

## California Pest Rating Proposal for *Diaporthe foeniculina* (Sacc.) Udayanga & Castl. 2014

**Current Pest Rating: Z**

**Proposed Pest Rating: B**

Kingdom: Fungi, Division: Ascomycota,  
Class: Sordariomycetes, Order: Diaporthales,  
Family: Diaporthaceae

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**Comment Period: 02/01/2021 through 03/18/2021**

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### Initiating Event:

In May 2017, a gardener submitted leaves of various plants to the CDFA Plant Pest Diagnostics Center as part of a survey for *Phytophthora ramorum*. The leaves were collected from a regional park in Contra Costa County. *Phomopsis foeniculina* (syn. *Diaporthe foeniculina*) was detected in culture from a sample of *Prosartes hookeri* (drops-of-gold), a California native in the lily family. CDFA plant pathologist Suzanne Rooney-Latham made the identification by culturing the fungus for morphological analysis followed by PCR sequencing of the ITS region. *Diaporthe foeniculina* has a wide host range, but this was a first report on this host. It is a known pathogen in California causing branch cankers and fruit rots, and sometimes acting as an opportunistic pathogen attacking weakened or stressed hosts. As this was the first official sample, it was assigned a temporary Z rating. In January 2018 it was isolated from roses growing in a rose garden in Sacramento County, and in March 2020 from *Arctostaphylos* spp. at a native plant nursery in San Francisco County.

In October 2020, a mass mortality event was observed with large numbers of *Acacia melanoxylon* (Australian blackwood) on a hillside in the city of Oakland showing leaf dieback and trunk cankers. Samples were collected by a University of California Urban Forestry Advisor. *Diaporthe foeniculina*, along with *Phytophthora* spp. and *Phacidiopycnis tuberivora*, were isolated from the samples, but their individual and collective contribution to the dieback symptoms has not yet been determined. The risk to California from *D. foeniculina* is described herein and a permanent rating is proposed.

### History & Status:

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**Background:** The genus *Diaporthe* is an economically important group of plant pathogenic fungi that cause diseases on a wide range of crops, ornamentals, and forest trees. For many decades, species in *Diaporthe* were described and named based on host associations, which led to a proliferation of species names. Research has shown that these species are generally not host-specific, and it is not uncommon for several species to be found on a single host (Farr and Rossman, 2020). Current taxonomy of the genus relies on molecular phylogenies to resolve species. More work is required to understand their roles as pathogens, endophytes, or saprobes.

*Diaporthe foeniculina* is known to occur on citrus and many other woody plants hosts in temperate and tropical regions of Australia, Europe, North America, and South Africa. It was originally described causing a stem end rot of lemandarin (*Citrus limonia*) and can also be observed as a saprobe on branches of this same host. In 2014, Udayanga et al. revised *Diaporthe* that infect citrus using worldwide collections, including strains from California. They were able to resolve taxonomic and nomenclatural uncertainty and provide modern descriptions while designating an epitype for *D. foeniculina*. Strains they examined included one (then called *Phomopsis californica*) collected by H. S. Fawcett in Santa Barbara County in 1922 on dead outer bark and decaying fruit of *Citrus limonia*.

In 2015, Lawrence et al. studied the diversity of *Diaporthe* species associated with wood cankers of fruit and nut crops in northern California. They were able to isolate *D. foeniculina* from grapevine cankers, but pathogenicity testing showed it was only weakly or non-pathogenic, suggesting instead that it was acting as an endophyte after colonizing grapevine wood. They also identified *Salix* sp., growing around the vineyards, as a new host.

*Hosts:* *Acacia* sp., *Acacia melanoxylon* (blackwood acacia), *Acer negundo* (box elder), *Achillea millefolium* (milfoil), *Actinidia deliciosa* (kiwi), *Ailanthus altissima* (tree of heaven), *Amorpha fruticosa* (indigo bush), *Angelica sylvestris* (wild angelica), *Arctium minus* (common burdock), *Arctostaphylos montana* subsp. *ravenii* (Presidio manzanita), *Asparagus* sp., *Camellia sinensis* (tea), *Castanea sativa* (European chestnut), *Citrus x aurantiifolia* (lime), *Citrus bergamia* (bergamot orange), *Citrus japonica* (kumquat), *Citrus latifolia* (Bearss lime), *Citrus x limon* (lemon), *Citrus maxima* (pummelo), *Citrus medica* (cintron), *Citrus mitis* (calamondin), *Citrus paradisi* (grapefruit), *Citrus reticulata* (mandarin), *Citrus sinensis* (orange), *Corylus avellana* (filbert), *Cupressus sempervirens* (Italian cypress), *Diospyros kaki* (Chinese persimmon), *Euphorbia pulcherrima* (poinsettia), *Ficus benjamina* (Benjamin fig), *Ficus carica* (fig), *Foeniculum vulgare* (fennel), *Fuchsia excorticata* (tree fuschia), *Glycine max* (soybean), *Hemerocallis fulva* (orange day-lily), *Hydrangea macrophylla* (hydrangea), *Juglans regia* (English walnut), *Lunaria rediviva* (perennial honesty), *Malus domestica* (apple), *Melilotus officinalis* (common melilot), *Microcitrus australasica* (finger-lime), *Paraserianthes lophantha* (cape-wattle), *Persea americana* (avocado), *Pistacia vera* (pistachio), *Platanus x hispanica* (London planetree), *Prosartes hookeri* (fairy-bells), *Prunus* sp., *Prunus avium* (sweet cherry), *Prunus dulcis* (almond), *Pyrus bretschneideri* (Chinese white pear), *Pyrus communis* (pear), *Pyrus pyrifolia* (Asian pear), *Rhus pendulina* (western karee), *Ribes nigrum* (black currant), *Rosa canina* (common-briar), *Rubus* sp., *Salix* sp., *Saposhnikovia divaricata* (siler), *Vaccinium corymbosum* (blueberry), *Vicia* sp., *Vitis vinifera* (grapevine), *Wisteria sinensis* (wisteria) (Farr and Rossman, 2020; CDFA PDR database, 2020).

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**Symptoms:** In general, *Diaporthe* spp. can cause a wide range of symptoms such as stem and branch cankers, shoot blight, twig dieback, fruit rot, and leaf spots. On citrus, *D. foeniculina* is associated with woody cankers and can be isolated as a saprophyte from dead wood (Udayanga et al., 2014). It also causes citrus fruit rot, both pre- and post-harvest, notably on lemons (Tekiner et al., 2020). It causes shoot cankers and dieback on woody hosts such as sweet chestnuts (Annesi et al., 2016), and yellowing and dieback of fig (Esmailzadeh et al., 2020).

**Transmission:** While specific information is lacking, it is likely that this species is like other species of *Diaporthe* occurring as plant pathogens, endophytes, or saprobes. The fungus produces ascospores (sexual spores) in perithecia (sexual fruiting bodies) and conidia (asexual spores) in pycnidia on living or dead twigs and leaves. Conidia are the main inoculum causing primary and secondary infections and are spread to host plants by splashing rains. Ascospores may be involved in long distance dispersal of the pathogen. The fungus is likely to overwinter as mycelium and/or as conidia within pycnidia, on a living host or on plant debris or dead branches. Transmission could occur with windblown/splashing rain and irrigation water, pruning tools, possibly insects, and animals can spread fungal spores to non-infected plants. Long distance spread can occur with infected nursery stock (Agrios, 2005)

**Damage Potential:** Quantitative losses caused by *D. foeniculina* have not been reported. The pathogen causes dieback, cankers, and fruit rot in multiple crops. However, its contribution as a primary pathogen, weak secondary pathogen, epiphyte, or saprophyte is often unresolved. Infections may result in reduced fruit and plant production and marketability. In California, nurseries and other growers of fruit trees, woody ornamentals, and natives may be at risk of damage caused by this pathogen.

**Worldwide Distribution:** Australia, Chile, China, Croatia, Germany, Greece, Iran, Italy, Malta, New Zealand, Portugal, Serbia, South Africa, Spain, Turkey, United States (California), Uruguay (Farr and Rossman, 2020).

**Official Control:** No official control is reported for *Diaporthe foeniculina* or *Diaporthe* spp. However, *Phomopsis* spp. is presently on the 'Harmful Organism List' for French Polynesia (USDA PCIT, 2020). Currently, *D. foeniculina* has a temporary Z rating in California.

**California Distribution:** There are official state records from Alameda, Contra Costa, Sacramento, and San Francisco counties and published reports from Napa, San Benito, and Santa Barbara counties (Lawrence et al., 2015; Farr and Rossman, 2020).

**California Interceptions:** None

The risk *Diaporthe foeniculina* would pose to California is evaluated below.

## Consequences of Introduction:

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- 1) Climate/Host Interaction:** This pathogen has an extensive host list and its hosts are grown throughout California

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 dozens of species of woody plants and some herbaceous hosts, and many of these are important as fruit crops (i.e. citrus, fig, stone fruit, pome fruit, persimmon, kiwi, and grapes).

Evaluate the host range of the pest.

**Score: 3**

- 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:** *Diaporthe foeniculina* has a high reproductive potential with an abundant production of spores. However, the spores are dependent on splashing water or movement of contaminated planting material for dispersal.

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:** The economic impact of this species has not been extensively studied, but it does cause wound cankers, shoot dieback, and pre- and post-harvest fruit rots when conditions are favorable.

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

**Economic Impact: A, B**

- 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.
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**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:** The host range of this pathogen includes many plants that are California natives (i.e. *Prosartes hookeri*, *Arctostaphylos* spp.) or are naturalized in California (i.e. *Acacia* spp.). It seems likely that it is endophytic, non-pathogenic or saprophytic on the bark or wounds of some hosts, but if they are stressed or weakened, it may become more pathogenic (Lawrence et al., 2015).

**Environmental Impact: A, B, C**

- 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 *Diaporthe foeniculina*: 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 'Medium'.** There are records from multiple hosts in multiple counties in the San Francisco Bay area, the Napa and Sacramento Valleys, and Santa Barbara County.

**Score: -2**

- 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 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 = 11*

### **Uncertainty:**

This pathogen was recently isolated from blackwood acacias experiencing mass dieback in Alameda County. Although acacias are a known host, it is not suspected to be the primary reason for the tree deaths. It could be attacking trees that were weakened by drought, or co-infecting with other pathogens. The host range of *D. foeniculina* is still expanding with new hosts being reported in California and worldwide.

### **Conclusion and Rating Justification:**

Based on the evidence provided above the proposed rating for *Diaporthe foeniculina* is B.

### **References:**

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

Annesi, T., Luongo, L., Vitale, S., Galli, M. and Belisario, A., 2016. Characterization and pathogenicity of *Phomopsis theicola* anamorph of *Diaporthe foeniculina* causing stem and shoot cankers on sweet chestnut in Italy. *Journal of Phytopathology*, 164(6), pp.412-416.

Esmailzadeh, A., Zafari, D. and Bagherabadi, S., 2020. First report of *Diaporthe foeniculina* causing yellowing and dieback on *Ficus benjamina*. *New Disease Reports*, 41, pp.16-16.

Farr, D.F., and Rossman, A.Y. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved December 22, 2020, from <https://nt.ars-grin.gov/fungaldatabases/>

Lawrence, D.P., Travadon, R. and Baumgartner, K., 2015. Diversity of *Diaporthe* species associated with wood cankers of fruit and nut crops in northern California. *Mycologia*, 107(5), pp.926-940.

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Tekiner, N., Tozlu, E. and Guarnaccia, V., 2020. First report of *Diaporthe foeniculina* causing fruit rot of lemon in Turkey. *Journal of Plant Pathology*, 102(1), pp.277-277.

Udayanga, D., Castlebury, L.A., Rossman, A.Y. and Hyde, K.D., 2014. Species limits in *Diaporthe*: molecular re-assessment of *D. citri*, *D. cytospora*, *D. foeniculina* and *D. rudis*. *Persoonia: Molecular Phylogeny and Evolution of Fungi*, 32, p.83.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PEXD) Harmful Organisms Database Report. *Phomopsis*. Accessed 12/22/2020

### Responsible Party:

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**\*Comment Period: 02/01/2021 through 03/18/2021**

### \*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](mailto:permits[@]cdfa.ca.gov).

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### 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;

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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.

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**Proposed Pest Rating: B**

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