CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Elsinoë australis Bitanc. & Jenkins 1936

Sweet orange scab

Current Pest Rating: A

Proposed Pest Rating: A

Kingdom: Fungi; Phylum: Ascomycota

Subphylum: Pezizomycotina; Class: Dothideomycetes

Order: Myriangiales; Family: Elsinoaceae

Comment Period: 5/22/2020 through 7/6/2020

Initiating Event:

Elsinoë australis, the pathogen that causes sweet orange scab (SOS), was detected for the first time in the United States near Houston, Texas in 2010. Subsequently, it was found in the commercial citrus production areas of Texas and California. Border stations began to intercept infected fruit from Texas at the end of 2010; by early 2011 SOS had also been found in Florida, Louisiana, Mississippi, and Arizona. A federal domestic quarantine order was enacted by USDA to limit the spread of the disease within the United States. During annual citrus commodity surveys in September 2013, CDFA crews from the Pest Detection Emergency Project branch found SOS in commercial groves within the Imperial County desert. The Federal order was amended in 2016 to cover affected California counties. The risk to California from *E. australis* is described herein and a permanent rating is proposed.

History & Status:

Background:

Two scab diseases on citrus are now common in many humid citrus growing areas worldwide: sour citrus scab, caused by *Elsinoë fawcettii*, and sweet orange scab (SOS), caused by *E. australis.* Multiple pathotypes have been identified for both species. Sour citrus scab has already been widely distributed

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around the world, whereas sweet orange scab was limited mostly to southern South America, until it was detected in Texas.

Hosts: Citrus aurantiifolia (lime), *C. aurantium* (bitter orange), *C. australis* (finger lime), *C. limon* (lemon), *C. nobilis* (tangor), *Citrus* × *paradisi* (grapefruit), *C. reticulata* (mandarin), *C. sinensis* (sweet orange), *C. unshiu* (Satsuma) *Fortunella margarita* (oval kumquat), and *Simmondsia chinensis* (jojoba) (Farr and Rossman, 2020; CABI-CPC, 2020).

Symptoms: SOS symptoms may be confused with other diseases, e.g. citrus canker (*Xanthomonas citri*) and melanose (*Diaporthe citri*), or with injuries caused by various abiotic agents (e.g. wind). *Elsinoë australis* forms larger, smoother and more circular scabs while *E. fawcettii* scabs are typically irregular, warty, and deeply fissured. Fruit infection is far more significant than leaf infection for yield loss. Symptoms seen at CDFA's pest diagnostic center look like slightly raised mechanical damage. This is consistent with reports from other low humidity areas like West Texas. In higher humidity areas like East Texas the lesions are raised and scabby (C. Blomquist, *pers.com.*).

SOS lesions on young citrus leaves begin as very small water-soaked spots, which develop into creamy yellowish or bright yellow-orange colored pustules on both the top and bottom leaf surfaces of sweet oranges. On tangerine, lemon, kumquat, and grapefruit, lesions were generally small, elongated, and rust-colored, but occasionally were large, broad, coalesced, and somewhat crust-like. As they grow, they coalesce and extend mostly along the main veins to cover a large part of the blade, particularly on the lower surface. The central area of the fungal growth is depressed and becomes drab, greyish, and velvety, when the pathogen is producing conidia. Old scab lesions have a rough surface, are dusk-colored and become cracked and fissured. Similar warty lesions and corky eruptions are formed on young twigs, shoots, and stems of nursery plants, which can grow bushy and stunted. Blossom pedicels and buttons may also be attacked (CABI, 2020; Kunta et al., 2013). Affected leaves become stunted, malformed, wrinkled, or puckered, with irregular torn margins. Severe infections result in defoliation.

Fruits are infected in the early stages of their development, grow misshapen, and are subject to premature drop. On the rind of developed fruits, raised lesions are formed with different shapes, sizes, and colors depending on citrus species and cultivar affected. These lesions can appear as scattered protuberances, conical projections, craters, extensive areas of fine eruptions, or they can coalesce to give scabby patches. Scab symptoms, however, do not extend to the albedo or the flesh (CABI, CPC, 2020; Kunta et al., 2013; Whiteside, 1975).

On grapefruit, satsumas, and tangerines, circular or elongated, depressed areas of the peel are surrounded by scabby cream to rust-colored tissue with puckering of the green part of the peel around the lesion. Alternatively, the entire lesion is covered in scabby tissue. Scabby cream-to-brown lesions surround the petiole of some fruit, particularly grapefruit. On other fruit, scabby lesions are dispersed, as if spread by water splash or scratches, and were in some cases slight raised, crusty, and brown to dark brown (CABI, CPC, 2020; Kunta et al., 2013).

Transmission: SOS on leaves and on the fruit and spreads through the production of conidia. Immature young fruit up to 6 to 8 weeks after petal fall are highly vulnerable to infection (Whiteside, 1975).

Conidia are fragile and short-lived, needing 2 to 3 h of continuous moisture to germinate and infect citrus tissues (Agostini et al., 2003;). Sour orange scab is primarily a disease problem on citrus in humid areas, but SOS seems to have a much lower moisture requirement, allowing it to establish in semi-arid to arid citrus areas in California, Texas and Arizona. Citrus scab in Florida does not spread readily from tree-to-tree, moving short distances only with rain splash (Timmer et al., 1996) and longer distances with infected nursery stock. The pathogen survives with mature leaves and other organs which allows it to withstand long periods in the absence of moisture.

Damage Potential: SOS has little impact on internal fruit quality, but significant limitations to yield result from fruit drop, and the stunting of young trees (both nursery and field planted). Blemished fruit has reduced marketability. All *Citrus* species are vulnerable; however sweet orange and tangerine are the most common hosts.

Worldwide Distribution: Argentina, Australia, Bolivia, Brazil, Cook Islands, Fiji, Japan, Korea, Niue, Paraguay, Uruguay, United States (Alabama, Arizona, California, Florida, Louisiana, Mississippi, Puerto Rico, Texas) (Farr and Rossman, 2020; CABI-CPC, 2020)

Official Control: *Elsinoë australis* is considered to be a pest that is transient, actionable, and under surveillance in the United States. On USDA PCIT's harmful organism list, the following countries list this pathogen: Australia, Cambodia, Chile, Colombia, Costa Rica, Ecuador, Egypt, European Union, Honduras, Israel, Japan, Republic of Korea, Peru, Taiwan, Thailand (USDA-PExD, 2020).

California Distribution: Limited distribution in orchards in Calpatria and Winterhaven, Imperial County, and in Blythe, Riverside County on lemon, tangelo, orange, and grapefruit. In addition, there was a detection in a residential area of Pomona, Los Angeles County and San Bernardino County

California Interceptions: Dozens of interceptions of infected fruit have been made on shipments entering California from Florida, Louisiana, Puerto Rico, and Texas.

The risk ***Elsinoë australis*** would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** The detection of sweet orange scab in the desert was a surprise as this fungus was assumed to require free water to infect. Its rapid distribution to multiple states with a variety of growing conditions implies it will not be limited to the desert and could be established in the main citrus growing areas in Southern California and in the Central Valley.

   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 citrus but most citrus is susceptible

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:** Sweet orange scab spreads with conidia that are produced en masse but do not disperse very far within an orchard.

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:** This disease does not affect internal fruit quality or juice and is considered mainly a cosmetic problem. However, most California citrus is grown as high value table fruit. It can be very serious for areas held under quarantine if fruit cannot be moved. It can also do damage to nursery stock and there may not be effective fungicides.

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:** Areas under quarantine will not be released until the pathogen has been eradicated and this requires the use of fungicides.

Environmental Impact: D

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 *Elsinoë australis:* Medium

Add up the total score and include it here. **12**
-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 'low'. Detections have been made in commercial citrus groves in the desert areas of Riverside and Imperial counties, and in residential areas in Pomona. It has not been found in the Central Valley.

Score: -1
-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:

The lack of specific symptoms associated with samples testing positive by PCR sequencing for *E. australis* has made diagnosis of the disease for regulatory purposes very difficult. It is possible the pathogen is more widespread in California but causing little to no recognizable damage.

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Elsinoë australis* is A.**

References:

Agostini, J. P., Bushong, P. M., Bhatia, A., and Timmer, L. W. 2003 Influence of environmental factors on severity of citrus scab and melanose. Plant Disease 87:1102-1106

CABI Crop Production Compendium 2020. Elsinoë australis. https://www.cabi.org/cpc/datasheet/20774/. Accessed 4/23/2020

Farr, D.F., and Rossman, A.Y. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved April 23, 2020 from https://nt.ars-grin.gov/fungaldatabases/

Kunta, M., Rascoe, J., Sa, P. B., Timmer, L. W., Palm, M. E., Graça, J. V., Mangan, R. L., Malik, N. S. A., Salas, B., Satpute, A., Sétamou, M., and Skaria, M. 2013. Sweet orange scab with a new scab disease "syndrome" of citrus in the USA associated with *Elsinoë australis*. Tropical Plant Pathology, 38(3), 203-212.

Timmer, L. W., Priest, M., Broadbent, P., and Tan, M.-K. 1996. Morphological and pathological characterization of species of Elsinoë causing scab diseases of citrus. Phytopathology 86:1032-1038.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. Elsinoë australis. Accessed 4/23/2020

Whiteside, J. O. 1975. Biological characteristics of Elsinoë fawcettii pertaining to the epidemiology of sour orange scab. Phytopathology 65:1170-1177.

Responsible Party:

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***Comment Period: 5/22/2020 through 7/6/2020**

***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.

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: A
