CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

***Pseudomonas savastanoi* pv. *phaseolicola* (Burkholder 1926) Gardan et al. 1992**

≡*Pseudomonas syringae* pv. *phaseolicola* (Burkholder 1926) Young et al. 1978

Halo blight of beans

Current Pest Rating: none

Proposed Pest Rating: B

Bacteria - Pseudomonadaceae

Comment Period: 2/4/2020 through 3/20/2020

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 savastanoi* pv. *phaseolicola* (Psp) is given herein and a permanent pest rating is proposed.

History & Status:

Background:

Halo blight of bean was first described by Burkholder in 1926, who named the pathogen *Phytomonas medicaginis* var. *phaseolicola*. The name was changed to *Pseudomonas phaseolicola* (Burkholder) Dowson in 1943 when that genus was formed. With results from pathogenicity tests, DNA hybridization studies and with common nutritional patterns analyzed, Schroth et al. (1971) proposed that all fluorescent pseudomonads that could cause halo blight symptoms should be reclassified as a

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Pseudomonas syringae. Then, it was recognized as a pathovar of this species, *P. syringae* pv. *phaseolicola*, following the work of Young et al. in 1978, as confirmed by international naming standards by Dye et al., 1980. Most recently it was re-classified as *P. savastanoi* pv. *phaseolicola* after DNA studies by Gardan et al. (1992). The synonym *P. syringae* pv. *phaseolicola* is still in common usage.

Phaseolotoxin [(Nδ-phosphosulphamyl) ornithylalanylhomoarginine] was identified as a phytotoxin produced by the pathogen which increased pathogenicity of Psp (Mitchell, 1978). Phaseolotoxin acts as an irreversible inhibitor of ornithine carbamyltransferase (OTC), an essential enzyme involved in the conversion from ornithine to arginine, an amino acid which is utilized in the biosynthesis of proteins in plants. As a result, disease symptoms appear within two days, consisting of chlorotic lesions appearing as yellow halos surrounding brown necrotic spots on the infected plants (Mitchell, 1978).

Hosts: The hosts include beans in multiple genera: *Vigna angularis* (adzuki bean), *Vigna radiata* (mung bean), *Vigna unguiculata* (cowpea), *Glycine max* (soybean), *Lablab purpureus* (hyacinth bean), *Pachyrrhizus erosus* (yam bean), *Neonotonia wightii* (perennial soybean), *Phaseolus acutifolius* (tepary bean), *Phaseolus coccineus* (runner bean), *Phaseolus lunatus* (lima bean), *Phaseolus vulgaris* (common bean). Other hosts include peas (*Cajanus cajan* (pigeon pea), *Pisum sativum* (pea), *Centrosema* (butterfly pea)) and weeds (*Desmodium* (tick clovers), *Mercurialis annua* (annual mercury), *Macroptilium atropurpureum* (purple bush bean), *Pueraria montana* var. *lobata* (kudzu), *Solanum nigrum* (black nightshade), *Sonchus oleraceus* (common sowthistle) (CABI CPC, 2019; Bradbury, 1986; Birch et al., 1981).

Symptoms: Symptoms of halo blight can be very similar to the symptoms of another disease of bean called common bacterial blight (*Xanthomonas campestris* pv. *phaseoli*) or a fungal disease, bean anthracnose, caused by *Colletotrichum lindemuthianum*. Therefore, it is advisable that the identity of suspected Psp be verified by a qualified diagnostic laboratory. Halo blight affects the foliage and pods of the bean hosts. Symptoms of halo blight of beans are most clearly seen on leaves. The first symptoms are pin-prick sized water-soaked spots scattered on the undersides of the leaves and along the leaf blades that quickly turn reddish brown and dry. When dry they become visible on both sides of the leaf. The spots remain small but there can be many spots per affected leaf.

The bacteria inside the leaves produce a phytotoxin which results in an irregular yellowish area (the 'halo') spreading outwards from the spots and give the disease its common name of halo blight. The yellow halo is not always observed with halo blight and can be caused by other pathogens. At high temperatures, the halo is often small or absent (Birch et al., 1981).

Pod symptoms also begin as tiny, water-soaked spots on the pod surface that gradually enlarge to form dark, sunken lesions. Water-soaked areas or lesions also develop on pods, stems, and leaf stalks, and sometimes produce a cream-colored to silver bacterial ooze that contains bacteria. Infections can become systemic and spread throughout the plant, leading to yellowing and death of new foliage. The nodes can rot, and plants are stunted and distorted with an overall lime-green color. Pod infections can lead to seed infections. Infected seed in infected pods can be discolored, shriveled, and small, but can also be asymptomatic. Seedlings that develop from diseased seed are systemically infected and often

have the characteristic halo blight symptoms on stems, cotyledons, and first true leaves (Saettler, 1991; Sherf and MacNab, 1986).

Transmission: Halo blight bacteria can overwinter in infested debris or seed. Infested seed is the most important inoculum source for movement over longer distances. Once introduced into the field, wet weather, hail, violent rain, and windstorms help the pathogen to spread. Continuous bean cropping allows the pathogen to survive in infected debris. Spreading old bean straw into fields to be planted with beans can be a source of inoculum. Fields that are wet should not be entered by workers or machinery because of the risk of moving the pathogen from infected to uninfected plants. (Harveson, 2019).

Damage Potential: Halo blight can cause extensive losses under humid, moist conditions and moderate temperatures (16° to 23°C) (Birch et al., 1981). Fortunately, such conditions are unusual in California (Frates et al., 2018). Leaves, stems, flowers, pods, and seeds can all be infected by Psp.

Worldwide Distribution:
This pathogen is widespread in Asia, Africa, North America, Central America, South America, Europe, and Oceana. In the United States it occurs in Hawaii, and across most of the lower 48 states except California and other southwestern states with arid summer climates.

Official Control: *Pseudomonas savastanoi* pv. *phaseolicola* a quarantine pest in Israel. It is on the EPPO A1 list in Brazil, Paraguay, Uruguay, and Bahrain and on the A2 list in Chile and Jordan. It is on USDA's Harmful Organism list for Argentina, China, Guatemala, Honduras, Israel, Jordan, Panama, Paraguay, Taiwan, and Uruguay. Halo blight is in CDFA's Phytosanitary Field Inspection manual as a disease of concern for common, adzuki, lima and mung beans grown for export.

California Distribution: There are records of occasional detections of Halo blight on beans grown along the coast and specifically in Kern County, but there are no records after 1979 (French, 2019)

California Interceptions: None

The risk *Pseudomonas savastanoi* pv. *phaseolicola* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Pseudomonad bacteria require leaf wetness for infection and spread. The optimal temperature for halo blight is 20-23 °C. Moist environments also allow the spread of the disease. Above 28 °C, symptoms will usually not develop even though some water-soaked spots may be present. The arid summer climates typical of California are not conducive to disease development or spread (Schwartz, 1989).

   Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: **1**
- ***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 of Psp includes multiple types of beans and peas, plus weeds.

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: This pathogen multiples exponentially under cool, wet weather and spreads easily with splashing water. It can also be seed borne.

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: This pathogen is a serious disease of beans and peas. It is a quarantine pest in several countries and is a pest of concern for producers of export seed.

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:** Development of halo bight disease resulting from seedborne inoculum is greatly exacerbated under sprinkler compared to in-furrow irrigation due to secondary spread of the pathogen (Snyder et al., 1965). Deep-ploughing or removal of infected debris and volunteer beans is essential to reduce initial inoculum sources (Schwartz, 1989). Crop rotations with cereals such as wheat, barley, oat and maize for 3 or more years are recommended (Schwartz and Otto, 2000).

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: 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 savastanoi* pv. *phaseolicola* is 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.

This pathogen has not been found in California since 1979 and is considered to be eradicated.

Evaluation is 'not established':

Score: -0
-**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 savastanoi* pv. *phaseolicola i*s B.**

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Responsible Party:

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***Comment Period: xx/xx/2020 through xx/xx/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: B
