CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Didymella fabae G.J. Jellis & Punith. 1991 (teleomorph)
Ascochyta fabae Speg. 1899 (anamorph)
= *Ascochyta pisi* var. *fabae* R. Sprague 1947

Ascochyta blight
Leaf and pod spot of fava beans

Current Pest Rating: none

Proposed Pest Rating: B

Kingdom: Fungi, Phylum: Ascomycota,
Subphylum: Pezizomycotina, Class: Dothideomycetes,
Subclass: Pleosporomycetidae, Order: Pleosporales,
Family: Didymellaceae

Comment Period: 09/20/2022 through 11/04/2022

Initiating Event:

This pathogen has not been through the current pest rating process. The risk to California from *Didymella fabae* is described herein and a permanent rating is proposed.

History & Status:

Background: Fava beans, also known as broad beans, grow well as a cool season crop in coastal California, unlike most other beans, which are warm weather crops. Favas are also grown as a winter cover crop because, along with other types of legumes, they can form a symbiotic relationship with nitrogen-fixing rhizobia. The result of this symbiosis is to form nodules on the plant roots, within which the rhizobia can convert atmospheric nitrogen into ammonia that can be used by the next crop.

California also produces beans for export seed, as our relative isolation from domestic commercial bean production east of the Rocky Mountains, and dry summer climate yields high-quality, disease-free seed crops.

This fungal pathogen, *Didymella fabae,* is highly specialized to fava bean *(Vicia faba*). *Didymella* is the sexual (teleomorph) stage of the fungus that produces ascospores, while *Ascochyta* is the asexual stage (anamorph) that produces conidia. Ascochyta disease of fava beans was first observed in 1927 in England. Since then, it has undergone several classifications that resulted in synonymizations of many different species and spread around the world to many production areas.

Ascochyta blight is the most severe disease of cool-season pulses (Davidson and Kimber, 2007). *Didymella fabae* can survive and reproduce in, and spread from, crop debris or be transported in infected seed. Ascospores are disseminated by wind from the debris as primary inoculum and secondary cycles are initiated by conidia spread by rain splash from plant lesions. The fungus is host-specific but may be able to survive in non-host plants and reproduce on their debris. Seed certification is the primary means of preventing its spread to new areas (CABI-CPC, 2022).

Hosts: Faba vulgaris (broad bean), *Onobrychis viciifolia* (common sainfoin), *Panicum virgatum* (switchgrass), *Phaseolus vulgaris* (common bean), *Vicia angustifolia* (bird vetch), *Vicia faba* (fava bean), *V. hirsuta* (hairy vetch), *V. sativa* (common vetch), *Vicia* sp., and *V. tetrasperma* (smooth vetch) (CABI-CPC, 2022).

Symptoms: Seedlings grown from infected seeds develop lesions on the upper parts of the stem and on the leaves. This combination may result in the death of the seedlings. Plants infected in the field develop symptoms on leaves, stems, and pods. Lesions on the leaves are usually circular, dark brown and initially about 1 mm diameter. They expand, becoming slightly sunken, with a pale brown to dark-grey center surrounded by a broad, dark, chocolate-colored margin. As the spots enlarge, they become more irregular in shape and coalesce to cover larger areas of the leaf. Some zonation may occur within the necrotic area of the lesions, which may resemble symptoms of chocolate spot caused by *Botrytis fabae*. Prominent, dark pycnidia develop within the lesions, particularly as the leaves age or under periods of leaf wetness. The pycnidia can vary in numbers and are sometimes concentrically arranged.

On the stems, the lesions begin small but can elongate up the stem and become markedly sunken. Stem lesions are dark and contain scattered pycnidia. When the lesions are deeply sunken, the stems may bend producing a kink, or the stems of the plants may break, causing the plants to lodge.

Lesions can be produced over the surface of developing pods. They become very deep with dark brown centers containing pycnidia. In damp conditions, pale pink to yellow conidial masses are produced from the pycnidia. Well-developed lesions may penetrate the pod wall and affect seed set or may blemish the developing seeds within the pod. However, seed staining does not always indicate infection by this pathogen, because saprobic organisms may invade the damaged pods and cause similar discoloration (CABI-CPC, 2022).

Transmission: The fungus survives on infected fava bean debris left in the field, or on the outside or inside of seed. The fungus survives only on crop debris, and it does not produce resting spores to survive in soil (Bond and Pope, 1980). The most common source of infection is through the seed (Hewett, 1973). During wet weather, asexual *Ascochyta* spores are released from pycnidia and are splashed or carried in rain or irrigation water. Repeating cycles of conidia and spread between plants

results in expanding areas of diseased plants in fields. Symptoms develop 3 to 6 days after infection. Moderate temperatures (20°-25°C) and wet weather are optimal conditions for severe disease epidemics. Pseudothecia may develop when both compatible mating types of the fungus are present. Ascospores of *Didymella* are produced in pseudothecia are airborne and may aid in long-distance dispersal of the pathogen, although they are not important in local and short-term disease development (Jellis and Punithalingam, 1991).

Damage Potential: Under favorable climatic conditions, ascochyta blight can be a severe disease of cool-season pulses (Davidson and Kimber, 2007; Gaunt, 1983). *Didymella fabae* is common in Europe and was accidentally introduced with seed to parts of Australia and Canada but has not been reported from the United States. Kaiser (1997) suggests that the fungus originated in, and spread from, southwestern Asia, the center of origin of the host plant. The disease is most prevalent where fava bean is grown as a winter crop in regions with Mediterranean or mild oceanic climates (Stoddard et al., 2010). Madeira et al. (1988) reported that the disease reduced the leaf area index and dry matter production and there was a significant seed weight reduction. Yield losses of 32-41% were reported in several years in the Czech Republic (Ondrej, 1991) with similar levels were observed in New Zealand (Hampton, 1980). In the drier areas of eastern England, crop losses are relatively low although pod infection can become severe later in the season, especially in fall-sown crops, resulting in high levels of seedborne infection. Worldwide yield losses can be as high as 90 to 100% in susceptible varieties (Hanounik and Robertson, 1989).

Worldwide Distribution: Africa: *Algeria, Egypt, Ethiopia, Morocco, Sudan, Tunisia*. Asia: *Afghanistan, Azerbaijan, China, Iran, Iraq, Israel, Japan, Lebanon, Pakistan, Saudi Arabia, South Korea, Syria, Turkey*. Europe: *Belarus, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Spain, Sweden, Switzerland, Ukraine, United Kingdom*. North America: *Canada*. Oceania: *Australia, New Zealand*. South America: *Argentina, Brazil, Chile* (CABI-CPC, 2022).

Official Control: *Ascochyta fabae/Didymella fabae* is on the USDA's harmful organisms list for Egypt, Guatemala, India, Israel, Nicaragua, Peru, and South Africa. It is on the EPPO's A1 list for Egypt. *Ascochyta fabae* is in CDFA's Phytosanitary Field Inspection manual as a disease of concern for fava bean seed grown for export.

California Distribution: none

California Interceptions: none

The risk *Didymella fabae* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:**

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: **2**

- 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.

Risk is Medium (2) – *Didymella fabae* requires cool and moist conditions to infect its host and cause ascochyta blight disease. At least 1 hour of wetness is required for infection and extended periods for disease development. This may limit the establishment of the disease in in California and may also be why this disease has never been observed in California. Therefore, a 'medium' rating is given to this category.

2) Known Pest Host Range:

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.

Risk is low (1) – The natural host range is limited to various species in the genus *Vicia.*

3) Pest Reproductive Potential:

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.**

Risk is High (3) – Under favorable environmental conditions *Didymella fabae* has a high reproductive rate with sexual and asexual spores and depends on wind and moisture or rain for its short distance dispersal. Infected seed provide the means for long distance dispersal.

4) Economic Impact:

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:
- 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.

Risk is High (3) – This blight pathogen could lower crop value and yield, cause increases in production costs for disease management, and negatively change normal cultural practices to mitigate potential damages. It is often regulated by other countries in their cleanliness standards for seed. Therefore, a 'high' rating is given to this category.

5) Environmental Impact:

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.

Risk is Medium (2) – Fava bean plants grown in home/urban gardens could be negatively impacted if infected with *Didymella fabae*.

Consequences of Introduction to California for *Didymella fabae:* Medium

Add up the total score and include it here. **11**
-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 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:

none

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Didymella fabae* is B.

References:

Bond, D.A., and Pope, M. 1980. *Ascochyta fabae* on winter beans (*Vicia faba*): pathogen spread and variation in host resistance. Plant Pathology, 29(2):59-65

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Kaiser, W. J. 1997. Inter- and intranational spread of *Ascochyta* pathogens of chickpea, faba bean, and lentil. Canadian Journal of Plant Pathology, 19(2):215-224; 61 ref.

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Stoddard, F.L., Nicholas, A. H., Rubiales, D., Thomas, J.. Villegas-Fernández, A. M. 2010. Integrated pest management in faba bean. Field Crops Research, 115(3):308-318.

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Responsible Party:

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***Comment Period: 09/20/2022 through 11/04/2022**

***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