoms usually start with the appearance of water-soaked lesions at the leaf margin, near the midvein and/or randomly distributed as leaf spots. Developing lesions are roughly circular and are rarely confined to the interveinal areas. The lesions enlarge and turn dark brown or black. Sometimes lesions are surrounded by bright yellow halos.

Lesions can coalesce to form very large necrotic areas and may affect the whole leaf. In some hosts (i.e. celery), symptoms may also be present on petioles, pedicels and/or stems, and flower buds (i.e. chrysanthemum). In high humidity, lesions are larger and there is more rotting of infected tissues. In low humidity conditions, lesions may only be a few mm in diameter and the disease may stop development. Abscission of severely infected leaves and, rarely, the death of the plants have also been reported (CABI-CPC, 2021).

'Varnish spot disease' of lettuce affects the blades and petioles of the inner leaves of head lettuce, and is characterized by shiny, dark-brown, necrotic lesions. Lesions range in size from a few mm to very large covering most of the leaf, and are not delimited by veins (Grogan et al., 1977). Vein blackening on the outer leaves can happen on lettuce grown in severely infested soils. The names "lettuce rot" and "midrib rot" are used for *P. cichorii* when it infects greenhouse-grown lettuce plants. Symptoms are small, brown spots that coalesce and expand into moist, dark brown to greenish black rotted lesions along the midrib of inner lettuce head leaves (Cottyn et al., 2011).

*Transmission:* Infection occurs through stomata, epidermal hairs or wounds, but wounding is not required for infection. Infection occurs when plants are subject to high levels of free moisture, such as under misting (Shirata et al., 1982). Periods of high humidity and leaf wetness are necessary for infection and disease development. Greater incidence of disease is associated with longer periods of moisture (Jones et al., 1983). Splashing water from rain or sprinkler irrigation disperses *P. cichorii* from soil to plant and from plant to plant. It is likely that this pathogen can be dispersed between adjacent

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crops by aerosols. With a very wide host range, *P. cichorii* can infect many weed plants that act as alternative hosts. Adults of *Liriomyza trifolii* (American serpentine leafminer) can acquire and transmit *P. cichorii* to chrysanthemums (Broadbent and Matteoni, 1991).

*Pseudomonas cichorii* has been shown to survive on artificially inoculated lettuce seeds (Ohata et al., 1982). Some authors have suspected *P. cichorii* to be seed transmitted, and there are field observations of early infections in the crop and in the nursery that support this hypothesis (CABI-CPC, 2021). No references clearly show seed as a pathway for *P. cichorii* in brassicas, carrots, lettuce, tomato or eggplant, thus it is considered to be a pathway not proven by the International Seed Federation. Vegetable seeds are usually produced in dry climates which are unfavorable to the development of *P. cichorii*. Infected propagative material can move *P. cichorii* over long distances as lesions on symptomatic plants, or epiphytically on asymptomatic plants. *Pseudomonas cichorii* is frequently associated with other fluorescent pseudomonads in soils and in the rhizosphere of vegetables and weeds (Grogan et al., 1977).

**Damage Potential:** Plants grown in high humidity environments such as polyethylene-covered greenhouses or tunnels, in nurseries, or subjected to rainfall or sprinkler-irrigation develop the most severe symptoms. Greenhouses are ideal environments for disease development because of the dense plant canopy and high humidity. Lesions will stop expanding in low moisture conditions. Prevention of infection of crops when adjacent plants are hosts to the pathogen may be impossible. Varnish spot disease on lettuce occurs sporadically in coastal California fields (Grogan et al., 1977).

**Worldwide Distribution:** Africa: Burundi, Egypt, South Africa, Tanzania. Asia: China, India, Iran, Japan, South Korea, Taiwan, Turkey. Europe: Belgium, Bulgaria, France, Germany, Italy, North Macedonia, Portugal, Russia, Serbia and Montenegro, Spain, Ukraine, United Kingdom. North America: Barbados, Canada, Cuba, Mexico, Puerto Rico, United States (Alabama, California, Florida, Georgia, Hawaii, Illinois, Indiana, Louisiana, Mississippi, Montana, New Jersey, New York, North Carolina, Pennsylvania, Tennessee, Washington). Oceania: Australia, New Caledonia, New Zealand. South America: Argentina, Brazil, Chile, Colombia (CABI-CPC, 2021).

**Official Control:** *Pseudomonas cichorii* is on the EPPO A1 list for Egypt, A2 list for Jordan, and a quarantine pest for Mexico. It is on the USDA's harmful organism list for Argentina, Australia, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, French Polynesia, Guatemala, India, Jordan, Mexico, Nicaragua, Nigeria, Panama, Paraguay, Peru, Philippines, Thailand, Uganda. *Pseudomonas cichorii* is in CDFA's Phytosanitary field inspection manual as a pest of concern for the certification of crucifers, lettuce, tomato, and sunflower seed for export.

**California Distribution:** There are official records in San Francisco, San Mateo, San Luis Obispo, and Santa Barbara counties (French, 1989).

**California Interceptions:** There was an interception in Santa Barbara County in 2014 on catnip plants (*Nepeta cataria*) from Florida.

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

### Consequences of Introduction:

- 1) **Climate/Host Interaction:** *Pseudomonas cichorii* causes serious diseases in all regions with mild temperatures and high humidity, or in protected environments such as greenhouses.

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 extremely large for this pathogen, infecting hosts in multiple plant families.

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:** This bacterium multiplies very rapidly under favorable conditions. It spreads in soil, water, infected plants, and seeds, and (epiphytically) on healthy plants.

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:**

*Pseudomonas cichorii* can damage crops and lower their yield and value. It is a quarantine pest in many countries, and important for export seed. If water is contaminated with *P. cichorii*, it should not be used to irrigate susceptible crops like head lettuce.

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

**Economic Impact: A, B, C, G**

- 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).**
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- 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:** Hosts include native and naturalized plants, and although no impacts have been reported, they are possible under favorable environmental conditions.

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

**Environmental Impact: A**

- 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: Medium**

- 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 cichorii*: High**

Add up the total score and include it here. 13

- 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.
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This pathogen has been identified in multiple counties on a variety of plants and in settings such as nurseries. It has been in coastal soils at least since the 1970's and is not under any official control.

**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 = 10*

**Uncertainty:**

None

**Conclusion and Rating Justification:**

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

**References:**

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**Responsible Party:**

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**\*Comment Period: 07/19/2021 through 09/02/2021**

**\*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](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:
    - 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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