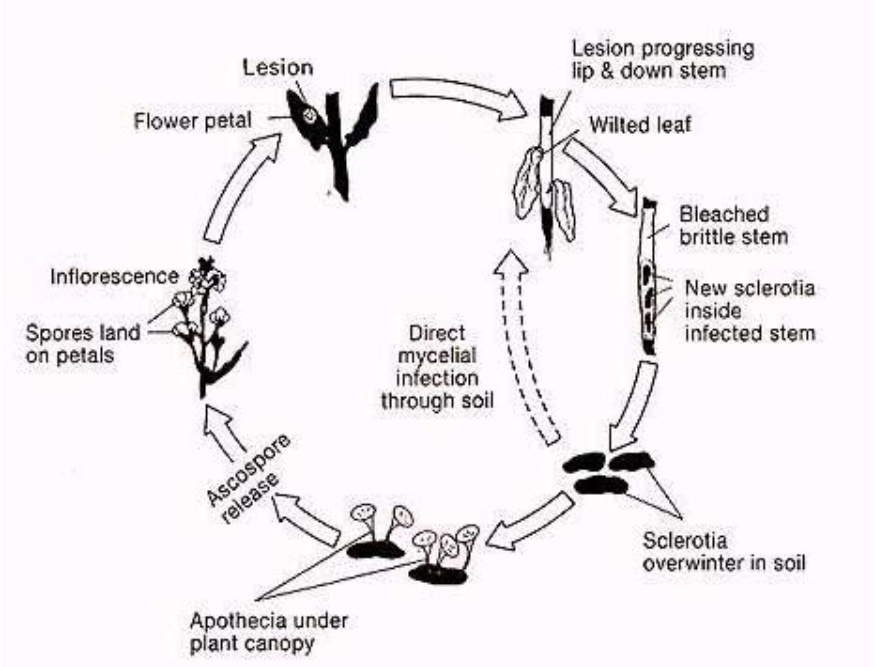
Sclerotinia Sclerotina model for canola, sunflowers and peppers

Biology and Lifecycle

The disease cycle is shown in the graphic beside. The stem rot fungus overwinters as sclerotia in the soil, in stubble at the soil surface and mixed with seed. Sclerotia are storage organs which can remain viable in the field for five years or more. Each year some sclerotia will germinate when conditions are suitable, but others will remain dormant. Germination produces either mycelium (microscopic filaments), which may infect plants in direct contact with sclerotia, or spore-producing apothecia (small golf-tee shaped structures). Most infections in canola result from air-borne spores produced by apothecia at the soil surface.



Only sclerotia in the top few centimetres of soil will produce functional apothecia, since the apothecial stalks are rarely longer than 5 cm (2 in). Deeply buried sclerotia will not produce apothecia but can remain dormant; if they are later brought near the surface by cultivation, they may germinate.

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A single sclerotium can produce up to 15 apothecia, either at one time or over a period of weeks. In Western Canada apothecia normally begin to appear in June but most develop during flowering. Apothecia can continue to develop until late September, but the critical period for causing damaging infections is from early to full bloom. However, for sclerotia to germinate and produce apothecia, they require prolonged moist soil conditions (at least ten days at or near field capacity) and moderate temperatures. Normally, such conditions do not occur until the crop canopy closes and permanently shades the soil surface. Since this is typically at the late rosette stage, with the 10-day delay, apothecia appear as flowering starts. Low. wet spots in a field and dense crops provide better conditions for sclerotia to germinate. They also protect the sensitive apothecia from desiccation and allow them to release infectious spores over a longer period. Even low levels of germinated sclerotia in a canola field or an adjacent cereal field may cause severe infection when conditions are particularly favorable for disease development.

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Biology and Lifecycle

Apothecia produce millions of microscopic spores that are released into moving air currents. The spores are easily carried by even the lightest breeze across a field or into adjacent fields, possibly as far as several kilometers. Spores cannot infect the leaves and stems directly, but must first grow in dead petals adhering to leaves and stems. The petals provide the food source necessary for the spores to germinate, grow and eventually penetrate the plant. Spores land on petals even before the petals die and fall from the flowering shoot. Moist conditions from rainfall or heavy dew, which may keep leaves and stems wet for two to three days, are also necessary for infection. Spores can remain alive for up to 21 days.
When leaves are infected the stem rot fungus may spread down into the stem. The fungus grows and invades healthy stem tissue when conditions are favorable. Heavy canola crops are more prone to infection. A dense canopy provides better conditions for symptom development. Heavy strands also tend to lodge, and stem rot ill spread from plant to plant by direct contact, especially if wet weather delays swathing. Spread will also occur in wet swaths. The fungus eventually forms new sclerotia in the diseased plant tissue and these return to the soil at harvest, thereby completing the disease cycle.

The stem rot fungus has a host range of over 350 species, mostly in broad-leaf plant families. Weed hosts such as chickweed, stinkweed, hemp-nettle, thistles, shepherd's purse, narrow-leafed hawk's-beard and wild mustard produce sclerotia after infection.

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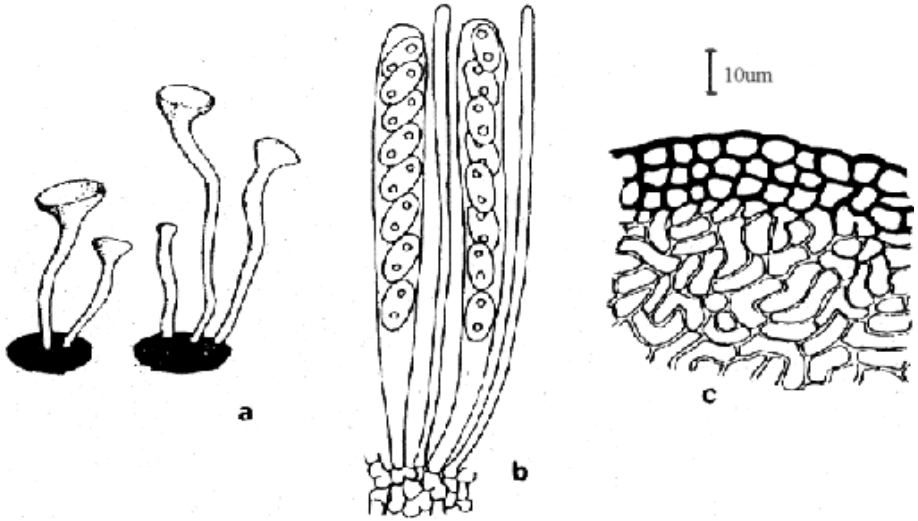
1. Risk of Sclerotinia Ascospore Production:

2 consecutive days with precipitation higher than 0.8 times ET_0 => **Risk level 1**

3 consecutive days with precipitation higher than 0.8 times ET_0 => **Risk level 2**

4 consecutive days with precipitation higher than 0.8 times ET_0 => **Risk level 3**



Sclerotinia sclerotiorum: a) Sclerotia with Apothecia, b) Asci with Paraphyses, c) Part of a Sclerotia (from Von Arx, 1981).

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2. Infection Model (The Relation between Leaf Wetness Duration and Temperature for *Botrytis cinerea* Infection has been used)**:**

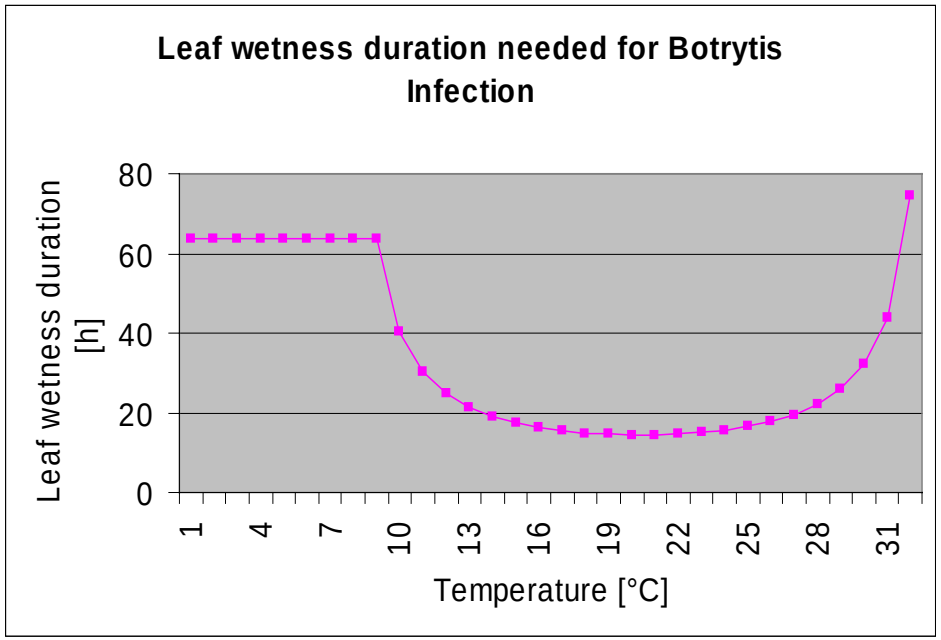
Input: temperature and leaf wetness

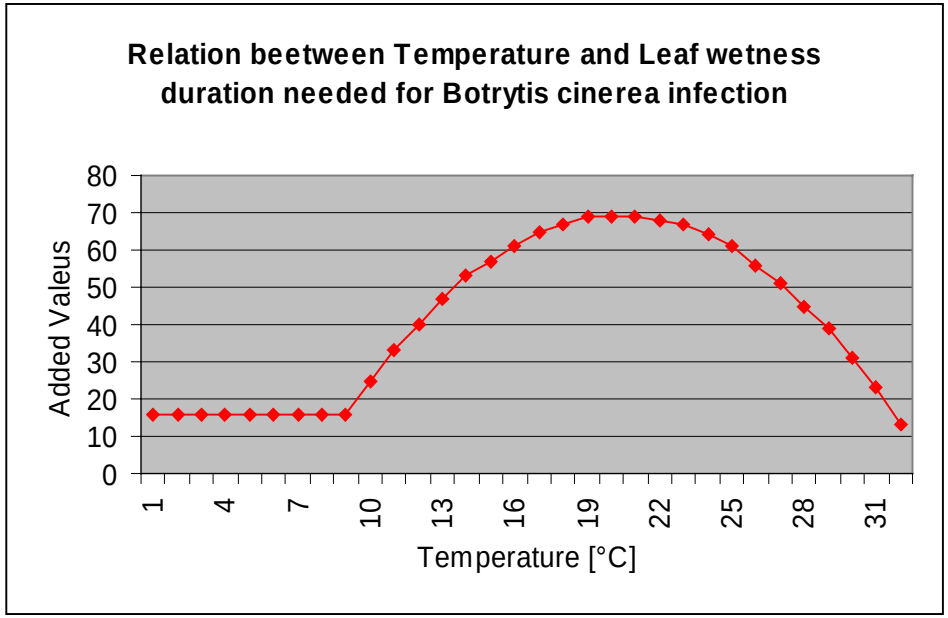
Starts: If Ascospore Production Risk is higher than 0

Progress: Accumulates an temperature depending Index value for every minute of Leaf wetness.

Completes: If Accumulated value is higher than threshold => 100% Infection.

Output: Infection Progress between =% and 100%





Pessl Instruments

Sclerotinia Sclerotina model for canola, sunflowers and peppers Data Presentation in µMETOS and µLINK:

the µMETOS display shows the risk of ascospore production as 1, 2 or 3 asterix. Infection progress is shown as vlaues form 0 to 100. The µMETOS changes withz click on the up and down Button simultanously from hourly values to daily maximum values.

µLINK siplays the progress of infection in a progres curve and the risk of ascospore production in 3 quality lines at the top of the graph.

S.sclerotorum Ascospore Risk, Infection
Click both for Max Values
M-DD HH RIS INF

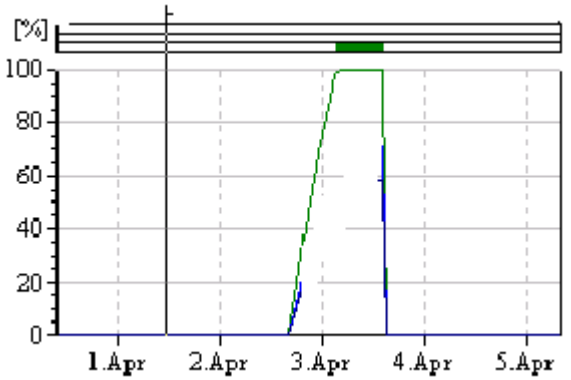
Label

5-12 07 ** 10 5-12 08 ** 18
M-DD HH RIS INF M-DD HH RIS INF

1th Screen

5-12 MX_** 20 5-13 MX_*** 90
M-DD MX RIS INF M-DD MX RIS INF

2nd Screen



Pessl Instruments

Sclerotinia Sclerotina model for canola, sunflowers and peppers, The practical Use of the Model:

The model indicates the risk of ascospore production. In thimes when the precipitation is higher than the evapotranspiration it can be assumed, that the top soil is moist. Moist topsoil is the most limiting condition for the formation of the ascospores.

Ascospores will infect the plant if the can feed on pollen and infect the intact plant by mycelia. Infection process will need moisture which is indicated by leaf wetness. The Botrytis infection model is used to indicate the possibility of Infections by Sclerotinia sclerotina.

A risk of ascospore production higher than 0 is indicating times when you can suspect the production of ascospores. The history of y specific field is importuned to decide which risk level can be accepted without spraying against this disease. New biocontrol agents can reduce the numbers of sclerotia hibernating in the soil. The infection model indicates times where an infection will take place. Moist periods which are long enough for ascospore production and infection during flowering of the crop are indicating a severe risk for your crop. The control of sclerotinia after syptoms are visible is not succesful. Therefore this model will help you to decide if a spray is probate on base of climate data.

Pessl Instruments