

**California Pest Rating Proposal for
Erwinia tracheiphila (Smith 1895) Bergey et al. 1923**

Bacterial wilt of cucurbits

Current Pest Rating: B

Proposed Pest Rating: B

Comment Period: 12/30/2019 through 2/13/2020

Initiating Event:

On August 9, 2019, USDA-APHIS published a list of “Native and Naturalized Plant Pests Permitted by Regulation”. Interstate movement of these plant pests is no longer federally regulated within the 48 contiguous United States. There are 49 plant pathogens (bacteria, fungi, viruses, and nematodes) on this list. California may choose to continue to regulate some or all these pathogens with state plant pest permits. In order to assess the need for a state permit, a formal risk analysis for *Erwinia tracheiphila* is given herein and a permanent pest rating is proposed.

History & Status:

Background:

Bacterial wilt of cucumber was one of the first bacterial plant pathogens to be described after entire fields of cucumbers, cataloupes, and winter squash were affected in Michigan in 1893 (Smith, 1911). It remains a serious disease problem for commercial cucurbit production in parts of North America east of the Rockies (CABI-CPC, 2019; Latin, 2000; Rojas et al., 2015). *Erwinia tracheiphila* is a xylem-occluding bacterium that causes the death of whole plants. Vascular plugging by masses of bacteria and the subsequent formation of gums and resins are the primary mechanisms of wilting (Agrios, 2005). The main vectors of bacterial wilt are striped (*Acalymma vittatum*) and spotted (*Diabrotica undecimpunctata howardi*) cucumber beetles, which are not known to be established in California. California does have western striped (*Acalymma trivittatum*), western spotted (*Diabrotica undecimpunctata undecimpunctata*), and banded (*D. balteata*) cucumber beetles, which are are

potential vectors (Goodell and Phillips, 2016). If the disease is accidentally introduced into the state, epidemic levels of bacterial wilt may occur here.

Hosts: Cucurbits including *Citrullus lanatus* (watermelon), *Cucumis melo* (melon) *C. sativus* (cucumber), *Cucurbita maxima* (winter squash), *C. moschata* (crookneck squash) and *C. pepo* (summer squash and pumpkins) (CABI- CPC).

Symptoms: The expression of bacterial wilt symptoms varies among the different types of cucurbit hosts. Symptoms can appear at all stages of plant development, but wilting is most severe early in the season, when the plants are growing rapidly. *Erwinia tracheiphila* can cause especially severe wilting symptoms in cucumbers and melons. The first symptoms on these hosts are dull-green patches on the leaves, which become progressively more flaccid in sunny weather. Initially, wilting may be confined to just a portion of a leaf, but may spread throughout the entire leaf, to other leaves on a vine, and throughout the plant. Affected runners appear dark green at first and then become necrotic as the wilt becomes irreversible. Individual runners or whole plants can wilt and die rapidly, and disease levels can become epidemic in the field (Agrios, 2005; Zitter et al., 1996).

Summer squash and pumpkin are less susceptible to bacterial wilt than cucumbers or melons. Plants may wilt dramatically during the heat of the day, but partially recover overnight. Foliage of affected plants often appears chlorotic. A distinct necrosis and chlorosis can develop at the leaf margins before the entire plant collapses and dies. Young pumpkin plants normally lose vigor and die within two weeks, but summer squash may remain vigorous and continue to produce for weeks after wilt symptoms appear (Rojas et al., 2015).

Watermelon was thought to be highly resistant and unaffected by this disease (Latin, 2000), but wilting of leaves and collapse of entire vines has been reported (Sanogo et al., 2011).

Transmission: *Erwinia tracheiphila* transmission occurs when cucumber beetles feed on plants. The bacteria can contaminate their mouth parts, or it can pass through the beetles and they can deposit infested frass onto fresh feeding wounds of the leaves or flowers (Leach, 1964). The bacteria do not reproduce inside the beetles, but may overwinter inside hibernating beetles (Mitchell and Hanks, 2009). Alternately, bacteria may infect asymptomatic weed hosts and may remain viable in dried plant debris, but weeds have not been shown to be ecologically important reservoirs of the pathogen (de Mackiewicz, et al., 1998). The disease is not seed transmitted and does not survive in the soil. Young plants are infected by beetle feeding in the spring. Secondary spread occurs during the growing season and amplifies the severity of epidemics (Latin, 2000). The proportion of infected plants in a cucurbit crop is correlated to the density of beetle vectors (Yao et al., 1996).

The western striped cucumber beetle (*A. trivittatum*), spotted cucumber beetle (*D. undecimpunctata undecimpunctata*), and the banded cucumber beetle (*D. balteata*) are common and widespread in

California (Goodell and Phillips, 2016) and these, along with other insects that cause wounds (ie. Grasshoppers), may also transmit the disease (Latin, 2000).

Damage Potential: Bacterial wilt of susceptible cucurbit crops is a major threat for cucurbit production in the Midwest, Mid-Atlantic, and Northeastern regions of the United States and insecticides are used to reduce and suppress cucumber beetles (Rojas et al., 2015). When vectors are abundant, yield losses in highly susceptible cucurbits can reach 80%. In these areas, the disease is most often vectored by the striped (*A. vittatum*) and spotted cucumber beetles (*D. undecimpunctata howardi*), which are generally not found in California (Goodell and Phillips, 2016). In southwestern New Mexico, incidence of bacterial wilt was observed to be as high as 25% in pumpkin fields, and 1% in watermelon fields (Sanogo et al., 2011), and was vectored by what was described as the “12-spotted cucumber beetle”, presumably *D. undecimpunctata*.

Worldwide Distribution: Asia: *China, Iran, Iraq, Japan, Korea, Taiwan, Thailand*; Africa: *Congo, South Africa*; North America: *Canada, United States*; Europe: *Former Czechoslovakia, Lithuania* (CABI-CPC, 2019).

Official Control: *Erwinia tracheiphila* is on the harmful organisms list for Colombia, Ecuador, French Polynesia, Guadeloupe, Honduras, Indonesia, Israel, Japan, Jordan, Martinique, Mexico, and Timor-Leste (USDA PExD, 2019).

California Distribution: None

California Interceptions: None

The risk *Erwinia tracheiphila* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** Climate is not likely to be a limiting factor. Cucurbits are grown throughout the state.

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 is limited to cucurbits and has been reported from three genera in this family.

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:** *Erwinia tracheiphila* has no specialized survival mechanisms and it desiccates easily. There are no records of it being seed- or pollen-borne, nor is it known to be spread in soil or by water or wind. *Erwinia tracheiphila* is completely dependent on cucumber beetles for survival and dispersal.

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:** Losses in susceptible hosts can be high.

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

Economic Impact: A, E

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:** California has several native cucurbits, including *Cucurbita foetidissima*, *C. digitata*, *C. palmata*, *Brandegea bigelovii*, *Marah fabacea*, *M. horrida*, *M. macrocarpa*, *M. oregana*, and *M. watsonii*. Their susceptibility to *E. tracheiphila* is unknown. Disease control would depend on control of cucumber beetles, which could include the need for multiple insecticide applications.

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.
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- 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 *Erwinia tracheiphila*: Medium

Add up the total score and include it here.

- 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'. There have been no interceptions nor detections in California

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: 11**

Final Score: Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 11

Uncertainty:

None.

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Erwinia tracheiphila* is B.**

References:

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Responsible Party:

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***Comment Period: 12/30/2019 through 2/13/2020**

***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
