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Contents

Editorial Board

Thinopyrum ponticum-derived leaf rust gene *Lr24* continued to be effective against all the occurring leaf rust pathotypes in India

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Introduction

Brown rust caused by *Puccinia triticina* is one of the devastating rust diseases targets wheat worldwide. The upper surface of the leaves occupied with orange-brown uredinia and form uredinio spores (Wegulo and Emmanuel, 2012). The infectious urediospores of *P. triticina* can travel to hundreds of miles by wind hence it can cause endemic outbreak (Bolton *et al*., 2008). The infected plants before the flowering stage results in less grain filling period and so kernel size reduced there by decreases yield by 14- 50% depending upon environmental conditions (Wegulo and Emmanuel, 2012). Tomar *et al*. (2014) reported that there are 49 Pathotypes of leaf rust pathogen in India. Among them, *P.triticina* race 77-1, 77-5, 77-9 and 104-2 are the most virulent path types with more frequency in India(Pramod Prasad et.al 2020).

To date there are 79 leaf rust resistance genes which were reported in wheat (Riaz *et al*., 2016). Almost more than 30 years, *Lr*24 continue to provide resistance to leaf rust in India. ‘Amigo’ wheat had an *Agropyron* (*Thinopyrum ponticum*)-derived segment with stem rust and leaf rust resistance gene, *Sr*24/*Lr*24 respectively (The *et al*., 1991). The leaf rust resistance gene *Lr24/Sr24* was originally detected in a bread wheat line possessing spontaneous translocation involving chromosome 3D in agent in the stock Agent derived from *Agropyron elongatum* (now *Lophopyrum elongatum*) selected from across of this line cv. Triumph is the origin (Gough and Merkle, 1971). The gene present in the genotype Agent is a spontaneous wheat- translocation involving 3 Ag and 3DL chromosomes. In Agent, *Lr24* is tightly linked with stem rust resistance gene *Sr24* and with a gene for red seed colour(McIntosh,1992). The initial impediment to use of *Lr24/Sr24* from Agent was in association with red grain colour but RA McIntosh and M. Partridge (un published 1977) were able to recover white-seeded recombinants. One of the white seeded recombinant lines *Tr 380-4***7/3 Ag#14* and Darf Kite were proved to be a valuable genetic stocks for wheat improvement, were used to develop BC lines of popular Indian cultivars carrying *Lr24/Sr24* at Wellington. The resistance gene *Lr*24 tightly linked to *Sr*24 showed complete resistance to all leaf rust Pathotypes in India. It showed both seedling resistance as well as adult plant resistance (APR) (Tomar et al., 2014).

There were some apprehensions raised on effectiveness of *Lr24* in India, hence the study was initiated to confirm the effectiveness of *Lr*24 gene through introgressed lines with *Lr24* which needs to be validated against the occurring leaf rust path types. About 20 genetic stocks (NIL's/BC lines) in the background of popular Indian wheat cultivars were developed with introgression of *Lr*24 gene in India at ICAR-IARI, RS, Wellington (Tomar *et al*., 2014).

Material and Methods

Plant and Fungal material

Twenty Near Isogenic Lines (NILs)/BC lines introgressed with *Lr*24 gene were developed by backcross breeding using Tr380-14*7/3/Ag#14 and *Darf kite* as donor parents at ICAR- IARI, Regional Station, Wellington, Tamil Nadu. Out of which 16 stocks all carrying *Lr*24 and their corresponding recurrent parents (listed in Table 1& 2) were used for this study

DNA isolation and molecular validation of *Lr*24 gene

The leaf samples were collected from the NILs at 15 days old seedlings and thei DNA was isolated using CTAB method (Murray and Thompson 1980). Two markers, *Sr*24#12 (Mago *et al*., 2005) and SCS73$_{719}$ (Prabhu *et al*., 2004) were used to molecularly validate the NILs for the presence of *Lr*24 gene along with the recurrent parents and donor parent Tr380-14*7/3/Ag#14.

The DNA samples were amplified with gene specific marker *Sr*24#12 and SCAR marker SCS73$_{719}$. The PCR reactions were carried out with 2X Dream Taq PCR master mix (Thermo Fisher Scientific) and 0.4pm forward and reverse primers. For *Sr*24#12, initial denaturation was kept at 94°C for 5mins, and 35 cycles of 94°C for 30s, 55°C for 30s and 72°C for 1min, and the final extension at 72°C for 10min and for SCS73$_{719}$ same condition with annealing temperature of 51°C was carried out. The PCR products were resolved with 1.2% agarose gel and documented with gel documentation system (Syngene, Gene Genius Match GGM/D2/F2-1).

Seedling Resistance Test

The seedling reaction of molecularly validated 16 NIL's (*Lr24*) and their corresponding recurrent parents were done with 6 different leaf rust Pathotypes viz., 12-5, 77-2, 77-5, 77-9, 104-2 and 106 during 2019 and again 16 different sets of NIL's against three predominantly occurring leaf rust pathotypes 77-5, 77-9 and 104-2 and stem rust pathotypes 15-1, 40-1 and 40A during 2020 at ICAR, IIWBR, Flowerdale, Shimla. Lines were inoculated at 14 days after sowing with leaf rust Pathotypes and incubated in humid chambers with diffused light for 48 hours. After 48 hours they were kept at glass house and maintained for symptom development. Symptoms appeared ten days after inoculation and seedling reactions were recorded (Nayar *et al*., 1994).

Adult plant resistance

The near isogenic lines with their recurrent parents were sown in field at ICAR-IARI, Regional Station, Wellington, Tamil Nadu with spreader rows around the field and artificial inoculations were also given. The adult plant reaction in the field conditions was recorded as per modified Cobb's scale(Peterson *et al* 1948) during Kharif 2019 and Rabi 2019-20.

Results

Genotypic validation of *Lr*24

The 16 NIL's and their corresponding recurrent parents DNA were isolated and amplified with *Sr*24#12 and $SCS73_{719}$ markers during 2019. All the introgressed lines were amplified with 500bp positive band for *Sr*24#12 (Fig. 1A and 1B) and 650bp positive band for $SCS73_{719}$ (Fig. 2A and 2B) but there is no amplification in corresponding recurrent parents. Further re-confirmation was done during 2020 and all the introgressed lines were amplified with 500bp positive band for *Sr*24#12 (Fig.3 & 4)

Phenotypic validation at seedling stage(SRT)

The infection type developed by the NIL's and corresponding recurrent parents were recorded and given in Table-1(2019) and Table-2(2020). The recurrent parents developed an infectious urediospores with score ranging from 1 to 3+ against different pathotype, where as NIL's with *Lr*24 showed resistant response. The results revealed and confirmed that the *Lr24* gene had seedling resistant response to all the occurring leaf rust Pathotypes in India. The *Lr24* linked stem rust gene *Sr24* recorded susceptible reaction

Phenotypic validation at adult plant stage

In the field the recurrent parents showed susceptible response with severity ranging from 80-100S score, while lines carrying *Lr*24 showed resistant response. The scores were tabulated in Table 1&2.

Table 1: Phenotypic validation of Seedling(SRT) and Adult plant resistance response of *Lr*24/Sr24 in NILs/back crossed lines, recurrent parent and donors against leaf rust pathotypes during 2019

S. No	Variety	SRT Score (IARI, RS, Wellington mixed races)	SRT Score (IIWBR, Shimla)						Field Score (IARI, RS, Wellington)
			12-5	77-2	77-5	77-9	104-2	106	
1	**HW 2001A**	**;**	**-**	**;**	**2**	**2**	**2**	**;-**	**0**
2	Sonalika	3+	3+	3+	3+	3+	3+	0;	100s
3	**HW 2002**	**0**	**-**	**;-**	**;**	**-**	**;**	**0;**	**0**
4	Kalyansona	3+	-	3+	3+	3+	3+	0;	100s
5	**HW 2003**	**0**	**;**	**;-**	**2-3**	**0;**	**;-**	**0;**	**0**
6	NI 5439	2+	-	-	3+	;-	-	-	80s
7	**HW 2004**	**0**	**0;**	**-**	**-**	**1**	**-**	**-**	**0**
8	C 306	3+	1	3+	2	3+	3+	0;	60s
9	**HW 2006**	**0**	**;**	**1**	**-**	**-**	**;**	**0;**	**0**
10	LOK 1	3+	-	-	-	-	-	-	100s
11	**HW 2007**	**0**	**-**	**2**	**-**	**-**	**-**	**-**	**0**
12	HD 2329	3+	0;	-	0;	3+	0;	0;	80s
13	**HW 2008**	**0**	**-**	**-**	**-**	**-**	**-**	**0;**	**0**
14	HD 2285	3+	-	-	-	-	-	-	80s
15	**HW 2014**	**0**	**;**	**;-**	**;-**	**;**	**;-**	**-**	**0**
16	WL 711	3+	-	-	-	-	3+	0;	100s
17	**HW 2015**	**;**	**0;**	**-**	**;-**	**;-**	**0;**	**0;**	**0**
18	HUW 234	3+	;	3+	3	3+	3+	0;	100s
19	**HW 2016**	**0**	**0;**	**;**	**;-**	**;-**	**;**	**0;**	**0**
20	PBW 226	3	;	-	3+	3+	;	0;	80s
21	**HW 2017**	**0**	**0;**	**;-**	**0;**	**;-**	**;-**	**;-**	**0**
22	HD 2402	3+	;	-	-	-	-	0;	80s
23	**HW 2018**	**0**	**0;**	**;-**	**0;**	**;-**	**;**	**0;**	**0**
24	HI 1077	3	0;	3+	;	3+	-	0;	80s
25	**HW 2019**	**;**	**0;**	**0;**	**;-**	**;-**	**;-**	**0;**	**0**
26	WH 542	3	3	0;	3+	3+	3+	0;	80s
27	**HW 2020**	**0**	**0;**	**;-**	**0;**	**0;**	**0;**	**0;**	**0**
28	HS 240	3+	0;	0;	2	3+	3+	0;	100s
29	**HW 2022**	**0;**	**;-**	**;-**	**0;**	**;**	**2**	**;1**	**0**
30	WH 147	3+	1-2	3+	3+	3+	3-3+	0;	80s
31	Darf Kite (Donor)	0	0;	0;	0;	-	0;	0;	0

Table 2: Phenotypic validation of Seedling(SRT) and Adult plant resistance response of *Lr*24/Sr24 in NILs/back crossed lines, recurrent parent and donors against predominant leaf and stem rust pathotypes during 2020

S.No.	**Wheat Lines**	**Pedigree/details**	**SRT Score (IARI, RS, Wellington) mixed races leaf rust pathotypes***	**SRT Score IIWBR, Flowerdale Shimla Leaf rust pathotypes**			**SRT Score IIWBR, Flowerdale Shimla Stem rust pathotypes**			**Adult plant response under natural epiphytotic conditions at IARI, RS, Wellington**
				77-5	**77-9**	**104-2**	**15-1**	**40-1**	**40A**	
1.	**HW 2002**	**K.sona (*Lr24/Sr24*)**	**0**	**;**	**;**	**0;**	**2-**	**3-**	**2-**	**0**
2.	**HW 2002A**	**K.sona (*Lr24/Sr24*)**	**0**	**;**	**;**	**0;**	**2=**	**3-**	**2-**	**0**
3.	Kalyansona	Recurrent Parent	3+	3+	3+	3+	2-	3+	3+	100S
4.	**HW 2003**	**NI5439(*Lr24/Sr24*)**	**0;**	**;**	**;**	**;**	**;**	**2=**	**;1**	**0**
5.	NI 5439	Recurrent Parent	2+	;	3+	0;	2=	3+	3+	80S
6.	**HW 2004**	**C306(*Lr24/Sr24*)**	**0**	**12**	**;**	**;**	**;**	**3-**	**2-**	**0**
7.	C 306	Recurrent Parent	3+	3+	3+	3+	3+	3+	3+	80S
8.	**HW2007**	**HD 2329(*Lr24/Sr24*)**	**0**	**;1**	**;1**	**;1**	**0;**	**2=**	**2-**	**0**
9.	HD 2329	Recurrent Parent	3+	3+	;1	3+	3+	33+	3+	100S
10.	**HW 2008**	**HD 2285(*Lr24/Sr24*)**	**0;**	**;1**	**;**	**;**	**;**	**2=**	**2-**	**0**
11.	HD 2285	Recurrent Parent	3+	3+	;1	3+	;1	2=	3+	80S
12.	**HW 2010**	**J24(*Lr24/Sr24*)**	**0;**	**;**	**;**	**;**	**;**	**2=**	**2-**	**0**
13.	J24	Recurrent Parent	3+	3+	3+	3+	3+	33+	3+	100S
14.	**HW 2011**	**HD2009(*Lr24/Sr24*)**	**0**	**0;**	**;1**	**0;**	**2-**	**2=**	**12-**	**0**
15.	HD 2009	Recurrent Parent	2+	3+	3+	3+	2-	3-	2-	80S
16.	**HW 2012**	**UP 262(*Lr24/Sr24*)**	**0;**	**;**	**;**	**;**	**0;**	**2=**	**2-**	**0**
17.	UP 262	Recurrent Parent	2+	3+	;1	3+	2-	33+	3	80S
18.	**HW 2015**	**HUW234(*Lr24/Sr24*)**	**;**	**;1**	**;**	**0;**	**2-**	**2-**	**2-**	**0**
19.	HUW 234	Recurrent Parent	3+	3+	3+	3+	2=	2=	3+	100S
20.	**HW 2016**	**PBW226(*Lr24/Sr24*)**	**0**	**;**	**;**	**;**	**0;**	**2=**	**2-**	**0**
21.	PBW 226	Recurrent Parent	3	;1	12	3+	0;	0;	;	80S
22.	**HW 2017**	**HD2402(*Lr24/Sr24*)**	**0;**	**;**	**;**	**;**	**;**	**2=**	**2**	**0**
23.	HD 2402	Recurrent Parent	3+	3+	;1	3+	0;	2=	2	80S
24.	**HW 2018**	**HI1077(*Lr24/Sr24*)**	**0**	**0;**	**;-**	**0;**	**;**	**2=**	**2-**	**0**
25.	HI 1077	Recurrent Parent	3	3+	3+	3+	;	2=	2	80S
26.	**HW 2019**	**WH 542(*Lr24/Sr24*)**	**;**	**;1**	**0;**	**0;**	**0;**	**2=**	**12**	**0**
27.	WH542	Recurrent Parent	3+	3+	;1	3	0;	2=	;	80S
28.	**HW 2020**	**HS240(*Lr24/Sr24*)**	**0**	**;1**	**;1**	**;-**	**2-**	**2=**	**2-**	**0**
29.	HS 240#	Recurrent Parent	3+	0;	;-	0;	2=	0;	2-	80S
30.	**HW 2022**	**WH147(*Lr24/Sr24*)**	**0;**	**;-**	**;-**	**0;**	**;**	**2**	**;1**	**0**
31.	WH 147	Recurrent Parent	3+	3+	3+	3+	0;	3+	2-	100S
32.	**Agent**	***Lr24/Sr24***		**;**	**;**	**;**	**2=**	**3+**	**2-**	**0**
33.	*Tr380-14#*	*Lr24/Sr24*	0;	3+	3+	;1	0;	2-	2	0

*Predominant leaf rust races occurring at Wellington are 77-1, 77-5, 77-9 and less frequent ones are 12-4, 12-8, 20, 77-6, 104-1, 162 & 1R31(***Mehtaensis 40 (2) July 20, IIWBR, Shimla***) # The resistance response to leaf rust pathotypes could be due to wrong seed supply of source seeds

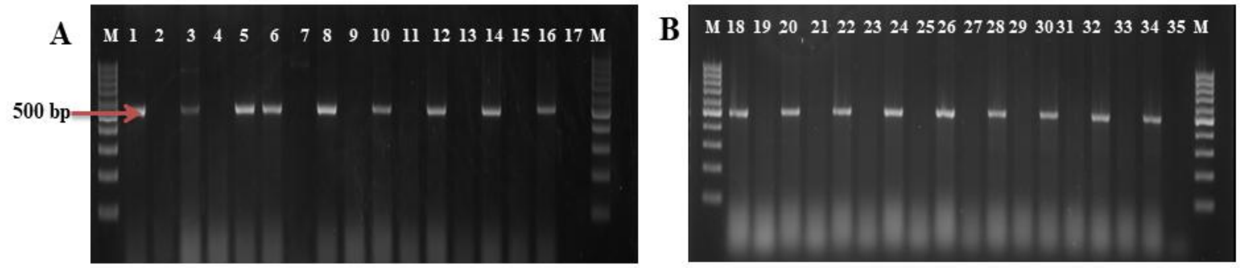

Fig 1: Molecular validation of *Lr*24 gene in NIL's with *Sr*24#12marker(2019)

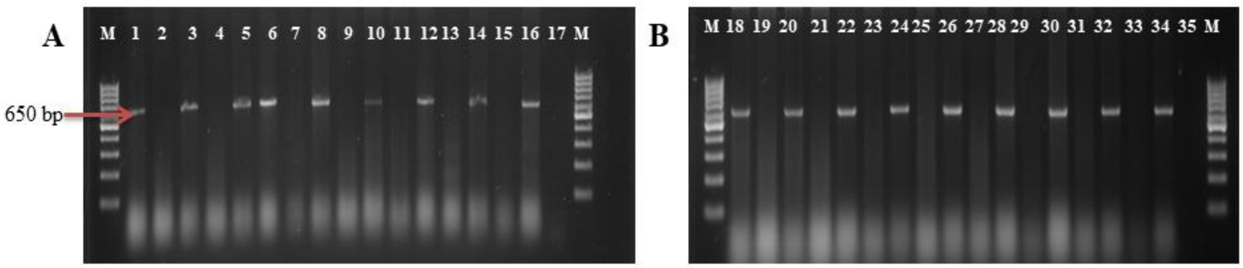

Fig 2: Molecular validation of *Lr*24 gene in 16 NIL's with $SCS73_{719}$marker(2019)

Fig. 1 and Fig. 2: M- 100bp Ladder, 1- Dargkite, 2- Sonalika, 3- HW 2001A, 4- Kalyansona, 5- HW 2002, 6-HW 2002A, 7- NI5439, 8- HW 2003, 9- C306, 10- HW 2004, 11- WH147, 12- HW 2005, 13- LOK1, 14- HW 2006, 15- HD2329, 16- HW 2007, 17- NTC, 18- Darfkite, 19- HD 2285, 20- HW 2008, 21- WL711, 22- HW 2014, 23- HUW234, 24- HW 2015, 25- PBW226, 26- HW 2016, 27- HD2402, 28- HW 2017, 29- HI1077, 30- HW 2018, 31- WH542, 32- HW 2019, 33- HS 240, 34- HW 2020, 35- NTC

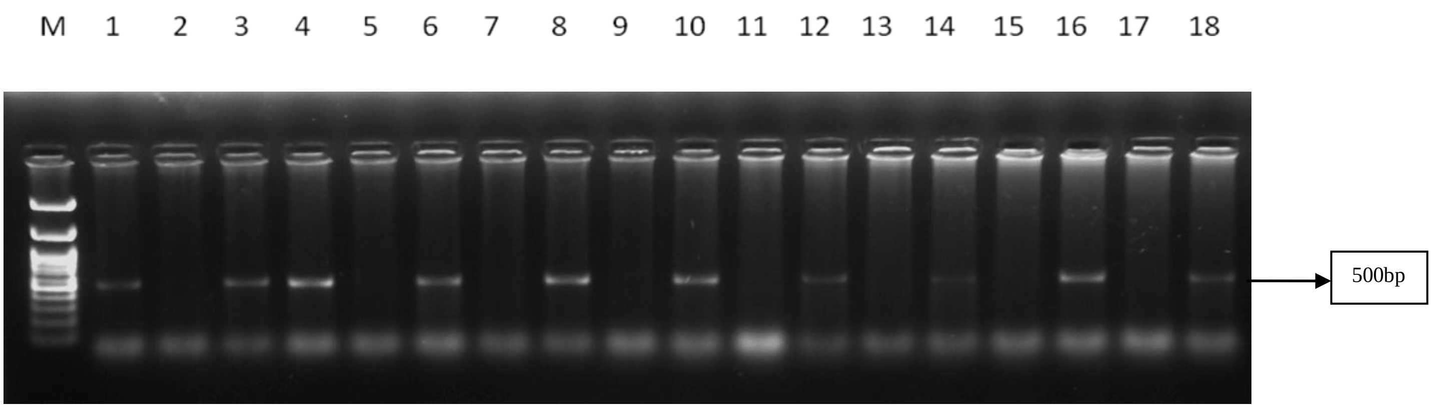

Fig 3: Molecular validation of *Lr*24 gene in NIL's with *Sr*24#12marker re-confirmed during 2020

M-100bp Ladder, 1.Tr380-4 (Donor), 2.Kalyansona , 3.HW 2002 (Kalyansona * *Lr24/Sr24*), 4. HW 2002A (Kalyansona * *Lr24/Sr24*), 5. NI 5439, 6. HW 2003 (NI 5439 * *Lr24/Sr24*), 7. C 306, 8. HW 2004 (C 306 * *Lr24/Sr24*), 9. HD 2329, 10. HW 2007 (HD 2329* *Lr24/Sr24)*, 11. HD 228, 12. HW 2008 (HD 2285 * *Lr24/Sr24*), 13. J24, 14. HW 2010 (J24**Lr24/Sr24*)

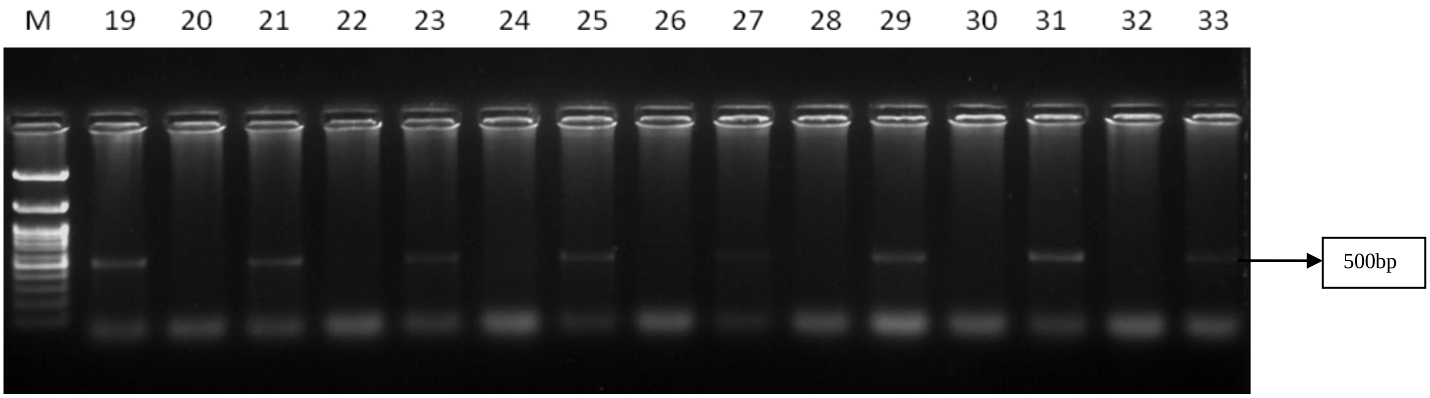

Fig 4: Molecular validation of *Lr*24 gene in NIL's with *Sr*24#12marker re-confirmed during 2020

M- 100bp ladder, 19. Tr380-4, 20. HUW 234, 21. HW 2015(HUW 234* *Lr24/Sr24*), 22. PBW 226, 23. HW 2016 (PBW 226**Lr24/Sr24*), 24. HD 2402, 25. HW 2017 (HD 2402**Lr24/Sr24*), 26. HI 1077, 27. HW 2018 (HI 1077**Lr24/Sr24*), 28.WH 542, 29.HW 2019(WH 542 * *Lr24/Sr24*), 30. HS 240, 31. HW 2020 (HS 240**Lr24/Sr24*), 32. WH 147, 33. HW 2022 (WH 147**Lr24/Sr24*)

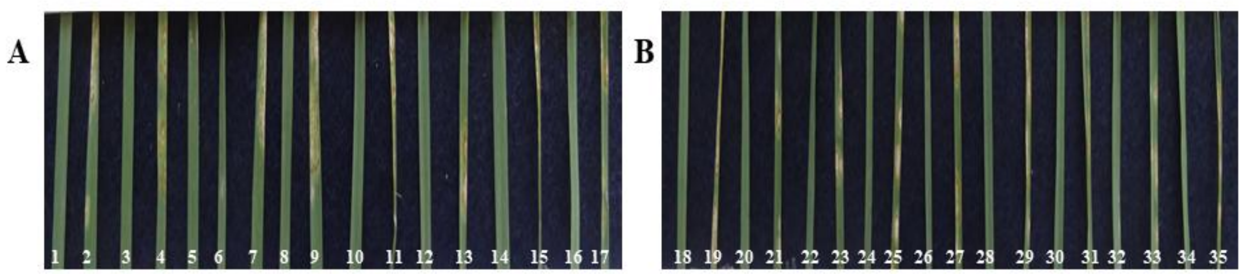

Fig 3: Seedling resistance pattern in NIL's

A: 1- Darfkite, 2- Sonalika, 3- HW 2002, 4- Kalyansona, 5- HW 2002, 6- HW 2002A, 7- NI5439, 8- HW 2003, 9- C306, 10- HW 2004, 11- WH147, 12- HW 2005, 13- LOK1, 14- HW 2006, 15- HD2329, 16- HW 2007, 17- Agralocal; **B:** 18- Drafkite, 19- HD2285, 20- HW 2008, 21- WL711, 22- HW 2014, 23- HUW234, 24- HW 2015, 25- PBW226, 26- HW 2016, 27- HD2402, 28- HW 2017, 29- HI1077, 30- HW 2018, 31- WH542, 32- HW 2019, 33- HS240, 34- HW2020, 35- WH147

Discussion

Among the several leaf rust resistant genes incorporated in wheat cultivars, *Lr*24 is one of the important genes conferring high level of resistance in India. In the recent past, efforts have been made to understand seedling and adult plant resistance provided by *Lr*24 gene through transcriptome analysis (Manjunatha, 2015). In the present study, molecular validation of *Lr*24 gene using two different markers (*Sr*24#12 and $SCS73_{719}$) showed that all the 16 introgressed lines carries *Lr*24 gene. It confirms that the breeding approaches followed to develop near isogenic lines were efficient, systematic and successful. Seedling resistance test carried out at ICAR- IIWBR, RS, Flowerdale, Shimla for the 16 NIL's carrying *Lr24* against 6 different pathotypes (12-5, 77-2, 77-5, 77-9, 104-2 and 106) showed complete resistance reaction and also seedling resistance test done at ICAR- IARI, RS, Wellington using mixed pathotypes collected from field. The adult plant response under field conditions at Wellington showed complete resistance reaction in all 16 NIL's.

Pathotypes virulent on *Lr24* have been reported from North America (Browder, 1973), Canada (Kolmer, 1991), South America (Singh, 1991) and South Africa (Pretorius *et al.*, 1990) However, *Lr24* still continues to be highly effective in seedling as well as in adult stage to Indian pathotypes of *P.recondita* and virulence for Lr24 occur in low frequencies in most geographical areas(Huerta-Espino,1992). Bread wheat cultivars carrying *Lr24/Sr24* are widely grown in Australia, North America and South Africa. In India the cultivars viz., DL784-3 (Vidisha), HW 2004 (Amar), DL788-2 (Vaishali), HW 2045 (Kausambi), HD 2781 (Aditya), HI 1500 (Amrita), MP4010 , Raj4037, HD2851 (Pusa Vishesh), HD 2833 (Tripti), HI 1531, COW(W)-1, HD 2888 (Pusa Wheat), AKAW3722 (Vimal), AKAW4627 and HW 5207(Pusa Navagiri) all carrying *Lr24/Sr24* have been released in recent years in India for commercial cultivation. The deployment of this effective gene complex in Indian released cultivars for the last more than a decade, widely across India played pivotal role in checkmating the brown rust (Tomar.*et.al*, 2014).

However the linked stem rust gene *Sr24* is not effective in India and a virulent pathotype 40-1 was reported (Bhardwaj *et al.*, 1990) although the donor *TR 380-14***7/3Ag#14* exhibited a high degree of adult plant resistance to stem rust indicating the presence of some additional factors for resistance. Field evaluation of same 16 NIL's carrying *Lr*24 showed resistance type of reaction; however their corresponding recurrent parents were sowing susceptibility score ranging from 60S to 100S. **From this study it is confirmed that *Lr*24 gene continued to provide resistance both in seedling as well as adult plant stage against all the occurring the leaf rust Pathotypes in India.**

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Germplasm Maintenance:

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ICAR-IARI, RS, Wellington

At ICAR-IARI, RS, Wellington large number(>5000) of wheat (*dicoccum, durum* and *aestivum*) and wheat related species(wild spp) including primary, secondary, tertiary gene pools, leaf, stem, stripe rusts gene sources, synthetics, non host resistance sources including, barley, oats and constituted rust resistant back crossed wheat lines are continuously maintained. They were screened against all three rusts, powdery mildew, FHB etc., during 2017 both Kharif and rabi seasons. The elite stocks and effective gene sources were used for developing multiple disease resistant wheat varieties and stocks

S.No	Stocks	No.Lines
1	Lr, Sr, Yr, Pm, FHB resistance gene source stocks	**446**
2	Indian Released wheat varieties	**427**
3	*Dicoccum*	**23**
4	*Durum*	**68**
5	*Aestivum* parental stocks	**711**
6	Barley	**233**
7	Rye	**32**
8	Oats	**24**
9	*Triticale*	**57**
10	Synthetics	**123**
11	CIMMYT advance line/gene stocks	**668**
12	Constituted NIL/back crossed rust/pm resistant lines	**820**
13	Wild spp. Primary, secondary and tertiary gene pool including Agropyron	**1650**
	Total	**5282**

Demonstration of ICAR-IARI released Indian mustard varieties in non-traditional areas of Tamilnadu and Karnataka

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During the *rabi* 2016-17, ICAR-IARI Regional Station, Wellington conducted demonstration of three IARI released Indian mustard varieties (Pusa mustard 25, Pusa mustard 28 and Pusa mustard 30) at selected places of Tamilnadu and Karnataka (Table). The seed germination and crop establishment was proper at all the four places but due to consequent drought (which was very severe during 2016-17, for second consecutive years, over the entire peninsula region) the crop suffered heavily leading to complete loss of crop at two places i.e Hosur, Krishnagiri dist., TN and D.Naganahalli village, Tumakuru dist., Karnataka. However, by providing irrigation at critical stages of the crop, the performance of variety Pusa mustard 25 at Kodaikanal was very impressive with a seed yield of 4 kg/20 m^2 plot (2000 kg/ha) underlying the genetic potential of this variety and its suitability for growing in high altitude places like Kodaikanal. At another place, Thambatty village, Nilgiri, TN, variety Pusa mustard 30 expressed well but the yield recorded was low due to lack of thinning and crowding effect.

Table: Performance of IARI released Indian mustard varieties in non-traditional areas of Tamilnadu and Karnataka

Sl. No.	Place	Variety grown	Date of sowing	Seed yield (kg)	Remarks
1	Thambatty village, Nilgiri dist., TN.	PM 30	02-12-2016	6.5/60 m^2	Good crop but thinning was not proper
2	Hosur, Krishnagiri dist., TN.	PM 25 & PM 30	23-11-2016	Not reported	Crop suffered due to severe drought
3	Mannnavanur, Kodaikanal, Dindigul dist., TN.	PM 25	14-12-2016	4/20 m^2	Very good expression
4	D. Naganahalli village, Tumakuru dist., Karnataka.	PM 25, PM 28 & PM 30	05-12-2016	Not reported	Crop suffered due to severe drought

Demonstration of Indian mustard varieties (*Rabi* 2016-17)

Thambatty, Ooty (DOS:02-12-2016)

D. Naganahalli, Tumakuru, Karnataka (DOS:05-12-2016)

Hosur, Krishnagiri (DOS:23-11-2016)

Mannavanur, Kodaikanal (DOS:14-12-2016)

Students Visit

Nearly 268 students of under graduate B.Sc(Ag), B.Sc(Horti), B.Sc(Botany) and post graduate M.Sc(Ag) from Acharya N G Ranga Agricultural University, Naira, AP, Kerala Agricultural University, Vellanikara, Thirussur, conventional University colleges, Kerala, constituent colleges of Tamil Nadu Agricultural University (RVS Padmavathy

College of Horticulture, Sempatti, Dindugul, TN, College of Agriculture, Vazhavachanur, Thiruvannamalai, TN, SRS Institute of Agricultural Technology, Vedansanthur, Dindugul, TN) and students of KV, Wellington had exposure visit to ICAR-IARI, RS, Wellington during Kharif and Rabi 2017. They have been explained about the research activities under taken at this station, role of this station in rust control programme and techniques involved in wheat improvement mainly of germplasm maintenance, crossing/ hybridization techniques, field phenotyping/rust scoring, field selection, seed production, AICWIP trials, lab techniques and SRT, glass house activities and summer nursery activities etc.,.