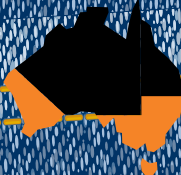


# DISEASES OF CANOLA AND THEIR MANAGEMENT



# THE BACK POCKET GUIDE

# INTRODUCTION

This *Back Pocket Guide* highlights a number of canola diseases. Canola can be infected by a number of pathogens in Australia that cause root rots, leaf diseases and crown to stem infections. Their presence and severity are dependent on plant susceptibility, presence of the pathogen and favourable climatic conditions. Generally, fungal diseases such as blackleg and Sclerotinia are more damaging in higher rainfall regions, but if unseasonably high rainfall occurs in lower rainfall regions these areas may also experience high disease levels.

Disease control varies for each pathogen but generally variety resistance, crop production practices and fungicides are used either in isolation or combination to reduce economic losses. If growers are aware of the disease risks in their area and follow strategic management plans they should be able to adequately control most canola diseases.

[www.grdc.com.au/GRDC-BPG-CanolaDiseases](http://www.grdc.com.au/GRDC-BPG-CanolaDiseases)

## COMMON CANOLA DISEASE DIAGNOSTIC KEY

Plant growth stage	Plant part infected	Possible disease
Seedling	roots hypocotyl leaves	damping-off blackleg blackleg, white leaf spot, downy mildew
Rosette	roots crown leaves	damping off, blackleg, clubroot blackleg blackleg, white leaf spot, downy mildew, white rust
Flowering	roots crown leaves stem & branches	blackleg, clubroot blackleg blackleg, Alternaria, white leaf spot, white rust Alternaria, blackleg, Sclerotinia
Podding	roots crown stem & branches pods	blackleg, clubroot blackleg Alternaria, blackleg, Sclerotinia Alternaria, blackleg, white rust

# Blackleg

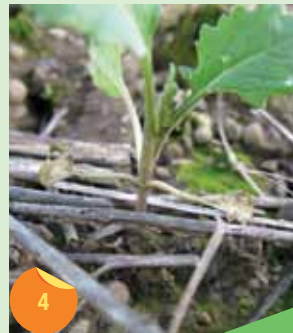
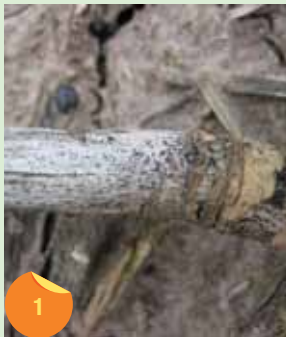
## INTRODUCTION

Blackleg is caused by the fungus *Leptosphaeria maculans* and is the most serious disease of canola in the medium to high rainfall production areas of Australia. Although not common, yield losses of 50% and greater have been recorded. Where cultivar blackleg resistance has been overcome up to 90% yield loss has been documented.

Blackleg is challenging to control:

- it is a sexually reproducing pathogen that will overcome cultivar resistance genes;
- fungal spores are released from canola stubble and the disease is more severe in areas of intensive canola production; and
- spores are spread extensively and quickly via wind and rain splash.

- 1 Blackleg fruiting bodies on stubble that produce wind-borne spores.
- 2 Blackleg lesions containing fruiting bodies (black dots).
- 3 Stem canker can kill the plant or cause partial restriction of the vascular tissue.
- 4 Seedling infection causes stem canker in adult plants.



## SYMPTOMS & DISEASE CYCLE

- Blackleg survives on canola stubble and produces fruiting bodies that contain large quantities of airborne spores (capable of travelling several kilometres).
- Autumn and winter rainfall triggers spore release from the fungal fruiting bodies.
- Within two weeks of spores landing on canola cotyledons and young leaves, visible off-white coloured lesions develop. These lesions produce pycnidial fruiting bodies (dark coloured dots), which release rain-splashed spores.
- Once the lesion has formed, the fungus grows within the plant's vascular system to the crown. The fungus causes the plant's crown to rot, resulting in a canker.
- Less severe infection can still result in the restriction of water and nutrient flow within the plant.
- Blackleg symptoms can also be found in plant roots. In severe cases the fungus will cause the entire plant to die prematurely.
- Management practices to control crown rot blackleg are the same for the root rot form of the disease.



Blackleg resistance breakdown in canola.

# MANAGEMENT

## STEP 1: DETERMINE IF YOUR FARM IS IN A REGION OF HIGH BLACKLEG RISK

**TABLE 1 REGIONAL BLACKLEG FACTORS**

Environmental factors that determine risk of severe blackleg infection	Blackleg severity risk factor								
	High risk			Medium risk			Low risk		
Regional canola intensity (% area sown to canola)	above 20	16-20	15	11-14	11-14	10	6-9	5	below 5
Annual rainfall (mm)	above 600	551-600	501-550	451-500	401-450	351-400	301-350	251-300	below 251
Total rainfall received March–May prior to sowing (mm)	above 100	above 100	above 100	above 100	91-100	81-90	71-80	61-70	below 61

Combined high canola intensity and adequate rainfall increases the probability of severe blackleg infection.

## STEP 2 DETERMINE EACH PADDOCK'S BLACKLEG SEVERITY

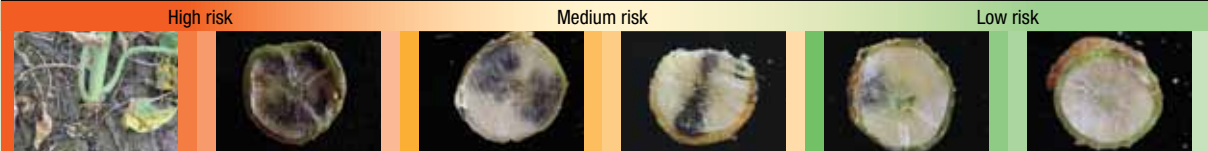
- Assess the level of disease in your current crop. At post-flowering pull 50 randomly chosen stalks out of the ground, cut off the roots with a pair of secateurs and, using the reference photos in Table 2 below, estimate the amount of disease in the stem cross-section. Yield loss occurs when more than half the cross-section is discoloured.
- Stem cankers are clearly visible at the crown of the plant. Severe cankers may cause the plant to fall over as the roots become separated from the stem.
- If you have identified that you are in a high-risk situation (Steps 1 and 2), use Steps 3 and 4 to reduce your risk of blackleg for future seasons.

PHOTO: STEVE MARCROFT



Cut a plant at the crown to assess internal infection.

**TABLE 2** PADDOCK BLACKLEG SEVERITY



Yield loss occurs when more than half the cross-section is discoloured.

## STEP 3 MANAGEMENT PRACTICES CAN REDUCE THE RISK OF BLACKLEG INFECTION

If your crop monitoring (see Step 2) showed yield loss in the previous year, the following practices can be used to reduce blackleg severity. Complete the following process for each canola paddock to be sown.

**WARNING: 'Canola on canola' will cause a significant yield loss and will reduce the effective life of canola cultivars and fungicides.**

**BLACKLEG MANAGEMENT PRACTICES THAT DETERMINE RISK OF BLACKLEG INFECTION, FROM HIGHEST TO LOWEST EFFECTIVENESS, ARE:**

**1. BLACKLEG RATINGS** The cultivar blackleg rating is the most important blackleg management tool. If your previous crop had a high level of disease, choose a cultivar with a higher blackleg rating.

High risk			Medium risk			Low risk		
VS	S-VS	S	MS-S	MS	MR-MS	MR	R-MR	R

VS = very susceptible; S = susceptible; MS = moderately susceptible; MR = moderately resistant; R = resistant

**2. DISTANCE FROM LAST YEAR'S CANOLA STUBBLE** The distance of your current crop from last year's canola stubble will determine disease severity. NEVER sow your canola crop into last year's canola stubble. Distances from last year's stubble up to 500m will reduce blackleg severity.

High risk			Medium risk			Low risk		
0m	100m	200m	300m	400m	500m	>500m		

**3. FUNGICIDE USE** Seed dressing and fertiliser-applied fungicides will reduce the level of blackleg infection. Foliar fungicides used in addition to seed/fertiliser fungicides will further reduce the level of blackleg. Fungicides are not a cure for blackleg. Fungicides should only be used where yield loss from blackleg is likely. If severe yield loss is likely, fungicides will reduce, but not avert, yield loss.

**Reliance on fungicides to control disease poses a high risk of fungicide resistance.**

Medium risk			Low risk		
No fungicide			Seed/fertiliser fungicide	Seed/fertiliser fungicide + foliar fungicide	

In addition, consideration should be given to the following:

#### 4. YEARS OF SAME CULTIVAR SOWN

#### 5. DISTANCE FROM TWO-YEAR-OLD CANOLA STUBBLE

#### 6. CANOLA STUBBLE CONSERVATION

#### 7. MONTH SOWN.

Please refer to the Blackleg Management Guide fact sheet – [www.grdc.com.au/GRDC-FS-BlacklegManagementGuide](http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide) for this information.

## STEP 4 BLACKLEG RESISTANCE GROUPS

All cultivars have been placed into groups (A-G) based on their resistance complement (see Blackleg Ratings – [www.grdc.com.au/GRDC-FS-BlacklegManagementGuide](http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide)). Some cultivars may belong to multiple groups. The blackleg fungus will most likely overcome resistance if cultivars with the same resistance complement are sown in close proximity for three years or more. By rotating resistance groups growers can avoid resistance breakdown and reduce disease severity.

**WARNING: Cultivar rotation is not a silver bullet against the disease; extreme disease severity such as ‘canola on canola’ will cause significant yield loss and will reduce the effective life of canola cultivars**

## HOW TO USE BLACKLEG RESISTANCE GROUPS:

- Use Steps 1 and 3 to identify if you are in a high risk region (adequate rainfall and high canola intensity) and monitor your crops to determine if blackleg is severe.
- If blackleg is not severe in your crop continue with current management practices as outlined in Step 3.
- If you have high blackleg severity and have used the same cultivar for 3 years or more:
  - Identify the resistance group of your current cultivar from the Blackleg Ratings – [www.grdc.com.au/GRDC-FS-BlacklegManagementGuide](http://www.grdc.com.au/GRDC-FS-BlacklegManagementGuide).
  - Select a cultivar from a different resistance group. If your current cultivar belongs to multiple groups do not choose a cultivar from any of these groups.



Canola infected by blackleg.



# Sclerotinia stem rot

## INTRODUCTION

The disease sclerotinia stem rot is caused by the fungi *Sclerotinia sclerotiorum* and *S. minor*. These fungi infect many broadleaf plants, including canola, peas, beans, lupins, sunflowers, pasture species and weeds. Cereal crops and grass weeds do not host the disease. The fungi can be soil-borne or carried with seed. In Australia, the disease is highly sporadic, requiring specific environmental conditions to develop; disease incidence can vary greatly from year to year, but is most damaging in prolonged wet conditions leading up to and during flowering.

The sporadic nature of the disease and its severity means that it is difficult to reliably make foliar fungicide application decisions. Several forecasting tools developed overseas have been evaluated in Australia, but were found to be inappropriate due to differences in climate and length of flowering. Yield loss is difficult to predict, but can be more than 24% under Australian conditions, depending on the percentage of plants infected and the crop growth stage when infection occurs. Current management options before sowing are limited to sowing clean seed, isolating canola from last year's infected paddocks, and crop rotation. The use of foliar fungicides at flowering is the only management option post-sowing.

Canola stems infected by *Sclerotinia* showing formation of the bleached stem lesions.



## SYMPTOMS & DISEASE CYCLE

- Sclerotinia survives as hard, black bodies resembling rat droppings called 'sclerotia' (see Figure 1).
- Sclerotia germinate in moist soil and form golf-tee-shaped fruiting structures, which release airborne spores in late winter.
- The spores infect and colonise flower petals under humid conditions. When infected, flower petals senesce and fall, some will become stuck against the main stem or side branches. These infected petals can spread the infection to the stem and adjoining side branches.
- Initial symptoms appear as water-soaked, light-brown coloured lesions on the stems or leaves, which expand and become greyish-white (see Figure 2).
- Where a lesion girdles the main stem, the plant quickly wilts and dies prematurely.
- Infected plants ripen earlier and stand out among green plants.
- Bleached stems tend to break and shred.
- In wet or humid weather, a white growth resembling cotton wool can appear on infected plant tissue (see Figure 3).
- Sclerotes can also develop on the surface of infected tissue (see Figure 3).
- The sclerotia will later be released onto the ground during harvesting or collected in the harvested seed.



- 1 Sclerotia commonly occur inside the stem within the pith. Slice stems open to confirm if sclerotia are present.
- 2 Typical Sclerotinia infection at the junction between the side branch and the main stem. Note that the plant is healthy below the infection point.
- 3 Sclerotinia growth resembling cotton wool. Sclerotia can also survive on the outside of the stem.

## WARNING SIGNS

The following conditions result in high Sclerotinia risk:

- growing in a high rainfall area (especially if the crop has been sown early at high seeding rates).
- growing in low-lying parts of the landscape, such as the floor of a valley, which stay wetter for longer than nearby hill slopes.
- intensive rotation with other broadleaf crop species, including summer crops of sunflowers and soybeans.
- Sclerotinia has been present within the past three years in the paddock or an adjacent paddock.

The following conditions favour a Sclerotinia outbreak in canola. All three must occur for infection to take place:

1. Wet soil conditions for at least 10 days in mid to late winter and temperatures of 11°C to 15°C to germinate sclerotia and trigger spore release.
2. Extended wet periods during flowering for petal infection.
3. Extended wet periods during petal fall allowing infected petals to cause stem rot infection. Stem lesion development is favoured by humid/wet conditions and mild temperatures (20°C to 25°C).

## MANAGEMENT OPTIONS

### BEFORE SOWING

#### 1. Clean seed

Sow only good quality seed that is free of sclerotia. If using 'farmer saved' seed for sowing it should be graded to remove any sclerotia. Carefully inspect seed before sowing. Ungraded seed used for sowing can inadvertently transfer sclerotia into the soil, which can later initiate the disease.

#### 2. Crop isolation and rotation

Avoid sowing canola into or next to paddocks that were heavily infected with Sclerotinia in the previous three years. The spores become airborne and will be blown some distance into surrounding paddocks. Although rotation does not effectively control Sclerotinia, close rotation of susceptible crops such as lupins may increase fungal inoculum build-up. In addition, it is preferable that crops be sown on the western side or 'up wind' from old canola stubbles.

#### 3. Wider row spacing and seeding rate

The use of wider row spacings and lower seeding rates can increase ventilation within the crop canopy's microclimate and reduce moisture retention. Avoid the temptation to sow crops at high seeding rates and follow the recommended plant population targets for your region.

## AFTER SOWING

### 4. Consider fungicide use

If favourable environmental conditions occur (see 'Warning signs' on page 11), fungicides are the only available option for managing sclerotinia stem rot after sowing. A number of products are currently registered in Australia to manage sclerotinia stem rot in canola.

Due to the sporadic nature of the disease it is uneconomical to apply fungicides routinely. To be effective they need to be applied before the plant becomes infected. This can be difficult as fungicides should be applied before petal infection occurs.

Research has shown that strategically applied foliar fungicides (1 or 2 applications) can be effective in reducing the level of sclerotinia stem rot and subsequent yield loss in crops with a high yield potential and at high risk of developing the disease.

If you decide to spray, the current recommendation is to apply a foliar fungicide at flowering where 20% to 30% of the canola flower buds have opened. A second foliar spray may be required 10 days later if favourable conditions for disease persist. If the crop is not growing in a Sclerotinia-prone area, fungicide application is unlikely to be economic.



Sclerotinia infection in canola.

# Alternaria leaf and pod spot (BLACK SPOT, DARK LEAF SPOT, ALTERNARIA BLIGHT)

## INTRODUCTION

Alternaria is usually caused by the fungal pathogen *Alternaria brassicae* and occasionally by *A. brassicicola*. Canola cultivars are more resistant to *A. brassicicola*. The severity of the disease varies between years and locations depending on seasonal conditions. The disease is favoured by warm, humid conditions during spring. Yield loss is unusual and is normally associated with premature shattering of infected pods. If infected seed is sown, seedling blight may occur (refer to 'Damping-off' section, see page 15).



1



2

- 1 Alternaria lesions on the leaf (note target-like rings).  
2 & 3 Pod lesions that can lead to premature pod shattering.

PHOTOS: STEVE MARCROFT, H. RAMAN



3

## SYMPTOMS

- *Alternaria* infects canola plants at all growth stages.
- Plants from mid-flowering onwards are more susceptible to infection.
- *Alternaria* symptoms are found on all parts of the plant – leaves, stems and pods.
- Spots on leaves and pods have a concentric or target-like appearance and are brown, black or greyish-white with a dark border (see Figure 1).
- Lesions on green leaves can be surrounded by a chlorotic (yellow) halo (see Figure 1).
- Severe pod infection may cause seed to shrivel and pods to ripen prematurely and shatter (see Figure 3). These symptoms are similar to those of blackleg and it can be difficult to distinguish between the two diseases.
- Stem spots are elongated and almost black.

## DISEASE CYCLE

*Alternaria* spp. survive the intercropping period on infected canola stubble, on cruciferous weeds and, to a lesser extent, on seed. Seed infections can cause seedlings to rot (refer to 'Damping-off' section), resulting in a seedling blight that reduces plant establishment. Initial crop infections are caused by wind-blown spores. Spores remain intact

on susceptible plants until moisture from dew or rain allows them to penetrate into the tissue and cause a lesion. These lesions produce further spores and infections that can then be spread throughout the crop by rain splash. Mild, humid conditions favour disease development and the disease cycle will continue throughout the season under favourable conditions. Hot and dry conditions interrupt epidemics as the absence of moisture greatly reduces spore production. Major outbreaks are not common in Australia as weather conditions are normally hot and dry throughout podding, which is unfavourable for prolonged infection.

## MANAGEMENT

- *Alternaria* is very common in canola crops but is not usually severe enough to warrant control.
- In Australia, there are no registered fungicide seed treatments for *Alternaria*.
- If pods were infected in the previous season, obtain fresh disease-free seed.
- In areas where *Alternaria* is a problem, select paddocks isolated from last year's canola stubble as *Alternaria* spores are easily transported by wind and can spread into areas that have not had canola for several years.

# Damping-off (SEEDLING BLIGHTS AND SEEDLING HYPOCOTYL ROT)

PHOTO: M. BARBETTI

## INTRODUCTION

Damping-off is usually caused by the fungus *Rhizoctonia solani*. However, other fungi, including *Fusarium* spp., *Pythium* spp., *Phytophthora* spp., and *Alternaria* spp., can also cause damping-off. Symptoms and crop management are similar for all these pathogens so they are grouped together and the disease referred to as "damping-off".

All species are common inhabitants of the soil and cause damage when conditions are not ideal for early seedling growth, especially where emergence is slow or root growth restricted. Problems are usually seen when seed is sown dry, close to the autumn break (within a couple of weeks of a normal break) or if weather conditions become cool and damp. Yield loss is unusual unless plant numbers are severely reduced or patchy establishment occurs.



1

1 Seedling (left) has damping-off symptoms.  
2 Infected seedlings that survive may be stunted and flower prematurely.

PHOTO: STEVE MARCROFT



2

## SYMPTOMS

- Damping-off symptoms vary: they range from pre-emergence rot (failure of plants to emerge) to post-emergence damping-off (plants emerge and collapse at ground level).
- Affected plants are normally stunted and may flower and mature prematurely (Figure 2).
- Canola plants post seedling stage are not adversely affected by damping-off.
- Pre- and post-emergent damping-off occurs in patches and can spread quickly under cold, wet conditions.
- Leaves affected by post-emergent damping-off may be discoloured, turning orange, purple and/or chlorotic.
- The tap root can appear dark in colour and shrivelled at ground level.
- Do not confuse these symptoms with insect damage where root tissue has been removed.

## DISEASE CYCLE

Damping-off fungi are soil-borne and survive in the soil by forming resistant resting structures when no host is present. These resting structures germinate with the break of the season and the fungi grow through the soil until they find a susceptible host plant. Dry seeds

become vulnerable to attack as soon as they begin to germinate. Once in the plant the fungi multiply, causing decay that damages or kills the seedling. Damping-off fungi are usually weak pathogens only able to infect young succulent tissue. At the two to four leaf stage canola roots become woody enough to withstand further infections. Therefore, most damage occurs when wet and cold weather slows plant growth. Temperature and soil moisture affect disease development. Loose, cold and dry soils favour *Rhizoctonia solani*, while cold, damp soils favour *Fusarium* spp. and wet, heavy soils favour *Pythium* spp.

## MANAGEMENT

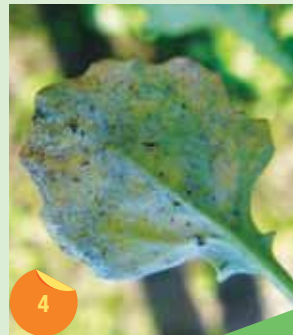
- Yields are only affected when plant numbers are severely reduced. If seedling loss is uniform throughout the crop, surrounding plants can often compensate by growing larger. If seedling loss is patchy and large areas die then re-sowing may be required.
- Damping-off fungi will germinate with the opening rains of the season. Once they have germinated they are very successfully controlled by soil tillage. Therefore dry-sown or crops sown very close to the opening rains may be more severely affected. If crops are re-sown, the sowing tillage will generally control the fungi.
- Application of seed fungicide treatments at sowing can reduce damping-off damage.



# Downy mildew

## INTRODUCTION

Downy mildew is a common disease of canola throughout the world and is caused by the fungus *Peronospora parasitica*. Infection occurs under cool, moist conditions where leaves or cotyledons are in contact with the soil or other leaves. Although seedlings can be severely attacked by the disease, significant yield loss does not usually occur. Downy mildew is rarely found beyond the rosette stage and crops normally grow away from it with the onset of warmer weather.



- 1 & 2 Upper side of leaf with chlorotic yellow areas.  
3 As the leaf ages the whole leaf becomes yellow with small brown lesions.  
4 Underside of leaf with typical mealy, white, hyphal growth.

PHOTOS: M. BARBETTI, STEVE MARCROFT

## SYMPTOMS

- First visual symptoms are chlorotic or yellow spots appearing on the upper leaf surface of young seedlings when cotyledons or the first true leaves are present (see Figures 1 & 2).
- Infected cotyledons tend to die prematurely and downy mildew can kill seedlings through defoliation (although this is rare and depends on seasonal conditions).
- Appearance of grey, mealy, fungal growth on underside of the leaf beneath these spots (see Figure 4).
- As disease develops the individual spots join up and form large irregularly shaped blotches (see Figure 2).
- These necrotic lesions can cause part of the leaf to dry, with the upper leaf surface turning a yellow/red colour (see Figure 3).

## DISEASE CYCLE

The fungus is both soil and seed-borne and can persist in the soil for a long time. Infection is favoured by cool, wet weather and, under ideal conditions, new infections can develop in as little as 3 to 4 days. The fungus is related to white rust, with specialised spores (oospores) responsible for primary infections. Conidial spores produced on the underside of the infected leaf are then responsible for the secondary spread of the disease.

## MANAGEMENT

- Downy mildew does not usually affect yield so control measures are not generally warranted unless plant densities are severely reduced on a regular basis.
- In areas where downy mildew is a severe problem, fungicides containing copper as the active ingredient are registered for use in Australia.
- Crop rotation and the control of cruciferous weeds between canola crops can reduce disease severity.

# Viruses

## INTRODUCTION

There are three important viruses of canola in Australia – beet western yellows virus (BWYV), cauliflower mosaic virus (CaMV) and turnip mosaic virus (TuMV). Infection with BWYV is common and all plants may become infected. TuMV and CaMV tend to occur at low incidences. Yield loss studies in Australia have shown that where aphids spread BWYV virus at the seedling growth stage, yield loss was up to 46% and reduced oil quality. Overseas studies indicate TuMV and CaMV can also cause significant yield losses.

## SYMPTOMS

- Infection with BWYV causes plant stunting and purpling or reddening of lower leaves (see Figure 1).
- CaMV causes stunting, yellow ring spots and mottling (see Figure 2).
- TuMV causes stunting and mosaic patterning, which is sometimes associated with necrotic spotting (see Figure 3).

- 1 Symptoms of beet western yellows virus (BWYV).
- 2 Turnip mosaic virus causes distorting of leaves and plants.
- 3 Mottling of leaves caused by cauliflower mosaic virus.

PHOTOS: R. JONES, DAFWA



## DISEASE CYCLE

These viruses are not seed-borne. They survive in weeds or volunteer canola host plants outside the growing season and are then spread from these infected plants into crops by aphids, which act as vectors for transmission of these viruses. BWYV is mainly transmitted persistently by the green peach aphid. Persistently transmitted viruses are carried within the aphid's body and retained there throughout the aphid's life. CaMV and TuMV are non-persistent and are transmitted by many aphid species. They are retained in the aphid mouthparts for short periods and lost when the infective aphid feeds on healthy plants.

Autumn is the most critical period for infection, so the earliest-sown crops usually have the highest infection incidence. BWYV causes most yield loss in crops that have been infected as seedlings. Infections can occur past the rosette growth stage of canola with little effect on yield.

## MANAGEMENT

- Control broadleaf weeds (especially over summer) as they act as reservoirs for the viruses.
- Retain stubble at sowing to cover the ground, this reduces the ability of aphids to land on young canola plants, thereby reducing virus spread.
- Sow at recommended times; earlier sown crops usually have a greater incidence of viral infection.
- Seed dressing with imidacloprid insecticide will kill the green peach aphid vector and greatly reduce BWYV spread. However, commercial seed dressing procedures may not treat all seeds, resulting in poor aphid control.
- Insecticide seed dressing application does not control the spread of CaCMV or TuMV by aphids.
- Most Australian canola varieties carry strain-specific TuMV resistance genes, which greatly limit the incidence of this virus.

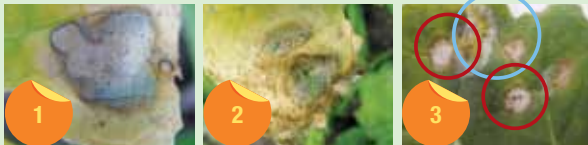
# White leaf spot

## INTRODUCTION

White leaf spot is caused by the fungus *Mycosphaerella capsellae* (also called *Pseudocercospora capsellae*). The disease has a worldwide distribution and a wide host range among cruciferous weeds. In Australia, white leaf spot commonly infects canola seedlings. It is not usually severe enough to cause yield loss.

## SYMPTOMS

- Leaf, stem and pod lesions are greyish-white to light brown in colour (see Figure 1).
- Unlike blackleg, white leaf spot lesions do not contain pycnidial fruiting bodies (black dots). See Figure 3, the blue circle is white leaf spot and the red circle blackleg lesions.
- Leaf lesions often have a brown margin when mature, can be up to 1 cm in diameter and often join to form large, irregular-shaped lesions (see Figure 1).
- Nutrient-deficient canola crops can be more severely affected by white leaf spot (see Figure 2).
- In severe epidemics, infections can defoliate susceptible varieties.



PHOTOS: STEVE MARCROFT

- 1 Mature white leaf spot lesions often have a brown margin, are up to 1 cm in diameter and join to form large, irregular-shaped lesions.
- 2 White leaf spot can more severely affect nutrient-deficient canola crops.
- 3 Typical white leaf spot lesion (red circles) and blackleg leaf lesions (blue circle). Note the white leaf spot lesions have no small black spots (fruiting bodies).

## DISEASE CYCLE

The fungus survives on canola stubble as thick-walled mycelium. When prolonged wet-weather conditions prevail, autumn/winter wind-borne spores are produced that cause primary leaf lesions on canola. These initial lesions go on to produce rain-dispersed spores that cause the rapid spread of the disease throughout the crop. The disease is not usually seed-borne but can be spread by infected seeds or infected debris with the seed.

## MANAGEMENT

- White leaf spot infection is not usually severe enough to warrant control.
- Crop rotation and isolation from the previous year's canola stubble will reduce infection from wind-borne spores.
- Control cruciferous weeds and volunteer canola.
- Provide adequate nutrition to reduce crop stress.

# White rust or staghead

## INTRODUCTION

White rust is caused by the fungus *Albugo candida*. The disease is uncommon on *Brassica napus* (Australian canola varieties) but does infect *B. juncea* (juncea canola).

## SYMPTOMS

- White to cream coloured pustules under the leaves and on floral parts.
- The pustules rupture the host epidermis exposing a white chalky dust.
- Infected areas appear on the upper leaf surface.
- Systemic infections of the growing tips and flowers develop into stagheads, which appear as swollen, twisted and distorted flowerheads that produce little or no seed and become brown and hard as they mature.
- Do not confuse white rust symptoms with those of a severe calcium deficiency, which can also cause the flowering stalks to collapse, resulting in the withering death of the flowerhead.

Distinctive white rust (staghead) on *B. juncea* plant.



## DISEASE CYCLE

Resting spores (oospores) of the fungus can survive in infected plant material or as a seed contaminant for many years when conditions remain dry. When conditions become moist the resting spores are able to directly infect plants. However, they usually produce tiny motile spores that can swim in free water to infect seedlings, causing cream-white pustules to form. Inside the pustules new swimming spores are formed and then distributed throughout the canopy by rain splash to form secondary infections. They do this by growing through stomata into adjacent cells, causing systemic infections and subsequent stagheads if the growing tips of plants become infected. The resting spores can be formed in any infected tissues but are present in larger numbers in stagheads. When the crop is harvested, stagheads break and release resting spores, which contaminate harvested seed or blow out to contaminate the soil.

## MANAGEMENT

- Obtain seed from disease-free or low-disease crops.
- Control cruciferous weeds.
- Extended rotations will allow crop residues to decompose and reduce the risk of infection.
- If warranted, consider growing *B. napus* rather than *B. juncea*.

# Clubroot in canola and juncea canola

## INTRODUCTION

Clubroot is caused by the soil-borne fungus *Plasmodiophora brassicae*. The disease occurs worldwide and only affects plants in the Cruciferae family, including canola, juncea canola (mustard), cabbage, cauliflower, Brussels sprouts and broccoli. In Australian vegetable brassicas clubroot is widespread and causes significant yield losses. The Australian oilseed industry has been somewhat protected from clubroot as the major production areas for vegetable and oilseed brassicas are usually separated from one another. In addition, most Australian pathotypes of clubroot are only able to cause disease in the warmer months and require irrigation water for dispersal. However, in recent years clubroot has been found in canola crops throughout the growing regions of Western Australia.

## SYMPTOMS

- Typically, swollen, galled roots on infected plants; these can appear as tiny nodules up to large, club-shaped outgrowths.
- Galls at the beginning are firm and white but then become soft and greyish brown as they mature and decay.
- Affected roots have an impaired ability to transport water and nutrients.



Canola roots with severe clubroot infection.

PHOTO: STEVE MARGROFT

## DISEASE CYCLE

Resting spores of the fungus can survive in soil for many years, even in the absence of a susceptible host. Infection can occur at any stage of growth but is restricted to the roots. The spores germinate and release tiny motile spores that swim in free water to the surface of the rootlets, penetrate and form a fungal colony (plasmodium) inside the root cells. The fungus causes cells to enlarge and divide rapidly, resulting in the characteristic galls. Late in the season, resting spores develop in the infected roots and are released into the soil as the galls decay. Paddocks become infected mainly by the movement of soil on cultivation equipment and by seedling transplants.

## MANAGEMENT

In the Australian vegetable brassica industry several methods of control have been developed that may be useful for oilseed brassicas.

- Five-year rotation – infected fields are kept free of susceptible crops and weeds for at least 5 years to allow sufficient natural decay of the long-lived spores.
- Equipment movement: Do not move cultivating equipment from infected to non-infected areas before thoroughly cleaning the equipment.
- Currently Australian cultivars are not resistant, but resistant cultivars are available overseas.

**Disclaimer:** Any recommendations, suggestions or opinions contained in this publication do not necessarily represent the policy or views of the Grains Research and Development Corporation (GRDC). No person should act on the basis of the contents of this publication without first obtaining specific, independent professional advice. The Corporation and contributors to this Back Pocket Guide may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well as or better than those specifically referred to. The GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication. will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

**Caution: Research on unregistered pesticide use** Any research with unregistered pesticides or of unregistered products reported in this document does not constitute a recommendation for that particular use by the authors or the authors' organisations. All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

**Copyright:** © All material published in *The Back Pocket Guide* is copyright protected and may not be reproduced in any form without written permission from the GRDC.

March 2013

## GRDC

Grains  
Research &  
Development  
Corporation

Your GRDC working with you

Maureen Cribb,  
GRDC Publishing Manager

T: 02 6166 4500 E: [maureen.cribb@grdc.com.au](mailto:maureen.cribb@grdc.com.au)

Diseases of Canola and their Management  
Back Pocket Guide is part of a series  
of Back Pocket Guides published by  
the GRDC.

Photos courtesy GRDC unless  
otherwise specified.

**GROUND COVER DIRECT** How to order

Free phone 1800 11 00 44 Free fax 1800 00 99 88

Email [ground-cover-direct@canprint.com.au](mailto:ground-cover-direct@canprint.com.au)

Post Ground Cover Direct is PO Box 7456, Canberra MC, ACT 2610

For a complete listing of all GRDC publications, go to [www.grdc.com.au/bookshop](http://www.grdc.com.au/bookshop)

Production and design by Coretext

T: 03 9670 1168 [www.coretext.com.au](http://www.coretext.com.au)

coretext

GRDC Grains Research &  
Development Corporation  
Your GRDC working with you

