CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Xanthomonas axonopodis pv. *mangiferaeindicae* (Patel et al. 1948) Robbs et al. 1974

Mango bacterial black spot

Pest Rating: B

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

Comment Period: 08/27/2025 through 10/11/2025

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Xanthomonas axonopodis* pv. *mangiferaeindicae* is described herein, and a permanent rating is proposed.

History & Status:

Background:

Xanthomonas is a genus of phytopathogenic bacteria with many species that cause diseases such as citrus canker, vascular wilts, leaf and fruit spots, and blights of annual and perennial plants. Unlike other genera of phytopathogenic bacteria that typically occupy a diversity of ecological niches, almost all *Xanthomonas* species are plant pathogens and are found only in association with plants or plant materials. Some begin their plant host associations as epiphytes, using surface polysaccharides and forming biofilms, then transition to a pathogenic lifestyle under favorable conditions. *Xanthomonas* spp. produce xanthomonadins, pigments that protect them from natural light and can give them yellow colors in axenic culture. Most *Xanthomonas* species are limited in their range, and subspecific pathovar designations have been assigned to some to reflect that specificity (Agrios, 2005). In the past, bacterial taxonomists defined species based on what they thought were the most important phenotypic characteristics. The taxonomy of xanthomonads was based on a single feature, host specificity, and this was used to name species. This method, over time, resulted in an unreasonable number of nomenspecies. Dye et al. (1980) drastically reduced this and relied mainly on one species, *X. campestris*, and developed a special-use classification system below species with pathovar names for

phytopathological variants. In 1995, Vauterin et al. created a new taxonomic system based on DNA homology data that considered both the genomic relationships among strains and the needs of plant pathologists to have a rational nomenclature for practical daily use.

The name of the bacterium that is the subject of this proposal has changed several times. *Xanthomonas axonopodis* pv. *mangiferaeindicae* (Patel et al. 1948) Ah-You et al. 2007, comb. nov. is the valid name at present. *Xanthomonas campestris* pv. *mangiferaeindicae* (Patel et al. 1948) Robbs et al. 1974 (ISPP List 1980), is a valid synonym. *Xanthomonas citri* pv. *mangiferaeindicae* Ah-You et al. 2009 is not considered valid (Bull et al., 2012).

Mango bacterial black spot disease, caused by *X. axonopodis* pv. *mangiferaeindicae* (XAM) infects stems, flowers, and fruit, and is a threat to some Anacardiaceae species in tropical and subtropical countries, including mango. Mango originated from the Indian subcontinent, and XAM may have originated from the same region. Symptoms of the disease were first observed in Bihar, India, in 1881 (Patel et al. 1948).

Mango bacterial black spot is difficult to control under favorable (for the bacterium) environmental conditions, and it can become a limiting factor for mango production. The disease can be very destructive in areas where high temperatures and rainfall occur concomitantly (Gagnevin and Pruvost, 2001). XAM was first seen in the United States on mango trees on the island of Maui, Hawaii, in 2012 (Yasuhara-Bell et al., 2013). Today, it is established in Hawaii (Yasuhara-Bell et al., 2013) and Florida (Sanahuja et al., 2016). It has not been found in California (French, 1989; CDFA PDR Database, 2025).

Hosts: Anacardium occidentale (cashew nut), *Mangifera indica* (mango), *Schinus terebinthifolius* (Brazilian pepper), *Spondias dulcis* (otaheite apple), and *S. mombin* (hog plum) (Pruvost et al., 1992; Gagnevin et al., 2001; Viana et al., 2007; CABI, 2025).

Symptoms: Infection from the bacterium causes raised, angular, black leaf lesions, some of which have yellow chlorotic halos. Leaf lesions can merge to form large necrotic patches that can produce bacterial ooze during wet conditions. Over time, leaf lesions dry and turn light brown or gray. Severe leaf infection may result in abscission; otherwise, leaves remain attached (Ploetz, 2003).

Fruit symptoms begin as small water-soaked spots on lenticels. These spots later become black, star-shaped, raised, and can exude an infectious gum. Often, a “tear stain” infection pattern can be seen on the fruit. (Pruvost et al., 2014). Fruit susceptibility increases as fruit matures, correlated with the weakening of the lenticels, which allows for pathogen colonization (Gagnevin and Pruvost 2001). Leaf and fruit symptoms are common, but twig and branch cankers may occur when infection is severe (i.e., on highly susceptible cultivars) (Ah-You et al., 2007a). Canker lesions or bacterial black spots are potential sources of inoculum (Pruvost et al., 2014). Severe infection may result in leaf abscission (Ah-You et al., 2007b) and pre-mature fruit drop (Pruvost et al., 2011).

XAM can infect host tissue without producing symptoms (Crane et al., 2020). In mango, bacteria may be epiphytic on juvenile tissue without visible symptoms (Pruvost et al., 2009). Bacteria then gain

access through stomata or wounds, where they become endophytic and eventually cause disease (Pruvost et al., 2009).

Transmission: XAM spreads in wind-driven water from lesions to natural openings and wounds on the tree. This is seen when climatic events such as tropical storms cause massive inoculum redistribution and wounding to trees and fruit (Gagnevin and Pruvost, 2001). The disease is not systemic and does not affect roots or survive in dead leaves or in the soil (Crane et al., 2020). Propagation tools can spread the pathogen. The movement of infected nursery stock is likely how the pathogen has moved over long distances.

Damage Potential: Severe infection of leaves or fruit will lead to premature drop. Less severe infections reduce fruit quality and allow entry of other pathogens. Twig cankers are potential sources of inoculum and weaken branch resistance to winds, and infected plant parts can also spread the bacterium (Crane et al., 2020).

The bacterium has been reported to reduce yield by 50% yield in untreated orchards (Pruvost et al., 1995). Most commercial cultivars are susceptible to this bacterium, which can also affect the quality of mango fruit (Pruvost et al., 2009; Ploetz, 2017). Economic losses ranging from 50%-100% have been reported (Irfan et al., 2017).

Worldwide Distribution: Africa: *Benin, Burkina Faso, Comoros, Côte d'Ivoire, Egypt, Ghana, Mali, Mauritius, Réunion, South Africa, Sudan, Togo*. Asia: *China, India, Iran, Japan, Malaysia, Myanmar, Pakistan, Philippines, Taiwan, Thailand*. North America: *Martinique, Puerto Rico, United States* (Florida, Hawaii). Oceania: *Australia, New Caledonia*. South America: *Brazil* (CABI, 2023).

Official Control*: Xanthomonas axonopodis* pv. *mangiferaeindicae* is on the EPPO's A1 list for Egypt and Iran, the A2 list for Bahrain, and is a quarantine pest in China (EPPO, 2025). It is on the USDA PCIT's harmful organisms list for China, Ecuador, Egypt, French Polynesia, Guatemala, Madagascar, New Caledonia, New Zealand, Peru, Qatar, and Venezuela (USDA PCIT, 2025). It is a US Regulated pest but has been proposed for de-regulation.

California Distribution: none

California Interceptions: none

The risk that *Xanthomonas axonopodis* pv. *mangiferaeindicae* would pose to California, is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Mangos grow only in frost-free areas of California. High humidity and rain during the growing season are necessary for infection of XAM. These conditions are unlikely to be found in areas of California where mangoes are grown.

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 be established 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 is limited to members of the Anacardiaceae family.

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:** Bacterial diseases, under favorable conditions, develop large epidemics. Bacteria are moved by wind and rain.

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:** Serious yield losses have been reported and XAM is a quarantine pest in some countries.

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

Economic Impact: A, C

A. The pest could lower crop yield.
B. The pest could lower crop value (including increasing crop production costs).
C. The pest could trigger the loss of markets (including 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:** One reported host of XAM is the Brazilian pepper tree (Pruvost et al., 1992), where it causes angular leaf spots. This is a widely planted ornamental in California.

Evaluate the environmental impact of the pest on California using the criteria below.

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 *Xanthomonas axonopodis* pv. *mangiferaeindicae:* Medium

Add up the total score and include it here. **9**
-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 consequence of the 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* ***= 9***

Uncertainty:

Climatic requirements for the survival and growth of this bacterium do not occur in non-tropical areas. For the US, this means it has a limited distribution in Florida and Hawaii. Climate change could allow this disease to spread to parts of California or Texas.

Conclusion and Rating Justification:

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

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Responsible Party:

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***Comment Period: 08/27/2025 through 10/11/2025**

***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.

Pest Rating: B