CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Seiridium cardinale (W.W. Wagener) B. Sutton & I.A.S. Gibson 1972

Cypress canker

Current Pest Rating: none

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Ascomycota,
Subphylum: Pezizomycotina, Class: Sordariomycetes,
Subclass: Sordariomycetidae, Order: Xylariales,
Family: Amphisphaeriaceae

Comment Period: 06/26/2024 through 08/10/2024

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Seiridium cardinale* is described herein and a permanent rating is proposed.

History & Status:

Background:

Cypress canker disease was found for the first time in Palo Alto, California on Monterey cypress (*Hesperocyparis* (previously *Cupressus*) *macrocarpa*) and described by Wagener (1928), although there was evidence that it had been present there since at least 1885 (Jepson field book). During the initial decade, the epidemic was so destructive that more than 30,000 Monterey and common cypress (*Cupressus sempervirens*) trees were killed rapidly (Grasso and Ponchet, 1980).

The fungus responsible for cypress canker was first described as a new species and named *Coryneum cardinale*, by Wagener (1939). The epithet 'cardinale' refers to the purplish cast seen in the resin-infiltrated, inner tissues of the cankered bark. The species was later reassigned to the genus *Seiridium* as *S. cardinale* (Wag.) by Sutton and Gibson (1972). Although there are three distinct *Seiridium* spp. (*S. cardinale, S. unicorne*, and *S. cupressi)* known to cause disease on cypress, they vary in incidence and severity (Graniti, 1998).

Seiridium cardinale is a highly dangerous pathogen, able to cause serious epidemics to susceptible Cupressaceae in temperate areas of the world. Monterey cypress is very susceptible to this lethal bark disease. Also affected are Italian cypress and many other American and exotic species of Cupressaceae. The disease spread rapidly north and south along the California coast and into the Pacific Northwest. San Francisco, and later Los Angeles, were identified as the two early foci of the disease (Wagener, 1939).

Between 1936 and 1939, efforts were made to eradicate the disease in numerous plantings in California. Nevertheless, losses were extensive. Eight years after the identification of the disease by Wagener, 75% of all planted Monterey cypress and a considerable number of native trees, along with other susceptible species including common cypress, were dead of *S. cardinale* attacks. These heavy losses resulted in the substitution of cypress by other tree species, such as eucalyptus, in landscapes and as windbreaks around citrus groves.

Subsequently, cypress canker disease has become a worldwide pandemic in the boreal latitudes between 30° and 40°N and some austral areas between 30° and 50°S (CABI, 2024). Within 50 years it had spread to the Mediterranean (Bartoloni et al., 1976), and California is likely the source of the cypress canker pathogen now present in the Mediterranean region (Della Rocca et al., 2011).

The genus *Leptosphaeria* was reported only once as the perfect stage of *S. cardinale*, found on dying and dead cypress trees over a large area of north central California. The specimen was only partially described by Hansen (1956), and the description is too incomplete to be fully recognized. In most regions affected by the cypress canker disease, no sexual stage of the fungus has been described, and the pathogen reproduces asexually.

Cypress canker disease has had a major economic impact worldwide. Cypress trees are important components of natural ecosystems, highly valued as ornamentals, and used to create windbreaks for agriculture. In the Mediterranean region and in Asia, cypress trees also have a great cultural relevance. It is reasonable to assume the rapid worldwide spread of the disease in the 20th century was due to the movement of infected nursery stock. Cypress trees are widely traded for ornamental purposes.

Hosts: The pathogen affects several species of *Cupressus, Chamaecyparis, Cryptomeria, Cupressocyparis, Juniperus, Thuja*, and related genera (and hybrids) of Cupressaceae. No subspecific entity or forma specialis of the fungus has been reported. Hosts include: *Callitris preissii* (camphorwood), *Callitris rhomboidea* (Oyster Bay pine), *Calocedrus decurrens* (incense cedar), *Chamaecyparis lawsoniana* (Port Orford cedar), *Cryptomeria japonica* (Japanese cedar), *Cupressocyparis leylandii* (Leyland cypress), *C. ovensii* (Oven's cypress), *Cupressus abramsiana* (Santa Cruz cypress), *C. arizonica* (Arizona cypress), *C. cashmeriana* (weeping cypress), *C. forbesii* (tecate cypress), *C. goveniana* (Gowen cypress), *C. lusitanica* (Mexican cypress), *C. macnabiana* (McNab's cypress), *C. pygmaea* (Mendocino cypress), *C. sargentii* (Sargent's cypress), *C. sempervirens* (Mediterranean cypress), *C. sempervirens* var. *horizontalis, Fitzroya cupressoides* (Patagonian cypress), *Hesperocyparis macrocarpa* (Monterey cypress), *Juniperus chinensis* (Chinese juniper), *J. communis* (common juniper), *J. excelsa* (Greek juniper), *J. foetidissima* (stinking juniper), *J. occidentalis* (western

juniper), *J. oxycedrus* (prickly juniper), *J. phoenicea* (Phoenician juniper), *J. virginiana* (eastern redcedar), *Libocedrus chilensis* (Chilean cedar), *Platycladus orientalis* (Chinese arborvitae), *Thuja occidentalis* (Eastern white cedar), *T. plicata* (western redcedar), *T. standishii* (Japanese arborvitae), and *Xanthocyparis nootkatensis* (Alaska cedar).

Symptoms: The first symptom is foliar blight, which traces back to a browning or reddening of the bark around the entry point of the pathogen. Next is the formation of a slight depression in the infected area, followed by the formation of longitudinal cracks, which can exude large amounts of resin. Cankers may girdle the small branches or the stems of young plants causing flagging of the foliage above the girdle. The expansion of cankers is generally a slow process on the large branches or main stems of adult trees. The tree will often decline and die in sections. Initially, the foliage will show a diffuse yellowing or reddening, subsequently turning to brown or reddish-brown as the dieback progresses. The spread of one, or the presence of several infections on a single tree, can kill the whole tree within a relatively short time. The speed of the decline depends on its age, the susceptibility of the host genotype, and the environment. Symptoms of foliage browning can be noticeable at a distance (Graniti, 1998).

Transmission: The fungal conidia moves within tree canopies and to nearby trees by splashing water and over moderate distances with wind. Under wet or humid conditions, the conidiomata open wide on the surface of the cankers and expose black slimy conidial masses. Conidia extruded from conidiomata are dispersed by rain over short distances. When they dry, fragments of this slimy material can be moved by strong winds (Panconesi and Ongaro, 1982).

Long-distance spread of inoculum, even to isolated areas, is done by insects and probably birds, which can carry inocula up to the tops of the trees. Any insects such as cork-borers or twig-mining beetles can spread the disease either by carrying the inoculum from cankered trees into young shoots of healthy trees, or by opening wounds in the cypress bark through which rain-carried conidia enter and initiate infection. Cone and seed beetles, and seed chalcids also contribute to spread of the disease (Wagener, 1939; Tiberi and Battisti, 1998). In California, the cypress bark moth *Cydia cupressana* [Enarmonia cupressana] is a vector (Frankie and Parameter, 1972). Cypress cankers attract cypress bark moths, and their larvae feed and tunnel in cankered bark. These insects are secondary invaders, and their control is generally not warranted as it is the fungus that kills branches and trees, not this insect.

The disease can be transmitted by contaminated or infected seed, both from cankered and asymptomatic trees. Conidiomata are frequently produced on cypress galbuli (fleshy cones) (Grasso, 1969). Seeds may also carry conidia on their surface or become infected by the pathogen with the final formation of conidiomata (Saponaro and Motta, 1981). Spores can also be moved on pruning tools. The fungus enters its hosts through natural openings or wounds. Because cypress trees are traded widely as ornamental plants, this remains the most plausible means of accidental transport of *S. cardinale* across continents. Infected cypress wood may have a role in long-distance movement, however, sporulation on dead wood or timber has not been observed (Panconesi et al., 1995), reducing the chance that it can be spread this way. The fungus can remain viable for several years after the death of infected trees and can sporulate from acervular craters, maintaining high levels of

inoculum. It also produces chlamydospores and sclerotia (long-lasting resting structures) (Panconesi and Raddi, 1990).

Damage Potential: Seiridium cardinale has caused repeated, destructive epidemics that have resulted in significant mortality in many species of Cupressaceae worldwide. This disease has led to devastating losses of plantations, natural stands, windbreaks, and decorative cypress trees (CABI, 2021). In California, the greatest damage was done in the first half of the 20th century, especially to the Monterey cypress. Today the disease is most recognized as very damaging to Leyland cypress (*Cupressocyparis leylandii*), leading to the University of California's recommendations not to even plant them (https://ipm.ucanr.edu/PMG/GARDEN/PLANTS/DISEASES/cyprcanker.html).

Worldwide Distribution: Africa: *Algeria, Morocco, South Africa*. Asia: *Georgia, Israel, Japan, Syria, Turkey*. Europe: *Croatia, Cyprus, France, Germany, Greece, Ireland, Italy, Montenegro, Portugal, Serbia, Spain, United Kingdom*. North America: *Canada, Costa Rica*, *United States* (Alaska, California, and Oregon). Oceania: *Australia, New Zealand*. South America: *Argentina, Chile.* (CABI, 2024)

Official Control*: Seiridium cardinale* is on the USDA PCIT's harmful organisms list for Guatemala, Namibia, Nicaragua, South Africa, and Sri Lanka (USDA PCIT 2024).

California Distribution: Since its first report almost 100 years ago, this disease has assumed major epidemic proportions throughout the western half of California and practically wiped out most inland plantations of Monterey cypress. Danti and Della Roca (2017) from an unpublished 2009 survey determined that cypress canker can be found today on its main hosts at an average incidence rate close to 12% and occasionally reaching as high as 34% in the following counties: Alameda, Contra Costa, El Dorado, Fresno, Kern, Los Angeles, Madera, Marin, Merced, Mendocino, Monterey, Napa, Orange, Sacramento, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Clara, Sonoma, Stanislaus, and Tulare. It is also present in Santa Barbara and Ventura counties.

California Interceptions: none

The risk that *Seiridium cardinale* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** The density of susceptible hosts and climate factors favorable to the pathogen contribute to the size of epidemics. In general, the Mediterranean climate—which includes mild, humid, rainy springs and autumns—is favorable for the spread of cypress canker disease (Panconesi, 1990). Trees such as Monterey cypress planted outside of their natural range along the coast (i.e., in the Central Valley), are also very susceptible to disease.

   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 be established 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 includes multiple genera in the family Cupressaceae.

Evaluate the host range of the pest.

Score: 2

- 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:** The pathogen spreads mainly with asexual conidia, moved with wind, water, or insects.

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:** Millions of susceptible trees have been killed by this pathogen all over the world. There have been losses to forestry, ornamental plantings, and agriculture where trees are used as windbreaks. It is a quarantine pest in several countries and can be vectored by multiple insect species.

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

Economic Impact: A, C, E

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 pathogen has caused significant damage to native cypress, especially to the Monterey and common cypress in California and to native cypress in the Mediterranean region. Ornamental and agricultural plantings have been heavily affected by the death of cypress trees.

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

Environmental Impact: A, B, C, 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 *Seiridium cardinale:* High

Add up the total score and include it here. **13**
-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.

Present in California for over a century, the pathogen has spread to all suitable climate/host areas.

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* ***= 10***

Uncertainty:

Cypress canker is also caused by sister species to *S. cardinale—S. cupressi* (Guba) Boesew. (anamorph of *Lepteutypa cupressi* (Nattrass, C. Booth & B. Sutton) H.J. Swart) and *S. unicorne* (Cooke & Ellis) B. Sutton—but they are less widespread and considered less aggressive. Their epidemiology has been substantially less studied compared to *S. cardinale*. If conditions change in the future, they may emerge as more important pathogens causing cypress canker disease. The presence of the pathogen can be masked by other fungi (e.g. *Pestalotiopsis* spp.) colonizing cankers.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for ***Seiridium cardinale*** **is C.**

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Responsible Party:

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***Comment Period: 06/26/2024 through 08/10/2024**

***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