cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Penicillium chrysogenum Thom 1910

Current Pest Rating: none

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Ascomycota

Subphylum: Pezizomycotina, Class: Eurotiomycetes

SubclassEurotiomycetidae, Order: Eurotiales

Family: Trichocomaceae

Comment Period: 9/18/2020 through 11/2/2020

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 movement of some or all these pathogens into and within the state. In order to assess the needs and potential requirements to issue a state permit, a formal risk analysis for *Penicillium chrysogenum* is given herein and a permanent pest rating is proposed.

History & Status:

Background: Postharvest diseases are caused mainly by ascomycete fungi, plus a few species of oomycetes, zygomycetes, basidiomycetes, and bacteria. Ascomycetes and imperfect mitosporic fungi are by far the most common and most important causes of postharvest decay. Diseases develop on fruit, seeds, or other plant products during harvesting, grading, packing, and transportation to market and up until the moment of actual consumption. All types of plant parts are susceptible to postharvest diseases. In general, the more tender or succulent the exterior of the product and the greater the water content of the entire product, the more susceptible it is to injury and infection and post-harvest

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decay. Postharvest rotting of cereal grains and of legumes is common and the losses can be large. Postharvest decays of bread, hay, and silage are quite common and extensive.

Plant products may or may not show symptoms of diseases that can begin in the field but remain latent at the time of harvest. Alternately, plant products can be infected in processing or storage. In some cases, post-harvest pathogens also secrete toxic substances that make the remainder of the product unfit for consumption or lower its nutritional and sale value (Agrios, 2005).

Hosts: Allium sativum, Ammophila sp., *Arachis hypogaea, Avena sativa, Bellis perennis, Betula pendula, Brassica campestris, Brassica napus, Brassica rapa, Capsicum annuum, Carya illinoensis, Celosia cristata, Cyamopsis psoralioides, Dactylis glomerata, Elaeis guineensis, Eruca sativa, Helianthus annuus, Hordeum* sp., *Hordeum vulgare, Hyoscyamus albus, Hyssopus* sp., *Ipomoea batatas, Lens culinaris, Lens esculenta, Lupinus luteus, Lupinus termis, Lycopersicon esculentum, Malus domestica, Medicago sativa, Onobrychis viciifolia, Ornithopus sativus, Peganum harmala, Pennisetum typhoides, Persea americana, Phaseolus mungo, Phaseolus vulgaris, Picea abies, Pinus caribaea, Pinus ponderosa, Pistacia vera, Pisum sativum, Pisum sativum* subsp. *arvense, Pisum sativum subsp. sativum, Plantago ovata, Protea repens, Punica granatum, Pyrus communis, Salix herbacea, Salvia officinalis, Secale cereale, Sesamum indicum, Solanum lycopersicum, Solanum tuberosum, Sorghum bicolor, Thalassia testudinum, Trifolium pretense, Triticum aestivum, Vicia faba, Vicia faba* var. *minor, Vigna unguiculate, Vitis* sp., *Zea mays, and Zinnia elegans* (Farr and Rossman, 2020).

Symptoms: Although this fungus has been associated with many plant species, reports of pathogenicity testing are limited. Apple fruit can develop wet core rot following infection by *P. chrysogenum* and other species. Core rot is characterized by white mycelia with conidia growing in the core region and the seed locules, with the apple flesh appearing wet and necrotic. Core infection likely occurs as spores become established on senescing blossoms after bloom (Gao et al., 2013).

Transmission: Penicillium spp. produce massive numbers of asexual conidia that are spread by air movement. Penetration through wounds is the most common way the pathogen gains entry to a host. Only minor or micro- wounds are required. Wounds can occur before harvest (insect injuries, wind damage, etc.) or more often during and after harvest with handling, transport, and packaging. Penetration of intact fruit is also possible, either through the surface of mature fruit, or as quiescent infections that are established early during fruit growth but remain inactive until the fruit matures (Agrios, 2005).

Penicillium species are ubiquitous and inoculum associated with apples is found in soil, on plant surfaces, in dump tank water, in flume water in contaminated wooden bins and in the atmosphere (Sanderson and Spotts, 1995).

Damage Potential: Specific data is limited for *P. chrysogenum* as it is often not identified to species or is found co-infecting with other species. Postharvest diseases usually cause the greatest losses of fresh fruits and vegetables by reducing their quality or quantity, or both. On apples in France, an estimated 7-10% of the fruit are lost to post harvest fungi, one of which is *P. chrysogenum*. Consequently, in recent years, sanitation within warehouses has become increasingly important as producers have

moved away from traditional postharvest fungicide treatments due to resistance and consumer and environmental concerns (Amiri and Bompeix, 2005).

Worldwide Distribution: Argentina, Brazil, Bulgaria, Canada, China, France, Greece, India, Iran, Italy, Libya, Malaysia, Norway, Pakistan, Poland, Poland, Puerto Rico, Russia, Saudi Arabia, South Africa, Tanzania, United Kingdom, United States (California, Iowa, Illinois, Indiana, Kansas, Minnesota, Ohio, Tennessee, Virginia, Wisconsin, Washington), and Uzbekistan.

Official Control: None

California Distribution: Many state records are listed as blue mold rot/*Penicillium* sp. as members of this genus are often not identified to species. *Penicillium chrysogenum* was identified as part of the mycoflora of *Pistacia vera* in the Central Valley but pathogenicity was not described (French, 1989; Chen et al., 2002).

California Interceptions: None

The risk *Penicillium chrysogenum* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:**

This pathogen lives in many environments as a saprophyte or a pathogen and survives well in orchards.

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 recorded host range is large including multiple plant families.

Evaluate the host range of the pest.

Score: 3
- 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:

Imperfect fungi such as *Penicillium* reproduce rapidly with huge numbers of asexual conidia that move with air currents and between plant products when in storage or packaged for sale.

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 species *P. chrysogenum* has only a few references of causing postharvest damage on apples, always in conjunction with other species.

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:

No negative environmental impacts have been reported for this species.

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

Environmental Impact:

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 *Penicillium chrysogenum:* 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 'high'. There are only records from the Central Valley (Chen et al. 2002), but this species is believed to be cosmopolitan (Farr and Rossman, 2020).

Score: -3
-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: 8

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* **= 8**

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Penicillium chrysogenum* is C.

References:

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Sanderson, P. G, Spotts, R. A, 1995. Postharvest decay of winter pear and apple fruit caused by species of *Penicillium*. Phytopathology 85, 103–10.

Responsible Party:

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***Comment Period: 9/18/2020 through 11/2/2020**

***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: C
