e-GRO Alert

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Preventing and Controlling White Mold (*Sclerotinia*) during Greenhouse Crop Production

Sclerotinia can infect many ornamental greenhouse and vegetable crops with symptoms including damping off, blighting, and stem rot. To diagnose, inspect plants for white cottony growth; for small, hard, black sclerotia on or in plant tissue; or submit plant samples to your preferred diagnostic lab. This Alert outlines disease prevention and management options.

White mold is a disease caused by a fungal pathogen (*Sclerotinia sclerotiorum*). Cool, moist conditions, similar to greenhouse environments during mid-spring, favor disease development. Microenvironments created by dense crop canopies or frequent irrigation can promote disease. Many greenhouse-produced annual and perennial bedding, potted flowering, and vegetable plants can become infected by *Sclerotinia*.

Signs and Symptoms

White mold can be clearly identified by the white cottony growth or mycelium produced by the pathogen which grows on the surfaces of stems (Fig. 1A) or leaf petioles (Fig. 2) and inside infected plant tissue. Plant-to-plant transmission can occur by stem-to-stem contact. Over time, the cottony mycelia (hyphae) will collect into clumps (Fig. 3) of mycelium on the stems, at nodes, leaf petioles, or on leaves. Mycelium clumps mature forming small, irregular-shaped, hard, black sclerotia (Fig. 4). These structures can be found on outside plant surfaces (Fig. 5) and inside stem cavities (Fig. 6) of infected plant material. The cottony mycelia (hyphae) can

Figure 1. *Sclerotinia* sp. mycelium growing on the surface of a stem. Photos by W. Garrett Owen.

also cause water-soaked lesions (Fig. 7) to develop on the surface of infected plant tissue. Stem lesions can enlarge, causing stem girdling, plant wilt, necrosis, and death.

Introduction into Greenhouses

Sclerotinia can be introduced to greenhouse environments by utilizing contaminated field topsoil (Fig. 8). Irrigation water and wind dispersal have been reported to cause localized infections. Historically, greenhouse substrates were once formulated to contain field soil, until the introduction of peat lite mixes. Today, few growers continue to incorporate field topsoil into peat-based substrates (Fig. 9) to enhance the physical and chemical properties. Without proper heat treatment of field topsoil prior to incorporation into peat-based mixes, sclerotia can remain viable for weeks or years.

During greenhouse production when environments are cool (53-59°F) and substrates moist, viable sclerotia, up to 2-cm below the container media, produce small mushroom-like fruiting bodies (apothecia) that release ascospores. Dispersal of ascospores occurs within days and are spread by irrigation events and air circulation or venting. Under extended periods of dark, cloudy days when leaves remain wet and the greenhouse environment is humid and warm (55-75°F), ascospore germination and infection can occur. If infection is not identified and disease plant material is not bagged and discarded, sclerotia can fall from containers or hanging baskets and survive in greenhouse gravel or under ground cloth for multiple years. For more information about white mold biology, disease cycle, and epidemiology, refer to The American Phytopathological Society White Mold plant disease lesson by

Figure 2. *Sclerotinia* sp. mycelium growing on the surface of a leaf petiole. Photo by W. Garrett Owen.

Figure 3. *Sclerotinia* sp. mycelia (hyphae) aggregating into clumps. Photo by W. Garrett Owen.

Figure 4. *Sclerotinia* sp. mycelia clumps mature forming small, irregular-shaped, hard, black sclerotia. Photo by W. Garrett Owen.

Link and Johnson (2012). For more information and an identification guide to white mold of floriculture crops, download the "*Sclerotinia*" iBook here (Note: This book can only be viewed using iBooks 2 on an iPad. iOS 5 is required.).

Prevention, Management, and Control

Growers challenged with white mold should consider identifying an alternative location to harvest topsoil or eliminate the use of topsoil in greenhouse substrates altogether. The use of commercially formulated substrate mixes with higher proportions of peat moss or other constituents may provide desirable substrate physical and chemical properties. Conducting substrates trials to determine the best mix or component is recommended.

Steam heat treatment of field topsoil for 30 mins beyond the time when the coldest spot of substrate being pasteurized reaches a minimum 160°F or higher (Nelson, 2012) will help prevent white mold infection. Most times, field topsoil is placed in a steam wagon or cart (Fig. 10) with a perforated bottom (Fig. 11), retro-fitted truck beds (Fig. 12), or in a designated area with access to a steam pipe (Fig. 13). The containers or designated areas have access to a mechanical heat source such as a boiler unit or generator to supply heat (Fig. 14). To retain heat, a high temperature resistant tarp is often placed over the soil, secured in place, and a thermometer is used to determine the temperature (Fig. 15). If steam heat treatment is practiced and white mold is still a re-occurring issue, either re-evaluate the soil pasteurization method, temperature, or duration of heat treatment or consider a chemical control option. Furthermore, greenhouses should be properly sanitized and weed free because weeds can become a host.

Figure 5. *Sclerotinia* sp. sclerotia can be found on outside plant surfaces. Photo by W. Garrett Owen.

Figure 6. *Sclerotinia* sp. sclerotia found inside a stem cavity. Photo by W. Garrett Owen.

Figure 7. *Sclerotinia* sp. mycelia (hyphae) causing water-soaked lesions. Photos by W. Garrett Owen.

Figure 8. Example of field topsoil used to incorporate into peat-based greenhouse substrates. Photo by W. Garrett Owen.

Figure. 9. Example of incorporated field topsoil into peat-based substrates. Photo by W. Garrett Owen.

Figure 10. Example of a steam wagon for field topsoil pasteurization. Photo by W. Garrett Owen.

Figure 11. Example of a steam wagon's perforated bottom for field topsoil pasteurization. Photo by W. Garrett Owen.

To help aid in proper diagnosis and management of white mold or any plant pathogen, it is always recommended to submit plant samples to your preferred diagnostic lab. Greenhouse growers should begin by managing the greenhouse environment through eliminating moisture and humidity with venting. Increase air circulation to dry foliage and inner crop canopies. Eliminate long irrigation events and overhead watering and if possible, use drip irrigation. If crops require water, limit irrigation events to early in the morning so that the foliage has time to dry before night. For chemical control options, consult with your state greenhouse Extension educator(s) or specialist(s) or preferred diagnostic lab. Most times they can direct you to a list of registered fungicides to control white mold.

Overall, to prevent white mold infection, growers should consider eliminating the use of field topsoil or re-evaluate current soil pasteurization practices. Proper environmental management can help mitigate infections. Chemical control options are available, but disease prevention is the best management practice.

Figure 12. Example of a retro-fitted truck used for field topsoil pasteurization. Photo by W. Garrett Owen.

Figure 13. Example of a designated area with access to a steam pipe for pasteurization of field topsoil. Photo by W. Garrett Owen.

Figure 14. Example of a boiler/generator to supply steam for pasteurization of field topsoil. Photo by W. Garrett Owen.

Figure 15. Example of thermometer used to determine the temperature during the pasteurization of field topsoil and other organic materials. Photo by W. Garrett Owen.

Literature Cited

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