

California Pest Rating Proposal for
***Puccinia pelargonii-zonalis* Doidge 1926**

Rust of pelargonium

Current Pest Rating: C

Proposed Pest Rating: C

Domain: Eukaryota; Kingdom: Fungi;

Phylum: Basidiomycota; Subphylum: Pucciniomycotina

Class: Pucciniomycetes; Order: Pucciniales

Family: Pucciniaceae

Garden geranium in Santa Barbara County infected by rust



Upper leaf surface

Lower leaf surface

Comment Period: 10/26/2020 through 12/10/2020

Initiating Event:

Plant pathologists at CDFA's Plant Pest Diagnostics Center requested a review and formal rating of this pathogen to replace an informal rating. The risk to California from *Puccinia pelargonii-zonalis* is described herein and a permanent rating is proposed.

History & Status:

Background:

Pelargoniums (also called geraniums) are among of the most popular ornamental plants as annuals and perennials, and there has been extensive trade and cultivation of horticultural varieties worldwide. Both *Geranium* L. and *Pelargonium* L'Her. are large and geographically widespread genera with many taxa now in cultivation, and both are often called "geranium" as a common name, though the genera are separate, monophyletic groups. *Geranium* spp. are often called "wild geranium", "hardy geranium," or "cranesbill". *Pelargonium* spp. are called "garden geraniums" or "pelargoniums". The widely cultivated *Pelargonium x hortorum* (garden geranium, fish geranium) is a horticultural hybrid of the South African species *Pelargonium inquinans* and *P. zonale*. Scented-leaved geraniums (one subset of the genus *Pelargonium*) include a variety of species and horticultural hybrids with strongly scented leaves, including *P. graveolens* (sweet-scented geranium; rose geranium) and *P. odoratissimum* (apple-scented geranium) (Dr. Robert Price, CDFA Primary Botanist, pers. comm.).

Puccinia pelargonii-zonalis is a short-cycle autoecious rust that produces large numbers of asexual urediniospores (stage II), and occasionally produces 2-celled teliospores (stage III). Pelargonium rust was first described from South Africa (where *Pelargonium* spp. originated) nearly a century ago. In the first half of the 20th century it spread through Europe and to Hawaii, and it was detected in Florida on plants of California origin in 1967 (Wehlburg, 1970). Distribution of pelargonium rust is still expanding around the globe with a recent detection in Korea (Aktaruzzamam et al., 2018).

Hosts: *Geranium* spp., *Pelargonium* spp., *Pelargonium graveolens*, *Pelargonium hortorum*, *Pelargonium hybridum*, *Pelargonium macranthum*, *Pelargonium odoratissimum*, *Pelargonium roseum*, *Pelargonium zonale*, *Pelargonium x hortorum*, *Pelargonium x hortorum-zonale*, *Pelargonium x inquinans-zonale*

Symptoms: Early symptoms of rust infection are nondescript, appearing as very small pale-yellow spots, mainly on the underside of the leaves. Initially they resemble edema or insect damage. Edema is an imbalance in osmotic pressure inside the plant cell that occurs with cool, damp conditions and under low light. If this pressure is great enough, it can cause the yellow spots and swellings where cells rupture, creating brown scab-like wounds that can resemble rust.

When rust has infected the leaves, the small pale-yellow spots increase in size and become rusty brown as the pustules containing urediniospores rupture through the epidermis. Over time, spores are formed in distinctive, concentric, expanding rings. On the corresponding upper leaf surface, spots turn from pale yellow to bright yellow, and may appear as a divot as the pustule on the lower leaf surface

expands. Heavily infected leaves can turn yellow and drop prematurely, leaving plants partially defoliated (Wehlburg, 1970).

Transmission: The fungus reproduces with urediospores produced on the surface of infected plants. Spores are dispersed by air currents, splashing water, infected cuttings, or the hands of workers. Germination of spores and infection is highest in moist, relatively cool (16 to 21° C) conditions. Temperatures above 27° C inhibit spore germination and pustule expansion. Five hours of free moisture are needed for a spore to germinate and infect a leaf. The period of latency, from spore germination to the appearance of the yellow spots, averages 7 to 10 days. This time is high risk for infected but asymptomatic plants to be shipped. An additional 7 to 9 days are required for new pustules to erupt and spores to be released. Thus, a complete disease cycle may be completed every 14 days under favorable conditions allowing exponential increase in disease over time (Harwood and Raabe, 1979).

Damage Potential: Species and varieties of cultivated pelargoniums have variable levels of resistance to *P. pelargonii-zonalis*. Some very susceptible genotypes (e.g. *P. hortorum*) may require repeat fungicide applications (Harwood and Raabe, 1979). Chemical control is less likely to be practiced in home gardening or landscape situations where plant growth may be slowed by rust infection and leaves may become unsightly as they are covered with pustules and yellowed.

Worldwide Distribution: Argentina, Australia, Austria, Azores, Belgium, Bermuda, Brazil, Bulgaria, Canada, Canary Islands, Colombia, Costa Rica, Croatia, Denmark, Egypt, El Salvador, Ethiopia, Finland, France, Jamaica, Kenya, Germany, Gibraltar, Greece, Hungary, India, Ireland, Israel, Italy, Kenya, Korea, Lithuania, Luxembourg, Madagascar, Madeira Islands, Malawi, Mauritius, Mexico, Montenegro, Morocco, Mozambique, Netherlands, New Caledonia, New Zealand, Norway, Panama, Papua New Guinea, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Tanzania, Tunisia, Turkey, Uganda, United Kingdom, United States (Arizona, California, Florida, Georgia, Hawaii, Minnesota, New York, North Carolina, Pennsylvania), Venezuela, Zambia, Zimbabwe (Farr and Rossman, 2020).

Official Control: *Puccinia pelargonii-zonalis* is on the USDA's harmful organism list for China, Ecuador, Eurasian Customs Union, French Polynesia, Mexico, Norway, and Turkey (USDA -PCIT, 2020) and is on the EPPO's A1 list for Kazakhstan, and is a Quarantine pest for Mexico, Norway and Tunisia (EPPO, 2020).

California Distribution: Alameda, Contra Costa, Imperial, Monterey, Riverside San Benito, San Joaquin, San Luis Obispo, San Mateo, Santa Cruz, Santa Barbara, and Ventura counties (French, 1989; CDFA PDR Database)

California Interceptions: None

The risk *Puccinia pelargonii-zonalis* would pose to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** The hosts of this pathogen are long lived perennials in the warmer parts of California and widely planted annuals in colder parts.

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 of this rust is very narrow, limited to geraniums and pelargoniums.

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 pathogen reproduces with large numbers of urediniospores that are moved by air currents and with infected nursery stock. The spores are durable and resistant to UV light

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:** Although rusts do not usually kill their hosts, the value of ornamentals such as pelargoniums can be destroyed by disfiguring pustules that can cover the leaves, causing yellowing and defoliation.

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

Economic Impact: B

- 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.
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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:** Fungicides are routinely used to protect nursery stock from rust infection. Home and urban gardens need to avoid susceptible varieties to avoid plant damage from repeating cycles of rust, especially on perennial plantings.

Environmental 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 for *Puccinia pelargonii-zonalis*: Medium

Add up the total score and include it here. **10**

- 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'. This pathogen is widely established in California on perennial plants growing in outdoor landscapes.

Score: -3

- Not established (0) Pest never detected in California or known only from incursions.
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-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 *Puccinia pelargonii-zonalis* is C.

References:

Aktaruzzamam, M., Afroz, T., Kim, B.S. and Shin, H.D., 2018. Occurrence of Geranium Rust Caused by *Puccinia pelargonii-zonalis* in Korea. *Plant Disease*, 102(12), pp.2652-2652.

CABI Crop Production Compendium 2020. *Puccinia pelargonii-zonalis* (rust of pelargonium) Accessed 9/15/2020 <https://www.cabi.org/cpc/datasheet/45851>

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

Harwood, C.A. and Raabe, R.D., 1979. The disease cycle and control of geranium rust. *Phytopathology*, 69, pp.923-927.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PEXD) Harmful Organisms Database Report. *Puccinia pelargonii-zonalis*. Accessed 9/16/2020

Wehlburg, C., 1970. Pelargonium rust (*Puccinia pelargonii-zonalis*) in Florida. *Plant Disease Reporter*, 54(10), pp.827-828.

Responsible Party:

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***Comment Period: 10/26/2020 through 12/10/2020**

***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[[@](mailto:permits@cdfa.ca.gov)]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: C
