CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Phytophthora phaseoli Thaxt. (1889)
Downy mildew of beans

Pest Rating: B

Kingdom: Chromista, Phylum: Oomycota, Class: Oomycetes, Order: Peronosporales, Family: Peronosporaceae

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Comment Period: 11/25/2025 through 01/10/2026

Initiating Event:

This pathogen has not been through the pest rating process. It is an important pathogen for export seed certification programs. The risk to California from *Phytophthora phaseoli* is described herein, and a permanent rating is proposed.

History & Status:

Background: Downy mildew is an important disease of lima bean (*Phaseolus lunatus*) on the East Coast of the United States. It was first collected from lima beans near New Haven, Connecticut, from pods, stems, and leaves (Thaxter, 1889). Currently, *P. phaseoli* is limited to the mid-Atlantic states of Delaware, Maryland, and New Jersey and has never been reported to occur in California. This is likely to be due, at least in part, to California's lower humidity compared with the eastern United States.

California is the largest producer of lima beans in the United States, especially for dry lima beans. While other states like Delaware and New York also grow lima beans, California's production of the dry varieties is so dominant that it accounts for nearly 99% of the U.S. domestic supply. The major growing areas are in the Sacramento and San Joaquin valleys. Mid-Atlantic states are the largest producers of green lima beans for processing, along with the Pacific Northwest and parts of the Midwest (USDA-NASS, 2023).

Oomycetes are also known as "water molds". They are distinct from fungi and more closely related to algae and to green plants. As a group, they contain some of the most devastating plant pathogens. There are approximately 700 obligate biotrophic species grouped into 20 genera (Oomycota, Peronosporaceae) that cause downy mildew diseases. Downy mildew genera are nested within the

family Peronosporaceae and represent at least two evolutionary transitions from hemitrophy to obligate biotrophy (Bourret et al. 2018). The downy mildews are obligate parasites, primarily causing foliar blights, attacking and growing rapidly on young leaves, twigs, and fruits, and causing rapid and severe losses in cool, wet weather. Downy mildews are generally highly host-specific (Thines and Choi, 2016).

Most *Phytophthora* species have a soilborne or waterborne lifestyle, producing persistent sporangia and releasing motile zoospores. The majority are necrotrophic or hemibiotrophic pathogens that infect herbaceous and woody plant hosts and cause a variety of diseases, but a small number of species can also live as saprophytes in aquatic environments (Erwin and Ribeiro, 1996). *Phytophthora phaseoli* is in subclade 1c. It is homothallic, produces oogonia, but does not make chlamydospores (Abad et al., 2023).

Presently, six physiological races of *P. phaseoli*, named A, B, C, D, E, and F, have been described (Davidson et al., 2008). A physiological race is a subdivision of a pathogen species distinguished from other members of the species by specialization for pathogenicity in different host cultivars. The races can be differentiated by determining the susceptibility of five baby lima bean cultivars. The development of new races of *P. phaseoli*, and the epidemics that they have produced in the eastern United States has been a major factor in the need to relocate lima bean growing grounds (Evans et al., 2007).

Hosts: Plant species other than lima beans have been reported to be hosts for *P. phaseoli,* but not all reports include detailed descriptions of the pathogen, and some were single reports made more than 100 years ago. These hosts are reported in the USDA Fungal Database: *Brassica juncea* (leaf mustard), *Hevea brasiliensis* (rubber tree), *Phaseolus lunatus* (lima bean), *Phaseolus vulgaris* (common bean), *Raphanus sativus* (radish), *Sandoricum koetjape* (santol), *Solanum lycopersicum* (tomato), *Solanum melongena* (eggplant), *Vigna unguiculata* (cowpea) (Farr and Rossman, 2025).In 2002, Dominiak published an extensive study of agricultural crops and weed species as alternate hosts of *P. phaseoli*. Of the 33 plant species, including tomato, common bean, radish, and weeds tested, only *P. lunatus* became infected.

Symptoms: Flower racemes, shoot tips, petioles, and pods of all growth stages of lima bean are the most susceptible plant parts to this disease. In dew chamber studies, hypocotyls and leaves of lima beans can become infected, but they play little to no role in disease progress in the field. When environmental conditions in the field are ideal, pods can be covered with white, cottony mycelial growth with abundant sporangia. A reddish band often surrounds the infected area. Infected pods become necrotic, dried, and eventually shrivel (Evans et al., 2007).

Transmission: The process by which the pathogen goes from an overwintering oospore in the soil to infection of the reproductive parts of the plant is not yet understood. However, it is likely that *P. phaseoli* overwinters in the soil and with plant debris as oospores. Initial infections generally appear on flowers, young pods (pins), or larger, flat pods. Secondary spread with sporangia rapidly builds the disease to epidemic levels. The pathogen is not known to be seed-transmitted (Cox and Hyre, 1951).

Damage Potential: Losses due to lima bean downy mildew have been estimated as high as 40% in the Atlantic production areas, causing millions of dollars of crop losses (Davidson et al, 2008).

Worldwide Distribution: Brazil, Costa Rica, Democratic Republic of the Congo, El Salvador, Guatemala, Italy, Mexico, Panama, Philippines, Romania, Russia, United States (Delaware, Kentucky, Maryland, Puerto Rico), Virgin Islands (Farr and Rossman, 2025).

Official Control*: Phytophthora phaseoli* is a quarantine pest in China (EPPO, 2025). It is on the USDA PCIT's harmful organisms list for China, India, Indonesia, Japan, and Timor-Leste (USDA-PCIT, 2025).

California Distribution: none

California Interceptions: none

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

Consequences of Introduction:

1) **Climate/Host Interaction:** It is likely too dry for this pathogen to establish in the San Joaquin or Sacramento valleys, where most lima beans are grown in California. Epidemics are worst where there are evening dews and extended periods of leaf wetness, along with cool temperatures.

   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 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 for this pathogen is the lima bean. There are no other significant hosts.

   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:** Downy mildews are known for having rapid epidemics when environmental conditions are favorable. This species does not produce chlamydospores for overwintering, and it is not seed-borne.

   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: In areas with conducive climates, crop yield is severely impacted. It is a quarantine pest in a few countries and a pest of concern for our export seed programs, although it is not seed-borne.

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

Economic Impact: A, C

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: **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: none have been described or reported.

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

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 *Phytophthora phaseoli:*

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 '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 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* ***= 7***

Uncertainty:

Symptoms caused by *P. phaseoli* infections can be difficult to separate from *P. capsici*. *Phytophthora capsici* is a C-rated pest in California.

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for ***Phytophthora phaseoli*** **is B.**

References:

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USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. *Phytophthora phaseoli*. Accessed 11/6/2025.

Responsible Party:

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***Comment Period: 11/26/2025 through 01/10/2026**

***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.

Pest Rating: B