

California Pest Rating Proposal for *Phytophthora pseudosyringae* Jung et al. 2003

Pest Rating: C

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

Comment Period: **05/07/2024 through 06/21/2024**

Initiating Event:

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

History & Status:

Background:

In 1861, De Bary coined the name *Phytophthora* from the Greek phyton, "plant," and phthora, "destroyer" to describe what he believed to be a fungus that was infecting potato leaves and the cause of late blight disease. From 1876 to 1999, approximately 60 species were described based on morphology. Since 1999, species descriptions have been based on morphological and molecular characteristics. Currently, the number of named species exceeds 200 (Abad et al., 2023). Worldwide, members of the genus *Phytophthora* cause diseases with high economic and environmental impacts in commercial agriculture, nurseries, orchards, forests, landscapes, and natural ecosystems (Hansen et al., 2012; Jung et al., 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. Fine root death, root rot, collar necrosis, and trunk or stem cankers are the primary symptoms of soilborne pathogenic *Phytophthora* diseases. At the canopy level, plants with root and collar infections sometimes exhibit dramatic secondary symptoms, including bleeding cankers, epicormic shoot production, and even abrupt mortality (Bregant et al., 2023).

Phytophthora species with airborne or mixed airborne and soilborne lifestyles produce caducous sporangia and infect fruits, leaves, shoots, twigs, and branches, causing necrosis, blights, and rots (Erwin and Ribeiro, 1996). In 2003, Jung et al. described a *Phytophthora* sp. causing root and collar rot; a moderately aggressive pathogen of various *Quercus* spp. with aerial phases causing fruit rot of apples, and leaf rot of *Ilex aquifolium* when inoculated. Based on its unique combination of morphological characters, colony growth patterns, cardinal temperatures for growth, growth rates, pathogenicity to oaks, beech, alder, apple, and holly, and ITS and mtDNA sequences, this semi-papillate caducous species was separated from related and similar *Phytophthora* spp. and was described as a new species, *P. pseudosyringae* sp. nov.

The cladistic position of *P. pseudosyringae* is in Clade 3. This clade is characterized by species with a partial aerial lifestyle, a relatively low optimum temperature for growth, and a common association with forest species. *Phytophthora pseudosyringae* is emerging as an invasive pathogen on a broad number of hosts around the world (Wickland et al., 2008; Beales et al., 2010; Jung et al., 2003; Fajardo et al., 2017).

Surveys in mixed-evergreen forests in California looking for *P. ramorum* found *P. pseudosyringae*, which was previously unknown. Detections ranged from locations in central California to southern Oregon within 50 km of the Pacific Ocean and were also made in the Sierra Nevada in California. *Phytophthora pseudosyringae* was primarily isolated from hosts found in coast live oak woodlands. Bay laurel (*Umbellularia californica*) was the most common host while infection of coast live oak (*Quercus agrifolia*) stems was found less frequently. In California forests, *P. ramorum*, *P. nemerosa* and *P. pseudosyringae* have overlapping host and geographic ranges. Although all three *Phytophthora* spp. seem to share a similar ecological niche, only *P. ramorum* was associated with landscape-level tree mortality (Wickland and Rizzo, 2004; Wickland et al., 2008). A survey of foliar diseases on ornamental nursery stock in California identified 13 species of *Phytophthora* with *P. pseudosyringae* making up close to 4% of the isolates (Yakabe et al., 2009).

Hosts: *Abies fraseri* (Fraser fir), *Acer rubrum* (red maple), *Aesculus hippocastanum* (European horse chestnut), *Alnus glutinosa* (black alder), *Arctostaphylos* sp. (manzanita), *Camellia* sp., *Castanea sativa* (sweet chestnut), *Fagus sylvatica* (European beech), *Fraxinus excelsior* (European ash), *Hedera helix* (common ivy), *Ilex aquifolium* (common holly), *Laburnum anagyroides* (golden chain tree), *Laurus* sp. (bay laurel), *Lithocarpus densiflorus* (tanoak), *Nothofagus alpina* (rauli), *N. obliqua* (Patagonian oak), *Pieris* sp. (Japanese andromeda), *Quercus agrifolia* (coast live oak), *Q. alba* (white oak), *Q. robur* (English oak), *Q. rubra* (red oak), *Rhododendron* sp., *Tilia cordata* (littleleaf linden), *Umbellularia californica* (California bay), and *Vaccinium myrtillus* (European blueberry) (Farr and Rossman, 2024).

Symptoms: *Phytophthora pseudosyringae* causes root and collar rot of beech and alder (Jung et al., 2003). It was reported to cause stem cankers on sweet chestnut seedlings in a nursery (Pintos Varela et al., 2007). It has also been recovered from soil and been associated with bleeding cankers on stems and branches of southern beech (Scanu and Webber, 2016). Additional symptoms such as twig blight and leaf necrosis indicate that aerial infection also occurs, as documented on *Vaccinium* (Beales et al.,

2010). In pathogenicity tests involving inoculation of logs, *P. pseudosyringae* was shown to be an aggressive bark pathogen. It has also been shown to cause necrotic roots in mature chestnut trees in Italy (Scanu et al., 2010).

In contrast to Europe, where *P. pseudosyringae* is found mainly, but not exclusively, as a root and collar pathogen, in northern California and southwest Oregon it causes aerial infections on foliage and twigs of bay laurel and other forest plants as well as stem cankers on tanoak and true oak (Wickland et al., 2008).

Transmission: The presence of water is critical for short-distance and long-distance transmission of *P. pseudosyringae*. In California forests, it has a similar lifestyle to *P. ramorum*, which is driven mainly by splash dispersal via windblown rain (Schweigkofler et al., 2021). Chlamyospores have been reported and oogonia are produced. *Phytophthora pseudosyringae* has caducous sporangia that can act directly as infective propagules or release motile zoospores (Bregant et al., 2023; Jung et al., 2003). This pathogen has the potential to spread with any method that moves soil, infested nursery stock, as well as through waterways (Sansford, 2012).

Damage Potential: *Phytophthora pseudosyringae* is a low-temperature species with optimum and maximum temperatures of 20 and 25 °C, respectively. Jung et al. (2003) described it as moderately aggressive to fine roots of oaks and beech, highly aggressive to holly leaves and apple fruits, and slightly pathogenic to alder bark. It is not uncommon for individual woody plants and communities of woody plants to be infected simultaneously with multiple *Phytophthora* species (Bregant et al., 2023; Wickland et al., 2008). It can be difficult to separate the effects of individual species. Research in California forests shows that *P. pseudosyringae* infects multiple hosts, causing foliar lesions, especially during years of high rainfall, but is not acting as a lethal tree pathogen. It has been occasionally detected with ornamental nursery stock causing foliar leaf spots (Yakabe et al., 2009; CDFA PDR database, 2024).

Worldwide Distribution: Europe: *France, Germany, Italy, Netherlands, Norway, Poland, Spain, United Kingdom*. North America: *United States* (California, North Carolina, Oregon). South America: *Chile* (CABI, 2024, Farr and Rossman, 2024).

Official Control: *Phytophthora pseudosyringae* is not listed by the EPPO (EPPO, 2024), or as a harmful organism by any country by PCIT (USDA PCIT 2024).

California Distribution: Alameda, Contra Costa, Del Norte, Humboldt, Marin, Mendocino, Monterey, Napa, Sacramento, San Francisco, San Luis Obispo, San Mateo, Solano, Sonoma (CDFA PDR database, 2024).

California Interceptions: None.

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

Consequences of Introduction:

- 1) Climate/Host Interaction:** Surveys have found this pathogen mainly within 50 km of the Pacific Coast in central and northern California and in the Sierra Nevada. It has a relatively low maximum temperature for growth, making it unlikely to survive summers in many parts of the state.

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 moderate, including woody and herbaceous plants in multiple families.

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:** It reproduces with multiple types of spores and new reports show it can produce chlamydospores. It moves with rain, irrigation water, streams and infested soils plus nursery stock.

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:** Loss of nursery stock and mature trees has been reported in Europe and South America. Damage in California forests appears to be limited to periods of high rainfall, and results in non-lethal blights.

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

Economic Impact: A, 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.
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- 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:** This pathogen can cause disease in native plants and ornamentals. Its origin is unknown. It is not listed as a quarantine pest.

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

Environmental Impact: A, 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: 3

- 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 pseudosyringae*: 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.
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-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 = 9*

Uncertainty:

Prior to its description by Jung in 2003, *Phytophthora pseudosyringae* was probably identified as *P. syringae* or *P. ilicis* and possibly as another species of *Phytophthora* that was “*ilicis*-like”. Thus, the number of official detections in California could be an underestimate.

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for *Phytophthora pseudosyringae* is **C**.

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Responsible Party:

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***Comment Period: 05/07/2024 through 06/21/2024**

***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](mailto: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: C
