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Blackleg and its management in canola

DPIRD-60

Blackleg, caused by the fungus *Leptosphaeria maculans*, is the most common and serious disease of canola in Western Australia (WA). Blackleg can cause significant damage by infecting the cotyledons or first leaves early in the season, leading ultimately to crown lesions or cankers later in the season.

Changes in variety choice, crop rotation, earlier sowing times, and stubble retention have extended the risk of blackleg disease. Because of early emergence, later stages of crop growth are more likely to be exposed and infection can occur on all parts of the plant above ground, including canola flowers, stems, and branches (this is referred to as Upper Canopy Infection or UCI).

Diagnosis of blackleg in canola is available via our DDLS Plant pathology services, which is a chargeable service.

Symptoms

Blackleg is a sexually reproducing fungus that will overcome cultivar resistance genes. While crown canker is the most damaging form, blackleg also causes upper canopy infections, which may reduce grain yield.

Plant

- Infection at the seedling stage also causes symptoms (canker) seen at later growth stages.
- Cotyledons develop grey circular spots with pinhead-sized black fruiting bodies, then die prematurely.
- Infection spreads through the plant to the hypocotyl, which pinches off, causing plant death or ring-barks the stem, causing the top to snap off.
- Leaves have round to irregular creamy-grey lesions with black fruiting bodies. These also occur on varieties with minor gene or quantitative blackleg resistance.
- After stem extension, internal blackening at the base of the stem causes yield loss without external signs.
- With very severe infection, dark cracked cankers from internal infection cause plants to lodge, with premature death and shrivelled seed.
- White or grey round to linear lesions with black specks and a dark rim may occur on the surface of stems, branches, and pods.
- Pale lesions with a purplish rim on petioles cause pod death and may grow into the stem causing a lesion to form there.

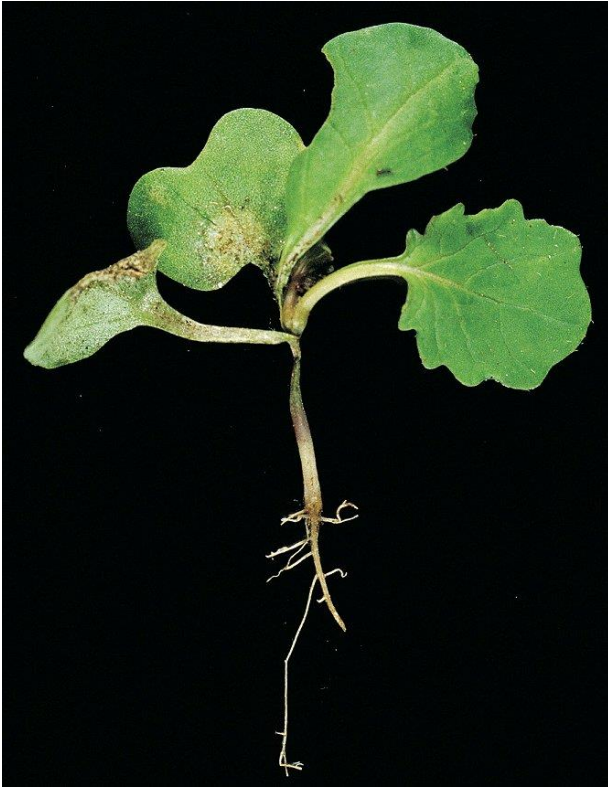


Image 1: Infection can spread from cotyledon of seedling leaf and pinch off the hypocotyl



Image 3: Mature canola pods with blackleg lesions. Seed underneath lesions may be absent (aborted) or shrivelled and will carry blackleg if retained for seed. Lesions are not always well correlated with grain yield losses from upper canopy infection blackleg, although they can cause premature shattering. Photo – Andrea Hills, Department of Primary Industries and Regional Development



Image 2: Upper canopy blackleg where a petiole infection has grown down into the main stem, causing a lesion, Photo – Andrea Hills, Department of Primary Industries and Regional Development

Paddock

- The most obvious symptom is plant death with lodging, and premature death after stem extension.
- Plants may be randomly distributed, or more affected in wetter areas or adjacent to canola stubble.
- From flowering onwards, stems, branches, and pods can develop dark lesions with a pale centre and black fruiting bodies.
- Flowers, pods, or flower spike may abort.

Background – where did it come from?

- Blackleg survives on canola stubble as black fruiting bodies that release large quantities of airborne spores after autumn and winter rainfall.
- Within 2 weeks of spores landing on canola cotyledons and young leaves, clearly visible off-white-coloured lesions develop fruiting bodies that release rain-splashed spores.
- Once the lesion has formed, the fungus grows within the plant's vascular system to the crown where it causes the crown of the plant to rot, and the plant may snap off and die.
- Less severe infection will result in a cracked canker at ground level that restricts water and nutrient flow within the plant, causing it to lodge and mature prematurely.
- Blackleg symptoms have also been found in the plant roots – this causes the entire plant to die prematurely.

Factors favouring disease risk and spread

- Several factors contribute to development of the disease:
 - the major source of primary inoculum is canola residue
 - the inoculum is also carried over by infected seed
- Seasonal conditions have a major influence on the level of disease.
- Rains in late autumn and throughout winter stimulate the release of blackleg spores from canola residue present on the surface of paddocks.
- Wet spring conditions can be conducive to aerial blackleg, which impacts flowers, stems, branches, and pods.
- Blackleg is spread primarily by wind, with the heaviest spore fallout normally occurring within 500 metres of any canola residue.
- Each year, canola residue continues to produce blackleg spores at a diminishing rate until the stubble has completely broken down. In WA, this breakdown could take up to 4 years.
- Long rotations are therefore recommended.

Biology

Seedling infection

- Blackleg can attack the crop at any stage, but early seedling infections are most critical in terms of the development of severe stem cankers.
- Stem cankers from blackleg infection on canola seedlings cause a constriction in the stem just below the first leaves but above the ground, leading to yield loss.
- Heavy seedling losses can occur under very high disease pressure and in environments that favour blackleg development. For example, where canola is planted on top of, or immediately downwind, of last year or the previous season's canola crop.
- The blackleg fungus can attack all aerial parts of the plant. However, it is the less obvious infection of the crown region (junction of root base and stem) that causes the largest grain yield loss from blackleg.
- Canola seedlings of many varieties are susceptible to blackleg until they achieve a degree of adult plant resistance, usually at about the 6-leaf stage. While leaf infection is the most obvious symptom, high levels of leaf infection after the 6-leaf stage do not necessarily indicate that major losses will occur from blackleg.



Image 4: Blackleg on canola stems, with presence of tiny pycnidia of the fungus. Photo – Ravjit Khangura, Department of Primary Industries and Regional Development



Image 5: Canola plant affected with blackleg at the crown region, which causes the largest grain yield loss from blackleg. Photo – Ravjit Khangura, Department of Primary Industries and Regional Development

Upper canopy infection

- The blackleg fungus can infect all aerial parts of the plant throughout the growing season.
- Upper canopy infection (UCI) is the collective term for blackleg flower, petiole, pod, main stem, and branch infection but does not include leaf lesions or crown canker.
- Important factors in the development of upper canopy infection are flowering time, seasonal conditions relating to spore development and release, infection events, variety resistance, and the interactions of these factors.
- Although infection of the crown is the most damaging phase of the disease, infection of the upper canopy can lead to severe yield losses.
- Stem and branch lesions are the most damaging, but pod lesions can impact yield.
- The extent of yield loss will vary by season and is still being studied as aspects such as variety resistance is under complex genetic control.

- Symptoms of upper canopy infection include the presence of abundant pycnidia (black specks) in affected plant parts. Lesions on the stems and branches are usually elongated with a dark margin and white centre with pycnidia. Occasionally, the entire flowering head is colonised by the fungus causing it to droop and shrivel.
- Effective major gene resistance provides control of upper canopy infection; if you see no blackleg lesions on leaves throughout the season, major gene resistance is likely to be active.
- Upper canopy infection is more often observed in canola varieties that have low to moderate resistance to blackleg and/or varieties that have recently been downgraded for resistance to blackleg.
- Upper canopy infection has been found to be more severe in crops that are sown in short canola rotations.



Image 6: Blackleg infection, with the presence of tiny pycnidia of the fungus, on a canola flower. Photo – Ravjit Khangura, Department of Primary Industries and Regional Development

Yield and quality losses

- Although infection of the crown is the most damaging phase of the disease, infection of the upper canopy can lead to severe yield losses.
- After stem extension, internal blackening at the base of the stem causes yield loss without external signs.
- With very severe infection, dark cracked cankers from internal infection cause plants to lodge, resulting in premature death and shrivelled seed.
- Stem and branch lesions are the most damaging, but pod lesions can impact yield.
- Yield losses from aerial (UCI) blackleg are most severe in early flowering crops.
- The extent of yield loss will vary by season and is still being studied, as variety resistance is under complex genetic control.

Monitoring

Growers are encouraged to monitor canola crops for blackleg from the end of flowering to windrowing/desiccation, because blackleg can overcome genetic resistance.

- It is important to monitor crops, because blackleg can overcome genetic resistance. Refer to guidelines in GRDC's Blackleg Management Guide (grdc.com.au).
- Sample crops for blackleg annually, from the end of flowering to windrowing (swathing).
- Pull 60 randomly selected stalks out of the ground, cut off the roots with a pair of secateurs and, using the reference photos in the Blackleg Management Guide, estimate the amount of disease in the stem cross-section.
- Yield loss occurs when more than half the crown cross-section is discoloured.

Managing blackleg in canola

Managing blackleg has the same underlying principles, regardless of the likely level of disease intensity.

Integrated disease management strategy

It is important to take an integrated approach and not rely only on the use of fungicides. Canola stubbles of any age are a source of inoculum.

Variety choice

- Choose the best adapted variety for your area with the highest level of blackleg/crown canker resistance.
- If you have grown the same cultivar for 3 years or more and suffered yield loss due to blackleg, choose to grow a cultivar from a different resistance group.
- In WA, Groups H and S are still effective in most regions. Groups A, B, and C are ineffective, and other genes vary by region.
- Apart from the major resistance groups, many varieties contain 'minor' (adult or quantitative) resistance genes that confer useful blackleg resistance but do not completely prevent symptoms from forming. Hence, these varieties may still form some blackleg lesions, but their effects are reduced. Monitoring crops at swathing/desiccation timing will assist growers to determine whether their variety has this type of resistance.
- The most current resistance ratings are published in GRDC's Blackleg Management Guide (grdc.com.au), updated in autumn and spring each year, and our BlacklegCM decision support tool, available on our website at dpird.wa.gov.au.
- Blackleg resistance groups for canola varieties are available in our current Western Australian crop sowing guide on the website at dpird.wa.gov.au.
- For both blackleg stem canker and blackleg upper canopy infection, growers should consider their varietal resistance levels before applying fungicides, as it may not be economical to spray varieties with high blackleg resistance level.

Paddock selection

- Choose the right paddock and minimise high disease risk situations.
- Avoid paddocks with recent canola residues, from the past one to 2 years.
- Maximise the distance between last year's infected residue and this year's crop - upwind is better.

Risk forecast

- Minimise the risk of seedling emergence and early seedling development coinciding with spore showers, if possible.
- Sowing early may help minimise blackleg canker but if flowering starts too early (June to mid-July) the crop may be exposed to aerial blackleg infection.
- Before seeding, check the latest Canola blackleg spore maturity forecast for your area of WA on our website at dpird.wa.gov.au.

Reduce canola residue

- Reduce existing canola residue by raking, burning, and/or burying (grazing can also be considered, but it is of limited value as the woody infected crowns are not eaten by stock).

Fungicides

- Crop protection fungicides are important tools for managing blackleg. Fungicides should be used wisely and where appropriate, as these are only a part of the overall risk management strategy against this disease.
- Relying only on fungicides to control blackleg creates a high risk of fungicide resistance developing.
- Use the BlacklegCM decision support tool to help you decide which blackleg crown canker treatments are economical under your circumstances.
- Use UCI BlacklegCM decision support tool, available at dpird.wa.gov.au, to help you decide whether a fungicide application at early flowering is likely to be economical for upper canopy blackleg management under your circumstances.

Seed dressings and in-furrow fungicides

For a list of available seed dressings and in-furrow fungicides, refer to the page, Seed dressing and in-furrow fungicides for broadacre crops in Western Australia, available dpird.wa.gov.au.

Foliar fungicides

For a list of foliar fungicides available for use in WA, refer to webpage, Registered foliar fungicides for broadacre crops in Western Australia at dpird.wa.gov.au.

Fungicide/chemical management

It is vital that product labels are read before application to ensure the chemical is registered for use on the crop and for the spectrum of diseases present, as well as the withholding period and any specific application instructions.

Be careful of tank mixes with other products. In some instances, fungicide sprays need to be mixed with an adjuvant (refer to label).

Chemicals at sowing

- Fungicide strategies to minimise canker infections include fungicide seed dressings and/or fungicide in-furrow treatments.

Foliar fungicides

- Foliar fungicide applications at the 4 to 6 leaf stages should not be necessary if other management guidelines are followed.
- Foliar fungicide application for managing blackleg upper canopy infection has highly variable responses.
- Research is in progress in Western Australia and eastern Australia under the GRDC funded National Canola Pathology project to investigate various strategies for controlling upper canopy blackleg infection.

Economic considerations of fungicide/chemical applications

- Consider whether sclerotinia is likely to be a risk in your crop as that may impact on potential economic returns from flowering fungicide applications.
- Situations where a susceptible variety has been grown on your farm for more than 3 years and the crop is flowering in early July, are conducive to upper canopy infection of blackleg and economic returns.

Factors to consider when deciding on fungicide applications

Reduce the risk of fungicide resistance

Fungicide resistance develops from misuse of fungicides and poor disease management practices. It is vital to adhere to fungicide resistance management guidelines to manage the disease and prolong the use of registered fungicides.

Reduce the risk of fungicide resistance developing by:

- growing varieties less susceptible to disease (where available)
- applying integrated disease management
- strategic and responsible use of fungicides by rotating and mixing fungicides with different modes of action.

For more information on how fungicide resistance develops, where it is occurring, and what you can do to avoid the risk of it developing in your crops go to the Australian Fungicide Resistance Extension Network (AFREN) website.

Poor disease control after fungicide/chemical application

Blackleg strains with reduced sensitivity to the DMI (Group 3) fungicides are known to exist, although their impact at the field level is unknown. Where fungicide failure is suspected, stubble from the previous year's crop can be submitted for experimental testing to help assess whether this is the case. To discuss this, contact one of our officers below.

Contact us

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More information

[2024 Western Australian crop sowing guide](#), by Brenda J. Shackley, Stacey Power et al. (dpird.wa.gov.au)

[Blackleg Management Guide](#) | Grains Research and Development Corporation (grdc.com.au)

[Fungicide resistance](#) | Australian Fungicide Resistance Extension Network (afren.com.au)

Refer to the department website at dpird.wa.gov.au for more information about the following:

- BlacklegCM decision support tool
- UCI BlacklegCM
- Canola blackleg spore maturity forecast for Western Australia
- Registered foliar fungicides for broadacre crops in Western Australia
- Seed dressing and in-furrow fungicides for broadacre crops in Western Australia

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