



SCLEROTINIA STEM ROT OR WHITE MOLD OF CANOLA Washington Oilseed Cropping Systems Series

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Sclerotinia Stem Rot or White Mold of Canola

Abstract

The Washington State Oilseed Cropping Systems Research and Extension Project (WOCS) is funded by the Washington State Legislature to meet expanding biofuel, food, and feed demands with diversified rotations in wheat based cropping systems. The WOCS fact sheet series provides practical oilseed production information based on research findings in eastern Washington. More information can be found at: http://css.wsu.edu/biofuels/.

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Introduction

Sclerotinia stem rot (*Sclerotinia sclerotiorum*), also known as white mold, can be a very destructive disease of canola. In the canola-producing areas of Canada's prairie provinces, as well as the midwestern and southern United States, Sclerotinia can be a major issue. Although the occurrence of Sclerotinia in the Pacific Northwest is minimal, it can cause extensive damage in infected fields.

The occurrence and severity of infection from Sclerotinia can vary on both a temporal and spatial scale. In the Midwest, average yield losses can reach up to 13%, while some individual fields can lose up to 50% (Markell et al. 2009). Canola infected by Sclerotinia will have reduced seed filling and increased likelihood of shattering before harvest.

Yield loss can vary according to multiple factors, including:

- The site of infection,
- canopy density,
- lodging potential, and
- stage of crop growth.

If environmental conditions are favorable and infection occurs at early flowering, yields can potentially be reduced by at least half. (Canola Council of Canada 2014).

With the increasing acreage of canola production in the Pacific Northwest, it is important to be aware of the visual symptoms and the environmental conditions that favor Sclerotinia. The environmental conditions required for infection of canola by *Sclerotinia sclerotiorum* occur in regions that typically receive summer rainfall during flowering.

In dryland areas, such as the interior Pacific Northwest where summers are dry, conditions favorable for this disease are not very common. However, in regions with dry summers, and where irrigation is used, canola can be seriously affected by the disease—causing issues not only for canola crops, but also for other susceptible rotation crops such as potato.

In growing areas that receive more rainfall, winter canola may be more prone to infection by *Sclerotinia* than spring canola, due to the timing of flowering, which is more likely to coincide with mid- to late-spring rain. *Sclerotinia sclerotiorum* has a very wide host range (over 400 plants), but only among broadleaf crops (dicots; Boland 1994). The pathogen does not infect monocot hosts such as wheat, barley, or corn.

Case Study

A grower located in Odessa, Washington, has experienced the effects of *Sclerotinia* since 2006. The irrigated rotation of canola, potatoes, and wheat has been impacted every year since the first occurrence, due to the short rotation of the susceptible host crops potato and canola. The extent of damage to the canola crop can vary each year, sometimes reaching up to 50% yield loss. The occurrence has been random throughout the fields, but is most prevalent in draws.

Some of the first signs include:

- Discoloration and bleaching of stems to a grey-white color, often near a leaf axil.
- The small golf tee or funnel shaped fruiting bodies (apothecia)

Management practices have been initiated since the first occurrence in 2006, including yearly fungicide treatments and irrigation management to limit water application at flowering.

Disease Cycle: How the Pathogen Survives, Infects, and Reproduces in Canola Crops

Sclerotinia sclerotiorum produces sclerotia in infected stems, which fall to the ground during harvest.



Figure 1. Black sclerotia of *Sclerotinia sclerotiorum* with salmon-colored fruiting bodies called apothecia that release ascospores into the air. Photo courtesy of Dilantha Fernando, University of Manitoba.

The pathogen overwinters in the soil as dark black sclerotia, each up to ³/₄-inch long with a rough, irregular appearance (Figure 1).

Sclerotia are white internally, and have a thin, black "rind." These structures are a dense mass of fungal cells and can survive in the soil for 3 to 4 years or more (Canola Council of Canada 2014).

Although sclerotia have the ability to germinate and directly infect the base of a canola or other susceptible plant, a common source of infection originates from the sexual stage fruiting bodies, called apothecia.

Irrigation or rain during the spring or summer will moisten the soil enough for the sclerotia to germinate, producing apothecia that look like tiny, stalked cups, which resemble small golf tees, as shown in Figures 1 and 2 (Markell et al. 2009).

The base of this cup is lined with millions of sacs called asci, each of which produces eight spores, called ascospores. This means each apothecium can eject billions of ascospores into the air. The ascospore may land on a flower petal that has dropped off a flower, and become stuck to a stem, typically in the leaf axil where the leaf attaches to the stem.

Ascospores can be spread by wind for several feet or even several miles under very windy, overcast conditions. Therefore, the disease may occur in patches in a field and is usually not evenly distributed.

Free water and 100% relative humidity are required for infection of a plant by the ascospore, so frequent overhead irrigation can make the disease more severe.



Figure 2. Life cycle and signs of infection of Sclerotinia sclerotiorum in canola. Figure courtesy of Tai McClellan Maaz, Washington State University.

The senescing petals that have fallen from canola flowers serve as a food source for the fungus. Once spores of the fungus have landed on a food source, the spores can infect the stem or leaves, causing a soft, watery rot as depicted in Figure 2 (Rimmer et al. 2007).

Later, the lesion takes on a bleached color in contrast to the healthy green tissue of the stem (Figure 3). Once the lesion girdles the stem, the tissue above the lesion wilts and dies.



Figure 3. Bleached stem lesions on a canola plant infected with Sclerotinia stem rot. Photo by Dilantha Fernando, University of Manitoba.

Toward the later part of the growing season, sclerotia are formed inside dead stems (Figures 1 and 4) and become distributed after harvest by equipment or may be harvested with the seed, causing contamination of seed lots. If a contaminated seed lot is used for planting, the pathogen can be introduced into fields that were not previously infected.

Timing and Ideal Environmental Conditions for Sclerotinia Stem Rot

- Infection occurs during flowering.
- A humid environment or at least 1 to 2 inches of rain or irrigation are needed within a week or two of flowering for infection to occur (Lamey and Bradley 2005).
- Infection does not occur when temperatures are greater than 86°F (Markell et al. 2009).

Where to Look

- Low, wet (but not flooded) spots in the field.
- Nearby fields that had some level of infection or fields where a host crop grew in the past 2 to 3 years.
- Any areas that have a dense canopy or thick residue mat.



Figure 4. Canola stem infected with *Sclerotinia sclerotiorum*. The stem has been broken open to reveal black sclerotia formed by the pathogen inside the stem. Photo by Karen Sowers, Extension and Outreach Specialist, WSU.

Visual Symptoms

Apothecia that are ¹/₄- to ¹/₂-inch wide with a tan color (Figure 1) can be produced on the sclerotia (Markell et al. 2009). If found during flowering, this is a sign that the pathogen is producing spores, and, if conditions are favorable, it may result in infection.

- Areas of brown to grey discoloration are found on leaves and stems, especially around the leaf axils.
- Infections on the stem, resulting from infected leaf axils, expand and turn grey-white in color (Figure 3).
- Premature ripening and wilting.
- Weakened stems that break easily; plants can lodge causing the stalk to bend.
- Premature death of the plant, if infection occurs in the main stem (Ehrensing 2008).
- Black resting bodies (sclerotia) are produced inside the bleached area of infected canola stems (Figure 4), after infection is established.

Disease Management

Most canola cultivars are susceptible to this disease; therefore, management decisions are crucial in order to minimize the risk of infection.

Crop Rotation. Crop rotation with a non-host, monocot plant (wheat, corn, barley, or grass) for at least three years is required, due to the long persistence of sclerotia in the soil (Brown et al. 2008).

Clean Seed. Seed should be properly cleaned to remove sclerotia or sclerotial pieces and prevent movement of the pathogen into new areas or fields. Management practices that limit the development of high humidity under the canopy, such as wide row spacing and lower seeding rates, can reduce susceptibility to the disease.

Careful Irrigation. Systems that utilize irrigation would benefit from reduced frequencies of leaf wetness, especially during the flowering period (Heffer Link and Johnson 2007). Initiating irrigation in the morning and ending before noon allows the foliage to dry before nightfall, avoiding prolonged periods of wetness. Irrigation timing may be more important than weather conditions for predicting outbreaks of Sclerotinia stem rot in irrigated canola in the Pacific Northwest.

Fungicide Use. One of the most effective ways to prevent outbreaks of Sclerotinia stem rot in canola crops is the use of protective fungicide sprays. In the Pacific Northwest, fungicide sprays may only be economical if rainy, humid weather is forecast during flowering, and the yield potential and expected price of the crop is high.

The Canola Council of Canada (2009) has produced a <u>Canola Disease Scouting & Risk Assessment Card</u> that can be used to improve the accuracy of estimating disease risk and the need for protective fungicide sprays. Protective applications of fungicides are often made at 20% to 50% bloom, depending on the weather conditions during flowering, and the timing and presence of petal drop (Pscheidt and Ocamb 2015).

Optimal timing of fungicide application is at 30% bloom: approximately 20 or more flowers open on the main stem (Markell et al. 2009). At this stage, the number of flowers open at one time is maximized and some fungicide penetrates the canopy to help protect potential infection sites.

The fungicide will only prevent further infection and will not cure previously established infections. Recommendations for protective fungicide treatments can be found in the *Pacific Northwest Plant Disease Management Handbook*. Fungicides used most commonly for Sclerotinia stem rot control in the Pacific Northwest include carboxamides (e.g., boscalid [Endura] and penthiopyrad [Vertisan]), and metconazole (Quash) (Pscheidt and Ocamb 2015). The biocontrol product Contans WG, which contains the mycoparasite *Coniothyrium minitans*, can also be used in conjunction with foliar fungicides.

The dried spores can be sprayed on infested residue after harvest or prior to planting (Heffer Link and Johnson 2007). Contans is used primarily to reduce basal stem infection by reducing the survival of sclerotia in the field, and therefore production of apothecia. For application rates refer to the *Pacific Northwest Disease Management Handbook*.

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