मैहतान्सिज

MEHTAENSIS

प्रो0 के.सी. मैहता के नाम पर जारी क्षेत्रीय केन्द्र के शोध का छमाही न्युजलैटर : संस्थापक डा. सुब्रमण्यम. नागराजन

(Six-monthly newsletter named after Prof. K.C. Mehta : Founder Dr. S. Nagarajan)

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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 co-operators are requested to send the rust samples for pathotype analyses.

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1. सारांश/Executive summary

ग्रीष्म ऋतु की गेहूँ में तने/काला का एवं पत्ते का रतुआ विलिंगटन (तमिलनाडु) तथा धारीधार/पीला एवं पत्ते/भूरा रतुआ दालांग मैदान में पाया गया। सामान्य फसल में पीले रतुए का हल्का आपतन रोपड़ (पंजाब) तथा यमुनानगर (हरियाणा) में पाया गया। पत्ते का रतुआ प्रायद्वीप क्षेत्र के करर्नाटक में देखा गया। गेहूँ के रतुओं की हर साल आने की स्थिति का अध्ययन करने के लिए ग्रीष्म काल में घास पर रतुओं का आपतन देखा गया। भूरा एवं काला रतुआ पंजाब, हरियाणा एवं हिमाचल प्रदेश में देखा गया लेकिन पीला रतुआ कहीं नहीं पाया गया।

भूरे रतुए का एक नया प्रभेद (77–12) नीलगिरी पहाड़ियों (तमिलनाडु) से विश्लेषित किया गया तथा इस पर अग्रिम अध्ययन चल रहा ह। घास पर भूरे रतुए की प्रभेद 77–5 तथा 104–2 एवं 162ए पाई गई। सामान्यतः भूरे रतुए के 173 नमूनों में से 72 प्रतिशत से अधिक में 77 समूह पाया गया तथा इनमें 77–5 की प्रतिशतता 35 थी। तने के रतुए में प्रभेद 40ए नीलगिरी में बहुतायत में पाया गया।

इस अवधि में 2830 गेहूँ एवं जौ की पंक्तियां रतुआ प्रभेदों के विरूद्व परखी गई। इसक अतिरिक्त डीएनए विविधता, गेहूँ की रतुआ विरोधी अनुवांशिकी एवं रतुआ प्रवन्धन हेतु विभिन्न जीन्स का अच्छी किस्मों में संग्रह हेतु प्रयत्न तेज किए गए। गेहूँ के रतुआ रोगों पर नजर रखने के लिए 70 से अधिक स्थानों पर नर्सरी लगाई गई। विभिन्न रतुओं के 127 प्रभेदों का शुद्व अवस्था में रख–रखाव किया गया एवं देश के अन्य स्थानों में शोध की प्रक्रिया हेतु 47 स्थानों एवं वैज्ञानिकों को जिवाणु संग्रह भेजा गया।

In Summer crop both stem and leaf rusts were observed at Wellington (Nilgiri hills Tamil Nadu) whereas stripe and leaf rusts of wheat were recorded at Dalang Maidan (Himachal Pradesh). In regular crop solitary incidences of stripe rust of wheat were reported from Ropar area of Punjab and Yamunanagar of Haryana. To study the role of grasses in the epidemiology of wheat rusts, surveys of the areas where stripe rust occurred year after year were conducted. Both leaf and stem rusts were observed in these surveys conducted in Punjab, Haryana and Himachal Pradesh. Stripe rust was not observed.

A new pathotype of *Puccinia triticina* (causing leaf rust of wheat) designated as 77-12 was identified from the Nilgiri hills. The pathotype is a backward mutation in pathotype 77-9. On grasses pathotype 77-5 was the most predominant followed by 104-2 and 162A whereas in stem rust, pathotype 40-2 was identified. Likewise in 173 samples of leaf rust 77 group of pathotype was observed in 72% of the samples. Pathotype 77-5 (121R63-1=THTTS) virulent to *Lr*1,2,3,10,13,20, 23 & 26 was most widespread. Proportion of pathotype 77-

9(121R60-1=MHTTS) has increased during the year. In stem rust of wheat (*P. graminis tritici*) pathotype 40A(62G29=PTHSC) which has virulence to *Sr*5,7b,8,9b,9e,11,28 was most frequent in India and Nepal.

More than 2830 lines of wheat and barley were evaluated/being evaluated against different pathotypes. Some basic studies on DNA polymorphism were conducted, efforts to study genetics of rust resistance and development of diverse rust resistant genetic stocks were stepped up. Nucleus/bulk inoculum of different rust pathotype of wheat barley and oat were supplied to 47 centres/scientists and pure culture of 127 pathotypes. To monitor the occurrence/spread of wheat diseases in India, Monitoring nurseries were planted at more than 70 locations.

2. Incidence of rusts in summer/regular wheat crop

Both stem (black) and leaf (brown) rusts of wheat were observed in summer crop in Nilgiri hills (Tamil Nadu) whereas all the rusts of wheat were identified in Leh–Ladhakh (Jammu & Kashmir). In Himachal Pradesh both yellow and brown rusts were recorded in Dalang Maidan (Lahaul & Spiti) whereas, black rust was not observed anywhere in Himachal Pradesh. In regular crop the weather has remained quite dry and there was no report of occurrence of wheat rusts except for some reports of stripe rust of wheat in Ropar area of Punjab and Yamunanagar track of Haryana in the first week of January, 2014.There was no record of wheat rusts from Himachal Pradesh except for a little infection on Wheat disease monitoring nursery at Dhaulakuan. In Peninsular India, mild brown rust was reported in some parts of Karnataka.

Aeciospores on *Berberis* from different areas in Himachal Pradesh, Uttarakhand and Nepal did not infect susceptible wheat at Flowerdale. Wheat rusts being obligate parasites are supposed to be killed due to high summer temperatures, succeeding rains and absence of wheat in plains of India. Even then rusts appear every year first in plains and later on in hills. To investigate, it off-season surveys of grasses/ other hosts supporting rusts were undertaken in areas where wheat rusts occur year after year in Himachal Pradesh, Punjab and Haryana. Stripe (yellow) rust was not observed in these surveys. Leaf rust on few grasses could infect wheat (Fig.1-3) whereas rust on non grass host in one case produced stem rust on wheat (Fig.4).

3. Sample receipt and analyses

Incidence of wheat rusts was comparatively less during summer season. While stem and leaf rusts were more common, stripe rust was hardly found on off season wheat. During this period 62 samples of three rusts of wheat were

Figure 1:Leaf rust on grass-a

Figure 2:Leaf rust on grass-b

Figure 3:Leaf rust on grass-c

Figure 4:Stem rust on grass host

collected. Rusts of barley were not observed in summer crop areas (Table-1).

Table- 1 : Samples of wheat and barley rusts received up to 31.12.2013

S. No.	State	RUSTS			
		Black	Brown	Yellow	
				Wheat	Barley
1	Tamil Nadu	55	50	-	-
2	Himachal Pradesh	5	6	9	-
3	Karanataka	-	1	-	-
4	Nepal	2	2	1	-
	Total	**62**	**59**	**10**	**-**

4. Pathotype distribution of *Puccinia* species

During this period 205 samples of wheat and grass rusts were analyzed for pathotype distribution. It includes some of the carry over samples from the previous crop season. Some of the leaf rust samples from grasses could infect wheat also.

i. Rust on different grass/ non grass hosts in off-season and pathotypes identified

Eight samples of leaf rust on grasses from Himachal , Punjab and Haryana yielded pathotype 77-5 in five ,104-2 in two and 162A in one sample . In case of stem rust pathotype 40-2 was identified on one grass host. Further studies to prove pathogenicity and identify the hosts would be undertaken subsequently as the grasses have dried in winter season. Other samples are being analyzed.

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

Thirty three samples of stem rust of wheat were analyzed from Nilgiri hills (Tamil Nadu) and Nepal. **Virulence on *Sr*31 (Ug99 type of pathotypes) were not identified anywhere in India, Bangladesh, Bhutan and Nepal.** Pathotype 40A (62G29=PTHSC) ,which has virulence to *Sr* 5, *Sr* 7b, Sr 8, *Sr* 9b, *Sr* 9e, *Sr*11, *Sr* 28, was most predominant and was identified in more than 60% samples followed by pathotype 40-3(127R29=PTTSF) which was observed in 25% samples. One sample each of pathotype 40-1 (62G29-1=PTHSH,virulent to*Sr*24), 117-3(167G3=KRHSC), 295 (7G43=RRHSC) were identified from Nilgiri hills. One sample each analyzed from Nepal had pathotype 40A and 21(9G5=CHPSC).

Pathotype 21 is the one which used to occur in the hills of Himachal Pradesh and Uttarakhand long back.

iii. Yellow rust (*Puccinia striiformis*)

Among the ten samples received, one sample analyzed from Nepal was of pathotype 46S119 virulent to *Yr* A, *Yr* 9 . Other samples from Himachal Pradesh are being analyzed.

iv. Brown rust (*Puccinia triticina*)

New Pathotype identified

In 8 samples from Nilgiri hills (Tamil Nadu) a new pathotype designated as 77-12 was identified. The new pathotype is a result of backwards mutation in pathotype 77-9 on *Lr*20. Rust resistance sources against the new pathotype are being identified. As of now based on its avirulence/virulence structure, it does not appear to be of any epidemiological consequence. The new pathotype was restricted only to the Nilgiri hills and was not identified elsewhere.

Pathotype distribution

During July –December, 2013, one hundred seventy three samples of leaf rust were analysed from ten states of India, Bangladesh, Bhutan and Nepal. Twenty three pathotypes were identified in these samples. Pathotype 77-5, virulent to *Lr*1, *Lr*2, *Lr*3, *Lr*10, *Lr*13, *Lr*20, *Lr*23 and *Lr*26, was most frequent in all the areas and was identified in 35% of the sampled population. The proportion of pathotype 77-9 which is like 77-5 but has avirulence *Lr*2a, *Lr*2c , has increased in Nilgiri hills as well in some other areas. In total, pathotypes of 77 group comprised nearly 72% of the population. Contrastingly proportion of pathotypes of 104 group has decreased (Table 2). Virulent phenotype for Lr, Lr19 though reported from India, however, were not observed in present surveys.

Pathotype 77-5 was most common in Bangladesh, Bhutan and Nepal. In Bangladesh, pathotype 77-5 followed by 12-1, 162-1 were very frequent, Seven other pathotypes were observed only in one or two samples. Likewise, in Bhutan in addition to pathotype 77-5 one sample each of 12-1 and 77-6 were identified. From Nepal, analysis of 32 samples revealed pathotype 77-5 most predominant followed by 104-2. Four other pathotypes were identified in one sample each (Table 2).

Fitness potential of pathotypes of *P. triticina*

To study the competitive ability, three sets of pathotypic combinations of *Puccinia triticina* on wheat were inoculated on *Lr*13, *Lr*17, *Lr*24 and Agra Local.

Pathotype 77-5(121R63-1) showed better competitive ability in comparison to other pathotypes 77(45R31), 77-2(109R31-1), 104-2(21R55) and 106(0R8) in most of the cases. Likewise in fitness studies pathotype 77-5 exhibited low incubation period, latent period, high number of uredial pustules and more urediniospore production/ cm^2 than the other pathotypes indicating its high fitness potential. Pathotype 106 (0R8) was found to be the most fit one on Agra Local, a susceptible host. These studies explain the high competitive ability and fitness potential in pathotype 77-5, which explains its predominance for the last 15 years in the natural population of *Puccinia triticina*.

5. Seedling resistance test

During this period 2830 lines of wheat and barley were/ are being evaluated against different pathotypes of three rusts. It includes lines of AVT, NBDSN, Breeders'/Pathologists' material for rust resistance and genetic studies (Table-3).

Table-3 : Details of material for seedling rust resistance up to 31.12.2013

Sr. No.	Details of Lines	No. of Lines	Pathotypes		
			Black rust	Brown rust	Yellow rust
1	AVT I & II	209	Selected	Selected	Selected
2	NBDSN/EBDSN	278	4	Mix	All
3	Other's Material				
a.	BHU Varanashi	47	Selected	Selected	Selected
b.	PAU, Ludhiana	162	-	Selected	Selected
c.	NBPGR, New Delhi	659	Selected	Selected	Selected
d.	DWR, Karnal	360	Selected	Selected	Selected
e.	CSSRI, Karnal	115	-	Selected	Selected
f.	IARI, Indore	1000	-	Selected	-

6. Studies on polymorphism in wheat rusts

Preliminary studies on molecular characterization of wheat rust races were done during this period. SSR and RAPD markers were used to study the variability among stripe and leaf rust races. The results of SSR markers were not so distinct as the markers we tested were not able to clearly differentiate among

Table-2 : Pathotype distribution of *Puccinia triticina* up to 31.12.2013

State/ Country	Sam-ples rece-ived	Pathotype observed																						
		12	12 -1	12 -3	12 -4	12 -9	77	77 -1	77 -2	77 -3	77 -5	77 -6	77 -8	77 -9	77 -11	77 -12	104 A	104 -2	104 -3	104 -4	107	107 -1	162-1	162 A
Tamil Nadu	65	-	-	2	2	-	1	-	1	-	10	8	1	30	1	8	-	-	-	-	1	-	-	-
Karnataka	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-		1	-	-
Madhya Pradesh	4	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-	-
West Bengal	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Uttar Pradesh	12	1	-	-	-	-	-	-	-	-	2	-	-	3	-	-	-	4	-	-	-	-	-	-
Punjab	7	-	-	1	-	-	-	1	-	2	1	-	1	1	-	-	-	1	-	-	-	-	-	-
Haryana & Uttrakhand	6	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-	-	1	1	1	-	-	-	1
Jammu & Kashmir	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Himachal Pradesh	15	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	6	1	-	-	-	-	1
Bangladesh	19	-	3	1	1	-	-	1	-	2	5	-	-	-	-	-	1	1	1	-	-	-	3	-
Bhutan	7	-	1	-	-	-	-	-	-	-	5	1	-	-	-	-		-	-	-	-	-	-	-
Nepal	32	1	-	1	-	-	-	-	-	1	22	-	-	1	-	-	1	5	-	-	-	-	-	-
Total	173	2	4	5	3	2	1	3	1	6	55	10	2	36	2	8	2	20	3	1	1	1	3	2

***12(5R5)=FGTTB,12-1(5R37)=FHPTL,12-3(49R37)=FHTTQ, 12-4(69R13)=FGTTN, 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,77-8(253R31)=TGTTQ,77-9(121R60-1)=MHTTS,77-10(377R60-1)=MHTTS,77-11(125R28)=MGTTS,77-12(121R52-1)=?New,104(17R23)=PGTKL,104A(21R31)=MGTGL,104-2(21R55)=PHTTL,104-3(21R63)=PHTKL,104-4(93R57)=NHKSP,107 (45R3) =JBGHQ, 107-1(45R35)=JCGKG, 162-1(93R47)=KHTTL, 162A(93R15)=KGTTL; Figures in parentheses are the Indian binomial names and those in letters are North American equivalents based on McVey, D.V., Nazim, M., Leonard, K.J. and Long, D.L. (2004). Patterns of diversity in *Puccinia triticina* on wheat in Egypt and the United States in 1998-2000. *Plant Dis.* 88: 271-279.**

stripe and leaf rust races. GC rich primers (RAPD) were able to differentiate between different races of stripe as well as leaf rust. More than 15 GC rich RAPD primers were tested to see the variability among stripe and leaf rust races. Most of these were able to clearly differentiate stripe and leaf rust races but the differentiation within stripe or leaf rust races was not that clear (**Fig5).**

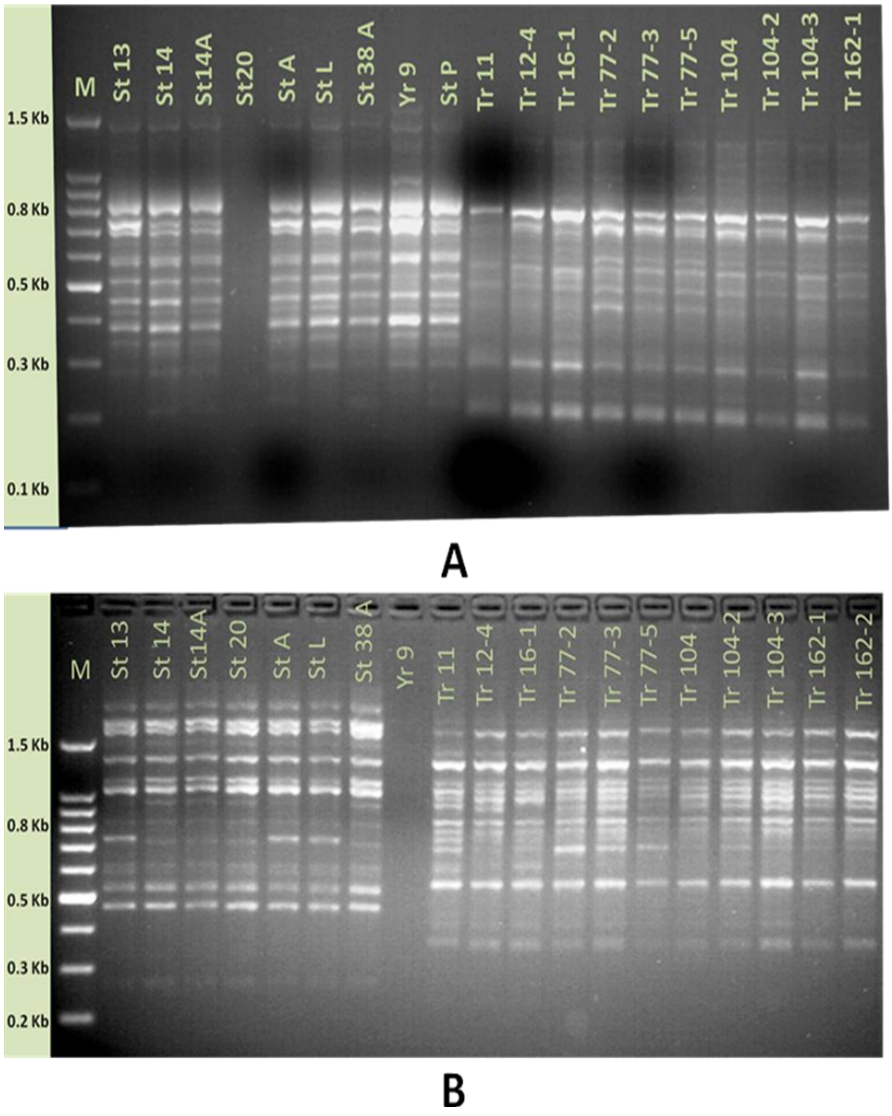

Fig. 5. Variability among stripe and leaf rust races. Polymerase chain reaction (PCR) amplification was performed using the GC rich RAPD primers CRL 22 (A) and CRL 31 (B). PCR products were separated by 1.5 % agarose gel electrophoresis.

7. Genetic analyses and development of rust resistant genetic stocks

Crossing Programme

Fifteen different crosses were attempted during off-season 2013. Ten F_1s were utilized for crossing with maize to generate haploid wheat embryos. Besides maize Blade-grass (*Imperata cylindrica*) pollens will also be used as haploid induction in wheat. Plants of *Imperata cylindrica* have been established in pots and field.

Based on seedling resistance tests against important pathotypes of the three rusts, thirty seven parents were planted for making crosses in the wheat season 2013-14. The parent genotypes selected for genetic analysis of rust resistance and development of rust resistant genetic stock are Access, Grisby, Sahara, Timber, *Ae. culinaris, Ae. uniaristata,* EC 631974, *Ae. multiflorate, Ae. ovata*, HI 8727, HI 8725, HPW399, UAS 347, HUW 668, HD 3076, NW 5054, NIAW 1951, VL 974, VL 3002, HS 576, DPW621-50, PBW 644, PBW 683, HS 507, FLW 21, FLW 22, FLW 14, VL 892, VL 907, HS 295, HD 2189, LOK-1, WHD 946, PDW 314 and MACS 3828.

Thirty one different crosses developed during wheat 2012-13 season (Table 4) were planted in the field after testing the F1 plants at seedling stage against appropriate rust pathotypes.

Table 4: Crossed made during 2012-13

S. No.	Cross	Purpose
1.	AKDW 4749 x LR	Inheritance and genetic analysis
2.	HI 8713 x LR	-Do-
3.	HI8726 x LR	-Do-
4.	MACS5008 x LR	-Do-
5.	DDK 1009 x LR	-Do-
6.	LWH X WHD-946	-Do-
7.	LWH X UAS 320	-Do-
8.	LWH X PDW-314	-Do-
9.	LWH X AKDW4749	-Do-
10.	LWH X HI8713	-Do-
11.	LWH X HI8726	-Do-
12.	LWH X MACS 3828	-Do-

13.	LWH X MACS 5008	-Do-
14.	LWH X DDK 1042	-Do-
15.	LWH X DDK 1009	-Do-
16.	RNB 1001 X LWH	-Do-
17.	FLW 14X LWH	-Do-
18.	FLW14 X VL892	Genetic stock (gene pyramiding)
19.	VL 892 X FLW21	-Do-
20.	VL 892 X FLW22	-Do-
21.	VL 907 X FLW21	-Do-
22.	VL 907 X FLW22	-Do-
23.	Sr 43 X VL892	-Do-
24.	RNB 1001 X FLW21	-Do-
25.	HSB 4 (2398)X VL907	-Do-
26.	F_2 x NI 5439 (BC)	-Do-
27.	FLW-14 X HS 507	-Do-
28.	Sr 43 x VL892	-Do-
29.	Sr 43 X HS 507	-Do-
30.	F2 x Lok-1 (BC)	-Do-
31.	Sr43 X FLW-14	-Do-

Genetic analysis and gene pyramiding

Six segregating populations viz. Local red (LR) x WHD 896 (F_3), LR x MACS 2971(F_3), Local Wheat Hango (LWH) x HD 2922(F_3), Agra Local x Sonalika (F_3), LWH x Lok-1 and LWH x NIAW34 (F_4) were tested against the appropriate rust pathotypes for genetic analysis of resistance and search for novel resistance genes . F_4 population of cross LWH x NIAW34 was planted in June, 2013 for characterizing adult plant rust resistance and to advance the generation for developing recombinant inbred lines (RILs). The RILs will be utilized for identification of QTLs associated with leaf rust resistance. F3 families of Lok-1 x LWH were evaluated to identify no-segregating lines against brown rust pt. 77-8. Homozygous resistant and susceptible lines have been identified and are being analysed for linkage of resistance with SSR markers.

Thirteen segregating populations HI1500/*Sr*43 (F_6), Lok-1/ *Sr*39 (F_4), Lok-1/*Sr*32 (F_4), Lok-45/*Sr*32 (F_4), HI1500/*Sr*32 (F_7), Raj 3765/ Eagle (BC_2F_5), *Yr*24/ Kalyansona (F_3), Lok-1/ Kite (F_4), Lok-1/ Kite (F_4), HI1077/Kite (F_4), Raj 3765/ Kite (F_4), NI5439/ Kite (F_4) and NI5439/ Lok-1 (F_4) were evaluated for rust resistance against the different pathotypes of rusts and plant characters. Selected plants were used for generation advancement to pyramid genes of rust resistance.

Utilization of F_2 and F_3 populations of spring-winter segregating nursery

A total of 370 plants were selected from spring-winter segregating nursery (F_2) and F_3 lines were tested against important pathotypes of leaf and stripe rusts. The resistant lines were planted for further selections generate advance breeding lines for Northern Hills Zone. Forty two populations (F_2) of spring-winter segregating nursery were screened for seedling resistance test against stripe rust pathotypes and promising populations were planted in the field for selection and generation advancement.

8. Repository of pathotypes and supply of nucleus inocula

A collection of 127 pathotypes of different rust pathogens of wheat, barley, oat and linseed was maintained in live culture as well as cryo-preserved. For the smooth conduct of rust research by wheat breeders/pathologists in public and private sector, nucleus/bulk inoculums of different rust were supplied to 46 centres/Scientists during this period (Table-5).

Table-5 : Details of rust inoculum supplied up to 31.12.2013

Sr. No.	Name	Place	Kind of rust/pathotypes supplied
1	A.N. Mishra	Indore	Black and Brown
2	A.P. Agarwal	Bilaspur	Black and Brown
3	A.M. Phade	Niphad	Black and Brown
4	B.K. Honrao	Pune	Black and Brown mix., pathotypes
5	B.K. Das	Mumbai	Mixture of Black and Brown
6	Deepshikha	Pantnagar	Mix. of Brown and Yellow
7	Dhanvir Singh	Dhaulakuan	Mixture of Black and Brown
8	Dharminder Singh	Badusahib	Brown
9	D.A. Godekar	Nasik	Black and Brown
10	D.P. Walia	Tutikandi	Yellow, Brown
11	Gurdev Singh	Ludhiana	Brown and Yellow
12	Hitesh Kumar	Karnal	Mix. of Brown
13	I.K. Kalappanwar	Dharwad	Mix., of Brown, Black and seed
14	J. Kumar	Pantnagar	Yellow and Brown
15	Javad Bahar Khan	Kanpur	Brown,Black and Yellow (Wheat & Barley)
16	J.B. Sharma	New Delhi	Brown, Black and Yellow
17	J.P. Jaswal	Pantnagar	Brown and Yellow
18	K.V. Jivani	Junagarh	Black and Brown
19	Kamini Kaushal	Indore	Brown
20	K.K. Mishra	Powerkheda	Brown & Black
21	K. Panchbhai	Indore	Brown, Black
22	Kuldeep Singh	Ludhiana	Yellow
23	Madhumeeta Jindal	Ludhiana	Yellow, Brown (Wheat & Barley)
24	M.K. Pande	Jammu	Brown & Yellow
25	Navtej Bains	Ludhiana	Yellow & Brown
26	N.B. Sawant	Mahabaleshwar	Black & Brown
27	Neelu Jain	Delhi	Brown
28	M.S. Saharan	Karnal	Yellow and Brown
29	Pradeep Shekhawat	Jaipur	Yellow and Brown (Barley)
30	Praveen Chhuneja	Ludhana	Brown, Seed
31	R.K. Bansal	Jaipur	Black and Brown
32	Rajvir Singh, MAHYCO	Karnal	Yellow, Brown & Black
33	Rashmi Agrawal	New Delhi	Brown, Black and Yellow
34	R.K. Bansal	Durgapura	Brown, Yellow
35	R.K. Jaiman	Vijapur	Black, Brown (2 times)
36	R .Selva Kumar	Karnal	Barley yellow, wheat yellow, Oat
37	S.K. Jain	Almora	Brown and yellow (2 times)
38	S.K. Rana	Malan	Brown and yellow mix (4 times)
39	S.S. Karwasara	Hissar	Brown and yellow mix. (Wheat and Barley) 3 times
40	S.S. Vaish	Varanasi	Brown & Yellow
41	Satinder Kaur	Ludhiana	Brown (2 times)

42	S. Acharya	Gujarat	Black and Brown
43	Vaibhav Singh	New Delhi	Yellow,Brown & Black, Seed.
44	Vinod Kumar	New Delhi	Brown
45	Vishnu Goel	Karnal	Barley brown, Yellow
46	T.R. Sharma	New Delhi	Brown, Black & Yellow (Genome Sequencing work)

9. Wheat disease monitoring nurseries

To monitor the occurrence and spread of wheat diseases in India and neighbouring countries, wheat disease monitoring nurseries including SAARC nursery were organized and planted at more than 70 locations. This year more sets of wheat disease monitoring nurseries were planted in collaboration with the Krishi Vigyan Kendras and State Dept. of Agriculture. So far rusts have not been reported anywhere on these nurseries except for little stripe rust at Dhaulakuan and leaf rust from Arabhavi (Karnataka).

10. Request for collection and mailing of rust samples of wheat and barley

Evolution of new pathotypes in wheat rust pathogens is a natural mechanism of survival and continuing of its generation. It results in resistant varieties of wheat becoming susceptible over a period of time. Rusts of wheat can not be stopped by geographical and political boundaries. Races of wheat rusts that have occurred in East Europe and East Africa have been traced in Australia and Asia subsequently.

Monitoring of wheat crop is undertaken to pick up a virulent pathotype in initial stages (much before it attains epidemic proportions) and remain prepared with resistant varieties for early deployment.

To monitor pathotype distribution of wheat rusts effectively and to detect new pathotypes in the initial stages in different agro-ecological regions of India, wheat rust samples are analyzed for the occurrence of pathotypes. Therefore, help of all the cooperators is solicited for collecting wheat rust samples from different regions, farmers' fields and disease monitoring nurseries representing different cultivars/lines in this endeavor to combat wheat rusts in the region.

Collection of rust samples

A good rust sample needs following treatment:

I. Small bits (2-3″) of rust infected fresh leaves/stems should be **shade dried**/ overnight at room temperature.

II. Shade dried samples should be put in **paper envelops** separately or wrapped in newspaper and sent immediately by post.

III. **Following information may be given on each envelope**

- **Type of rust: brown/black/yellow**
- **Details of host: wheat/barley, variety/line**
- **Place of collection**
- **Date of collection**
- **Name and address of the co-operator**

IV. Since samples from lines/varieties having **little rust or from rust resistant material are important from analysis point of view, therefore, these should be treated on priority.**

Precautions to be taken

I. Samples should be **representative of a locality, variety and not repetitive.**

II. Samples **should not be taken from moist, dried or dead plant parts/plants.**

III. Only **fresh uredial infections** may be sent, as old and dried plant parts may not have viable spores.

IV. Samples should be sent at the earliest possible.

Very Important

I. **Glossy paper/polythene envelopes should not be used for collecting or mailing samples.**

II. **Samples should not be taken from the sites of artificial inoculations; otherwise it should be mentioned accordingly.**

11. News and visitors

a. News

i. **Obituary**: Dr. V.C. Lele, who headed Flowerdale Research Station between 1946-1963 left for his heavenly abode on October 6, 2013. He was a founder member of Indian Phytopathology. He is credited with many important publications on wheat rusts which include identification of new races, Racial distribution, evaluation for rust resistance and identification of grasses related to wheat rusts. We convey our heartfelt condolences to the bereaved family. We pray almighty to grant peace to the departed soul in heaven.

ii. Drs. S.C. Bhardwaj, Hanif Khan and Pramod Prasad participated in BGRI 2013 technical meeting at New Delhi from August 19-22, 2013.

iii. Dr. Pramod Prasad, Scientist visited Kenya to attend "Standardization of stem rust field notes and germplasm evaluation, with

discussions on stripe and leaf rust" at Kenya Agricultural Research Institute (KARI) Research Station, Njoro, Kenya from September 22nd - October 2nd, 2013.

iv. Ph.D. Degree was conferred on Dr. Subodh Kumar by G.B. Pant Univ. of Agr. And Technology in Plant Pathology.His topic for Ph. D. thesis was 'Studies on yellow and brown rust resistance in some Indian wheat cultivar'.

b. Visitors

- Dr. Robert J. Bowden, Kansas, USA was at the station on August 16, 2013. He discussed the ongoing research activities and areas of mutual interest.
- Dr. Cristobel Uay, John Inns Centre UK and Dr. Brande Wulff, TSL, UK who are partners in one international collaborative project on stripe rust of wheat visited the centre on August 17, 2013 and discussed the project activities.
- Post BGRI 2013 Delhi Workshop tour comprising about 45 scientists from 25 countries were at Flowerdale on August 23, 2013. One day programme comprised of four lectures in the forenoon and greenhouse visit/practical in the afternoon. Prominent among the visitors were Ms Jeanie Borlaug (D/o Noble Laureate Dr. Normon Borlaug), Dr. Bob McIntosh (PBI Australia), Dr. Robert Park (PBI Australia), Dr. Dave Hodson, CIMMYT, Ethiopia, Dr. Gordon Cisar, Cornell University, USA and many other dignitaries.
- Dr. Mahmoud El Solh, DG, ICARDA, had an extensive interaction at the station on August 24th, 2013.
- Dr. Harbans Bariana, PBI, Cobbitty, Australia visited this station on 26th August, 2013.
- Dr. Indu Sharma, Project Director, DWR, Karnal discussed about the research activities at the station on October 7, 2013.

Hindi Divas

The station celebrated Hindi divas on 15.9.2013. The day was marked with interactive discussions. Different staff members put forth their views. Messages of President ICAR, Home Minister, Govt. of India were read. Activities and efforts to promote Hindi in day to day activities were discussed. A satisfaction was felt on the achievements made during the preceding year.