

## California Pest Rating Proposal for *Colletotrichum clidemiae* B. Weir & P.R. Johnst. 2012

**Current Pest Rating: Q**

**Proposed Pest Rating: B**

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

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**Comment Period: 12/15/2021 through 01/29/2022**

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### Initiating Event:

On May 5, 2019 a shipment of lance-leaf greenbrier (*Smilax* sp.) cut foliage showing leaf blight symptoms and destined to a florist in San Luis Obispo County was intercepted and sampled by San Luis Obispo County Agricultural officials. The shipment had originated in Florida. Diseased plant samples were sent to the CDFA Plant Diagnostics Branch for diagnosis. Suzanne Latham, CDFA plant pathologist identified the leaf spot and anthracnose pathogen, *Colletotrichum clidemiae* as the cause for the disease by morphology and molecular sequence. This species is known to be in Hawaii and Florida. The pathogen was assigned a temporary Q rating by the CDFA and consequently, all infected plant materials were destroyed. The risk to California from *C. clidemiae* is evaluated and a permanent rating is proposed.

### History & Status:

#### **Background:**

The genus *Colletotrichum* contains many species that cause destructive diseases on a wide variety of agricultural crops, often causing leaf spots and postharvest fruit rots. Species of *Colletotrichum* are also important because of their use as model organisms (Dean et al., 2012). Species-level identification of this genus is complex and challenging. In the past, members of this genus that would today be considered a single species were described as multiple species according to their host. It is now understood that many *Colletotrichum* species have wide host ranges. For an individual species, distinct morphological traits are typically uncharacteristic, and they can have tremendous variation in

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pathogenicity, depending on the host. Some hosts may be parasitized by multiple species of *Colletotrichum*, and some species of *Colletotrichum* are known to have dozens of hosts (Cannon et al., 2012). While they can act as endophytes, saprophytes, and necrotrophs, they most commonly act as hemi-biotrophs, which cause disease under select conditions.

Historically, many isolates were classified as either *C. acutatum* Simmonds ex Simmonds or *C. gloeosporioides* (Penzig) Penzig & Saccardo. Both are now known to be species complexes made up of numerous genetically diverse and distinct species. The name *Colletotrichum gloeosporioides* was first proposed by Penzig in 1882 for a pathogen collected from citrus in Italy. Over time, plant pathologists noticed morphological similarity between the fungus described by Penzig and *Colletotrichum* infecting other hosts. Species, subspecies, and forma speciales of *Colletotrichum* were subsequently described based on the host they were first found on, and on features that can be variable or subjective such as conidial size and shape, appressoria shape, growth rate in culture, color of cultures, presence, or absence of setae, and whether or not the teleomorph (sexual stage) develops.

About 750 names exist in the literature for teleomorphs and anamorphs synonymized with *C. gloeosporioides* (Small, 1921; Arx, 1970; Sutton, 1992) and many are now believed to be distinct species. Recent and ongoing molecular studies have resulted in a much better understanding of the taxonomic relationships amongst all these. The *gloeosporioides* species complex has approximately 40 closely related species, mainly consisting of plant pathogens, but some species act primarily as endophytes (Liu et al., 2015).

Weir et al. (2012) performed DNA- phylogenetic analysis using genes from eight nuclear gene regions, the ribosomal ITS, glutamine synthetase, manganese-superoxide dismutase, and  $\beta$ -tubulin 2 to classify isolates as *C. gloeosporioides* in its currently defined sense. Based on the analysis, Weir et al. (2012) recognized two subclades within the species complex, naming them Kahawae and Musae. In this same publication they described *C. clidemiae* for the first time as a member of Kahawae and as a genetically defined species based on multi-gene phylogenies. For the ex-type (authentic culture), they used an isolate of *C. clidemiae* from *Clidemia hirta* (Koster's curse or soapbush) from Hawaii.

*Clidemia hirta*, a member of the Melastomataceae, is a perennial shrub of tropical American origin that is a major Hawaiian weed. It is considered one of the most important noxious weeds in the rain forest areas of Oahu and has spread to other islands. *Colletotrichum clidemiae* is used as an anthracnose bioherbicide for this weed. It was released in Hawaii in 1985 from isolates collected in Panama and referred to as *C. gloeosporioides* "f. sp. *clidemiae*" by Trujillo et al. (1986). Repeated inoculations with this fungus have caused striking decline of the weed in Aiea State Park and Palolo Valley, Oahu. This fungus becomes airborne only during extended windy and rainy periods, which limits its natural distribution. Therefore, repeated applications are required to enhance it as a bioherbicide (Trujillo et al., 1986; Trujillo, 2005).

A fungus isolated from *Quercus* sp. and *Vitis* sp. in Florida was referred to as "*Glomerella cingulata* native host" by MacKenzie et al. (2007). This is a teleomorphic name for *C. gloeosporioides*. These are genetically and micro-morphologically very close to the isolates studied by Weir et al. (2012) from *Clidemia* and they refer to them the same species. Data in MacKenzie et al. (2007) shows the pathogen

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occurs on both *Vitis* and *Quercus* in multiple locations in Florida. Whether or not the *Clidemia*-associated isolates are biologically distinct from the genetically matching isolates on native *Vitis* and *Quercus* spp. in Florida still requires pathogenicity testing. The isolation from *Smilax* from Florida made by CDFA represents a new host for this pathogen.

*Hosts:* *Clidemia hirta* (Koster's curse), *Quercus* sp. (oak), *Vitis* sp. (grape), *Smilax* sp. (greenbriers) (Farr and Rossman, 2021; CDFA PDR database).

*Symptoms:* Anthracnose is the most common name given to diseases caused by *Colletotrichum* spp. Generally, symptoms of anthracnose include dark brown leaf spots, stem and fruit spots, fruit rot, and wilting of leaves that often results in dieback and reduction in plant quality. *Colletotrichum* spp. have similar life cycles and survive 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) that bear conidiophores on the plant surface. Conidia (spores) are produced at the tips of the conidiophores. Conidia germinate, penetrate host tissue by means of specialized hyphae (appressoria) and invade host tissue.

*Colletotrichum clidemiae* produces numerous small, dark-based acervuli with deep orange conidial ooze and scattered setae. On leaves of *Clidemia* observed in Panama, lesions are dark brown, irregular, angular and large (nearly 1 cm in diameter). On inoculated plants in Hawaii, small light brown angular lesions developed in 5 days. The lesions became circular to irregular with dark brown centers and light-yellow halos 7 days after inoculation. The often coalesced into large brown areas causing the leaves to abscise and resulting in premature defoliation. Acervuli were produced within 8 days on the abaxial sides of the leaves, mostly on leaf veins and leaf axils (Trujillo et al., 2986).

*Transmission:* *Colletotrichum* conidia are transmitted to host plants and humid, wet, rainy weather is necessary for infection to occur. Conidia can be spread via wind, wind-driven rain, cultivation tools, and human contact. In biocontrol experiments in Hawaii, the pathogen was introduced to the host growing in areas that have extremely high annual rainfall of 7 m and a relative humidity generally not less than 75%. These requirements in particular may limit the occurrence of the pathogen in California fields and therefore the pathogen may be more of a problem in the controlled environment of greenhouses.

*Damage Potential:* *Colletotrichum clidemiae* is a serious pathogen of *Clidemia hirta*, so much so that it is used as a bioherbicide in Hawaii. Mackenzie et al (2007) isolated *C. clidemiae* from necrotic lesions on oak (*Quercus* spp.) and wild grape (*Vitis* spp.) as a part of a study on strawberry anthracnose. Leaf spot symptoms were observed on *Smilax* spp. imported from Florida. Generally, florist stock is intolerant of any necrosis or discoloration of the leaves.

**Worldwide Distribution:** *United States* (Hawaii, Florida) (Farr and Rossman, 2021; CDFA PDR database)

**Official Control:** none

**California Distribution:** none

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**California Interceptions:** There has been one interception on cut foliage of *Smilax* sp. florist stock from Florida

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

### Consequences of Introduction:

- 1) Climate/Host Interaction:** Similar to other species of *Colletotrichum*, *C. clidemiae* 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. clidemiae* may be able to effectively infect and spread to host plants grown under conducive climate conditions in nurseries.

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 of this pathogen is confirmed on plants in four families

Evaluate the host range of the pest.

**Score: 2**

- 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:** Under suitable climates, the pathogen could lower plant growth and value

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

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**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:** There are two native species of *Smilax* in California, *S. californica* and *S. jamesii*. Both are considered to be rare (Calflora.org). Their susceptibility to this pathogen is unknown. The susceptibility of native or cultivated *Quercus* and *Vitis* is also unknown.

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 *Colletotrichum clidemiae*: Medium**

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

-Low = 5-8 points

**-Medium = 9-12 points**

-High = 13-15 points

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- 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 'not established'.***

**Score: 0**

**-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 = 11*

### **Uncertainty:**

Detection of *C. clidemiae* on a new host from Florida, *Smilax* spp., suggests the host range for this species is larger than was previously known, and may continue to expand.

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

Based on the evidence provided above the proposed rating for *Colletotrichum clidemiae* is B.

### **References:**

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## Responsible Party:

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**\*Comment Period: 12/15/2021 through 01/29/2022**

## \*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).

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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;
  - 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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