Agriculture and Agri-Food Canada
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Blueberry

Diseases Guide

Canada

Blueberry Diseases Guide

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INTRODUCTION

The lowbush blueberry plant (*Vaccinium angustifolium, V. myrtilloides*) is susceptible to many diseases, some of which are more serious than others. Several diseases require intense management while others, do not significantly impact the crop and do not require any management efforts. An accurate diagnosis of a disease and its cause is therefore essential in making wise decisions on implementing control measures.

The purpose of this guide is to aid in the identification of diseases commonly found in lowbush blueberry fields in Eastern Canada and to assist in disease management decisions.

The shift away from burn pruning to flail mowing has resulted in an increased reliance on fungicides. While fungicides can be effective for managing many diseases, they need to be applied at the right time in relation to the life cycle of a pathogen. If they are applied too early or late, their effectiveness will not be realized. The increased use of fertilizer has also, in some cases, resulted in increased disease pressure. Provincial production guides should be consulted for recommended and timing of fungicides and appropriate use of fertilizers.

For more detailed information please refer to the manual “Diseases of Lowbush Blueberries and their identification” published by AAFC in 2016.

MONILINIA BLIGHT (MUMMY BERRY)

Latin Name:	*Monilinia vaccinii-corymbosi*
Importance:	High
Symptoms and time of appearance :	• Late May-early June – leaves wilt and mid veins of leaves become dark brown/black. Entire leaves and flower clusters quickly turn brown after initial symptoms. All infected tissue eventually falls off plant. • Disease often occurs in low lying areas. • August – infected berries become mummified. They first turn pink, tan then gray, are initially soft, then harden and fall to the ground.
Cycle:	• Spores are produced from overwintering mummy berries in early May and infect developing leaf and flower buds. • Secondary spores are produced on diseased leaves and flower clusters during bloom and are spread to healthy flowers by insects and wind. • Infected berries appear healthy until ripening when they become mummified. Mummy berries remain viable in the leaf litter for several years.
Control:	• Fungicides; first spray should be applied when 40-50% of buds reach the F2 stage (bud scale leaves beginning to separate giving the appearance of a crown) with a second application in 7-10 days. • Burn pruning destroys the mummy berries while flail mowing has no effect on them.

Refer to pages 7-9 in manual.

Fig. 1 – Blighted leaf shoots resulting from ascospore infections. Conidia are produced on diseased tissue.

Fig. 2 – Blighted flower clusters resulting from ascospore infections. Conidia are produced on diseased tissue.

BOTRYTIS BLIGHT (GREY MOLD)

Latin Name:	*Botrytis cinerea*
Importance:	High
Symptoms and time of appearance :	• Early-mid June – infected flowers turn brown and develop a whiskery fungal growth. • Infection may move from flower clusters into stem tips turning them brown. • Disease is often limited to distinct clones and so appears in patches throughout a field. • Berries may become infected which could be a concern for fresh marketing due to decay. • Often confused with *Monilinia* blight but easily identified by the whiskery appearance of the fungus on the dead flowers.
Cycle:	• Fungus overwinters in diseased blueberry and weed debris. • Spores are produced on debris beginning at early bloom and infect early flowering clones that act as an infection source for later flowering clones. • Spores are produced on blueberry flowers within only a few days after infection so the fungus may cycle many times if prolonged wet periods occur.
Control:	• Fungicides: first spray should be applied before forecasted wet weather beginning at midbloom and every 7-10 days until the end of bloom. • Burn pruning does not affect this disease.

Refer to pages 10-12 in manual.

Fig. 3 – Blighted flowers.

Fig. 4 – *Botrytis cinerea* producing spores on blighted flowers.

LEAF RUST

Latin Name:	*Thekopsora minima (*formerly *Pucciniastrum vaccinii)*
Importance:	High
Symptoms and time of appearance :	• Mid-late July – first symptoms appear as isolated red lesions on both leaf surfaces. • Yellow-orange blisters (pustules) form in the centre of the lesions on the undersurface of leaves. • Symptoms are more severe in sprout fields. • Late August-early September – lesions on leaves become numerous causing the leaf undersurface to be covered with yellow pustules. • Early September – defoliation becomes noticeable and clones may become completely defoliated.
Cycle:	• Fungus overwinters in diseased blueberry leaves. • Early June - spores infect developing Eastern hemlock needles, but symptoms are inconspicuous. • Late June-early July – spores produced on diseased hemlock needles infect blueberry leaves. • Number of lesions dramatically increases in August and September.
Control:	• Fungicides: a spray should be applied in sprout fields at the tip dieback stage of growth (mid-late July). • Burn pruning and cutting of nearby hemlock trees will not reduce the disease.

Refer to pages 13-14 in manual.

Fig. 5 – Red to brown spots occur on the upper leaf surface (left) and pustules (uredinia) that produce masses of yellow coloured spores (urediniospores) occur on the lower leaf surface (right).

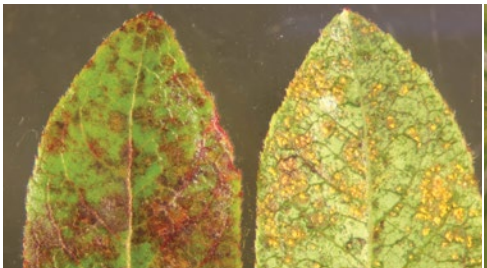


Fig. 6 – Fruiting bodies (aecia) containing masses of yellow coloured spores (aeciospores) on Eastern hemlock needles.

SEPTORIA LEAF SPOT AND STEM CANKER

Latin Name:	*Septoria spp.*
Importance:	High
Symptoms and time of appearance :	• Late April-early May – stem cankers appear on the lower half of fruiting stems as red/purple lesions that enlarge and the centres become sunken and turn brown. • Mid-late June – minute water soaked lesions appear on the undersurface of leaves of fruiting stems that are visible only with a hand lens. Over time the lesions increase in number, size and become slightly raised and visible to the naked eye. • Late July – spots begin to merge on leaf undersurface producing irregular shaped spots up to 5mm in size and turn brown. • Lesions penetrate the upper leaf surface and appear as red/purple spots with irregular borders. • Similar leaf symptoms occur on sprout stems, but only on the lower half. • Mid-August – difficult to differentiate this disease from leaf rust, powdery mildew or other leaf spotting pathogens.
Cycle:	• Fungus overwinters in leaf debris and in sprout stem tissues. • April-early May – infections that occurred in the sprout year develop into cankers on fruiting stems. • Late May-early June – spores are released from infected leaf debris and stem cankers by rain most intensively over a 3-4 week period beginning when 1-10% of flowers are open. • Leaf spotting appears 10-14 days following infection. • Mid-August – some fruiting clones may become severely defoliated.
Control:	• Fungicides: if this disease has previously caused severe premature leaf drop, a spray should be applied at 1-10% bloom. • Intensive and uniform burn pruning can reduce disease by destroying infected leaf debris.

Refer to pages 15-17 in manual.

Fig. 7 – Lower leaves of sprout stems are more diseased than upper leaves.

Fig. 8 – Advanced disease symptoms appear as irregular shaped brown spots on the leaf undersurface.

VALDENSINIA LEAF SPOT

Latin Name:	*Valdensinia heterodoxa*
Importance:	High
Symptoms and time of appearance :	• Early June – circular, brown lesions, up to 1 cm in diameter, with a dark brown or purple-red border appear on leaves of sprout and fruiting stems. • Infected leaves fall rapidly from stems while still green. • Lesions on green fruit are distinctly circular and sunken. • A single large spore may be visible in the centre of lesions with a hand lens. • First symptoms often appear in the shade of wooded areas of the field. • If disease is severe, localized areas of infection may merge resulting in large defoliated areas in fields. • Severely affected fruiting fields have poor yields while sprout fields may have reduced yields in the following year.
Cycle:	• Fungus overwinters in infected leaves and can survive for at least 2 years. • Early June – 2-3 days of continuous wetness release first round of spores which rapidly infect young leaves. Lesions reach 5-10 mm in 24-48 hours after which leaves begin to drop. • A further 48 hours of wetness restarts the cycle leading to multiple cycles of infection/spore production during a wet week. • As leaf tissues mature in July, disease slows and stops.
Control:	• Spores are easily spread from field to field by mechanical transfer on machinery, tires and footwear. Ensure machinery is power washed to remove all leaves and work diseased fields last. • Burning and fungicides may reduce disease – see manual for detailed practices. • Avoid over-fertilization of fields as the fungus is highly responsive to nitrogen levels in leaves.

Refer to pages 18-20 in manual.

Fig. 9 – Several large spots may appear on a leaf.

Fig. 10 – Spots on leaves and sunken spots on fruit.

POWDERY MILDEW

Latin Name:	*Microsphaera vaccinii*
Importance:	Moderate
Symptoms and time of appearance :	• Mid-late July – in susceptible clones the first symptoms of disease appear as small blotches of reddish discolouration on the upper leaf surface and may be confused with Septoria leaf spot, but the latter causes water soaked lesions on the leaf undersurface. • Blotches expand and may be covered with very fine white fungal threads visible with a hand lens. Small spherical yellow/black bodies of the fungus may also be observed on the leaf under surface. • Early-mid August – red discolouration becomes severe and leaf undersides may also turn red. Some clones may show mostly white fungal growth and little red discolouration. • By mid-August severely affected leaves begin to curl, turn brown and drop making it difficult to distinguish from Septoria leaf spot. • Can cause severe defoliation in both fruiting and sprout fields.
Cycle:	• Fungus overwinters in diseased leaf debris and possibly in buds. • First spores are released in June, but symptoms cannot be seen until mid-late July. • Many infection cycles can occur throughout the summer months. • Disease is present annually in most lowbush blueberry fields to some degree but severity is highly dependent on weather conditions. The fungus is favoured by long periods of warm, dry but humid weather, particularly in July. Rainy weather will inhibit the fungus.
Control:	• Fungicides have recently been approved and may be applied when symptoms first became visible. • Burn pruning does not affect this disease.

Refer to pages 21-23 in manual.

Fig. 11 – Severe powdery mildew symptoms on leaves.

Fig. 12 – Leaves covered with a white powdery fungal growth; leaves of some clones do not turn red.

RED LEAF

Latin Name:	*Exobasidium vaccinii*
Importance:	Moderate
Symptoms and time of appearance :	• Mid-late May – the disease may be observed as a reddish discolouration of young foliage, but it becomes conspicuous in June/July when the affected foliage turns bright red and stands out in contrast to lush healthy green foliage. • The leaf undersurface is often covered with a white fungal deposit. • The disease is most conspicuous in fruiting fields. • Late July-early August – leaves turn brown and fall from stems. • Berries on affected stems shrivel and drop.
Cycle:	• Fungus overwinters in affected rhizomes. • Once established, symptoms will occur annually in stems because the fungus grows systemically from the rhizomes. • Although the disease may be well established in some fields, it does not progress significantly from year to year.
Control:	• Disease management strategies are not available; fungicides are not effective. • Burn pruning will not control this disease because the fungus grows systemically within rhizomes below soil level and is protected from fire.

Refer to pages 24-25 in manual.

Fig. 13 – Bright red leaf symptoms in a fruiting field.

Fig. 14 – Undersurface of leaves covered with masses of white spores.

FALSE VALDENSINIA

Latin Name:	Unnamed species
Importance:	Moderate
Symptoms and time of appearance :	• Early June – circular brown lesions up to 1 cm diameter appear on leaves of fruiting stems. • Symptoms are almost identical to those of Valdensinia leaf spot, but lesions caused by False Valdensinia tend to remain brown whereas those caused by Valdensinia leaf spot tend to develop a lighter centre with time. • Defoliation is not as severe as with Valdensinia leaf spot. • If there are no signs of the large spore in the centre of a lesion typical of Valdensinia leaf spot, then the disease is likely caused by False Valdensinia. • Lesions on green fruit are dark brown and affected areas become sunken.
Cycle:	• Fungus overwinters in diseased leaves and produces spores in early June. • The number of infection cycles appears to be restricted because False Valdensinia does not spread rapidly unlike Valdensinia leaf spot.
Control:	• No disease control strategies have been studied, but it is believed that fungicides used for the control of Valdensinia leaf spot will also control False Valdensinia. • Burn pruning is likely beneficial for disease control.

Refer to pages 26-27 in manual.

Fig. 15 – Many leaves may be affected with several spots on a leaf.

Fig. 16 – Spots on fruit are dark brown and sunken.

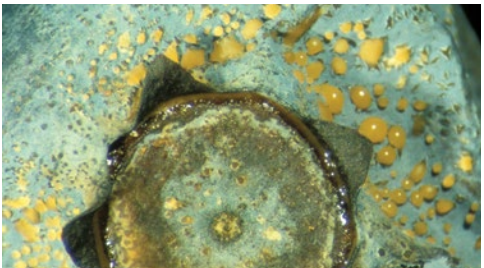
ANTHRACNOSE FRUIT ROT

Latin Name:	*Colletotrichum acutatum*
Importance:	Moderate
Symptoms and time of appearance :	• Late June – small, sunken, circular to angled spots with dark brown or blackened centres and red borders appear on leaves of fruiting stems. The lesions are small and often not noticed. • More noticeable symptoms occur as softening, shrivelling and slight sinking of the blossom end of ripe or nearly ripe fruit. • Under wet conditions, small droplets of salmon coloured ooze develop on infected berries. • This disease is becoming increasingly important.
Cycle:	• Fungus overwinters in blueberry debris. • Spores are first released during bloom and continue throughout the growing season and infect fruit at all stages. • Infection occurs during periods of rain. • In highbush blueberry, substantial losses can occur with prolonged periods of warm, wet weather during bloom and just before harvest.
Control:	• Disease management strategies have not been developed • Burn pruning is likely beneficial for disease control.

Refer to pages 28-29 in manual.

Fig. 17 – Infections on young leaves appear as small dark sunken spots with red borders.

Fig. 18 – Masses of spores (conidia) in salmon-coloured ooze on infected berries.



PHOMOPSIS CANKER

Latin Name:	*Phomopsis vaccinii*
Importance:	Low
Symptoms and time of appearance :	• Late June-early July – diseased stems have foliage that is orange-brown in colour and are relatively easy to identify against the green background of healthy stems and leaves. • Disease usually affects single stems scattered throughout a field, but sometimes can be more intense and affect many stems in small patches. • Phomopsis canker affects both fruiting and sprout stems.
Cycle:	• The fungus overwinters on dead stem tissue. • Infection occurs at the base of both fruiting and sprout stems during June.
Control:	• Disease severity in lowbush blueberry is usually low so specific control measures have not been necessary. • Burn pruning is likely beneficial for disease control.

Refer to pages 30-31 in manual.

Fig. 19 – Foliage on stems affected by Phomopsis canker turns reddish brown.

Fig. 20 – Basal cankers eventually cause entire stem to collapse.

GODRONIA CANKER (FUSICOCCUM CANKER)

Latin Name:	*Godronia Cassandrae*
Importance:	Low
Symptoms and time of appearance :	• Late May-early June – stem cankers appear on fruiting stems about midway up the stem and are almost always centred around leaf buds. • Cankers are orange-brown in colour, surrounded by a purple border. • Small black fruiting bodies of the fungus may be visible in the canker. • Leaf and flower buds above the canker are killed resulting in stem dieback. Leaf buds below the canker are not affected.
Cycle:	• Initial infections occur on sprout stems in early July when stems are about half grown. • The infections remain symptomless until the following spring.
Control:	• Burn pruning is beneficial for disease control.

Refer to pages 32-33 in manual.

Fig. 21 – Fruiting bodies (pycnidia) in canker surrounding a leaf bud.

Fig. 22 – Stem death occurs above a canker.

RED WART

Latin Name:	*Phomopsis spp.*
Importance:	Low
Symptoms and time of appearance :	• Late June-mid-July – small, raised, red coloured spots or warts appear on sprout stems. • September-October – the warts turn a red-brown colour, and some may split open longitudinally. • May and June of the following fruiting year, the centres of warts turn gray and splitting of the bark expands. • Late July, cracking of stems can be severe if they are covered with many warts. • Leaf undersurfaces may also become covered with red warts and foliage may drop.
Cycle:	• The fungus overwinters in diseased stems and leaves. • Spores are released during June in response to rain and infect sprout stems and foliage in fruiting fields. • Hot, dry weather causing moisture stress during July and August promotes drop of infected leaves and fruit.
Control:	• Burn pruning is likely beneficial for disease control.

Refer to pages 34-35 in manual.

Fig. 23 – Brightly coloured and raised Red wart lesions on sprout stems during early summer.

Fig. 24 – Severe defoliation caused by Red wart.

EXOBASIDIUM FRUIT AND LEAF SPOT

Latin Name:	*Exobasidium spp.*
Importance:	Low
Symptoms and time of appearance :	• Late June – appears initially as small scattered white to pale yellow circular spots on leaves in fruiting fields. • Attacks berries causing small, circular, firm spots that fail to ripen and remain green or pink. • Usually not observed in sprout fields.
Cycle:	• Fungus overwinters in leaf and berry debris. • Appearance of disease during late June indicates that infection occurs when leaves are young. • Appears to be more prominent following prolonged wet periods in June.
Control:	• Burn pruning is likely beneficial for disease control.

Refer to page 36 in manual.

Fig. 25 – White to pale yellow spots on leaves of fruiting stems.

Fig. 26 – Spots on fruit fail to ripen.

WITCHES' BROOM

Latin Name:	*Pucciniastrum goeppertianum*
Importance:	Low
Symptoms and time of appearance :	• Observed in fruiting fields beginning in June. • Infected shoots are swollen, turn reddish of yellow and have smaller leaves that eventually drop. • Stems turn brown and shiny, and eventually dry and crack. • The fungus stimulates production of multiple diseased shoots resulting in broomlike masses of shoots scattered throughout a field.
Cycle:	• During June, spores are produced on overwintered, diseased fruiting stems and are carried by wind and infect newly expanding balsm fir needles. • In late June-early July, the fungus produces small, white, cylindrical fruiting bodies on the undersides of needles, but these are difficult to detect. • From here, spores are carried by wind and infect blueberry sprout stems and the fungus grows systemically in the rhizome. • The fungus does not produce multiple infection cycles and so does not spread in fields. • Infected rhizomes eventually die.
Control:	• Witches' broom is not considered a serious disease and so development of control strategies has not been required. • Burn pruning does not reduce the incidence of diseased plants.

Refer to pages 37-38 in manual.

Fig. 27 – Symptoms of Witches' broom appear as thickened brown stems in a broomlike mass.

Fig. 28 – Fruiting bodies (aecia) containing white coloured spores (aeciospores) on the undersides of the needles of Balsam fir.

FALSE SEPTORIA

Latin Name:	*Mycocentrodochium spp.*
Importance:	Low
Symptoms and time of appearance :	• Late June – symptoms appear on leaves of fruiting stems as small red-brown spots that soon develop a tan coloured centre. • Outer borders of spots remain a red-brown to purple colour, with the centres becoming distinctly sunken. • Leaves usually become peppered with many spots. • Late July to early August – leaves begin to shrivel and drop.
Cycle:	• The fungus is presumed to overwinter in infected leaves. • Infection is presumed to occur in mid-June. • The disease occurs in small patches and does not spread.
Control:	• To date, the disease has been of little consequence and so management strategies have not been studied.

Refer to pages 39-40 in manual.

Fig. 29 – Spots on leaves of sprout stems caused by False Septoria.

Fig. 30 – Lesions on leaves are initially brown becoming tan coloured, distinctly sunken and surrounded by a red-brown to purple border.

Occurs during the winter months, during early spring before bud break or during the bloom period.

Winter Kill

- Occurs when the tips of overwintering sprout stems are not adequately protected by snow during low temperatures and high winds.
- Symptoms tend to be more prominent on knolls with less protection.
- Leaf and flower buds fail to develop and the bark eventually turns dark brown and dies.
- Symptoms occur at the same height on stems within affected areas of fields reflecting the level of snow cover at the time of injury.
- Winter kill can be reduced by planting coniferous trees around fields to trap snow and reduce damaging wind speeds.

Early Spring

- Early spring injury is associated with unusually low temperatures when the buds are beginning to swell, but before they crack open.
- Leaf shoots fail to expand and the growing point is blackened and flower buds fail to develop normally reducing numbers available for pollination.
- To determine if flower buds have been damaged, they can be cut longitudinally and observed for internal brown tissues.

Frost During Bloom

- Fully open flowers can tolerate light frosts of temperatures down to about -2 ^{0}C.
- Frost injury on flowers may appear only in low lying areas within a field.
- Affected corollas of flowers begin to shrivel and turn tan coloured and calyces turn purple. Within 24 hours, flowers turn fully brown and may appear as though they have been affected by Botrytis blight.

Refer to pages 41-42 in manual.

Fig. 31 – Winter kill appears as dark brown dead tissue at the tips of stems.

Fig. 32 – Corollas of open flowers affected by frost during bloom turn brown and calyces turn purple.

Blueberry

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