California Pest Rating Proposal for

Colletotrichum phormii (Henn.) D.F. Farr & Rossman 2006

Current Pest Rating: Z

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Ascomycota,
Subphylum: Pezizomycotina, Class: Sordariomycetes,
Subclass: Sordariomycetidae, Order: Phyllachorales,
Family: Glomerellaceae

Comment Period: 03/16/2021 through 04/30/2021

Initiating Event:

In February 2012, the Oregon State University Plant Clinic received *Phormium cookianum* 'Black Adder' plants from a commercial nursery in Santa Cruz County. The plants had brown lesions on the margins and midribs of several leaves. The fungus *Colletotrichum phormii* was isolated from the lesions and the diagnosis was confirmed by the USDA-APHIS National Identification Service. In March 2012, CDFA's Plant Pest Diagnostics Center received official samples from the same nursery lot and also recovered *C. phormii*. Plant Pathologist Suzanne Rooney-Latham made the identification by morphology and by analysis of rDNA sequences from the internal transcribed spacer regions using primers ITS1 and ITS4. She assigned it a temporary Q-rating. Following detections in multiple counties, the rating was changed to a temporary Z. The risk to California from *Colletotrichum phormii* is described herein and a permanent rating is proposed.

History & Status:

Background: *Phormium* is a genus of herbaceous, perennial monocots. The genus is now assigned to the daylily subfamily, Hemerocallidoideae, of the family Asphodelaceae; it was formerly in the Agavaceae. There are only two species in the genus, *P. cookianum* (=syn. *P. colensoi,* mountain flax) and *P. tenax* (New Zealand flax); the first is native to New Zealand and second is native to New Zealand and Norfolk Island (Moore and Edgar, 1970). These plants are now widely distributed in temperate regions of the world as important fiber and ornamental plants. They are not closely related to common

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linseed flax (*Linum usitatissimum*) but have many of the same uses as the leaves can be processed with cutting, washing, bleaching, dying and drying and can be woven and used as the primary material for clothing, shoes, baskets, cording, ropes and mats. Phormium species also have medicinal properties and is used in poultices, purgatives, disinfectants, and ointments (Brown, 2006). The genus name *Phormium* comes from Ancient Greek for a "basket", while the species *tenax* is a Latin adjective meaning "holding fast, or tenacious".

Colletotrichum is a large genus with members that cause diseases to diverse host plants. Their diseases are often referred to as “anthracnoses”, with infection causing black spots and blights on fruits, stems, leaves and seeds. They can be important causes of preharvest and postharvest disease as latent or quiescent infections that occur early in the season that may not visible at harvest but cause significant economic loss of fruit in storage over time. Some species of *Colletotrichum* are plant pathogens of quarantine significance. *Colletotrichum* are also frequently described as endophytes of woody plants (Damm et al., 2012).

Work published by Farr et al. in 2006, characterized species of *Colletotrichum* found on plants belonging to the Agavaceae (monocotyledons: Liliales), which was the previous location of the genus *Phormium*. The species *C. phormii* (synonym *C. rhodocyclum*) was first described in this paper based on multigene molecular analysis and an epitype was recorded. It has been isolated from living and recently killed leaves of *Phormium cookianum*, *Phormium* sp. and *P. tenax*. It is most closely related to *C. acutatum*, an important pathogen with a wide host range that is now considered a species complex. *Colletotrichum phormii* is a distinct and host-specific species within the *C. acutatum* lineage (Jayawardena et al., 2016). The geographic distribution of *C. phormii* is New Zealand, where the hosts are native, and elsewhere in temperate regions where *Phormium,* especially *P. tenax*, is cultivated, often in greenhouses. Previously, *Colletotrichum* isolates from *Phormium* with long spores were called *C. rhodocyclum.* Today *C. phormii* is considered a regulated quarantine pest, prohibited by USDA when found on *Phormium* spp. seeking to enter the United States.

Hosts: Phormium colensoi (syn= P. cookianum), Phormium spp., and *P. tenax* (Farr and Rossman, 2021).

Symptoms: *Colletotrichum phormii*- infected host plants exhibit symptoms of anthracnose, which include dark brown leaf, stem and fruit spots and wilting of leaves often resulting in dieback and reduction in plant quality. Typical symptoms on *Phormium* are dark brown lesions with discoloration of central tissues that eventually coalesce to form large irregular necrotic areas. In older lesions, black sub-epidermal acervuli are produced that erupt through the epidermis with no obvious setae (Golzar and Wang, 2010). The brown lesions can be on the margins or midribs of the leaves with variable lesion sizes, fusiform to ellipsoidal in shape. Black acervuli can exude salmon-colored spore masses under moist conditions (Serdani et al., 2013).

Transmission: It is likely that *Colletotrichum phormii* has a similar life cycle to that of other *Colletotrichum* species. Because *Phormium* is a perennial, the pathogen can persist for many years on the leaves. If the plants are cut back, it can survive as mycelium on plant residue in soil. During active growth, the pathogen produces masses of hyphae which bear conidiophores, on the plant surface. Conidia (spores) are produced at the tips of the conidiophores and disseminated by wind, rain,

cultivation tools, equipment, and field workers to host plants. Humid, wet, rainy weather is necessary for infection to occur. These requirements may limit the severity of the pathogen in some California landscapes and subsequently, the pathogen may be more of a problem during wet spring conditions or humid overcast weather, found in coastal California or under the controlled environments of greenhouses. Conidia germinate, penetrate host tissue by means of specialized hyphae (appressoria) and invade host tissue. Phormium varieties are vegetatively propagated as clones and daughter plants divided from infected mother plants may also be infected.

Damage Potential: When a pathogen is of quarantine significance, it is often necessary to eradicate it from nursery stock or landscapes. For Phormiums this would require plants to be cut back and treated with fungicide or destroyed. At ports of entry, *Phormium* infected with anthracnose are denied entry to the US. Anthracnose can result in reduced plant quality and growth. Estimates of yield/crop loss due to this pathogen have not been reported but nursery production of potted host plants or in greenhouses is particularly at risk as nursery conditions are often conducive to infection by *Colletotrichum* species. In landscapes, disease development may be sporadic as it is affected by levels of pathogen inoculum and environmental conditions.

Worldwide Distribution: Australia, Austria, Georgia, Germany, Italy, Netherlands, New Zealand, South Africa, Spain, United Kingdom, United States (California and Oregon) (Farr and Rossman, 2021).

Official Control: *Colletotrichum phormii* is on the USDA's regulated pest list and a quarantine pest for the United States under the authority of the Plant Protection Act.

California Distribution: Monterey, Sacramento, San Luis Obispo, Santa Barbara, Solano, and Yolo counties (CDFA PDR database; Serdani et al., 2013).

California Interceptions: None

The risk *Colletotrichum phormii* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** *Colletotrichum phormii* could be limited in very dry climates (*Phormium* is drought tolerant) but often they are planted densely in humid landscapes or irrigated with sprinklers. Along the coast, heavy fog or dew could provide enough moisture for infection.

   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 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 is limited to *Phormium*.

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:** It has only one type of spore, conidia, but they can be produced in large numbers. Spores are spread with rain splash or wind-blown rain.

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 nursery situations, even low disease incidence or severity can greatly reduce the marketability of infected plants. It is currently a quarantine pest in the United States. Infected or exposed mother plants should not be used for propagation. Plant foliage should be kept as dry as possible.

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

Economic Impact: A, B, C, D

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:** With a very narrow host range and no native *Phormium* spp. in California, the environmental impact should be low. It could impact ornamental plantings as phormiums are grown for their foliage and this pathogen causes noticeable leaf lesions.

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 *Colletotrichum phormii:* Medium

Add up the total score and include it here. **10**
-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'. There are official records from six counties ranging from the coast to the Sacramento Valley

Score: -3
-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* ***= 7***

Uncertainty:

It is likely that this disease is more widespread in California than is reflected by official samples. There have been multiple detections in nurseries since 2012. On darker leaved varieties, it may be more difficult to see or may be confused with abiotic diseases such as edema or cold injury, or with insect feeding damage.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Colletotrichum phormii* is C.

References:

Brown, A. M. 2006. The history of New Zealand Flax. http://www.alibrown.co.nz/history-of-new-zealand-flax.html

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Farr, D.F., Aime, M.C., Rossman, A.Y., and Palm, M.E. 2006. Species of *Colletotrichum* on Agavaceae. Mycol. Res. 110: 1395-1408.

Farr, D.F., and Rossman, A.Y. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved February 18, 2021, from https://nt.ars-grin.gov/fungaldatabases/

Golzar, H., and Wang, C. 2010. First report of *Colletotrichum phormii* the cause of anthracnose on *Phormium tenax* in Australia. Australasian Plant Disease Notes 5: 110-112.

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Moore, L.B. and Edgar, E., 1970. Flora of New Zealand. Volume 2. Indigenous Tracheophyta. Monocotyledones except Gramineae. Flora of New Zealand. Volume 2. Indigenous Tracheophyta. Monocotyledones except Gramineae.

Serdani, M., Rooney-Latham, S., Wallis, K.M., and Blomquist, C.L. 2013. First Report of *Colletotrichum phormii* Causing Anthracnose on New Zealand Flax in the United States. Pl. Dis. 97: 1115.

Responsible Party:

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***Comment Period: 03/16/2021 through 04/30/2021**

***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: C