Best-practice guidelines for protected herbs -

Sclerotinia rot *(Sclerotinia sclerotiorum)*

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Introduction

Sclerotinia rot affects a wide range of herb crops particularly non-woody species. In the UK, sclerotinia rot is caused by *S. sclerotiorum,* while in the USA, basil may also be affected by *S. minor*. Coriander, fennel, mint, parsley, tarragon and basil have all been reported as hosts of *S. sclerotiorum.* Sclerotinia rot can affect plants at any stage of production including seedlings, mature plants and harvested products. Plants with senescing or dead tissue are particularly susceptible to infection. Sclerotinia rot is most commonly a disease of field-grown herbs but protected herbs are also affected. Within protected herb production systems, soil-grown herbs are most at risk from sclerotinia rot, but the disease is also occasionally found on pot herbs from all year round production.

Symptoms

The infected area of a plant initially takes on a dark green or brown water-soaked appearance, then may become paler in colour. Dense white cottony mycelium usually develops and the plant begins to wilt and eventually dies. Resting or survival structures (sclerotia) are produced externally on affected plant parts and internally in stem pith cavities. The sclerotia are hard, black, irregular in shape, mostly 2-4 mm in size, and difficult to see once incorporated into the soil.

[Click here to view photos of sclerotinia rot]

Disease sources and spread

The life-cycle of *S. sclerotiorum* includes both a soil-borne and an air-borne phase. Sclerotia of *S. sclerotiorum* can survive in the soil for ten years or more. They germinate to produce small funnel-shaped fruiting bodies (apothecia) that are approximately 1 cm in diameter. Apothecia produce air-borne spores, which can cause infection when they land on a susceptible host plant, either via flowers, or by direct germination on leaves. Occasionally, infection of stem bases can occur when fungal strands (mycelium) develop directly from sclerotia near the surface. New sclerotia develop in infected plant tissue and when the plant dies these remain on the soil surface or may become incorporated during subsequent soil cultivation.

In addition to herbs, sclerotinia rot affects a wide range of crops such as celery, carrot, lettuce and oilseed rape. Spores or sclerotia produced when any of these crops is affected can be a source of the disease on herbs. For example, air-borne spores released and blown from apothecia in a lettuce field could infect herb crops in a neighbouring polytunnel or glasshouse.

[Click here to see the life-cycle of *Sclerotinia sclerotiorum* causing sclerotinia rot on herbs]

Conditions for infection

After a period of cold conditioning in winter, sclerotia in the top 5 cm of the soil germinate from spring onwards to produce apothecia, when soil temperatures are 10°C or higher and the soil is moist. Sclerotia do not germinate in dry soil or when the soil temperature is above 25°C. Sclerotia buried below 5 cm in the soil are less likely to germinate.

Once apothecia are fully formed, spore release can occur in the light or dark but is temperature dependent, so tends to peak around midday. Apothecia can last about 20 days at 15 to 20°C, but shrivel after less than 10 days at 25°C.

For flowering herbs, spores landing on petals and stamens germinate rapidly (germination within 3-6 hours and infection within 24 hours) in optimum conditions of 15-25°C, continuous leaf wetness and high humidity within the crop. Subsequent infection of leaves and stems depends on petals falling and sticking on leaves. The risk of infection is increased if the leaves are wet because this causes more petals to stick. Infected dead or senescing petals provide nutrients for the invasion of the fungus into leaves and stems.

For non-flowering herbs, infection is mainly by air-borne spores landing directly on leaves. Spores can survive on leaves for several weeks until conditions favourable for leaf infection occur. Spore germination and infection depend on the presence of nutrients on leaves, either from plant wounds or senescing plant material. As for flowering herbs, the optimum spore germination and infection conditions are 15-25°C with continuous leaf wetness and high humidity.

Once plant infection has occurred, rapid disease progress is favoured by warm (15-20°C) and moist conditions in dense crops.

Disease management

Cultural control

For soil-grown herbs, avoid planting susceptible species in an area where sclerotinia rot has been observed previously. Due to the wide host range of *S. sclerotiorum* and the ability of sclerotia to survive in soil for several years, crop rotation may reduce but not eliminate the risk of disease.

If soil is known to be infested with sclerotia, an appropriate method of soil disinfestation may be used to eliminate sclerotia from soil. Once soil has been treated, do not re-cultivate because untreated sclerotia from deeper soil layers could be brought closer to the soil surface.

As the disease thrives under warm, moist conditions, manage irrigation to avoid over-watering and prolonged leaf wetness durations. If sclerotinia rot occurs in pot herbs, the simplest management approach is to remove affected plants promptly and dispose of them carefully.

Biological control

A biological fungicide Contans® WG is approved for use against sclerotinia rot on edible and non-edible crops, including protected herbs. Contans® WG contains spores of the naturally occurring fungus *Coniothyrium minitans* which once incorporated into the soil, attack and destroy the sclerotia of *S. sclerotiorum*. The fungicide needs at least two months to destroy the sclerotia in soil and ideally should be incorporated thoroughly and evenly into the soil prior to planting. Once the fungicide is incorporated, soil should not be tilled deeper than the treated layer prior to planting, otherwise untreated sclerotia from lower soil layers may be brought closer to the soil surface.

Chemical control (protected herbs)

Amistar (azoxystrobin) and Signum (boscalid + pyraclostrobin) are routinely used for the control of sclerotinia rot on other horticultural crops such as carrot and lettuce. Both of these fungicides have a specific off-label approval for use on protected herbs.

Control is most effective when these fungicides are applied as protectants, ensuring that thorough coverage of the crop is achieved, particularly at plant bases where senescing tissue may be present. For soil-grown crops, this is most easily achieved before plants meet in or across rows.