

California Pest Rating Proposal for

Fusarium proliferatum (Matsush.) Nirenberg ex Gerlach & Nirenberg 1982
≡ *Cephalosporium proliferatum* Matsush. 1971

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Ascomycota,
Subphylum: Pezizomycotina, Class: Sordariomycetes,
Subclass: Hypocreomycetidae, Order: Hypocreales,
Family: Nectriaceae

Comment Period: 07/08/2022 through 08/22/2022

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from *Fusarium proliferatum* is described herein and a permanent rating is proposed.

History & Status:

Background: *Fusarium* is a large genus of filamentous fungi. Most species live in the soil and are saprobes, some can cause vascular wilts, blights, or root, stem, seed, or pod rots of plants. Some are pathogens of people and animals; and a few, including *F. proliferatum*, produce mycotoxins that negatively affect human and animal health. *Fusarium proliferatum* is one of the most common *Fusarium* spp. infecting numerous plant families and occurring in various climatic zones (Farr and Rossman, 2022). It can easily be confused with morphologically similar species and can co-occur in the same environments with other species.

Reproduction of *Fusarium* is done with up to with three kinds of asexual spores. These are microconidia, macroconidia, and chlamydoconidia. The micro- and- macro conidia are produced in same sporodochia. These sporodochia develop on the surface of stem, leaves and other parts of the host plant. These spores are easily disseminated by wind and after falling on the suitable substratum, they germinate and infect the host plants. The third type of asexual spore is the chlamydoconidium, a thick-walled resting structure.

The sexual stage or teleomorph of this fungus is *Gibberella fujikuroi*. The genus *Gibberella* belongs in the Hypocreaceae, a family characterized by brightly colored perithecia that frequently form in stromata. The perithecia of *Gibberella* are a dark blue in color at maturity. Ascospores (sexual spores) form within sacs called asci and are forcibly discharged from the perithecium through a single small opening known as an ostiole. The ascospores are hyaline to light brown in color, and slightly curved with rounded ends.

This species can produce ascospores from the combination of different mating types. At one time the teleomorph was called *Gibberella intermedia* (Kuhlmann) Samuels et al., later moved to *G. fujikuroi* mating population D (Leslie, 1995). *Gibberella fujikuroi* is a complex species comprised of distinct mating populations with *Fusarium* anamorphs. These fungi are common pathogens of maize, rice, and sorghum, and cause billions of dollars of losses in these crops worldwide.

Fusarium proliferatum causes diverse diseases, including but not limited to root rot on soybeans and small grains, stalk and ear rot on maize, vascular wilt of strawberry, trunk canker on trees, grapevine decline, daylily flower rot, garlic and onion bulb rot, rice spikelet rot, fuzzy pedicle of banana, and fruit rot of jujube (CABI-CPC, 2022). In California, it is well known for damaging the rachis of palms, resulting in a disfiguring leaf blight (CDFA PDR Database, 2022).

Fusarium proliferatum is a toxigenic species capable of producing a broad range of toxins, such as fumonisin B1, moniliformin, beauvericin, fusaric acid, and fusaproliferin. Some of these toxins have well-known phytotoxic activity. They have been implicated in the pathogenesis of tomato-wilt symptoms and are phytotoxic toward tobacco and maize (Lamprecht et al., 1994; Ritieni et al., 1995). Additionally, it can cause a disseminated infection in immunocompromised patients (Tortorano et al., 2014) and abscesses in the human body where trauma is caused by a plant (Palmore, 2010).

Hosts: This pathogen has a very large and diverse host range, including many agronomic crops: vegetables, tree fruit, small fruit, vines, also forest trees and ornamentals. California detections have been made on *Archontophoenix alexandrae* (king palm), *Areca* (palm), *Arecastrum romanzoffianum* (queen palm), *Beaucarnea spp.* (ponytail palm), *Cannabis spp.*, *Citrus limon* (lemon), *Dendrobium spp.* (orchid), *Ficus carica* (fig), *Juglans nigra* (black walnut), *Phalaenopsis* (moth orchid), *Phoenix canariensis* (Canary Island date palm), *P. dactylifera* (date palm), *P. roebellinii* (miniature date palm), *Pinus lambertiana* (sugar pine), *Pinus sp.* (pine), *Pistacia vera* (pistachio), *Platanus × hispanica* (London plane), *Pseudotsuga menziesii* (douglas-fir), *Quercus sp.* (oak), *Solanum lycopersicum* (tomato), *Sorghum sp.* (great millet), *Syagrus romanzoffiana* (queen palm), and *Zea mays* (corn) (CDFA PDR Database).

Symptoms: This pathogen causes several types of diseases depending on the host. On banana, it causes postharvest crown rot symptoms. Beginning in the field, the crown tissues became blackened and softened, followed by an internal development of infection affecting the peduncle and the fruit, which triggered early ripening of bananas. Subsequently, necrosis of the pedicels and fruits appeared and caused the fingers to fall off (Waliullah et al., 2021). On onions, aboveground parts showed stunted growth, wilting, and drying. Underground parts of infected plants were lacking normal tiller number and growth. Root showed red lesions and rot in severe cases. The bulb disc appeared brown to

dark brown and rotted (Liu et al., 2022). Pistachios in California develop symptoms of crown rot and stem canker with dark brown wood discoloration. Trees exhibited a general decline with symptoms included poor vigor, leaf chlorosis, and light-colored gumming on the lower portion of the trunk. Additional trees displayed cankers, wood discolorations, and lesions. (Crespo et al., 2019). *Fusarium proliferatum* can be isolated from roots and leaves of declining date palms causing symptoms similar to palm wilt caused by *F. oxysporum*. Some of the strains infecting date palms have been shown to be toxigenic, producing beauvericin, fumonisin B1, fusaproliferin, fusaric acid, and moniliformin (Abdalla et al., 2007). Lesions at the bases of palm rachises, plus wilt and dieback symptoms were described on young and adult palms in the genera *Chamaerops*, *Phoenix*, *Trachycarpus* and *Washingtonia*, caused by *F. proliferatum* (Armengol et al., 2005). Sugar pine (*P. lambertiana*) seedlings growing in a container forest nursery in California showed classic symptoms of *Fusarium* root disease: needle chlorosis, needle tip/twig dieback, foliar/branch/stem necrosis, and root decay (Stewart et al., 2016).

Transmission: *Fusarium proliferatum* overwinters on infested crop residues (stems, stalks, straw, roots, dropped fruit, seeds, and other parts of host plants). From infested residues, the fungus produces asexual spores (conidia) which are dispersed by rain-splash or wind. When conditions are warm, humid, and wet, the sexual stage of the fungus (*Gibberella fujikuroi*) may develop on the infested plant debris. Bluish black perithecia form on the surface of these residues, and forcibly discharge sexual spores (ascospores) into the air. The ascospores are picked up by turbulent wind currents and may travel great distances. The pathogen can be seedborne in both corn and wheat, which is likely the cause of long-distance spread. It also has a soilborne phase and anything that moves soil or irrigation water can spread the pathogen (Agrios, 2005). This species is not known to produce chlamydospores.

Many insects can transmit fungi either during feeding process or mechanically via insect movement or laying egg operation. *Fusarium proliferatum* was isolated from date palm borer *Oryctes elegans* in Iraq. The fungus was isolated from both adult insects and plant materials from trees that showed wilt symptoms (Khudhair et al., 2014).

Damage Potential: As a post-harvest pathogen of bananas in Georgia, 100% of fruits were affected with 90% severity from infection with *F. proliferatum* (Waliullah et al., 2021). For tiller onions with root and bulb rot, up to 70% of the plants in the field were negatively affected (Liu et al, 2022). Tree death was reported on young pistachio trees with crown rot symptoms caused by *F. proliferatum* (Crespo et al., 2019). Thirty percent of sugar pine seedlings were damaged by root rot in California (Stewart et al., 2016). For pathosystems where mycotoxins are produced, in addition to more severe disease symptoms, there is a potential for mycotoxin accumulation and contamination in plant parts consumed by people and animals (Stankovic, et al., 2007).

Worldwide Distribution: Africa: *Algeria, Egypt, South Africa, Tunisia, Zambia*. Asia: *China, India, Indonesia, Iran, Iraq, Malaysia, Pakistan, South Korea, Thailand, Turkey*. Europe: *Croatia, France, Greece, Hungary, Italy, Poland, Russia, Serbia, Slovakia, Spain*. North America: *Canada, Cuba, Mexico, Trinidad and Tobago, United States* (Arkansas, California, Connecticut, Florida, Idaho, Iowa, Michigan, Nebraska, New Jersey, North Carolina, Tennessee). Oceania: *American Samoa, Australia, Guam*. South America: *Argentina* (CABI-CPC, 2022).

Official Control: *Fusarium proliferatum* is on the USDA PCIT's harmful organism list for India.

California Distribution: There are official records from Imperial, Los Angeles, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, Santa Barbara, Santa Clara, Ventura, Yolo counties, plus published reports from Merced County (Crespo et al., 2019) and El Dorado County (Stewart et al, 2016). Many detections have been made from infected nursery stock (CDFA PDR database, 2022).

California Interceptions: none

The risk *Fusarium proliferatum* would pose to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** This pathogen is widespread in tropical and temperate climates.

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:** This pathogen has a very wide host range and can infect a variety of plant parts (roots, stems, leaves, flowers, and seeds), plus it can survive in the soil.

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:** *Fusarium proliferation* reproduces with sexual and asexual spores, but it is not known to make chlamydospores.

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.
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- 4) Economic Impact:** With a very large number of hosts and diverse methods of pathogenicity, this pathogen causes significant loss of yield and loss of esthetic value. There is a report of this fungus vectored by a date palm borer. The ability of some strains to produce mycotoxins is a risk to people and animals.

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

Economic Impact: A, B, E, F

- 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:** This pathogen has a large host range that includes plants that make up natural communities that could be affected.

Evaluate the environmental impact of the pest to California using the criteria below

Environmental Impact: A

- 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 proliferatum*: 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.

This pathogen is already widespread in California with official detections made on many hosts.

Evaluation is 'high'.

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 = 10*

Uncertainty:

The taxonomy of *Fusarium* spp. is often reviewed, updated, and improved. *Fusarium proliferatum* may be found to be part of species complex, or its placement in a teleomorph may be changed in the future.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Fusarium proliferatum* is C.

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Responsible Party:

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***Comment Period: 07/08/2022 through 08/22/2022**

*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.

Proposed Pest Rating: C
