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Seedling resistant test of wheat genotypes against selective pathotypes of stem and leaf rusts under glass house condition

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ABSTRACT

Forty six AVT wheat genotypes received from the Indian Institute of Wheat and Barly Research, Karnal (Haryana) during *Rabi* 2017-18 were screened for testing their resistance against selective and virulent pathotypes of stem and leaf rusts under glass house condition. These genotypes were tested at seedling stage against thirteen pathotypes of stem rust *viz.* 11, 21-1,34-1, 40A, 42, 42-B, 117, 117A, 117-2, 117-3, 117-6, 122 and 184 and fourteen pathotypes of leaf rust *viz.* 77, 77A1, 77-4, 77-5, 77-9, 104A, 104-1, 104-2, 12A, 12-2, 12-3, 12-5, 162A and 108. Among them, seventeen wheat genotypes *viz,.* HI 1544 (C), GW 495, DBW 110 (C), DDW 47(d), MP 3288 (C), GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), GW 495, HI 1625, PBW 770, GW 492, MPO 1336 (d) and MACS 6695 were found resistant to stem rust disease of wheat. While, thirteen wheat genotypes *viz,.* HI 1544 (C), GW 495, MP 3288 (C), AKAW 4924, GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625, UAS 428 (d) (C), GW 492, GW 1346 (d) and DBW 93 (c) were found to be resistant to leaf rust disease of wheat. Whereas nine genotypes *viz,.* HI 1544 (C), GW 495, MP 3288 (C), GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625 and GW 492 were resistant to both rusts under glasshouse condition. These AVT genotypes resistant to both rust pathotypes are recommended for further breeding programme.

Key words: *Advanced Varietal Trial (AVT), Pathotypes*

Introduction

Wheat (*Triticum aestivum* L.) is one of the world's leading cereal crops for food security worldwide (Travlos, 2012). According to FAO global wheat production in 2017-18 was 762.79 million metric tonnes, thereby making it the third most produced cereal crop after maize (872.79 million metric tonnes) and rice (769.9 million metric tonnes) (Anonymous, 2018). It is a foremost staple food crop of India and plays a vital role for stability of country's economy and people's food requirement.

According to Roelfs *et al.* (1992) the occurrence of rust diseases in cultivated cereals has significantly influenced the development of human civilization. Wheat rusts have historically been one of the major biotic stress production constraints in Asia and globally (Singh *et al.,* 1991). Park *et al.* (2007) reported that, leaf rust caused by *Puccinia triticina* Eriks., is a severe fungal disease in most of the wheat growing areas. Huerta-Espino *et al.* (2011) reported that, leaf rust has potential to cause losses up to 50% and because of its more frequent and widespread occurrence, leaf rust probably results in greater total annual losses worldwide than stem and stripe rusts.

The objective of the current study was to identify

the potential of novel resistance of wheat genotypes against selective pathotypes of stem and leaf rust under glass house conditions. These interventions in identifying good sources of resistance to stem and leaf rust will offer an indispensable relief and this formed the thrust of this study.

Materials and Methods

Fourty six AVT (I and II) wheat genotypes received from the Indian Institute of Wheat and Barly Research, Karnal (Haryana) during *Rabi* 2017-18 were used for current studies at Regional Wheat Rust Research Station, Mahabaleshwar.

Seedling Resistance Test

These genotypes were screened at seedling stage by using seedling resistant test for testing against selective pathotypes of stem and leaf rusts under glass house condition (Ibrahim, *et. al.*2015)

Maintenance of pathotypes

The pathotypes of stem and leaf rust were maintained in pure form on susceptible wheat variety Pusa-4 and Agra Local, respectively under glass house conditions.

The AVT wheat genotypes were tested at seedling stage against selective prevalent and virulent thirteen pathotypes of stem rust *viz.* 11, 21-1,34-1, 40A, 42, 42-B, 117, 117A, 117-2, 117-3, 117-6, 122 and 184 and fourteen pathotypes of leaf rust *viz.* 77, 77A1, 77-4, 77-5, 77-9, 104A, 104-1, 104-2, 12A, 12-2, 12-3, 12-5, 162A and 108.

Results

The data of testing of AVT wheat genotypes revealed that out of fourty six genotypes, seventeen wheat genotypes (Table 1) *viz,.* CZ-TS-106, CZ-TS-107, CZ-RI-301, CZ-RI-302, CZ-RI-304, PZ-TS-102, PZ-TS-103, PZ-TS-104, PZ-TS-105, PZ-TS-106, PZ-TS-107, PZ-TS-108, PZ-TS-114, PZ-TS-116, PZ-TS-117, PZ-RI-304 and PZ-RI-312 were found resistant to stem rust disease of wheat.

While, thirteen wheat genotypes (Table 2) *viz,.* CZ-TS-106, CZ-TS-107, CZ-RI-304, PZ-TS-101, PZ-TS-102, PZ-TS-103, PZ-TS-105, PZ-TS-106, PZ-TS-114, PZ-TS-115, PZ-TS-117, PZ-RI-301 and PZ-RI-311 were found resistant to leaf rust disease of wheat.

Plate. Seedling Resistance Test of AVT wheat genotypes.

Whereas nine genotypes *viz,.* CZ-TS-106, CZ-TS-107, CZ-RI-304, PZ-TS-102, PZ-TS-103, PZ-TS-105, PZ-TS-106, PZ-TS-114 and PZ-TS-117 were resistant to both rusts under glasshouse condition (Table 3).

Discussion

According to Rehman *et al.,* 2013, leaf rust poses a potential threat wheat growing areas of the world and plays a devastating role in reducing crop yield resulting in socio-economic instability. The present study was conducted to study the response of different AVT wheat genotypes against stem and leaf rust pathotypes (Table 1 to 3). Since it was research station trial, there is no any event of research data of the same genotypes. However, some workers had reported their research data on the same line (Singh, *et al.*, 2001; Muhammad *et al.,* 2015)

Conclusion

These AVT genotypes resistant to both rust pathotypes are recommended for further breeding programme.

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Table 1. Reaction of AVT- I wheat genotypes at seedling stage against pathotypes of stem rust during 2017-18

Sr. No.	AVT I Genotypes Central Zone	Reaction against stem rust pathotypes												
		R-11	R-21-1	R-34-1	R-40A	R-42	R-42B	R-117	R-117-A	R-117-2	R-117-3	R-117-6	R-122	R-184
1	HI 1544 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
2	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R
3	DBW 110 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
4	DDW 47(d)	R	R	R	R	R	R	R	R	R	R	R	R	R
5	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
6	GW 1339 (d)	R	R	S	S	S	R	R	R	R	R	R	R	R
7	AKAW 4924	R	R	R	R	R	R	S	R	R	R	R	R	R
8	GW 322 (C)	S	R	S	R	R	R	R	R	R	R	S	R	R
9	HI 8713 (d) (C)	R	S	R	R	R	R	R	S	R	S	R	S	R
10	HI 8737 (d) (C)	R	R	S	R	R	R	R	R	R	R	S	R	R
11	UAS 465 (d)	R	S	R	R	R	R	R	R	R	R	R	R	R
12	MPO 1343 (d)	R	S	R	R	R	R	R	R	S	R	R	R	R
13	MP 1331	R	R	R	R	R	R	S	R	R	R	R	R	R
14	HI 8627 (d) (C)	R	R	S	R	R	R	S	R	S	R	R	R	R
15	UAS 466 (d)	R	R	R	R	R	R	S	R	R	R	S	R	R
16	NIAW 3170	S	R	S	R	R	R	R	R	R	R	R	R	R
	Peninsular Zone													
17	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R
18	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R
19	DBW 235	R	R	R	R	R	R	R	R	R	R	R	R	R
20	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R
21	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
22	DBW 168 (I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
23	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R
24	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R
25	PBW 770	R	R	R	R	R	R	R	R	R	R	R	R	R
26	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R
27	MPO 1336 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R
28	MACS 6695	R	R	R	R	R	R	R	R	R	R	R	R	R
29	AKAW 4924	R	R	R	R	R	S	R	R	R	R	R	R	R
30	MP 1338	R	R	R	R	R	R	S	R	R	R	R	R	S
31	MACS 3949 (d) (C)	R	R	R	R	R	S	R	R	R	R	R	R	R
32	HI 8800(d)	R	R	R	R	R	R	S	R	R	R	R	R	R
33	MACS 6478 (C)	R	R	R	S	R	R	S	R	R	R	R	R	R
34	MACS 6709	R	S	S	R	R	R	S	R	R	R	R	R	R
35	UAS 428 (d) (C)	R	R	R	R	R	R	R	R	S	R	R	R	R
36	GW 1346 (d)	R	R	R	R	R	R	R	S	R	R	R	R	S

Table 1. *Continued ...*

Sr. No.	AVT I Genotypes Central Zone	Reaction against stem rust pathotypes												
		R-11	R-21-1	R-34-1	R-40A	R-42	R-42B	R-117	R-117-A	R-117-2	R-117-3	R-117-6	R-122	R-184
37	HI 1605 (C)	R	S	R	R	R	R	S	R	R	R	S	R	R
38	AKDW 2997-16(d) (C)	S	S	R	S	R	R	R	R	S	R	S	R	R
39	UAS 446 (d) (C)	S	R	R	R	R	R	R	R	R	R	R	R	S
40	HI 8805 (d)	R	R	R	R	S	R	R	R	R	R	R	R	R
41	MACS 4058 (d)	R	S	S	R	R	S	R	S	R	R	R	R	R
42	MACS 6696	R	R	S	R	R	R	S	R	R	R	R	R	S
43	MACS 4059 (d)	R	R	R	R	R	R	R	NG	R	R	R	R	S
44	NIAW 3170	R	R	R	R	R	R	R	NG	R	R	R	R	S
45	DBW 93 (c)	S	R	R	R	R	R	R	R	R	R	R	R	R
46	HI 8802 (d)	R	S	S	R	R	R	R	R	R	R	R	R	R

Reaction R: Resistant; Reaction S: Susceptible; Reaction NG: Not Germinited

Table 2. Reaction of AVT- I wheat genotypes at seedling stage against pathotypes of leaf rust during 2017-18

Sr. No.	AVT I Genotypes	Reaction against stem rust pathotypes												
		R-77	R-77A1	R-77-4	R-77-5	R-77-9	R-104A	R-104-1	R-104-2	R-12A	R-12-2	R-12-3	R-12-5	R-162A	R-108
	Central Zone														
1	HI 1544 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R
3	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
4	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R
5	DBW 110 (C)	S	R	R	R	R	R	S	R	R	S	R	R	S	R
6	DDW 47(d)	R	R	R	R	R	R	S	R	S	R	R	R	R	R
7	GW 1339 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
8	GW 322 (C)	S	R	S	S	S	R	S	S	S	R	R	S	R	S
9	HI 8713 (d) (C)	R	S	R	R	R	R	S	R	R	S	R	R	R	R
10	HI 8737 (d) (C)	R	R	R	R	R	R	R	R	S	S	R	R	R	R
11	UAS 465 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
12	MPO 1343 (d)	R	S	R	R	R	S	S	R	R	S	R	R	R	R
13	MP 1331	R	R	R	R	R	R	S	R	R	R	S	R	S	R
14	HI 8627 (d) (C)	R	R	R	R	R	R	S	R	R	S	R	R	S	R
15	UAS 466 (d)	R	S	R	R	R	R	S	R	R	S	R	R	R	R
16	NIAW 3170	R	R	R	R	R	R	S	R	R	R	R	R	R	R
	Peninsular Zone														
17	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R	R
18	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R	R
19	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R	R
20	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Table 2. *Continued ...*

Sr. No.	AVT I Genotypes	Reaction against stem rust pathotypes													
		R-77	R-77A1	R-77-4	R-77-5	R-77-9	R-104A	R-104-1	R-104-2	R-12A	R-12-2	R-12-3	R-12-5	R-162A	R-108
21	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R	R
22	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R	R
23	UAS 428 (d) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
24	GW 1346 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
25	DBW 93 (c)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
26	DBW 168 (I) (C)	R	R	S	R	R	R	R	R	R	R	S	R	R	R
27	DBW 235	S	S	R	R	R	R	S	R	R	R	R	R	R	S
28	MPO 1336 (d)	R	R	NG	R	R	R	R	R	R	S	R	R	R	R
29	GW 495	R	R	S	R	R	R	R	R	R	R	R	R	R	R
30	PBW 770	R	R	R	R	R	R	R	R	R	S	R	R	R	R
31	MACS 6695	S	R	S	R	R	R	S	R	S	S	S	R	S	R
32	MP 1338	R	R	S	R	R	R	R	R	R	S	R	R	S	R
33	MACS 3949 (d) C)	R	S	R	R	R	R	R	R	R	R	R	R	R	R
34	HI 8800 (d)	R	R	R	R	R	R	S	R	R	S	R	R	R	R
35	MACS 6478 (C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R
36	MACS 6709	S	R	R	R	R	R	S	R	R	R	R	R	R	R
37	HI 1605 (C)	S	R	R	R	R	S	S	R	R	S	R	R	R	S
38	AKDW 2997-16(d) (C)	R	S	R	R	R	S	S	R	R	R	R	R	R	R
39	UAS 446 (d) (C)	R	S	R	R	R	R	S	R	R	R	R	R	R	R
40	HI 8805 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
41	MACS 4058 (d)	R	R	R	R	R	R	S	R	R	R	R	R	R	R
42	MACS 6696	S	S	R	R	R	S	S	R	S	S	S	R	S	S
43	MACS 4059 (d)	R	R	R	R	R	S	S	R	S	S	S	R	S	R
44	NIAW 3170	R	R	R	R	R	R	R	R	R	S	R	R	R	R
45	AKAW 4924	R	R	R	R	R	R	R	R	R	S	R	R	R	R
46	HI 8802 (d)	R	R	R	R	R	R	R	R	S	R	R	R	R	R

Reaction R: Resistant; Reaction S: Susceptible; Reaction NG: Not Germinited

Table 3. Resistant genotypes of wheat against selective pathotypes at seedling stage under glass house condition

Resistant genotypes		
Stem rust AVT : (46)	Leaf rust	Both the rusts
HI 1544 (C), GW 495, DBW 110 (C), DDW 47 (d), MP 3288 (C), GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), GW 495, HI 1625, PBW 770, GW 492, MPO 1336 (d), MACS 6695	HI 1544 (C), GW 495, MP 3288 (C), AKAW 4924, GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625, UAS 428 (d) (C), GW 492, GW 1346 (d), DBW 93 (c)	HI 1544 (C), GW 495, MP 3288 (C), GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625, GW 492

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