cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

# California Pest Rating Proposal for

## *Xanthomonas phaseoli* pv. *phaseoli* (Smith) Constantin et al. 2016

## Common bacterial blight of beans

**Current Pest Rating: C**

**Proposed Pest Rating: C**

Kingdom: Bacteria, Phylum: Proteobacteria,

Class: Gammaproteobacteria, Order: Lysobacterales,

Family: Lysobacteraceae

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**Comment Period: 01/04/2024 through 02/18/2024**

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## Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Xanthomonas phaseoli* pv. *phaseoli* is described herein and a permanent rating is proposed.

## History & Status:

**Background:**

California is a major producer of dry beans with large acreages grown in Kern, Tulare, and Fresno counties, and with smaller concentrations in the San Joaquin Delta and the Sacramento Valley, Santa Barbara County, and near Encinitas in San Diego County. Dry beans with significant production include lima, baby lima, black eye, garbanzos, and common beans including pinto, kidney, pink, white, yellow, black, red, and cranberry (Long and Temple, 2010). The state had 377,000 acres of edible dry bean production in 2021 (CDFA Ag Stats, 2022). California also grows significant acres of dry bean seed stock for export to other states and international markets.

The causal agent of common bacterial blight of bean was first identified as *Bacillus phaseoli* by E. F. Smith (1897). Variant strains that produced a brown pigment on tyrosine-containing medium were

described by Burkholder as “fuscous strains” (Burkholder, 1930). Revisions of the taxonomy led the non-fuscous and fuscous strains to be separated, and the non-fuscous strains were classified under the names *Xanthomonas phaseoli* (Corey and Starr, 1957), then *X. campestris* pv. *phaseoli* (Dye et al., 1980), and then *X. axonopodis* pv. *phaseoli* (Vauterin et al., 1995). Based on molecular studies done by Schaad et al., (2005) the fuscous strains were renamed as *X. fuscans* subsp. *fuscans*, while the non-fuscous strains conserved the name *X. axonopodis* pv. *phaseoli*. Bacterial pathogens responsible for common bacterial blight of bean are currently distributed across two separate species within the *Xanthomonas* genus, as non-fuscous *X. phaseoli* pv. *phaseoli* (Xpp), and fuscous *X. citri* pv. *fuscans* (Xcf) (Constantin et al., 2016).

Common bacterial blight of bean is a widespread problem, reported in over 100 countries across continents. It is found frequently in most places where common beans are cultivated, except in dry tropical areas. It can be assumed that it has become widespread due to the global seed market. It is difficult to assess if the disease presence reported in a given country is due Xpp, Xcf, or both, as commonly used detection methods do not differentiate between them (CABI, 2023). Bacterial blights are considered mainly foliar diseases on beans, but pod infections are observed, and defoliation and wilting may occur. The use of pathogen-free seeds is essential.

*Hosts: Digitaria abyssinica* (East African couchgrass), *Helianthus annuus* (sunflower), *Lablab purpureus* (hyacinth bean), *Mucuna deeringiana* (velvet bean), *Phaseolus aconitifolius* (moth bean), *Phaseolus acutifolius* (tepary bean), *Phaseolus coccineus* (runner bean), *Phaseolus lunatus* (lima bean), *Phaseolus vulgaris* (common bean), *Senna hirsuta* (hairy senna), *Solanum nigrum* (black nightshade), *Vigna angularis* (adzuki bean), *Vigna radiata* (mung bean), *Vigna unguiculata* (black-eyed pea) (EPPO, 2023; CABI, 2023).

*Symptoms*: Symptoms can develop on all above-ground parts of bean plants from Xpp (Gilbertson and Maxwell, 1992). On leaves, symptoms appear as water-soaked spots usually starting from leaf hydathodes. Spots or lesions develop on the edges or interveinal areas of leaves. These spots develop into dry and brown necrotic lesions surrounded by a narrow yellow halo (Chupp and Sherf, 1960). These spots may merge, resulting in a burnt appearance. There can be defoliation and even death of plants. In cases of systemic infection, a reddish-brown discoloration of the veins with water-soaking of adjoining interveinal areas can be observed. Infected stems will have reddish longitudinal streaks.

On pods, symptoms appear as water-soaked spots, later evolving into dark red-brown lesions, slightly depressed circular spots, and sometimes with yellow, slimy, bacterial ooze. Shrinking and death of pods may occur in the case of severe infection (EPPO, 2023). On seeds, symptoms appear as butter-yellow spots that turn brown. In severe cases, the seed may be shriveled, affecting germination rate and vigor (Darrasse et al., 2018). Seedlings are usually asymptomatic (Darrasse et al., 2007), but may show water-soaked symptoms on the stem, cotyledons, and/or primary leaves when inoculum levels are high (Gilbertson and Maxwell, 1992).

Symptoms on pods and leaves are very similar between Xpp and Xcf, and very similar to those caused by another other bacterial disease, halo blight, caused by *Pseudomonas savastanoi* pv. *phaseolicola* (https://blogs.cdfa.ca.gov/Section3162/?p=6802).

*Transmission:* The primary sources of inoculum are infected seeds, infected weeds, or volunteer beans. The bacteria can spread naturally over short distances within or between fields, with long-distance dispersal occurring through people transporting infected bean seeds (Zaumeyer and Thomas, 1957). Secondary spread in the field mainly occurs through direct contact between infected plants, wind-blown rain or splashing, and dissemination via people or agricultural equipment (Belete and Bastas, 2017).

Bacteria may reside on the surface of bean leaves as epiphytes without causing disease, then inciting lesions under favorable environmental conditions. The role of bean-feeding insects as vectors is still under study, but potential insect vectors include the weevils *Chalcodermus ebeninus* and *Diaprepes abbreviates*, the leaf beetle *Ceratoma ruficornis*, leafhoppers in the genus *Empoasca*, and the stinkbug *Nezara viridula* (Kaiser and Vakili, 1978).

*Damage Potential:* Infection with Xpp can directly reduce the area of photosynthetic tissues, impacting the yield of bean pods and seeds. Xpp is a major threat to seed quality, and the bacterium is seed-transmitted. Infected seed lots, even in the absence of symptoms, cannot be sold in many countries, in particular where the disease does not occur or has a limited distribution. Xpp is a major disease impacting common bean production in areas with suitable climates, and yield losses of up to 45% have been reported (Saettler, 1989; CABI, 2023; EPPO, 2023).

**Worldwide Distribution**: **Africa:** Angola, Burundi, Central African Republic, Democratic Republic of the Congo, Egypt, Eritrea, Eswatini, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Reunion, Rwanda, Somalia, South Africa, Sudan, Tanzania, Tunisia, Uganda, Zambia, Zimbabwe. **The Americas:** Argentina, Barbados, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Puerto Rico, St Vincent and the Grenadines, Trinidad and Tobago, United States of America, Uruguay, Venezuela. **Asia:** Bangladesh, Brunei Darussalam, Cambodia, China India, Indonesia, Iran, Israel, Japan, Jordan, Korea Dem. People's Republic, Korea Republic, Lebanon, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam, Yemen. **Europe:** Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Cyprus, Czech Republic, France, Georgia, Germany, Greece, Hungary, Italy, Lithuania, Moldova, Netherlands, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Türkiye. **Oceania:** American Samoa, Australia, New Caledonia, New Zealand, Papua New Guinea, Samoa (CABI, 2023).

**Official Control:** Xpp is on the USDA PCIT's harmful organism list for Algeria, Albania, Australia, Ecuador, Egypt, European Union, Holy See (Vatican City State), Israel, Jordan, Morocco, Madagascar, Monaco, Morocco, Nauru, New Caledonia, Republic of North Macedonia, Panama, Peru, Qatar, San Marino, Serbia, Taiwan, Turkey, Tunisia, and the United Kingdom. Xpp is on the EPPO's A1 list for Azerbaijan and Egypt and the A2 list for Bahrain, the European Plant Protection Organization, Jordan, and Turkey, and it is a quarantine pest for Israel, Morocco, and Tunisia and a regulated non-quarantine pest in Switzerland and the United Kingdom (EPPO, 2023).

**California Distribution:** California records from bean-producing counties have been sporadic and rare over the decades (French, 1989; CDFA PDR Database, 2023). Because of dry summers and the predominance of furrow or drip rather than sprinkler irrigation, this disease is uncommon in California (Frate et al., 2018).

**California Interceptions:** None

The risk that *Xanthomonas phaseoli* pv. *phaseoli* would pose to California is evaluated below.

## Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen requires moisture to reproduce and spread. Many parts of California have hot dry summers that would not allow for epidemics of Xpp to occur.

   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 be established 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 mostly legumes.

   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:** Xanthomonads can reproduce at a nearly exponential rate under ideal environmental conditions. This pathogen is highly dependent on water to reproduce and spread, and epidemics can occur with sprinkler irrigation.

   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:** This disease is mainly an issue for seed exporters. The impact in production fields is generally below the threshold for treatment, but seed lots can be rejected if this pathogen is detected by seed wash or field inspection of mother plants.

   Evaluate the economic impact of the pest on 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 (including increasing crop production costs).**
**C. The pest could trigger the loss of markets (including 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 disease impacts cultural practices. Sprinkler irrigation should be minimized and foliage allowed to dry. Seed treatments may be used but they can lower germination rates.

Evaluate the environmental impact of the pest on California using the criteria below.

**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 *Xanthomonas phaseoli* pv. *phaseoli:* 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.

There are very limited official records, and most are from Santa Barbara County. This is despite the inspection of thousands of bean acres annually as part of the state's export seed certification program.

***Evaluation is 'low'***.

**Score: -1**

-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 the 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:

Differentiation between Xpp and Xcf requires a taxonomic expert. Reports of common bacterial blight in the historical literature could be referring to one species or the other, or both.

## Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Xanthomonas phaseoli* pv. *phaseoli* **is C.**

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**Responsible Party:**

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***Comment Period: 01/04/2024 through 02/18/2024**

***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.

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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.]

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- 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**