CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Aculeastrum americanum (Farl.) M. Scholler & U. Braun 2022

Late leaf rust of raspberry

Current Pest Rating: Z

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Basidiomycota,
Subphylum: Pucciniomycotina, Class: Pucciniomycetes,
Order: Pucciniales, Family: Coleosporiaceae

Comment Period: 08/31/2026 through 10/15/2026

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from *Aculeastrum americanum* is described herein, and a permanent rating is proposed.

History & Status:

Background: California is the leading raspberry-producing state in the United States. In 2024, California accounted for approximately 56% of U.S. utilized raspberry production (102.1 million of 180.6 million pounds). Commercial production is concentrated along the state's coastal regions, particularly in Ventura, Santa Cruz, Monterey, and Santa Barbara counties, where moderate temperatures and an extended growing season support high-quality fruit production (Bolda et al., 2017; USDA NASS, 2025).

In 2024, California harvested approximately 6,500 acres of raspberries, produced about 102.5 million pounds, and had a utilized crop value of approximately $385.5 million (USDA NASS, 2025). California raspberry production commonly uses raised beds, drip irrigation, fertigation, plastic mulch, trellising, and frequent hand harvesting to maximize fruit quality and extend the marketing season (Bolda et al., 2017).

Farlow originally described the fungus as *Pucciniastrum arcticum* var. *americanum* from North American collections on raspberry (Farlow, 1908). Arthur (1934) treated it under the species name *Pucciniastrum americanum*. Aime and McTaggart (2021) subsequently transferred it to *Thekopsora* as *T. americana.*

Molecular phylogenetic and morphological studies demonstrated that *Pucciniastrum americanum* and the related *P. arcticum* formed a distinct lineage within Coleosporiaceae. Scholler et al. (2022) established the genus *Aculeastrum* and transferred the species to A. americanum. They designated a lectotype from Rubus strigosus collected in Massachusetts in 1893 and an epitype from R. strigosus collected in Minnesota in 2005. Coleosporiaceae includes rusts with Pinus or Picea aecial hosts; the Rosaceae-infecting lineages include T*hekopsora, Quasipucciniastrum*, and *Aculeastrum. Aculeastrum* has coarsely spiny ostiolar cells, forms spermogonia and aecia on Picea needles, and includes species that infect Rubus as telial hosts. The accepted name used in this proposal is *Aculeastrum americanum*. The names *Thekopsora americana* and *Pucciniastrum americanum* are included as synonyms so that records published under earlier combinations can be evaluated (Scholler et al., 2022).

Late leaf rust is native to North America and has long been recognized as a disease of red and purple raspberries. The name “late” was adopted because it typically appears later in the growing season than diseases caused by either *Arthuriomyces peckianus* or *Gymnoconia nitens*. Late leaf rust has been reported from commercial or residential raspberry plantings in several countries outside its presumed native range, including Argentina, Brazil, Mexico, New Zealand, and Slovenia (Lucero et al., 2008; Marín Cortez et al., 2019; Hofer et al., 2025; Schroers et al., 2025).

Aculeastrum americanum is an obligate biotrophic rust fungus. It obtains nutrients from living host cells and cannot complete its normal life cycle independently of susceptible plants. The fungus is heteroecious, with uredinia and telia produced on *Rubus* and spermogonia and aecia produced on *Picea* (Scholler et al., 2022).

On raspberry, repeated production of urediniospores allows the disease to increase during a growing season. Teliospores develop later and may produce basidiospores capable of infecting spruce needles; aeciospores produced on spruce can infect raspberries and complete the host-alternating cycle. Late leaf rust is not considered systemic in raspberry and may affect leaves, petioles, canes, flowers, sepals, and fruit, unlike systemic orange rust diseases of caneberries (Ellis and Erincik, 2016; Scholler et al., 2022).

The importance of the alternate host varies among production regions. Late leaf rust has recurred where susceptible spruce was absent or distant, and the means of overwintering in the absence of spruce remains uncertain (Ellis and Erincik, 2016).

Hosts: Picea engelmannii (Englemann spruce), *Picea glauca* (white spruce), *Rubus idaeus* (raspberry), *R. leucodermis* (western raspberry), *R. occidentalis* (black raspberry) (Farr et al., 2026).

Symptoms: Symptoms may occur on raspberry leaves, petioles, canes, flowers, sepals, and fruit. Foliar symptoms commonly begin as small, pale green or yellow spots on the upper leaf surface. Yellow to orange, powdery uredinial pustules develop primarily on the lower surface of corresponding lesions. As the disease progresses, lesions may become necrotic and infected leaves may fall prematurely. Severe disease can result in extensive defoliation (Ellis and Erincik, 2016; Barbosa et al., 2025).

Microscopic examination of infected raspberry leaves has demonstrated intercellular fungal growth and the formation of haustoria within host cells. Infection may be associated with collapse of host cells, disruption of chloroplast structure, reduced chlorophyll fluorescence, and reduced gas exchange. These effects provide a physiological basis for the loss of photosynthetic capacity associated with severe foliar disease (Barbosa et al., 2025).

Flowers, sepals, petioles, and young canes may develop yellow-orange pustules. On fruit, yellow or orange uredinia develop on individual drupelets and produce powdery spores. Infected berries may retain their general shape but become unevenly colored and unacceptable for fresh-market sale; symptoms may occur before harvest or become more apparent as berries mature (Ellis and Erincik, 2016).

Spruce species serve as alternate hosts. White spruce, *Picea glauca*, is the most frequently reported aecial host. Spermogonia and aecia are produced on spruce needles, and infection may cause yellowing of current-season needles (Scholler et al., 2022).

Transmission: Aculeastrum americanum is transmitted primarily by airborne spores. In the complete host-alternating life cycle, basidiospores infect susceptible spruce needles; spermogonia and aecia then develop on spruce, and aeciospores infect raspberry. On raspberry, uredinia produce urediniospores that can initiate repeated secondary cycles. Splashing water and contact with sporulating tissue may contribute to localized movement (Ellis and Erincik, 2016; Scholler et al., 2022).

Moisture is required for infection, and disease development is favored by humid conditions and prolonged leaf wetness. Dense canopies, overhead irrigation, rainfall, fog, and limited air movement can increase moisture duration on susceptible tissues (Ellis and Erincik, 2016).

The fungus may move long distances on infected raspberry plants for planting. Aboveground tissues may carry active or latent infections into new production areas. Fresh fruit bearing uredinia is also a documented pathway; findings on imported raspberries in the United Kingdom show that infected fruit can move through international commerce (DEFRA, 2023).

Damage Potential: Late leaf rust can cause direct losses through fruit infection and indirect losses through foliar disease and premature defoliation. Yellow or orange pustules on drupelets can make berries unmarketable for fresh sale because visible fungal growth and discoloration reduce fruit quality (Ellis and Erincik, 2016).

Foliar infection reduces functional leaf area through chlorosis, necrosis, and premature leaf fall. Severe defoliation may reduce fruit maturation, yield, carbohydrate accumulation, and cane vigor; in colder regions it may also reduce winter hardiness. Losses of approximately 30% of marketable fruit have been reported during severe outbreaks in commercial raspberry plantings in Ohio (Ellis and Erincik, 2016).

Worldwide Distribution: *Aculeastrum americanum* is native to North America. Within Canada and the United States, it has been reported primarily from regions where susceptible raspberries are grown. Outside the continental United States and Canada, the fungus has been reported from Mexico,

Argentina, Brazil, New Zealand, Japan, and Slovenia. (Lucero et al., 2008; Marín Cortez et al., 2019; Barbosa et al., 2025; Schroers et al., 2025; Hofer et al., 2025; Farr et al., 2026).

Official Control: is on the USDA PCIT's Harmful Organisms list as *Pucciniastrum americanum* for India, Japan, and Peru, and as *Thekopsora americana* for Colombia and Ecuador (USDA PCIT, 2026). The United Kingdom Plant Health Risk Register includes A. americanum, with P. americanum listed as a synonym. The United Kingdom has taken statutory action on findings and has identified fresh raspberry fruit as an important entry pathway. Numerous findings were reported on imported raspberry fruit in 2023 (DEFRA, 2023). Following its detection in New Zealand, *A. americanum* was treated as an unwanted organism under New Zealand biosecurity legislation (Hofer et al., 2025).

California Distribution: There is one official sample from Santa Cruz County. Because this pathogen's alternate host, white spruce (*Picea glauca*), is not common in coastal California where caneberries are cultivated, the fungus probably overwinters as mycelium within remaining canes and produces urediniospores in spring. These spring urediniospores then infect growing plants.

California Interceptions: There was one interception in Sonoma County on raspberry plants shipped from Erie, New York.

The risk that *Aculeastrum americanum* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** California has extensive commercial red raspberry production, particularly in coastal areas. Fog, high relative humidity, and prolonged leaf wetness in these areas may favor rust infection and repeated uredinial cycles (Bolda et al., 2017; Ellis and Erincik, 2016).

   White spruce is not a major component of coastal raspberry production regions. Recurrence of late leaf rust in locations without nearby spruce indicates that completion of the full heteroecious life cycle may not be necessary for local persistence, although the mechanism remains uncertain (Ellis and Erincik, 2016).

   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:** The economically important telial hosts are principally red, yellow, and purple raspberries. White spruce and other susceptible Picea species serve as alternate hosts (Farr et al., 2026; Scholler et al., 2022).

   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:** Establishment requires susceptible hosts and favorable moisture conditions. Repeated urediniospore production, airborne dispersal, perennial raspberry plantings, and movement of infected plants or fruit provide opportunities for persistence and spread (DEFRA, 2023; Ellis and Erincik, 2016; Scholler et al., 2022).

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 reproductive and dispersal potential.

4) **Economic Impact:** Late leaf rust can directly reduce marketable yield through conspicuous fruit infection. Severe foliar disease can reduce photosynthetic capacity, cause premature defoliation, and reduce plant vigor and fruit development (Barbosa et al., 2025; Ellis and Erincik, 2016).

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

Economic Impact: A, B, C
A. The pest could lower crop yield.
B. The pest could lower crop value (including increasing crop production costs).
C. The pest could trigger the loss of markets (including 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:** This disease could impact home gardens

Evaluate the environmental impact of the pest on 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.

Consequences of Introduction to California for *Aculeastrum americanum:* 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'.

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 the 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* ***= 8***

Uncertainty:

Older host records may be affected by taxonomic confusion among *Aculeastrum americanum, A. arcticum,* and other rust fungi on *Rubus*. Records based only on symptoms or limited morphology should be treated cautiously unless supported by specimens, diagnostic morphology, or molecular data (Scholler et al., 2022). The role of spruce in California epidemiology is uncertain. Although the

complete life cycle includes Picea, recurrent infections have been reported where spruce was absent or distant, and local persistence without the recognized alternate host has been assumed but not clearly demonstrated (Ellis and Erincik, 2016).

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for ***Aculeastrum americanum*** **is C.**

References:

Aime, M.C. and McTaggart, A.R. 2021. A higher-rank classification for rust fungi, with notes on genera. Fungal Systematics and Evolution 7: 21–47. https://doi.org/10.3114/fuse.2021.07.02.

Arthur, J.C. 1934. Manual of the Rusts in United States and Canada. Purdue Research Foundation, Lafayette, Indiana.

Barbosa, L.H.S., Neumann, U., Timmers, T., Andersen, T.G. and Appezzato-da-Glória, B. 2025. Histopathology of *Aculeastrum americanum* on *Rubus idaeus* and insights into the chloroplast-pathogen interaction. Frontiers in Plant Science 16: 1630100. https://doi.org/10.3389/fpls.2025.1630100.

Bolda, M., Tourte, L., Klonsky, K. and De Moura, R. 2017. Sample Costs to Produce and Harvest Raspberries, Central Coast Region of California. University of California Cooperative Extension. https://ucanr.edu/media/256616.

Department for Environment, Food and Rural Affairs (DEFRA). 2023. UK Plant Health Risk Register: *Aculeastrum americanum* (synonym *Pucciniastrum americanum*). Updated August 21, 2023. https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=11990.

Ellis, M.A. and Erincik, O. 2016. Late Leaf Rust of Red Raspberries. Ohio State University Extension, PLPATH-FRU-17. https://ohioline.osu.edu/factsheet/plpath-fru-17.

Farlow, W.G. 1908. Notes on fungi—I. Rhodora 10: 9–17. https://www.jstor.org/stable/23296052.

Farr, D.F., Rossman, A.Y. and Castlebury, L.A. 2026. United States National Fungus Collections, Fungal Databases. USDA Agricultural Research Service. Accessed July 17, 2026. https://fungi.ars.usda.gov.

Hofer, K., Griffin, R. and Toome, M. 2025. First report of late leaf rust on raspberry caused by *Aculeastrum americanum* in New Zealand. New Disease Reports 51: e70013. https://doi.org/10.1002/ndr2.70013.

Lucero, X., Wright, E.R. and Pérez, B.A. 2008. Occurrence of late leaf rust caused by *Pucciniastrum americanum* in red raspberry, *Rubus idaeus*, in Buenos Aires, Córdoba, and Entre Ríos, Argentina. Plant Disease 92: 653. https://doi.org/10.1094/PDIS-92-4-0653B.

Marín Cortez, F.A., Chan-Cupul, W., Buenrostro Nava, M.T., Hernández-Ortega, H.A., Manzo-Sánchez, G. and Galindo Velasco, E. 2019. Biological control of late leaf rust disease caused by *Pucciniastrum americanum* in raspberry, *Rubus idaeus*, using two biological products under screenhouse conditions. Idesia 37: 125–133. https://doi.org/10.4067/S0718-34292019005000504.

Scholler, M., Braun, U., Buchheit, R., Schulte, T. and Bubner, B. 2022. Studies on European rust fungi, Pucciniales: molecular phylogeny, taxonomy, and nomenclature of miscellaneous genera and species in Pucciniastraceae and Coleosporiaceae. Mycological Progress 21: 64. https://doi.org/10.1007/s11557-022-01810-3.

Schroers, H.-J., Prislan, U., Kocjan, V., Maier, W. and Zajc Žunič, J. 2025. First report of *Aculeastrum (Pucciniastrum) americanum* causing late leaf rust on raspberry in Slovenia. Plant Disease 109: 2210. https://doi.org/10.1094/PDIS-02-25-0294-PDN.

USDA National Agricultural Statistics Service (USDA NASS). 2025. Noncitrus Fruits and Nuts 2024 Summary. May 2025. https://esmis.nal.usda.gov/sites/default/release-files/zs25x846c/mc87rn20c/w37656321/ncit0525.pdf.

USDA Phytosanitary Certificate Issuance and Tracking System (PCIT). 2026. Phytosanitary Export Database (PExD), Harmful Organisms Database reports for *Pucciniastrum americanum* and *Thekopsora americana*. Accessed July 17, 2026. https://pcit.aphis.usda.gov/pcit/.

Responsible Party:

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***Comment Period: 08/31/2026 through 10/15/2026**

***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
