CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Athelia rolfsii (Curzi) C.C. Tu & Kimbr. 1978
=*Sclerotium rolfsii* Sacc. 1911

Southern blight

Current Pest Rating: B

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Basidiomycota,
Class: Agaricomycotina, Subclass: Agaricomycetes,
Order: Atheliales, Family: Atheliaceae

Comment Period: 12/09/2021 through 01/23/2022

Initiating Event:

A pest risk assessment of *Athelia rolfsii* and a re-evaluation of its current pest rating in California is presented here.

History & Status:

Background: Sclerotial diseases occur primarily in tropical and subtropical climates. They cause damping-off of seedlings, stem cankers, crown blights, root, crown, bulb, and tuber rots, and fruit rots. Severe losses of fleshy fruits and vegetables during shipment and storage are frequent. First described from tomato in Florida, common names include southern wilts, southern blights, and white molds. They affect a wide variety of plants, including most vegetables, flowers, legumes, cereals, forage plants, turf, and weeds (Koike et al., 2007; Mullen, 2006).

Southern blight is not consistently a widespread problem in California, although there are sporadic reports on many agronomic and ornamental crops (CDFA PDR database). It has been a B-rated pest at least since the 1970s, and although the original reason for the B-rating is uncertain, most likely it was related to nursery crops and the difficulty in eradicating the sclerotia (T. Tidwell, CDFA Primary Plant Pathologist (retired), pers. comm.). Historically, major impacts have been restricted to the Kern County area, however, in the past 5 years, a more widespread distribution of higher levels of disease has been reported in the Sacramento and Northern San Joaquin Valleys by UCCE Farm advisors. Rather than an expansion of inoculum into new areas, it has been attributed to high temperatures (over 86°F), high

soil moisture, dense canopies, and frequent irrigation. A combination of late planting dates and record high summer temperatures has likely created unusually favorable conditions for the pathogen in these areas (Swett and Nunez, 2017; Long, 2018).

The preferred name for this basidiomycete is that of the teleomorph or sexual stage, *Athelia rolfsii* (Tu and Kimborough, 1978). The teleomorph is found infrequently in the field and is probably not of primary importance in disease transmission (Mordue, 1974). The asexual mycelial stage is widely known as *Sclerotium rolfsii*, however, it is not a species of *Sclerotium* in the strict sense. *Athelia rolfsii* occurs in soil mainly as a saprotroph, but it can also attack and parasitize living plants. It has an extremely large host range, and its ability to form long-lasting sclerotia allows it to cause disease on rotational legume and vegetable crops. It is found mainly in warm soils (above 15 °C) and can be a serious pest in warm, humid, and rainy climates. Today this disease occurs around the world in the equatorial zone between the 45° N and S latitudes. It is commonly found in the Southern United States, Central America, the Caribbean, South America, countries bordering the Mediterranean Sea, Africa, India, Japan, the Philippines, Hawaii, Australia, and New Zealand. Occasionally, southern blight has been reported in Northern China, Europe, and some northern areas of the United States (CABI-CPC, 2021).

Athelia rolfsii is the name for the teleomorph but this pathogen typically occurs as *S. rolfsii* with characteristic mycelium and sclerotia, a structure composed of a hard rind containing hyphae. The primary source of inoculum in diseased fields is sclerotia. Mycelium that grows from the sclerotium colonizes the host crown and stem tissues at the soil line by producing several compounds such as oxalic acid, in addition to enzymes that are pectinolytic and cellulytic. These compounds effectively destroy plant tissue and allow the entry of the pathogen to the plant. After colonizing plant tissues, it often forms dense mycelial mats. Sclerotia form in the mats and infected tissues under warm and humid conditions. Infected plants will exhibit stem lesions near the soil line before they wilt and die.

Southern wilt symptoms can be easily confused with other crown and root rotting soil borne pathogens including those caused by *Verticillium, Fusarium, Phytophthora* or *Pythium* sp., or with other species of *Sclerotium*. An unofficial B-rating has been applied to this pathogen for more than 50 years, but no action is taken for agronomic or field crops. A C-rating will still require commercial cleanliness under nursery regulations.

Hosts: Athelia rolfsii infects more than 500 species of monocotyledonous and dicotyledonous plants; (Farr and Rossman, 2021). California detections have been made on vegetables, field crops, ornamentals and turfgrass; it is often found on legumes, solanaceous crops, cucurbits and other vegetables grown in rotation with beans (French, 1989; CDFA PDR database, 2021).

Symptoms: *Sclerotium rolfsii* infects seedlings, herbaceous plants, woody plants, and fleshy roots, bulbs, or fruits. Most frequently, this fungus infects lower stems near or at the soil surface, but it also may infect any part of a susceptible plant if favorable environmental conditions exist. It begins with a small, water-soaked lesion on the lower stem at or near the soil surface. The lesion can spread rapidly to girdle the stem. Wilted plants often fall over, decline, and die rapidly because of an extensive lower stem rot. Some older plants with multiple stems from a crown i.e., *Hostas,* the older and lower foliage

wilts, becomes yellow and then brown. Lower stems rot but the rotting may not extend completely throughout the crown tissues, and the plants may recover. On mature pepper and tomato plants, the stem cortex several centimeters above and below the soil surface will decay, but the stem central cylinder does not. Plants usually remain erect as the foliage wilts. On many hosts, wilted leaves gradually become brown and remain hanging on the plant. As lower stems decay, a white mat of mycelium will develop at the lesion site. This white mat can spread across the soil surface. Small (0.5-1 mm), white, round, fuzzy mycelial bodies begin to develop on the mats and stems These mustard-seed-sized sclerotia, become smooth and light tan, brown or black in color (Mullen, 2006).

For monocots such as wheat and grasses, brown lesions occur at the crown and lower parts of the culm. Lesions are often small, but they may extend into the hollow part of the culm. Strands of mycelium grow inside the lower internodes. Seed heads may appear normal, but they do not form grains. On millet, grain sorghum, and tall fescue, the leaf sheath becomes water-soaked, and the brown discoloration turns to dark brown or black. Mats of white mycelium develop and spread upward inside and outside the leaf sheath. The mycelium eventually spreads over the base of grass blades where sclerotia develop (Mullen, 2006).

Cool season turf including bentgrass, fescue, perennial ryegrass, bluegrass, and broad leaf turf species such as *Dichondra* spp. can be infected when conditions are warm (above 24° C) and moisture is abundant. Circular dead areas of turf enlarging up to 3 m in diameter form (although some plants may escape infection and remain alive in these areas). Sometimes only partial circles or crescent-shaped areas of affected turf are seen. The turfgrass turns reddish brown as it dies, and infected plants are necrotized. As the fungus advances, abundant white mycelia can appear on the turfgrass. Light to dark brown sclerotia, will begin to develop at the base of the stems. Optimal conditions for disease are air temperatures of 85° to 95° F coupled with high moisture in the thatch layer from precipitation, high humidity, or over-irrigation. (Downer and Harivandi; 2016).

Southern blight causes a soft rot of fleshy organs. Potato tubers show small slightly sunken, yellow-tan colored lesions (2-3 mm) at lenticels. Disease development causes tissues to become soft and collapse. Mycelium and sclerotia develop abundantly on rotting tissues and secondary decay bacteria may enter the previously damaged tissues. Rotted tissues are initially moist, but later dry and smell of dried, rotted wood. Sclerotia develop from mycelium in the rotted areas. Fruit including tomatoes, peppers or eggplants that that touch the soil surface can become infected with mycelium of S*. rolfsii*. Soft, water-soaked slightly yellow lesions develop and spread quickly across the fruits which will collapse. Mycelium continues to develop and produce sclerotia (Mullen, 2006).

Transmission: Athelia rolfsii typically exists only as mycelium and sclerotia (as *S. rolfsii*). Overwintering as sclerotia, a structure composed of a hard rind and cortex containing hyphae, this is typically the primary inoculum. Mycelium from the sclerotia attacks the host crown and stem tissues at the soil line by producing several compounds such as oxalic acid, in addition to enzymes that are pectinolytic and cellulytic. These compounds effectively destroy plant tissue and allow the entry to the plant. After colonizing plant tissues, it often forms dense mycelial mats. Sclerotia form under warm and humid conditions. Sclerotia are typically 0.5 - 2 mm diameter, but some can become as large as 8 - 10 mm

diameter. Sclerotia can remain viable for several years in soil, potting media, or on plant debris in areas with mild winters.

The pathogen can move with leaves, bulbs, tubers, corms, and rhizomes, fruits (inc. pods) as fungal hyphae or sclerotia. Anything that moves contaminated planting materials or soil including machinery, equipment, containers, tires, and boots risks moving sclerotia. Infected plants can literally produce tens of thousands of sclerotia which become more widely distributed in a field with each successive field operation (Swett and Nunez, 2017).

Damage Potential: With a very large host range, many agronomic and horticultural crops are at risk. Southern blight is very fast acting and destructive. The huge host range and the ability of the pathogen to survive in the soil for several years, makes crop rotation or fallow an unsuccessful means of disease management. In years where there are extended high summer temperatures, losses on pepper, potato, tomato, cucumber, bean, chard and sunflower can be major (Swett and Nunez, 2017; Long, 2018). In greenhouses with high temperatures and moist or wet soil conditions, losses on highly susceptible seedlings or soft herbaceous plants can be great (Koike et al., 2020).

Worldwide Distribution: *Athelia rolfsii* is found worldwide in Africa, America, Asia, Europe, and Oceana. There are records from 32 of the United States. (CABI-CPC, 2021).

Official Control: *Athelia rolfsii* is on the USDA PCIT's harmful organism list for Colombia, Egypt, and Mexico (USDA, 2021).

California Distribution: Colusa, Glenn, Monterey, Orange, Sacramento, San Diego, San Joaquin, San Luis Obispo, San Mateo, Solano, Sutter, Tehama, Yolo, Yuba (CDFA PDR database, 2021)

California Interceptions: One interception was made at the Needles border station on plants from West Virginia.

The risk *Athelia rolfsii* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This pathogen is most aggressive in warm and wet climates. These conditions can exist statewide in irrigated agriculture in the summer, and all year in greenhouses.

   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 *A. rolfsii* is very large including multiple plant families

Evaluate the host range of the pest.

Score: 3

- 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:** In the absence of the *Athelia* stage of the pathogen, there are no spores. It produces large numbers of sclerotia which enter the soil with crop debris. It is depending on the movement of soil or infected or contaminated planting material to move larger distances.

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:** Crop losses in areas where the environment is very conducive to epidemics can be very high. It is a quarantine pathogen in some countries.

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

Economic Impact: A, 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: **2**

- 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:** Once an area is infested with sclerotia, fungicide treatments are often required to reduce plant infection.

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

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 *Athelia rolfsii:* 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.

There are official records statewide going back more than 50 years.

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 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:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Athelia rolfsii* is C.

References:

CABI Crop Production Compendium 2021. *Athelia rolfsii* www.cabi.org/cpc/datasheet/49155

Downer, A. J. and Harivandi, M. A. 2016Southern Blight. UC IPM pest management guidelines: Turfgrass. UC ANR Publication 3365-T.

EPPO Global Database. 2021. *Athelia rolfsii* https://gd.eppo.int/taxon/SCLORO Accessed 10/27/21

Farr, D.F., and Rossman, A.Y. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved October 27, 2021, 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., Gladders, P. and Paulus, A.O., 2007. Vegetable diseases: a color handbook. Gulf Professional Publishing.

Koike, S. T., Tjesvold, S. A and Mathews, D. M. 2020. Southern Blight. UC IPM Pest Management Guidelines: Floriculture and Ornamental Nurseries. UC ANR publication 3392

Long, R. F. Southern Blight in Lima Beans. UC dry bean blog. 8/7/2018. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27918

Mordue JEM, 1974. *Corticium rolfsii*. CMI Descriptions of Pathogenic Fungi and Bacteria, No. 410. Wallingford, UK: CAB International.

Mullen, J. 2001. Southern blight, Southern stem blight, White mold. The Plant Health Instructor. DOI: 10.1094/PHI-I-2001-0104-01. Updated 2006.

Swett, C., and Nunez, J. Southern Blight Cliff Notes- 2017 https://swettlab.faculty.ucdavis.edu/wp-content/uploads/sites/434/2017/09/Southern-Blight-Cliff-Notes-2017.pdf

Tu, C.C., and Kimbrough, J.W. 1978. Systematics and phylogeny of fungi in the Rhizoctonia complex. Botanical Gazette, 139(4):454-466.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. Athelia rolfsii. Accessed 10/26/2021

Responsible Party:

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***Comment Period: 12/09/2021 through 01/23/2022**

***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