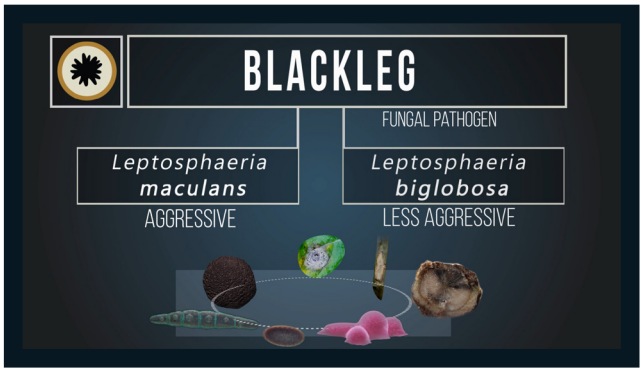
BLACKLEG MANAGEMENT GUIDE

CANADIAN EDITION

Blackleg is a serious canola disease that can cause significant yield loss when not properly managed. This disease requires an integrated management strategy that utilizes a range of tools to minimize the risk to canola. Work through these following four levels to understand your risk of blackleg damage and how to manage it.

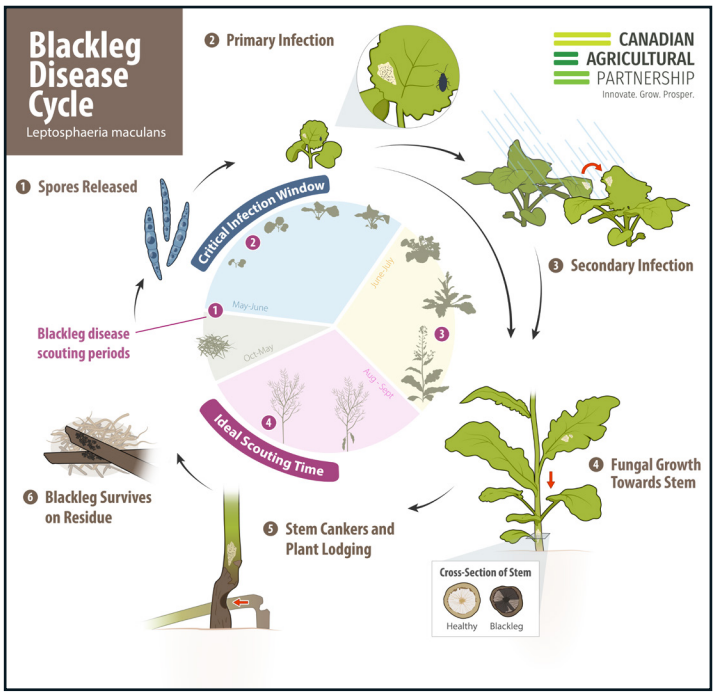
LEVEL 1: Understanding the disease

Blackleg disease of canola is caused by two fungal species, *Leptosphaeria maculans* and *Leptosphaeria biglobosa*. *Leptosphaeria maculans* is the aggressive species causing infection from the seedling stage onward. **The most critical stage of infection is the cotyledon stage** where the fungus moves into the stem base and progressively damages the crop by developing cankers and girdling stems, leading to yield loss. *Leptosphaeria biglobosa* is a less aggressive species that is often associated with upper stem lesions and doesn't typically contribute too much to yield loss in Canada.



LIFE CYCLE

The *L. maculans* fungus overwinters for several years on infected canola residue. In spring this fungus produces a spore-producing body or structure called **pseudothecia**, which produce air-borne ascospores that distribute the disease to newly planted canola. The blackleg fungus produces another type of fruiting body known as **pycnidia**.



Pycnidia appear as pepper-like spots within lesions or on canola residue. The pycnidia ooze masses of tiny spores called **pycnidiospores** that can be dispersed locally by rain splash and wind, causing a secondary infection within a crop. In general, this secondary infection is less important in Canada due to our shorter canola growing season.

The fungus typically enters the plant through the cotyledons and grows through the stem downwards, eventually leading to the most damaging phase of the disease, basal stem cankering. The cankering happens at ground level, where it restricts or halts moisture and nutrient supply to the plant, causing pre-maturing ripening or even plant death.

The earlier plants are infected, the greater the likelihood of severe canker development and yield loss. High levels of infection on the cotyledons can often be associated with greater yield loss; later infections cause less damage but will contribute to fungus inoculum (pathogenic material which has the ability to propagate) within the field, which can lead to high inoculum pressure in following years.

Pseudothecia on canola stubble.

Blackleg leaf lesion with pycnidia.

Blackleg stem cankering.

LEVEL 2: Determine the blackleg severity of a canola crop

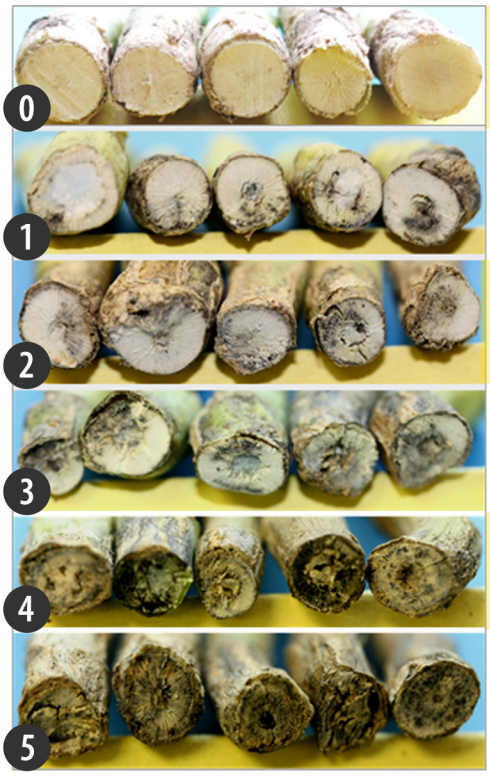
The best time to assess the level of disease in the current crop is at 60% seed colour change, right around swath timing.

To collect a representative sample, randomly pull up 100 plants or freshly cut stubble in a W-pattern across the field to assess for disease. Take a pair of clippers and clip at the base of stem/top of the root (into the root tissue) and look for blackened tissue.

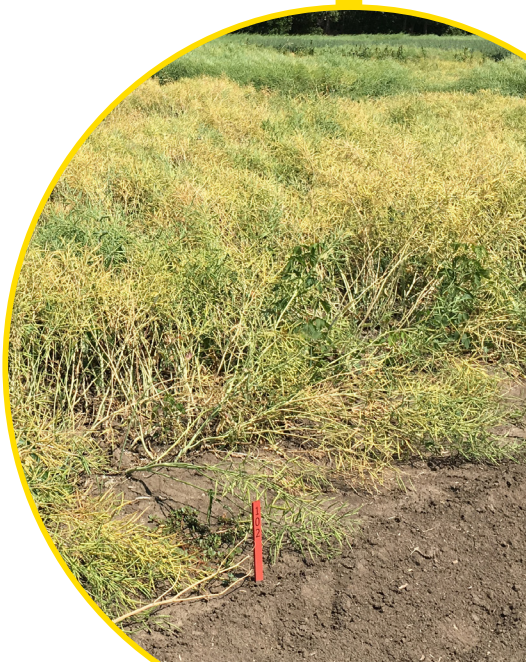
Rate plants on the basis of the amount of blackened tissue inside the root tissue using the 0-5 Blackleg Disease Severity Rating Scale **(pictured below)**.

BLACKLEG
Disease Severity Rating Scale

Blackleg severity is scored for each canola plant using the following scale based on the area of diseased tissue in the cross section



0	0: No diseased tissue visible in the cross section.
1	1: Diseased tissue occupies <25% or less of cross section
2	2: Diseased tissue occupies 26-50% of cross section
3	3: Diseased tissue occupies 51-75% of cross section
4	4: Diseased tissue occupies >75% of cross section with little or no constriction of affected tissues
5	5: Diseased tissue occupies 100% of cross section with significant constriction of affected tissues; tissue dry and brittle, plant dead



The severity of infection within the field will help to assess the effectiveness of the blackleg-resistant cultivar grown. This will impove the ability to make informed major gene deployment decisions, which can reduce potential yield loss and the risk level for growing canola the next time.

Substantial yield loss typically occurs in plants showing a disease rating of '2' or greater.

High-disease situations should consult levels 3 and 4 (below) for management strategies that will help to reduce the risk of blackleg in future canola crops.

LEVEL 3: Best management practices can reduce the risk of blackleg

If the previous canola crop was infected severely, resulting in yield loss from blackleg, the following practices should be considered to assess the risk and manage the disease.

Canola in rotation.

Tightened canola rotations allow for blackleg inoculum to build within the field. Extending canola rotations (greater than a two-year break from canola) will allow more time for inoculum levels to decline, as old canola stubble decomposes.

Scout for the disease.

Look for internal stem blackening at ground level during swathing or straight cutting, and for pseudothecia on previous year's canola residue prior to seeding. The presence of either will help determine the risk of infection in the next canola crop.

Field resistance used.

Plant either "Resistant" (R) or "Moderately Resistant" (MR) cultivars. Resistant cultivars outperform susceptible or bin run seed.

Resistance source rotation.

Rotate cultivars by their major blackleg resistance gene. Similar to herbicide group rotation, rotating blackleg major resistance genes will slow the *L. maculans* races from becoming resistant towards these genes. Use a *L. maculans* race identification test to determine predominant *L. maculans* races in the field to help match appropriate resistance sources.

Fungicide use.

The option to add a fungicide seed treatment is available for many canola cultivars. A seed treatment fungicide protects plants from blackleg when they are most susceptible. An early season foliar fungicide application can help to prevent yield losses if applied during the cotyledon to two-leaf stage. Later foliar applications can help to reduce the inoculum in the field.

LEVEL 4: Decoding blackleg resistance identification

Blackleg resistance is composed of two main components: major gene (seedling) resistance and quantitative (adult plant) resistance. Many cultivars on the market use both components to help manage blackleg.

Major gene resistance
is race-specific, meaning it needs to match the specific blackleg races within the field for a defense response in the plant to be induced. Once this happens, the plant stops the disease from spreading past the site of infection.

Quantitative resistance
is race non-specific, meaning it will help reduce the infection caused by any blackleg race within the field by slowing infection as it moves into or down the plant stem.

• Canola cultivars can have different combinations of blackleg resistance genes. Over time, growing cultivars with the same blackleg resistance genes can lead to changes (natural selection) in the blackleg pathogen's virulence (ability to cause disease), enabling it to overcome the resistance deployed in the cultivars. Rotation of cultivars with different resistance sources reduces resistance erosion and minimizes disease severity in your field.

• Blackleg resistance gene information enables producers to make better informed cultivar selection decisions.

Blackleg resistance labels can be composed of two parts: the existing field resistance label and a major gene resistance label which is voluntary for seed developers to apply to their cultivars.

Field resistance label

The R/MR/MS/S label on cultivars is based on the disease severity compared to the susceptible check cultivar, Westar.

Field resistance rating	% Disease severity of Westar
R (Resistant)	0-29.9
MR (Moderately Resistant)	30-49.9
MS (Moderately Susceptible)	50-69.9
S (Susceptible)	70-100

A major gene resistance group label

The resistance group labels identify the resistance group (RG) based on the major genes in a canola cultivar. It appears after the field resistance label in the two-part label. While 15 major gene resistance groups have been identified, currently only 10 are relevant to Canadian canola producers **(see table below).**

Resistance Groups	A	B	C	D	E_1	E_2	F	G	X
Major Gene	Rlm1 or LepR3	Rlm2	Rlm3	LepR1	Rlm4	Rlm7	Rlm9	RlmS or LepR2	unknown

Example of a blackleg resistance two-part label

TWO-PART LABELS AND THEIR MEANINGS:

Example 1 - Cultivar Alpha, with the label: R (BC)
Rated 'resistant' based on the blackleg field resistance rating of less than 30% severity; contains the major resistance genes Rlm2 and Rlm3

Example 2 - Cultivar Beta, with the label: MR (A)
Rated 'moderately resistant' based on the blackleg field resistance rating of 30-49.9% severity; contains the major resistance genes LepR3 or Rlm1

Example 3 - Cultivar Charlie, with the label: R (CX)
Rated 'resistant' based on the blackleg field resistance rating of less than 30% severity; contains the major resistance gene Rlm3 and a major resistance gene that was an unidentified at the time of labelling

How to use major gene resistance groups

STEP 01

Scout your field for blackleg and assess the level of infection.

- If many plants are infected (>30%) and blackleg severity appears to be high (average rating of 2 or greater) then proceed to **step 3**. If no infection, then proceed to **step 2**.

STEP 02

No need to make immediate changes to the current management techniques being deployed for the disease; continue vigilant scouting, as the disease pressure can rapidly change.

STEP 03

If high levels of blackleg were found in the previous canola crop, it may indicate high disease pressure and inadequate cultivar resistance. It is recommended to grow an R-rated cultivar with a different type of major gene resistance to combat the pathogen population in your field more effectively and for better stewardship. **(See examples below.)**

For example:

Previous crop with high infection was from a cultivar with resistance group(s):	Next canola cultivar recommended:	Try to avoid using cultivar from resistance group(s):
C	B, D, E_1, E_2, G,	C
AC	B, D, E_1, E_2, G,	A,C

ADDITIONAL CONSIDERATIONS:

- If the previous canola cultivar (which contained resistance group "C") had severe blackleg, a new cultivar with resistance groups "B" and "C" can be used successfully. This is because the resistance group "B" will still be functional even if resistance group "C" is not.
- Resistance groups E_1 and E_2, are sub-grouped because the genes can often be recognized by the same pathogen races in the field. So if used, it is recommended that the E_1 cultivar is grown first, followed by the E_2 cultivar, rather than the reverse (E_2 followed by E_1 cultivar).

For more information on blackleg checkout: www.Blackleg.ca