Nilgiri Wheat News

(September – December, 2011)

IARI, Regional Station, Wellington

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IARI, Regional Station, Wellington collaborates with BGRI-DRRW in developing Ug99 resistant stocks
(*M.Sivasamy***)**

Under the Durable Rust Resistance in Wheat (DRRW)-BGRI-ICAR MoU, Dr. M. Sivasamy, Sr. Scientist of this station was selected to work on stem rust project, specifically to develop rust resistant varieties for Ug99. He visited department of Plant Breeding and Genetics, CALS, Cornell University, Ithaca, NY, USA and worked for six months with Dr. Mark Sorrells. DNA samples of the 137 selective lines constituted through ongoing backcross programme at IARI, Regional Station, Wellington were taken to Cornell University, USA as part of the study to analyse the genetic basis of resistance. These lines were taken along with 21 recurrent parents, five positive controls (*Sr*2, *Sr*24, *Sr*25, *Sr*26, *Sr*36 and *Lr*34) carrying specific rust resistance genes. Polymerase chain reaction (PCR) was performed using specific DNA markers to confirm the presence of stem and leaf rust genes as per the standard protocols. The results of the final confirmation of presence of particular gene(s) are given in one of the following tables. *Sr*2 or *Lr*34 gene complex alone can't protect the crop under high disease pressure and show susceptibility to TTKST(Ug99) and other Indian stem and leaf rust pathotypes, but in combination with other major genes these are expected to give durable rust resistance.

Genetic Markers used to confirm individual genes

1	*Sr*2+*Yr*30 (Pleiotropic)	cs*Sr*2(CAPS)	172	cs*Sr*2-F 5' -CAA GGG TTG CTA GGA TTG GAA AAC -3' cs*Sr*2-R 5' –AGA TAA CTC TTA TGA TCT TAC ATT TTT CTG-3'
2	*Sr*24+*Lr*24	*Sr*24#50 (AFLP)	500bp	*Sr*24#50-F 5'- CCC AGC ATC GGT GAA AGA A-3' *Sr*24#50-R 5' ATG CGG AGC CTT CAC ATT TT-3'
3	*Sr*25+*Lr*19	Gb(Dominant) BF145935 (co-dominant)	130bp	Gb- F 5' – CAT CCT TGG GGA CCT C -3' Gb-R 5'- CCA GCT CGC ATA CAT CCA – 3'
4	*Sr*26	*Sr26*#43 and BE518379(Dominant and co-dominant)	207 bp	*Sr*26#43 –F 5' – AAT CG CCA CAT TGG CTT CT -3' *Sr*26#43 –R 5' _ CGC AAC AAA ATC ATG CAC TA -3' BE518379 –F 5'- AGC CGC GAA ATC TAC TTT GA -3' BE518379 –R 5' TTA AAC GGA CAG AGC ACA CG -3'
5	*Lr*34+Yr18+Bydv+ltn (Pleiotropic)	cs*Lr*34(STS)	150bp is product and a 229-bp band is amplified in non-*Lr*34	cs*Lr*34-F 5'-GTT GGT TAA GAC TGG TGA TGG -3' cs*Lr*34 –R 5' TGC TTG CTA TTG CTG AAT AGT -3'

Genotyping results summary

Sl.No	Gene complex confirmed to carry	Names of the variety
1	*Sr*26+(*Sr*24+*Lr*14) and (*Sr*2+*Yr*30[a])	HW 2027
2	(*Sr*25+*Lr*19)+ (*Lr*34+*Yr*18+BYdv+Ltn[a])+(*Sr*24+*Lr*24)	HW 4220
3	(*Lr*34+*Yr*18+BYdv+Ltn[a])+(*Sr*24+*Lr*24)+(*Sr*2+*Yr*30[a])	HW 2093, HW 4057
4	(*Sr*25+*Lr*19)+ (*Sr*2+*Yr*30[a])	HW4209,HW4218, HW3627
5	(*Sr*24+*Lr*24)+(*Sr*2+*Yr*30[a])	HW2005, HW2008, HW2015, HW 2016, HW2091, HW2096, HW 5207*, HW2043, HW 2044, HW 2071-1A**, HW 2072**, HW 4029, HW 4066** AND HW 2081
6	(*Sr*25+*Lr*19)+ (*Lr*34+*Yr*18+BYdv+Ltn[a])	HW 4205, HW 4219 AND HW 3607
7	*Sr*26+ (*Sr*2+*Yr*30[a])	HW2099
8	(*Lr*34+*Yr*18+BYdv+Ltn[a])+(*Sr*2+*Yr*30[a])	HW 2017
9	*Sr*2+*Yr*30[a]	HW 3070**, HW 4005, HW 4042, HW 4042, HW 4043, HW 4049, HW 4050
10	*Sr*24+*Lr*14	HW 2059**, HW 4053, HW 4055, HW 4065A, HW 4055
11	*Sr*25+*Lr*19	HW 4204, HW 4206**, HW 4207**, HW 4208, HW 4213**, HW 3608**, HW 3601, HW 3620**, HW 3614**
12	*Sr*26	HW 2021
13	*Lr*34+*Yr*18+BYdv+Ltn[a]	HW 2022, HW 4202, HW 2062**

a : APR race non specific minor gene, *- additionally confirmed to carry *Yr*15
**- all the recurrent parents carry additional gene complex *Sr*31+*Lr*26+*Yr*9+*Pm*8
-Many of the lines listed above are expected to carry additional rust resistance genes either *Sr*27, *Sr*36+*Pm*6 , *Lr*28, *Lr*32 and *Lr*37+ gene complexes for which we have not evaluated with the markers

Results of wheat rust surveillance in Nilgiri hills – role of Berberis in rust perpetuation in Nilgiris

(*J. Kumar, M. Sivasamy, P. Jayprakash, Vikas, V.K. and John Peter)*

Seventy seven samples of brown rust and 52 of black rust were analysed during the previous four months. Field dominance of brown rust race 77 - 5 followed by 77 - 8 and 77-7 observed in Nilgiri hills. While in black rust race 40-1 dominated. Ug 99 race could not be recorded anywhere in India. Race 78 S84 (*Yr*9 virulence) noted to occur in Nilgiris. During the month of August, 2011, leaves of native species of Berberis growing in Nilgiri hills were noticed to contain aecial sori on the abaxial surfaces. Scrapping of aecial sori when inoculated on universally susceptible wheat Agra Local resulted in formation of brown rust pustules (Puccinia triticina). Further investigations are in progress to find out whether Berberis plays any role as an alternate host of Puccinia triticina in Nilgiri hills.

IARI, Regional Station, Wellington participates in DRRW meeting at Kathmandu, Nepal – the proceedings (*J.Kumar*)

Dr. Jagdish Kumar, Head, IARI, Regional Station, Wellington participated in a meeting held by DRRW on 2-3 November, 2011 to strengthen the activities of Durable Rust Resistance Project (DRRW) related to wheat rust surveillance in SAARC countries. Meeting started with opening remarks of Dr. Ronnie Koffman, chairman, DRRW. He appreciated efforts of all SAARC countries in keeping a vigil on prevalence and distribution of wheat rust virulences in the sub – continent. A keynote address was also delivered by Dr. B.N. Mahato, DG, NARC, Nepal. Dr. Mahato highlighted the importance of Nepal Himalayas in perpetuation of wheat rusts. He emphasized that Nepal has been keeping a continuous watch on variations arising in wheat rust pathogens and alerting the affected countries by sharing the data. He expressed his thanks to the regional station, DWR (ICAR), Flowerdale, Shimla in providing help in virulence analysis of Nepal samples. The information availed after this virulence

analysis accomplished at Flowerdale becomes of great utility to wheat breeders in SAARC countries in general and India and Nepal in particular. It was also reported by Dr. Mahato that Berberis species have been existing in Nepal harbouring rust aecial sori and studies are in progress to find correlation of Berberis aecial sori with further infection of wheat. Dr. S.C. Bhardwaj of DWR, Flowerdale, Shimla gave an overview of wheat rust research activities going on in India and he volunteered for virulence analysis of samples received from any neighbouring country. Dr. Jagdish Kumar, Head, IARI, Regional station, Wellington also reported about Berberis species observed in Nilgiri hills of south India with aecial sori which are under investigation at IARI, Regional Station, Wellington for their relevance in wheat rust perpetuation in Nilgiri hills. Berberis species were reported to host aecial sori in Pakistan also and Dr. Atiq Rattu of PARC reported that further investigations are being pursued for role of Berberis in perpetuation of wheat rusts in Pakistan. It was decided that DRRW must take initiative to cooperate the efforts of SAARC countries in resolving the role of Berberis which have been reported by wheat rust workers of India, Nepal and Pakistan hosting rust aeciosori in their respective countries. Dr. Robert Park of University of Sydney offered to extend facilities of SNP rust fingerprinting and SSR phenotyping for the purpose of illucidating role of Berberis species in perpetuation of wheat rusts in the sub-continent. Issue of having a common global set of differentials for virulence typing of wheat rust pathogens was raised and discussed at length. Having common differential set worldvide would be helpful in recognizing the virulence structure of wheat rust pathogens' variants for the purpose of comparison across the countries. It was particularly stressed that there should be a platform created where surveillance data can be made available to all the beneficiary nations and Dr. Dave Hodson of CIMMYT reported that efforts are already on to address this issue at CIMMYT, Mexico. It was also informed by DRRW officials that BGRI (Borlaug Global Rust Initiative) has opened a website where surveillance data of all countries is always welcome and thereby can be made easily accessible to all the users. Dr. Indu Sharma, Project Director (Wheat) briefed about the activities of rust resistance breeding going on in India and stressed upon the germplasm sharing among the SAARC countries. She urged CIMMYT to intervene in this regards.

Developing genetic stocks for rust resistance

(M. Sivasamy, P. Jayprakash, Vikas, V.K., R. Nisha, J.Kumar)

Final constitution of lines carrying *Lr*45+*Lr*19, *Lr*45+*Sr*31, *Lr*45+*Yr*10 and their combinations in 15 popular Indian bread wheat cultivars are complete. BC3F3 generation has been raised carrying resistance gene Lr45 in 15 cultivars. The advance 662 wheat lines carrying diverse gene sources for rust resistance which were developed through bulk pedigree have been constituted at F9 and further tested for station trial for its yield potential.

Effect of leaf/stem rust resistance gene *Lr*24/*Sr*24 on yield and its components

(Vikas, V.K., M.Sivasamy, P.Jayprakash, J.Kumar)

Near isogenic lines (NILs) carrying the *Lr*24/*Sr*24 gene developed in four genetic backgrounds (HW 2059, HW 4053, HW 4055 and HW 4065A) were evaluated for one season in a randomized block design with three replications in two separate experiments *viz*., rust free (fungicide treated) and rust infected conditions in May 2011 in the experimental fields of I.A.R.I., Regional Station, Wellington. Infector rows containing mixture of susceptible variety was planted between and around the experimental plots. The NILs and their respective recurrent parents didn't show significant differences for productivity traits (number of productive tillers per

plant, panicle length, number of grains per panicle grain yield per plant and 1000 grain weight) in rust free plot. However, mean performance of NILs in rust infected plots showed significantly higher number of productive tillers per plant, panicle length, number of grains per panicle grain yield per plant and 1000 grain weight than their respective recurrent parents. Therefore the differences between the mean values of NILs and their recurrent parents in rust infected plots could be attributed to the direct effect of protection afforded by *Lr*24/*Sr*24 gene against leaf and stem rust pathogen. The same experiment is repeated in November 2011 for the confirmation/alteration of the above result.

News:

- Dr. M. Sivasamy, Sr. Scientist (Wheat Breeding) successfully completed his 6 months foreign assignment for developing molecular markers of wheat rust resistance genes in Cornell University, United states w.e.f. May, 2011.
- Dr. Jagdish Kumar, Head visited Kathmandu, Nepal for participating in a DRRW meeting held on 2-3rd November, 2011.
- NBPGR has planted around 22000 accessions of Indian wheat germplasm for evaluation of rust resistance under natural epiphytotics at IARI, Regional Station, Wellington. Interested scientists may visit Wellington to have a glimpse of rust resistant materials available in this wealthy collection of Indian wheat germplasm. This collection of wheat germplasm maintained in the long term storage at NBPGR is constituted of the entries contributed by cooperating centres of AICW&BIP since the inception of this coordinated project in early sixtees.

Retirement:

Mr. K. Paramsivan SSG-1 superannuated in the month of September, 2011 after contributing glorious 35 years in the service of the station. We wish him a happy, prosperous and healthy retired life.