	The University of Sydney **Plant Breeding Institute Cobbitty** **Cereal Rust Laboratory**

2000-2001 CEREAL RUST SURVEY ANNUAL REPORT

I. SUMMARY

Wheat Stem Rust Outbreaks were reported from a wide range of areas in WA and significant yield losses were recorded in some crops. The predominant pathotypes in WA were 34-2 and 34-2,7, with pts 34-1,2,7 and 98-1,2,3,5,6 detected for the first time. In eastern Australia, stem rust was observed on self sown wheat in the Mallee in early August but it remained at low levels. Samples received comprised mainly pt 98-1,2,3,5,6.

Wheat Leaf Rust Leaf rust was severe in some parts of WA, and all samples received were identified as pt 104-1,2,3,(6),(7),11. Drought conditions prevailed in northern regions of eastern Australia, but the generally better conditions in southern regions led to widespread occurrence of leaf rust. Of significance was the detection of pathotype 104-1,2,3,(6),(7),11+*Lr24*, virulent for *Lr24*. This pathotype was first detected in SA in October, and subsequently in southern NSW, Qld and Victoria. The most common pathotypes in eastern Australia were pt 104-1,2,3,(6),(7),11, pt 104-1,2,3,(6),(7),11,12, and the Triller pt 104-1,2,3,(6),(7),9,11.

Wheat Stripe Rust Sample numbers were low although the number of pathotypes identified remained relatively high. Virulence for *Yr17* was reported for the second season, and cultivars vulnerable to this pathotype (Trident, Camm) should continue to be monitored for concerning levels of disease. No crop losses were reported for wheat striope rust in 2000.

Oat Stem Rust Stem rust was widespread in 2000 with reports of concerning levels of stem rust in oat crops in southern parts of WA, and of severe stem rusting in Euro oats in Victoria. The main pathotype identified was 94, especially in WA, with a mixture of pathotypes in the eastern states. Virulence for *Pga* was rare compared to previous seasons.

Oat Leaf Rust Leaf rust was widespread and common on wild oats in WA and in southern parts of eastern Australia. Pathotype distribution was similar to that observed in 1998 and 1999. Virulence for *Pc68* was common in northern NSW and Qld. Virulences were confirmed in single samples for the cultivars Nugene and Gwydir. The only currently recommended cultivars that remain resistant are Bettong and Barcoo. Virulence has not been detected for *Pc91* in Australia to date.

Barley Stem Rust Levels of stem rust in commercial barley crops were very low in 2000. Samples of stem rusted barley from WA yielded primarily wheat stem rust (pts 34-2 or 34-2,7), whilst samples from eastern Australia yielded the non-wheat attacking “scabrum” stem rust.

Barley Leaf Rust The most common pathotypes in 2000 were all virulent on *Rph12*. An early infestation of leaf rust in barley at Gairdner WA on cv. Gairdner was caused by pt 5610P+. The disease was common in southern regions of eastern Australia, including Tasmania. The most commonly identified pathotypes in eastern Australia were 4610P+, 5610P+, 4652P+ and 4653P+.

Barley grass stripe rust This pathogen, which is a variant of the wheat stripe rust pathogen, was again common in spring in the southern states and was recovered from weedy barley grass and occasional barley crops. This pathogen is capable of causing significant disease in certain barley cultivars, especially Skiff, although no crop losses were reported in 2000.

Triticale and Rye Rusts There were no reports of rust in commercial crops of triticale during 2000. One crop of cereal rye at North Watheroo, WA, was heavily infected with rye leaf rust and had moderate to moderately high levels of stem rust. The stem rust was identified as rye stem rust.

II. DETAILED REPORT

INTRODUCTION

Rust surveys or inspections conducted during 2000-2001 included:

Victoria/SA long season wheat areas	27-29 March 2000	Prof R.A. McIntosh
WA, north of Perth	25-28 Sept 2000	Dr R. F. Park
Northern NSW/Qld	8-13 Oct 2000	Prof R.A. McIntosh
South Australia, Yorke Peninsula and Mid-North	16-17 Oct 2000	Dr C.R. Wellings
Southern NSW	9-10 Nov 2000	Dr C.R. Wellings

In the survey of the Victoria/SA long season wheat areas conducted in March 2000, stem rust and leaf rust were present in wheat seed increase blocks on centre pivot irrigated fields of southwestern Victoria and southeastern SA. It seems that if summer increases of non-fully resistant cereals are to continue such crops should be routinely sprayed to protect them from rusts. Stem rust and leaf rust were also present in wheat and barley increase nurseries run by the Dept. of Plant Science, University of Adelaide at Langhorne Creek.

SEASONAL CONDITIONS

Early seasonal conditions in most areas of Australia's grainbelt were average to slightly above average allowing adequate land preparation and sowing activities. However, conditions in northern NSW and Queensland were very dry, with almost no rainfall in the wheat growing regions of Qld during September, resulting in a significant reduction in the realised predicted yield for that state. Conditions were better in the Central Queensland areas and yield improvements over previous seasons were recorded.

Damaging heavy rain and flooding during crop finishing were the final strokes of a poor season for northern NSW. In contrast, southern regions of eastern Australia (southern NSW, Victoria, South Australia) experienced generally favourable conditions and this was reflected in greater rust sample numbers collected in these regions compared to the other states. Conditions in WA during autumn-winter were dry following a wet summer, and this contributed to a reduction in the expected potential for rust epidemics.

WHEAT RUST PATHOGENS

Wheat Stem Rust (caused by *Puccinia graminis* f. sp. *tritici*)
R. F. Park and M. Williams
University of Sydney

Epidemiology and Pathotype Distribution

Conditions in WA during autumn and winter were dry following a wet summer. Outbreaks were reported from a wide range of areas in 2000 and despite the dry conditions a substantial spread of this disease has occurred over the last season with high levels of the disease and significant yield losses in some crops.

Samples of stem rust were forwarded for pathogenicity analyses from WA from March onwards. As in recent years, the predominant pathotypes in WA were 34-2 and 34-2,7 (Table 1). A new variant, 34-1,2,7, with virulence for *Sr6* was detected from several sites in northern regions of WA. Pt 98-1,2,3,5,6, common in eastern Australia but not previously detected in WA, was detected in the Moorine Rock region, and one isolate was also identified from Merredin/ Esperance. Pt 98-1,2,3,5,6 was first detected in eastern Australia in 1978, and was thought to have developed from pt 343-1,2,3,5,6 by mutation to virulence for *Sr9g*. Whilst it is possible that this pathotype developed in WA in the same manner, the low frequency of pt 343-1,2,3,5,6 in WA in recent years would make this less likely and tends to suggest that it may have originated from eastern Australia. The threat posed to current WA cultivars by pts 34-1,2,7 and 98-1,2,3,5,6 should be no greater than that from the resident pathotypes 34-2, 34-2,7 and 343-1,2,3,5,6.

In eastern Australia, stem rust was observed on self sown wheat in the Mallee around Lascelles/ Hopeton in early August. The disease remained at low levels in eastern states, and samples received comprised primarily pt 98-1,2,3,5,6. The Oxley pt 343-1,2,3,5,6, and two pathotypes derived from pt 98-1,2,3,5,6 (*viz*. 34-1,2,3,5,6 (+*Sr7b*) and 98-1,2,3,5,6,7 (+*Sr15*)) were also detected in eastern Australia (Table wsr).

Notes on Cultivars Carrying Genes for Stem Rust Resistance

All cultivars with the following genes are resistant to the pathotypes isolated in 2000-01. Cultivars with *Sr30* should be considered with caution since virulence for *Sr30* has been detected in recent years, and a single isolate of a pathotype combining virulence for *Sr9g* and *Sr30* was isolated from WA during 1999-2000. Furthermore, field studies at PBIC have shown clearly that some cultivars with *Sr30* perform better than others to avirulent pathotypes. This is currently being examined in experimental plots and further information should be available in the near future.

Sr9e Sunland and Yarralinka

Sr22 Schomburghk

Sr24 Cunningham, Datatine, Goroke, Janz, Krichauff, Perouse, Sunco, Sunelg, Swift, Tasman and Worrakatta

Sr26 Hybrid Apollo, Blade, Chough, Currawong, Darter, Flinders, Hybrid Gemini, Harrier, Hybrid Mercury, Petrel, Hybrid Pulsar, Shrike, Snipe, Sunelg, Sunlin, Tern and Yanak

Sr30 Ajana, Arrino (heterogeneous), Brookton, Buckley, Calingiri, Cranbrook, Cunderdin, Frame, Hybrid Galaxy, Kalannie, Katunga, Molineux, Osprey, Rosella, Silverstar, Sunfield, Sunmist

Sr31 Grebe, Mawson,Tennant,Triller and Warbler

Sr38 Bowie, Camm, Sunbri, Sunstate, Sunvale and Trident

The gene *Sr2* confers adequate adult plant resistance and is present in the cultivars Arnhem, Batavia (heterogeneous), Baxter, Brennan, Carnamah, Diamondbird, Dollarbird, Eradu, Goldmark, Gordon, Hartog, Houtman, Kennedy, Leichardt, Lowan, Machete, Nyabing, Pelsart, Rowan, Sunbrook, Suneca, Sunstate, Tailorbird. Cultivars with *Sr13* (Gutha, Machete, Stiletto, Sunmist and Wialki) are moderately susceptible to moderately resistant.

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

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University of Sydney

Epidemiology and Pathotype Distribution

In WA**,** leaf rust became severe in the far northern wheat belt, was moderately severe in early sown crops in the east and south-eastern areas and occurred sporadically in the central and south coastal areas. Samples were received as early as March, and all processed yielded pt 104-1,2,3,(6),(7),11. As was the case last year, variability was observed within this pathotype for virulence on the cultivar Gaza, used as a differential genotype for *Lr23*. Gaza possess additional uncharacterised resistance effective against some isolates of this pathotype (pt 104-1,2,3,(6),(7),11) and ineffective against others (104-1,2,3,(6),(7),11+Gaza high). The virulent variants are of no importance for current commercial wheat cultivars. Similar variability was observed amongst isolates of pt 104-1,2,3,(6),(7),11 and 104-2,3,(6),(7),11 in eastern Australia (Table 2).

Whilst the drought conditions in northern regions of eastern Australia during 2000 did not favour rust development, the generally better conditions in southern regions led to widespread occurrence of leaf rust. Leaf rust was present in plots at Ginninderra ACT in May, and there were reports of the disease at low levels in crops of Kellalac in Victoria in mid September. Samples were received from all eastern states from August onwards.

As has been the case since 1989, pathotype 104-2,3,(6),(7),11 or one of its derivative pathotypes predominated in all regions (Table 2). First detected in Victoria in 1984, pt 104-2,3,(6),(7),11 has had a profound effect on Australian leaf rust populations. Eight mutational derivatives were detected in 2000, most of which had been detected in previous years, accounting for 97% of the isolates identified. The most common pathotypes in south eastern Australia were pt 104-1,2,3,(6),(7),11, pt 104-1,2,3,(6),(7),11,12, and the Triller (*Lr26* virulent) pt 104-1,2,3,(6),(7),9,11 (Table wlr). Pathotypes 76-1,3,5,10,12 and 53-1,(6),(7),10,11,12 were also isolated but at a lower frequency, and primarily off winter wheat cultivars.

The most significant development during 2000 was the detection of a new pathotype with virulence for the resistance gene *Lr24*. Observations made at an experimental field site at Urania, Yorke Peninsula in South Australia on 10 October 2000 by Dr Hugh Wallwork, SARDI, indicated significant levels of leaf rust in plots of Janz, Krichauff and Worrakatta, all of which possess the leaf rust resistance gene *Lr24*. Samples were forwarded to PBIC and initial greenhouse tests on differential sets and the cultivars Cunningham, Janz, Perouse, Sunco, and Tasman confirmed the presence of a new pathotype with virulence for *Lr24* in four samples. This was the first confirmed case of virulence for *Lr24* in Australasia. Greenhouse tests indicated that the new pathotype is a single step mutational derivative of pt 104-1,2,3,(6),(7),11, and it was designated 104-1,2,3,(6),(7),11+*Lr24*. In the week following the initial detection of virulence for *Lr24* in South Australia, a survey was conducted of commercial wheat crops and experimental plots on the Yorke Peninsula and extending east to Balaklava and Gawler. Further collections of leaf rusted wheat were also received from all other wheat growing states from October- mid December. Virulence for *Lr24* was detected in South Australian samples from five sites on the Yorke Peninsula (Coobowie, Wool Bay, Urania, Maitland and Arthurton) and from two sites in the Mid North (Mintaro and Blyth), and also in samples collected in mid-November from several sites in southern and central New South Wales (Coleambally, Wagga Wagga, Pleasant Hills, Henty, Temora, Harden, and as far north as Cowra). Most of these samples comprised mixtures of the putative parental pathotype avirulent on *Lr24,* plus the

Lr24 virulent derivative pathotype. Pt 104-1,2,3,(6),(7),11+*Lr24* was subsequently detected in samples collected from summer nurseries at Horsham, Victoria and Toowoomba, Qld in March 2001.

Given the increasing importance of *Lr37*, and the difficulty associated with testing pathogenicity for this gene in seedling tests, several tests were conducted in which samples from regions were bulked and applied to adult plants with this gene. Lines with the adult plant resistance genes *Lr22a* and *Lr35* were also included in these tests. In all, 7 samples from Qld, 17 samples from NSW/ACT, 18 samples from Victoria, 29 samples from SA, and 65 samples from WA were tested. No virulence was detected for the three resistance genes.

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 virulence for this gene. Cultivars with *Lr13* in combination with *Lr1* (Hybrid Apollo, Arnham, Batavia, Cunderdin, Diamondbird, Dollarbird, Goldmark, Hartog, Kennedy, Leichardt, Lowan, Hybrid Pulsar, Rowan, Silverstar, Sunbrook, Suneca, Sunfield and Tailorbird) or *Lr2a* (Sunmist) are also resistant to the pathotypes isolated, however pt 64-(6),(7),(10),11, isolated only once in 2000 (from Henty, southern NSW), combines virulence for *Lr1* with partial virulence for *Lr13* and the response of wheats with these genes to this pathotype is not known. Cultivars with *Lr26* (Grebe, Mawson, Triller and Warbler) are seedling susceptible to pt 104-1,2,3,(6),(7),9,11, now present in all eastern states. Sunland (*Lr28*) is resistant to the pathotypes isolated during 2000.

All cultivars with *Lr37* (Bowie, Camm, Sunbri, Sunstate, Sunlin, Sunvale and Trident) are resistant to all pathotypes isolated from Australasia during 2000.

The long season dual purpose wheats Longbow and More (*Lr13*), Gordon (*Lr17b* plus possibly *Lr13*), and Lawson, Muchmore (*Lr17b* and *Lr13)* are all seedling susceptible to pts 73-1,3,5,10,12, 53-1,(6),(7),10,11,12, and 104-1,2,3,(6),(7),11,12. Declic (*Lr13*, *Lr14a*, *Lr17b*) is resistant to all pathotypes except 76-1,3,5,10,12 and 104-1,2,3,(6),(7),11,12. It is anticipated that Tennant (*Lr26*) will be at least seedling susceptible to the Triller pathotype. It is possible that these cultivars may possess additional adult plant resistance.

Further information is required regarding the responses of cultivars with *Lr24* (Cunningham, Datatine, Goroke, Janz, Krichauff, Nyabing, Perouse, Sunco, Sunelg, Swift, Tasman and Worrakatta) to the new *Lr24* virulent pathotype. Greenhouse tests of 28 Australian wheat cultivars with *Lr24* revealed that all except Dennis, Giles, Petrie, and Sunsoft98 were seedling susceptible to the new pathotype. The additional resistances observed in these four cultivars were postulated to be *Lr17b* or *Lr13* in Dennis, and *Lr13* in the remaining three. Adult plant field tests of 20 cultivars with *Lr24* conducted during the summer of 2000-01 confirmed the resistance of these four cultivars to the new pathotype, and indicated that all other cultivars tested were either moderately susceptible or susceptible to the new pathotype

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

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([1]on secondment from NSW Agriculture)

Disease development

Following the first recording of wheat stripe rust in Qld at Meandarra in early August, the disease was subsequently detected in trial plots at Narrabri, NSW (29/08), Yarrawonga, Victoria (12/09), Roseworthy, SA (13/09) and Walpeup, Victoria (18/09). The epidemic was largely confined to southern NSW and Victoria, especially during the months of October and November. However, stripe rust on wheat was generally of low incidence in eastern Australia and no reports of crop loss were received. Samples were not received from Tasmania and the disease continues to be absent from Western Australia.

Pathotype distribution

The distribution of pathotypes detected in 2000-01 are detailed in Table 3. Although sample number was low, the diversity of pathotypes recovered in the survey was relatively high. The early isolates from Queensland and northern NSW and subsequently southern NSW were pathotype 104 E137 A-, which has been common in this region for many years. Pathotype 104 E153 A+ was again recovered in 2000, following the observation of an increased frequency in the previous year. This pathotype, which is a derivative of 104 E137 A+, was first detected in the 1980s and has reappeared over the last two seasons for no apparent reason. Samples received from Camm (*Yr17*) and other unnamed wheats yielded the *Yr17* virulent pathotype 104 E137 A-, Yr17+. This pathotype was first recorded in 1999 and is expected to continue to survive while wheats with this resistance gene in a susceptible background (Camm, Trident) are cultivated. Varieties with *Yr17* and effective adult plant resistances (Bowie, Sunvale, Sunbri, Sunlin, Sunstate) are not expected to be vulnerable to the *Yr17*-virulent pathotypes. A variant of the latter pathotype (*ie* 104 E137 A+, Yr17+) was detected in one sample for the first time.

New Zealand pathotypes were similar to previous seasons, although sample numbers were low. The major pathotype was 234 E139 A-, Yr17+ which combined virulence for *Yr7, Yr9, Yr17.*

Notes on current resistances

Resistance genes *YrA, Yr6, Yr7, Yr9, Yr18* are deployed in certain Australian wheats and these will generally continue to provide varying protection in areas where the prevailing pathotypes remain avirulent. Among these genes, however, only *Yr18* has provided durable resistance in association with other undescribed adult plant resistances.

OAT RUST PATHOGENS

Oat Stem Rust (caused by *Puccinia graminis* f. sp. *avenae*)
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Disease development and pathotype distribution

Survey sample numbers were relatively low during 2000 representing half of those received in the previous season. However, samples were generally representative of all Australian cereal growing districts with the exception of Queensland. Samples were received from April, were predictably low during winter and were most frequent during October and November. There were reports of concerning levels of stem rust in oat crops in southern parts of WA, and of severe stem rusting in Euro oats in Victoria.

Pathotype distribution was similar to previous seasons (Table 4). The main pathotype identified was 94, especially in Western Australia, with a mixture of pathotypes in the eastern states. Pathotype 94, which is broadly virulent on most resistance genes in the differential set, has been the dominant pathotype group for several years. Virulence for *Pga* (noted by the addition of '4' in the pathotype formula) was rare compared to previous seasons. Virulence for this gene had stabilised at around 20% for several years, but appeared to drop to less than 10% in 2000. Pathotype group 41 was also rare in 2000 compared to previous seasons.
Effective stem rust resistance in Australian oat cultivars is essentially unavailable. However cultivars carrying *Pga* (Barcoo, Culgoa II, Glider, Cleanleaf, Nobby) will be protected in situations where the matching virulence is absent in the pathogen population.

Oat Leaf Rust (caused by *Puccinia coronata* f. sp. *avenae*)
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Epidemiology and Pathotype Distribution
Leaf rust was widespread and common on wild oats in WA and in southern parts of eastern Australia, however the number of samples received in 2000 was lower than in recent years. As is usually the case, most samples comprised mixtures of two or more pathotypes, and again, considerable effort was put into subculturing components of mixtures to allow accurate identification of pathotypes. From the 91 samples received, 18 failed to yield a viable isolate, and 137 isolates comprising 17 pathotypes were identified from the remaining 73 samples (Table 5).

Of importance during 2000 was the detection of virulences for the cultivars Nugene and Gwydir. Virulence for Nugene was detected in a single sample received from Qld early in 2000, with the pathotype responsible a single-step mutational derivative of the Cleanleaf pathotype, 0207-4,6,10. Virulence for Gwydir was also detected in a sample from Qld, and again, the virulent pathotype appears to be a derivative from the Cleanleaf group of pathotypes (0207-1,4,6,10,11,12+Gwydir). Both Nugene and Gwydir were released as a leaf rust resistant cultivars, and the detection of virulence for them further demonstrates the ability of the oat leaf rust pathogens to overcome the resistance of newly released cultivars. Virulence was not detected for *Pc91* and has not been detected in surveys to date.

Overall pathotype distribution was similar to that observed in 1998 and 1999. Virulence for *Pc68* (present in Graza 68 and Moola), first detected in 1999, was common in samples from northern NSW and Qld. The common occurrence of virulence for *Pc38*, *Pc39*, *PcCleanleaf* and *Pc61* in Qld and NSW and low frequency or absence in other regions, seen in recent years, was also apparent during 2000 (Table 5). The most common pathotypes in

Qld and NSW were the Amby pathotype (0071-0), the Cleanleaf pathotype or several derivatives, and pt 0001-0. In other states, pts 0000-2 or 0001-0 were most common (Table 5), continuing a pattern observed in 1998 and 1999.

Notes on Cultivars Carrying Genes for Leaf Rust Resistance

Virulence was detected for all current cultivars except Bettong and Barcoo, which remain the only recommended cultivars for which virulence has not yet been detected.

BARLEY RUST PATHOGENS

<u>Barley Stem Rust</u> (caused by *Puccinia graminis*)
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Levels of stem rust in commercial barley crops were very low in 2000. Seven samples of stem rusted barley from WA that yielded viable isolates all comprised wheat stem rust (pts 34-2, 34-2,7, or 98-1,2,3,5,6), whilst samples from eastern Australia yielded either the non-wheat attacking “scabrum” stem rust or wheat stem rust (pts 98-1,2,3,5,6 or 343-1,2,3,5,6) (Table 6).

<u>Barley Leaf Rust</u> (caused by *Puccinia hordei*)
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Epidemiology and Pathotype Distribution

In WA, there was one early infestation of leaf rust in barley at Gairdner on cv. Gairdner at late stem elongation stage, and the crop was sprayed with triadimefon in late August. No other significant reports of barley leaf rust were made in WA, and the pathotype isolated from the crop of Gairdner was identified as 5610P+. This pathotype is virulent for *Rph12* (present in the cultivars Franklin, Gairdner, Tallon and Lindwall), and was first detected in Australia in WA in 1997, and the following year it was detected in eastern Australia.

Leaf rust in barley was common in southern regions of eastern Australia, including Tasmania. The most commonly identified pathotypes were all virulent on *Rph12 viz.* 4610P+, 5610P+, 4652P+ and 4653P+. The latter pathotype, virulent for the recently characterised gene *Rph13*, was detected in Qld for the first time. Virulence for this gene was first detected in a single pathotype (4610P+) in Tasmania in 1991, and since then a further three pathotypes have been identified and virulence is present in all barley growing regions. Pathotypes 220P+ and 222P+ were also isolated from SA (Table 7).

Notes on Cultivars Carrying Genes for Leaf Rust Resistance

Many Australian barley cultivars carry 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 since their adult plant responses to the *Rph12* virulent pathotypes detected in the region last year are currently unknown. The cultivar Galaxy, with *Rph7*, is resistant to all isolates identified since formal pathogenicity surveys were commenced in 1992. Gilbert also possesses partial resistance to leaf rust.

<u>Barley Grass Stripe Rust</u> (caused by *Puccinia striiformis*)

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([1]on secondment from NSW Agriculture)

Disease development

Samples of stripe rust on barley grass (*Hordeum glaucum, H. leporinum*) comprised two types: the first was wheat stripe rust (*P. striiformis tritici*) while the second has been described as a unique form of the pathogen which is specialized in its ability to infect wild barley grasses and certain cultivated barleys, notably Skiff. The latter was again common in 2000, although it predominated in southern NSW and Victoria in September (Table 3).

While some samples were received from stripe rust infections in commercial barleys, crop losses were not reported. Field experiments in 2000 failed to demonstrate crop losses, although difficulties were experienced at each trial site. These experiments will be repeated in 2001, together with screening of breeding material to identify and eliminate susceptible lines.

TRITICALE AND RYE RUST PATHOGENS

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There were no reports of rust in commercial crops of triticale during 2000. One crop of cereal rye at North Watheroo, WA, was heavily infected with rye leaf rust and had moderate to moderately high levels of stem rust. The stem rust was identified in greenhouse tests at PBIC as the non-wheat attacking rye stem rust pathogen.

MISCELLANEOUS RUST PATHOGENS ON GRASSES

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Twenty one samples of rusted grasses were submitted, most of which did not yield viable isolates capable of infecting cereals. One sample of stem rusted barley grass collected from Latham, WA, comprised oat stem rust. An isolate of a grass infecting stem rust with intermediate virulence on the oat cultivar Swan was isolated from Phalaris, collected in SA. Eight samples of rust on rye grass did not produce symptoms on the wheat, barley, and oat differentials used, but did cause occasional flecking on Black Winter Rye. These samples were concluded to be either rye grass leaf rust (*Puccinia coronata* f.sp. *lollii*) or rye grass stem rust (*P. graminis* f.sp. *lolii*).

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Table 1. Wheat stem rust isolates identified by region, 1 April 2000- 31 March 2001.

	Number of Isolates								
	Region 1			Region 2		Region 3	Region 4	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	NZ	**TOTAL**
34-1,2,3,5,6	-	1	-	4	-	1	-	-	**6**
34-1,2,7	-	-	-	-	-	-	8	-	**8**
34-2	-	-	-	-	-	-	33	-	**33**
34-2,7	-	-	-	-	-	-	49	-	**49**
34-2,7,10	-	-	-	-	-	-	5	-	**5**
98-1,2,3,5,6	-	-	2	14	-	12	14	-	**42**
98-1,2,3,5,6,7	-	-	-	-	3	-	1	-	**4**
343-1,2,3,5,6	2	-	-	-	-	-	-	-	**2**
Total no isolates	**2**	**1**	**2**	**18**	**3**	**13**	**110**	**0**	**149**
Total no samples	**2**	**1**	**2**	**18**	**3**	**14**	**120**	**0**	**160**
No failed samples	**0**	**0**	**0**	**1**	**0**	**1**	**12**	**0**	**14**

Table 2. Wheat leaf rust isolates identified by region, 1 April 2000 – 31 March 2001

	Number of Isolates								
	Region 1			Region 2		Region 3	Region 4	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	NZ	**TOTAL**
53-1,(6),(7),10,11	-	1	-	-	-	-	-	-	**1**
53-1,(6),(7),10,11,12	-	-	4	1	-	-	-	-	**5**
64-(6),(7),(10),11	-	-	1	-	-	-	-	-	**1**
76-1,3,5,10,12	-	-	5	-	-	1	-	-	**6**
104-1,2,3,(6),(7),11	-	5	17	12	1	23	77	-	**135**
104-1,2,3,(6),(7),11+Gaza High	-	1	1	5	1	5	76	-	**89**
104-1,2,3,(6),(7),11,12	-	4	24	30	-	32	-	-	**90**
104-1,2,3,(6),(7),9,11	12	7	48	10	-	5	-	-	**82**
104-1,2,3,(6),(7),9,11,12	-	-	1	-	-	-	-	-	**1**
104-1,2,3,(6),(7),11+Lr24	5	1	12	4	-	24	-	-	**46**
104-2,3,(6),(7),11	-	3	8	2	-	-	-	-	**13**
104-2,3,(6),(7),11+Gaza High	-	1	-	-	-	-	-	-	**1**
122-1,2,3,(6),(7),11	-	-	-	-	-	4	1	-	**5**
Total no isolates	**17**	**23**	**121**	**64**	**2**	**94**	**154**	**0**	**475**
Total no samples	**16**	**14**	**79**	**44**	**2**	**51**	**182**	**0**	**388**
No failed samples	**0**	**2**	**11**	**8**	**0**	**2**	**39**	**0**	**62**

Table 3. Stripe rust isolates identified by region, 1 April 2000 – 31 March 2001

	Number of Isolates							
	Region 1			Region 2		Region 3	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	NZ	**TOTAL**
104 E9 A-	-	1	-	1	-	-	-	**2**
104 E137 A-	1	2	3	-	-	1	-	**7**
104 E137 A+	-	-	3	2	-	-	-	**5**
104 E137 A-, Yr17+	-	-	1	3	-	-	-	**4**
104 E137 A+, Yr17+	-	-	1	-	-	-	-	**1**
104 E153 A+	-	-	2	2	-	2	-	**6**
110 E143 A+	-	1	-	-	-	1	1	**3**
234 E139 A+	-	-	-	-	-	-	1	**1**
234 E139 A-, Yr17+	-	-	-	-	-	-	5	**5**
235 E139 A-	-	-	-	-	-	-	1	**1**
238 E143 A+	-	-	-	-	-	-	1	**1**
BGYR ? *	-	5	29	4	-	1	-	**39**
Miscellaneous	-	-	6	2	-	-	1	**9**
Total no isolates	**1**	**9**	**65**	**23**	**0**	**8**	**10**	**116**
Total no samples	**1**	**14**	**82**	**31**	**0**	**15**	**10**	**153**
No failed samples	**0**	**5**	**17**	**8**	**0**	**7**	**0**	**37**

* BGYR ? indicates samples presumed to be BGYR, based on limited data on the response of certain differentials. However these isolates failed in later tests on the set of test genotypes and hence a definite conclusion could not be completed.

Table 4. Oat stem rust isolates identified by region, 1 April 2000 – 31 March 2001

	Number of Isolates								
	Region 1		Region 2			Region 3	Region 4	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	NZ	**TOTAL**
30	-	-	1	-	-	-	-	-	**1**
30-1	-	-	1	-	-	1	-	-	**2**
30-3	-	-	1	1	-	-	-	-	**2**
30-1,3	-	-	2	1	-	1	-	-	**4**
30-1,3,4	-	-	1	-	-	-	-	-	**1**
30-1,2	-	-	-	-	-	-	1	-	**1**
30-1,2,3	-	-	-	1	-	-	-	-	**1**
30-1,2,3,4	-	-	1	1	-	-	-	-	**2**
31-3	-	-	-	1	-	-	-	-	**1**
94	-	-	2	-	-	3	10	-	**15**
94-2	-	-	6	1	-	1	14	-	**22**
94-3	-	1	5	2	-	4	1	-	**13**
94-2,3	-	-	7	1	-	3	3	-	**14**
94-2,3,4	-	-	-	1	-	2	-	-	**3**
96-2,3	-	-	-	1	-	-	1	-	**2**
Miscellaneous	-	-	3	11	-	1	1	-	**16**
Total no isolates	**0**	**1**	**30**	**22**	**0**	**16**	**31**	**0**	**100**
Total no samples	**1**	**1**	**36**	**22**	**0**	**18**	**37**	**0**	**115**
No failed samples	**1**	**0**	**6**	**0**	**0**	**2**	**6**	**0**	**15**

Table 5. Oat leaf rust isolates identified by region, 1 April 2000 – 31 March 2001.

	Number of Isolates								
	Region 1		Region 2			Region 3	Region 4	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	NZ	**TOTAL**
0000-2	-	-	-	-	-	7	8	-	**15**
0001-0	1	3	16	1	-	12	13	-	**46**
0001-1	-	-	2	-	-	-	-	-	**2**
0001-1,4,11,12	-	-	1	-	-	-	-	-	**1**
0001-2	-	-	1	-	-	1	-	-	**2**
0001-4	-	-	2	-	-	-	-	-	**2**
0001-4,7	-	1	-	-	-	-	-	-	**1**
0003-1,6,10,11,12	-	-	1	-	-	-	-	-	**1**
0007-6,10	-	-	2	-	-	-	-	-	**2**
0007-6,8,10	-	-	1	-	-	-	-	-	**1**
0071-0	1	3	18	-	-	5	-	-	**27**
0207-1,6,10,11,12	1	-	-	-	-	-	-	-	**1**
0207-6,10	-	1	9	1	-	-	-	-	**11**
0307-6,10	4	3	5	-	-	-	-	-	**12**
0607-6,10	1	-	2	-	-	-	-	-	**3**
2207-6,10	2	-	2	-	-	-	-	-	**4**
4473-6,10	2	-	4	-	-	-	-	-	**6**
Total No. Isolates	**12**	**11**	**66**	**2**	**0**	**25**	**21**	**0**	**137**
Total no samples	**6**	**6**	**40**	**2**	**0**	**17**	**20**	**0**	**91**
No failed samples	**1**	**0**	**12**	**1**	**0**	**2**	**2**	**0**	**18**

Table 6. Barley stem rust isolates identified by region, 1 April 2000 – 31 March 2001.

	Number of Isolates							
	Region 1		Region 2			Region 3	Region 4	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	**TOTAL**
Scabrum-Sr21	-	-	-	1	-	1	-	**2**
Scabrum+Sr21	1	-	-	1	-	3	-	**5**
34-2	-	-	-	-	-	-	5	**5**
34-2,7	-	-	-	-	-	-	1	**1**
98-1,2,3,5,6	-	-	-	2	3	1	1	**7**
343-1,2,3,5,6	1	-	-	-	-	-	-	**1**
								0
Total no isolates	**2**	**0**	**0**	**4**	**3**	**5**	**7**	**21**
Total no samples	**2**	**0**	**0**	**2**	**3**	**3**	**11**	**21**
No failed samples	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**4**

Table 7. Isolates of Puccinia hordei identified by region, 1 April 2000 – 31 March 2001.

	Number of Isolates								
	Region 1		Region 2			Region 3	Region 4	Region 5	
Pathotype	QLD	NNSW	SNSW	VIC	TAS	SA	WA	NZ	**TOTAL**
220P+	-	-	-	1	-	6	-	-	**7**
222P+	-	-	-	-	-	2	-	-	**2**
4610P+	1	-	3	3	1	5	-	-	**13**
4652P+[a]	-	-	7	5	4	7	-	-	**23**
4653P+[ab]	1	-	1	3	4	-	-	-	**9**
5610P+[a]	-	-	1	-	2	3	1	-	**7**
Total no isolates	**2**	**0**	**12**	**12**	**11**	**23**	**1**	**0**	**61**
Total no samples	**2**	**2**	**11**	**9**	**4**	**12**	**3**	**0**	**39**
No failed samples	**1**	**2**	**4**	**2**	**0**	**2**	**2**	**0**	**13**

[a] Virulent on PI344666.
[b] Virulent on *Rph13*.

