California Pest Rating Proposal for

Phytophthora occultans Man in't Veld and Rosendahl (2015)

Current Pest Rating: Z

Proposed Pest Rating: B

Kingdom: Chromista, Phylum: Oomycota,

Order: Peronosporales, Family: Peronosporaceae

Comment Period: 11/3/2020 through 12/18/2020

Initiating Event:

In June 2018, a symptomatic, mature, boxwood (*Buxus microphylla*) from a landscaped area inside a federal park in San Francisco County, California was submitted by a ranger to CDFA's Meadowview Pest Diagnostics Center. Plant pathologist Suzanne Rooney-Latham isolated a *Phytophthora* sp. in culture and determined it to be *P. occultans*. As this was not considered an official sample, it was unrated. In September 2020, a sample from a block of Mexican orange blossoms (*Choisya ternata*) that belonged to a contractor but were slated to be planted in a new landscape at the same Federal park, was submitted to CDFA. Suzanne Rooney-Latham again isolated *P. occultans*. As this was an official sample and the first detection of this pathogen in California, it was given a temporary Z rating. The risk to California from *P. occultans* is described herein and a permanent rating is proposed.

History & Status:

Background:

Phytophthora occultans is an oomycete pathogen that can cause a range of disease symptoms including root rot, collar, and crown rot and stem cankers on woody plants. *Phytophthora* spp. are widespread in temperate regions of all continents and occur in soils of natural forests, agricultural fields, landscaping, and orchards. They can persist and spread in different environments and can survive in the soil in the absence of a host. Since the discovery of *Phytophthora ramorum*, causal organism for the sudden oak death and Ramorum blight, there has been an increase of surveys in

California and throughout the world for *Phytophthora* spp., which has resulted in the description of dozens of new species (Hyun, and Choi, 2014). Increasing numbers of previously unknown Phytophthora species have been circulating globally, facilitated primarily by the nursery plant trade, and plant health specialists are aware of the potentialthreat that these pathogens pose to agriculture, forestry, horticulture, and landscapes.

Phytophthora occultans is a recently described homothallic species and a member of clade 2a of the *Phytophthora* phylogenetic tree. It is closely related to *P. terminalis*; the other notable and infamous member of clade 2a is *P. citrophthora*. *Phytophthora occultans* was described and named by Man in't Veld et al. in 2014. The type strain was isolated from *Buxus sempervirens* in the Netherlands, but their study included additional isolates the United Kingdom and Belgium, plus isolates from *Taxus* sp., *Choisya ternata*, and *Acer plamatum* from the United Kingdom. The etymology of the name is from "occultare", meaning hiding. The species was found for the first time in 1998 in the Netherlands, then went unnoticed for more than 10 years, only to re-emerge in 2010. Subsequently it has been reported in other parts of Europe and Asia and from nursery stock in Oregon (Reeser et al., 2015) and from landscapes in Massachusetts and Virginia (Gitto et al., 2018).

The host range has expanded to include woody plant species in multiple families. Although *Phytophthora* species are a well-known problem in horticultural nurseries, less attention has been placed on native plant or restoration nurseries and plantings. The potential for dangerous plant pathogens to be outplanted along with native plant nursery stock is very high, posing a threat to native landscapes, ornamental landscapes, and neighboring forests (Rooney-Latham et al., 2014, 2019; Sims et al., 2019).

Hosts: Acer palmatum (Japanese maple), *Acer* sp., *Achillea sp., Alnus sp., Arctostaphylos uva-ursi* (bear berry), *Berberis* sp., *Buxus sempervirens* (European box), *Buxus* sp. (boxwood), *Ceanothus integerrimus* (deerbrush), *Ceanothus sanguineus* (red stem ceanothus), *Ceanothus velutinus* (snowbrush ceanothus), *Choisya ternata* (Mexican orange blossom), *Cornus* sp.,*Gaultheria shallon* (salal), *Mahonia nervosa* (Oregon grape), *Quercus douglasii* (blue oak), *Rhododendron* sp. (rhododendron), *Taxus* sp. (yew), *Umbellularia* spp. (Farr and Rossman, 2020; Bourret et al., in preparation).

Symptoms: Affected plants exhibited decline and dieback in the canopy and had typical root rot symptoms. but the symptoms are not diagnostic (Gitto et al., 2018; Reeser et al., 2015). Man In't Veld et al., (2015) showed that *P. occultans* grew optimally on media from about 22 to 28 C, with a minimum growth temperature between 10 and 17 C and a maximum of 30 C, showing that it has wide adaptability to a range of temperatures. Reeser et al. (2015) conducted successful pathogenicity tests at 20-22 C.

Transmission: Species of *Phytophthora* similar to *P. occultans* that cause root, collar, and stem rots survive cold winters or hot and dry summers as mycelium in infected roots or stems or in soil. During spring or fall, sporangia are produced. The sporangia can be infective, or under favorable environmental conditions, the sporangia produce motile spores (zoospores). They are attracted to the exudates from roots of susceptible hosts and can swim with their flagella. This species is homothallic and self-fertile, able to produce sexual oospores alone, but it does not produce chlamydospores (Man

in't Veld et al, 2014). Infected soils, plants, planting stock, and seedlings, rain and irrigation water, and cultivation equipment and tools may spread contaminated soil and plant materials to non-infected plants and to new sites. Inoculum levels can increase exponentially under wet conditions (Agrios, 2005)

Damage Potential: Currently, there are no reports on quantitative economic losses in plant production caused specifically by *P. occultans*. However, infestations may result in significant damage and loss in production and stands of host plants by causing root and collar rots of infected plants. Nursery ornamentals and plants grown for outplanting in restoration sites could be particularly affected. It is common for multiple species of *Phytophthora* to co-occur in contaminated nursery blocks. Generally, infected stock cannot be rehabilitated.

Worldwide Distribution: Belgium, Germany, Netherlands, Romania, Turkey, United Kingdom, United States (California, Massachusetts, Oregon, Virginia). (Farr and Rossman, 2020; Simsek et al., 2019).

Official Control: None

California Distribution: There have been two detections, two years apart, in San Francisco County.

California Interceptions: None

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

Consequences of Introduction:

1) **Climate/Host Interaction:** *Phytophthora* spp. are widespread in California and this species is likely to be able to establish wherever its hosts are able to grow.

   Evaluate if the pest would have suitable hosts and climate to establish in California.
   > **Score**: 3
   > - 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 includes woody 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:** *Phytophthora occultans* reproduces with multiple types of spores and is moved with water, contaminated soil, and infested nursery stock.

   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:** *Phytophthora occultans* is known to be affecting woody plants in the California nursery trades. There are few fungicide treatments, and none are curative. Strict adherence to best management practices and sanitation are necessary to keep nursery stock free from *Phytophthora* spp.

   Evaluate the economic impact of the pest to California using the criteria below.
   > **Economic Impact: A, B, D, 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).
   > **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:** *Phytophthora occultans* has only been found in one *Buxus* sp. that was planted in a federal park. It has the potential to cause damage to native plant landscapes and possibly to the native forests of California, as this has been observed with other Phytophthora spp.

   > **Environmental Impact: A, B, C, D, 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 occultans:* 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.

   Evaluation is 'low'. Although it is suspected to be in the California nursery trades as it likely is in Oregon, there are limited official detections.

   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 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 = **12***

Uncertainty:

The host range of this species is likely to expand as resolution of species inside *Phytophthora* clade 2a improves (Bourret et al., 2021 in preparation). Published literature (Sims et al., 2018; Frankel et al., 2020; T. Bourret, pers. com.) shows that it is more widespread than is reflected by official samples.

Conclusion and Rating Justification:

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

References:

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*Comment Period: 11/3/2020 through 12/18/2020

*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