

Botrytis Blight & Stem Canker of Greenhouse Tomato

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Biology & Disease Cycle of Grey Mould (*Botrytis cinerea*)

Grey mould (*Botrytis cinerea*) can be a serious problem on greenhouse tomatoes under cool and wet (high humidity) conditions. In British Columbia, the fungus can cause serious damage to greenhouse tomato in early spring and late fall. *B. cinerea* is a cosmopolitan fungus that has a wide host range, including tomato, pepper and lettuce. The fungus can infect almost all parts of a plant, including stem, leaf, petiole, peduncle and fruit. Stem infection through leaf-pruning scars and peduncles (fruit stem) often leads to stem canker, the most destructive stage of the disease causing substantial crop losses.

Grey mould thrives under cool, wet conditions and often establishes on dying tissues. It produces masses of dry spores called conidia that are air-borne. Spores are readily dispersed by wind (air currents), over-head irrigation or sprays, tools (particularly pruning shears & knives), machinery and workers. An epidemic situation can happen from air-borne spores that can infect soft tissues, cut-wounds and blossoms when moisture is present.

The most common and damaging infections take place through leaf-scars during de-leafing operation. *Botrytis* spores can remain dormant for 10 to 12 weeks within leaf scars made at pruning. Such spores can be triggered to germinate by low light, plant stress or shift in fruit load. Spores germinate and penetrate the plant surface within 5 to 8 hours on wet/moist plant surfaces at the optimum temperature of 15-20°C. A new infection can produce visible symptoms and masses of spores (conidia) within a few days, thus a multiple cycles of infection can be expected in a given growing season.

Botrytis can survive/overwinter as mycelia and/or sclerotia in the soil, on plant debris, and on perennial plants and weeds for several months or years.



Fig. 1. *Botrytis* infection on tomato (var. 'Bizarr') stem, showing brownish-grey, dry lesion and girdling of the stem. Masses of grey colour *Botrytis* spores can be seen on the surface.



Fig. 2. *Botrytis* infection on tomato (var. 'Bizzarr') stem and fruit peduncle. Infected tissues turn brownish-grey and masses of grey *Botrytis* spores can be seen on the surface.



Fig. 3. Tomato (var. 'Bizzarr') leaf infected with *Botrytis* showing brownish-grey discoloration and withering.

Management of *Botrytis*

Prevention (Steps to be taken before the onset of disease):

Follow overall biosecurity procedures: Enforce strict biosecurity & phytosanitary requirements as appropriate for your greenhouse operation.

Prevent initial infection and introduction of *Botrytis* into greenhouse: Enforce general year-around sanitation practices and thorough year-end clean up (thoroughly disinfect greenhouse physical structures, machinery and tools between crops).

Grow resistant/tolerant varieties if any: Avoid growing tomato varieties that are highly susceptible to *Botrytis*. Choosing a resistant if not a tolerant variety will reduce disease severity and buildup of spores during critical infection period.

Adopt good cultural practices: Remember! Cool & wet conditions are ideal for *Botrytis* outbreaks and high humidity (>80%) is highly conducive for disease development. To avoid this, leave adequate spacing between plants, increase air circulation by removing lower leaves from overly shaded areas. Maintain adequate heat and ventilation, particularly in the nights where temperature can be expected to drop significantly. Monitor the moisture level in the greenhouse. Avoid over-head irrigation. Avoid spray operations in the late afternoons and on cloudy days; spray operation in the morning hours is highly recommended. Any water-based irrigation or spray operations must be done in the morning hours and on sunny days to minimize prolonged wetness on plant surfaces. Avoid puddling of water on the surfaces of greenhouse production sites.

Scouting and early detection of *Botrytis* infection: Periodically and closely monitor for *Botrytis* disease symptoms, especially in the spring and fall seasons. Follow a strict and structured fungicide spray program (see below) and cultural practices to prevent the spread and severity of the disease.

Eradication / Management:

Follow strict sanitation and cultural practices as outlined under PREVENTION.

Most importantly, eliminate or minimize the inoculum (spore) load & sources of inoculum in the greenhouse:

1. Remove heavily infected plants from the bay. When doing so, if possible, wrap the infected plant tissues with a wet paper towel/newspaper (use soap water or KleenGrow®, previously Chemprocide) to prevent spores from dislodging into the air.
2. Cover cull/trash piles of infected plants with a plastic sheet and take immediately to a far site for deep-burial or incineration. Consider the greenhouse location and the wind direction when choosing a plant refuse dump-site.
3. Treat the *Botrytis* lesions on stems at a very early stage – scrape off the epidermal layer of the tissue and immediately apply an appropriate fungicide paste (Ferbam, see below).
4. Severe lesions cannot be treated, as described in step (3), since they have already damaged the vascular system; for such lesions, cover the lesions with disinfectant-treated paper towels/newspaper to reduce spore dispersal.
5. Treat the tarped-flow periodically with an appropriate disinfect.

De-leafing operation and worker sanitation practices: One of the primary sources of *Botrytis* infection is via leaf-cut wounds, which often result in severe stem canker. Pruning is recommended in the early afternoon since it will allow leaf-cut wounds to dry quickly. Treat pruning shears and knives with disinfectant after pruning each plant. Use a couple of pruners alternatively; this will give sufficient time to disinfect a pruner (dip pruning shears/knives in either 70% ethanol or 0.1-0.2% KleenGrow for a minimum of 2 min). The second factor is handling of infected plants and de-leafing of plants by the workers. Use hand-sanitizers as frequently as possible, particularly when de-leafing.

Follow a scheduled fungicide spray program: Begin using fungicides at the very first sign of symptoms or when the conditions are favourable for disease development. Expected results may not be achieved with any good fungicide program if the disease pressure is high. Use a combination of chemical- and bio-fungicides (Table I); choose from different chemical groups for maximum efficacy for *Botrytis* control and to prevent the pathogen from developing resistance to a specific chemical.

REMEMBER:

Decree is restricted to 3 applications and Pristine and Scala to 1 application per crop cycle. Since *Botrytis* can be expected to cause damage in spring and fall use Pristine and Scala wisely, alternating with other chemicals in spring and fall.

Use the biological fungicides Prestop and Rhapsody preventatively, before the onset of disease or when disease pressure is low. Biological fungicides may not give expected results when applied at high disease pressure.

To prevent resistance development in the pathogen to a fungicide:

- Never apply a fungicide below recommended rate
- Use fungicide at the highest recommended rate
- Do not apply the same fungicide repeatedly. Rotate fungicides from different chemical groups.

Table 1. A summary of registered fungicides and label information (Please adhere to product label instructions when using each chemical). For more information refer to Health Canada's [Pest Management Regulatory Agency](#) website for fungicide label information.

Product	Chemical / biocontrol agent	Chemical Group	Mode of Action	REI ¹	PHI ²	Application
Decree 50 WDG	fenhexamid	17	preventative, non-systemic	4 hrs	1 day	Use preventatively; do not exceed 3 applications per year; apply at 7-10 day intervals; treated tomatoes CANNOT be used for processing
Double Nickel	<i>Bacillus amyloliquefaciens</i> D747	biological	preventative, non-systemic		0 day	Use preventatively; apply at 3-10 day intervals from flowering to fruit maturity
Ferbam 76 WDG	ferbam	M3	preventative, non-systemic	until dry	1 day	Use preventatively
Fontelis SUS	penthiopyrad	7	Curative, locally systemic	Until dry	0 day	Use preventatively; apply at 7-10 day intervals; do not exceed 5.25 L/ha per crop season.
Prestop	<i>Gliocladium catenulatum</i>	biological	suppressive	4 hrs	0 day	Use preventatively before onset of disease or at first sign of symptoms; apply at 3-4 week intervals
Pristine WG	boscalid & pyraclostrobin	7 & 11	preventative, locally systemic	until dry	0 day	Do not exceed 1 application per crop cycle, use in rotation with other fungicides at 7-14 day intervals
Regalia	<i>Reynoutria sachalinensis</i> extract	natural product	suppressive	until dry	0 day	Use preventatively; do not exceed 2 application per crop cycle; use in rotation with other fungicides at 7-10 day intervals
Rhapsody ASO	<i>Bacillus subtilis</i> QST 713	biological	suppressive		0 day	Use preventatively before onset of disease or at first sign of symptoms; apply at 7-10 day intervals
Rovral	iprodione	2	preventative, non-systemic	12 hr	2 days	Use preventatively; no residue tolerance for export to USA
Scala SC	pyrimethanil	9	preventative, locally systemic	12 hrs	1 day	Use preventatively; do not exceed 1 application per crop cycle; use in rotation with other fungicides at 7-10 day intervals
StorOx	hydrogen peroxide	NC	suppressive	until dry	0 day	Use preventatively before onset of disease or at first sign of symptoms. Caution: toxic to bees & beneficial insects
Switch	cyprodinil & fludioxonil	9 + 12	preventative/ some curative action, locally systemic	1 day	1 day	Use preventatively; do not exceed 2 application per crop cycle, hence, use in rotation with other fungicides at 7 - 10 day intervals

¹REI - re-entry interval indicated on label

²PHI - pre-harvest interval

NC - not classified

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