

California Pest Rating Proposal for *Xanthomonas campestris* pv. *fici* (Cavara 1905) Dye 1978

Leafspot and dieback of fig

Current Pest Rating: Q

Proposed Pest Rating: B

Domain: Bacteria, Phylum: Proteobacteria,
Class: Gammaproteobacteria, Order: Xanthomonadales,
Family: Xanthomonadaceae

Comment Period: 02/17/2021 through 04/03/2021

Initiating Event:

On December 1, 2020, a San Diego County agricultural inspector examined an incoming shipment of *Ficus elastica* (rubber plants) nursery stock from Martin County, Florida. The inspector observed and collected leaves with necrotic spots. The leaves were sent to CDFA's Plant Pest Diagnostics Center at Meadowview. CDFA Plant pathologist Sebastian Albu detected *Xanthomonas campestris* pv. *fici* after culturing from the leaf spots. He confirmed his diagnosis with PCR, DNA sequencing, and phylogenetic analysis. This is a known pathogen of *Ficus* spp. and other tropical foliage plants in Florida and Australia, but this was a first detection for California. The shipper received a notice of rejection from San Diego County and it was assigned a temporary Q rating. The risk to California from *Xanthomonas campestris* pv. *fici* is described herein and a permanent rating is proposed.

History & Status:

Background: Xanthomonads are bacterial plant pathogens that can cause cankers, vascular wilts, leaf spots, fruit spots, and blights of annual and perennial plants. They are found in tropical and temperate climates. They live as plant pathogens and epiphytes, with short survival times in the soil. Some are very aggressive primary pathogens while others are limited to secondary invasion after infection by primary pathogens. Some begin their association with host plants as epiphytes, using surface polysaccharides and forming biofilms. Under favorable conditions, they can become pathogens. Xanthomonads produce xanthomonadins, pigments that protect them from natural light and give them yellow, pink, red, or purple colors in axenic culture (Agrios, 2005).

In the past, bacterial taxonomists worked from what they thought were the most important phenotypic characteristics of their strains. Most *Xanthomonas* species show a high degree of host specificity and taxonomy of species within this genus was based on that host specificity. This method, over time, resulted in an unreasonable number of species. Dye et al. (1980) drastically reduced this by consolidating many strains into one species, *X. campestris*, and developing a special use subspecific classification system using pathovar names for phytopathological variants that often correlated to a host plant.

A bacterial leafspot and dieback of fig was first reported in Italy on *Ficus carica* (common fig) by Cavera in 1905. In 1972, Jindal and Patel reported it from India, followed by Duff in 1991 in Australia. A publication by Campoverde and Palmateer (2011) detailed the first Florida record of this pathogen causing similar symptoms and a severe disease outbreak on *Ficus elastica*. Pathogenicity tests on several other hosts indicated that several *Ficus* species and their cultivars were susceptible, including several economically important cultivars of ornamental *F. elastica*.

Hosts: *Ficus carica* (common fig), *F. benjamina* (Benjamin fig), *F. buxifolia* (Congo fig), *F. elastica* (rubber plant), *F. maclellandii* 'Alli' (banana-leaf fig), *F. mexicana* (Mexican fig), *F. microcarpa* 'Green Island' (green island fig), *F. retusa* 'California nitida' and 'Green Gem' (Indian laurel fig), *F. religiosa* (pipal), *F. triangularis* (triangle fig), *Strelitzia reginae* (orange bird of paradise), *Cordyline terminalis* (red ti), and *Syngonium podophyllum* (arrowhead plant) (Jindal and Patal, 1972; Duff, 1991; Campoverde and Palmateer, 2011).

Symptoms: Young, tender growth is most susceptible and depending on the timing of infection, blight can systemically infect whole plants. Initial symptoms are small, water-soaked, circular lesions with irregular borders near the leaf margins. As they grow, the lesions will become angular as they are limited by the leaf veins and they will turn brown and necrotic. Leaves will defoliate prematurely, and subsequent new growth can become infected. Systemic infections result in plant collapse (Duff, 1991; Campoverde and Palmateer, 2011).

Transmission: Hot, humid, and rainy conditions are highly favorable for *Xanthomonas* spp. and highly conducive to disease epidemics. The bacteria are spread very effectively in water, especially by irrigation sprinklers and windblown rain. The bacteria enter the plants through wounds or natural openings including stomata or hydathodes. When inside the plant, bacterial cells can move systemically. Spread can occur on contaminated tools, between mother and daughter plants, and long distances with the movement of contaminated nursery stock (Duff, 1991; Campoverde and Palmateer, 2011).

Damage Potential: In Florida, where environmental conditions were highly favorable, a severe leaf blight outbreak was reported on *Ficus* spp. in nurseries, resulting in significant crop loss (Campoverde and Palmateer, 2011). In Darwin, Australia, Duff (1991) reported a serious leaf drop on *Ficus microcarpa* with symptoms that were more severe in the hot, wet summer and declined in the dry winter. In India, Jindal and Patel (1972), reported an angular leaf spot on *F. religiosa*.

Worldwide Distribution: Australia, India, Italy, and United States (Florida) (CABI, 2020).

Official Control: *Xanthomonas campestris* pv. *fici* is on the USDA PCIT's harmful organism list for Chile and Colombia and on the EPPO A1 quarantine list for Chile (USDA, 2020; EPPO, 2020)

California Distribution: None

California Interceptions: There has been one interception of infected *Ficus elastica* nursery stock from Florida (see 'Initiating event').

The risk *Xanthomonas campestris* pv. *fici* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** Serious outbreaks of *X. campestris* pv. *fici* have been documented in Florida and Northern Australia, both places with a humid, tropical climate. Xanthomonads need water to infect, multiply, and spread. It is likely that most locations in California do not meet this high temperature and high moisture requirement. Establishment in greenhouses is a concern.

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: 1

- **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 multiple species of fig, including edible fig, but there are no modern reports of damage to *Ficus carica*. The host range also includes other tropical foliage plants in addition to ornamental *Ficus* spp.

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:** Bacterial pathogens are notable for exponential rates of increase and severe epidemics when the environment is highly favorable. This pathogen can disperse over short distances with sprinklers; long distance spread may occur with movement of infected host plants.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 2

- Low (1) does not have high reproductive or dispersal potential.
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- **Medium (2) has either high reproductive or dispersal potential.**
- High (3) has both high reproduction and dispersal potential.

4) Economic Impact: There are two reports of *X. campestris* pv. *fici* causing heavy crop losses in ornamental *Ficus* plants, one in Florida and one in Australia. Both describe severe defoliation as a symptom of heavy infection or repeating cycles of infection. In Florida, the disease severely affected plant quality, requiring numerous growers to abandon their crop or drastically cut back the plant canopy, resulting in substantial economic losses (Campoverde and Palmateer, 2011). Chile and Colombia list *X. campestris* pv. *fici* as a quarantine pest of concern.

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

Economic Impact: A, B, C

- 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: There are no native *Ficus* in California, but edible figs, *Ficus carica*, are widely planted and are naturalized from creeks, riverbanks, floodplains, seeps, disturbed areas, below 800 m elevation, from south coastal counties to the Bay Area and the Central Valley (Baldwin et al., 2012). They are a commercial agricultural crop in the San Joaquin Valley, Riverside and Imperial counties with approx. 7300 planted acres (UC Davis Fruit and Nut Research and Information, 2020). *Ficus microcarpa* (a cultivated banyan), has become naturalized in mostly urban sites in the south coastal counties (Riefner, 2016). Disease prevention is very important for bacterial pathogens as there are few or no curative treatments (Chase and Henley, 1993).

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.**
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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 *X. campestris* pv. *fici*: Medium

Add up the total score and include it here. 10

- 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 '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 = 10

Uncertainty:

Although originally described on *Ficus carica* in Italy more than a century ago, all modern records are on *Ficus* grown for foliage plants in wet, tropical climates. The susceptibility of *F. carica* or other *Ficus* hosts in California climates is unknown.

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for *Xanthomonas campestris* pv. *fici* is B.

References:

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Responsible Party:

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***Comment Period: 02/17/2021 through 04/03/2021**

***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).

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
