मैहतान्सिज

MEHTAENSIS

प्रो0 के.सी. मैहता के नाम पर जारी क्षेत्रीय केन्द्र के शोध का छमाही न्युजलैटर

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सहकर्मियों से अनुरोध किया जाता है कि वे अपने आस–पास क्षेत्र से रतुआ नमूने एकत्रित करके प्रभेद विश्लेशण के लिए भेजें। THE COOPERATORS ARE REQUESTED TO SEND THE RUST SAMPLES FOR PATHOTYPE ANALYSES

संकलन :
क्षेत्रीय केन्द्र,
गेहूँ अनुसंधान निदेशालय,
(भा. कृ. अनु. प.)
फ्लावरडेल, शिमला-171002

फोन 0177– 2621978 फैक्स : 0177–2620108 ई मेल : dwrfdl@hotmail.com

1. सारांश /EXECUTIVE SUMMARY

इस वर्ष (2011–12) आरम्भ में वर्षा तुलनात्मक कम रही तथा रतुआ रोग पिछले वर्षो की अपेक्षा देर से देखे गए तथा इनकी मात्रा भी कम रही। उतरी भारत के कुछ स्थानों में गेहूँ का पीला रतुआ अधिक पाया गया। इन क्षेत्रों में उपयुक्त फफूंदीनाशक से पीले रतुए का नियन्त्रण किया गया। जम्मू काश्मीर के लद्वाख क्षेत्र में पीला एवं काला रतुआ अवलोकित किया गया। गेहूँ की पुरानी एवं क्षेत्र की परम्परागत किस्मों के कारण रतुए का प्रकोप अधिक पाया गया। बरबेरिस पर विद्यमान एसियल विजाणुओं का गेहूँ, जौ एवं जई के साथ कोई सम्बन्ध नहीं पाया गया।

इस वर्ष 1655 गेहूँ एवं जौ के रतुआ नमूने प्रभेद विश्लेषण के लिए एकत्रित किए गए तथा 1006 का अभी तक विश्लेषण किया जा चुका है। उतरी भारत में पीले रतुए का प्रभेद 46एस119 तथा 78एस84 अधिक मात्रा में पाए गए। लद्वाख क्षेत्र में इसके सी1, सी2, सी3 प्रभेद पाए गए जो शेष भारत में नहीं पाए जाते। काले रतुए के प्रभेद 40ए,40–1 अधिक मात्रा में नीलगिरी पहाड़ियों में पाए गए। लद्वाख क्षेत्र में प्रभेद 34–1 अधिक मात्रा में विद्यमान था। भूरे रतुए का प्रभेद 77–5 भारत, नेपाल, भूटान में तथा 104–3 बंगलादेश में पाया गया।

रतुआ प्रतिरोधी परीक्षण के लिए 1625 गेहूँ एवं जौ की अग्रिम पंक्तियों का शीशगृह में मुल्यांकन किया गया। गेहूँ की कोई भी पंक्ति तीनों रतुओं के लिए प्रतिरोधी नहीं पाई गई। जौ की तीन पंक्तियां सब रतुओं को प्रतिरोधी पाई गई। गेहूँ की 151 पंक्तियों में 10 एलआर जींस, 117 में पांच वाईआर जींस तथा 159 में 13 एसआर जींस विश्लेषित की गई। इस वर्ष गेहूँ रोग निरीक्षण पौध 38 क्षेत्रों में तथा सार्क देशों में 23 स्थानों पर सार्क गेहूँ रोग निरीक्षण पौध लगाई गई। उतरी भारत, निकटवर्ती पाकिस्तान, नेपाल एवं भूटान में कई क्षेत्रों में पीले रतुए के प्रकोप को छोड कर कुल मिलाकर रतुआ रोग काफी कम मात्रा में पाए गए।

During 2011-12 crop year, there was scanty rainfall early in the season. Wheat rusts appeared almost one month late than previous year. Except for some localized incidences of yellow rust in northern India, it was comparatively less rust year. Inoculation of aecial stages from *Berberis* on wheat, barley and oat showed that these were not related. Likewise, rust samples from grasses could not infect wheat, barley however, one sample infected oat. This year 1655 samples of wheat and barley rusts were collected and 1006 were analyzed. Pathotype 46S119 of yellow rust was most predominant followed by 78S84 in northern India. In Nilgiri hills pathotype I(38S102) was common. In Ladhakh pathotype CI, followed by CII and CIII were observed. These pathotypes do not occur anywhere else in India. In Black rust pathotype 40A followed by 40-1 were common in Nilgiri hills. In Ladhakh area, pathotype 34-1 was identified in all the

samples. This pathotype is very primitive and does not occur in other parts of India. In brown rust pathotype 77-5 was observed in most of the samples from India, Nepal, Pakistan and Bangladesh.

During this year 1625 wheat and barley lines were evaluated at seedling stage against different pathotypes of three rusts. None of the wheat AVT lines showed resistance to all the rusts however, three lines of barley were resistant to three rusts. Ten *Lr* genes were characterized in 151 lines, 5 *Yr* genes in 117 and 13 *Sr* genes in 159 lines. Wheat disease monitoring nurseries was planted at 38 locations distributed in all the wheat growing areas of India. Likewise SAARC nursery was planted in 23 locations in five SAARC nations.

2. INCIDENCE OF WHEAT RUSTS

This year was comparatively a dry season. Early in the crop year, rainfall was scanty. The development of rusts occurred almost one month late than the previous two years. Except for yellow rust, incidence of other rusts was minimal. In some localities in Northern India, high severity of yellow rust of wheat was observed. Chemical intervention in the initial stages checkmated the yellow rust. Black rust was recorded in Laddakh and Nilgiri hills on summer crop. In Laddakh, the high incidence of wheat and barley rusts was observed to be due to the cultivation of old varieties and land races. Brown rust occurred late in the season and incidence was very low.

3. OBSERVATIONS ON AECIAL COLLECTIONS FROM DIFFERENT *Berberis* SPECIES

None of the aecial samples from at least six *Berberis* species could infect wheat, barley and oat. These samples were drawn from at least four districts of Himachal Pradesh and Nepal. It indicated that the aecial cups in these areas do not relate to wheat rust. Similarly grass samples did not infect wheat, however, one sample infected oat and was recorded as leaf rust of oat.

Aecial stage on *Berberis* in a sample from Kullu (HP)

Further fact to support the non functional role of alternate hosts in India, is the occurrence of only few races of different species of *Puccinia*. In countries where alternate hosts are operational for wheat rusts, the races occur in hundreds. The sexual reproduction favours in independent assortment of different combinations resulting in large number of new races. Since, there are only few races of wheat rusts in India (around 100) during last 90 years, which is further indicative of the fact that alternate hosts may not be functional in this part of Asia.

4. SAMPLE RECEIPT AND ANALYSIS

During this period 1655 samples of different rusts of wheat and barley were received/collected for pathotype analysis. These samples were from fifteen states of India, Nepal, Bhutan and Bangladesh (Table 1)

Table 1: Detail of rust samples of Wheat and Barley received/collected during 2011-12

S. No.	State/Area	RUST		
		Brown	Yellow	Black
1	Tamil Nadu	114	62	52
2	Karnataka	76	-	-
3	Maharashtra	12	-	16
4	Gujarat	2	-	10
5	Madhya Pradesh	8	-	-
6	Jharkhand	2	-	-
7	Uttar Pradesh	86	11	-
8	Rajasthan	-	46	-
9	Haryana	33	41	6
10	Punjab	9	203	-
11	Uttarakhand	92	87	-
12	Himachal Pradesh	37	244	13
13	Jammu & Kashmir	22	51	24
14	Chattishgarh	9		-
15	Delhi	6		-
16	Nepal	31	54	4
17	Bangladesh	136		-
18	Bhutan	37	16	4
	Total	712	815	128

5. PATHOTYPE DISTRIBUTION

To know the pathotype distribution, this year 1006 samples of different wheat and barley rusts have been analysed so far.

i. Yellow rust of wheat and barley (*Puccinia striiformis*)

During this year 510 samples of yellow rust were analysed from 8 states of India and Nepal. Among the 8 pathotypes reported on wheat, 46S119 was most frequent and widely distributed followed by 78S84 in Northern India. During previous year, pathotype 78S84 was more prevalent. Other pathotypes were observed in very low frequency. In Nilgiri hills pathotype 38S102 (I) was observed in all the samples. Occurrence of 46S119 in this area needs confirmation. This pathotype does not occur in Southern India (Table 2).

Table 2: Pathotype distribution of *Puccinia striifromis* in India and in neighbouring countries during 2011-12

S. No.	State/ Country	No. of isola-tes analy-zed	PATHOTYPES											
			WHEAT								BARLEY			
			46S 119	78S 84	P (46S 103)	T (47S 103)	I (38S 102)	CI (14S 64)	CII (15S 64)	CIII (78S 64)	24 (0S0-1)	57 (0S0)	M (1S0)	Q (5S0)
1	**Himachal Pradesh**	**162**	**105**	**47**	**7**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
2	**Punjab**	**177**	**89**	**79**	**5**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**Haryana**	**26**	**14**	**9**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
4	**Jammu & Kashmir**	**33**	**2**	**2**	**-**	**-**	**-**	**15**	**6**	**5**	**1**	**-**	**2**	**-**
5	**Rajasthan**	**32**	**22**	**7**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
6	**Uttar Pradesh**	**2**		**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
7	**Uttra-khand**	**56**	**28**	**15**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**9**	**-**
8	**Tamil Nadu**	**21**	**3***	**-**	**-**	**-**	**18**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
9	**Nepal**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
10	**Bhutan**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Total	**510**	**263**	**161**	**17**	**7**	**18**	**15**	**6**	**5**	**3**	**1**	**13**	**1**

***Needs to be confirmed**

In barley yellow rust 18 samples were analysed from India and Nepal. Among the four pathotypes identified, pathotype 1S0 (M) was most common. Other pathotypes occurred in few samples only.

Leh Laddakh area (Jammu and Kashmir)

In this area pathotypes 14S64 (C I) followed by 15S64 (C II) and 78S64 (C III) were observed during 2011 summer crop. These pathotypes are very simple and can infect Kalyansona only. There is no change in racial pattern in this area in comparison to 1992. All the present day wheat varieties or those released for cultivation in the last 20 years in Northern India are resistant to these pathotypes. Pathotype 1S0 (M) was observed in the samples of barley yellow rust from this area.

ii. Brown rust of Wheat (*Puccinia triticina*)

More than 426 samples of brown rust of wheat were analysed from 14 states of India, Bhutan, Nepal and Bangladesh. Among the 23 pathotypes identified this year (Table 3), pathotype 121R63-1 (77-5) was most widely distributed and was observed in all the areas followed by pathotypes 21R55(104-2), 21R63 (104-3). These pathotypes constituted more than 80 percent population of *P. triticina* in this part of Asia. Pathotype 93R57(104-4), which was identified two years ago has increased in proportion in Himachal Pradesh, Uttrakhand and Uttar Pradesh. Another pathotype which was recorded in few samples was 121R60-1 (77-9) which occurred only in three states and Bangladesh. Pathotype 121R55-1(77-6) was also identified in 15 samples from four states. Other pathotypes were observed in few samples only.

In Nepal and Bhutan pathotype 121R63-1(77-5) which was predominant in India, was also common in these areas. In Nepal, 5 pathotypes were identified in 21 samples. Likewise, in Bangladesh, 8 pathotypes were identified in 18 samples, of which 21R63 (104-3) was most common. It is evident from the these results that India, Nepal, Bangladesh and Bhutan fall in one epidemiological zone.

iii. Black rust of wheat (*Puccinia graminis tritici*)

Seventy samples of black rust of wheat were analysed from five states of India and Bhutan (Table 4). Pathotype 62G29 (40A) was the most frequent and was observed in 40% of the samples. In four samples from Karnal, pathotype 79G31(11) was observed in four, 127G29(40-3) in two and 62G29(40A) in one sample only. All the 8 samples from Gujarat were of pathotype 62G29 only. In Tamil Nadu pathotype 62G29-1 (40-1) was more predominant followed by 62G29. One sample analyzed from Bhutan was of pathotype 58G13-3(40-2).

Laddakh Area

All the samples of *Puccinia graminis tritici* (Black rust) from this area harbour pt. 10G13 (34-1). Common *Sr* genes like *Sr* 8, *Sr* 11, *Sr* 31 of Indian wheat varieties are resistant to this pathotype. Wheat varieties under cultivation or released for cultivation in Northern India for the last 20 years are resistant to this pathotype.

Table 3: Pathotype distribution of *Puccinia triticina* in India and neighbouring countries during 2011-12

S. No.	State/ Country	No. of Isolates	PATHOTYPES																						
			12A	12-3	12-4	12-5	12-8	12-9	77	77-1	77-2	77-3	77-5	77-6	77-9	77-10	77A-1	104-2	104-3	104-4	104B	162	162-1	162-2	162A
1	Himachal Pradesh	39	-	-		-	-	-	-		-	-	3	-	-	-	-	12	6	16	-	-	-	2	-
2	Tamil Nadu	98	-	-		-	-	-	-		-	2	69	6	14	7	-	-	-	-	-	-	-	-	-
3	Karnataka	72	-	1		1	-	1	-		-	-	44	4	1	-	1	8	3	-	2	1	-	5	-
4	Punjab	7	-	-		-	-	-	-		-	-	-	-	-	-	-	6	-	-	-	-	-	1	-
5	Uttar Pradesh	46	-	-		-	1	-	-	1	1	1	14	1	-	-	-	5	12	8	-	-	2	-	-
6	Uttrakhand	32	-	-		-	-	-	1		-	-	10	-	-	-	-	5	8	8	-	-	-	-	-
7	Delhi	4																		4					-
8	Gujarat	2	-	-		-	-	-	-		-	-	2	-	-	-	-	-		-	-	-	-	-	-
9	Haryana	36	-	-		-	-	-	1	1	-	-	6	-	-	-	-	26	2	-	-	-	-	-	-
10	Jharkhand	2	-	-		-	-	-	-		-	-	1	-	-	-	-	1		-	-	-	-	-	-
11	Jammu & Kashmir	15	-	-		-	-	-	-		-	-	5	3	-	-	-	3	1	-	-	-	-	3	-
12	Madhya Pradesh	6	-	-		-	-	-	-		-	-	2	-	-	-	-	2	1	-	1	-	-	-	-
13	Maharashtra	14	-	-		-	-	-	-		-	-	4	-	3	-	-	4	3	-	-	-	-	-	-
14	Chhatisgarh	10	1										2					6					1		-
15	Bhutan	4	-	-		-	-	-	-		-	-	3	-	-	-	-	-	1	-	-	-	-	-	-
16	Nepal	21	-	-		1	-	-	-	-	1	-	16	1	-	-	-	2	-	-	-	-	-	-	-
17	Bangladesh	18	1	-	1	-	-	-	-		-	-	5	-	1	-	-	2	6	-	-	-	1	-	1
	Total	426	2	1	1	2	1	1	2	2	2	3	186	15	19	7	1	82	43	36	3	1	4	11	1

12A(5R13 =FGTTL), 12-3(49R37=FHTTQ),12-4(69R13= FGTTN) 12-5(29R45=FHTKL),12-8(49R45=FHRPQ), 12-9(93R37-1=FHTTL),77(45R31=TGTKQ),77-1(109R63=THTTQ) 77-2(109R31-1=TGTTQ), 77-3(125R55=THTTS),77-5(121R63-1=THTTS), 77-6(121R55-1=THTTQ),77-9(121R60-1=MHTTS),77-10(377R60-1=MHTTS), 77A-1(109R23=TGTTQ),104-2(21R55=PHTTL),104-3(21R63=PHTKL), 104-4(93R57=NHKSP), 104B(29R23=MGTQN),162(93R7=KGTTL),162-1(93R47=KHTTL),162-2(93R39=KHTTL), 162A(93R15=KGTTL).

Table 4: Pathotype distribution of *Puccinia graminis f.sp. tritici* in India and neighbouring countries during 2011-12

S. No.	State/ Country	No. of isolates analyzed	PATHOTYPES					
			11	34-1	40A	40-1	40-2	40-3
1	Haryana	7	4	-	1	-	-	2
2	Jammu & Kashmir	18	-	18	-	-	-	-
3	Gujarat	8	-	-	8	-	-	-
4	Maharashtra	12	-	1	7	-	2	2
5	Tamil Nadu	24	-	-	11	13	-	-
6	Bhutan	1	-	-	-	-	1	-
	Total	70	4	19	27	13	3	4

11 (79G31=RRTSF), 34-1 (10G13=MHGSF), 40A (62G29=PTHSC), 40-1 (62G29-1=PTHSH), 40-2 (58G13-3=PKTSC), 40-3 (127G29=PTTSF)

6. SEEDLING RESISTANCE TEST AGAINST WHEAT AND BARLEY RUSTS

More than 1625 lines comprising advance varietal material and breeders material were evaluated against different pathotypes of rust pathogens (Table 5). To identify rust resistance in wheat, 230 lines of AVT were subjected to multi-pathotype tests at seedling stage against different pathotypes of *Puccinia triticina* (brown rust) , *Puccinia graminis tritici* (black rust) *Puccinia striiformis* (yellow rust) The test were repeated to confirm the consistency of infection types and effect of temperature on the resistance.

Table 5 : Details of material for seedling resistance test against wheat and barley rusts

Name	Place	No.of. Lines	Brown	Yellow	Black
Madhumeeta Jindal	Ludhiana	42	Sel	Sel	Sel
AICW&BIP	AVT	230	Sel	Sel	Sel
Vijay Rana	Palampur	50	-	Sel	Sel
R. Tiwari	Karnal	127	Sel	Sel	Sel
AICW&BIP	NBDSN+ EBDSN	240	Mix	Sel	Sel
A.P. Agrawal	Chattisgarh	33	Sel	Sel	Sel
D.P. Walia	Tutikandi	65	Sel	Sel	Sel
V.K. Mishra	BHU Varanasi	330	Sel	Mix	Sel
P. Chhuneja	Ludhiana	5	Sel	Sel	Sel
Rekha Malik	Karnal	1	Sel	Sel	Sel
Laxmi Kant	Almora	220	Sel	Sel	-
Selva Kumar (Barley)	Karnal	72	-	Sel	-
R Chatrath	Karnal	104	Sel	Sel	-
P.D. Material	Karnal	106	-	Sel	-
		1625			

Rust Resistant Lines

During 2011-12, two hundred thirty lines of AVT material were evaluated against different pathotypes of yellow rust (*Puccinia striiformis*) brown rust (*Puccinia triticina*) and black rust (*Puccinia graminis tritici*) under controlled conditions. To ascertain the host-pathogen interaction, the experiment was repeated with selected pathotypes.

Rust Resistant Lines

Resistance to all the rusts was not observed in any of the lines. All the lines possessing *Sr*31 resistant to black rust.

i.) **Resistant to brown and black rusts :** Thirteen lines viz. Cow(W)-1, GW 432, HD2864, HD3093, HD3095, HI1544,HI1563, HUW652, NIAW1689, RAJ4240, RAJ4245, RAJ4270 and UP2825.

ii.) **Resistant to yellow rust only :** Six lines viz. HS557, MACS3828(D), MPO1256(D), MPO1262(D), RKD219(D) and VL972.

iii.) **Resistant to black rust only :** Eight lines viz. AKAW 4731, HD3096, HI1584, HI8731(D), HS556, NW5055, PBW644 (I) (C) and VL950.

iv.) **Resistant to brown rust only :** Twenty lines viz. AKWD4749, HD3090, HD3091, HD3098, HS536, HS541, HW2044, HW5216, HW5224, MACS2971, MACS5012, MACS6222, MP4010, NIAW1415, PBW590, RAJ4229, RAJ4238, VL971, WH1127, WHD948.

Rust Resistance genes in AVT lines

Rust resistance genes were characterized in more than 170 lines on the basis of gene matching technique. Morphological markers, linked resistance genes and characteristic infection types were also criteria for postulation of rust resistance genes when host-pathogen interaction was not sufficient to postulate resistance genes.

Lr Gene

Ten *Lr* genes (*Lr*1,3,10,13,18,23,24,26,28,34) were characterized in 151 lines (Table 6). Most of the lines possessed more than two resistance genes. *Lr*23 was the most common resistance gene and was characterized in 58 lines followed by *Lr*13 (56 lines). The proportion of lines with *Lr*26 has reduced and was identified in 42 lines only. Likewise *Lr*10 was postulated in 46 lines *Lr*1 in 25 lines. *Lr*28, *Lr*3 and *Lr*24 were inferred in few lines only. Evaluation of durum showed that four lines possessed *Lr*18. *Lr*34 was postulated in eight lines only.

Yr Genes

Five *Yr* pattern were postulated in 117 lines (Table 7). *Yr*2 was the most commonly identified resistance gene and was identified in 64 lines. However, *Yr*2 is susceptible to most of the pathotypes. *Yr*9 linked to *Lr*26 and *Sr*31 was identified in 42 lines. Other resistance genes like *Yr*A, 18, 27 were identified in 8 lines each.

Sr Genes

Thirteen *Sr* genes (*Sr*2,5,7b,8a,8b,9b,9e,11,12,13,24,30,31) were characterized in 159 lines (Table 8). *Sr*11 was postulated in 59 lines followed by *Sr*31 and *Sr*2 in 42 and 37 lines, respectively. Postulation of *Sr*31 is based on its linkage to *Lr*26 and *Yr*9. *Sr*8a was identified in 30 lines. *Sr*5 in 17, *Sr*7b in 10, *Sr*30 in7 lines. Other resistance genes were postulated in few lines only. Most of the durum wheat varieties had resistance based on *Sr*7b,*Sr*9e, *Sr*11 and *Sr*13.

Table 6: Postulation of *Lr* genes in AVT lines during 2011-12

Lr Gene	No. of Lines	Lines
13+	23	AKW4731, DBW74, GW322, GW428, GW1280, HD2932, HD3077, HD3080, HD3081,HPW360, KRL330, KRL402, MACS6478,MP3353, NW5038, NW5055, RW3705, VL950, VL974, WH1080, WH1098, WH1105, WH1126
13+1	1	HPW385
13+3+	1	HPW387
13+10+	23	CG1006, DBW88, DBW90, HD3043, HD3065, HD3075, HD3078, HP1939, HPW349, HPW376, HPW377, HS542, HS560, K0906, KRL210, MP3336, NIAW1846, VL892, VL972, WH1100, WH1112, WH1120, WH1124
13+10+1+	3	HS526, PBW670, UP2852
13+10+3+	2	HD3086, HPW386
13+34+	1	NIAW34
23+	22	A-9-30-1, DBW14, GW431, HD3059*, HD3096, HD4725, HI8498, HI8724, HI8727, HPW368, HS490, NIAW1773^{Q}, PDW291, PDW314, PDW329, RAJ4083, RKD219, UAS428, UAS442, VL973, VL975, WHD950
23+1+	4	HP1940, K0307, PBW644, PBW674
23+3+	1	NW5054
23+3+1+	1	HS557
23+10+	9	HD3076, HD3079,K1006, K1016, PBW661, PBW675, RAJ4246^{Q}, WH1097, WH1123
23+10+1+	2	PBW658, RAJ4250*
23+13+	1	HI1579
23+34+	2	HS295, PBW175
24+	6	HD2888, HD3095, HI1500, HW2044, MP4010, RAJ4238
26+	14	DBW71, GW433, HD3090, HW5216, HW5224, KRL283, KRL331, MACS5022, MP1259, NIAW1415, PBW343, PBW373, PBW660, RAJ4250*
26+1	7	HS507, K 0911, MACS6222, UAS334, UAS336, VL907, WH1021
26+3+1+	1	UP2822

26+10+	1	PBW662
26+10+1+	1	HS561
26+10+3+	1	UP2851
26+23+	6	DBW17, DBW93, HD3070, HPW251, NW2036, UP2824
26+23+1+	5	DBW111, HS559, KRL327, PBW590, UP2828
26+23+10+	3	DBW39, NIAW1594, PBW665
26+23+34+	1	VL829
26+34+	2	HD2733, VL804
28+	1	HS541
34+	2	C306, NI5439
18+	3	HI8730, MPO1255, MPO1256
18+23+	1	UPD93
Total	151	

*RAJ 4250 different seed lot.

Table 7 : Postulation of *Yr* genes in AVT lines during 2011-12

***Yr* Gene**	**No. of Lines**	**Lines**
A+	7	DBW88, HD 3079, HD 3081, HI1500, HD3046, HS 490*, VL950
2+	60	AKAW4731, DBW74, DBW90, DDK1042, HD2864, HD3043, HD3077, HD3080, HD3091, HD3098, HI1563, HI8724, HD3043, HD3077, HD3080, HD3091, HD3098, HI1563, HI8724(d), HI8725(d), HI8730(d), HP1940, HPW349, HPW360, HPW368, HPW376, HPW377, HPW386, HPW387, HS541,HS542, HS556, HS560, HUW652, HW2044, K8027, K1016, KRL330, MACS6478, MP4010(c) , NW5055, PBW644(1)(c), PBW661, PBW670, PBW675, RAJ4083 RAJ4229, RAJ4245, RAJ4246, RAJ 4250*, RW3705, UP2825, VL971, VL973, VL975, WH1098, WH1105, WH1123, WH1126, WHD950
2+18+	3	HS295, NI5439, PBW175
2+27+	1	HS526
9+	33	DBW17(c), DBW39(c), DBW71, DBW93, DBW111, HD3070, HD3090, GW433, HPW251(c), HS507, HS559, HS561, HW5216, HW5224, K0911, KRL283, KRL327, KRL331, MACS5022, MP1259, NIAW 1415(c), NIAW1594, NW2036(c), PBW590(c), PBW660, PBW662, RAJ4250*, UAS336, UP2822, UP2828, UP2851, UP2824, WH1021
9+A+	1	UAS334
9+18+	3	HD2733 (c),VL804(c) VL829 (c)
9+27+	5	MACS 6222 (c), PBW343, PBW373, PBW665, VL907
18+	2	C 306, NIAW 34
27+	2	HD 3076, MACS2828
Total	117	

***Raj 4250 had two different seed lots.**

Table 8: Postulation of *Sr* genes in AVT lines during 2011-12

Sr Gene	No. of Lines	Lines
2+	10	DBW14(C), HD2864(C), HD3075, HD3086, HD3093, HD3098, HI1563(C), HUW652, NIAW1773, PBW175(C)
2+5+	1	RAJ4229*
2+5+31+	2	PBW343(C), PBW373
2+7b+	2	MACS 3828*, WHD 948*
2+8a+9b+11+	1	K1016
2+8a+11+	1	K0906*
2+8b+	1	HS295 (C)
2+9b+	1	HS490 (C)
2+9e+	1	WH1080 (C)
2+9e+12+	1	NIDW 295 (d) (C)
2+11+	4	AKDW4749, GW322 (C), HI8398 (d) (C), MP3336*
2+13+	2	PDW329 (d), UPD93 (d)
2+24+	3	HI1500 (C), HW2044 (C), MP4010 (C),
2+30+	1	HD3076
2+31+	6	HPW251, KRL 283*, KRL 327, MACS6222(C), NIAW1594*, UP2822
5+	1	HPW376
5+8a+	2	HS557, WH1124
5+8a+9b+11+	1	HS542
5+8a+11+	2	HS 526*, HS536
5+9b+11+	1	HPW368
5+31+	6	DBW71*, PBW660*, PBW665, VL804(C), VL829, UP2828,
5+8a+11+	1	HP1940
7b+	6	AKDW2997-16(d)(C), KRL210(C), MPO1255(d), MP01262 (d), NW5054, WH112
7b+11+	2	UAS439(d), WH1097*
8a+	7	HD3079, HD3081, RAJ4250*, VL972, VL975, WH1127, WH1098*,
8a+9b+11+	10	CG1006, DBW74*, HD2932 (C), HD3078, HP1939, HPW385, K1006, MP3353, RAJ4083(C), UP2852
8a+11+	5	HD293(C), HD3077, HD3080, HPW387, VL973
9b+11+	5	HS541, HS560, K0307 (C), PBW675, WH1123
9e+	4	HD4725, PDW291(C), PDW314(C), WHD950
11+	26	A-9-30-1(C), DBW88, DDK1042, DOK1009(C), GW428, GW1276(d), GW1277(d), GW1280(d), HD3091, HI8713*(d), HI8726(d), HI8727(d), HI8728(d), HW1098*, KRL402, MACS2971(C), MACS5008, MACS5012, MPO1215(d)(C), MPO1256(d), NI5439 (C), NIAW 34(C), PBW661, PBW674, UAS442 (d), WH1105*
13+	6	DBW90, HI8724 (d), HI8730 (d), MACS 3817 (d), MACS 6478, PDW327(d)
24+	3	HD2888, HD3095, Raj4238*
30+	6	GW431, HPW360, HPW377, NIAW 1846, RW3705, VL974
31+	28	DBW17(C), DBW39(C), DBW93, DBW111, GW433, HD2733(C), HD3070, HD3090, HS507, HS559, HS561, HW5216*, HW5224, K0911, KRL331, MACS5022, MP1259, NIAW1415(C), NW2036(C), PBW590(C), PBW662, RAJ4250*, UAS334, UAS336, UP2824, UP2851, VL907(C), WH1021(C)
Total	**159**	

***Raj 4250 had two different seed lots.**

Evaluation for seedling rust resistance in barley lines

To find out rust resistant barley material, 240 lines of NBDSN and EBDSN were evaluated against five pathotypes and mixture of pathotypes of *Puccinia striiformis hordei* (Stripe rust), mixture of pathotypes of *P. hordei* (leaf rust) and four pts. of *P. graminis tritici* (Stem rust).

Three lines viz PL830, UPB1021 and VLB132 were resistant to all the rusts of barley. Twenty six lines were resistant to both stripe and leaf and 12 to leaf and stem rust .

Rust Resistant lines of Barley

Resistant to rusts	No. of lines	Details of lines
All	3	PL830, UPB1021, VLB13
Stripe and leaf rust	26	BHS404, BH902,RD 2552, RD 2715, RD2784, RD 2786, RD 2787, RD 2810, RD 2815, RD 2816, RD2820, RD 2831, RD 2834, RD2836, RD 2837, RD 2839, RD 2840, RD 2844, RD 2845, RD3145, RD287, RD 2851, RD 2887, JB 240
Leaf and stem	12	BHS405, BHS409, BH962, DWR85, DWR13, DWR73, DWRB106, DWRB108,JYOTI©, HBL712, PL866, VLB124, VLB130

7. SUPPLY OF NUCLEUS INOCULA OF RUST PATHOTYPES

To facilitate research work on the rusts of wheat and barley in different parts of India, nucleus inocula were supplied to scientists located in different parts of India (Table 9). The inoculums was supplied to ICAR institutes, SAU's, Self help Groups and Private organizations engaged in search and development works.

Table 9 :Details of rust inoculum supplied up to 31.07.2012

Name	Place	Nucleus inoculums supply
A.N. Mishra	Indore	Pts. of brown and black rusts
A.P. Agarwal	Bilaspur	Brown and black rust mixture
Atul Kumar	Samastipur	Pts. mixture of brown rust
B.K. Mishra	Varanasi	Pts. of brown rusts
B.N. Singh	Faizabad	Brown and black rusts Mix.
B.K Honrao	Pune	Pts. Mix of brown and black rusts
B.P. Krundakar	Mahabaleshwar	Pts. of black rust
B.Sarkar	Karnal	Mix of brown and yellow rust
C.N. Mishra	Karnal	Brown & Yellow rusts mixture
Dhanbir Singh	Dhaulakuan	Mix of yellow and brown rusts of wheat and barley
D.P. Singh	Karnal	Pts. & Mix of brown and yellow rust
D.P. Walia	Tutikandi	Pts. of yellow rust
Deep Shikha	Pantnagar	Pts. of brown and yellow rust

D.V. Gohil	Bhavnagar	Mixture of brown and black rusts
Gireesh C	New Delhi	Black rusts pathotype
Gurdev Singh	Ludhiana	Brown and yellow rusts mixture
I.K. Kalppanavar	Dharwad	Mix. & pts of brown and yellow rusts
J.B. Sharma	New Delhi	Pts. & mix. of brown , black & yellow rusts
J.B. Khan	Kanpur	Mix. of brown and yellow rusts of wheat and barley.
J.P. Jaiswal	Pantnagar	Brown and yellow rusts mixture
Kamini Kaushal	Indore	Pts. of brown rust
K.V.Jivani	Junagadh	Pts. of brown and block rusts
Madhumeeta jindal	Ludhiana	Pts. of yellow rusts of wheat and barley
Mahyco	Karnal	Pts. of brown, black and yellow rusts
M.S. Saharan	Karnal	Mix of brown and yellow rusts
Neeraj Kulshreshtha	Karnal	Mix of brown and yellow rusts
Neeraj Kumar	Varanasi	Mix. & pts. of brown rusts
P.C. Mishra	Powarkheda	Mix. of brown and black rusts
Praveen Chhuneja	Ludhiana	Pts. of yellow & brown rusts
Praveen Kumar	Ludhiana	Pts. of yellow rust
P.P.S. Pannu	Ludhiana	Pts. of yellow rust
P. Shekhawat	Jaipur	Yellow and brown rusts mixture of wheat and barley
P. Silvakumar	Karnal	Pts. of barley yellow and brown rusts
R. Devlash	Bajaura	Mix. of barley yellow rust
Rashmi Bansal	New Delhi	Pts. of brown rust
Ravindra Singh	Jammu	Mix of yellow rust
Rajbir Yadav	New Delhi	Pts. of brown rust and mix of yellow rust
Rekha Malik	Karnal	Pts. of brown & Black rusts.
R.P. bal	Ludhiana	Mixture of yellow rust
R.P. Khokhar	Karnal	Black rust pts.
R.P.S. Verma	Karnal	Mix. of barley yellow and brown rusts
S.I. Patel	Vijapur	Mix. of brown and black rusts
S.K. Jain	Almora	Mixture of brown and yellow rusts of wheat and barley
S.K. Rana	Malan	Mix of brown and yellow rusts
S.P. Singh	Faizabad	Mix. of brown rust of wheat and barley
S.S. Karwasara	Hisar	Mix of brown and yellow rusts of wheat and barley
Subhash	New Delhi	Pts. of brown , black and yellow rusts
Subodh Kumar	Pantnagar	Mix & pts. of brown & yellow rusts
Subhashish Sarkhel	New Delhi	Pts. of brown and yellow rusts
T.R. Sharma	New Delhi	Pts. of brown rust (106 and 77 group for genome sequencing of *Puccinia triticina*).
U.D. Singh	New Delhi	Pts. & Mix. of brown, black and yellow rusts
U.S. Singh	New Delhi	Mixture of brown and yellow rusts
Veena Bharti	Hisar	Mix of brown & yellow rusts
V.K. Mishra	Varanasi	Pt. of black rusts
V.L. Majumdar	Durgapura	Mix. of barley yellow rust and mixture of brown rust of wheat.

8. EFFORTS IN MONITORING OF WHEAT AND BARLEY RUSTS

During this crop year a large numbers of wheat researchers helped in monitoring wheat rust situation and collecting samples for pathotype analyses at Flowerdale. Their efforts

in combating wheat and barley rusts are praiseworthy and we acknowledge the receipt of samples with gratitude (Table 10).

9. WHEAT DISEASE MONITORING NURSERIES

Wheat disease monitoring nursery was proposed to be planted in 2011-12 at 38 locations covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighbouring countries. Data on wheat disease situation was received from 38 locations. Information on disease situation was received from Almora, Pantnagar, Dhaulakuan, Malan, Sundernagar, Shimla, Bajaura, Dalang Maidan, Sangla, Kukumseri, Kangra, Kathua, Jammu, Rajauri, Leh, Dera-Baba-Nanak, Abohar, Ludhiana, Hisar, Yamuna Nagar, Kalyani, Sabour, Ranchi, Faizabad, Kanpur, Bilaspur, Sagar, Powarkheda, Vijapur, Junagarh, Pune, Niphad, Akola, Dharwad and Wellington. Incidence of disease was less in most of the areas. Wheat rusts were not observed in the locations at Akola, Sagar, Indore, Pusa and Kalyani.

During 2011-12, SAARC wheat disease monitoring nursery was planted at 23 locations across the five SAARC countries. Details of locations

10. VISITORS & NEWS

i. Visitors

S. No.	Visitor	Dates
1	Dr. Indu Sharma, Project Director, DWR, Karnal	January 21, 2012
2	Dr. H.S. Bariana, Plant Breeding Institute, Australia	21-23 January,2012
3	Participants of Malting Quality Improvement in Barley Sorghum and Corn by DWR Karnal	Feb., 2, 2012
4	Participants of DRRW/BGRI Programme on " Surveillance collaborative initiative 2012	March 7-9, 2012
5	Dr. S.S. Chahal, Former Vice Chancellor, MP Rajasthan Agr. & Tech. Univ. Udeypur.	June 28, 2012
6	Dr. Sukhwinder Singh, CIMMYT, Mexico	July 18, 2012
7	Dr. M.L. Lodha, Former Head, Div. of Biochemistry, Dr. T.R. Sharma, Principal Scientist, NRCPB, New Delhi	July 19, 2012

ii. **Joining** : Dr. Pramod Prasad, Scientist joined at R.S. DWR, Shimla w.e.f. May10. 2012

iii. **Deputation**: Sh. O.P. Gangwar, Scientist has proceeded on deputation to CIMMYT Mexico for advance course on Wheat (August 1- Sept. 28, 2012).

iv. **Leaving** : Ms Shweta Pathania,JRF in DBT Project left the position on April 7, 2012

v. **Meeting Attended** : Dr. S.C. Bhardwaj, Principal Scientist & In-charge attended 22nd meeting of ICAR Regional Committee No. 1 (June 8-9, 2012) at HPKV, Palampur

Table 10: List of Cooperators for monitoring wheat rusts

Name	Place	Name	Place
Ajay Prakash	Bilaspur	Nitin Chawala	Jaipur
A.K. Joshi	CIMMYT, Nepal	P. Jha	Nepal
A.K. Sharma	Karnal	P.K. Malakar	Bangladesh
Anil Kumar	Indore	P.P.S Pannu	Ludhiana
A.R. Washnikar	Jabalpur	R. Davlesh	Bajoura
A.N. Mishra	Indore	R.P.S Verma	Karnal
Arun Kumar	Dharwad	S.A. Acharya	Vijapur
B.K. Honrao	Pune	S.C. Mishra	Pune
B.K. Sharma	Una	S.C. Bharat	Nepal
CIMMYT	Nepal	S.P. Singh	Faizabad
D.P. Singh	Karnal	S.P. Singh	Varansi
Deep Shikha	Pantnagar	Subodh Kumar	Pantnagar
Deepak Bhandari	Nepal	Suraj Vaidya	Nepal
Dhanbir Singh	Dhaulakuan	S.S. Vaish	Varanasi
Elias Mohamad	Nasik	S.S. Patel	Vijapur
H.C. Lal	Ranchi	S. Sharma	Nepal
Indu Sharma	Karnal	Subhashish Sarkhel	New Delhi
I.K. Kalppanavar	Dharwad	S.S. Karwarasra	Hisar
J.B. Khan	Kanpur	S.K. Jain	Almora
J.Kumar	Pantnagar	S.K. Rana	Malan
J.Kumar	Wellington	S.S. Singh	New Delhi
Kanak Srivastva	Pantnagar	Vijay Rana	Palampur
M. Prashar	Aurangabad	V.K. Rajdan	Jammu
Madhumeeta Jindal	Ludhiana	V. Tiwari	Karnal
M.K. Pandey	Jammu	Y.P. Sharma	Shimla
M.S. Saharan	Karnal		