Nilgiri Wheat News

(May – August, 2013)

IARI, Regional Station, Wellington
Vol 5 (2)

Phenotypic and molecular confirmation of durable adult plant leaf rust resistance (APR) genes-*Lr34+, Lr46+ and Lr67+* linked to leaf tip necrosis (LTN) in selected Indian wheat (*T. aestivum*) genetic stocks

M. Sivasamy, M. Aparna, J.Kumar, P. Jayaprakash, V.K Vikas, John Peter, R .Nisha, Satyaprakash, K.Sivan and E. Punniakotti

Nearly twenty thousand wheat lines were phenotyped for the presence of leaf tip necrosis (LTN), a phenotypic trait linked to adult plant leaf rust resistance (APR) genes viz., *Lr34*, *Lr46* and *Lr67* having pleiotropic association with multiple disease resistance genes. Thirty six lines showed varied expression of LTN and moderate level of leaf rust severity at adult plant stage with slow rusting (disease progress at a retarded rate). Seedling resistance test (SRT) revealed susceptible and mixed infection types, a characteristic of adult plant resistance (APR) genes. Further molecular confirmation for the presence of these genes using available microsatellite markers revealed that of the 36 lines, five lines carried *Lr46+* alone and five other lines carried *Lr67+* alone. Seven lines carried the combination of *Lr34+* and *Lr67+* while six lines confirmed to carry the combination of *Lr46+* and *Lr67+*. Remarkably three lines carried all the three APR genes viz., *Lr34+*, *Lr46+* and *Lr67+*. All these stocks can be a source of APR multiple disease resistance genes. Ten lines were not confirmed to carry any of the genes but still had LTN and SRT results showing an infection type typical of APR genes and these can be the source of identifying newer APR genes. The resistance based on minor APR genes when combined with a few additional minor genes in the background of high yielding cultivars is expected to have high level of race non-specific resistance and to be durable.

Adult plant resistance to leaf rust (*Puccinia triticina* Eriks.) in some Indian bread wheat (*Triticum aestivum L.*) accessions bearing leaf tip necrosis

J. Kumar, V. K. Vikas, M. Sivasmy P. Jayaprakash, G.P. Singh,Rajbir Yadav and J.Peter

Cultivation of resistant varieties is the most economical and environment friendly approach to curtail the losses caused by leaf rust *(Puccinia triticina* Eriks). Many varieties with different resistant genes have been developed and deployed to reduce the effect of leaf rust on wheat yield. However, most of these varieties carrying major seedling resistant genes have followed boom and bust cycle and for durable solution the breeders are putting more emphasis on adult plant resistant genes. One of such genes is *Lr34* which has been widely used as a buffer in case of immediate breakdown of other major genes. *Lr34*, is recognised by the presence of leaf tip necrosis, a trait associated with it. Presently, *Lr34* is present in large number of varieties either singly or in combination and is providing effective and durable resistance against leaf rust. Presently, of the 2200 germplasm accessions of *Triticum aestivum* L. screened under field condition against leaf rust (*Puccinia triticina*),1526 exhibited symptom of leaf tip necrosis (LTN). Ninety eight per cent of accessions showing LTN revealed reduced leaf rust severities from traces to 40 compared to 80 – 100 in susceptible infector rows. LTN reduced leaf rust severities independent of its low, medium and high expressions across the accessions. It is hoped that wheat lines identified with leaf tip necrosis as well

as resistance to leaf rust may become useful sources of resistance in the future breeding programmes.

Breeding for multiple rust resistance in wheat at Indian Agricultural Research Institute, Regional Station, Wellington

M. Sivasamy, V.K.Vikas, Jagdish Kumar, P. Jayaprakash, U.C.Umamaheswari, E.P.Venkatasalam and S.M.S.Tomar

The stem rust (*Puccinia graminis tritici*), leaf rust (*P. triticina*) and stripe rust (*P.striformis tritici*) pose serious threat to world wheat production. Fortunately there have been no epidemics of wheat rusts in India during the last 35 years which can be attributed to knowledge of spatial and temporal dynamics of wheat rust virulences, knowledge of rust resistance of available wheat germplasm and strategic deployment of wheat varieties with known specific genes. However, emergence of virulent pathotypes renders a variety susceptible in about five years. At Indian Agricultural Research Institute Regional Station, Wellington the number of wheat lines carrying effective rust resistance genes have been developed over the last 50 years and many of them released as cultivars in India or shared among wheat scientists across the country. A comprehensive and meticulously planned back-cross programme was initiated during mid-eighties and was reo-oriented time to time to develop high yielding, multiple rust resistant wheat varieties. Nearly 30 popular Indian wheat cultivars namely C 306, Kalyansona , WH147, WH542, HD 2285,HD 2329, HD2402, HD2687, HD2733, HD2877, HS240, HUW234, Lok1, MACS 2496, NI 5439, PBW226, PBW 343, PBW 502, NIAW 34, HI1077, HI977, RAJ3077, PBN51, KRL99, HP 1205, HW 3070, J24, UP 2338, HW 5207 and HW 5555 were taken to introgress and pyramid known effective rust resistance genes. Number of back crosses initially effected were up to 6-9 during conventional breeding approach and later restricted to BC2 and BC3 when employed MAS. The data of seedling test of finally constituted back crossed lines along with their recurrent parents with selected pathotypes of rusts supported the identification of resistance genotypes. Under this program, many genotypes were released as varieties in India which include NP 200, NP 201, NP, 202, HW 641, HW 741, HW 971, HW 2004, HW 1085, HW 2044, HW 2045, MACS 6145, COW(W)1, COW2, HD 2833, HW 5216, SONAK and WH 711 and seventeen of them were registered with NBPGR, New Delhi. Initially introgression of single gene was followed which in the later stage due to the emergence of new virulent pathotypes viz., 77-1, 77-3 , 77-5 and 77-7 compelled us to reorient our gene deployment strategy. Presently, pyramiding two or more rust resistance genes of either major (Race specific) or minor (Race non specific) in nature are expected to give durable resistance, comprising of stem/leaf rust resistance genes *Lr*19/*Sr*25, *Sr*36, *Sr*24/*Lr*24, *Lr*37/*Sr*38, *Sr*2, *Sr*22, *Sr*26, *Sr*27, *Sr*38, *Sr*44, *Sr*45, stripe rust genes *Yr*10, *Yr*15 and *Yr17* as well as powdery mildew gene *Pm*6. These combinations give high degree of resistance, not only to occurring pathotypes in India but also protect from emerging threats posed by Ug99 stem rust race and its variants.

Incidence, intensity and survival of powdery mildew of wheat in Nilgiris

P. Nallathambi, J.Kumar, C. Umamaheswari, E. P. Venkatasalam, M. Sivasamy, P. Jayaprakash and V. K Vikas

Wheat powdery mildew caused by the ascomycetous fungi belongs to an obligate parasite group. The test organism *Blumeria graminis* (DC) Speer (Syn. *Erysiphe graminis* DC f.sp. *tritici)* infects almost all the cultivated wheats in India. The above ground parts of the susceptible genotypes are adversely infected. Systematic investigations were carried out in both Kharif and Rabi season for two consecutive years 2012 and 2013 in the research farm of IARI, Regional station wellington, Nilgiris. Enormous number of wheat genetic materials received from different parts of the country were also evaluated using 0-9 scale as per the standard procedures and the overall results summarized that majority of the genotypes belong to *Triticum aestivum* (L.) group are susceptible than *Triticum durum* and *T. dicoccum* group. Moderate temperature ranging from 15-25^{o}C with dry and cool weather favoured maximum intensity of score 9 in *Triticum aestivum* (L.) group. However, *T. durum* recorded less than score 3. The field evaluation also revealed that some of the genotypes which are resistant at seedling and tillering stages expressed high compatible reactions during anthesis, milky, dough and ripening stages. Critical observations on survival and transmission of the pathogen under field conditions revealed the formation of sexual structures ie., chasmothecia (previously termed as cleistothecia) on both surfaces of leaves.

Conduct of AICWIP yield trials 2012-13 in south hill zone (SHZ)

M. Sivasamy, J. Kumar, V.K. Vikas, P. Jayaprakash, P. Nallthambi, E. Venkatsalam and U. Mahaeshwary

The AICW&BIP yield trials under Southern Hill Zone (which include hilly areas and adjoining plain) viz., AVT(TS/LS), IVT(TS/LS), Special trial on *dicoccum* and Agronomy trials were proposed and conducted. The trial locations proposed were Wellington(TS), Wellington(LS), Kotagiri, Kodaikanal, Ooty, Muthorai, Paiyur and Yercaud in Tamilnadu and Mandya in Karnataka. Trials were conducted at all the proposed locations except Yercaud and Paiyur (AVT-TS) and Yercaud (IVT-TS) where as AVT/IVT-LS were conducted only at Wellington. The Special Trial on *dicoccum* was conducted at Wellington and Agronomy trials for final year entries were conducted only at Wellington location.The AVT trials were conducted with 6 test entries including three checks (Table 2). The final year entry **HW 5224** ranked sixth with the yield level of 37.3 q/ha which was significantly below the checks. Low yield in terms of zonal mean was attributed to the terminal heat susceptibility of HW5224 at Mandya location. Data of AVT from Paiyur, Ooty and Muthorai were rejected due to RMT, HCV and RMT respectively. Promising test entry HW 5235 will be retained for second year testing during rabi 2013-14.

Table-1: Statement of IVT/AVT/agronomy/special trials in SHZ : 2012-13

Trial	No. trials proposed in 2012 workshop	No. trials conducted	Trials rejected/Not conducted/Not reported	Reasons / Remarks
AVT-MF-RIR	9 (Wellington-TS, Wellington-LS, Kotagiri, Paiyur, Kodaikanal, Ooty, Muthorai, Yercaud and Mandya)	8	Rejected-3 Paiyur Ooty Muthorai Not conducted-1 Yercaud	 RMT HCV RMT Sowings couldn't be taken in time due to rains
IVT-MF-RIR	8 (Wellington-TS, Wellington-LS, Kotagiri, Kodaikanal, Ooty, Muthorai, Yercaud and Mandya)	7	Rejected-2 Ooty Muthorai Not conducted-1 Yercaud	 HCV RMT Sowings couldn't be taken in time due to rains
Spl.trial T.*dicoccum*	1(Wellington)	1	Rejected	Poor crop stand due to problem in soil
Agronomy-*T.aestivum*-*Irrigation levels*	1(Wellington)	1	Nil	Nil

Advance Varietal Trials: AVT-RI-TS-TAS-SHZ-ZONE

Table-2: STATE AND ZONAL MEAN: Mean Grain Yield (q/ha): Rabi 2012-13

Entry	Code	Karnataka			Tamil Nadu			Zonal		
		Yield	Rk	G	Yield	Rk	G	Yield	RK	G
1.HW 5224*	AVT-SHZ-8	28.4	8	0	39.5	5	1	37.3	6	0
2.HW 1900	AVT-SHZ-1	42.8	2	1	33.9	8	0	35.6	5	0
3.HW 4042	AVT-SHZ-3	29.9	7	0	39.5	4	1	37.6	5	0
4.HW 5237	AVT-SHZ-5	33.8	5	0	34.0	7	0	33.9	8	0
5.HW5235	AVT-SHZ-6	32.9	6	0	40.0	3	1	38.6	3	1
6.HW4013	AVT-SHZ-7	25.0	9	0	33.4	9	0	31.7	9	0
7.HW5216(I)#	AVT-SHZ-9	34.3	4	0	40.1	2	1	38.9	2	1
8.HW 2044#	AVT-SHZ-4	36.5	3	0	39.0	6	1	38.5	4	1
9.CoW(W)1#	AVT-SHZ-2	43.3	1	1	40.4	1	1	40.9	1	1
S.E(M)		1.812			1.300			1.113		
C.D.		5.2			3.6			3.1		

* Final (third) year of testing; # Check

Table -3: Promotion/retention of varieties in AVT trials in SHZ 2012-13 based on zonal mean yield and response to diseases

Response to rust	Grain Yield	Others	Remarks
More than 20S Susceptibility with ACI of 10.0 and above for one or more rusts are rejected which include the varieties as under	Numerically not at par with the checks are rejected which include the varieties	Varieties sowing Seg/Mix more than 10% and very late mature than Std. Check and high lodging score.	Rejected
HW 5224	HW 1900, HW 4013, HW 4042, HW 5237 & HW 5224	None	HW 1900, HW 4013, HW 4042, HW 5237 & HW 5224
Less than 20S with ACI 10.0 or less to one or more rusts	Numerically at par and above with the best check	Genetically pure	Retained/ Promoted
HW 5235	HW 5235	Checks and all other test entries	HW 5235

Table- 4 : Probable varieties to be constituted for AVT trials in SHZ Rabi 2013-14

Sr. No.	Name of the Varieties qualify for promotion	Year of testing in AVT (2012-13 (Three years of AVT for SHZ)
1.	**HW 5235**	**Second year of testing**
2.	**HW 5555**	1st year AVT
3.	**MACS 6507**	,,
4.	**UAS 358**	,,
5.	CoW(W)1#	Check
6.	HW 2044#	Check
7.	If any identified variety	Check

Initial Varietal Trials (IVT)

The results of IVT zonal mean grain yields are presented in Table 5. The trials were conducted at 7 locations viz., Wellington (TS), Wellington (LS), Kotagiri, Kodaikanal, Ooty and Muthorai in Tamilnadu and Mandya in Karnataka during Rabi 2012-13. At zonal level the varieties **HW 5555, MACS 6507 and UAS 358** either yielded better or at par with the best check.

Table – 5: Mean Grain Yield (q/ha): Rabi 2012-13
IVT-RI-TS/LS-TAS-SHZ-ZONE

S.NO	VARIETY	CODE	TAMIL NADU			KARNATAKA			ZONAL		
			Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
1	NIAW 2059	IVT-SHZ-2	39.4	4	1	40.4	7	0	39.6	5	1
2	UAS 359	IVT-SHZ-3	40.3	3	1	40.1	8	0	40.3	3	1
3	HS 571	IVT-SHZ-4	32.2	18	0	44.2	4	0	34.6	14	0
4	UAS 358	IVT-SHZ-5	40.8	2	1	44.8	3	0	41.6	1	1
5	HW 5244	IVT-SHZ-6	34.6	15	0	33.5	16	0	34.4	15	0
6	HS 570	IVT-SHZ-7	36.3	10	0	14.0	20	0	31.8	19	0
7	HW 5243	IVT-SHZ-8	35.7	12	0	37.1	11	0	36.0	11	0
8	HW 5239	IVT-SHZ-10	36.5	8	0	24.2	19	0	34.0	16	0
9	HW 5242	IVT-SHZ-11	30.9	20	0	33.6	15	0	31.4	20	0
10	HW 4015	IVT-SHZ-12	36.4	9	0	43.8	5	0	37.9	7	0
11	MACS 6516	IVT-SHZ-13	36.1	11	0	37.0	12	0	36.3	9	0
12	HW 5555	IVT-SHZ-14	37.7	6	0	37.3	10	0	37.6	8	0
13	HS 565	IVT-SHZ-15	34.3	16	0	37.9	9	0	35.0	13	0
14	HS 572	IVT-SHZ-16	34.2	17	0	28.4	18	0	33.0	17	0
15	HW 1900-1	IVT-SHZ-17	36.8	7	0	32.8	17	0	36.0	10	0
16	MACS 6507	IVT-SHZ-18	41.4	1	1	40.5	6	0	41.3	2	1
17	NIAW 2073	IVT-SHZ-19	31.7	19	0	36.4	13	0	32.7	18	0
18	HS 569	IVT-SHZ-20	34.8	14	0	36.3	14	0	35.1	12	0
19	CoW(W)1(C)	IVT-SHZ-1	38.0	5	1	46.7	2	1	39.7	4	1
20	HW 2044 (C)	IVT-SHZ-9	35.2	13	0	51.3	1	1	38.4	6	1
	S.E.(M)		1.312			2.043	-	-	1.150	-	-
	C.D.		3.6			5.8	-	-	3.2	-	-

Table-6: Promotion/retention of varieties from IVT trials SHZ 2012-13 based on zonal mean yield and response to diseases

Response to rust	Grain Yield	Others	Remarks
More than 20S Susceptibility with ACI of 10.0 and above for one or more rusts are rejected which include the varieties as under (For black and Brown rust -South reaction)	Numerically not at par with the checks other than the final year entries are rejected include the varieties as under	Varieties sowing Seg/Mix more than 10% and very late mature than Std. Check and high lodging score	Rejected
NIAW 2059, UAS 359, HS571, HS570, HS565, HS572, HW4015, HW5243 & HW5244	HS 565, HS 569, HS 570, HS 571, HS 572, HW 1900-1, HW 5239, HW 5242, HW 5243, HW 5244, MACS 6516 & NIAW 2073	None	HS 565, HS 569, HS 570, HS 571, HS 572, HW 1900-1, HW 5239, HW 5242, HW 5243, HW 5244, MACS 6516, NIAW 2073, NIAW 2059, UAS 359 & HW4015
Less than 20S with ACI 10.0 or less to one or more rusts	Numerically at par and above with the best check as under	Genetically pure	Promoted
UAS 358, HW 5239, HW 5242, HW 5555, HW 1900-1, MACS 6516, MACS 6507, HS 569 & NIAW 2073	HW 4015, HW 5555, MACS 6507, NIAW 2059, UAS 358 & UAS 359	All	HW 5555, MACS 6507 & UAS 358

Table -7: Proposed entries for IVT, SHZ Rabi 2013-14 and its details (based on CVT meeting of IARI, New Delhi)

S. No.	Name of proposed entry	Pedigree
1	HW 3608	HD 2687*2// COOK*6/C80-1
2	HW 5047	HW 3083 // PDSN 224
3	HW 5048	HW 3083 // PDSN 101
4	HW 5049	HD 2402 // HW 2043
5	HW 4215-1	RAJ 3077*2// COOK*6/C80-1
6	HW 3620	MACS 2496*2// COOK*6/C80-1
7	HW 5802	HW 3083 // PDSN 111
8	HW 3906	Lr 39 // HD 2402
9	HW 3607	HD 2402*2// COOK*6/C80-1
10	HW 3627	RAJ 3077*2// COOK*6/C80-1
11	HS 588	-
12	HS 589	-
13	HW 2044#	PBW 226 * 6 // SUNSTAR * 6 / C 80 – 1
14	CoW(W)1#	HD 2646//HW 2002A/CPAN 3057
15	Identified Variety	

Summer Nursery Notice

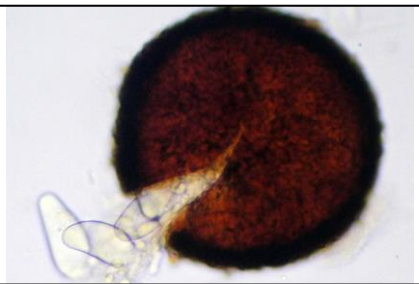
Off- season trials for crops such as Wheat, barley, mustard, sunflower, lentil, Bengal gram, pea, safflower etc. have been successfully conducted. Now materials are ready for harvest. It will be appreciated if user or representative are present physically at the time of harvesting.

Important contacts:

- Dr. M. Sivasamy, Sr. Scientist – Farm Incharge (09442350239), Dr P. Jayaprakash, Sr. Scientist – Summer Nursery Incharge (09842506455), Dr. V.K. Vikas, Incharge, guest house (09442921061)

Powdery mildew symptoms on wheat leaf

Black colored clestothecial bodies of powdery mildew pathogen formed on wheat leaf surface



Ascospores of powdery mildew pathogen coming out of a germinating cleistothecium (chsmothecium)

News

Retirement:

- Mr. A. Gopalan, SSS superannuated on 31st August, 2013 after putting his 40 years of dedicated services at the station. Staff , IARI, Regional Station, Wellington wishes him a happy retired life.

Transfer

- Dr. E. Vankatsalam, Scientist has been transferred to CPRI, Regional Station, Mutthorai w.e.f. 1st September, 2013.