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Southern Blight Disease in Ornamental Production and Landscapes

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Overview of Southern Blight Disease

Southern blight is caused by the fungus *Agroathelia rolfsii* (formerly *Sclerotium rolfsii*) and is a destructive soil-borne disease that threatens plants in ornamental production and landscapes. First documented in 1911 on tomatoes in the southern United States (U.S.), this plant pathogen now infects more than 500 plant species, causing rapid wilting, stem rot and eventually plant death. Once established in soil, managing this fungus becomes expensive due to the need for both labor-intensive practices and repeated fungicide applications. The fungus thrives in the warm, humid conditions of the southern U.S. and remains in soil for up to seven years by producing tough resting structures known as sclerotia. Due to its long-term persistence in soil, southern blight remains a recurring challenge for growers in infested fields. Effective management relies on combining good sanitation practices, soil health maintenance, and integrated disease management strategies. Early detection and preventive measures are the key to reducing losses from this persistent pathogen.

Distribution and Host Range

Southern blight is prevalent from Florida to California, with outbreaks common in states that experience summer air temperatures higher than 85 F (30 C) and relative humidity above 85 percent [1,2]. Soil temperature strongly affects the fungus activity, with the highest germination and growth occurring in moist soils at 80-86 F (27-30 C) soil temperature[3,4]. Because disease distribution is largely constrained by temperature, *A. rolfsii* is uncommon north of USDA Plant Hardiness Zone 7. However, outbreaks have been reported in greenhouses in northern U.S. states, typically resulting from plant contact with contaminated soil or growing media[2]. In the warm, humid regions of the southern U.S., southern blight has become a common management challenge for nursery production and landscapes. Recent climate models project a 30 percent expansion in the geographic area susceptible to soilborne plant pathogens by 2050 due to rising global temperatures [5].

Agroathelia rolfsii has a broad plant host range and can infect more than 500 plant species across more than 100 plant families [6,7,8,9]. This pathogen poses serious risk to many ornamental plants, including several staple crop types:

- **Annuals:** impatiens, petunia, salvia and viola.
- **Herbaceous perennials:** asters, dahlia, daylily, gladiolus, hosta, liriope, peony and phlox.
- **Woody ornamentals:** apple trees, azaleas, boxwood (seedlings), crabapple, dogwood, forsythia, hydrangeas, maple (young trees) and roses.

Signs and Symptoms of Disease

The first visible symptom of southern blight on infected plants is wilting, also called flagging, of the leaves and young shoots. Infected plants often turn yellow, stems may lodge and plants can die (Figure 1A and 1B). A key symptom is dark brown, water-soaked lesion or canker that develops low on the stem at or very near the soil line. This lesion girdles the stem, cutting off water movement and causing sudden wilting and death of the plant. Soft and semi-soft stems and crowns of infected plants turn soft and mushy and may seem to “melt,” while outer bark on woody stems may slough off or fall apart easily when touched[10].

An obvious sign of southern blight is the presence of dense, white fan-shaped fungal growth (mycelia) at the base of the plant (crown) (Figure 1C), lower stems, on adjacent soil or surfaces of potting media or soilless substrate. Cottony mycelium is most noticeable during warm, humid conditions [2]. As the disease progresses, sclerotia begin to form as white and fluffy but mature into a tan or brown color (Figure 1D). These seed-like structures range in size from 0.5 to 2.0 mm in diameter, resembling mustard seeds[6, 11] or like small prills of slow-release fertilizer (Figure 1D).

Field Identification

Southern blight can often be identified on plants in the field by observing plants that are presenting the types of symptoms described above. To seek additional evidence, carefully remove any mulch or surface soil around the crown of the plant and inspect the presence of white, cottony fungal growth and round tan and/or brown colored sclerotia on the base of the infected stem or in the surrounding soil [2,10]. This combination of white mycelium and brown sclerotia can be clearly seen during warm weather (temperatures higher than 85 F/30 C), particularly after rainfall or irrigation when humidity is high. Within ground cover plants, look for circular patches of declining or dead plants, as the disease often spreads outward from a single infected plant to other adjacent plants.

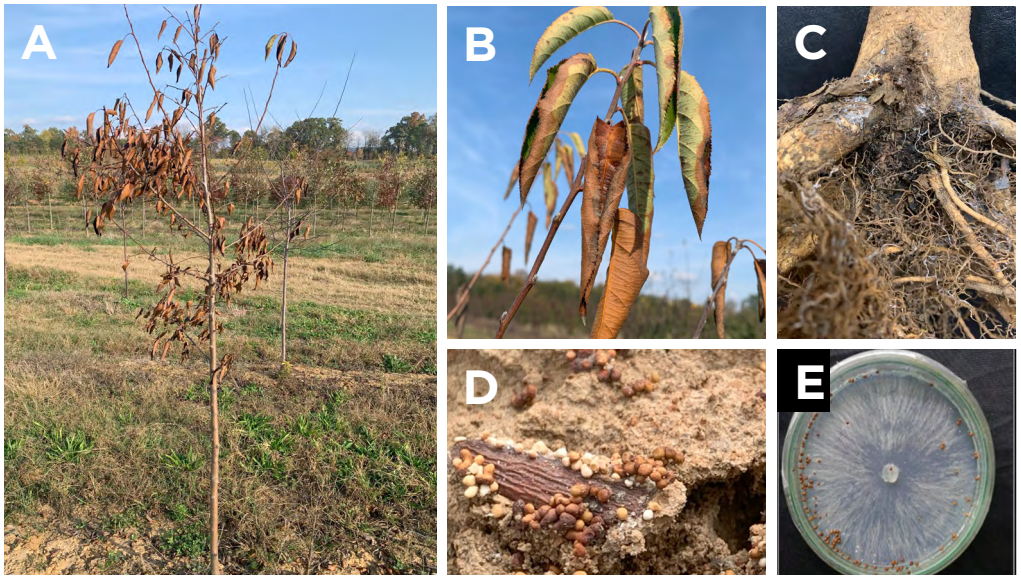

Figure 1: ***Symptoms and signs of southern blight. A****. A crabapple plant that declined and died following southern blight infection;* ***B.*** *A close-up of wilting and yellowing foliage;* ***C.*** *A white, cottony mycelial mat colonizing root and crown,* ***D.*** *Tan- to brown-colored sclerotia forming at the soil line near the base of an infected stem and;* ***E.*** *Sclerotia developing on the outer margins of agar media in culture. Image credits: A to D: Nar Ranabhat, E: Dipika Sharma, University of Tennessee.*

Laboratory Confirmation

Lab diagnosis is often necessary to confirm southern blight from symptomatic plant tissues. Suspected samples should be submitted to a plant diagnostic lab for testing. An appropriate sample includes two to three pieces of a 12-inch section collected from the crown or trunk at the transition zone between healthy and diseased tissue. Guidelines for proper sample collection and packaging are available from the UT Soil, Plant and Pest Center [12].

In the lab, small pieces of infected tissue are placed on nutrient-rich medium and held at 85 F (30 C). The fungus produces clear (hyaline) hyphae which can be observed under the microscope. Within two to three days, the fungus will typically grow to form the start of a culture that can be sampled for testing and after seven to 10 days, the fungus forms sclerotia (mature culture after 15 days, Figure 1E). These sclerotia help confirm the diagnosis of southern blight. For additional confirmation, molecular testing such as PCR targeting the internal transcribed spacer (ITS) region can be used. Molecular methods not only verify the different strains of *A. rolfsii* but also allow researchers to study genetic differences among isolates infecting different host plants. In general, molecular testing is not required unless samples are further analyzed for research purposes, or when a diagnosis cannot be made via evidence from field symptoms and laboratory culture methods.

Life History, Disease Cycle and Spread of Southern Blight

Agroathelia rolfsii reproduces asexually through sclerotia. These sclerotia can survive in soil and plant debris for three to seven years [2]. Sclerotia germinate under warm (82-95 F/28–35 C), moist conditions, and germination may be triggered by release of natural chemicals, such as sugars and amino acids, that are exuded by plant roots [1]. The southern blight pathogen performs best in acidic soils (pH 4.0 -5.5) that are rich in organic matter. As a saprophyte, the fungus may first colonize debris before becoming a facultative pathogen that infects the living host plants. Once established, the fungus spreads rapidly via extensive, white, cottony mats of fungal threads (mycelia) that release oxalic acid and polygalacturonase enzymes that break down plant cell walls. This activity results in quick softening of host plant tissues, followed by wilting and plant decline [13].

Understanding the disease cycle of southern blight is essential for managing the disease and reducing its spread. The *A. rolfsii* fungus survives in the soil and plant debris primarily as sclerotia for several years. When temperatures rise above 80 F (27 C) and the soil is moist, the sclerotia can germinate. As described above, active fungal growth from germinated sclerotia yields mycelia that will infect plant stems at locations close to the soil surface. Initially infected plants are often the first to wilt, rot and eventually die, while the fungal hyphae are capable of infecting other nearby plants. As the season progresses, new sclerotia form in the soil or adhere to plant debris, serving as the source of future infections and allowing the disease cycle to repeat in subsequent years (Figure 2).

Natural spread of southern blight is commonly assisted by water. Rain and puddle splashes and overhead irrigation in production and landscape systems can move sclerotia and fungal hyphae from an infected host plant to nearby plants. While wind alone seldom moves sclerotia, which are generally too heavy, winds can carry contaminated soil or debris that harbors the pathogen [14]. Soil erosion and runoff can also transport sclerotia to new areas. Vertebrate rodents including mice, rabbits and squirrels can also spread southern blight by picking up sclerotia on their bodies and carrying them to new locations. This "biotic transmission" helps the fungus move within and between fields or garden beds.

Sclerotia can also be transported within soil and substrates or media that cling to mowers, farm equipment, field and hand tools, pots and footwear. As a result, "clean" areas can become suddenly contaminated by introduction of the pathogen from external sources. Human activities such as moving/trading infected transplants, soil, mulch, compost or plant debris can spread the pathogen across long distances.

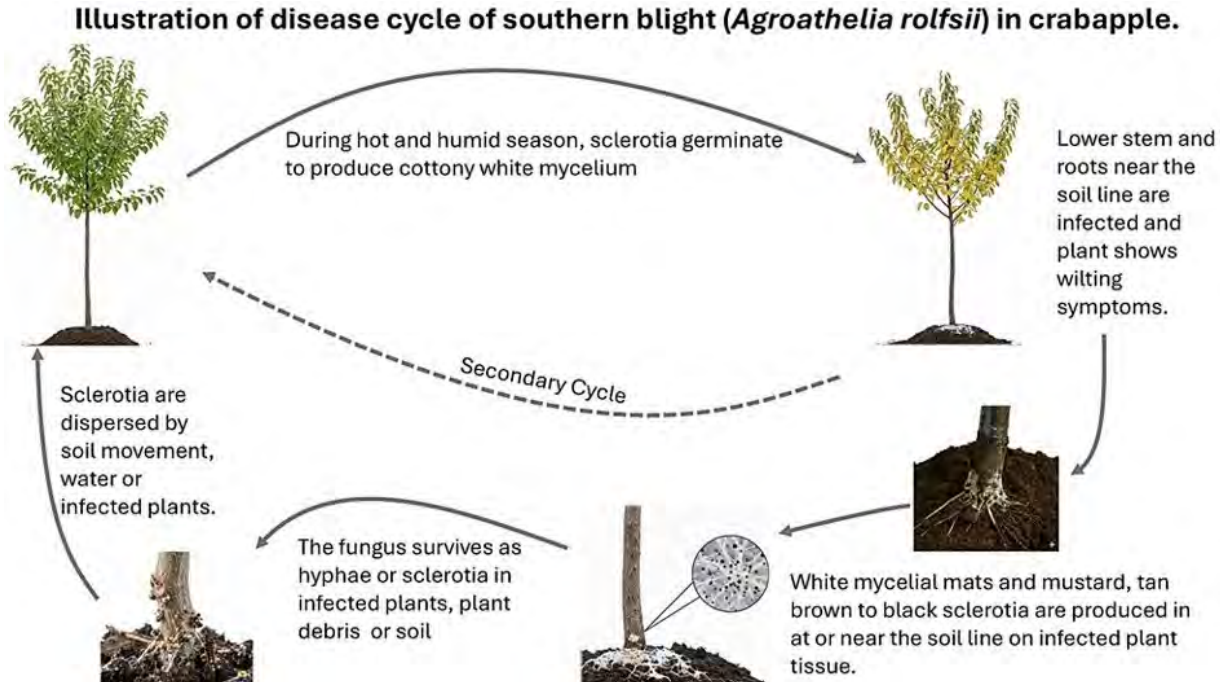

Figure 2: *Illustration of disease cycle of southern blight disease caused by Agroathelia rolfsii. (Illustrator: Dipika Sharma; Adapted from Mullen, 2001)*[15]

Integrated Strategies for Managing Southern Blight

1. Cultural Practices for Limiting Infection and Spread

Cultural practices are an essential first line of defense against southern blight. They help prevent the introduction and spread of the pathogen and reduce the conditions that are conducive to disease development.

Best Practices for Keeping Production and Landscape Systems Agroathelia rolfsii*-free*

- **Start with disease-free plant materials:** Always select healthy plants, cuttings or seeds that are free from infection. Carefully inspect stems and roots for lesions, wilting or the presence of hyphae and sclerotia. Purchase materials from growers who can provide a phytosanitary certificate, which will help minimize the risk of introducing *A. rolfsii* into new plantings.
- **Plant resistant cultivars, if available and rotate crops:** While resistance is limited in many ornamental plants, selecting cultivars with known tolerance or resistance to southern blight can reduce disease incidence. Some ornamental grasses and certain woody plants show lower susceptibility. Crop rotation with non-host species such as certain grasses or resistant woody plants will reduce the buildup of sclerotia in the infected soil.
- **Scout and monitor regularly for early detection:** Inspect ornamental plantings frequently for early symptoms such as wilting, stem lesions and for cottony white fungal growth as well as presence of sclerotia. Prompt identification and removal of infected plants can help stop disease outbreaks before they spread widely in nurseries or landscapes.
- **Quarantine new plants that show suspicious symptoms or signs:** Sclerotia spread locally through contaminated soil, tools and equipment and over long distance through human activities such as moving infected plants, soils or debris. Therefore, borrowed or rented equipment should be cleaned before being brought into new production or landscape areas. Planting resources, including, the soil, substrates and plant root systems should be inspected at purchase and again prior to transplanting. Where warranted, plant material may be held in quarantine if diagnostic screening of suspect host plant tissues is necessary.
- **Use sterile soil, aged and composted soilless substrates or bagged potting media:** Use sterilized soil or potting mixes, especially in containers and propagation beds. Use commercially prepared media or treat substrates with aerated steam or solarization. This step is crucial as it helps prevent new infections via sclerotia present in contaminated soil or organic debris.

- **Use of soil amendments:** Organic amendments such as aged compost, oat or corn straw, cotton gin trash and pine bark extracts can suppress southern blight. These materials enhance microbial activity in the soil, supporting colonization of the biological agents and favors the killing of the pathogen [16]. Additionally, fertilizers such as ammonium, calcium nitrate and calcium sulfate have also shown to be effective against southern blight pathogen [15].
- **Sterilize tools, mowers and mechanical equipment between uses:** Sclerotia and fungal mycelium can adhere to tools, pots and equipment, spreading southern blight between plants and growing areas. To prevent this, thoroughly clean and disinfect tools after each use using a 10 percent bleach solution (1:9 ratio of bleach to water) or commercial sanitizers. If renting, borrowing equipment, and especially when working between fields of locations at which southern blight has been known to occur, wash equipment before leaving or moving equipment to a new (clean) site location.

When and where southern blight has been identified as a problem in production or landscape systems:

- **Plant and soil removal:** Southern blight typically infects the crown of the plants and contaminated surrounding soil. Once symptoms are present, the entire plant including roots and debris should be removed. Additionally, remove the top three inches (7.6 cm) of soil extending at least 12 inches (30 cm) beyond visibly affected area. This helps eliminate most sclerotia and fungal mycelium. All removed material should be securely bagged and disposed of in a landfill. Do not compost infested soil or infected plants, this should help prevent further spread. Recycled pots and containers should be thoroughly cleaned to remove any residual potting media.
- **Deep plowing:** Tilling the soil to a depth of 7 to 8 inches (15-20 cm) can bury sclerotia deeper in the soil profile, where they are less likely to survive and infect new plants. Deep burial reduces oxygen and contacts with plant roots. When planted deep, sclerotia are more likely to be attacked by soil microbes, which further reduces their viability. Research by Mehan et al., (1994) suggests that soil mixing prior to planting, or immediately after crop harvesting, could assist in drying sclerotia and reducing disease pressure the following season[17].
- **Soil solarization:** Soil solarization is an effective technique for reducing southern blight in planting beds and nurseries sites. Cover well prepared moist soil with a clear polythene tarp during the hottest part of summer for four to six weeks. This method traps solar radiation, raising soil temperatures above 113–122 F (45–50 C) in the upper soil layers, which is enough to kill the fungal sclerotia. Research by Katan (1981) demonstrated that solarization can reduce sclerotia viability by up to 95 percent [18]. Soil solarization can also help control other soilborne pathogens, plant parasitic nematodes and weed seeds.

2. Biological Control

Biological control is another tool to manage southern blight. This approach uses “good microbes” or beneficial fungi and bacteria, to fight against the southern blight fungus. Research has shown that some of these microbes, including fungal and bacterial biocontrol agents, can suppress the growth of southern blight pathogen. Currently, two products are available commercially: Trianum-P (*Trichoderm harzianum* T-22, a beneficial fungus) and DoubleNickle 55® (*Bacillus amyloliquefaciens* strain D747, a beneficial bacterium). When used in conjunction with the cultural practices described above, these biocontrol agents can play an important role in reducing losses from southern blight in nurseries and landscapes.

3. Chemical Fungicide Management

Fungicides labeled for southern blight can be effective tools when used correctly, especially as part of an integrated disease management program. Some fungicides work best when applied preventively, before symptoms appear, or at the very first sign of disease, particularly during hot, humid weather when southern blight is most active.

Several products are labeled for use on ornamental plants for managing the southern blight pathogen. Always read and follow the label for information concerning mixing, application rates, crop safety and reentry intervals. For long-term success and to reduce the risk of fungicide resistance development:

- Rotate products with different FRAC (Fungicide Resistance Action Committee) codes which indicate different modes of action. Be cautious; fungicides with the same FRAC code may be sold under different trade names, but they have the same mode of action.
- Avoid repeated use of the same active ingredient or mode of action.
- Follow label guidelines carefully for crop-specific directions and safety recommendations.

Common active ingredients (sold under different product trade names by various companies) labeled for southern blight management in ornamentals include:

- fludioxonil (FRAC Code 12)
- cyprodinil + fludioxonil (FRAC Code 9 + 12)
- tebuconazole (FRAC Code 3)
- flutolanil + thiophanate methyl (FRAC Code 7+1)

FRAC Web resource: Chemical active ingredients presented within this document are based on FRAC classifications (**frac.info/media/ljsi3qrv/frac-code-list-2025.pdf**)

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