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Screening of genotypes against alternaria blight in rapeseed and mustard

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Abstract
The field experiments were conducted at Student's Instruction Form, ANDUA&T, Kumarganj Ayodhya. The climate is hot and humid summer and cold winters, during the *rabi* crop season in the year 2017-18. One hundred genotypes of Rapeseed-mustard were used for the present investigation. The earliest appearance of disease (30 days) was noted in genotypes RAURD-09-32, RM-WR-09-5, PAB-09-07, PRB-2004-3-4, RGN-307, RH-0834, RH-0902, RH-0952, RH-0903, RHH-1101, YSWB- 2012/9 (44 days) PPBJ-2, RAURD-09-78, and (45 days) PPBN-3, PT-2006-4 and lowest disease severity was recorded genotypes PHR-2, (9.5) PAB- 2004-4 (20.5) PPBJ-2 (22.2), PPBN-3 (22.3) PPBN-2 (22.6) PPBJ-5 (23.3), PPBJ-3 (24.3), PPBJ-4 (24.5) PAB-2005-16 (24.5), RRM-789, (43.6), RH-0555A, (43.7). AUDPC showed more susceptible genotypes the lowest PHR-2 (214.5) was recorded and genotypes screened, none of the genotypes were found disease -free or highly resistance, only 1 genotype namely (PHR-2) were found resistance, 8 genotypes namely (PPBN-2, PPBN-3, PPBJ-3, PPBJ-2, PPBJ-5, PPBJ-4, PAB-2005-16, PAB- 2004-4), were rated as moderated resistance, 37 moderated susceptible and 54 as susceptible.

Keywords: Rapeseed–mustard, Alternaria blight, screening, disease reaction

Introduction

India is the paradise for oilseed crops accounting fourth largest oilseed producing country in the world, next to USA, China and Brazil. (Jha *et al.*, 2012) [4]. Among different oilseeds, rapeseed-mustard alone contributes 32.00% of total oilseed production in India (Jha *et al.*, 2012) [4]. Thus playing a pivotal role in agricultural economy of the country. A wide gap exist between the potential yield and the yield realized at the farmer's field due to expose of number of biotic and a biotic stresses among the biotic stress, Alternaria blight is the most important disease causing both yield and quality loss up to 47.00% (Kolte, 1985) [5] with no proven source of transferable resistance in any of the host. Saharan, (1992; and Kolte, 2002) [12, 7] reported that Alternaria blight sometimes causes more severe losses (70.00%) in rapeseed (*Brassica campestris*). Alternaria blight severity on rapeseed-mustard differs among seasons and regions and also between individual crops within a region. This may be due to existence of variability within the isolates of *Alternari*a spp. (Meena *et al*., 2005, Verma *et al*., 2006) [10, 15]. The economical and environmentally safe method of controlling the disease is the use of resistant varieties. Proper information and studies are not done for resistant sources (Shah *et al*., 2005, Prasad *et al*., 2003) [13, 11]. However, there is an absence of stable, desirable and diverse source of resistance to the Alternaria blight of mustard (Chattopadhyay and Bhaggi, 1994) [3].

Material and Methods

Genotypic screening of rapeseed -mustard against Alternaria blight

The field experiments were conducted at Student's Instruction Form, ANDUA&T, Kumarganj Ayodhya. The Climate is hot and humid summer and cold winters, during the *rabi* crop season in the year 2017-18. One hundred genotypes of Rapeseed-mustard were used for the present investigation. Observations were recorded on randomly selected five plants from each genotypes. Numerical rating grade was given on the basis of percentage of area covered by pathogen on the leaves. On the basis of disease intensity genotypes were classified into different groups *viz*., near immune/highly resistant, resistant, moderately resistant, moderately susceptible, susceptible, and highly susceptible.

Table 1: Modified 0-9 scale for rating disease intensity of *Alternaria blight* in Indian mustard (AICRP-RP-2011)

Rating scale	Disease Intensity (%)	Pathogen Reaction
0	0	Near immune/highly resistant (I)
1	<5	Resistant (R)
3	5-10	Moderately Resistant (MR)
5	11-25	Moderately Susceptible (MS)
7	26-50	Susceptible (S)
9	>50	Highly Susceptible (HS)

Area under the disease progress curve (AUDPC) was calculated for disease severity over time from 60 to 90 days after transplanting using the formulae as follows (Shaner and Finney, 1977) [14]

$$\text{Disease severity} = \frac{\text{Sum of all numerical ratings}}{\text{Number of leaves observationxMaximum number of rating scale}} \times 100$$

Area under disease progress curve (AUDPC)

$$\text{AUDPC} = \sum_{n-1}^{n} \left[(y_{i+1} + y_i)/2\right]\left[X_{i+1} - x_i\right]$$

Where

y_i and y_{i+1} = Disease severity in the i th and (i + 1) th observations

x_i and x_{i+1} = Time (weekly) in the i th and (i + 1) th observations

n = Total number of observations

Result and discussion

Appearance of disease

This initial symptoms of the disease could not be between 30 t0 45 days after in different genotypes and earliest appearance of disease (30 days) was noted in genotypes RAURD-09-32, RM-WR-09-5, PAB-09-07, PRB-2004-3-4, RGN-307, RH-0834, RH-0902, RH-0952, RH-0903, RHH-1101, YSWB-2012/9 and (42days) in genotypes PR-2008-12, PRL-2010-10, PT-2008-2, RB-57, RGN-321, RMT-10-10, SKM-815, TKM-102, with other genotypes showing (43 days) PPBJ-5, PR-2008-1, PRO-51-11, TM-117, Varuna, (44 days) PPBJ-2, RAURD-09-78, and (45 days) PPBN-3, PT-2006-4. (Table. 2) similar studies on Bal and Kumar (2014) [2] noted that the first appearance of Alternaria leaf spot symptoms from *A. brassicae* (RLM 619).

Severity of disease

An examination of data in table 2 reveled that lowest disease severity was recorded genotypes PHR-2, (9.5) PAB- 2004-4 (20.5) PPBJ-2 (22.2), PPBN-3 (22.3) PPBN-2 (22.6) PPBJ-5 (23.3), PPBJ-3 (24.3), PPBJ-4 (24.5) PAB-2005-16 (24.5), RRM-789, (43.6), RH-0555A, (43.7) (Table.2) similar result reported that Kolte *et al*., (2001) [6] reported that genotypes PR-8988 and PR-9024 showed high degree of resistance to Alternaria blight and genotypes PR-9301 and PR-9650 showed high degree of susceptibility.

Area under disease progress curve (AUDPC)

On average basis a Area Under Disease Progress Curve (AUDPC) showed more susceptible genotypes (Table. 2) the lowest AUDPC (214.5) was recorded in genotypes in genotypes PHR-2 followed by PPBN-2 (428.25), PPBJ-2 (438.75), PAB- 2004-4 (446.25), PPBN-3 (457.5), PPBJ-5 (459.75), PPBJ-3 (483.75), PPBJ-4 (525.75), PAB-2005-16, (570.75), RH-0834 (635.25) (Table 1) Kumar *et al.*, (2001) [8] also concluded that calculation for AUDPC in mustard crop sown on different dates helps in identifying the disease severity progress of *Alternaria* blight of mustard on leaves and pods.

Host reaction

Out of 100 genotypes screened, none of the genotypes were found disease –free or highly resistance, only 1 genotype namely (PHR-2) were found resistance, 8 genotypes namely (PPBN-2, PPBN-3, PPBJ-3, PPBJ-2, PPBJ-5, PPBJ-4, PAB-2005-16, PAB- 2004-4), were rated as moderated resistance, 37 moderated susceptible and 54 as susceptible. (Table 2). Similar, several researches have also reported other genotypes resistance to this time to time (Kumar and Singh 2012) [9].

Table 2: Screening of rapeseed mustard genotypes against Alternaria blight

S. No.	Name of genotypes	Appearance of disease (DAS)	Disease severity on leaves			AUDPC	Maximum grade (0-9)	Host reaction
			60 DAS	75 DAS	90 DAS			
1.	PAB-09-07	30	17.5	34.7	62.6	1121.25	9	HS
2.	PAB- 2004-4	34	9.8	14.6	20.5	446.25	5	MR
3.	PAB-2005-16	35	12.4	19.6	24.5	570.75	5	MR
4.	PBR-384	37	18.4	36.6	53.6	1089	7	S
5.	PBR-422	32	15.3	37.6	55.4	1094.25	7	S
6.	PHR-2	40	3.5	7.8	9.5	214.5	3	R
7.	PMH-12-1	40	14.5	34.5	53.5	1027.5	9	HS
8.	PMH-12-2	32	16.5	36.6	56.5	1096.5	7	S
9.	PMH-12-3	36	17.5	35.6	54.6	1074.75	7	S
10.	PPBJ-4	35	10.4	17.6	24.5	525.75	5	MR
11.	PPBJ-5	43	6.6	15.7	23.3	459.75	5	MR
12.	PPBJ-2	44	7.1	14.6	22.2	438.75	5	MR
13.	PPBJ-3	32	9.2	15.5	24.3	483.75	5	MR
14.	PPBN-3	45	7.1	15.8	22.3	457.5	5	MR
15.	PPBN-2	36	9.1	12.7	22.6	428.25	5	MR
16.	PPBR-2	34	21.5	38.5	55.4	1154.25	9	HS
17.	PR-2006-14	35	15.5	34.6	47.6	992.25	7	S
18.	PR-2008-1	43	13.4	23.6	48.6	819	7	S
19.	PR-2008-12	42	14.4	26.6	47.6	864	7	S
20.	PRB-2004—3-4	30	17.6	29.0	44.6	901.5	7	S
21.	PRB-2008-5	35	15.5	33.4	44.7	952.5	7	S

22.	PRB-2008-5	36	12.5	36.5	47.9	1000.5	7	S
23.	PRE-2007-6	37	20.3	36.7	54.8	1113.75	9	HS
24.	PRE-2010-15	36	16.4	35.6	46.7	1007.25	7	S
25.	PRE-2010-19	38	12.5	27.5	48.6	870.75	7	S
26.	PRL-2009-3	37	13.5	29.0	47.7	894	7	S
27.	PRL-2010-10	42	16.5	30.4	49.1	948	7	S
28.	PRO-51-11	43	13.4	26.5	47.5	854.25	7	S
29.	PT-2006-4	46	15.3	25.4	52.7	891	9	HS
30.	PT-2008-2	42	16.6	28.6	58.7	993.75	9	HS
31.	PT-2010-10	41	17.5	34.7	62.6	1121.25	9	HS
32.	PT-303	34	15.4	31.5	60.4	1041	9	HS
33.	PTE-2008-02	32	15.3	25.4	52.7	891	9	HS
34.	PYS-2007-10	33	17.5	34.7	62.6	1121.25	9	HS
35.	PYS-2008-5	37	15.3	25.4	52.7	891	9	HS
36.	RAUDT-10-18	35	12.2	24.3	48.4	819	7	S
37.	RAUDT-10-33	36	17.5	34.7	62.6	1121.25	9	HS
38.	RAUDYS-10-07	34	13.5	34.4	65.6	1109.25	9	HS
39.	RAUDYS-10-12	38	15.3	25.4	52.7	891	9	HS
40.	RAURD-09-25	40	12.2	24.4	45.5	798.75	7	S
41.	RAURD-09-78	44	14.5	34.5	53.5	1027.5	9	HS
42.	RAURD-09-212	32	15.3	25.4	52.7	891	9	HS
43.	RAURD-09-32	30	17.5	34.7	62.6	1121.25	9	HS
44.	RAURDL-02-01	35	15.3	25.4	52.7	891	9	HS
45.	RB-57	42	15.6	27.6	51.5	917.25	9	HS
46.	RB-59	34	12.3	23.4	45.6	785.25	7	S
47.	RB-64	35	11.3	24.5	47.4	807.75	7	S
48.	RGN-306	31	13.4	23.6	46.7	804.75	7	S
49.	RGN-307	30	15.3	25.4	52.7	891	9	HS
50.	RGN-308	33	17.5	34.7	62.6	1121.25	9	HS
51.	RGN-315	36	11.2	28.6	49.6	885	7	S
52.	RGN-321	42	14.5	34.5	53.5	1027.5	9	HS
53.	RGN-323	41	12.4	26.6	46.6	841.5	7	S
54.	RH-0749	40	15.3	25.4	52.7	891	9	HS
55.	RH-0555A	36	11.2	25.5	43.7	794.25	7	S
56.	RH-0831	31	15.5	26.6	47.5	871.5	7	S
57.	RH-0834	30	12.3	13.4	45.6	635.25	7	S
58.	RH-0901	32	14.5	25.4	47.6	846.75	7	S
59.	RH-0902	30	15.3	25.4	52.7	891	9	HS
60.	RH-0904	35	15.5	28.5	58.5	982.5	9	HS
61.	RH-0948	32	17.5	34.7	62.6	1121.25	7	S
62.	RH-0952	30	13.5	24.5	47.6	825.75	7	S
63.	RH-0903	30	12.4	25.5	46.6	825	7	S
64.	RHH-1101	30	11.3	22.9	45.6	770.25	7	S
65.	RM-10-1	39	15.3	25.4	52.7	891	9	HS
66.	RM-10-12	38	17.4	28.6	67.5	1065.75	9	HS
67.	RM-9-12	37	12.3	27.5	45.5	846	7	S
68.	RM-9-4	36	17.5	34.7	62.6	1121.25	9	HS
69.	RMT-08-2	41	15.6	26.4	55.8	931.5	9	HS
70.	RMT-10-10	42	14.5	34.5	53.5	1027.5	9	HS
71.	RMT-10-7	35	13.3	26.4	46.5	844.5	7	S
72.	RM-WR-09-4	34	15.3	28.4	47.5	897	7	S
73.	RM-WR-09-5	30	12.4	26.3	46.6	837	7	S
74.	RM-WR-09-6	32	15.3	25.4	52.7	891	9	HS
75.	Rohini	35	16.4	28.4	53.3	948.75	9	HS
76.	RRM-783	36	15.3	25.4	52.7	891	9	HS
77.	RRM-788	32	17.5	34.7	62.6	1121.25	9	HS
78.	RRM-789	32	15.3	26.4	43.6	837.75	7	S
79.	RRM-813	33	14.5	34.5	53.5	1027.5	9	HS
80.	RTM-10-10	40	15.4	27.6	54.4	937.5	9	HS
81.	RTM-1351	41	15.3	25.4	52.7	891	9	HS
82.	RTM-1359	37	13.2	27.4	47.5	866.25	7	S
83.	SKM-1013	36	17.5	34.7	62.6	1121.25	9	HS
84.	SKM-1040	31	17.4	29.7	54.6	985.5	9	HS
85.	SKM-815	42	12.4	27.7	45.8	852	7	S
86.	SKM-B-817	40	15.3	25.4	52.7	891	9	HS
87.	TK-17-14	31	14.5	34.5	53.5	1027.5	9	HS
88.	TKM-102	42	15.4	36.4	66.9	1163.25	9	HS
89.	TL-21	41	15.3	22.4	54.7	861	9	HS
90.	TM-106	32	17.5	34.7	62.6	1121.25	9	HS

91.	TM-117	43	14.9	34.5	54.5	1038	9	HS
92.	Varuna	43	16.4	37.7	54.5	1097.25	9	HS
93.	YSB-9	32	15.3	25.4	52.7	891	9	HS
94.	YSKM-12-1	35	17.3	28.4	55.3	970.5	9	HS
95.	YSKM-12-2	31	17.5	34.7	62.6	1121.25	9	HS
96.	YSWB-2010/8	36	13.3	23.5	57.7	885	9	HS
97.	YSWB- 2011-10-1	34	14.5	35.5	54.5	1050	9	HS
98.	YSWB- 2012/9	30	13.6	38.4	55.4	1093.5	9	HS
99.	YSWB-2004/3-12	31	15.3	25.4	52.7	891	9	HS
100.	YSWB-20229/2-12	32	16.5	35.4	56.6	1079.25	9	HS

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