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Exotic wheat leaf rust pathotype detected in South Australia

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A new pathotype of the wheat leaf rust pathogen, *Puccinia triticina*, was detected in a sample of leaf rust collected from a crop of the wheat cultivar SQP Revenue at South Bool Lagoon (South Australia) in mid-August 2014. The new pathotype, 104-1,3,4,6,7,8,9,10,12 +Lr37, is considered to be an exotic incursion based on its unique virulence profile and SSR fingerprint. This pathotype is the 12th documented incursion of an exotic wheat rust pathogen since Australia-wide cereal rust surveys conducted by University of Sydney staff began in 1922. More detailed tests are currently underway to assess the full impact of this new pathotype on wheat and triticale cultivars.

A sample of leaf rust collected from the wheat cultivar SQP Revenue from South Australia (South Bool Lagoon) on 19th August 2014 was forwarded to the Plant Breeding Institute for pathotype analysis. The sample comprised a single pathotype (pt.), designated 104-1,3,4,6,7,8,9,10,12 +Lr37.

Origin of the new pathotype

Subsequent comparative tests confirmed the identity of the pathotype and showed that while it resembled a pathotype isolated for the first time last year in northern NSW, pt. 104-1,3,5,7,9,10,11,12 +Lr37, it differed in being virulent for three resistances in wheat: the complementary genes *Lr27+Lr31*, gene *Lr15* and gene *Lr28* (Figure 1). While virulence for all three resistances has been recorded in Australia in the past, they have not been recorded for some time (1991, 2005 and 1983, respectively) and virulences for *Lr15* and *Lr28* have been very rare for at least the past 30 years. Moreover, the new pathotype is the first detected in Australia that combines virulence for all three genes.

DNA fingerprinting was conducted on the isolate from SQP Revenue and 7 other leaf rust pathotypes representing those most common in Australia over the past 5 years (Figure 2). A total of 10 microsatellite (SSR) markers developed at the Plant Breeding Institute specifically for the causal agent of leaf rust (*Puccinia triticina*) were used to genotype the 8 pathotypes. The fingerprints generated for the new pathotype with five of these SSR markers differed to all other pathotypes, and four of the alleles generated were unique to this pathotype.

Taken together, the pathogenic differences and the fingerprint differences strongly imply that the new pathotype was introduced to Australia from another unknown wheat growing region. This is the 12th documented instance of an incursion of an exotic wheat rust pathogen into Australia since our surveys began in 1922.

While further tests are underway to assess the vulnerability of all current Australian wheat cultivars to the new pathotype, no significant changes in the seedling leaf rust responses of current cultivars are

expected. The gene *Lr15* has not been used in any Australian wheat cultivar, and *Lr28* only once (Sunland, released in 1992).

The complementary genes *Lr27 +Lr31* have been used in a number of older wheat cultivars (e.g. Gatcher, Timgalen) that are likely no longer grown. Based on previous research at the Plant Breeding Institute in which a complete association between virulence for the complementary genes *Lr27 +Lr31* and the adult plant resistance gene *Lr12* was established, it is likely that the new pathotype is also virulent for this APR gene. Controlled greenhouse studies are underway to confirm this, and also to determine if any Australian wheat cultivars carry *Lr12*. Should this prove to be the case, it is possible that the new pathotype will render such cultivars more susceptible to leaf rust at adult plant growth stages.

Conclusion

On past experience, the new pathotype is expected to spread widely in eastern Australia from the point of first detection. Growers are advised to monitor crops for leaf rust and forward samples of any leaf rust detected to the Plant Breeding Institute for pathotype analysis. It is likely that we will not know the full impact of this new pathotype until we have completed the seedling and adult plant tests in both the greenhouse and field.

Table 1: Documented incursions of exotic wheat rust pathogens into Australia since national cereal rust pathogenicity surveys began at the University of Sydney in 1922

#	Wheat disease	Pathogen	Pathotype	Year	Origin
1	Stem rust	*Puccinia graminis* f. sp. *tritici*	126-5,7,11	1925	?
2	Stem rust	*Puccinia graminis* f. sp. *tritici*	21-0	1954	Africa?
3	Stem rust	*Puccinia graminis* f. sp. *tritici*	326-1,2,3,5,6	1969	Africa?
4	Stem rust	*Puccinia graminis* f. sp. *tritici*	194-1,2,3,5,6	1969	Africa?
5	Stripe rust	*Puccinia striiformis* f. sp. *tritici*	104 E137 A-	1979	France?
6	Leaf rust	*Puccinia triticina*	53-1,(6),(7),10,11	1981	?
7	Leaf rust	*Puccinia triticina*	104-2,3,(6),(7),11	1984	?
8	Leaf rust	*Puccinia triticina*	76-1,3,5,10,12	1996	?
9	Stripe rust	*Puccinia striiformis* f. sp. *tritici*	134 E16 A+	2002	USA?
10	Leaf rust	*Puccinia triticina*	10-1,3,9,10,12	2004	?
11	Leaf rust	*Puccinia triticina*	76-3,5,7,9,10 +Lr37	2004	?
12	Leaf rust	*Puccinia triticina*	104-1,3,4,6,7,8,9,10,12 +Lr37	2014	?

Figure 1: Seedling leaves of (L to R) Tarsa (*Lr1*), Democrat (*Lr3a*), Kenya 1483 (*Lr15*), Gatcher (*Lr27 +Lr31*), Songlen (*Lr17a*), CS 2A/2M (*Lr28*), Thatcher +Lr13 (*Lr13*), Thatcher +Lr37 (*Lr37*), Mace (*Lr3a*, *Lr13*, *Lr20**, *Lr37*), and SQP Revenue (*Lr13*, *Lr37*) infected with (A) pathotype 76-3,5,7,9,10,12,13 +Lr24 (B) 122-1,2,3,(6),(7),11 and (C) 104-1,3,4,6,7,8,9,10,12 +Lr37

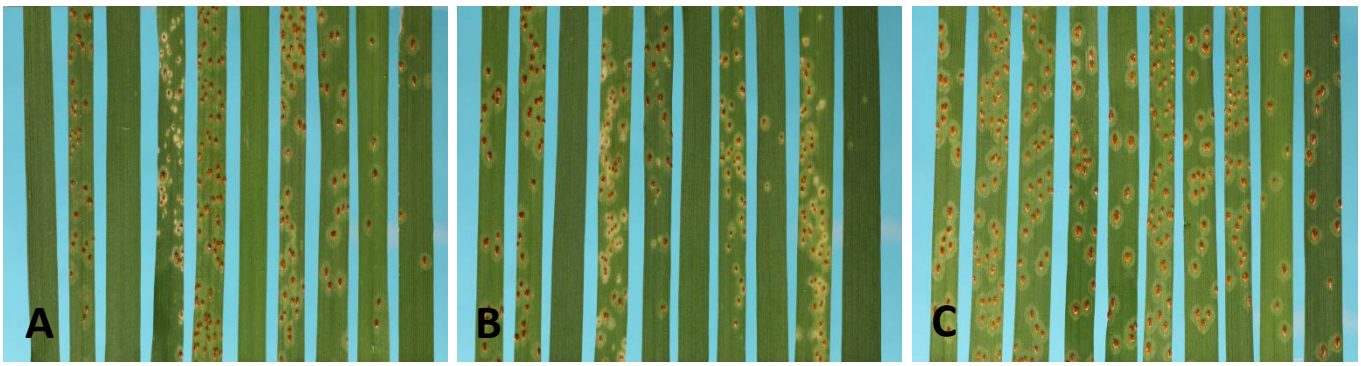
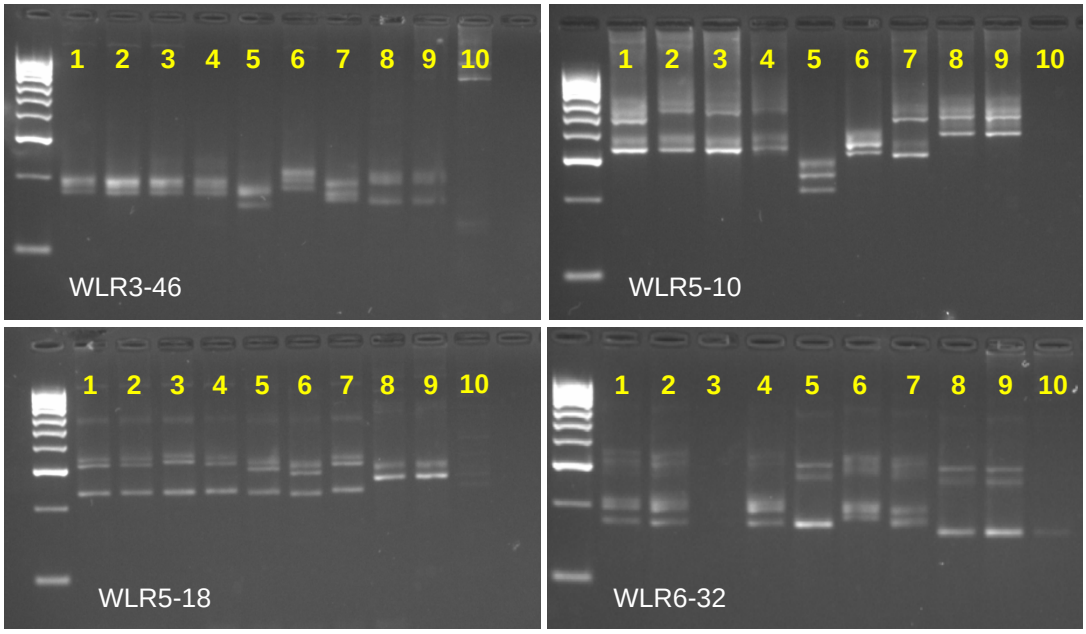


Figure 2: DNA fingerprints of seven Australian pathotypes of *Puccinia triticina* and two sources of DNA from the newly isolated pathotype 104-1,3,4,6,7,8,9,10,12 +Lr37 with four microsatellite markers



Lane #	Pathotype	Culture #
1	76- 3,5,7,9,10 + Lr37	594
2	76- 1,3,5,7,9,10, 12 + Lr37	621
3	76- 3,5,7,9,10,12,13 + Lr37	625
4	76- 1,3,5,7,9,10,12 +Lr37	130115
5	10-1,3,9,10,11,12	592
6	76-1,3,5,10,12	539
7	104-2,3,(6),(7),11	423
8	104-1,3,4,6,7,8,9,10,12 +Lr37	DNA ex urediniospores
9	104-1,3,4,6,7,8,9,10,12 +Lr37	DNA ex infected leaf
10	Nil	Leaf DNA

Notes to Figure 2:

- pathotypes in lanes 2, 3, and 4 are believed to have been derived from that in lane 1 (first detected in 2004; Table 1) via simple mutation. All (Lanes 1-4) show the same DNA fingerprint, consistent with this
- pathotype in lane 5 was first detected in 2004 from Mackellar wheat (Table 1). Distinct from all other Australian pathotypes of *P. triticina* both in virulence and DNA fingerprint
- pathotype in lane 6 was first detected in 1996 (see Table 1) from Paterson wheat
- pathotype in lane 7 was first detected in 1984 (see Table 1), and gave rise to many derivative pathotypes via mutation that dominated the Australian wheat leaf rust population in most years from 1987 through 2011
- lanes 8 and 9 are duplicates of the newly detected pathotype

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RUSTED PLANT SAMPLES
can be mailed in paper envelopes; do not use plastic wrapping or plastic lined packages.
Direct samples to:

Australian Cereal Rust Survey
Plant Breeding Institute
Private Bag 4011, Narellan NSW 2567

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