

AUGUST 2018



MANAGING THE RISK OF REDBACK SPIDERS IN BROCCOLI CROPS

INTRODUCTION

Since 2016 there have been numerous customer complaints about redback spiders (*Latrodectus hasselti*) in broccoli. Complaints have mainly come between January and June, and from customers in all Australian states. This suggests that this is not an issue for a single production area, but can occur anywhere that broccoli is grown.

Redback spiders are clearly unacceptable to consumers, and also pose risks to growers, pickers and packers.

Despite their fearsome reputation, redback spiders are generally timid. They are nocturnal, travel only short distances and need protection from wind, rain and extremes of temperatures. Broccoli crops are not their usual habitat.

This Fact Sheet summarises what we know about the risk of redback spiders contaminating broccoli.

LIFE OF A REDBACK SPIDER

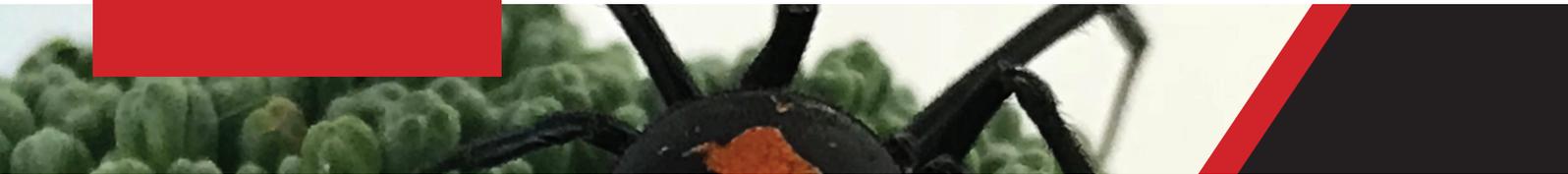
Developing to maturity

Redbacks can reproduce anywhere where daily temperatures are $>15^{\circ}\text{C}$ for three months or more. Temperatures of 25°C to 30°C are optimal. Under these conditions tiny spiderlings can grow into mature females within **6 to 8 weeks**. Maturation is slower at 15 to 25°C and effectively stops at 10°C or less.

In redback spiders the differences between the sexes are extreme. Females can be 50 times larger than the tiny, brownish coloured males.

Males usually only live a few months, whereas female spiders can live for 12 months or more if conditions are good. The population peaks at the end of summer, after which many of the mature females die.

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Juvenile female – Ed Nieuwenhuys, Sydney.



Mature female – Greg Anderson, Stirling Ranges WA.



Mature male – Beth Shaw, Perth.

Reproduction

Redback populations can increase rapidly. Females are able to lay up to 16 egg sacs during a season, although most will produce 4-7. Each egg sac contains around 150 eggs, of which ~75% emerge as spiderlings. **A well-fed female redback can therefore produce 430-800 spiderlings over summer.**



Female with egg sac and smaller male – E. Nieuwenhuys.

The eggs are surrounded by a thick layer of water-repellent silk, which protects them from changes in temperature and humidity and keeps them dry.

Dispersal

Many species of spider initially disperse by “ballooning”, where young spiderlings are carried to new areas on the wind.

Redback spiders do not commonly spread through ballooning. Without human help, redback colonies expand by 0.1-0.3km/year. Spiders cover these distances simply by walking. Roads, rivers and cleared areas can therefore act as natural barriers to spread of redback spiders.

The majority of long-distance spread occurs due to human movement. Redbacks readily hitchhike on vehicles, construction materials, equipment or other goods.

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Habitat

Redback spiders prefer undisturbed and well-sheltered sites, protected from temperature extremes as well as wind and rain. They are legendary for being found in outdoor toilets, a habit long popularised in Australian folklore.

There is a strong association between redbacks and humans. The expansion in built environments has allowed them to increase their range and population. Redbacks are mostly found places like drains, parking lots, cemeteries, public facilities, sheds, electrical boxes etc.

They are less common in natural areas, although they can be found hiding under rocks and logs, or sheltering inside disused rabbit holes. Dense patches of plants such as yucca can also provide the dry, sheltered environment they need.

Redbacks are occasionally found in crops such as cotton. Related black widow spiders have been found in Californian table grapes, with the result grapes must be fumigated before export to Australia. Redbacks are also sometimes found in table grapes, probably because rain covers provide the hot, dry environment they prefer.

There are several reports of redbacks living under pumpkins. It's possible they can also colonise other cucurbits, such as watermelons. The combination of dense foliage and under-fruit protection effectively provides redbacks with dry, sheltered spots to live.

Webs

The webs of redbacks have specific features that make them relatively easy to distinguish from those of other types of spiders:

- Redbacks are ground dwellers, so the web often contacts the ground
- As they are nocturnal, they spend the daytime in a "retreat" connected to and above the main web
- Redbacks make "tangle webs", which have a few sticky strands at the base, and tangled mass above
- Webs often contain leaves, sticks and dried

cadavers of prey, as redback spiders don't clean their webs (unlike most other species)

- Their webbing is relatively strong, so does not break easily when touched

Redback webs should not be confused with those of house spiders or daddy long legs, both of which are also found in sheltered locations. House spiders make untidy, lacy sheets, with funnel like retreats formed inside the web. Daddy long legs make untidy, fragile webs. They are often found within the web, which they shake violently if disturbed. Daddy long legs will kill and eat redbacks, so they are not usually found together.

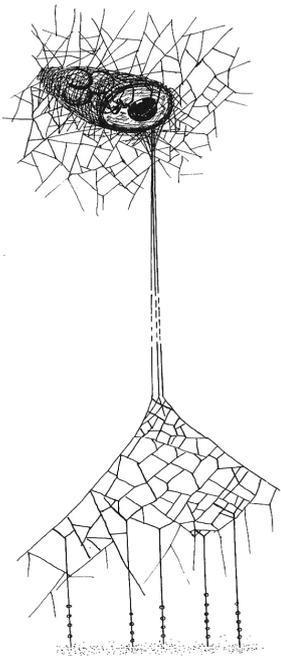
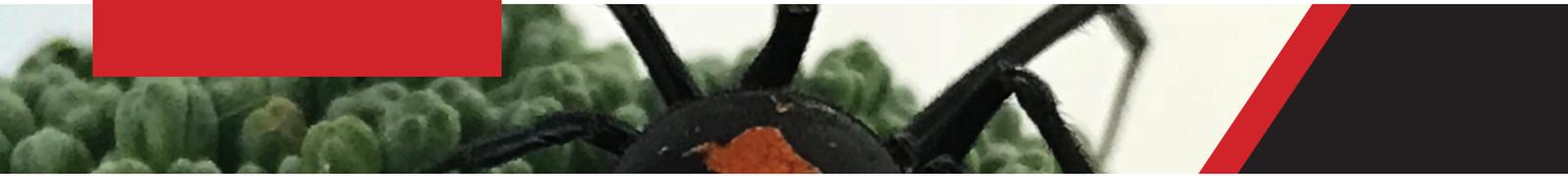


Redback webs often contain leaves and debris, as well as old insect cadavers, as they do not clean their webs.



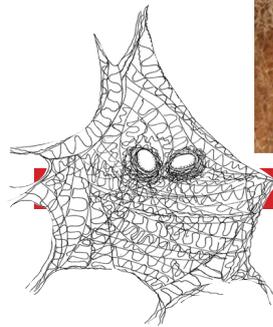
The retreat of a redback living inside an electrical box, complete with egg sacs.

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REDBACK SPIDER WEB

Structure (left, from B. York Main) and tangle web (above) of a redback spider.



HOUSE SPIDER WEB

Structure (left, from B. York Main) and web (above) of a house spider.

Prey

The majority of the diet of redbacks is ground-dwelling beetles. They will also attack millipedes, slaters, flies and even tiny lizards and mice that become snared in their webs.

Beetles, millipedes and other ground dwellers are not



Redback spider web containing millipedes, beetles, a bush cockroach and even another spider.

usually considered significant horticultural pests, so may not be controlled by pest management programs. Moreover, the warm, dry conditions that favour growth of redbacks also increase insect populations.

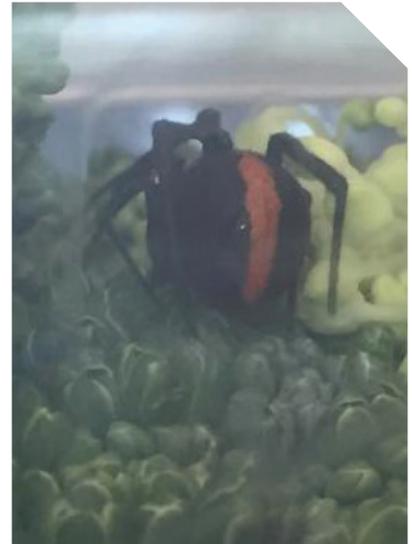
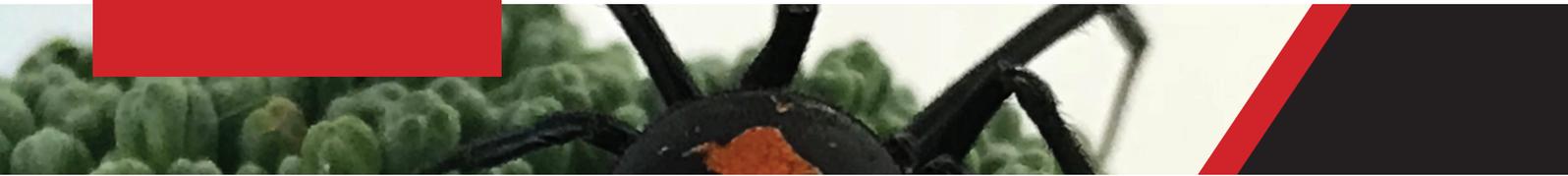
Distribution and survival

Redback spiders are now found in New Zealand, Iran, Japan and even Belgian greenhouses. This is thought to be due to their ability to hitchhike on and inside shipping containers and exported goods. Most outbreaks are associated with ports.

This spread is partly due to redbacks' ability to survive extremes of temperature as well as long periods without food or water. They can live without food for four months at 10°C, or six weeks at 25°C. Provided with shelter, redbacks can also survive winter temperatures falling to -3°C, and remain active at 40°C during summer.

Redbacks can easily survive the times and temperatures involved in broccoli supply chains.

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Images of spiders in broccoli, taken by consumers in April 2016 and 2017.

REDBACKS IN BROCCOLI

Detections

There are no official records of redback spiders in broccoli crops, and growers who have searched for them have failed to find any. This doesn't mean they are not there, but does suggest they are very uncommon.

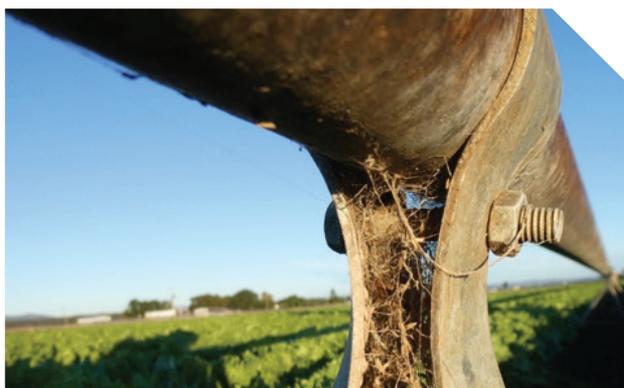
Redbacks are occasionally found in broccoli heads after harvest, either during packing or by consumers preparing them for a meal. Most finds have been between January and June, with peak months in April and May. This is unsurprising, as this is when redback populations are highest.

Quite apart from negative media, redback spiders in broccoli pose a number of risks, as detailed in the table **below**.

RISK	IMPACTS	LIKELIHOOD
Worker bitten by redback spider during harvest / packing	Variable and potentially severe effects lasting 1 to 7 days, worker time off and compensation.	Moderate to low – workers wear gloves and boots
Redback spider found in broccoli displayed at retail	Possible product withdrawal, loss of reputation and sales.	Low
Redback spider found by customer when taking broccoli out of the fridge	Major loss of reputation and sales due to wide negative reporting on social media and news services.	Low
Redback spider bites customer when taking broccoli out of the fridge	Variable effects ranging from increasing localised pain for approx. 24 hours to nausea, severe sweating, intense referred pain in other parts of the body and other effects lasting up to a week.	Very low – Spider inactive while cold so unlikely to bite
Redback spider bites customer during preparation of broccoli		Low
Redback spider accidentally eaten by customer	Negligible; the proteins in venom are denatured by heating and/or destroyed by low pH in the stomach.	Very low

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Spiders can potentially move around the farm on irrigation equipment.



Plastic bins used during harvesting could introduce redback spiders into the crop or directly onto picked product.

Risk factors

It is not known how or why redbacks get into broccoli, only that they are occasionally found in broccoli heads after harvest.

- Redback spiders can enter broccoli crops by being carried in on equipment such as irrigation pipes, machinery, seedling trays or harvest bins.
- Cross-contamination may be more likely if equipment used for broccoli was previously used for growing and harvesting cucurbits.
- Bins and equipment that have been sitting undisturbed for several weeks are more likely to have been colonised by spiders.
- High populations of potential prey (e.g. millipedes, ground beetles) could support redback spider survival and breeding in cropping areas.
- Spider discoveries appear to correspond with hot, dry summers, which are likely to lead to spikes in population.

Pictures of redback spiders in broccoli posted on social media appear to show newly mature females, perhaps 2–4 months old. However, no webbing is visible in these photos. This suggests that the spider was not living in the broccoli head in the field, but entered at

or after harvest. For example, it is easy to imagine a scenario where a spider living on the bottom of a plastic harvest bin crawls into picked broccoli after it is moved into a cold room.

REDBACK SPIDERS LIVING ON HARVEST BINS COULD POTENTIALLY CONTAMINATE BROCCOLI AT HARVEST

Control strategies

Chemical

There are a number of broad-spectrum insecticides registered for use on broccoli crops with active ingredients that *may* control redback spiders. However, they are not registered for this purpose. Application of these products to control spiders would be an off-label use pattern and therefore illegal.

In any case, application of a broad-spectrum insecticide to kill redback spiders in broccoli is not recommended. There are likely to be extremely few, if any, spiders within the crop. Moreover, such sprays will strongly disrupt existing IPM programs. This therefore appears an inefficient control strategy.

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PESTICIDES REGISTERED FOR CONTROL OF SPIDERS ON EQUIPMENT INCLUDE:

- **Bifenthrin** (e.g. Kenso Agricare, Terminate 80 SC)
- **Chlorpyrifos** (e.g. Chlorban 500 EC)
- **α -cypermethrin** (e.g. Fendona)

The best use of insecticide/miticide is to control redback spiders in potential harbourages and on equipment and machinery for growing broccoli.

There is very limited information on the effects of various pesticides on redback spiders. However, products registered for controlling spiders which contain a synthetic pyrethroid (e.g. permethrin),

Physical

The best way to avoid contamination of broccoli by redback spiders is to stop them entering the crop in the first place. Ensuring equipment, machinery and bins used for broccoli are free of spiders and egg sacs is key to preventing contamination.



Electrical boxes, piles of disused materials, and irrigation pipes can make good habitat for redbacks.



THE BEST WAY TO KEEP SPIDERS OUT OF AN AREA IS NOT TO BRING THEM IN.

organophosphate (e.g. diazinon) or fipronil as the active ingredient are most likely to be effective against adult spiders. Efficacy generally ranges from 70–100%.

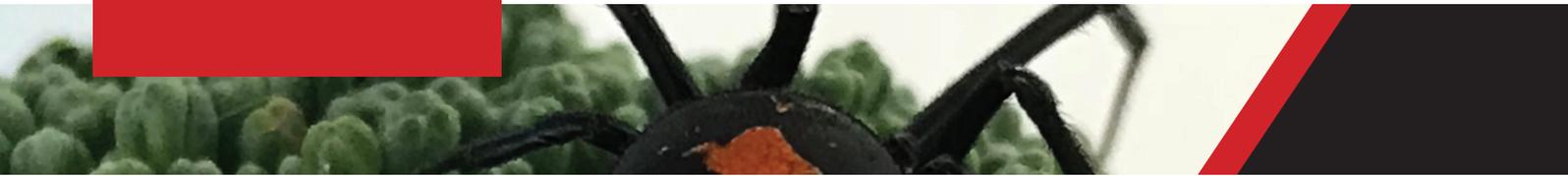
The effects of pesticides are likely to be reduced if spiders are protected by their webbing. This effect is strongest for egg sacs, which are protected by a thick layer of waterproof silk. Pesticides formulated in oil are far more effective against eggs than the same products formulated in water.

Webbing may also be dissolved using chlorine compounds (e.g. bleach), but care needs to be taken not to damage equipment with the strong concentrations required.

Removing or cleaning sites that provide habitat for redback spiders – such as piles of building equipment, disused machinery, pump houses and farm sheds – will help prevent local populations from increasing and spreading.

If redback spiders were present in the crop grown prior to broccoli, such as a summer planting of pumpkins before autumn broccoli, then crop residues should be thoroughly ploughed in before re-planting. Redback spiders will die if their shelter is destroyed and they are left exposed.

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Strategies to reduce the risk of redback spider contamination of broccoli

STEP	INPUT / HAZARD	RISK REDUCTION
CLIMATE ↓	<ul style="list-style-type: none"> Weather 	<ul style="list-style-type: none"> Contamination less likely during cool, wet weather
SITE HISTORY ↓	<ul style="list-style-type: none"> Previous crops grown e.g. cucurbits Adjacent crops 	<ul style="list-style-type: none"> Clean site thoroughly if previous crop provided potential harbourages for spiders Apply broad spectrum pesticide pre-planting if spiders present
SITE PREPARATION ↓	<ul style="list-style-type: none"> Nearby habitat, shelters Crop residues Pre-planting herbicides Irrigation type 	<ul style="list-style-type: none"> Keep crop edges clear Till to eliminate protected sites in-field Apply product that includes surfactant Overhead (not drip) irrigation; clean irrigation pipes before transfer to crop area
PLANTING ↓	<ul style="list-style-type: none"> Equipment Seedling trays 	<ul style="list-style-type: none"> Vehicles and planters cleaned before use Check for spiderlings under seedling trays
SPRAYING ↓	<ul style="list-style-type: none"> Equipment Chemicals used 	<ul style="list-style-type: none"> Vehicles and equipment kept physically clean Application of broad spectrum insecticide / miticide (e.g. a synthetic pyrethroid or organophosphate) to equipment, machinery and harbourages
HARVEST ↓	<ul style="list-style-type: none"> Bins Machinery 	<ul style="list-style-type: none"> Plastic harvest bins pressure cleaned inside and out Machinery cleaned before use
COOLING ↓	<ul style="list-style-type: none"> Cooling method Other stored products 	<ul style="list-style-type: none"> Hydro-cooling / vacuum cooling MAY reduce risk Broccoli bins not stored alongside potentially contaminated products
PACKING	<ul style="list-style-type: none"> Packing materials Packing line and equipment Product inspection 	<ul style="list-style-type: none"> Packing materials exclude spiders Facilities well managed and clean Staff trained to look for redbacks during packing