WHEAT CURL MITE
FACT SHEET

GRDC Grains Research & Development Corporation

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A tiny mite that spreads wheat streak mosaic virus

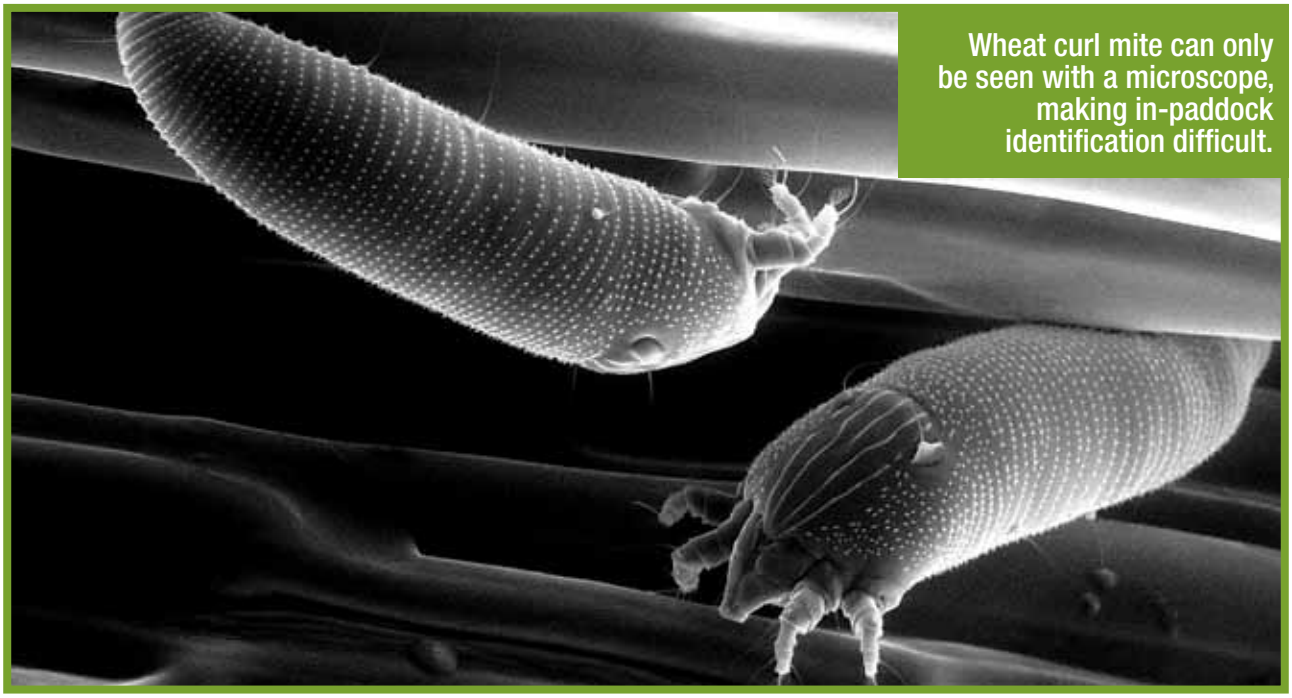
Management of host plants over summer and autumn is the main tool in controlling wheat curl mite, the carrier of wheat streak mosaic virus, a disease which may cause up to 100 per cent yield loss with early and widespread infection of young wheat plants.

KEY MESSAGES

- Wheat curl mite (WCM), *Aceria tosichella*, is the primary source for the spread of wheat streak mosaic virus (WSMV). WSMV can cause severe yield loss in wheat and affects yield in barley, oats and rye and also infest a range of grass weeds.
- WCM colonises the youngest tissue of a wheat plant and acquires WSMV when feeding on infected plants, carrying it to other plants.
- Mild summers with adequate rain for volunteer cereal and grass growth favour mite survival and virus build up between wheat crops.

About WCM

- Immature and adult wheat curl mite (WMC) transmit wheat streak mosaic virus (WSMV).
  To break the disease cycle, summer-germinating grasses and wheat volunteers must be controlled across the landscape, not just in-paddock.
  These host WCM and the WSMV, creating a 'green bridge' to the following winter crop.
- WCM is predominantly spread by wind.
- While research is under way, there are no WCM/WSMV-resistant wheat varieties available in Australia.
- WCM breeds rapidly in temperatures between 24°C and 27°C, often making early-sown crops a prime target.
- Serious outbreaks of WSMV can only occur if the virus is present and WCM is abundant.
- WCM has been implicated as the vector (carrier) of at least five viruses in addition to WSMV, including wheat spot mosaic virus, wheat spot chlorosis pathogen, cereal spotting, triticum mosaic virus and high plains virus.
- WSMV has been detected in wheat crops in NSW, Queensland, South Australia, Tasmania, Victoria and Western Australia.



Wheat curl mite can only be seen with a microscope, making in-paddock identification difficult.

PHOTO: COURTESY CESAR

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WHAT IS WHEAT CURL MITE?

The Wheat Curl Mite (WCM) is an eriophyoid mite that typically colonises the youngest tissue of wheat plants and is considered the principal *Aceria* species on cereal hosts. WCM alone will generally not cause damage to wheat plants, except when population sizes become extremely large. WCM presence can be identified by a longitudinal rolling or curling of the leaf, a characteristic trait for which it derives its name. The mite is tiny (approximately 0.2 millimetres in length), wingless, cream coloured and cigar shaped. It can only be seen with a microscope, making in-paddock identification difficult.

Populations increase dramatically at temperatures around 25ºC, but are limited by temperatures above 30ºC and below 15ºC. Lifespan under ideal conditions is typically eight to 10 days, but it can survive for up to three months in cold conditions where reproduction is significantly slowed.

A single female WCM is capable of laying 12-20 eggs and can produce more than three million descendants within 60 days.

WCM do not have wings and are spread between crops by wind.

Although wheat is a primary host of WCM, the species has been recorded on more than 60 other plant species (see page 3, Ideal Conditions), which could serve as bridging hosts between wheat crops. WCM do not colonise broad leaf plants.

PHOTO: COURTESY OF DAFWA

A wheat streak mosaic virus-affected wheat crop.

HOW DOES WCM SPREAD WSMV?

Spread of wheat streak mosaic virus (WSMV) is achieved by mass dispersal of WCM from WSMV-infected cereals or grasses. As the host dies from natural annual mortality, lack of moisture or herbicide application, the microscopic creatures crawl to leaf edges or awns of the ears, anchor themselves with their anal sucker, positioning vertically with their featherclaws outward, and releasing themselves into an air current in search of another host. The distance and direction of dispersal of this 'shower' of mite depends on the wind speed and direction.

Unless found in extremely high numbers, WCM generally cause little direct damage in the field other than the characteristic leaf curling and the occasional trapping of the flag leaf.

However, both immature and adult WCM transmit WSMV.

To become viruliferous the virus must be acquired by the WCM during either of the two nymphal stages, typically after at least 15-30 minutes of feeding on infected plant material. Once infected, the mite has the potential to transmit the virus to non-infected plants for at least seven days. Infected volunteer wheat and alternate host plants provide both an effective 'green bridge' refuge for WCM outside growing periods, and a potential source of re-infestation and spread of WSMV to successive wheat crops. Additionally, WCM has a large dispersal potential facilitated by wind. As a result, WCM survival and dispersal are the key factors influencing the spread of WSMV. Despite efforts to develop mite-resistant wheat cultivars, primary management of WSMV focuses on reducing numbers of WCM through the control of volunteer wheat and alternate plant hosts.

PHOTO: EMMA LEONARD

Mite dispersal is dependent on wind speed and direction.

IDEAL CONDITIONS

WCM populations rapidly grow in periods of high summer and early autumn rainfall followed by warm temperatures, when large populations of host grasses or volunteer cereals grow. Grass weeds that have tested positive for WSMV include liverseed grass, great brome, black oats, barley grass and brome grass. Known carriers of WCM include barley grass, great brome, annual ryegrass, cocksfoot, black oats, prairie grass, couch grass, slender panic, liverseed grass, pigeon grass and rats tail fescue.

Trials have shown summer and autumn volunteer wheat plants to be infested with WCM over widespread areas when sampled at the heading growth stage, where WCM finds refuge in the glumes and seed creases.

In the field, plants infested with WCM may display leaf curling (rolling of leaf edges) and the occasional trapping of the flag leaf. However, there are often no symptoms of WCM apparent.

Plants infected with WSMV are typically characterised by leaf mottling and streaking. Light green streaks running parallel to the leaf veins are the first signs of WSMV infection, particularly on the newer leaves.

As the disease becomes more established the streaks turn yellow and develop into blotches, giving the leaf a green and yellow 'mosaic-like' pattern. Tillers on affected plants tend to be less erect than those on uninfected plants. Affected plants can die prematurely or fail to grow, becoming stunted relative to healthy plants.

Volunteer cereals and many common grass weeds that germinate after summer rain host WCM and can provide a green bridge to the following crop.

PHOTO: EMMA LEONARD

Heads on infected plants can be sterile and contain no seed, or can contain small or shrivelled grain. Affected plants often occur in patches or at crop boundaries closest to grasses that were growing when the crop emerged. In severe cases, the whole crop can be affected.

Symptoms typically develop at temperatures above 10°C, so they may be masked during winter.

Visual symptoms of WSMV can be confused with those of other cereal pathogens, nutritional deficiencies and environmental and chemical-related damage.

Also, plants with low levels of infection may show minor or no visual symptoms, with symptoms becoming more pronounced as the virus advances. Consequently, attempts to identify WSMV using visual symptoms alone may be difficult and require validation using alternative methods of assessment.

Modern laboratory techniques provide rapid and reliable assessments of WSMV infection status and are sensitive to low and high levels of infection. Genetic methodologies can also easily distinguish between WSMV and other cereal pathogens.

Management tools

- Break the disease cycle. Control of summer volunteer cereals and grasses within fields, on field boundaries, on roadsides and around storage areas reduces the number of WCM that can invade autumn sown crops. This has proven to be an effective control strategy in Australia.
- When possible, delay sowing in autumn until temperatures are too low for mite activity (temperatures between 24°C and 27°C are optimal for WCM population survival and growth). This may not be feasible for grazing wheat.

Welcome to **www.wheatcurlmite.org**

The Centre for Environmental Stress and Adaptation Research (CESAR – The University of Melbourne) has recently created a website funded by GRDC that will act as an online repository for facts and management guidelines concerning wheat streak mosaic virus and its vector, the wheat curl mite. This website has been created primarily for use by grain growers, agronomists and scientists, providing direct access to information concerning virus detections (both current season and historical), species biology/ecology, field observations including identification and management guidelines, and research.

This website is expected to evolve over the coming years as results emerge from research being conducted in Australia. The website will play an important role in disseminating up-to-date research findings and management guidelines, and facilitating assessments of local risks of wheat steak mosaic virus infection via the virus detection archive. Grain growers, agronomists and scientists from across the country are encouraged to use the online reporting system to report virus detections and field observations. The website is located at www.wheatcurlmite.org

Frequently asked questions:

Q. Can I spray to control WCM?

A. Insecticide/miticide control of mites is believed to be largely ineffective as WCM predominantly lives (and is protected) within leaf whorls. Research from abroad has shown pesticide usage to be ineffective as mites are difficult to target and do not respond well to insecticides.

Q. If I destroy the volunteer cereals and grasses with a herbicide, will I destroy the WCM?

A. Yes, WCM lacks a diapause over-summering egg stage that many mite species have. Therefore, the eggs must die off or hatch and, without a host, all WCM present will starve out and die over a 1-2 week period, depending on environmental conditions. However, herbicides such as glyphosate require up to four weeks to achieve full plant death, and WCM will survive and disperse by the wind during this time in search of a new host.

Q. When am I most at risk of WSMV infection?

A. From crop emergence to early tillering growth stage is the period of highest risk of infection leading to yield loss. Yield loss has generally been limited when introduced post-tillering. Risk is higher where there are uncontrolled pre-season cereals and grasses and where there has been a history of WSMV.

Q. What if I suspect WCM or WSMV?

A. Collect samples of suspected plants, place in a sealed bag and contact your local district agronomist.

Q. Can grazing livestock carry WCM between crops?

A. This is possible, but it is not considered the main means of WCM moving to new areas.

Q. What can I do if I have WSMV in my crop?

A. There are no in-season control options. The later WSMV is transmitted into the crop, the less impact the virus has on the plants. Many cases of late infection (late tillering and later) have resulted in average yields. As WSMV is also seed borne, harvested seed can be tested for the virus when considering sowing the seed the following year.

Useful resources:

Specialist repository for WCM/WSMV information	**www.wheatcurlmite.org**
Plant Health Diagnostic Services, NSW DPI EMAI (Menangle)	**Email menangle.rvl@dpi.nsw.gov.au Orange: Email orangeai.rvl@dpi.nsw.gov.au**
SARDI Seed and Plant Pathology Services	**08 8303 9384**
AGWEST Plant Labs, Department of Agriculture and Food WA (includes WSMV seed testing service)	**08 9368 3721 or website www.agric.wa.gov.au and click on 'services' then the word 'AGWEST'**
Crop Insect Pests – Ute Guide	**www.grdc.com.au**
Cereal Variety Disease Guides	**visit state department websites**
Centre for Environmental Stress and Adaptation Research	**www.cesar.org.au**

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