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RESEARCH ARTICLE

STUDY OF THE VARIABILITY FOR RESISTANCE TO SPOT BOTCH IN SPRING WHEAT

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ABSTRACT

Seeds of 365 divers bred wheat lines were sown in paired row plots of 2m length. The field was heavily fertilized and frequently irrigated to provide a congenial environment for the development of the spot blotch disease. Observations were recorded for disease severity (%) as well as using 0-9 scale. Disease was rated three times i.e. at growth stages 69, 77 and 83 (Zadoks et.al.1974) to calculate AUDPC. Plant height, days to maturity and test weight was also recorded for each genotype. A wide variability for resistance to spot blotch was observed in the wheat lines screened. In one year of testing, 15 lines were found to have resistant. The proportion of moderately resistant, moderately susceptible and susceptible lines were 47%, 43% and 6% respectively. The resistant as well as susceptible lines belonged to early, medium as well as late maturity groups. However the late maturity lines appeared to carry greater resistance than early ones. The useful resistant lines having dwarf stature and early days to maturity were 15. These lines can be exploited in crossing programme to developing spot blotch resistant early maturing lines suited to rice wheat cropping system of NEPZ. Most of the wheat lines showed susceptible reaction. However, differential reaction was also observed in same line. Thus, the differential reaction for spot blotch severely in some of the genotypes supported the idea of independent gene control.

INTRODUCTION

Wheat (*Triticum aestivum* L.em.Thell) is an important staple food crop not only of India but of the entire world and occupies a unique position as it is used for the preparation of a wide range of food stuffs. Wheat is grown under various climatic conditions between 47°S and 57°N latitudes. In India, its cultivation extends between 10°N in the peninsular India to 35°N in the North-Western Himalayan foot hills. The congenial temperature for its cultivation is less than 25°C, which therefore restricts its duration to around 100 days, in warmer areas such as peninsular India. wheat production increase from 5.7 million tonnes (1947) to around 75 million tonnes in the last 50 years is mainly attribute to the evolution of efficient dwarf higher yielding and disease resistant varieties. It is presumed that we need to produce around 110 million tonnes of wheat to feed our population in 2020. Among various strategies targeted to achieve this increase, development of disease resistant wheat varieties is of paramount importance. Foliar blight persent the wheat areas of eastern India was considered to be a complex caused by *Alternoria- triticina* Prasada & Prabhu and *Bipoloaris sorokiniana*. Occasionally, two or more species of *Bipolaris* and *Alternaria* were also reported to be associated with the disease (Prabhu & Prasada, 1966; Joshi *et al*; 1986; Singh & Srivastava, 1997). However recently it has been proved that Biporasis sorokiniana is the actual pathogen for causing leaf blight in NEPZ of India (Chaurasia *et al*., 1999; Joshi & Chand 2002; Joshi *et al*., 2004a,b.) Despite spot blotch of wheat attracting wide scale attention, many questions concerning host-pathogen interaction are still to be answered. One of the important issue to be explored has been the availability of diverse resistant genetic stocks of wheat for our ongoing breeding programmes.

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So research work is needed to explore the variability in spring wheat germplasm. The present investigation on spot botch is initiating with the objectives to find out the variability for resistance to spot botch in spring wheat germplasm line and to find out the distribution of variability for resistance among genotypes of different height and maturity groups.

MATERIAL AND METHOD

The present investigation on wheat was conducted at the Agricultural Research Farm, Banaras Hindu University, Varanasi. This Farm is situated about 52.2' N latitude and 83' E longitude. The experimental materials consisted of 365 diverse and elite bread wheat varieties these lines were obtained from the germplasm collection maintained by the Wheat Improvement Project, Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. Seeds of each of the 365 wheat genotypes were sown in a one rows plot at the Agriculture farm of University. Each plot consisted of two row of 2 m length, row to row and plant to plant distances being 25 cm and 5 cm respectively. Recommended management practices were followed to raise a good crop. The field was heavily fertilized and frequently irrigated to provide a congenial environment for the development of spot blotch. A total of six irrigation were given first being after 21st day of sowing. The fertilizer were applied at the rate of 120N: 80P:60 K. The whole of phosphorus and potash were applied at the time of sowing while nitrogen was applied as split in 50% at sowing and 25% each after Ist and IInd irrigation. The observations were taken on ten randomly selected plant from each plot. The mean values were subjected to statistical analysis.

RESULT

A wide variability was observed for resistance to spot blotch in the wheat lines screened (Table 1) Based on over all leaf score of 0-9 scale 4% lines were found to be resistant. The proportion of moderately resistant lines was 47%. The moderately susceptible lines

and susceptible lines constituted 43% and 6% of the germplasm respectively.

Table 1. Spot blotch response of wheat genotype based on maximum score (0-9 scale) in 2002-03

Spot blotch score and frequency of genotypes				
0-3(R)	4-5(MR)	6-7(MS)	8-9(S)	Total
5	173	156	21	365
(4%)	(47%)	(43%)	(6%)	

The frequency distribution for spot blotch severity and maturity duration of germplasm lines has been presented in table 2. It was observed that the resistant as well as susceptible lines belonged to early, medium as well as late maturity groups. However, the late maturing lines appeared to carry greater resistance than early ones. The observations showed that out of 116 early maturing times 4 were resistant, 51 moderately resistant, 54 moderately susceptible and 7 were high susceptible.

Table 2. Frequency distribution for maturity duration and spot blotch response of wheat genotypes in 2002 - 03 testing

Maturity duration (days)	0-3 (R)	4-5 (MR)	6-7 (MS)	8-9(S)	Total
Early (<120)	4 (3%)	51 (44%)	54(47%)	7(6%)	116
Medium (121-125)	8 (4%)	98 (49%)	81(41%)	12(6%)	199
Late (>125)	3 (6%)	24 (48%)	21(42%)	2(4%)	50
Total	15	173	156	21	365

In the medium - maturity group, out of 199 genotypes, 8 were resistant, 98 moderately resistant and 81 moderately susceptible and 12 susceptible; out of 50 late maturity lines, 3 were resistant, 24 moderately resistant, 21 were moderately susceptible, while 2 were highly susceptible. The resistant and susceptible lines possessed all types of height i.e. tall, single dwarf, double dwarf or triple dwarf. However the proportion of resistant lines was greater in the tall lines than other height categories. Lowest proportion of resistant lines was persent in triple dwarf lines. Out of 5 tall genotypes 20% plants showed resistance, 20% moderate resistance, 40% moderate susceptibility and 20% susceptibility. Among the 13 single dwarf lines, 8% were resistant, 46% were moderate resistant, 38% moderate susceptible and 8% susceptible.

Among double dwarf genotypes, 9% showed resistance, 38% moderate resistance, 47% moderate susceptible and 6% susceptible. In case of triple dwarf genotypes, 3% were resistance, 49% moderate resistance 43% moderate susceptible and 5% susceptible. The proportion of genotypes displaying relationship for disease severity and test weight is given in the Table 4. It was observed that majority of resistant lines had 30-40 g test weight wile the susceptible lines possessed test weight lesser than 30 g. Out of 69 genotypes having <30 g. test weight, 3% were resistant, 56% moderate resistant 33% moderate susceptible and 8% were susceptible. In the test weight range of 30-40g, 6% were resistant, 45% moderate resistant, 43 % moderate susceptible and 6% susceptible. In the lines having high test weight i.e, 40-50g, almost equal proportion of lines displayed moderately resistant (46%) and moderately susceptible (49%) behaviour while, 5% lines were susceptible. It was interesting to note that none high test weight of such line displayed resistance.

Table 5. Frequency distribution of wheat germplasm lines for AUDPC score of spot blotch disease score in 2002-2003 testing

AUDPC	Number of genotypes
0-500	5 (1%)
501-1000	40(11%)
1001-1500	193 (53%)
1501-2000	106 (29%)
2001-2500	21 (6%)
Total	365

The frequency distribution of genotypes for AUDPC is given in the Table 5. It was observed that only 1% genotypes showed AUDPC values in the range of 0-500. Around 11% genotypes showed AUDPC range of 501-1000, 53% of1001-1500 while 29% genotypes had a range of 1501-2000 and around 6% genotypes showed very high AUDPC i.e, between 2001-2500.

DISCUSSION

The evaluation of genotypes showed that there was wide variability for resistance to spot blotch in the Indian germplasm/ lines genotypes investigated. Based on maximum score of testing, 15 genotypes were found to be resistant. These genotypes may be utilized in breeding programmes for enhancing resistance to spot blotch disease, which is now considered (number one pathogen in the NEPZ of India. The presence of substantial variability for spot blotch resistance is an indirect indicator that some success has been achieved towards enhancement of spot blotch resistance as

Table 3. Frequency distribution for plant height and maximum spot blotch score in 2002-03 of testing

Plant height (cm)	Disease Score and frequency of lines				
	0-3 (R)	4-5 (MR)	6-7 (MS)	8-9 (S)	Total
Tall	1	1	2	1	5
(>105 cm)	(20%)	(20%)	(40%)	(20%)	
Single dwarf (95-105 cm)	1	6	5	1	13
	(8%)	(46%)	(38%)	(8%)	
Double dwarf	3	13	16	2	34
(85-95cm)	(9%)	(38%)	(47%)	(6%)	
Triple dwarf	10	153	133	17	313
(<85 cm)	(3%)	(49%)	(43%)	(5%)	
Total	15	173	156	21	365

Table 4. Frequency distribution for test weight and maximum spot blotch score in 2002-03 of testing

Test weight (gm)	Disease score and frequency of Lines				
	0-3(R)	4-5(MR)	6-7(MS)	8-9(S)	Total
<30	2	39	23	5	69
	(3%)	(56%)	(33%)	(8%)	
30-40	13	97	94	12	216
	(6%)	(45%)	(43%)	(6%)	
40-50	0	37	39	4	80
		(46%)	(49%)	(5%)	
Total	15	173	156	21	365

Table 6. Plant height and days to maturity of wheat genotypes resistant to spot blotch

S.No.	Resistant Genotypes	Over all Score (%)	Plant height (cm)	Days to maturity
1	CPAN 2063	30	64	123
2	PATO(R)TEPPSNXNAL	30	72	124
3	VEE(s)	30	75	127
4	CB	30	107	128
5	ACC NO.8226	30	74	123
6	PC-OF-BW-22	30	77	121
7	TRIGO	30	94	127
8	JOB 628	30	99	123
9	HUW468	30	61	120
10	GALVEZ	30	71	119
11	HW 2004	30	92	125
12	BAGULA	30	69	120
13	HUW 528	30	60	119
14	HUW 524	30	82	123
15	CPAN 4061	30	71	122
	MEAN	30	77.9	124

indicated by Ginkel and Rajaram (1998) and Joshi *et al*. (2004a.) The studies conducted in the 70's and 80's depicted relatively lower level of resistance (both in terms of number of genotypes and reaction) by many workers (Das,1972;) Goloschopov, 1980; Paul, 1982; Kulkarni and Naragund, 1986. Spot blotch severity has been reported to increase with growth stages (chaurasia et. al. 1999) and late varieties are reported to display less disease (Duveiller *et al.,* 1998a, Dubin *et al.,*1998). It was also believed that also influences spot blotch severity (Dubin *et al.,* 1998). Due to these observation, it has been suggested that further studies are needed to understand the effect of earliness and plant height on disease development (Duveiller *et al*., 199a). Recently, Joshi *et al.* (2002) reported that plant height and airlines are not related to resistance to spot blotch and it is possible to obtain dwarf and early resistant lines. However lack of adequate information on this aspect has encouraged wheat breeders to select late and taller genotypes for securing more resistance to spot blotch. In the present study, the resistant genotypes possessed variable plant height and days to maturity (Table 6). Most of the resistant lines were derived from lines Seri, Myna, Bau, Kauz and hork's' as well as from *Triticum tauschii* known for good resistance against folior blight (Chaurasia *et al*., 1997 Several lines such as Bhrikuti, Kundan HUW 206, HUW468, PBa343, NL297 etc. have all been released commercially in spot blotch endemic areas and continue to be more resistant than the older cultivars such as Sonalika and UP262.

Summary

The present investigation on wheat was conducted during the rabi seasons of 2002-03 with the objective to study variability for spot blotch resistance caused by *B. sorokiniana* in the wheat germplasm lines and to find out the distribution of resistance across various height and maturity groups. Seeds of 365 divers bred wheat lines were sown in 2002-03 in paired row plots of 2m length. The field was heavily fertilized and frequently irrigated to provide a congenial environment for the development of the spot blotch disease. Observations were recorded for disease severity (%) as well as using 0-9 scale. Disease was rated three times i.e. at growth stages 69, 77 and 83 (Zadoks *et al*., 1974) to calculate AUDPC. Plant height, days to maturity and test weight was also recorded for each genotype. A wide variability for resistance to spot blotch was observed in the wheat lines screened. In one year of testing, 15 lines were found to have resistant. The proportion of moderately resistant, moderately susceptible and susceptible lines were 47%, 43% and 6% respectively. The resistant as well as susceptible lines belonged to early, medium as well as late maturity groups. However the late maturity lines appeared to carry greater resistance than early ones. The useful resistant lines having dwarf stature and early days to maturity were 15. These lines can be exploited in crossing programme to developing spot blotch resistant early maturing lines suited to rice wheat cropping system of NEPZ. Most of the wheat lines showed susceptible reaction. However, differential reaction was also observed in same line. Thus, the differential reaction for spot blotch severely in some of the genotypes supported the idea of independent gene control.

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