cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Fusarium oxysporum f. sp. *palmarum* Elliott & al. 2010

Fusarium wilt of palm

Current Pest Rating: None

Proposed Pest Rating: B

Kingdom: Fungi; Division: Ascomycota; Class: Sordariomyces;

Order:Hypocreales; Family: Nectriaceae

Comment Period: 02/19/2020 through 04/04/2020

Initiating Event:

On January 20, 2020, as a requirement of holding a of state diagnostic permit, a report was received from a private diagnostics lab in Southern California. The permittee reported that in July 2019, sections of frond petiole along with radial trunk pieces from a pair of queen palms (*Syagrus romanzoffiana*) were submitted to their laboratory from a private residential landscape in Fallbrook, California (San Diego County) for diagnostic purposes. Both palms were said to exhibit symptoms of frond necrosis and wilt. Symptomatic tissues were cultured from them and *Fusarium oxysporum* was isolated from the trunks. The culture plates were forwarded to the National Diagnostic Laboratory at the University of Florida for analysis. PCR testing confirmed that the isolate was a match for *Fusarium oxysporum* f. sp. *palmarum.*

This is the first report of this pathogen in California. *Fusarium oxysporum* f. sp. *palmarum* has not been assessed under the pest rating proposal system. The diagnostics lab provided contact information for the submitter of the sample for follow up from San Diego agricultural officials. The trees have already been removed from the property and an article detailing the detection has been published (Hodel and Santos, 2019). The risk of this pathogen to California is evaluated herein and a permanent rating is proposed.

History & Status:

Background: Fusarium wilt of *Syagrus romanzoffiana* (queen palm) and *Washingtonia robusta* (Mexican fan palm), caused by the fungal plant pathogen *Fusarium oxysporum* f. sp. *palmarum,* was first described as a distinct form in 2010. In 2011, this fungus also was reported to attack *Phoenix canariensis* (Canary Island date palm) in Florida, but infection of this host is reported to be rare. *Phoenix canariensis* is more commonly infected with a different forma specialis of this fungus, *F. oxysporum* f. sp. *canariensis*. Disease caused by *F. oxysporum* f. sp. *palmarum* is widespread in Florida and in the Houston-Galveston area of Texas (Giesbrecht et al., 2013, Elliott 2017), and has recently been reported in Arizona (Gomez and Pryor, 2019) and in California (Hodel and Santos, 2019).

Hosts: Syagrus romanzoffiana (queen palm), *Washingtonia robusta* (Mexican fan palm) (Elliott, 2010; Elliott et al., 2010), *Phoenix canariensis* (Canary Island date palm) (Elliott, 2011), X*Butyagrus nabonnandii* (mule palm) (Elliott et al., 2017).

Symptoms: As is typical for a Fusarium wilt, the disease affects the vascular system of the palm by occluding the xylem vessels with macroconidia and hyphae, blocking the movement of water into the leaves. Diagnosis often starts with the observation of foliar wilt in excess of normal leaf senescence. Early symptoms on individual fronds are a one-sided leaflet dieback, necrotic and brown streaking on the lower rachis base of older fronds, and a light brown to red brown necrosis within the vascular bundles. The symptoms usually appear on the oldest fronds first and often on only one quadrant or one side of the tree. Over a few months to a few years, symptoms spread up and around in the canopy as successively younger fronds die and wilt but remain attached to the trunk. The tree dies when it lacks enough foliage to photosynthesize or when the leaf bud is infected. Trees growing in moderate climates along the coast die more slowly than trees growing in hotter, inland areas (Downer et al., 2009). Trees are often co-infected with Pink Rot (*Nalanthamala vermoeseni*) which can make isolation of *F. oxysporum* more difficult. Morphological identification of the pathogen in culture cannot be done below the species level and identification to the forma specialis level is made through DNA sequencing.

Decline of queen palms infected with *F. oxysporum* f. sp. *palmarum* is rapid. Affected fronds may not always show the conspicuous contrasting one-sided necrosis of brown vs. green; one side may be brown and the other side yellow (Hodel and Santos, 2019). Also, in contrast to other formae speciales, the dead fronds might not wilt, they may remain desiccated but in their pre-disease position on the trunk (Elliott, 2017).

Transmission: The fungus can spread through the movement of infested/infected soil, water, trees, and seeds, and through pruning (Downer et al., 2009; Simone, 2004). Although often speculated on based from the observed patterns of disease in nurseries and ornamental plantings, no aerial spread of the disease with wind-born or vectored conidial spores has been proven. The use of boot spikes to climb trees and chain saws for pruning creates wounds on trees and allows introduction of the conidia directly to susceptible green tissues.

Current disease management centers around the rapid and accurate diagnosis of the pathogen from mixed fungal infections with Pink Rot or secondary decay organisms, prevention of pathogen introduction to new plantings through sanitation of equipment, and destruction of diseased plants without using chipping or other methods that allow movement of inoculum (Downer et al., 2009). The pathogen produces long-lasting, thick walled chlamydospores that can survive in the soil without a host for as long as 25 years. When new trees are planted on sites where trees have died, they can be infected through their roots growing in infested soil (Downer, 2006).

Damage Potential: Fusarium wilts can be highly lethal disease of young and mature trees that is easily spread by unsanitary tree trimming practices and by the planting of contaminated nursery stock. Removal of diseased fronds by the nurseries immediately prior to sale is problematic as consumers are unaware that their trees had any symptoms of disease. Arborists and landscapers should observe untrimmed trees at a nursery for a minimum of 12 months prior to purchasing and moving them. Transplanting of mature trees, often moving them from the desert to the coast to create "instant landscapes" around new construction, is a common stressor that increases tree susceptibility. Over-pruning to form "pineapples" or "chicken heads" in the tree crowns should also be avoided as it involves the cutting of green fronds which creates an entry point for the pathogen and increases tree stress. The loss of a mature landscape specimen and the cost of the subsequent removal of the dead tree by digging and craning can be thousands of dollars per tree. When tree trimmers move through ornamental plantings without properly sanitizing their tools, large numbers of mature trees can be infected simultaneously and will die over the subsequent months to years. Because the pathogen can survive as chlamydospores in the soil for decades, it is not advisable to replant with any susceptible host. This disease can permanently remove multiple palm species from landscapes.

Worldwide Distribution: Florida (Elliot 2010), Texas (Giesbrecht et al., 2013), Arizona (Gomez and Pryor, 2019), California (Hodel and Santos, 2019) .

Official Control: None

California Distribution: This pathogen has been reported from San Diego County, but this was not an official sample.

California Interceptions: none

The risk *Fusarium oxysporum* f. sp. *palmarum* poses to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Based on observations in Texas, Arizona, and Florida, this pathogen can establish in the climates where its hosts are grown. Queen palms, Mexican fan palms, and Canary Island date palms are extensively planted 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:** For this formae specialis of *Fusarium oxysporum*, the hosts appear to be limited to a few species of palms.

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:** The pathogen does not have an aerial spore but spores are present inside the green wood and spread easily with unsanitary tree trimming. It forms long lasting chlamydospores that stay in the soil for decades. It can be 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:** This is a lethal pathogen and when spread to a nursery or landscape, it can remain in the soil for decades, eliminating the land from production.

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

Economic Impact: A, B, 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:** None of these palm trees are native to California but the are important and widespread in landscape plantings. *Phoenix canariensis* and *Washingtonia robusta* have escaped cultivation in southern California to invade stream corridors as well as orchards and, occasionally, landscaped areas. These escaped trees could become a resevoir for inoculum in a local area.

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 *Fusarium oxysporum* f. sp. *palmarum:* Medium

Add up the total score and include it here. **11**
-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.

There are no official records in California of this pathogen but there is a published report .

Evaluation is 'Low'.

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:

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information:* ***10***

Uncertainty:

Washingtonia filifera (California fan palm) is a native species. It is unknown if *W. filifera* is susceptible to this disease.

Conclusion and Rating Justification:

Based on the evidence provided above and its status as a quarantine pest in California, **the proposed rating for *Fusarium oxysporum* f. sp. *palmarum* is B.**

References:

Downer, A. J. 2006. Fusarium wilt pathogen of *Phoenix canariensis* is a soil survivor. Landscape Notes 19(3): 1-2

Downer, A. J., Hodel, D. R., and Mochizuki. M. J. 2009. Pruning landscape palms. HortTech. 19:695-699.

Elliott, M. L., 2010. Fusarium wilt of queen palm and Mexican fan palm. EDIS. Publication #PP278

Elliott, M. L. 2011. First Report of Fusarium Wilt Caused by *Fusarium oxysporum* f. sp. *palmarum* on Canary Island Date Palm in Florida. Amer. Phytopath. Soc. Pp. 356.

Elliott, M. L., Broschat, T. K., Uchida, J. Y., Simone, G. W. 2004. Compendium of ornamental palm disease and disorders. Amer. Phytopath. Soc. Press, St. Paul, MN.

Elliott, M. L., Des Jardin, E. A., O'Donnell, K., Geiser, D. M., Harrion, N. A, and Broschat, T. K. 2010. *Fusarium oxysporum* f. sp. *palmarum*, a novel forma specialis causing a lethal disease of *Syagrus romanzoffiana* and *Washingtonia robusta* in Florida. Plant Dis. 94: 31-38.

Elliott, M. L., Des Jardin, E. A., Harmon, C. L., and Bec, S. 2017. Confirmation of Fusarium Wilt Caused by *Fusarium oxysporum* f. sp. *palmarum* on × *Butyagrus nabonnandii* (mule palm) in Florida. Plant Disease Vol. 101. No.2

Giesbrecht, M., McCarthy, M., Elliott, M. L., and Ong, K. L. 2013. First Report of *Fusarium oxysporum* f. sp. *palmarum* in Texas Causing Fusarium Wilt of *Washingtonia robusta*. Plant Disease. Vol 97: No. 11

Gomez, B. A., and Pryor, B. 2019. First report of Fusarium wilt of queen palm in Arizona caused by *Fusarium oxysporum* f. sp. *palmarum*. Vol 103: No 12

Hodel, D., and Santos, P. 2019. New Fusarium Wilt Disease of Palms. PALMARBOR. 2019-2: 1-17

Simone, G. W. 2004. Canary island date palm wilt, p. 17-19. In: M. L. Elliot, T. K. Broschat, J. Y. Uchida, and G. W. Simone (eds.). Compendium of ornamental palm disease and disorders. APS Press

Responsible Party:

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*Comment Period: 02/19/2020 through 04/04/2020

*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