CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Pseudomonas syringae pv. *hibisci* (ex Jones et al. 1986) Young et al. 1991

Current Pest Rating: Q

Proposed Pest Rating: C

Comment Period: 10/29/2019 through 12/13/2019

Initiating Event:

On May 16, July 3, and August 8, 2019, Santa Cruz County agricultural officials inspected incoming nursery shipments of Chinese hibiscus (*Hibiscus rosa-sinensis*) at a large retail store. Two of the shipments were recorded as arriving from a broker in San Diego County and an origin location was not indicated for the third. Some plants showed symptoms of necrotic leaf spots and were placed on hold with samples sent to the CDFA plant pathology diagnostic lab in Meadowview. CDFA plant pathologist Sebastian Albu cultured from the leaf spots on the symptomatic leaves and isolated blue fluorescing, oxidase-negative pseudomonads. He used PCR to target portions of the gyrB, rpoB, and rpoD genes and amplified products from suspect cultures. Amplicons were sequenced and sequences were analyzed by maximum likelihood in a phylogeny that included all currently described species and pathovars of *Pseudomonas*. The hibiscus isolates nested within a clade that includes the type strain of *Pseudomonas syringae* pv. *hibisci* (99% bootstrap support). A temporary Q rating was assigned. The risk to California from *P. syringae* pv. *hibisci* is evaluated herein and a permanent rating is proposed.

History & Status:

Background:

In 1923, Nakata and Takimoto reported a bacterial leaf spot on *Hibiscus* occuring in Japan. Because of the time elapsed and the changes in methodology, it is not possible to know if this is the same pathogen as reported in Florida by Chase in 1984, and described by Jones et al. in 1985. Originally the pathogen was designated *Bacterium hibisci*, but later it was reanamed as *Pseudomonas syringae* (Palleroni, 1984).

Phytobacteriologists often use the term "*Pseudomonas syringae* complex" when referring to strains of *Pseudomonas syringae* that are closely-related and difficult to discriminate based on morphological, cultural or biochemical characteristics. The pathovar taxonomic designation is used to discern among pathogenic isolates that are usually (with exceptions) capable of infecting only limited numbers of hosts. Currently there are more than 50 described pathovars of *P. syringae*, often named after their primary host or the host from where they were first isolated (Young, 2010; Xin et al., 2018). *Pseudomonas syringae* pv. *hibisci* appears to have a very limited host range, only having been isolated from Chinese hibiscus (*Hibiscus rosa-sinensis*) (CABI-CPC, 2019).

There are two other species of phytopathogenic bacteria that cause leaf spots on *Hibiscus* in Florida: *Pseudomonas cichorii* and *Xanthomonas campestris* pv. *malvacearum. Pseudomonas cichorii* is widespread in California and able to infect diverse hosts, including chrysanthemum, endive, lettuce, and magnolia. *Xanthomonas campestris* pv. *malvacearum* is also in California and causes a leaf spot on upland cotton (French, 1989). It would be impossible to distinguish either of these from *P. syringae* pv. *hibisci* based on symptoms in the field (Chase, 1986).

Hosts: Chinese hibiscus (*Hibiscus rosa-sinensis*) (CABI CPC, 2019)

Symptoms: On hibiscus, the pathogen causes small, irregular-shaped dark brown to black lesions that occasionally have a prominent chlorotic halo around them. Bacterial streaming from affected areas is typically observed using light microscopy. There are no symptoms associated with the flowers, petioles, or stems of hibiscus. The lesions can be up to 3 mm wide. If lesions develop on immature leaves, the leaves take on a crinkled appearance as they grow. Development of symptoms in Florida occurred only under mist propagation and in the cooler months (Jones et al., 1985, 1986). This is consistent with the environmental conditions generally required by *P. syrinage* pathovars where the optimal temperature for disease development is 18° C under high humidity (Jones, 1986)

Transmission: Pseudomonads are common inhabitants of soil and of freshwater and marine environments and though most are phytopathogens, some species can also infect animals or humans. *Pseudomonas syringae* pathovars are typical pseudomonads in that they can reproduce exponentially under favorable conditions. Using an asexual process known as binary fission, they can divide every 20 to 50 minutes until resources become depleted (Agrios, 2005). The movement of *P. syringae* for very short distances occurs by self-propulsion with polar flagella, but movement from one plant to another or to other parts of the same plant is carried out primarily by movement with water, but also by insects, other animals, and humans. Rain or sprinker irrigation, by their washing and spattering effect, can carry and redistribute the pathogen. People help spread bacteria locally by handling plants or with contaminated tools or equipment, and over long distances by transporting infected transplants or infected seeds (Agrios, 2005).

Damage Potential: Pseudomonas syringae has two phases of growth in or on plants: the epiphytic phase, where the bacteria live only on the phyllosphere (on the surface of above-ground plant parts), and the endophytic phase, when bacteria enter the plant tissue through wounds or natural openings like stomata or hydathodes and colonize the intercellular spaces. Once inside the intercellular spaces,

they can release toxins and other virulence factors that cause plant cells to necrotize, and they use the nutrients released for their own rapid reproduction (Agrios, 2005, Xin et al., 2018).

Worldwide Distribution: This pathogen has only been reported from Florida and Georgia (CABI, 2019).

Official Control: *Pseudomonas syringae* pv. *hibisci* is rated Q in California (see "initiating event"). This pathogen is not on the USDA PExD list of harmful organisms for any country.

California Distribution: None is known.

California Interceptions: The pathogen has been intercepted on shipments of nursery plants on three occasions by Santa Cruz County agricultural inspectors (see "initiating events")

The risk ***Pseudomonas syringae* pv. *hibisci*** would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen requires water to multiply, disseminate, and infect. Nursery conditions with misting or sprinklers and high humidity inside greenhouses are highly favorable to the development of *Pseudomonas* foliar diseases. For plants growing outdoors in more arid parts of the state, the lack of leaf wetness will severely limit disease development.

   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 is limited to Chinese hibiscus.

   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:** *Pseudomonas* spp. reproduce at an exponential rate under favorable environmental conditions. They are easily disseminated by sprinkers, rain, and human activity

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.

4) **Economic Impact:** *Pseudomonas* diseases can be very damaging when they reach epidemic levels. With a host range limited to Chinese hibiscus and a high water requirement, this pathogen will likely only be a problem in nurseries.

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

Economic Impact: A

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: **1**

- **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:** None is known or expected

Environmental Impact: none

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: 1

- 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 *Pseudomonas syringae* pv. *hibisci:* Low

Add up the total score and include it here. **6**
-Low = 5-8 points
-Medium = 9-12 points
-High = 13-15 points

6) **Post Entry Distribution and Survey Information**:

Evaluation is 'Not Established'. This pathogen has only been detected in incoming nursery shipments in Santa Cruz County.

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:

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* ***= 6***

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Pseudomonas syringae* pv. *hibisci* is C.**

References:

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Responsible Party:

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***Comment Period: 10/29/2019 through 12/13/2019**

***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 plant.health[@]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