The University of Sydney
Plant Breeding Institute Cobbitty
Cereal Rust Laboratory

2004-2005 CEREAL RUST SURVEY ANNUAL REPORT

I. SUMMARY

Wheat Stem Rust Stem rust was found on volunteer barley and wheat in WA during March 2004, and was first recorded in a commercial wheat crop in early August. It was also recorded in SA in early Sept. Fifty two samples were successfully typed. Single samples from QLD and northern NSW were identified as pt. 98-1,2,3,5,6. Samples from SA were identified as pt 34-1,2,7 +Sr38, which was also identified from Vic. This was also the predominant pathotype in WA. Pt 98-1,2,3,5,6,7 was again isolated from WA.

Wheat Leaf Rust Leaf rust was common in parts of WA and eastern Australia but did not reach damaging levels. Thirty five samples were typed. The most common pathotype in WA was pt 104-1,2,3,(6),(7),11 +Lr37, which was also recorded in eastern Australia including northern NSW. The *Lr24* pathotype was again widely distributed in eastern Australia and absent from WA. Pt. 10-1,3,9,10,11,12 was detected for the first time, isolated from cv. Mackellar at Bairnsdale. It was concluded to be an exotic introduction.

Wheat Stripe Rust The most extensive and severe stripe rust epidemic on record occurred throughout Australia in 2004. It was estimated that $90million was spent on chemical control. The dominant pathotype 134 E16 A+, first reported in 2002, continued to cause more disease on varieties than seen prior to 2002. However, several resistances in certain varieties provided good protection.

Oat Stem Rust Low sample number was a feature of the 2004 season, for reasons that remain unclear. The most significant observation was the failure to recover virulence for *Pga*, which was first detected in 1997 and rose to 20% of isolates before gradually declining. Pathotype group 94 continues to dominate.

Oat Leaf Rust Eight pathotypes were identified from 29 samples, considerably fewer than in previous years. Most originated from SA and WA, where the pathotypes 0000-2 and 0001-0 predominated. These pathotypes are avirulent on many of the differentials used, and are frequent in southern regions of eastern Australia and in WA, but infrequent in northern NSW and QLD. Other pathotypes detected were 0001-1,12; 0061-0; 0071-0; and 0307-1,4,5,6,10,12.

Barley Stem Rust There were no reports of barley crops affected by stem rust during 2004. Twelve samples of stem rusted self sown barley were received. Two from QLD and one from southern NSW were identified as the Scabrum rust with virulence for the wheat stem rust resistance gene *Sr21*, and nine from WA were all identified as the wheat stem rust pathotype 34-1,2,7 +Sr38.

Barley Leaf Rust Four pathotypes of barley leaf rust were identified from 15 samples. All were virulent for the resistance gene *Rph12*. Pt 5453P- and 5453P+, first detected in WA, were also detected in SA and Tasmania. Both were common in WA. The most common pathotype in eastern Australia was pt 5652P+, recorded in SA, Victoria and NSW. A single isolate of pt 5610P+ was identified from QLD.

Barley grass stripe rust There were only a small number of isolates recovered, and no reports of infection in commercial barley varieties.

Triticale and Rye Rusts One sample of stripe rust from triticale collected at Skipton Victoria was identified as the “WA” pathotype. No other reports of rust in crops of triticale or cereal rye were made during 2004.

II. DETAILED REPORT

INTRODUCTION

Rust surveys or inspections conducted by PBI staff during 2004-05 included:

North NSW, Queensland	26 August-3 September	RA McIntosh
Western Australia	10-13 October 2004	CR Wellings
Central NSW	26-30 October	RA McIntosh
South Australia	1-4 November	RA McIntosh
Victoria	November 2004	CR Wellings

SEASONAL CONDITIONS

The 2004 season was marked by erratic rainfall, with only average to below average falls in most wheat growing areas. The exception was northern NSW and parts of southern Queensland that received above average rain early in the year and this allowed main season plantings to establish in optimal conditions. However, follow up rain was variable, with useful falls not coming until mid-late winter. Southern areas of eastern Australia experienced more extreme rainfall variation, with delayed planting and dry spring conditions that ultimately limited yield potential. Western Australia experienced a dry start, an average winter and a return to dry conditions in spring, especially in the great southern region which is usually more rainfall reliant.

Temperatures were generally average to above average during the season, especially during crop establishment. The combination of elevated temperature and moisture limitations checked yield potential, especially during an unusually hot dry period in September. Inadequate subsoil moisture reserves meant that many crops in the Wimmera (Victoria) and Mallee (Victoria and South Australia) were seriously stressed during this September period, and failed to meet earlier expectations.

WHEAT RUST PATHOGENS

Wheat Stem Rust (caused by *Puccinia graminis* f. sp. *tritici*)
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Epidemiology and Pathotype Distribution

Continuing the trend of recent years, stem rust of wheat was uncommon in eastern Australia. Stem rust was found on volunteer barley and wheat in WA in March 2004, and was first recorded in a commercial crop in August at Koolyanobbing. It was found on volunteer barley and wheat in WA during March 2004, and was first recorded in a commercial wheat crop in early August at Koolyanobbing. It was also recorded at Penong and Ceduna, SA, in early September.

Fifty eight samples of stem rusted wheat were received, 46 of which were forwarded from WA, and six of which did not yield a viable isolate (Table 1). Six pathotypes were identified, three belonging to race 34 and three belonging to the race 98/343 family (Table 1).

Two samples from QLD, both from experimental plots, were identified as comprising pathotype (pt) 98-1,2,3,5,6. Two samples from northern NSW were identified as pts 98-1,2,3,5,6 and 34-1,2,7 +Sr38. The latter, first detected in WA in 2001, was detected in eastern Australia for the first time during the 2003 wheat growing season and has now been detected SA, Victoria and NSW. Samples collected in 2004 that yielded pt 34-1,2,7 +Sr38 included several from Narracorte and Horsham collected in February. Pt 34-1,2,7 +Sr38 was the predominant pathotype in WA. Other pathotypes identified from WA included 34-2,7, 34-1,2,7, 98-1,2,3,5,6, and the Wyalkatchem attacking pathotype 98-1,2,3,5,6,7, which was isolated from Carnarvon.

Notes on Cultivars Carrying Genes for Stem Rust Resistance

The stem rust responses of wheat cultivars are not expected to change from those of 2003.

Sr9e	Sunland and Yarralinka (a single isolate of a pathotype virulent for *Sr9e* was identified from WA in 2002.
Sr22	Schomburghk
Sr24	Anlace, Annuello, Babbler, Cunningham, Datatine, Dennis, Giles, Harrismith, Janz, Koelbird, Krichauff, Lang, Mira, Mitre, Mulgara, Pardalote, Perouse, Petrie, QAL2000, QALBis, Sunco, Sunsoft 98, Swift and Worrakatta
Sr26	Chough, Currawong, Darter, Hybrid Mercury, Petrel, Snipe, Sunlin, and Wylah
Sr30	1. (close monitoring required; significant rust may develop even with Sr30-avirulent isolates): Ajana, Arrino (heterogeneous), Kalgarin, Yitpi
	2. Batavia, Brookton, Calingiri, Chara, Cunderdin, EGA Bonnie Rock, EGA Hume, EGA Wedgetail, Frame, H45, Kalannie, Katunga, Lark, Lorikeet, Osprey, Rosella, Silverstar, Sunfield, Sunmist.
Sr31	Grebe, Tennant and Warbler

The gene *Sr2* confers adequate adult plant resistance and is present in the cultivars Arnhem, Batavia (heterogeneous), Baxter, Bowerbird, Brennan, Carnamah, Diamondbird, Dollarbird, Eradu, Glover, Goldmark, Hartog, Kennedy, Kukri, Leichardt, Lowan, Machete, Mackellar, Nyabing, Sunbrook, Sunstate and Tailorbird. Cultivars with *Sr13* (Gutha, Machete, Stiletto, Sunmist and Wialki) are moderately susceptible to moderately resistant. The cultivars Braewood and Sunvale are protected from all stem rust pahtotypes by the presence of the gene combination *Sr36* + *Sr38*.

<u>Wheat Leaf Rust</u> (caused by *Puccinia triticina*; formerly *Puccinia recondita* f. sp. *tritici*)

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Epidemiology and Pathotype Distribution

Leaf rust was common in parts of WA and eastern Australia but did not reach damaging levels. Fifty samples were received for pathotype analysis, of which 15 failed to yield a viable isolate (Table 2). Nine pathotypes were identified, regarded as belonging to three different lineages in the pathogen population; 10-1,3,9,10,11,12; 76-1,3,5,10,12; and the race 104 group (seven pathotypes) that has dominated Australian populations of *P. triticina* since 1990.

The most common pathotype in WA was the *Lr37* attacking pt 104-1,2,3,(6),(7),11 +Lr37, which was also recorded in eastern Australia where it extended its distribution to northern NSW (Narrabri and Willow Tree). The *Lr24* attacking pathotype was again widely distributed in eastern Australia and absent from WA. Other pathotypes identified in eastern Australia included pts 76-1,3,5,10,12, 104-2,3,(6),(7),11; 104-1,2,3,(6),(7),11,12; 104-1,2,3,(6),(7),9,11; and 10-1,3,9,10,11,12.

Pt 10-1,3,9,10,11,12 (the "Mackellar" pathotype) was detected for the first time during 2004, when it was isolated from the winter wheat Mackellar growing at Bairnsdale. A significant amount of work was needed to characterise this pathotype, and it is now quite clear that is has an exotic but unknown origin. The most unusual feature of this pathotype is that it is avirulent on cultivar Morocco, a wheat genotype that is very susceptible to a wide range of wheat rust isolates. This pathotype is the first confirmed Australasian leaf rust isolate to carry avirulence to Morocco. Cv Morocco is used routinely to increase wheat rust isolates in the PBI greenhouse system. Initial attempts were made to increase the "Mackellar" pathotype on Morocco failed because of its avirulence and it was only when another susceptible wheat genotype was used that an amount of inoculum sufficient for detailed comparative tests could be generated. The most important feature of this pathotype is that it combines virulence for *Lr13* with several other genes including *Lr1* (see below). An isolated nursery was established in early 2005 to assess the impact of this pathotype on current wheat cultivars.

Notes on Cultivars Carrying Genes for Leaf Rust Resistance

It is possible that some cultivars with *Lr17a* (Baxter, heterogeneous; Perenjori), may be more susceptible to a variant of pt 104-1,2,3,(6),(7),11 that has been detected in most wheat growing regions, which appears to have increased but still incomplete virulence for this gene.

Cultivars with *Lr13* in combination with *Lr1* (Arnhem, Batavia, Bowerbird, Cunderdin, Diamondbird, Glover, Hartog, Kukri, Leichardt, Sunbrook, Sunfield and Tailorbird) or *Lr2a* (Sunmist) could be vulnerable to the new Mackellar pathotype. Cultivars with *Lr13* in combination with *Lr23* (EGA Hume, Strzelecki), *Lr24* (Dennis, Giles, Petrie and Sunsoft 98) or *Lr37* (Braewood, Rudd and Sunstate) are resistant to all pathotypes isolated in 2004. The combination of *Lr13* and *Lr17b*, found in several winter wheats (Gordon, Mackellar, Paterson) is ineffective in protecting against pts 10-1,3,9,10,11,12; 53-1,(6),(7),10,11,12 (not detected in 2004); and 76-1,3,5,10,12. Declic, which carries *Lr14a* in addition to *Lr13* and *Lr17b*, and although resistant to pt 53-1,(6),(7),10,11,12, is seedling susceptible to pts 76-1,3,5,10,12 and 10-1,3,9,10,11,12.

Cultivars with *Lr26* (Grebe, Tennant and Warbler) are at least seedling susceptible to pts 104-1,2,3,(6),(7),9,11 and 10-1,3,9,10,11,12.

Cultivars with *Lr37* in combination with *Lr13* (see above) or *Lr24* (QAL2000) are resistant to all pathotypes isolated from Australasia during the 2004 survey period.

Cultivars with *Lr21* (Thornbill), *Lr28* (Sunland) and the complementary seedling resistance genes *Lr27*+*Lr31* (Carnamah and Karlgarin) are resistant to all pathotypes isolated in 2004. Genetic studies at PBIC have indicated that Carnamah and Kalgarin should also carry the adult plant resistance gene *Lr12*, which is completely linked to *Lr31*, and in fact may be the same gene.

It is apparent that many cultivars protected previously by *Lr24*, and at least some cultivars protected previously by *Lr37* have some adult plant resistance to pathotypes virulent for these genes.

<u>Wheat Stripe Rust</u> (caused by *Puccinia striiformis* f. sp. *tritici*)

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Disease development

The 2004 stripe rust epidemic was the most widespread and arguably the most economically damaging since the disease was first reported in Australia in 1979. Samples were received from seed increase plots at Naracoorte (SA) and Horsham (Vic) in late March. The first samples from commercial fields were processed in late July (Merredin, WA) and early August (Esperance, WA; Millicent, SA; Grenfell, southern NSW; Bellata, northern NSW). These widespread reports again indicate that the pathogen survived independently across a range of environments.

The epidemic in WA was initially centered on Merredin and Esperance, but subsequently spread rapidly among much of the Great Southern region in September. However, the extent of the epidemic appeared to be less than the initial severe epidemic in 2002, but considerably more extensive than 2003. Early infections in SA were sighted on the far west of the Ayre Peninsular. The disease was, however, more common in the traditionally stripe rust prone area of the south east.

The epidemic in the remainder of eastern Australia was somewhat localised by early August, but became progressively more widespread in September. The majority of samples were received from NSW, and on the basis of sample number, the epidemic progressed more extensively compared to the same period in 2003.

Spike infection was again a problem in 2004, and was expected to cause grain shriveling resulting in increased screenings in situations of high disease pressure. Chemical control operations were a feature of 2004, with widespread spraying occurring mid-season. Estimates of approximately $90 million was spent on chemical control across the east and western wheat growing areas. However, the dry September period limited wheat yields and therefore reduced expected returns from chemical control.

Pathotype distribution

The results of pathotypes detected by region are presented in Table 3. A total of 562 samples were received, with a successful recovery rate of approx. 85%. This was less than in previous years, and may have reflected poor samples, some of which may have been sprayed with fungicide prior to collection. The dominant pathotype was 134 E16 A+, first detected in Western Australia in 2002 and subsequently spread to the eastern states in 2003. This pathotype accounted for 95% of the samples received for analysis. The evident dominance of this pathotype is a new phenomenon for stripe rust pathogen dynamics.

The pathotype virulent for *Yr17* (104 E137 A-, Yr17+) was recovered in only a few samples. Similarly pathotypes 110 E143 A+ and 111 E143 A-, which were recorded in previous seasons, were at very low frequency in 2004.

Notes on current resistances

The dominant pathotype 134 E16 A+ is avirulent for *Yr17* and this resistance continues to provide good protection in varieties that carry this gene, *eg* Braewood, Marombi, Rudd, Sunbri, Sunlin, Sunstate, Sunvale. The adult plant resistance *Yr18* also remains effective and is expected to provide protection, especially when combined with other resistances.

A large number of current varieties are noticeably more affected by stripe rust since pathotype 134 E16 A+ has become widespread. Variety responses to this pathotype are regularly reviewed and published as Cereal Rust Reports, and are available from the PBI website.

OAT RUST PATHOGENS

<u>Oat Stem Rust</u> (caused by *Puccinia graminis* f. sp. *avenae*)

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Sample numbers were low 2004 with just 29 samples yielding 28 isolates for pathotype assessment (Table 4). The most significant development was the lack of recovery of isolates carrying *Pga* virulence, indicating that this resistance gene will continue to provide protection for cultivars such as Barcoo, Culgoa II, Glider, Cleanleaf, Nobby.

Pathotype group 94 again dominated the population, with variants showing virulence for *Pg13* and *PgSaia*. Pathotype group 31 was also recovered, as noted in previous seasons. The reasons for reductions in pathogen populations over recent seasons remains unclear.

<u>Oat Leaf Rust</u> (caused by *Puccinia coronata* f. sp. *avenae*)
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Epidemiology and Pathotype Distribution

The number of samples received and the number of pathotypes identified in 2004 were considerably fewer than in previous years. Thirty four samples of leaf rust were received, of which five failed to yield a viable isolate. Eight pathotypes were identified (Table 5).

Most samples originated from SA and WA, where pts 0000-2 and 0001-0 predominated. These pathotypes are avirulent on many of the differentials used, and have been frequent in southern regions of eastern Australia and in WA and infrequent in northern NSW and QLD in recent years. Three isolates of pt 0001-0 (one from QLD and two from SA; Table 5) were found that although avirulent for the differentials H548, PC39 and PC71, displayed marked temperature sensitivity in their interaction on these differentials. In each case, the isolate was initially identified as pt 4003-10, and after retesting, was found to be pt 0001-0. Other pathotypes identified during 2004 were 0001-1,12, 0001-2, 0061-0 (detected for the first time), 0071-0, and 0307-1,4,5,6,10,12 (also detected for the first time) (Table 5).

The differential genotypes used to characterise *P. coronata* f. sp. *avenae* include several of the older North American differentials (viz. Landhafer, Santa Fe, Ukraine, Trispernia and Bondvic). The virulence/avirulence of isolates on these differentials is not represented in the current system of pathotype designation, which it must be acknowledged is not an ideal system of nomenclature. Whilst pathotypes that have been detected for the first time in more recent years tend to have the same virulence/avirulence on these older differentials (*eg* pathotypes belonging to triplet codes 0071, 4473, 0207 and 0307), isolates identified as triplet code 0001 often display pathogenic variability on these differentials. For example, during 2004, isolates of pathotype 0001-0 were identified that were virulent only on Ukraine, and others that were avirulent on all five differentials. The difficulty in interpreting the pathogenic variability on these older differentials is that we do not know exactly what resistance genes they carry, and also, which if any of these genes are present in Australian oat cultivars.

Notes on Cultivars Carrying Genes for Leaf Rust Resistance

With the exception of cultivar Volta, released in 2003, all current Australian oat cultivars are susceptible to leaf rust. Volta appears resistant to all current pathotypes. Greenhouse tests have provided clear evidence of the Warrego resistance plus something else in this cultivar. Cultivar Taipan, released in 2001, has the Nugene resistance. Some of the cultivars released in Region 1 and regarded at the time of release as resistant to *P. coronata* f. sp. *avenae*, are now susceptible to a range of pathotypes.

BARLEY RUST PATHOGENS

<u>Barley Stem Rust</u> (caused by *Puccinia graminis*)
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There were no reports of barley crops affected by stem rust during 2004. Thirteen samples of stem rusted self sown barley were received, one of which failed to yield a viable isolate (Table 6) Two samples from QLD and one from southern NSW were identified as the Scabrum rust with virulence for the wheat stem rust resistance gene *Sr21*, and nine from WA were all identified as the wheat stem rust pathotype 34-1,2,7 +Sr38. Previous surveys have indicated that the stem rust found n barley tends to be determined by what predominates in other crops like wheat. The detection of wheat stem rust in all samples from WA where wheat stem rust has been present in recent years, and the non-wheat attacking scabrum rust in samples from north-eastern Australia where wheat stem rust has been rare, is in agreement with these previous findings.

Barley Leaf Rust (caused by *Puccinia hordei*)
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Epidemiology and Pathotype Distribution

Twenty six samples of barley leaf rust were received, 11 of which did not yield viable isolates (Table 7). Four pathotypes were identified, all of which were virulent for the resistance gene *Rph12*. Pt 5453P- and 5453P+, first detected in WA, were also detected in SA and Tasmania. Both were common in WA. The most common pathotype in eastern Australia was pt 5652P+, recorded in SA, Victoria and NSW. A single isolate of pt 5610P+ was identified from QLD.

Notes on Cultivars Carrying Genes for Leaf Rust Resistance

Many Australian barley cultivars carry seedling genes for resistance to *P. hordei*, however most of these genes are ineffective against pathotypes that currently prevail. Before 1999–2000, the cultivars Tallon and Lindwall (*Rph12*) were regarded as resistant to the pathotypes occurring in Region 1. These cultivars will now need to be monitored carefully because their adult plant responses to the *Rph12* virulent pathotypes detected in the region last year are not well understood. Only Galaxy has effective seedling resistance to leaf rust in Australia, however, not all cultivars will become severely infected and cultivars like Gilbert are known to have good levels of resistance at later growth stages.
The cultivars Baudin (*Rph12*) and Hamelin (no resistance gene), released in WA during 2002, are susceptible pathotypes predominating in all barley growing regions.

Barley Grass Stripe Rust (caused by *Puccinia striiformis*)
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The samples recovered in 2004 are presented in Table 3. The overall frequency was very low, and no reports were received of infection in commercial barley fields. Barley grass stripe rust has not been recorded in Western Australia.

TRITICALE AND RYE RUST PATHOGENS

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One sample of stripe rust from triticale collected at Skipton Victoria was identified as the “WA” pathotype. No other reports of rust in crops of triticale or cereal rye were made during 2004. There are however some concerns over increased susceptibilities of some triticale cultivars to the “WA” stripe rust pathotype, and further work is being conducted to provide more information on this.

MISCELLANEOUS RUST PATHOGENS ON GRASSES

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Several samples of rusted grasses were forwarded to the survey in 2004. These samples are tested on a range of rust susceptible cereal genotypes to determine if they are cereal rust pathogens. The normal procedure for pathotype analysis is then followed in cases where a cereal rust pathogen is found.

Six samples of rust on Phalaris were tested, and only one (from northern NSW) was capable of infecting any of the cereal genotypes tested. It was concluded to be *P. graminis* f. sp. *phalaridis*, which is weakly pathogenic on a few oat genotypes. Four samples of leaf rust on rye grass were received; none infected cereals. Two samples of leaf rust on Fescue, and four of leaf rust on barley grass similarly failed to infect any of the cereal testers used. Two samples of stem rust on barley grass, one from SA and one from WA, we both identified as the wheat stem rust pathogen, and were subsequently identified as pt 34-1,2,7 +Sr38. Previous studies have identified not only wheat stem rust on stem rusted barley grass, but also the rye stem rust pathogen and the scabrum rust pathogen.

ACKNOWLEDGEMENTS

Funding for this work was provided by the Grains Research and Development Corporation. The success of the annual surveys relies heavily on the co-operation of many colleagues including state based cereal pathologists, breeders and field advisory staff. Their interest and assistance is gratefully acknowledged.

Table 1. Wheat stem rust isolates identified by region, 1 April 2004 - 31 March 2005

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
34-1,2,7	-	-	-	-	-	-	2	2
34-1,2,7 +Sr38	-	1	-	-	-	6	28	35
34-2,7	-	-	-	-	-	-	2	2
98-1,2,3,5,6	2	2	1	-	-	-	9	14
98-1,2,3,5,6,7	-	-	-	-	-	-	6	6
343-1,2,3,5,6	-	-	-	-	-	-	1	1
Total no isolates	**2**	**3**	**1**	**0**	**0**	**6**	**48**	**60**
Total no samples	**3**	**2**	**1**	**0**	**0**	**6**	**46**	**58**
No failed samples	1	0	0	0	0	0	5	**6**

Table 2. Wheat leaf rust isolates identified by region, 1 April 2004 – 31 March 2005

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
10-1,3,9,10,11,12	-	-	-	1	-	-	-	**1**
76-1,3,5,10,12	-	-	-	-	-	1	-	**1**
104-2,3,(6),(7),11	-	-	-	1	-	-	-	**1**
104-1,2,3,(6),(7),11	-	1	-	6	-	1	3	**11**
104-1,2,3,(6),(7),9,11	-	-	-	1	-	1	-	**2**
104-1,2,3,(6),(7),11 +GH*	-	1	-	-	-	-	4	**5**
104-1,2,3,(6),(7),11,12	-	-	1	2	-	-	-	**3**
104-1,2,3,(6),(7),11,13	6	-	-	2	-	4	-	**12**
104-1,2,3,(6),(7),11 +Lr37	-	4	-	1	-	1	8	**14**
Total no isolates	**6**	**6**	**1**	**14**	**0**	**8**	**15**	**50**
Total no samples	**6**	**4**	**2**	**17**	**0**	**8**	**13**	**50**
No failed samples	0	0	1	6	0	4	4	**15**

* Differential Gaza carries uncharacterised resistance in addition to *Lr23* that is effective to some pathotypes of leaf rust. This pathotype is fully virulent on Gaza.

Table 3. Stripe rust isolates identified by region, 1 April 2004 – 31 March 2005

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
104 E137 A+	-	1	1	-	-	-	-	2
104 E137 A- Yr17+	-	-	-	2	-	-	-	2
110 E143 A+	-	1	-	-	-	-	-	1
111 E143 A-	-	-	1	-	4	1	-	6
134 E16 A+	17	99	136	60	9	27	103	451
BGYR	-	-	5	3	-	2	-	10
Miscellaneous	-	-	2	-	-	-	1	3
Total no isolates	**17**	**101**	**145**	**65**	**13**	**30**	**104**	**475**
Total no samples	**19**	**109**	**169**	**81**	**16**	**32**	**136**	**562**
No failed samples	2	9	26	16	3	3	32	91

Table 4. Oat stem rust isolates identified by region, 1 April 2004 – 31 March 2005

	Number of Isolates						
	Region 1		Region 2		Region 3	Region 4	
Pathotype	QLD	NNSW	SNSW	VIC	SA	WA	TOTAL
31-1,2					1		1
31-3					1		1
94-2		1		1	1	10	13
94-3	1			1	4		6
94-2,3		3	2	1	1		7
Total no isolates	**1**	**4**	**2**	**3**	**8**	**10**	**28**
Total no samples	**1**	**4**	**2**	**3**	**7**	**12**	**29**
No failed samples		1				2	3

Table 5. Oat leaf rust isolates identified by region, 1 April 2004 – 31 March 2005.

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
0000-2	-	-	-	-	-	10	1	**11**
0001-0	-	1	-	-	-	6	9	**16**
0001-0 (4003-10)*	1	-	-	-	-	2	-	**3**
0001-1,12	1	-	-	-	-	-	-	**1**
0001-2	-	-	-	-	-	2	-	**2**
0061-0	-	-	-	-	-	1	-	**1**
0071-0	-	-	-	-	-	1	-	**1**
0307-1,4,5,6,10,12	1	-	-	-	-	-	-	**1**
Total no isolates	**3**	**1**	**0**	**0**	**0**	**22**	**10**	**36**
Total no samples	**3**	**1**	**1**	**0**	**0**	**18**	**11**	**34**
No failed samples	1	0	1	0	0	2	1	**5**

* Although this pathotype is regarded as being avirulent on the differentials H548, PC39 and PC71 (in which case it would be given a designation of 0001-0), the interaction on these differentials was highly temperature sensitive (4003-10).

Table 6. Barley stem rust isolates identified by region, 1 April 2004 – 31 March 2005.

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
Scabrum +Sr21	2	1	-	-	-	-	-	**3**
P. graminis f. sp .tritici	-	-	-	-	-	-	9	**9**
Total no isolates	**2**	**1**	**0**	**0**	**0**	**0**	**9**	**12**
Total no samples	**3**	**1**	**0**	**0**	**0**	**0**	**9**	**13**
No failed samples	1	0	0	0	0	0	0	**1**

Table 7. Isolates of *Puccinia hordei* identified by region, 1 April 2004 – 31 March 2005.

	Number of Isolates							
	Region 1	Region 2	Region 3	Region 4		Region 5	Region 6	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	TOTAL
5452P+	-	1	-	3	1	4	-	9
5453P- (+PI366444)	-	-	-	-	3	2	3	8
5453P+ (+PI366444)	-	-	-	-	3	-	9	12
5610P+ (+PI366444)	1	-	-	-	-	-	-	1
Total no isolates	**1**	**1**	**0**	**3**	**7**	**6**	**12**	**30**
Total no samples	**2**	**1**	**2**	**6**	**0**	**4**	**11**	**26**
No failed samples	1	0	1	3	4	0	2	**11**