BGRI 2013 Technical Workshop

19–22 August, New Delhi, India

Index to Posters

Adoption or Rust Resistant Wheat

1 **Accelerated women's participation in promotion of rust resistant wheat varieties in hills of Nepal,** *S. Sharma et al.*

2 **Nepal-CIMMYT collaboration in increasing food security through wheat research and development,** *D.B. Thapa et al.*

3 **Going beyond component technologies to integrated systems for enhancing the adoption of rust tolerant wheat varieties: Experience of EAAPP in Ethiopia,** *M. Yami et al.*

4 **Determinants of adoption of rust resistant improved wheat varieties in the Robe and Digelu Tijo districts of Oromiya region, Ethiopia***, T. Solomon et al.*

New Tools for Breeding

5 **A consensus map for race Ug99 stem rust resistance loci in wheat,** *L.-X. Yu et al.*

6 **Closely linked markers for *Yr51*: From discovery to implementation,** *M.S. Randhawa et al.*

7 **Development of a wheat core germplasm set for precision breeding,** *A. Tiwari et al.*

8 **Evaluation of design strategies for genomic selection training populations: A wheat stem rust resistance case study,** *J. Rutkoski et al.*

Mapping and Molecular Dissection of Rust Resistance

9 **Sources of resistance to stripe rust identified using molecular markers,** *J.P. Jaiswal et al.*

10 **Genetic analysis of resistance to leaf rust and stripe rust in Indian wheat cv. Sujata and NP876,** *C.X. Lan et al.*

11 **Resistance to leaf rust and stripe rust in common wheat cv. Francolin#1,** *C.X. Lan et al.*

12 **Identification and mapping of genetic factors controlling stripe and leaf rust resistance in spring wheat,** *A. Singh et al.*

13 **Molecular mapping and improvement of leaf rust resistance in wheat breeding lines,** *T. J. Tsilo et al.*

14 **Identification and mapping of genetic factors controlling stem rust resistance in spring wheat and the study of their epistatic interactions across multiple environments ,** *A. Singh et al.*

15 **Genomic localization and genetic mapping of race-specific stem rust resistance in the Synthetic W7984 x Opata M85 double haploid population,** *S.M. Dunckel et al.*

16 **Seedling resistance to wheat leaf rust in Thatcher isolines carrying race specific and race non-specific genes,** *S. Dugyala et al.*

17 **Breeding high yielding micronutrient-rich wheat varieties with resistance to rusts,** *G. Velu et al.*

18 **Leaf tip necrosis, lesion mimic genes and resistance to spot blotch in spring wheat,** *P.S. Yadav et al.*

19 **Molecular marker assisted accelerated improvement of wheat varieties with multiple rust resistances,** *Vinod et al.*

20 **Comparison of GBS vs. SNP-chip approaches for mapping Ug99-effective APR QTLs,** *P. Bajgain et al.*

21 **Deciphering single nucleotide polymorphism using Next-Generation Sequencing data in hexaploid bread wheat,** *S. Chandra et al.*

22 **Characterization of recombinant *Lr34* protein: A putative wheat ABC transporter involved in leaf rust resistance,** *R. Nandhakishore et al.*

23 ***In silico* identification, annotation and expression profiling of wheat WRKY transcription factors in response to leaf rust pathogenesis using Next Generation Sequencing data,** *L. Satapathy et al.*

24 **Functional characterization of a wheat WRKY transcription factor with protective role in leaf rust pathogenesis and AFM imaging of the protein-DNA complex,** *D. Kumar et al.*

25 **Mining, annotation and characterization of stress responsive transcription factor genes ZIM, GRAS and HSF in wheat,** *Poonam S. and K. Mukhopadhyay*

26 **Evidence of *Yr36*-mediated partial resistance at low temperatures,** *V. Segovia et al.*

27 **Validation of a candidate barley stem rust susceptibility gene determining the recessive nature of rpg4-mediated Ug99 resistance ,** *D. Arora and R. Brueggeman*

27.1 **Genome-wide association analysis on seedling and adult plant resistance of stripe rust in elite Pacific Northwest spring wheat lines,** *K. Ando and M. O. Pumphrey*

New Sources of Resistance

28 **Wheat-alien chromosome addition lines for stem rust and yellow rust resistances,** *M. Rahmatov et al.*

29 **Inheritance of Ug99 resistance in spring wheat landrace PI 374670,** *E.M. Babiker et al.*

30 **Reaction of Turkish wild and landrace wheat and barley accessions to African *Pgt* race TTKSK,** *B. Steffenson et al.*

31 **Introgression of resistance to African Pgt races from Sharon goatgrass (*Aegilops sharonensis*) into wheat,** *E. Millet et al.*

32 **Identification of novel genes for resistance to African *Pgt* races in *Aegilops* spp. ,** *J. Manisterski et al.*

33 **Stem rust resistance in *Aegilops* spp.,** *P.D. Olivera and Y. Jin*

34 **Genetics of resistance to African *Pgt* races in Sharon goatgrass,** *B. Steffenson*

35 **Stem rust and leaf rust resistances in wild relatives of wheat with D genomes,** *V.K. Vikas et al.*

36 **Sources of resistance to stem rust in durum wheat,** *A.N. Mishra et al.*

37 **Identification of new sources of resistance to wheat rusts,** *Satish-Kumar et al.*

38 **A novel gene for leaf rust resistance in Tunisian durum wheat,** *S. Berraies et al.*

39 **Yield evaluation of wheat lines carrying stem rust resistance genes derived from alien species,** *I. Dundas et al.*

40 **Preliminary evaluation of Ethiopian emmer landraces to wheat rusts and *Septoria tritici* blotch in southeastern Ethiopia,** *B. Hundie*

41 **Reactions of Turkish wheat landraces to *Pgt* race TTKTF,** *K. Akan et al.*

42 **Reactions of some Turkish *Aegilops* and *Triticum* materials to *Pgt* race TTKTF,** *K. Akan et al.*

National and Regional Efforts toward Wheat Rust Resistance

43 **Genetic mapping and QTL analysis of leaf rust resistance genes in Australian wheat cultivar 'Cook',** *A. Akhmetova et al.*

44 **Breeding for durable rust resistance in Texas hard red winter wheat using synthetic-derived wheat lines,** *B. Reddy et al.*

45 **Resistance to *Pgt* race TTKSF in the wheat cv. Matlabas,** *Z. Pretorius et al.*

46 **Development of wheat lines with complex resistance to rusts,** *L. Herselman et al.*

47 **Stripe (yellow) rust resistant spring bread wheat genotypes for the CWANA region,** *W. Tadesse et al.*

48 **Variation in seedling response to North American *Pgt* and *Pt* races in an inclusive East African bread wheat panel,** *M. Godwin et al.*

49 **Evaluation of bread wheat germplasm from the CGIAR Centers against *Pgt* race Ug99 in 2012,** *Z. Tadesse*

50 **Yield performance and rust reactions of Ethiopian bread wheat genotypes ,** *Y.S. Ishetu et al.*

51 **Zakia: A new Ug99-resistant variety for the heat stressed environments of Sudan,** *I.S.A. Tahir et al.*

52 **Resistance of some Turkish bread wheat genotypes to yellow rust and stem rust,** *L. Çetin et al.*

53 **Seedling and adult plant resistance to stripe rust among winter wheat commercial cultivars and advanced breeding lines in Uzbekistan,** *Z. Ziyaev et al.*

54 **Molecular breeding for leaf rust resistance in wheat,** *A. Kokhmetova et al.*

55 **Characterization of Afghan wheat landraces for response to rusts,** *A. Manickavelu et al.*

56 **Stem rust reactions of candidate wheat lines under artificially inoculated and natural conditions in southern Pakistan,** *K.A. Khanzada et al.*

57 **Response of wheat cv.Seher-06 to leaf rust in Pakistan,** *J.I. Mizra et al.*

58 **Wheat cultivation in Bhutan: Prospects and challenges,** *S. Tshewang and Doe Doe*

59 **Genetics of rust resistances in Nepalese wheats,** *B.N. Mahto et al.*

60 **Determining rust resistance genes in Nepalese wheat lines using SSR markers ,** *S. Baidya et al.*

61 **Rust resistant wheat varieties released in Bangladesh,** *N.D.C. Barma et al.*

62 **HD-2189: A bread wheat variety undefeated by *Puccinia triticina* for 25 years in India,** *G.S. Arunkumar et al.*

63 **Yield reductions caused by stripe rust in a diverse group of Indian wheat genotypes,** *R. Tiwari et al.*

64 **Screening Indian germplasm for leaf rust resistance,** *A.L. Bipinraj et al.*

65 **Utilization of Australian germplasm for enhancing stripe rust resistance in popular Indian wheat cultivars ,** *R. Chatrath et al.*

66 **Marker assisted pyramiding of stem rust resistance genes *Sr24* and *Sr26* in Indian wheat breeding,** *B.K. Das et al.*

67 **Adult plant leaf rust resistance in Indian bread wheat accessions bearing leaf tip necrosis,** *J Kumar et al.*

68 **Assaying stem rust resistance genes in Indian wheat varieties using molecular markers,** *R. Malik et al.*

69 **An accelerated breeding approach to pyramid resistance genes as a means of addressing wheat rust threats in India,** *M. Sivasamy et al.*

70 **Exploring untapped variability for stripe rust resistance in indigenous wheat germplasm,** *C.N. Mishra et al.*

71 **Identification of slow ruster wheat genotypes for stripe and leaf rusts under artificially inoculated conditions,** *M.S. Sarahan et al.*

72 **Evaluation of barley genotypes for stripe rust (*Puccinia striiformis* f. sp. *hordei*) resistance in India,** *R. Selvakumar et al.*

73 **A need to diversify *Lr24*-based leaf rust resistance of wheat in central India,** *T.L. Prakasha et al.*

74 **Frequency of Ug99 resistant wheat lines derived from segregating populations selected under the Mexican and Mexico-Kenya shuttle breeding schemes,** *J. Huerta-Espino et al.*

Breeding Rust Resistance Durum Wheat

75 **Stem rust resistance in durum wheat,** *P.D. Olivera et al.*

76 **Breeding for leaf rust resistance in durum wheat in Morocco,** *N. Nsarellah et al.*

77 **Preliminary characterization of resistance to stripe rust from six elite durum lines,** *A. Loladze and K. Ammar*

78 **Leaf rust resistance in landraces and wild relatives of durum wheat from the Caucasus region,** *A. Loladze and K. Ammar*

79 **Characterization of leaf rust resistance of durum wheat lines derived from crosses with wild relatives,** *A. Loladze et al.*

80 **Mitigating the threat of leaf rust to durum yield stability in new, *Septoria tritici* blotch resistant, germplasm in Tunisia,** *M.S. Gharbi et al.*

81 **Identification and mapping of markers linked to leaf rust resistance in Indian durum genotype Malvilocal,** *A.L. Bipinraj et al.*

Global Surveillance Tools

82 **Wheat rust information resources: Integrated tools and data for improved decision making,** *D. Hodson et al.*

83 **FAO Global Wheat Rusts Program strengthens national capacities to manage wheat rusts,** *F.Dusunceli et al.*

84 **An SMS network tool for rapid surveillance of wheat rusts through extension offices: A pilot initiative in Turkey,** *F.Dusunceli et al.*

85 **A new early-warning system for stripe rust affecting wheat and triticale: Host-pathogen interactions under different environmental conditions,** *J. Rodríguez-Algaba et al.*

86 **Inferring the origin and trajectories of recent invasions of wheat yellow rust strains from worldwide population structure,** *S. Ali et al.*

87 **Screening for stem rust resistance in East Africa: A global effort to mitigate the threat of Ug99,** *S. Bhavani et al.*

National Surveillance Efforts

88 **SSR analysis of herbarium specimens of *Puccinia graminis* f. sp. *tritici* in South Africa,** *B. Visser et al.*

89 **Variation among *Puccinia graminis* f. sp. *tritici* isolates from wheat in South Africa, 2011 and 2012,** *T.G. Terefe and Z.A. Pretorius*

90 **The rusts of *Secale africanum* in South Africa,** *C.M. Bender et al.*

91 **Wheat rusts: Distribution and virulence analysis of stem rust in the major wheat growing regions of Ethiopia in 2012 and 2013,** *G. Woldeab et al.*

92 **Occurrence of wheat rusts in Algeria and strategies to reduce crop losses,** *A. Benbelkacem and H.J. Braun*

93 **The rusts on winter wheat in southeastern Kazakhstan,** *Y. Dutbaev et al.*

94 **Wheat stem rust research in Georgia,** *Z. Sikharulidze et al.*

95 **Wheat rust virulence in southern Russia,** *G. Volkova et al.*

96 **Phenotypic and genotypic analyses of Turkish *Pgt* samples collected in 2012 ,** *M. Newcomb et al.*

97 **Epidemics and adult-plant responses of Iranian wheat genotypes to the *Yr27*-virulent *Pst* race in 2013,** *F. Afshari et al.*

98 ***Puccinia striiformis* f. sp. *tritci* races and their distribution in Syria during 2008 and,** *S. Kharouf et al.*

99 **Physiologic specialization of *Puccinia triticina* on durum wheat in Syria in 2010,** *M. Kassem and M. Nachit*

100 **Virulence spectra of wheat rusts in Pakistan during 2012-13,** *A.R. Rattu et al.*

101 **Status of stripe rust and virulence patterns of *Pst* in Pakistan,** *J.I. Mirza et al.*

102 **Current status of *Pgt* virulence in Pakistan,** *J.I. Mirza et al.*

103 **Surveillance of wheat rusts in Bangladesh,** *P.K. Malaker et al.*

104 **Prevalence and distribution of wheat stripe rust in Jammu and determination of sources of resistance,** *V. Gupta et al.*

105 **Stripe rust of wheat: An Indian puzzle,** *S.C. Bhardwaj et al.*

106 **Virulence analysis of *Pst* isolates collected from western Canada,** *H.S. Randhawa et al.*

107 **Physiological specialization of *Puccinia triticina* on wheat in Argentina in 2011,** *P. Campos*

108 **Upgrading knowledge of Chilean hexaploid wheat yield losses caused by stripe rust and leaf rust,** *R. Madariaga and I. Matus*

Barberry Surveillance

109 **Barberry rust survey: Developing tools for diagnosis, analysis and data management,** *A.F. Justesen et al.*

110 **Survey of barberry and associated rust pathogens in Nepal ,** *M. Newcomb et al.*

Characterizing Wheat Rusts

111 **EMS mutagenesis of avirulent *Puccinia graminis* f. sp. *tritici* urediniospores,** *G. Singh et al.*

112 **Analysis of simple sequence repeats in genic regions of the wheat rust fungi ,** *R. Singh et al.*

113 **Analysis of effector proteins from the flax rust and wheat stem rust pathogens,** *P. Dodds et al.*

114 **Genome analyses of the wheat yellow (stripe) rust pathogen *Puccinia striiformis* f. sp. *tritici* reveal polymorphic and haustorial expressed secreted proteins as candidate effectors,** D.G.O. Saunders et al.

115 **Next-generation sequencing to characterize *Pst* races from western Canada,** *A. Laroche et al.*

116 **Identification and characterization of microRNAs and their putative target genes in *Puccinia* spp.**, *B. Pandey et al.*

117 **Characterization of seedling yellow rust resistance in wheat commercial cultivars, landraces and elite genotypes from Syria and Lebanon**, *R. Al Amil et al.*

SSR analysis of herbarium specimens of *Puccinia graminis* f. sp. *tritici* in South Africa

B. Visser, L. Herselman and Z.A. Pretorius

Department of Plant Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa

E-mail: visserb@ufs.ac.za

The South African *Puccinia graminis* f. sp. *tritici* (*Pgt*) population is divided into two groups. The first consists of four members of the Ug99 race group, namely TTKSF, TTKSF+, TTKSP and PTKST, some of which are thought to have entered South Africa as exotic introductions. The second group is assumed to have developed, through step-wise acquisitions of virulence from older Stakman races 34 and 21 described in 1922 and 1929, respectively. Even though the evolution of South African *Pgt* races is reasonably well documented through phenotypic data, genetic studies of the older races are limited by the non-availability of DNA. To partially address this problem, 24 herbarium specimens labelled as *Pgt* were obtained from the South African National Collection of Fungi (PREM) housed by the ARC Plant Protection Research Institute in Pretoria. The collection dates ranged from 1906 to 1945, with 17 collections being from South Africa, three from Rhodesia (Zimbabwe) and one each from Zambia, Mozambique, Tanganyika (Tanzania) and Uganda. SSR analysis is being used to align these isolates with current South African races including the four members of the Ug99 race group.

Variation among *Puccinia graminis* f. sp. *tritici* isolates from wheat in South Africa, 2011 and 2012

T.G. Terefe[1] and Z.A. Pretorius[2]

[1]Agricultural Research Council-Small Grain Institute, Private Bag X29, Bethlehem 9700, South Africa; [2]Department of Plant Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa

E-mail: terefet@arc.agric.za

Stem rust is commonly found on bread wheat in South Africa, sometimes reaching epidemic levels in the milder winter-rainfall regions. Monitoring the stem rust pathogen population helps in intercepting new races which can subsequently be used in risk assessment and resistance breeding. Surveys were conducted in 2011 and 2012 to obtain pathogenicity profiles of *Pgt* in South Africa. Isolates collected from infected wheat and triticale were tested on the North American differential set and additional tester lines. Four races were identified from 132 isolates pathotyped during the two seasons. Races TTKSF (79% frequency) and BPGSC+*Sr27*,*Kw,Satu* (16%) were most frequently found. These two races were also predominant during the preceding seasons. BPGSC+*Sr27*,*Kw,Satu* was detected mostly on triticale cultivars in the Western Cape. Race TTKSF (a member of the Ug99 race group) has dominated the *Pgt* race population in South Africa during the past 12 years. In addition to TTKSF, Ug99 variants collected in South Africa include TTKSF+, TTKSP and PTKST. These three races were not found in 2011 and 2012. Seedling susceptibility of advanced breeding lines to the dominant TTKSF race varied from 23 to 89%, indicating different approaches in selecting for or against all-stage resistance by different breeding companies. Field tests with PTKST showed higher levels of resistance in winter wheats than in spring types during the study period.

The rusts of *Secale africanum* in South Africa

C.M. Bender, B. Visser and Z.A. Pretorius

Department of Plant Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa

E-mail: pretorza@ufs.ac.za

Secale africanum (syn. *S. strictum* subsp. *africanum*), a self-fertile and perennial wild rye species, is endemic to the Roggeveld Mountains of the south-western Karoo, South Africa. Despite an historical abundance along river beds and moist areas, *S. africanum* is currently threatened by extinction. Many reasons have been given for its decline, including susceptibility to rusts. Leaves with stem and stripe rust pustules were sampled from a cultivated *S. africanum* field, and leaves with leaf rust pustules were taken from wild rye growing on a river bank during December 2012 and February 2013. Greenhouse tests showed that isolates from the samples were avirulent on McNair 701 and Morocco wheat seedlings (infection type [IT] 0;), but were virulent on *S. cereale* cv. Pan 233. The stripe rust sample was virulent on bread wheat (IT 4) and identified as *Pst* race 6E16A-. Using ITS sequencing and GenBank BLAST analysis, the wild rye leaf rust isolate was confirmed as *P. recondita* f. sp. *secalis* (*Prs*)and the stripe rust isolate as *Pst*. Sequencing of two randomly selected stem rust pustules unexpectedly identified the pathogen as *Pgt* and not *P. graminis* f. sp. *secalis*. Inoculation of 2-month-old wild rye plants with *Pgt* races PTKST and BPGSC confirmed its susceptibility to wheat stem rust. Current evidence indicates that *S. africanum* is a host for both the rye and wheat stem rust forms, rye leaf rust and wheat stripe rust.

Wheat rusts: Distribution and virulence analysis of stem rust in the major wheat growing regions of Ethiopia in 2012 and 2013

G. Woldeab[1], E. Hailu[1], B. Hundie[2], W. Denbel[3], A. Badebo[4], B. Kassa[5], T. Abebe[6], A. Mekonen[7], B. Bitew[8], T. Taye[9], F. Hondoro[10], D. Hodson[11], T. Hussein[12], W. Zegeye[13], G. Girma[14], T. Gebrekidan[15] and B. Girma[3]

[1]Plant Protection Research Center, PO Box 37, Ambo, Ethiopia; [2]Sinana Agricultural Research Center, PO Box 208, Robe, Ethiopia; [3]Kulumsa Agricultural Research Center, PO Box 489, Assela, Ethiopia; [4]Debre Zeit Agricultural Research Center, PO Box 32, Debre Zeit, Ethiopia; [5]Holetta Agricultural Research Center, PO Box 2003, Addis Ababa, Ethiopia; [6]Alamata Agricultural Research Center, PO Box 56, Alamata, Ethiopia; [7]Sirinka Agricultural Research Center, PO Box 74, Bahir Dar, Ethiopia; [8]Debre Birhan Agricultural Research Center, PO Box 112, Debre Birhan, Ethiopia; [9]Yabello Agricultural Research Center, PO Box 56, Yabello, Ethiopia; [10]Awassa Agricultural Research Center, PO Box 6, Awassa, Ethiopia; [11]CIMMYT, PO Box, Addis Ababa, Ethiopia; [12]Haromaya University, PO Box 138, Dire Dawa, Ethiopia; [13]Adet Agricultural Research Center, PO Box 8, Bahir Dar, Ethiopia; [14]Bako Agricultural Research Center, PO Box 3, Bako, Ethiopia; [15]Mekele Agricultural Research Center, PO Box 492, Mekele, Ethiopia

E-mail: getanehwoldeab@gmail.com

The distribution of wheat rusts and virulence analysis of stem rust were studied in four regions of Ethiopia in the 2012 and 2013 crop seasons. In the main season, 795, and in the off-season, 54 wheat fields were assessed for rust presence. The overall occurrences of stem rust, leaf rust and stripe (yellow) rust in the main season were 24.3, 33.1 and 46%, respectively. In the off-season, stem rust was observed in 61% of fields, leaf rust in 42.6%, and no stripe rust was found. The mean incidences of stem rust for the surveyed zones ranged from zero in south Tigray to 62.2% in Bale zone, Oromiya region. The lowest and highest mean incidences of leaf rust were recorded in south and north Tigray, respectively. Stripe rust incidence was lowest in east Shewa and highest in north Tigray. Similarly, severities of stem rust did not exceed 10%, leaf rust 24% and stripe rust 29%. The highest stem rust scores (40MSS-60S) were recorded on cultivars Digelu, Danda'a and Meda Wolabu in Bale zone. Leaf rust was high (40MSS) on cultivars ET 13 A2 and Local in Wello zone of Amhara region. Cultivars Kubsa and Local were severely affected by yellow rust in Tigray region. However, cultivar Digelu was the least affected by rusts in many zones. Virulence analyses of 67 stem rust samples collected during the two seasons from the Oromiya, Tigray and SNNP regions yielded race TTKSK, which was isolated from improved cultivars Meda Wolabu, Tusie, Kubsa and Dure, as well as from Morocco.

Occurrence of wheat rusts in Algeria and strategies to reduce crop losses

A. Benbelkacem[1] and H.-J. Braun[2]

[1]National Agronomic Research Institute of Algeria, INRAA/URC Station ITGC BP35, Elkhroub, 25100, Algeria; [2]CIMMYT, Apdo Postal 6-641, 06600 Mexico D.F., Mexico

E-mail: benbelkacem@mail.com

Stripe (yellow) rust and leaf rust are common diseases in Algeria. Stem rust is seldom found, but Septoria tritici blotch is important in some wheat-growing areas. Epidemics of stripe rust continue to cause occasional severe losses as in many other parts of the world where it threatens food security and livelihoods of resource-poor farmers and their communities. The most recent threat has come from the breakdown of *Yr27*. Aggressive new strains of *Pst* in Algeria have decimated wheat crops (80% losses in 2005) of the most widely grown bread wheat variety (Hidhab) in both the high rainfall and semi arid regions with losses of 20 to 80% being recorded almost annually. Most other varieties grown by farmers are also susceptible (Cham 8, Inquilab 91, Attila, Veery, Bobwhite and Kauz). Recent strategies to reduce the threat of wheat rusts (stripe and leaf) include intensified surveillance across all parts of northern Algeria and neighboring countries (Tunisia and Morocco), increased effort on breeding for rust resistance, diversified cropping (reduced planting of mega-varieties across large areas), and rapid multiplication and promotion of new stripe rust resistant varieties such as Tiddis, Boumerzoug, Akhamokh, Massine, and also Yacine which is resistant to *Pgt* race Ug99 (*Sr2*, *Sr25*).

The rusts on winter wheat in southeastern Kazakhstan

Y. Dutbayev[1], M. Ibraiymova[1], Sh. Suyessinova[1], G.A. Kampitova[1], N.Zh. Sultanova[2] and R. Eleshev[1]

[1]Kazakh National Agrarian University, Faculty of Plant Growing Technology, Department of Horticulture, Vegetable Growing, Chemistry and Plant Protection, AbayAv. 8, Almaty 050010, Kazakhstan; [2]Kazakh Scientific Research Institute for Plant Protection, Department of Protection of Cereal Crops, 040924 Rakhat, Karasay District, Almaty Oblast, Kazakhstan

E-mail: edutbaev@mail.ru

Winter wheat is grown on 1.0-1.3 m ha in southern and southeastern Kazakhstan. Our investigation was conducted in 2009-2012 in the mountain zone of southeastern Kazakhstan. We studied foliar diseases on commercial wheat varieties and lines. Yellow rust and leaf rust were present at low to moderate levels. Leaf rust was more frequent and appeared earlier in the south and somewhat later and less severely in the southeast. The potential productivities of winter wheat cv. Steklovidnaya 24 and Almaly with fungicide protection were 3.7 and 4.5 t/ha, respectively. In epiphytotic conditions of yellow rust and spot blotches yield levels of susceptible varieties can be reduced by 15-40% compared to fungicide-protected controls. Losses in varieties with moderate disease responses are 7-10%. Evaluation of yellow rust and leaf rust responses of commercial winter wheat varieties from Kazakhstan and Kyrgystan in 2011 indicated that Steklovidnaya 24, Eritrospermym 350, Zhetisy, Karlygash, Bogarnaya 56, Progress, OPAX, Intensivnaya, Kiual, Kzyl Dan, Tilek, and Adyr were susceptible to both diseases, whereas Nelli, Jup, Ak Dan, Almaly, Egemen, and Tyngysh showed resistance. Cultivation of these varieties is being promoted and breeders are encouraged to use them as parents in crosses. Dry weather conditions in 2012 were not favorable to foliar wheat diseases, which appeared late and were of no consequence. We are evaluating winter wheat lines from CIMMYT and ICARDA in inoculated quarantine nurseries.

Wheat stem rust research in Georgia

Z. Sikharulidze, K. Natsarishvili, L. Mgeladze and R. Dumbadze

Institute of Phytopathology, Batumi Shota Rustaveli State University, Kobuleti, Georgia

E-mail: zsikharulidze@ymail.com

In Georgia, stem rust is one of the major threats to wheat production. Its importance from area to area depends on the weather conditions and degree of cultivar resistance. Mainly bread wheat cultivars are grown, with the Russian variety Bezostaya 1 occupying the majority of sowings. Since 2004, the Institute of Phytopathology has collaborated with CIMMYT, ICARDA, and BGRI. Cereal rust surveys undertaken in different agroecological zones during 2009-2012 indicated that wheat stem rust occurred in nearly all regions. Incidence and severity ranged from 1 to 100% depending on observation date, place and cultivar. In previous years stem rust was less distributed than in 2011 and 2012. Stem rust incidence was higher than leaf rust and less than stripe rust, but in 2012 only stem rust was present in wheat fields. High incidences of stem rust occur nearly every year in the Akhaltsikhe and Khashuri regions where barberry is common. Seventy five single pustule isolates were analyzed on the North American differential set of 20 genotypes. Twenty five *Pgt* races were identified in 2011; these included LCFHC (14.7%), LCFGC (12%), PCFCC (10.7%), PCFHC and LCFCC (9.3%) as the most prevalent. Races LDFHC, LFFHC, MCFHC and NCFHC each made up 4% of isolates, and the remaining races were represented by 1 or 2 isolates. The prevalent races carried 6-9 virulence factors.

Wheat rust virulence in southern Russia

G. Volkova, V. Nadykta, O. Vaganova, E. Sinyak and Y. Shumilov

All-Russian Research Institute of Biological Plant Protection, Krasnodar-39, Russia

E-mail: galvol@bk.ru

Winter wheat is the most important crop in southern Russia. The crop is affected by a pathogen complex with leaf rust, stripe rust and stem rust being regular threats in the region. Grain shortages in years favorable for the rusts can be substantial. Seedling stage tests with three local pathogen isolates showed that the majority of seedling resistance genes are ineffective. However, *Lr9, Lr29, Lr41, Lr42*, *Lr43+24*, and *Lr47* continue to confer complete protection. Genes effective against stripe rust include *Yr3b+4b+H46, 3c+Min, 5, 8+19, 24, 25+32, 26, 27, 32, SP, Tr1+Tr2, Tye, 2+3a+4a+Yam, 3a+4a+D+Dru+Dru2, Exp1+Exp2, Pa1+Pa2+Pa3, Pr1+Pr2, SD+25* and those effective against current *Pgt* races include *Sr9e*, *Sr30*, *Sr31*, and *SrWLD*. These various genes can be used in breeding for resistance.

Phenotypic and genotypic analyses of Turkish *Pgt* samples collected in 2012

M. Newcomb[1], Z. Mert[2], B. Akin[3], A. Morgounov[3], M. Carter[4], J. Johnson[1], D. Luster[4], L.J. Szabo[1] and Y. Jin[1]

[1]USDA-ARS, Cereal Disease Laboratory, University of Minnesota, St. Paul, MN 55108, USA; [2]The Central Research Institute for Field Crops, Sehit Cem Ersever Cd., No. 9-11, Yenimahalle, Ankara, Turkey; [3]CIMMYT, P.K. 39 Emek 06511, Ankara, Turkey; [4]USDA-ARS, Foreign Disease-Weed Science Research Unit, 1301 Ditto Ave., Ft. Detrick, MD 21702, USA

E-mail: Yue.Jin@ars.usda.gov

Stem rust is a threat to wheat production in many parts of the world. The severity of the threat is in part due to the pathogen's potential for changes in virulence toward deployed host resistance genes and rapid alterations in the diversity structure. Disease management is dependent on our knowledge and understanding of the diversity and factors that influence it. Z. Mert and others (Turk J Agric For 36 (2012) 107-120) reported on races of *Puccinia graminis* f. sp. *tritici* (*Pgt*) isolated from wheat stem rust samples collected in 2007 and 2008. In this study we evaluated single-pustule isolates derived from seven samples collected from the Aegean (Izmir), East Mediterranean (Adana), and Trace (Edirne) Research Institutes collected in 2012. Preliminary results indicated no new virulence relative to previously reported surveys in 2007-8. While phenotypic characterization of race types provides information with immediate application for disease management, it is known that genotypic diversity in pathogen isolates is not always captured by phenotypic characterization. For example, a single race type may harbor different genotypes. To obtain knowledge of genotypic diversity, these isolates are being genotyped using molecular markers. Combined phenotypic and genotypic information on *Pgt* will benefit our understanding of the complexity and origin of pathogen diversity.

Epidemics and adult-plant responses of Iranian wheat genotypes to the *Yr27*-virulent *Pst* race in 2013

F. Afshari[1], M. Aghaee[1], K. Nazari[2], M. Esmaeilzadeh[1], G. Najafian[1], A. Yazdansepas[1], M. Vahabzadeh[1], S. Mahfouzi[1], G.A. Ayneh[1], N. Tabatabaei[1], M. Khodarahmei[1], A. Amini[1], A.R. Mohammadi[1], M.R. Jalal Kamali[3], M. Patpour[1], R. Rohparvar[1], A. Malihipour[1] and M. Hashamei[1]

[1]Seed and Plant Improvement Institute (SPII), PO Box 31585-4119, Karaj, Iran; [2]ICARDA, Sehit Cem Ersever Caddesi No: 9-11, Tarla Bitkileri Merkez Arastirma Enstitusu Icinde, Yenimahalle, 06170, Ankara, Turkey; [3]CIMMYT, Seed and Plant Improvement Institute Campus, PO Box 31585-1119, Karaj, Iran

E-mail: fafshari2003@yahoo.com

In the winter and spring of 2013 there was widespread occurrence of wheat stripe rust in southwestern and western parts of Iran. More than 100,000 ha were sprayed. Crop losses in untreated susceptible cultivars were estimated to be around 60%. Race analysis at SPII confirmed the presence of *Yr27*-virulence. This race was found in southwestern Iran in 2003 and subsequently in different parts of the country over the last ten years. After the first detection of *Yr27* virulence, breeding for resistance was adopted as the first priority of the national wheat breeding program. The objective of the present study was to evaluate adult-plant responses of the current wheat germplasm to the *Yr27*-virulent race. Adult-plant tests were conducted at Ahvaz Research Station under natural infection by that race. Twenty six (56.5%) of 46 commercial wheats were resistant at the adult plant stage. Among 54 advanced lines, 39 (72%) were resistant. Overall 65% of genotypes were resistant in the field. There has been significant recent progress in development of resistance to the *Yr27*-virulent race in the Iranian breeding germplasm. Further study is required to genetically characterise the seedling and adult-plant resistances of genotypes resistant to the *Yr27*-virulent race.

***Puccinia striiformis* f. sp. *tritci* races and their distribution in Syria during 2008 and 2009**

S. Kharouf[1], F. Azmeh[1] and A. Yahyaoui[2]

[1]Ministry of Higher Education, National Commission for Biotechnology, PO Box 31902, Damascus, Syria; [2]Global Wheat Program, CIMMYT, Km. 45, Carretera México-Veracruz, El Batan, Texcoco, Estado de México CP 56130, Mexico

E-mail: shoula_kharouf@yahoo.com; Ah.Yahyaoui@cgiar.org

Stripe (yellow) rust is an important disease on bread wheat in relatively cool and humid wheat growing seasons/areas. It is usually present in all wheat-growing areas of central and northern Syria. This work was aimed at race identification, distribution and severity of stripe rust during the 2008 and 2009 seasons. The survey covered 141 fields in 2008 and 163 in 2009. Diseased leaf samples were collected and urediniospores isolated from individual pustules of each sample. Race nomenclature followed Johnson et al. (*Trans Brit Mycol Soc* 58:475-480, 1972). Thirty three races were identified from of 161 *Pst* isolates from the first season; 27 were found only once and 6 races were in more than one sample. Thirty seven races were identified from 171 isolates from 2009 collections; the number of races exceeded the previous season as more fields were surveyed. Twenty nine races were identified only once and 8 came from more than one site. This study revealed the presence of 14 new races in Syria: 126 E150, 134 E44, 68 E130, 14 E6, 255 E112, 24 E0, 214 E16, 4 E134, 114 E16, 78 E30, 230 E222, 108 E14, 198 E4 and 16 E150. Although virulence for *Yr27* was first reported before 2002 (Yahaoui et al. *Plant Dis* 68:499-506) the important *Yr27*-virulent race 230 E150 was not recorded in 2008 and 2009.

Physiologic specialization of *Puccinia triticina* on durum wheat in Syria in 2010

M. Kassem[1,2] and M. Nachit[2]

[1]ICARDA; [2]Faculty of Agriculture, Aleppo University, Aleppo, Syria

E-mail: m.kassem@cgiar.org

Leaf rust is one of the major diseases of wheat in Syria. Surveys of wheat fields were carried out in all wheat-growing regions in Syria during April and May, 2010. A total of 122 samples were collected. Single pustules from each isolate were multiplied on susceptible bread wheat line Morocco. The percentage of wheat leaf rust-infected fields was 85%, the highest level ever recorded in the current decade in Syria. Pathotype analyses identified 21 physiological races when the North American system of nomenclature was used. Based on the Unified System 8 groups of races were identified. Races varied in frequency. The correlation coefficient between frequency and virulence for races was negative (-0.472); races with a narrow virulence range were more frequent than those with a wider virulence range. Five races (HGJP, LBBT, RMRR, SCBK, and TBRM) were recorded for the first time. The most widely virulent races in this study were TBRT, found in Lebanon in 2008, followed by PBPT, but the most frequent were BBBB, BBDL, BBBL and BBCL. Some old races such as CBRT were found in most areas. This race was first found in 2005 when it occupied only few fields near Lattakia in Western Syria.

Virulence spectra of wheat rusts in Pakistan during 2012-13

A.R. Rattu[1], M. Fayyaz[1], A. Munir[1], J.I. Mirza[1], K.A. Khanzada[1], M. Imtiaz[2], Y. Rauf[2], M.Y. Mujahid[3], I. Ahmad[4], S. Masood[4], R. Ward[2], I.A. Shah[5], F. Muhammad[6], S.A. Khan[7] and K. Nazari[8]

[1]Crop Diseases Research Institute, PARC, Park Road, Islamabad, Pakistan; [2]CIMMYT International, NARC, Park Road, Islamabad, Pakistan; [3]National Wheat Coordination Program, NARC, Park Road, Islamabad, Pakistan; [4]Pakistan Agricultural Research Council, G-5, Islamabad, Pakistan; [5]Cereal Crop Research Institute, Pirsabak, Pakistan; [6]Ayub Agriculture Research Institute, Jhang Road, Faisalabad, Pakistan; [7]Regional Agricultural research Institute, Bahawalpur, Pakistan; [8]ICARDA, Yenimahalle 06170, Ankara, Turkey

E-mail: anjums41@yahoo.com

Wheat is the staple food crop in Pakistan and in 2013was harvested by most of the country's six million farmers from over 8.5 million hectares. The Crop Disease Research Institute monitors the rust pathogens in different agro-ecological zones by means of trap nurseries comprising isogenic lines. In 2012-13 trap nurseries were planted at 14 locations considered hot spots for rust development. Stripe (yellow) rust was observed in almost all wheat growing areas in the country. Most of the yellow rust testers were susceptible except lines with *Yr5, Yr10, Yr15* and *Yrsp.* Southern parts of the country are prone to stem rust. The 7th and 8th Stem Rust Trap Nurseries were also planted at Karachi and Kunri. Lines with *Sr5, Sr6, Sr7a, Sr8b, Sr9a, Sr9d, Sr9g, Sr9e, Sr10, Sr11, Sr12, Sr17, Sr18, Sr19, Sr20, Sr21, SrMcN, Sr28, Sr29, Sr35, Sr36, Sr37* and *SrTmp* were susceptible, and those with *Sr7b, Sr8a*, *Sr24, Sr25, Sr26, Sr30, Sr31, Sr32, Sr33, Sr34, Sr39* and *Sr40* showed resistance. *Lr9* and *Lr28* were the only leaf rust resistance genes that conferred immunity; the others were scored as leaf rust susceptible. Our poster will present the virulence spectra of the wheat rust pathogens in Pakistan in 2013. No changes relative to the previous year were evident.

Current status of *Pgt* virulence in Pakistan

J.I. Mirza[1], A.R. Rattu[1], M. Fayyaz[1], K.A. Khanzada[1], A. Munir[1], M. Imtiaz[2], Y. Rauf[2], M.Y. Mujahid[3], I. Ahmad[4], S. Masood[4], R. Ward[2], J.K. Afridi[5], M. Ahmad[5], I.A. Shah[6], N. Ahmad[6], Ihtramullah[6], F. Muhammad[7], S.A. Khan[8], M.A. Hussain[8], M. Hussain[7], N. Ahmad[7] and K. Nazari[9]

[1]Crop Diseases Research Institute, Park Road, PARC, Islamabad, Pakistan; [2]CIMMYT International, NARC, Park Road, Islamabad, Pakistan; [3]National Wheat Coordination Program, NARC, Park Road, Islamabad, Pakistan; [4]Pakistan Agricultural Research Council, G-5, Islamabad, Pakistan; [5]Arid Zone Research Institute, Brewery Road, Quetta, Pakistan; [6]Cereal Crop Research Institute, Pirsabak, Nowshehra, Pakistan; [7]Ayub Agriculture Research Institute, Jhag Road, Faisalabad, Pakistan; [8]Regional Agricultural Research Institute, Bahawalpur, Pakistan; [9]ICARDA, Yenimahalle, 06170, Ankara, Turkey

E-mail: anjums41@yahoo.com

Pgt race RRTTF has continuously affected wheat grown in coastal areas of Pakistan since 2006. Due to a conducive environment, it spread to many locations in southern Punjab in 2008. In the 2012-13 cropping season stem rust was observed in Tando Jam, Thatta, Gharo, Burle Shah Karim, Moro, Sakrand, Hala, Kunri, Sanghar, and Jhok Sharif in Sindh; Jampur and Bahawalpur in southern Punjab; Killa Saifullah and Lorali in Baluchistan; and Pirsabak in Khyber Pakhtunkhwa. Data the from the 7th and 8th SRTN nurseries planted at Kunri (Sindh) and Karachi indicated absence of virulence for stem rust resistance genes *Sr9e, 24, 25* and *31* whereas virulence for *Sr8a* was observed only at Kunri. Virulence for *Sr36* was present at both locations. Field data showed moderately susceptible to susceptible reactions on cultivars Faisalabad 08, Kiran, Sarsabz, TJ-83 and NIA Sunder. Disease samples from Sarsabz, Faisalabad 08, Sher 06, TD1, Kiran 95, TJ83 were received from stem rust affected areas. Preliminary analysis of samples from Karachi, Thatta, and Kunri confirmed the presence of RRTTF. This indicates the potential of RRTTF to spread to wheat cultivation areas in other provinces. Analysis of disease samples from other locations is being conducted at CDRI, Murree.

Status of stripe rust and virulence patterns of *Pst* in Pakistan

J.I. Mirza[1], A.R. Rattu[1], M. Fayyaz[1], K.A. Khanzada[1], A. Munir[1], M. Imtiaz[2], Y. Rauf[2], M.Y. Mujahid[3], I. Ahmad[4], S. Masood[4], R. Ward[2], X. Chen[5], K. Nazari[9], I.A. Shah[6], N. Ahmad[6], Ihtramullah[6], F. Muhammad[7], S.A. Khan[8], M.A. Hussain[8], M. Hussain[7] and N. Ahmad[7]

[1]Crop Diseases Research Institute, PARC, Park Road, Islamabad, Pakistan; [2]CIMMYT International, NARC, Park Road, Islamabad, Pakistan; [3]National Wheat Coordination Program, NARC, Park Road, Islamabad, Pakistan; [4]Pakistan Agricultural Research Council, G-5, Islamabad, Pakistan; [5]USDA-ARS, and Washington State University, Pullman, WA 99164, USA; [6]Cereal Crop Research Institute, Pirsabak, Nowshehra, Pakistan; [7]Ayub Agriculture Research Institute, Jhang Road, Faisalabad, Pakistan; [8]Regional Agricultural Research Institute, Bahawalpur, Pakistan; [9]ICARDA, Yenimahalle, 06170, Ankara, Turkey

E-mail: anjums41@yahoo.com

During the 2012-13 season, stripe (yellow) rust occurred on wheat cultivars in Khyber Pakhtunkhwa, Punjab, Sindh and Baluchistan. Moderate susceptibility was observed at many locations in these provinces. Cultivars Wattan, Bhakkar, Meraj, Inqilab, AAR II, Shafaq, Meraj, NIA Sunder, Raskoh, Millat, and KT2000 were infected. Virulence togenes *Yr2, 6, 7, 8, 9, 17,18* and *27*was common at Bahawalpur, Faisalabad, Sialkot, Chakwal, Islamabad, Fatehjang, Nowshehra, and Peshawar. Virulence to*Yr32* (*YrCV*) was observed at Faisalabad, Nowshera and Peshawar. Pathotypeanalysis of samples collected within Pakistan during 2011-12 identified 14 races among 17 isolates, thereby revealing high diversity in the of Pakistani *Puccinia striiformis* population. Virulence analysis of samples from the 2012-13 crop is being conducted at CDRI Murree, and preliminary results for six samples from southern Punjab and Khyber Pakhtun khwa showed the presence of at least three races virulent to genes *Yr1, 6, 7, 8, 9, 17, 27, 43, 44, Tr1, Exp2, 25, 28, 31,* and *43*. Virulence to*Yr5, 10, 15, 32, SP* and *Tye* was absent among the isolates analyzed to date. Analysis of further samples is being conducted at CDRI Murree, and in parallel analysis at USDA-ARS, Pullman, WA, USA.

Surveillance of wheat rusts in Bangladesh

P.K. Malaker[1], N.C.D. Barma[2], M.M.A. Reza[1], M.S. Hossain[1], M.A. Hakim[1], K. Mustarin[1], M.M. Hossain[2], M.F. Amin[2], F. Ahmed[3], M.R. Islam[3], M. Asaduzzaman[4], M. Mokhlesur Rahman[4], M. Mahbubur Rahman[5], M.J. Islam[5], Y. Abida[5] and M.J. Uddin[1]

[1]Wheat Research Center, BARI, Dinajpur-5200, Bangladesh; [2]Regional Wheat Research Center, BARI, Gazipur-1701, Bangladesh; [3]Regional Agricultural Research Station, BARI, Jessore-7400, Bangladesh; [4]Regional Agricultural Research Station, BARI, Jamalpur-2000, Bangladesh; [5]Regional Wheat Research Center, BARI, Rajshahi-6212, Bangladesh

E-mail: pkmalakerwrc@gmail.com

Farm fields and trial sites in major wheat-growing areas of Bangladesh were surveyed for presence of wheat rusts during 2012-13. The survey followed BGRI protocols. Percentages of infected plants were recorded and severities of infection estimated using the modified Cobb scale. Stem rust and stripe (yellow) rust were not found, but leaf rust occurred at varying levels of severity depending on field location, sowing time and cultivar. About 41% of 250 fields investigated had leaf rust with the majority of infected fields showing low (<20%) to moderate (20-40%) levels of disease. Timely (15-30 November) planted crops largely escaped or had less disease compared to those planted late in the season. North-western areas were affected more than other parts of the country. The predominant cultivar inspected was Prodip and it showed low to high (>40%) disease levels with MS-S type reactions, whereas BARI Gom-25 and BARI Gom-26 displayed only low disease severities with MRMS-MSS responses. Five varieties, viz. Shatabdi, Sourav, Bijoy, BARI Gom-27 and BARI Gom-28, were leaf rust free.

Prevalence and distribution of wheat stripe rust in Jammu and determination of sources of resistance

V. Gupta, R.A. Ahanger, V.K. Razdan, B.C. Sharma and M.K. Pandey

Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Chatha 180 009, Jammu, India

E-mail: vishal94gupta@rediffmail.com

To assess the prevalence, distribution and severity of stripe rust a survey of randomly selected wheat fields in Jammu province of Jammu and Kashmir province was conducted in consecutive seasons of 2009-10, 2010-11and 2011-12. All areas under study were affected with maximum and minimum AURDPC values of 2956.05 and 355.72 estimated for fields in the Jammu and Doda districts, respectively. The highest disease prevalence was in 2010-11, probably due to favorable environmental conditions. Among twenty wheat lines screened for disease response, Agra local and PBW-343 were susceptible, RSP-561 was moderately resistant and all other lines were moderately susceptible.

Stripe rust of wheat: An Indian puzzle

S.C. Bhardwaj[1], O.P. Gangwar[1], P. Prasad[1], H. Khan[1] and I. Sharma[2]

[1]Directorate of Wheat Research, Flowerdale, Shimla, H.P. 171002, India; [2]Directorate of Wheat Research, Karnal, Haryana 132001, India

E-mail: scbfdl@hotmail.com

Stripe rust is a major threat to wheat produced on 10 M ha in northern India. Current evidence indicates that alternate hosts like *Berberis* spp. do not play a role in the epidemiology of wheat stripe rust in India. Pathotype 46S119, virulent to *Yr9* and identified in 1996, was present in the majority of samples from Gurdaspur (Punjab) and the foothills of Himachal Pradesh, but was not found in the hills. Likewise pathotype 78S84, virulent to PBW343 (*Yr3, 9, 27*) and found at Batala (Punjab) in 2002, was not encountered anywhere else until 2005 when it was recorded in 8 samples from Punjab. In 2006 it occurred in northern India, and was observed in the hills in 2007. Every year the first report of stripe rust is from Punjab and subsequently from the foothills of Himachal Pradesh and Uttrakhand. We do not have virulence on Clement (*Yr9*+), or Yr11/3*Avocet and Wembley (*Yr*14) both of which are susceptible in western Asia (Yahyaoui et al. 2002, *Plant Dis.* 86:499-504) and South Africa (Boshoff et al. 2002, *Plant Dis.* 86:485-492), respectively. Studies on avirulence/virulence structure indicate that evolution occurs locally in northern India or adjoining Pakistan. Further studies on the roles of alternate and collateral hosts in the epidemiology of wheat stripe rust in northern India are underway. Meanwhile a well-conceptualized management strategy based on diverse adult plant and slow rusting resistances is in place to tackle the stripe rust menace.

Virulence analysis of *Pst* isolates collected from western Canada

H.S. Randhawa, Brent Puchalski, Byron Puchalski, A. Laroche, R. Graf and D. Gaudet

Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB T1J 4B1, Canada

E-mail: Harpinder.Randhawa@AGR.GC.CA

Wheat stripe rust has become a serious problem in western Canada. Southern Alberta is a hotspot for stripe rust because of its close proximity to the Pacific Northwestern United States where the pathogen overwinters on a regular basis. However, epidemics in 2006 and 2011 were attributed to the pathogen overwintering in southern Alberta. Avirulence/virulence analyses were conducted on stripe rust samples collected in 2011 and 2012 in southern Alberta or near Creston, British Columbia. These comprised infected leaf tissue or vacuumed urediniospores. Single pustule isolates were made from Avocet seedlings that had been inoculated with the samples. Once sufficient quantities of urediniospores were generated, the Avocet NILs were inoculated at the 3 leaf stage to evaluate avirulence/virulence. These Avocet NILs with *Yr1, Yr5, Yr6, Yr7, Yr8, Yr9, Yr10, Yr11, Yr12, Yr15, Yr17, Yr18, Yr23, Yr24, Yr26, Yr27, YrA,* and *YrSp*. The latency period for sporulation of the isolates at 15°C ranged from 10-18 days. Leaves were rated for the presence of pustules and hypersensitivity on a 1-9 scale. The avirulence/virulence characteristics of isolates collected in southern Alberta shared similarity to *Pst* types from both central Alberta and Washington.

Physiological specialization of *Puccinia triticina* on wheat in Argentina in 2011

P. Campos

National Institute of Agricultural Technology, EEA Bordenave CC44 CP 8187, Bordenave, Buenos Aires, Argentina

E-mail: pcampos@bordenave.inta.gov.ar

Leaf rust is the most important wheat disease in Argentina; 3.6 M ha of wheat were grown in 2012. The objective of the study was to identify virulence phenotypes of the *Pr* population in leaf rusted samples collected in the wheat areas during 2011. Single uredinial isolates were taken from samples and tested for infection type on Thatcher near-isogenic lines and some local varieties. The genes included *Lr1, Lr2a, Lr2c, Lr3, Lr9, Lr16, Lr24, Lr3ka, Lr11, Lr17, Lr30, Lr10, Lr14a, Lr19, Lr20, Lr21, Lr23, Lr25, Lr26, Lr27+31, Lr29, Lr36, Lr39/41, Lr42, "Lr43", Lr44* and *Lr47*. Race designations was based on the first three sets of four genotypes proposed by Long and Kolmer and the gene designations *Lr10* and/or *Lr20* are appended to indicate virulence on lines with those genes. Two hundred and sixteen single uredinial isolates were assessed. Fifteen races were identified. Race MDP, second most frequent in 2010, was the most frequent; accounting for 30.1% of isolates. Race MFP was second, with 23.1% frequency (first in 2010). Both were isolated for the first time in 2005. Only one new race, MDP 10, was found. Seven new races identified in 2010 also were isolated in 2011. Virulence was not found for genes *Lr19, Lr21, Lr25, Lr29, Lr36, "Lr43", Lr44* or *Lr47*. Ninety-nine percent of isolates were virulent to *Lr24*.

Upgrading knowledge of Chilean hexaploid wheat yield losses caused by stripe rust and leaf rust

R. Madariaga and I. Matus

Wheat Breeding Program, Instituto de Investigaciones Agropecuarias (INIA), Chillán, Chile

E-mail: rmadaria@inia.cl

During the 2012-13 crop season, nine stripe rust and leaf rust chemical control experiments were conducted at INIA Chile to assess the impact of these diseases on yield of moderately susceptible cultivars. The hypothesis was that genetic resistance is only significant when there is no response to chemical sprays. If a cultivar is effectively resistant to the pathogen population but does not express this feature in production, resistance is meaningless. Experiments were arranged in a randomized block design with 5 to 10 treatments, four replicates, and experimental units of six parallel rows with 0.2 m row spacing. A total of 303 experimental units were studied and 77 treatments of old and new chemicals were tested at two locations. Experiments were conducted under natural infection in the breeding program fields where susceptible spreader rows were included to ensure disease presence. It was concluded that 1) stripe rust and leaf rust can significantly reduce grain production and harvested grain quality of moderately susceptible and susceptible varieties in Chile; 2) moderately susceptible varieties can provide adequate grain production for farmers without using chemicals; and 3) new recently developed fungicides combining strobilurins, carboxamides, and morpholines provide new tools to reduce the impact of rusts.