Pak. J. Phytopathol., Vol. 26 (01) 2014. 137-141

Official publication of Pakistan Phytopathological Society
Pakistan Journal of Phytopathology
ISSN: 1019-763X (Print), 2305-0284 (Online)
http://www.pakps.com

EVALUATION OF WHEAT TEST LINES / COMMERCIAL VARIETIES AGAINST KARNAL BUNT (*TILLETIA INDICA*) UNDER FIELD CONDITIONS

Arshad Mahmood, Muhammad Idrees, *Muhammad Burhan, Faqeer Muhammad & Muhammad Z. Niaz
Plant Pathology Research Institute, AARI, Faisalabad, Pakistan.

A B S T R A C T

Thirty seven test lines / varieties of wheat received from Regional Agricultural Research Institute, Bahawalpur, National Institute for Biology and Genetic Engineering (NIBGE), and Wheat Research Institute (WRI), AARI, Faisalabad were screened in a vivo trial to identify the best source of resistance for breeding programme against karnal bunt of wheat at Plant Pathology Research Institute, Faisalabad during rabi season 2011-2012 and 2012-2013. A susceptible check AS-2002 was also planted after ten entries. Among the test lines / varieties, only one entry, Parwaz 94, was found to be highly resistant. However, 4 lines obtained from RARI, Bahawalpur region were found to be resistance while 4 lines were moderately susceptible. Out of 25 lines received from WRI (AARI), 5 lines displayed resistant, 8 were moderately susceptible and 2 were categorized as highly susceptible. Two lines obtained from NIBGE, Faisalabad exhibited moderately resistant. The disease ranged from 0 to16.9 percent.

Keywords: Karnal bunt, wheat, screening, resistance, susceptible.

INTRODUCTION

Bread wheat (*Triticum aestivum* L.*)* is the main staple food crop and major source of nutrition for the people of Pakistan. It is an important food crop worldwide (Haung and Roder, 2004). Pakistan produced 24.2 million tons from 8805 thousand hectare (2012-2013). The average yield is 2750 Kg / hectares (Govt. of Pakistan, 2011). Average yield is extremely low as compared to other wheat producing countries of the world such as Ireland, Denmark, United Kingdom, France, Egypt and Saudi Arabia having 7.86, 7.83, 7.78, 6.23, 6.15 & 4.48 mt/hac (Anonymous, 1999). This low yield of wheat due to the attack of many viral, fungal and nematodes agents. Among fungal pathogen, *Tilletia indica* Mitra (syn. *Neovossia indica*) causing karnal bunt of wheat is considered to be most damaging one. Karnal bunt was first detected in 1931 at karnal in Haryana, (Mitra, 1931). Wheat plants are most susceptible when the spikes emerge from the boot, but infection can take place throughout anthesis (Warham, 1984). Karnal bunt is a disease of quarantine importance and cause quality and economic losses (Datta *et al.,* 2000). Karnal bunt reduces the weight of grains, deteriorates its quality and makes it inedible for human consumption (Gopal and Sekhon, 1988). Incidence of karnal bunt of wheat has increased with the passage of time in Punjab and it has induced a quality as well as quantity losses and a threat to wheat production even in the dry and hot region of the Punjab (Khan *et al.,* 2010). It was also reported from Pakistan in Sialkot, Gujranwala and Mardan districts during the cropping years of 1966-71. The easiest and economical method to control a disease in the use of resistant source. So present study was especially designed to screen the resistant wheat material through artificial inoculation. The findings of these studies *Prima facie* will be helpful for breeders to select promising and resistant cultivars for boosting of wheat yield.

MATERIALS AND METHODS

In this research Thirty seven germplasm lines / varieties of wheat obtained from Regional Agricultural Research Institute, Bahawalpur, National Institute for Biology and Genetic Engineering and Wheat Research Institute, Faisalabad were evaluated for the source of resistance and susceptibility against karnal bunt of wheat caused by *Tilletia indica* in the field area of Plant Pathology

* Corresponding Author:
Email: burhan_azri@yahoo.com

Research Section, Faisalabad during 2011-12 and 2012-13. Each test lines / varieties were sown in double row of six meter length with 30 cm row to row distance. A susceptible check AS-2002 was also planted after every 10 test entries. Test entries were boot inoculated by injecting 2-3 ml of sporidial suspension of *T. indica* with a hypodermic syringe. Ten to fifty heads of each test entry were inoculated at boot leaf stage. The data was calculated for each test line / variety by using the following formula;

$$Karnal\ bund\ \%age = \frac{Bunted\ grains}{Total\ no.of\ grains} \times 100$$

The level of resistance and susceptibility of each test entry was determined by using following modified disease rating scale (0-9) of Aujla *et al*., (1989) as presented below:

Disease rating scale	% grain infection	Level of resistance or susceptibility
0	No infection	Highly resistant
1	1% or less grains bunted	Resistant
3	1.1-2% grains bunted	Moderately resistant
5	2.1-5% grains bunted	Moderately susceptible
7	5.1-10% grain bunted	Susceptible
9	More than 10 % of grains bunted	Highly susceptible

Isolation of *Tilletia indica*: About 10-15 infected wheat grains were taken in a test tube containing sterile water and agitated well. Teliospores and water were filtered. The filterate was centrifuged for two mins. Spore suspension was prepared. One ml of spore suspension with the help of micro pipette was distributed to each Petri plates containing water agar medium & incubated at 15-18 centigrade. Teliospores germinated & primary sickle shape sporidia were visible, under microscope. Star shaped colonies of desired fungus was observed.

Preparation of mass culture and Purification of *T. indica*: Primary sporidia was transferred on PDA by cutting the primary sporidial culture & placed on the upper edge of slants of PDA in the flasks & incubated at 18-20 C. After 7 days flasks were filled with the culture of *T. indica.*

RESULTS AND DISCUSSION

Inoculation with *Tilletia indica* produced well developed symptoms on wheat grains. The screening of thirty seven test lines / varieties originating from Regional Agricultural Research Institute, Bahawalpur, National Institute for Biology and Genetic Engineering and Wheat Research Institute, Faisalabad during 2011-12 & 2012-13 (Table-1) showed that only one test line / variety Parwaz-94 was highly resistant. Test lines / varieties were found more or less infected with karnal bunt during 2011-12 and 2013. (Table 1).

Disease incidence varies significantly each year depends on favourable weather conditions during heading. Initial infection occurs when temperature is fairly cool 20-25 C (Bonde *et al.,* 1998) in concurrence with high relative humidity. Out of 10 lines/ varieties belonging to RARI, Bahawalpur, 4 behaved as resistant, while 2 lines 9375 and 6422 were moderately resistant with 1.39 & 1.61 % disease (Table-2). Two test entries from NIBGE, Faisalabad displayed as moderately resistant against disease. In a similar type of study, Mirza (2005) reported that MH-97, Inqelab-91 and Wattan which were growing in the wheat growing areas of Punjab were infected with karnal bunt disease. Out of twenty five test lines/ varieties from WRI, Faisalabad, eight were moderately susceptible, four were susceptible and two 8086 & 10306 with 16.9% and 12.5% disease were highly susceptible (Table 2).

Similarly Ahmad *et al* (2013), inoculated artificially 119 wheat advance line and 11 commercial varieties to check the degree of susceptibility. Two advance lines MN-8 & MN-26 were found to be susceptible with 10.2 & 19.2 coefficient of infection and Kohinoor-83 with 7.73. Many workers have reported the occurrence and screening the wheat against karnal bunt. (Ahmad *et al* 2013 and Aasma *et al* 2012).

CONCLUSION

Karnal bunt of wheat is one of the main quarantine related disease of wheat, which strictly affects the import and export of wheat grain. Thus it is very important to identify the source of resistant against disease which will be greatly helpful for the management of karnal bunt thus improves the ultimate yield of the wheat crop. On the basis of these finding it is recommended that lines / varieties identified as resistant can be exploited in future breeding programme.

Table 1. Response of commercial varieties / lines from various sources after artificial inoculation with *Tillitia indica.*

Name of organizations		2011-12					2012-13				
	Sr.	Test lines / varieties	Bunted grains	Healthy grains	Total grains	disease% age	Disease reactions	Bunted grains	Healthy grains	Total grains	Disease % age	Disease reactions
1. Regional Agril. Research Institute, Bahawalpur	1.	8124	02	860	862	0.23	1R	0	227	227	0	0Hr
	2.	0346	06	854	860	0.69	1R	01	159	160	0.6	IR
	3.	8148	08	786	794	1.48	3Mr	08	311	319	2.5	5Ms
	4.	9375	06	349	355	1.69	3Mr	05	430	435	1.14	3Mr
	5.	6422	13	740	753	1.72	3Mr	02	171	173	1.15	3Mr
	6.	9157	25	670	695	3.59	5Ms	37	739	776	4.76	5Ms
	7.	6309	14	790	840	1.74	3Mr	12	740	752	1.59	3Mr
	8.	Fareed-06	14	278	292	4.74	5Ms	34	786	820	4.14	5Ms
	9.	Miraj	1	286	287	0.3	IR	02	121	123	1.6	3Mr
	10.	Punjnad	13	406	419	3.1	5Ms	12	396	408	2.9	5Ms
2. NIBGE Faisalabad	1.	NNI Gandam	08	420	428	1.8	3Mr	02	325	327	0.6	1R
	2.	NNII Gandam	16	1060	1076	1048	3Mr	08	311	319	2.5	5Ms
3.Wheat Research Institute, Faisalabad	1.	9137	04	810	814	0.49	1R	02	177	179	1.11	3Mr
	2.	8212	04	446	450	0.88	1R	0	350	350	0	OHr
	3.	10317	08	685	693	1015	3Mr	01	212	213	0.46	1R
	4.	10296	05	354	359	1039	3Mr	0	223	223	0	0Hr
	5.	9082	08	478	486	1.64	3Mr	05	220	225	2.2	3Mr
	6.	9031	25	1458	1483	1.68	3Mr	04	604	608	0.65	1R
	7.	8171	35	1105	1140	3.07	5Ms	06	123	129	4.65	5Ms
	8.	9136	13	537	550	2.36	5Ms	03	487	290	1.03	3Mr
	9.	8314	29	575	604	4.8	5Ms	02	191	193	1.3	3Mr
	10.	10306	30	485	515	5.82	7S	106	464	570	18.5	9HS
	11.	AS-2002	32	430	462	6.92	7S	30	720	750	4.0	5Ms
	12.	Pak-81	24	289	313	7.64	7S	24	276	300	8.0	7S
	13.	WL-711	10	283	293	3.41	5Ms	27	362	389	6.9	7S
	14.	Lasani08	10	270	280	3.5	5Ms	03	145	148	2.02	5Ms
	15.	Inqlab 91	7	294	301	2.3	5Ms	10	210	220	4.5	5Ms
	16.	FSD-08	1	237	238	0.4	1R	02	310	312	0.64	1R
	17.	Borlog-95	5	299	294	1.67	3Mr	07	432	439	105	3Mr
	18.	Parwaz94	0	289	289	0	OHr	0	445	445	0	0Hr
	19.	Iqbal 2000	24	287	311	7.7	7S	24	730	759	3.1	5Ms
	20.	Shalimar -88	12	297	309	3.88	5Ms	21	392	413	5.08	5Ms
	21.	Blue silver	7	255	262	2.67	5Ms	32	349	381	8.3	7S
	22.	8064	04	257	261	1.53	3Mr	03	222	225	1.3	3Mr
	23.	8086	62	299	361	17.1	9Hs	40	200	240	16.6	9Hs
	24.	8081	6	256	262	2.29	5Ms	6	250	256	2.34	5Ms
	25.	88132	9	258	267	3.37	5Ms	12	270	282	4.2	5Ms

Table 2. Average response of cultivars / lines of two years (2012 & 2013) against *Tilletia indica.*

Name of organization	Sr.	Varieties / test lines	Bunted grains	Total grains	Disease % age	Disease reaction
1. Regional Agril. Res. Institute, Bahawalpur	1.	8124	02	1089	0.18	R
	2.	0346	07	1020	0.69	R
	3.	8148	08	929	0.86	R
	4.	9375	11	790	1.39	Mr
	5.	6422	15	926	1.61	Mr
	6.	9157	62	1471	4.2	Ms
	7.	8314	31	797	3.88	Ms
	8.	Fareed-06	48	1112	4.3	Ms
	9.	Miraj	3	409	0.73	R
	10.	Punjnad	25	827	3.02	Ms
2.NIBGE, Faisalabad	1	NNI Gandam	10	756	1.32	Mr
	2	NNII Gandam	24	1395	1.72	Mr
3.Wheat Research Institute, Faisalabad	1.	9137	6	993	0.66	R
	2.	8212	4	800	0.50	R
	3.	10317	9	906	.99	R
	4.	10296	5	582	0.85	R
	5.	9082	13	711	1.82	Mr
	6.	9031	29	2091	1.38	Mr
	7.	8171	41	1269	3.2	Ms
	8.	9136	16	840	1.90	Mr
	9.	8314	31	797	3.88	Ms
	10.	10306	136	1085	12.5	HS
	11.	AS-2002	62	1212	5.11	S
	12.	Pak-81	48	613	7.8	S
	13.	WL-711	37	682	5.42	S
	14.	Lasani08	13	418	3.11	Ms
	15.	Inqlab 91	17	521	3.2	Ms
	16.	FSD-08	3	550	0.54	R
	17.	Berlog-95	12	733	1.6	Mr
	18.	Parwaz 94	0	734	0	HR
	19.	Iqbal 2000	48	1065	4.5	Ms
	20.	Shalimar -88	33	722	4.5	Ms
	21.	Blue silver	39	643	6.06	S
	22.	8064	7	482	1.45	Mr
	23.	8086	102	601	16.9	HS
	24.	8081	12	518	2.31	Ms
	25.	88132	21	549	3.82	Ms

Table 3. Frequency of wheat genotypes in various disease reaction group, belonging to different sources.

Sources	**HR**	**R**	**Mr**	**Ms**	**S**	**HS**
1. Regional Agril. Research Institute, B/Pur	-	4	2	4	-	-
2. NIBGE	-	-	2	-	-	-
3. Wheat Research Institute, Faisalabad	1	5	5	8	4	2
Total	1	9	9	12	4	2

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