

Botrytis Blight & Stem Canker of Greenhouse Tomato

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Biology & Disease Cycle

Grey mould (*Botrytis cinerea*) can be a serious problem on greenhouse tomatoes under cool and wet (high humidity) conditions. In British Columbia (B.C.), the fungus can cause serious damage to greenhouse tomato in early spring and late fall. *Botrytis* 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 peduncles (fruit stem) and leaf scars from pruning can often lead to stem canker, the most destructive stage of the disease resulting in substantial crop losses.

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

The most common and damaging infections take place through leaf-scars during de-leaving operation where *Botrytis* spores can remain dormant for 10 to 12 weeks. 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 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, growing media, on plant debris, perennial plants and weeds for several months or years.



Figure 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.



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



Figure 3. *Botrytis* infection on a tomato (var. 'Bizarr') leaf showing brownish-grey discoloration and withering.

Management of *Botrytis*

Prevention

- Follow overall biosecurity guidelines: Enforce strict biosecurity & phytosanitary measures as appropriate for the greenhouse operation. For details, refer to the Ministry's factsheets on "[Disinfection and Sanitation Practices](#)"
- Prevent initial infection and introduction of *Botrytis* into greenhouse: Enforce year-around sanitation practices and thorough year-end clean up (thoroughly disinfect greenhouse physical structures, machinery and tools between crop cycles).
- 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: 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.

Control

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:

- 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®) to prevent spores from dislodging into the air.
- 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 dumpsite for plant refuse.
- Treat *Botrytis* lesions on stems at a very early stage – scrape off the epidermal layer of the tissue and immediately apply an appropriate fungicide paste (e.g. Ferbam, see below).
- 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 towel/newspaper to reduce spore dispersal.
- 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 the 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). *Botrytis* spores can also spread by handling of infected plants and de-leafing of plants by the workers. Use hand-sanitizers as frequently as possible, particularly when de-leafing.

Apply 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 1); choose from different chemical groups for maximum efficacy for *Botrytis* control and to prevent the pathogen from developing resistance to a specific chemical.

To prevent resistance development in the pathogen to a specific fungicide:

- Do not apply a fungicide below recommended rate
- Always use fungicide at the recommended rate
- Do not apply a fungicide or the same group of fungicides repeatedly, rotate with different chemical groups.

Note: 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.

Table 1. A summary of registered chemical and biological bactericides and application information. Please refer to Health Canada's [Pest Management Regulatory Agency](https://www.hc-sc.gc.ca/pest/management-regulatory-agency) website for the manufacture's label and strictly follow the instructions as outlined on the label.

Product	Active ingredient	Chemical or biological group	Mode of Action	REI ¹ hrs	PHI ² days	Application guidelines
Ferbam	ferbam	M	protectant (non-systemic)	until dry	1	Apply preventatively
Rovral	iprodione	2	protectant (non-systemic)	12	2	Apply preventatively. No residue tolerance for export to USA
Fontelis	penthiopyrad	7	curative (locally systemic)	until dry	0	Apply preventatively at 7-10 days interval. Do not exceed 5.25 L/ha per crop season.
Pristine	boscalid & pyraclostrobin	7 & 11	Protectant & curative (locally systemic)	until dry	0	Apply in rotation with other fungicides at 10-14 days interval. Do not exceed 1 application per crop cycle.
Scala	pyrimethanil	9	protectant (locally systemic)	24	1	Apply preventatively in rotation with other fungicides at 14-day interval. Do not exceed 2 applications per crop cycle.
Palladium	cyprodinil & fludioxonil	9 & 12	protectant & curative (locally systemic)	1	1	Use preventatively in rotation with other fungicides at 7-10 days interval. Do not exceed 2 applications per crop cycle.
Decree	fenhexamid	17	protectant (non-systemic)	4	1	Apply preventatively at 7-10 days interval. Do not exceed 3 applications per year. Treated tomatoes CANNOT be used for processing.
Diplomat	polyoxin D	19	protectant (locally systemic)	-	0	Apply preventatively at 7-10 days interval. Do not apply more than 150 g a.i./ha/season.
PROBLAD	polypeptide	biological	protectant (non-systemic)	-	0	Apply preventatively at 7-10 days interval. Do not exceed 5 applications per season.
Double Nickel	<i>Bacillus amyloliquefaciens</i> D747	biological	protectant (non-systemic)	0	0	Apply preventatively at 3-10 days interval, from flowering to fruit maturity.

PreStop	<i>Gliocladium catenulatum</i>	biological	suppressive	4	0	Apply preventatively before onset of disease or at first sign of symptoms, at 3-4 weeks interval.
Regalia	<i>Reynoutria sachalinensis</i> extract	biological	suppressive	until dry	0	Apply preventatively, in rotation with other fungicides, at 7-10 days interval. Do not exceed 2 applications per crop cycle.
Rhapsody	<i>Bacillus subtilis</i> QST 713	biological	suppressive	until dry	0	Use preventatively before onset of disease or at first sign of symptoms at 7- to 10-day interval.
StorOx	hydrogen peroxide	NC	suppressive	until dry	0	Use preventatively before onset of disease or at first sign of symptoms. Caution: toxic to bees & beneficial insects.

¹REI - re-entry interval indicated on label

²PHI - pre-harvest interval

NC - not classified

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