

California Pest Rating Proposal for
***Peronospora dipsaci* Tul. 1854 ex de Bary 1863**

Current Pest Rating: Z

Proposed Pest Rating: C

Kingdom: Eukaryota, Supergroup: SAR,
Infrakingdom: Heterokonta, Phylum: Oomycota,
Order: Peronosporales; Family: Peronosporaceae



Downy mildew on *Scabiosa*. Photo by C. Taylor

Comment Period: 01/13/2021 through 02/27/2021

Initiating Event:

In November 2020, an agricultural inspector from San Luis Obispo County submitted leaves from *Scabiosa columbaria* “Flutter Pure White” to CDFA’s Pest diagnostics center at Meadowview. The leaves were collected during a regulatory nursery inspection. From purple leaf spots, CDFA plant pathologist Cheryl Blomquist identified *Peronospora dipsaci*, a downy mildew. This pathogen had not been detected recently in California but there are historical records in the state (French, 1989). It was assigned a temporary Z rating. The risk to California from *P. dipsaci* is described herein and a permanent rating is proposed.

History & Status:

Background:

Oomycetes are also known as “water molds”. They are distinct from fungi, more closely related to algae and to green plants. As a group they contain some of the most devastating plant pathogens. The downy mildews are obligate parasites, primarily causing foliar blights, attacking and growing rapidly on young leaves, twigs, and fruits and causing rapid and severe losses in cool, wet weather. *Peronospora* is the largest genus in Peronosporaceae and its hosts are mainly eudicots, plus some monocots in Alliaceae and Liliaceae. They have purplish gray to blackish sporangia that germinate directly with a germ tube rather than producing zoospores. Downy mildews are generally highly host specific (Thines and Choi, 2015).

The teasel family (Dipsacaceae) of asterid flowering plants has recently been treated as subfamily Dipsacoideae of the Caprifoliaceae (honeysuckles) based on molecular phylogenetic studies. Within this group are the genera *Dipsacus* (the teasels) and *Scabiosa* (the pincushions). None of these genera are native to California. The teasels are Eurasian plants that can be weedy and invasive; some species of pincushions are cultivated as ornamentals. *Dipsacus fullonum* is widely naturalized as a weed in California (Cal Flora, 2020). The purple pincushion (*S. atropurpurea*) is an ornamental species that has naturalized in parts of the state and is on the California Invasive Plant Council’s watch list as an invasive species (Cal-ipc.org).

Hosts: *Dipsacus asper* (Sichuan teasel), *D. fullonum* (syn. *D. sylvestris*) (common teasel), *D. laciniatus* (cut-leaf teasel), *D. pilosus* (syn. *Virga pilosa*) (small teasel), *Scabiosa atropurpurea* (syn. *Sixalix atropurpurea*) (purple pincushion), *S. columbaria* (small scabious), and *Scabiosa* sp. (pincushions) (Farr and Rossman, 2020).

Symptoms: On the upper side of the leaves, the first symptom is pale yellow spots that become purple with age. On the corresponding underside of the leaf, under favorable conditions, the greyish brown-

purple growth of the downy mildew can be seen. This growth consists of conidiophores and conidia that are produced in very large numbers. Leaf lesions are often angular in shape, as their expansion is stopped by the leaf veins. When disease is severe, leaves can dry, curl, and drop (Koike and Wilen, 2009).

Transmission: Spores can be spread by wind and water including rain and sprinkler irrigation. Some species of *Peronospora* can be seed borne, but this has not been determined for this species. In general, *Peronospora* spores germinate and infect over a wide range of temperatures, with a short latent period. Infection and growth require high relative humidity and leaf wetness of approximately 6 hours. Spores are short-lived under dry, sunny conditions because they are sensitive to UV and dehydration. Some species produce oospores that survive in plant debris. Movement of infected nursery stock is likely a method of transmission for this disease (Agrios, 2005).

Damage Potential: Damage estimates have not been made for this species, but downy mildews can be very damaging in nursery situations, where plants experience wet leaves from regular irrigation and elevated humidity in greenhouses and shade houses. Most are host specific, infecting only a single family of plants (Koike and Wilen, 2009).

Worldwide Distribution: Bulgaria, China, Czechia, England, France, Germany, Greece, Poland, Ukraine, United States (California, Missouri) (Farr and Rossman, 2020).

Official Control: None

California Distribution: There are historical records of this pathogen on *Scabiosa* in California listed as “coast south”. The recent detection was on *Scabiosa* nursery stock grown in San Luis Obispo County (French, 1989).

California Interceptions: None

The risk *Peronospora dipsaci* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** *Peronospora* spp. require cool, wet conditions with high relative humidity to grow and sporulate. They are most often found near the coast. They are not likely to be found in the desert or areas with hot, dry summers unless there is supplemental irrigation or dense crop canopies.

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.
-

- 2) Known Pest Host Range:** Most downy mildews have narrow host ranges. For this species, all known hosts are in one family, Dipsacaceae.

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:** *Peronospora* reproduces with spores that can be produced in large numbers. It is unknown if this species produces oospores, or can become systemic, or be seed borne.

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:** Downy mildews can be very damaging, especially to young plants and in highly favorable conditions, for example, inside greenhouses. The plants seen recently in San Luis Obispo had large purple leaf spots which reduced their aesthetic value.

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:** None of the hosts of this disease are native to California. Some have naturalized and are considered weedy. One is on a watch list as a possible invasive. It could potentially cause damage to ornamental plantings of *Scabiosa*.
-

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 *Peronospora dipsaci*:

Add up the total score and include it here. **8**

-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'. CDFFA records show this disease has been found on the south coast, a recent detection is on the central coast.

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 = 7*

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Peronospora dipsaci* is C.

References:

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

Calflora Database. Accessed 12/17/2020. Berkeley, CA. calflora.org

Farr, D.F., and Rossman, A.Y. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved December 17, 2020, from <https://nt.ars-grin.gov/fungaldatabases/>

French, A. M. 1989. California plant disease host index. CA Division of Plant Industry. 2nd Ed. 394 pg

Koike, S. T., and Wilen, C.A. 2009. Floriculture and ornamental nurseries Downy Mildew. UC IPM Pest Management Guidelines: Floriculture and Ornamental Nurseries UC ANR Publication 3392

Thines, M. and Choi, Y.J., 2016. Evolution, diversity, and taxonomy of the Peronosporaceae, with focus on the genus Peronospora. *Phytopathology*, 106(1), pp.6-18.

Responsible Party:

Heather J. Scheck, Primary Plant Pathologist/Nematologist, CDFA/PHPPS ECOPERS, 2800 Gateway Oaks Suite 200, Sacramento, CA 95833 Phone: (916) 654-1017, [permits\[@\]cdfa.ca.gov](mailto:permits[@]cdfa.ca.gov).

***Comment Period: 01/13/2021 through 02/27/2021**

***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.

Proposed Pest Rating: C
