cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Diaporthe sclerotioides (van Kesteren) Udayanga, Crous & Hyde 2012

Black root rot of cucumber

Current Pest Rating: Q

Proposed Pest Rating: B

Kingdom: Fungi, Phylum: Ascomycota,
Subphylum: Pezizomycotina, Class: Sordariomycetes,
Subclass: Diaporthomycetidae, Order: Diaporthales,
Family: Diaporthaceae

Comment Period: 09/19/2023 through 11/03/2023

Initiating Event:

This pathogen has not been through the pest rating system. The threat to California from *Diaporthe sclerotioides* is described herein and a permanent rating is proposed.

History & Status:

Background: Cucurbits are profitable crops over a large area of California. California is a top producer in the nation of many types of cucurbits including raking #1 for cantaloupe ($163M), honeydew ($49M), squash ($45M), and pumpkins ($27M), #3 for watermelons ($70M) and #4 for cucumbers ($24M). These totaled to $378M in 2022, growing on approx. 60,000 acres (California Agricultural Statists Review https://www.cdfa.ca.gov/Statistics/PDFs/2022_Ag_Stats_Review.pdf).

In addition to cucurbit fruit, California is an important world producer of hybrid cucurbit seeds for domestic and export markets. The bulk of production is in the lower Sacramento Valley with Colusa, Sutter, and Glenn Counties, and limited seed production in the San Joaquin and Imperial Valleys (Murray et al., 1997).

The genera *Diaporthe* and *Phomopsis* have often been reported as plant pathogens, non-pathogenic endophytes, or saprobes. Many economically important species attack woody and herbaceous plants. In the past, species were described under the assumption that they were host-specific and thus were

named for the hosts from which they were isolated. Recent studies have found that many species can colonize diverse hosts as opportunists and that several different species can even co-occur on the same host or lesion (Yang et al., 2018). Some species have wide host ranges and broad geographic distributions (Gomes et al., 2013).

Species assignments in *Diaporthe* and *Phomoposis* have historically been based on morphology, culture characteristics, and hosts. DNA sequence comparisons have made it possible to connect sexual and asexual states within the pleomorph. Udayanga et al., in 2012, published a study that used multi-locus phylogeny to recognize species in the genus *Diaporthe*, and nine species previously known as *Phomopsis*, including *P. sclerotioides*, were transferred to *Diaporthe*. The older name, *Diaporthe* Nitschke (1870) has priority over the newer name *Phomopsis* Saccardo (1884) and is the preferred generic name for this fungus.

Black root rot of cucumber (*Cucumis sativus*) caused by *Phomopsis sclerotioides* was first reported in 1967 in the Netherlands by van Kesteren. Subsequently, it has spread in Europe and Asia, causing extensive losses in temperate climates (Van Kesteren,1966; Cappelli et al., 2004; Shishido et al., 2006). In 2017, it was detected in the United States for the first time, in Washington State by Fukada et al., (2018). It is a soil-borne pathogen that can affect various cucurbit plants by invading and rotting their roots, inhibiting the uptake of water. While it can occur on cucurbits grown in artificial growth mediums, its primary impact is observed in soil-based cultivation, often in greenhouses (Bruton, 1996).

Hosts: Citrullus lanatus (watermelon), *Cucumis sativus* (cucumber), *Cucumis melo* (cantaloupe), *Cucurbita maxima* (pumpkin), *Lagenaria siceraria* var. *gorda* (calabash) (Farr and Rossman, 2023; Shishido et al., 2014).

Symptoms: On infected cucumbers, the crowns, tap roots, and secondary roots were salmon pink to brown, dry, and corky, with necrotic lesions (Fukada et al., 2018). Black pseudostromata and rectangular pseudomicroscleroia develop within root cortical cells (Van Kesteren, 1966). When roots are infested, the take-up of water is impaired or blocked. Cucumber plants start to wilt late in the season, usually after the fruit has formed. Wilting develops very rapidly over the whole plant, usually without initial yellowing (chlorosis) or necrosis of the leaves (Fukada and du Toit, 2023). Wilting can be followed by plant collapse or death. It has been shown that cucurbit seeds sown in soil infested with *D. sclerotioides* can suffer from seedling wilt or damping off (Shishido et al., 2014).

Transmission: Diaporthe sclerotioides is a soil inhabitant. It can disseminate through water, infested soils or substrates, equipment, machinery, and people. The fungus occasionally forms black pycnidia in infected roots and crowns, but pseudomomicrosclerotia are the most important form of inoculum (Shishido et al., 2016). In less favorable conditions, the fungus can persist in the soil for extended periods, even in the absence of a cucurbit crop. No references were found indicating seed as a pathway for *D. sclerotioides* on cucumber, pumpkin, squash, or watermelon. Available information indicates there is no scientific basis for the regulation of *D. sclerotioides* on the seed.

Damage Potential: Black root rot is a serious disease of greenhouse-grown cucumbers (Bruton, 1996) and occurs in field-grown crops. It has been described as devastating in the northeast region of Japan

(Shishido et al., 2016). The disease is favored by acid soils (pH < 6.5), water deficit, heat stress, and fruiting. Most cucumber varieties are highly susceptible. Pumpkins and squash are much more tolerant than cucumbers (Fukada and du Toit, 2023).

Worldwide Distribution: America: *Canada* (British Columbia). Asia: *India, Malaysia*. Europe: *Austria, Denmark, France, Germany, Netherlands, Norway, Sweden, Switzerland, United Kingdom* (England, Scotland), *United States* (Washington) (EPPO, 2023; CABI, 2023). It is on the USDA PCIT's harmful organism list for China, Colombia, Honduras, Israel, and the United Arab Emirates (PCIT, 2023).

Official Control: *Diaporthe sclerotioides* is on the EPPO's A1 list in Bahrain and the Inter-African Phytosanitary Council and is a quarantine pest in China and Israel (EPPO, 2023). It is on the USDA PCIT's harmful organism list for India, Qatar, and The Republic of Korea (USDA-PCIT, 2023).

California Distribution: none

California Interceptions: none

The risk *Diaporthe sclerotioides* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen is likely to be found wherever its hosts can grow.

   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 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 a few types of cucurbits.

   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:** This fungus produces long-lasting resting spores that can survive for months to years in the soil. Pycnidia on roots and crowns have been observed, but the role of

pycnospores in pathogenesis has not been established. It is not seed-borne, but fungal resting structures could contaminate seed lots.

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:** This is described as a serious pathogen in several other countries where it affects both field-grown and greenhouse-grown cucumbers. It is a quarantine pest in several countries. Infectious fungal structures can be moved with water.

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

Economic Impact: A, C, G

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:** With a limited host range, no environmental impacts are expected, but it could affect home and urban cucurbits.

Evaluate the environmental impact of the pest to 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 *Diaporthe sclerotioides:* 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 '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 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* ***= 12***

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for ***Diaporthe sclerotioides*** **is B.**

References:

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Udayanga, D., Liu, X.-z., Crous, P.W., McKenzie, E.H.C., Chukeatirote, E., and Hyde, K.D. 2012. A multi-locus phylogenetic evaluation of *Diaporthe* (*Phomopsis*). Fung. Diversity 56:157-171

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USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. *Diaporthe sclerotioides*. Accessed 4/20/23.

Responsible Party:

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***Comment Period: 09/19/2023 through 11/03/2023**

***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: B