

CALIFORNIA PEST RATING PROPOSAL

Chrysanthemum white rust - *Puccinia horiana* (Hennings 1901)

Current Rating: Q

Proposed Rating: A

Comment Period: 6/6/2019 through 7/21/2019

Initiating Event: *Puccinia horiana* has a temporary Q rating. The status of this pathogen and the threat to California are reviewed herein, and a permanent rating is proposed.

History & Status:

Background:

Chrysanthemum white rust (CWR) is a disease caused by a fungal pathogen, *Puccinia horiana* (Henn.) (Pucciniaceae: Uredinales). This species is not known to be established in California and is currently considered to be a pest of plant quarantine significance in the United States, Canada, and Mexico. In the last 25 years, multiple localized introductions of CWR have occurred within all three countries in both commercial and residential plantings. The first positive detections in California of CWR were from commercial cut and potted flowers grown in Carpinteria, Santa Barbara County, in 1991. Subsequently, periodic and sometimes serious outbreaks have been found in commercial nurseries in San Diego, Ventura, San Luis Obispo, Monterey, and Santa Clara counties.

In 2009, USDA-APHIS produced an economic assessment of the impact of deregulating chrysanthemum white rust using a partial budgeting model and concluded there would be a net economic benefit of deregulation to the country approximately 66.5% of the time. This was due to the number of states at risk for the disease (9 states) and the number of likely outbreaks per year (5 outbreaks). Additionally, they considered the cost of inspections of foreign shipments of cut flowers, cost of domestic surveys, and cost of eradication under state or federal oversight. (https://www.aphis.usda.gov/plant_health/plant_pest_info/cwr/downloads/CWR%20Economic%20Assessment.pdf).

A notice of proposed rulemaking in 2012 by the USDA (Federal Register Vol 77, no 211) solicited suggestions for changes to domestic chrysanthemum white rust outbreaks and policy regarding rules for the importation of host plants (<https://www.regulations.gov/document?D=APHIS-2012-0001-0054>).

No changes have so far been made but, it is possible that the USDA could, at some point in the future, deregulate chrysanthemum white rust, which would leave California more vulnerable to domestic or international sources of the disease.

Disease Development:

Puccinia horiana is an obligate biotrophic pathogen that infects mainly fresh tissue of growing plants (Firman, 1968). It is an autoecious microcyclic rust fungus that requires only one plant host to complete its life cycle. Teliospores germinate *in situ* (in the leaves), and each 2-celled teliospore can produce 16 basidiospores. The basidiospores (sporidia) can form without requiring a period of dormancy. Although they are very delicate and sensitive to drying and UV light, the basidiospores can be dispersed by air currents up to a distance of 700 meters (Zandvoort et al., 1968). It is the dispersal of very large numbers of basidiospores that explains the rapid development of *P. horiana* epidemics. Under ideal environmental conditions, the life cycle of the pathogen averages 4 weeks but can be as short as 2 weeks (Schubert, 2016). High humidity and a thin film of moisture on the leaf surface are essential for the germination of both telio- and basidiospores. Low humidity is often a limiting factor for disease spread outside of greenhouses (Horst and Nelson, 1997). Leaves can be latently infected for several weeks before pustules and teliospores (necessary for disease identification) are formed (Pedley, 2009). In 2012 there was a report that *P. horiana* was able to overwinter in Pennsylvania (O'Keefe and Davis). This led to research that showed evidence for systemic infection of chrysanthemums by *P. horiana* (Bonde et al. 2015).

Dispersal and spread:

This rust is spread by wind/air currents, and rain splash in open environments. Long distance spread is through the movement of infected plants or cuttings. In greenhouses and for mother plants, early and accurate identification of CWR is essential to limit the spread and ensure clean stock for propagation.

Hosts:

- **Florist's chrysanthemum, chrysanthemum, mum, pompon** (*Chrysanthemum* × *morifolium* = *Anthemis grandiflorum*, *Anthemis stipulacea*, *Chrysanthemum sinense*, *Chrysanthemum stipulaceum*, *Dendranthema* × *grandiflorum*, *Dendranthema* × *morifolium*, *Matricaria morifolia*)
- Arctic chrysanthemum, arctic daisy (*Chrysanthemum arcticum* = *Arctanthemum arcticum*, *Dendranthema arcticum*)
- *Chrysanthemum boreale* = *Chrysanthemum indicum* var. *boreale*, *Dendranthema boreale*
- *Chrysanthemum indicum* = *Dendranthema indicum*
- Nojigiku (*Chrysanthemum japonense* = *Dendranthema japonense*, *Dendranthema occidentali-japonense*)

- Ryuno-giku (*Chrysanthemum japonicum* = *Chrysanthemum makinoi*, *Dendranthema japonicum*)
- Iso-giku (*Chrysanthemum pacificum* = *Ajania pacifica*, *Dendranthema pacificum*)
- Shio-giku (*Chrysanthemum shiwogiku* = *Ajania shiwogiku*, *Dendranthema shiwogiku*)
- *Chrysanthemum yoshinaganthum* (*Dendranthema yoshinaganthum*)
- *Chrysanthemum zawadskii* = *Chrysanthemum arcticum* subsp. *Maekawanum*, *Chrysanthemum arcticum* var. *yezoense*, *Chrysanthemum yezoense*, *Dendranthema yezoense*, *Leucanthemum yezoense*
- *Chrysanthemum zawadskii* subsp. *Zawadskii* = *Chrysanthemum sibiricum*, *Dendranthema zawadskii*, *Dendranthema zawadskii* var. *zawadskii*
- *Leucanthemella serotina* = *Chrysanthemum serotinum*, *Chrysanthemum uliginosum*, *Pyrethrum uliginosum*
- Nippon daisy, Nippon-chrysanthemum (*Nipponanthemum nipponicum* = *Chrysanthemum nipponicum*, *Leucanthemum nipponicum*)

Ref: USDA APHIS, 2015

Symptoms: Symptoms are primarily exhibited on the leaves. Basidiospores spread by air movement or rain splash, land on the top surface of the leaves, germinate, and if there is moisture present, penetrate the leaf epidermis. Pale-green to yellow spots up to 5 mm diameter develop on the upper leaf surface. Early infections are very difficult to differentiate from insect damage, especially leaf miner stings. The centers of these spots become brown and necrotic with age. Raised, buff or pinkish pustules (sori) that produce the teliospores develop on the corresponding lower leaf surface. The sori turn white at maturity when the teliospores begin to produce basidiospores and later tan with age. As the spots on the upper surface become sunken, the pustules on the lower leaf become quite prominent. Sori with teliospores are occasionally found on the upper leaf surface. Severely attacked leaves wilt and hang down the stem-, and gradually dry up completely (Horst and Nelson, 1997). Sori and teliospores occasionally develop on flower bracts and stems. Infection has been recorded as necrotic flecking with occasional pustules on petals (Dickens, 1970).

Damage potential: Rust pathogens rarely kill their hosts but can weaken them and stunt their growth (Agrios, 2005). Large numbers of pustules on leaves, stems, bracts and flowers cause serious cosmetic damage to potted plants and cut flowers, rendering them unmarketable.

Worldwide distribution: The disease was first discovered in Japan in 1895 (Hiratsuka) and described by Hennings in 1901. Although confined to Japan and China until 1963 (Baker), global trade of chrysanthemums for planting and by chrysanthemum hobbyists have helped disseminate *P. horiana* around the world. The pathogen occurs commonly in Japan, China, Taiwan, and Thailand and has become established in South Africa as well as many countries in Europe (EPPO A2 list) and South America (CABI 2018). Although occasionally reported, this rust is considered

eradicated from Australia and New Zealand (Walker, 1983). There is a 2015 report of the pathogen in India for the first time (Deepak et al). In North America it is present in Mexico but is considered a quarantine pest of limited distribution. There have been multiple outbreaks in British Columbia and Ontario but the pathogen is currently listed as eradicated from Canada (CABI, 2018). Whenever *P. horiana* has been detected in the United States, USDA-APHIS has treated it as transient and actionable, and it has a national eradication plan in place. In addition to California (CDFA 1992), CWR has also been detected in New Jersey (1977), Pennsylvania (1977, 2004, 2006-10), Oregon and Washington (1990), New York (2003-04), Delaware (2004), Massachusetts (2008), and Maryland (2011). (USDA National Invasive Species Information Center. <https://www.invasivespeciesinfo.gov/profile/chrysanthemum-white-rust>)

Official Control: Chrysanthemum white rust is a quarantine pest under Title 7, Code of Federal Regulations, Part 319.37 and 319.74. USDA-APHIS has a Chrysanthemum white rust eradication protocol for nurseries containing plants infected with *P. horiana* that includes scouting, sanitation, host free periods, crop destruction, and prescribed fungicide treatments. https://www.aphis.usda.gov/plant_health/plant_pest_info/cwr/downloads/cwrplan.pdf.

In California, annual nursery surveys are conducted by the CDFA or counties to detect CWR. Growers are encouraged to use preventative practices including pre-plant fungicide dips of cuttings, scouting, and regular fungicide applications to prevent infection.

California Distribution: Chrysanthemum white rust is not known to be established in California.

California Interceptions: Chrysanthemum white rust has been found periodically at indoor and outdoor nurseries that grow flowers for cutting and potted plants in the major chrysanthemum producing counties in California, and in additional counties from the results of trace-forwards of nursery stock.

Consequences of Introduction:

1) Climate/Host Interaction: *Puccinia horiana* has been detected from a wide range of climates world-wide, wherever chrysanthemums can grow. This includes parts of the Northeastern United States with below freezing temperatures in the winter months. Humidity is a limiting factor for spore dispersal and leaf infections

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 restricted to Chrysanthemums; some species and varieties are resistant to CWR.

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 Dispersal Potential: The pathogen has high reproductive potential. Natural spread is limited by the need for high relative humidity. Movement of infected cuttings is a major pathway of disease spread.

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: Under suitable conditions for epidemics, the pathogen could lower plant growth and value, and trigger the loss of markets. Specifically, other states and countries could enact quarantines against chrysanthemums from California.

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: The pathogen could significantly impact commercial cultural practices, home gardening, and ornamental plantings.

Evaluate the environmental impact of the pest on California using the criteria below

Environment Impact: **D, 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: 3

- 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:

Add up the total score and include it here. (Score): **13**

-Low = 5-8 points

-Medium = 9-12 points

-High = 13-15 points

Total points obtained on evaluation of consequences of introduction to California = 13

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. Presently, *Puccinia horiana* is not known to exist in California; - it is given a score of 0 in this category.

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.

Final Score:

7) The final score is the consequences of introduction score minus the post entry distribution and survey information score

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 13*

Uncertainty:

Chrysanthemums are perennial plants and the ability of *P. horiana* to survive indefinitely outdoors in California has not been observed or studied.

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Puccinia horiana* is A**

References:

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Responsible Party:

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*** Comment Period: 6/6/2019 through 7/21/2019**

***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 [plant.health\[@\]cdfa.ca.gov](mailto:plant.health[@]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.
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Proposed Pest Rating: A