Incursion of new pathotype of wheat leaf rust into Western Australia in 2013 and its potential impact in Mace

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Key Messages

- The wheat leaf rust pathotype 76-1,3,5,7,9,10,12+Lr37, first identified in WA in 2013, is an incursion from eastern Australia.
- This incursion has resulted in changes to leaf rust ranking of several popular varieties, including Mace.
- When inoculated with pathotype 76-1,3,5,7,9,10,12+Lr37 under glasshouse conditions, Mace showed Moderately Susceptible to Susceptible response in seedling and adult plants.
- In a field experiment with high inoculum pressure of this pathotype from tillering (Z25), Mace exhibited significant leaf rust and yield loss (greater than 30%).
- In a separate experiment with initial leaf rust infection at flag leaf emergence, Mace exhibited only minimal levels of rust expression with this pathotype.

Background

Unusually high levels of leaf rust on a range of wheat varieties, including Wyalkatchem, were observed in September and October of 2013. These reports came in from diverse regions including Northampton, Borden, Esperance and the Great Southern Region from Brookton to Hyden. Samples sent to the Australian Cereal Rust Control Program's (ACRCP) laboratories at the University of Sydney indicated the presence of a new leaf rust pathotype in Western Australia. This pathotype (76-1,3,5,7,9,10,12+Lr37) represents the first occurrence of virulence against the resistance genes *Lr13*, *Lr17a*, *Lr17b*, and *Lr26* in WA. It is speculated that this new pathotype of leaf rust moved to WA from eastern Australia where it had been present since 2011. Varieties that carry the *Lr13* gene (such as Mace, Wyalkatchem, Corack and Emu Rock) currently dominate the area sown to wheat in WA and significant reductions in the leaf rust resistance rankings of these varieties may mean that fungicide management of leaf rust is required in coming seasons.

Aims

- To evaluate response of a range of varieties to the leaf rust pathotype 76-1,3,5,7,9,10,12+Lr37, following its incursion into Western Australia.
- To characterise disease severity and yield loss in Mace and other varieties infected by the leaf rust pathotype 76-1,3,5,7,9,10,12+Lr37 under field conditions

Method

Glasshouse

Six pots of 12 wheat varieties, representing a range of resistance categories, were sown into 5 cm pots at two times to achieve two growth stages (~Z13 and ~Z39) at time of leaf rust inoculation. Two leaf rust pathotypes, 104-1,(2),3,(6),(7),11 +Lr37 (dominant pathotype prior to 2013) and 76-1,3,5,7,9,10,12 +Lr37 (identified in October 2013) were used to inoculate 3 replicate pots of each growth stage by variety combination. Pots were inoculated by suspending rust urediniospores in Pegasol mineral oil and applying as an aerosol. Inoculated plants were subjected to 24 hours moist incubation (100% leaf wetness) and then maintained under ideal conditions in a glasshouse (natural lighting at ~22C temperature). Each pathotype was inoculated separately and pots were incubated in separate misting chambers to avoid cross contamination. Rust severity, as leaf area affected and pustule type, was assessed 14 and 21 days after inoculation.

Field

Inoculated field experiments were carried out at sites geographically removed from the wheatbelt to limit any chance of crop contamination

Carnarvon: Six varieties (Stiletto, Spear, Correll, Mace, Estoc, Axe) representing six resistance categories were sown in a randomised paired plot design, with three replicates, with each paired plot comprising an unprotected and fully fungicide protected plot. Plot size was 5 rows x 6 m. Pre-sown spreader plots, comprising an equal mix if Tincurrin and Wyalkatchem were sown on either side of every paired plot. Spreader plots were sown in the second week of April and experimental plots were sown in the second week of May.

Leaf rust infection with pathotype 76-1,3,5,7,9,10,12+Lr37 was established in spreader plots in the second week of June (~Z25 of test plots) by introducing infected transplants every 0.5 m and aerial inoculation with 5 g of leaf rust urediniospores suspended in Pegasol light mineral oil applied as an aerosol across the experiment. Fungicide (Tebuconazole @ 125 g/ha) was applied by hand boom at 3, 6, 9, 12 and 15 weeks after sowing.

Assessment of leaf rust severity as percentage leaf area affected was measured in all plots on the 14th August (Z83 of Mace) and again on the 20th August (Z85 of Mace).

Yield was assessed by machine harvest of all plots.

Medina: Four varieties (Stiletto, Cobra, Mace, Corack) with full fungicide protection or untreated, were sown by machine in a randomised block design with three replicates on 16th May. Plot size was 5 rows x 9.8 m.

Leaf rust infection with pathotype 76-1,3,5,7,9,10,12 +Lr37 was established in experimental plots on the 8th and 20th of August (~Z39 and Z51 of Mace) by aerial inoculation with 5 g of leaf rust urediniospores suspended in Pegasol light mineral oil applied as an aerosol across the experiment. Fungicide (150 ml Prosaro +BS1000) was applied by hand boom in ~100 l/ha water on 5th September (3 days prior to rust inoculation) and 10th September.

Assessment of leaf rust severity as percentage leaf area affected on top three leaves on the main tiller was measured in all plots on the 10th September (Z55-61 of Mace) and again as percentage leaf area affected on the on flag leaf of secondary tillers on the 30th September (~Z81 on primary tillers of Mace).

Yields are not reported due to bird damage to plots and non-rust related necrosis in some varieties.

Results

Glasshouse

Clear differences were evident between varieties in response to the two pathotypes. Mace, Wyalkatchem, Corack, Bonnie Rock, Emu Rock, Fortune and Magenta exhibited MR to R adult plant responses to the 104-1,(2),3,(6),(7),11+Lr37 pathotype. However Mace, Bonnie Rock, Corack and Wyalkatchem exhibited greater levels of infection, showing a moderately susceptible to susceptible reaction when inoculated with 76-1,3,5,7,9,10,12+Lr37 pathotype. Conversely, Carnamah and Cobra were comparatively more resistant to the 76-1,3,5,7,9,10,12+Lr37 pathotype. Magenta was Resistant to both pathotypes.

Field

Carnarvon: Leaf rust established well in spreader plots and experimental plots were placed under very high disease pressure from early stem extension. At both assessment times, significant differences in rust severity were evident between varieties, with rust severity reflecting the resistance rankings of varieties for this pathotype. Fungicide protection prevented the development of leaf rust in all varieties.

Leaf rust severity in Stiletto (59% at Z83 and 72% at Z85) was significantly greater than all other varieties. Leaf area affected in Mace (25% at Z83 and 26% at Z85) was significantly less than Stiletto, Spear or Correll but was greater than the MRMS variety Estoc or the MR variety Axe (<5% in both assessments) (Table 1).

Samples taken from within the trial were submitted to ACRCP to confirm the pathotype present was 76-1,3,5,7,9,10,12+Lr37.

Yield of all varieties except Axe and Estoc was significantly reduced by leaf rust infection, with Stiletto losing more than 50% and Mace more than 30% of yield. In fungicide protected plots, yield of Stiletto was 4.1 t/ha compared to 6.7 t/ha of Mace.

Table 1: Wheat leaf rust severity in six wheat varieties inoculated with pathotype 76-1,3,5,7,9,10,12+Lr37 at Gascoyne Research Station, Carnarvon, in 2014.

Variety	Fungicide	Flag leaf area affected by WLR (%)		Yield (t/ha)
		14 August#	20 August##	
Spear	Tebuconazole	1	1	5.3
Spear	Nil	43	52	3.0
Stiletto	Tebuconazole	1	1	4.1
Stiletto	Nil	59	72	2.0
Correll	Tebuconazole	0	0	5.9
Correll	Nil	40	44	4.5
Mace	Tebuconazole	1	0	6.7
Mace	Nil	25	26	4.6
Estoc	Tebuconazole	0	0	6.1
Estoc	Nil	2	3	5.9
Axe	Tebuconazole	0	0	6.1
Axe	Nil	3	3	5.4
P		<0.001	<0.001	0.014
lsd		5.87	6.49	0.9

(Z83 of Mace)
(Z85 of Mace)

Medina: By the 29th August, 3 weeks after first inoculation, leaf rust was well established in untreated control plots of Stiletto (20-50% leaf area affected) with some rust evident on Mace (0-20% leaf area affected). Fungicide protection prevented the development of leaf rust in all varieties.

On the 10th September the untreated control plots of the susceptible control Stiletto had an average of 50% area affected by rust (20-80% range), significantly greater than leaf area affected in Corack (<10%), Mace (<5%) or Cobra (0%). A similar trend was evident in the assessment on flag leaf of secondary tillers measured on the 30th September (Table 2)

Samples taken from within the trial were submitted to ACRCP confirming the pathotype present was 76-1,3,5,7,9,10,12+Lr37.

Table 1: Wheat leaf rust severity in four wheat varieties inoculated with pathotype 76-1,3,5,7,9,10,12+Lr37 at Medina Research Station in 2014.

Variety	Fungicide	Flag leaf area affected by WLR (%)	
		Z55#	Z75##
Cobra	Prosaro	0.0	0.0
Cobra	Nil	0.0	0.0
Corack	Prosaro	0.3	0.4
Corack	Nil	9.5	7.8
Mace	Prosaro	0.2	0.4
Mace	Nil	2.2	2.9
Stiletto	Prosaro	8.0	0.6
Stiletto	Nil	50	77
P		0.026	<.001
lsd		13.6	3.4

Main stem flag leaf
Secondary tiller flag leaf

Conclusion

Glasshouse assessment confirmed that responses of some varieties to the leaf rust pathotype 76-1,3,5,7,9,10,12+Lr37 was different from the response to the previously dominant pathotype 104-1,(2),3,(6),(7),11+Lr37. Varieties Mace, Wyalkatchem and Corack and other varieties which carry *Lr13*, are more susceptible to this new pathotype and exhibited moderately susceptible to susceptible responses as seedling or adult plants. This is a significant reduction in resistance from the moderately-resistant (MR) response of these varieties to the 104-1,(2),3,(6),(7),11+Lr37 pathotype. Not all varieties are adversely affected; Magenta (*Lr24*) remains resistant to both pathotype.

Under high disease pressure, occurring from late tillering, leaf rust was well established in Mace and yield loss was strongly related to rust severity, with more than 30% and 50% yield loss in Mace and Stiletto respectively. On the other hand, with onset of disease at flag leaf emergence at Medina and without susceptible spreader plots, severe levels of rust (>50%) developed in Stiletto but less than 5% infection was evident in Mace.

Dry conditions and lack of green bridge in the summer of 2013/14 limited risk across the wheatbelt in 2014 associated with the incursion of leaf rust pathotype 76-1,3,5,7,9,10,12+Lr37. The survival and establishment of this pathotype in crops during 2014 is not confirmed at this time. However the results reported here suggest that if summer and autumn conditions favour green bridge and rust survival into 2015, then leaf rust infection at early growth stages in varieties such as Mace may require fungicide intervention to prevent yield losses.

The potential impact of 76-1,3,5,7,9,10,12+Lr37 on the varieties currently dominant in the WA cropping system highlight the risks associated with incursions of new rust pathotypes. Within eastern Australia pathotypes of stripe and leaf rust exist which could further drastically change the resistance status of varieties such as Mace. This reinforces the importance of biosecurity awareness among grain growers and agronomists to limit the chances of these incursions occurring as a result of human transfer of inoculum on clothes and equipment.

Key words

Puccinia triticina, leaf rust, yield loss

Acknowledgments

Ryan Varischetti, DAFWA for trial maintenance, treatment application and disease assessment.

David Farleigh, DAFWA, for trial sowing Carnarvon and Medina.

Simon Rogers, DAFWA for assistance with Carnarvon harvest.

GRDC Project No.: DAW00229, DAW00245

Paper reviewed by: Bill MacLeod