CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Colletotrichum karstii Yan L. Yang, Zuo Y. Liu, K. D. Hyde & L. Cai 2011

Current Pest Rating: B

Proposed Pest Rating: C

Kingdom: Fungi, Division: Ascomycota

Class: Sordariomycetes, Order: Glomerellales

Family: Glomerellaceae

Comment Period: 12/22/2020 through 02/05/2021

Initiating Event:

Colletotrichum karstii was first detected in 2015 in an incoming nursery shipment from Guatemala destined for San Diego County. Between 2015 and 2020, CDFA plant pathologists at the Pest and Disease Diagnostics Center have identified it on 24 separate occasions. *Colletotrichum karstii* has been isolated from samples sourced from California, Hawaii, Florida, and Oklahoma. It has been primarily found on ornamental foliage plants such *Dracaena* and *Aglaonema* spp., but it is known to cause anthracnose on at least 42 host genera. From two separate publications, it was identified and associated with canker diseases of pistachio in orchards in Glenn, Fresno and Tulare Counties, which are separated by hundreds of miles (Lichtemberg et al, 2017; Nouri et al., 2019). In 2019, it was associated with twig and shoot dieback in Citrus in Fresno, Madera, Kern and Tulare counties (Mayorquin et al., 2019).

This pathogen was assigned a permanent B rating in 2015. Because of significant and ongoing host range expansion, and detections in pistachio and citrus orchards, the pest rating and mitigating actions in California should be re-assessed. Therefore, a revised pest rating proposal is needed. The risk to California from *C. karstii* is described herein and a new permanent rating is proposed.

History & Status:

Background: *Colletotrichum karstii* was originally discovered in an infected leaf of *Vanda* sp. (Orchidaceae) and several other orchids in southwest China (Yang et al., 2011). The pathogen is a

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fungus species belonging to the complex species group *C. boninense* which was originally described in 2003 as a segregate of the vastly morphological and physiological variable *C. gloeosporioides* complex (CABI, 2014; Morikwaki et al., 2003). In the past, isolates of *C. boninense* were often identified as C*. gloeosporioides*. However, after segregation from *C. gloeosporioides*, researchers found that *C. boninense* actually comprised of a complex of several species and by 2012, through molecular phylogenetic analyses of 86 strains of *C. boninense*, Damm et al. (2012) were able to recognize 18 separate and distinct species within the *C. boninense* complex including *C. karstii* based on DNA sequence data and morphology.

In the USA, *Colletotrichum karstii* was first detected in white Phalaenopsis orchid flowers growing in a greenhouse in San Francisco, California (Jadrane et al., 2012).

Hosts: Colletotrichum karstii is pathogenic on many host plants and is the most common and geographically diverse species in the *C. boninense* complex (Damm et al., 2012). Hosts include, *Acacia heterophylla, Aglaonema* sp*., Alocasia macrorrhizos, Annona cherimola, Annona muricata, Annona* sp*., Annona squamosa, Anthurium* sp*., Areca catechu, Arundina graminifolia, Bletilla ochracea, Bombax aquaticum, Brunfelsia pauciflora, Calanthe argenteo-striata, Camellia oleifera, Camellia sinensis, Camellia* sp*., Capsicum annuum, Capsicum* sp*., Carica papaya, Chamaedorea falcifera, Chamaedorea* sp*., Citrus aurantifolia, Citrus limon, Citrus paradise, Citrus reticulata, Citrus sinensis, Citrus* sp*., Coffea arabica, Coffea canephora* var*. robusta, Coffea* sp*., Cyperus* sp*., Diospyros australis, Diospyros kaki, Dracaena borinquensis, Dracaena deremensis, Dracaena sanderiana, Dracaena* sp*., Dypsis lutencens, Elettaria cardamomum, Eria coronaria, Eucalyptus grandis, Euonymus japonicus, Ficus benjaminea, Fortunella margarita, Gossypium hirsutum, Hevea brasiliensis, Howeia forsteriana, Howea* sp*., Hylocereus undatus, Laurus nobilis, Malus domestica, Leucospermum* sp*., Malus domestica, Mangifera indica, Manihot esculenta, Morus alba, Murraya paniculate, Musa banksia, Musa* sp*., Nandina domestica, Nicotiana tabacum, Olea dioica, Olea europaea, Pachira* sp*., Passiflora edulis, Persea americana, Phalaenopsis amabilis, Phalaenopsis aphrodite, Pistacia vera, Platostoma palustre, Pleione bulbocodioides, Protea cynaroides, Protea obtusifolia, Pyrus pyrifolia, Quercus salicifolia, Sapium integerrimum, Schefflera arboricola, Sclerocroton integerrimus, Smilax* sp., *Solanum betaceum, Stylosanthes guianensis, Syringa reticulata, Taxus wallichiana var. mairei, Vaccinium* sp*., Vanda* sp*., Vitis* sp. and *Yucca elephantipes* (Farr and Rossman, 2020).

Symptoms: *Colletotrichum*-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. In white Phalaenopsis orchid flowers, petals infected with *C. karstii* show anthracnose-like lesions where necrotic tissue is surrounded by a ring of green tissue (Jadrane et al., 2012). On pistachio, *C. karstii* has been isolated from active branch cankers with associated dieback symptoms in mature trees (Nouri et al., 2019). In citrus orchards, *C. karstii* was associated with twig and shoot dieback, gummosis, and in some cases branch dieback and wood cankers. With pathogenicity tests on citrus, Mayorquin et al. (2019) showed that *C. karstii* could form dark colored internal lesions on citrus shoots and form fruiting bodies

Transmission: It is likely that *Colletotrichum karstii* has a similar life cycle to that of other Colletotrichum species and survives between crops during winter as mycelium on plant residue in soil, on infected plants, and on seeds. During active growth, the pathogen produces masses of hyphae (stromata) 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. Conidia are transmitted to host plants. Humid, wet, rainy weather is necessary for infection to occur. These requirements in particular may limit the occurrence of the pathogen in California fields and subsequently, the pathogen may be more of a problem under controlled environments of greenhouses. Conidia germinate, penetrate host tissue by means of specialized hyphae (appresoria) and invade host tissue.

Damage Potential: Anthracnose disease caused by *C. boninense* can result in reduced plant quality and growth. Estimates of yield/crop loss due to this pathogen have not been reported. Nursery production of potted host plants or in greenhouses are particularly at risk as nursery conditions are often conducive to infection by Colletotrichum species. In cultivated fields, disease development may be sporadic as it is affected by levels of pathogen inoculum and environmental conditions. *Colletotricum* spp. on pistachio causes significant yield losses in years with a wet summer in Australia (Ash and Lanoiselet 2001). In California, during the wet spring of 1998, anthracnose was found in Tulare Co. but not identified at that time. *Colletotrichum* spp. have been isolated during the plating of dormant buds of pistachio to check for infection by Botryosphaeria species, causing panicle and shoot blight of pistachio (Lichtemberg et al., 2017). *Colletotrichum karstii* was one of several pathogenic fungi causing cankers in the trunks and branches of mature pistachio trees in multiple orchards in California (Nouri et al., 2019). A study has reported that *C. karstii* as a pathogen of citrus causing twig and shoot dieback with or without gumming and occasionally branch dieback and wood canker in California (Mayorquin et al., 2019).

Worldwide Distribution: Australia, Brazil, China, Costa Rica, Guatemala, India, Mexico, New Zealand, Thailand, and USA (California, Florida, Hawaii, Oklahoma, and Texas). Damm et al. (2012) determined an isolate of *C. boninense* from Florida USA, and ITS (internal transcribed spacer) sequences of strains of C. gloeosporioides "group 2" from Thailand to be identical or similar to *C. karstii*.

Official Control: None

California Distribution: In citrus and pistachio orchards in Glenn, Fresno, Tulare, Madera, and Kern Counties, in nurseries in Santa Barbara and San Diego Counties (CDFA PDR database, Mayorquin et al., 2019: Lichtemberg et al., 2017).

California Interceptions: Detected on incoming nursery shipments from Texas, Hawaii, Florida, Oklahoma, Costa Rica, and Guatemala

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

Consequences of Introduction:

1) **Climate/Host Interaction:** Similar to other species of *Colletotrichum, C. karstii* requires humid, wet, rainy weather for conidia to infect host plants. This environmental requirement may limit the ability of the pathogen to fully establish and spread under dry field conditions in California. Limited regions with conducive climates within California could enable the pathogen to establish. In particular, *C. boninense* s. str. can effectively infect and spread to host plants grown under conducive climate conditions in nurseries. Recent detections in the Central Valley plus Glenn County on citrus and pistachio show that orchard climates are also favorable.

   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 of *Colletotrichum karstii* is diverse and includes several plant families.

   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:** The pathogen has high reproductive potential and conidia are produced successively. They are transmitted by wind, wind-driven rain, cultivation tools, and human contact however conidial germination and plant infection require long, wet periods**.**

   Evaluate the natural and artificial dispersal potential of the pest.

   Score: 3
   - 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 pathogen could lower plant growth and value.

   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.

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 pathogen could significantly impact cultural practices, home gardening or ornamental plantings.

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 karstii*:

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 'High'. With detections in multiple counties on diverse hosts, and the possibility that earlier detections of the complex species group C. gloeosporioides in several plant families in California

have not be verified by the use of specific molecular diagnostic tests for the distinction of *C. karstii* as it is possible that these detections may have included *C. karstii*.

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 possibility that a portion the 1980 official detections of *C. gloeosporioides* in the CDFA PDR Database may have included the now segregate species, *C. karstii*, can only be ascertained through survey and molecular testing for the pathogen isolated from infected host plants particularly those obtained from suspect counties included in early detection reports of *C. gloeosporioides*. Subsequent results may alter the herein proposed rating for the pathogen.

Conclusion and Rating Justification:

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

References:

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Responsible Party:

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***Comment Period: 12/22/2020 through 02/05/2021**

***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
