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Screening of rapeseed and mustard genotypes against Alternaria blight in Assam

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ABSTRACT

Screening of thirty genotypes of rapeseed-mustard against Alternaria blight during 2012-13 and 2013-14 at Instructional cum research farm, AAU, Jorhat, Assam revealed four genotypes as moderately resistant while none was highly resistant. Nine genotypes were susceptible, sixteen moderately susceptible and the control (TS 38) was highly susceptible. Lowest number of spots/leaf was found in Pusa Mustard 25 at 80 DAS while; in Pusa Mustard 28, it was at 60 DAS. Highest number of spots/leaf was in TS 38 at 80 DAS. Lowest and highest number of spots/pod was found in NRCDR 601 and TS 38 at 100 DAS respectively. NRCDR 601 exhibited lowest number of spots/pod and TS 38 the highest at 100 DAS. The smallest and largest spots on leave were found in Pusa Mustard 28 and TS 38 at 80 DAS respectively. Smallest spot in pod was observed in Pusa Mustard 27 and the largest in TS 38 at 100 DAS.

Key words: Alternaria blight, Disease resistance, Genotypes, Rapeseed and mustard, Screening.

Abbreviations: HS: highly susceptible, MS: moderately susceptible, S: susceptible, MR: moderately resistant.

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). Among different oilseeds, rapeseed and mustard alone contributes 32.00 per cent of total oilseed production in India (Jha *et al.*, 2012). In 2012-13, total production of rapeseed and mustard was 78.20 lakh tones with an area of 6.92m ha and yield of 1307kg/ha while in 2013-14, it was targeted to produce 74.90 lakh tones with an yield of 1147kg/ha (Agricultural Statistic Division, (2014), thus playing a pivotal role in agricultural economy of the country.

The production of rapeseed and mustard in our country has been increasing by leaps and bounds in the last few years. But still, 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 abiotic stresses Among the biotic stressors, Alternaria blight (*Alternaria* spp.) is the most important disease causing both yield and quality loss (Sharma *et al*., 2013). This disease has been reported from all the continents of the world causing up to 47.00 per cent yield losses (Kolte, 1985) with no proven source of transferable resistance in any of the host. Saharan, (1992); and Kolte, (2002) reported that Alternaria blight sometimes causes more severe losses (up to 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 *Alternaria* spp. (Meena *et al*., 2005; and Verma *et al*., 2006). 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). However, there is an absence of stable, desirable and diverse source of resistance to the Alternaria blight of mustard (Chattopadhyay and Bhaggi, 1994). In Assam, though rapeseed and mustard is mostly cultivated as a source of edible oil, not much research work has been done regarding pathogenic variation and varietal screening for resistance. The present study is an attempt on genotypic screening of rapeseed and mustard against Alternaria blight under field conditions in Assam.

MATERIALS AND METHODS

The investigation was carried out at the Instructional cum Research farm (ICR) of Assam Agricultural University, Jorhat, Assam situated at 26°47'N latitude, 94°12'E longitude and at an altitude of 86.6m from the mean sea level.

Genotypic screening of rapeseed and mustard against Alternaria blight: Thirty genotypes, collected from Regional Research Station (RARS), Shillongoni and National Seed Project (NSP), AAU, Jorhat were sown in single line of three meter length. Prior to sowing, the seeds were tested by blotter method that showed 95.00 per cent germination. Fifteen days prior to sowing of test entries, a susceptible variety TS-38 was sown in between five test entries in all the experimental blocks. Repeated inoculations of spore

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suspension (1x105 conidia/ml) at 35, 50 and 65 DAS (days after sowing) on the rapeseed and mustard were applied along with the application of higher dose (80kg/ha) of nitrogen. Observations for initial appearance of disease symptoms and the disease index at 30 to 90 days (depending on variety) after sowing were recorded, using modified 0 to 5 scales given by Wheeler, (1969) as described here. First appearance of the disease spot was also recorded in each of the thirty genotypes as described by All India Coordinated Research Project on Rapeseed and Mustard, Pathology, Planning and Review Session (2001-02) (Anonymous 2002).

The percent disease index (PDI) was calculated using the formula (Wheeler, 1969)

$$PDI = \frac{\text{Sum of individual rating}}{\text{Number of leaves examined x Maximum disease grade}} \times 100$$

Alternaria blight development on rapeseed and mustard genotypes: The numbers of spots were counted per leaf and pod area at randomly tagged plants with the help of glass slide. Observations were taken randomly at four places/leaf lamina on upper surface of the leaf, starting from lowermost leaf to the uppermost fully developed leaves. Spots were also counted on pods one week prior to maturity (Table 1). Diameter of randomly selected spots was measured in mm including yellow halo chlorotic area with necrotic brown area in the center. Spots were measured in the same leaf and in the same sequence starting from lower to upper leaf in each observation. Average size of leaf spot on different leaf positions on five selected plants in each genotype was calculated. Five largest spots of the infected pods were measured and average was taken on the basis of 50 spots/ genotype (Kumar and Singh, 2006).

RESULTS AND DISCUSSION

Among 30 genotypes, none was highly resistant against Alternaria blight (Table 2). Initial appearance of the disease started from 30 days and continued to spread till 60 days after sowing. Four genotypes *viz*., Pusa Mustard-27, Pusa Mustard-25, Pusa Mustard-28 and Sej-2 with disease index of 23.56, 25.00, 25.00 and 24.55 per cent on leaves and 11.55, 13.34, 15.56 and 20.88 per cent on pods respectively, were rated as moderately resistant (MR).

Sixteen genotypes were recorded as moderately susceptible (MS) in which disease index was found to be 66.95, 49.90, 45.56, 46.67, 42.45, 46.67, 45.66,56.66, 47.78, 48.78, 50.00, 45.55, 46.66, 47.87, 50.00 and 49.78 per cent on leaves and 40.02, 28.67, 26.05, 27.85, 26.00, 27.05, 30.87, 32.65, 35.76, 36.76, 34.47, 35.45, 37.22, 40.45 and 39.77 per cent in pods respectively. These lines were Binoy, Pusa Mustard 22, Pusa Mustard 26, Pusa Bahar, Pusa Bijoy, Pusa Jagannath, Pusa Bold, Pusa Mustard 24, Pusa Tarak, JT-90-1, NRCDR 601, NDRE 7, RGN 145, NDRE 4, NRCDR 02 and VSH 401.

The susceptible (S) group comprised of nine genotypes namely, TS 62, TS 67, TS 65, TS 50, NH1-100, PRE 2007-6, NRCHB101, Anuradha (Toria) and Maya with 74.96, 74.67, 74.78, 70.76, 75.00, 70.87,70.88, 70.55 and 70.78 per cent infection on leaves and 51.55 51.06, 52.05, 41.90, 55.55, 56.78, 56.88, 59.48 and 60.65per cent on pods, respectively. Control (TS 38) was found highly susceptible (HS) towards blight disease exhibiting the highest disease index of 80.56 per cent on leaves and 76.66 per cent on pods.

In a field experiment as reported by Yadav *et al*. (2014), none of the 31 varieties/lines screened against blight of the rapeseed-mustard was found immune or HR. The variety NPN- 1 was found to be resistant with only 9.2 per cent incidence of disease. Five genotypes *viz*. NPC-15, PBC-2004-1, PRQ-2004-1, NDR-03-06 and PR-2003-30 were found to be MR. Ten lines were found to be MS exhibiting 26.00 to 50.00 per cent disease incidence. Nine lines were categorized as S (51.00 to 75.00 per cent disease incidence) and HS group comprised of 6 lines. Among all, line NPJ-102 exhibited the highest disease incidence (79.2%).

Summuna *et al.* (2012), assessed that out of 27 genotypes, two genotypes showed MR against the disease (>10-20%) while four genotypes *viz*. showed MS (>20-30%) and eighteen genotypes were found to be S recording disease severity ranging from 30.00-50.00 per cent. Three genotypes showed HS and the disease severity was found to be more than 50.00 per cent. Rahman *et al.* (2010), found varying degree of disease severity while evaluating 26 varieties/lines of rapeseed-mustard during their extensive research on blight at RARS, Jamalpur. On the basis of disease severity index, none was found highly resistant or resistant while six among

Table 1: Disease severity of Alternaria blight (Modified 0-5 scale)

Grade/ Rating	Description on Disease severity scale	Disease/ PathogenReaction
0	No symptoms on the leaf	Highly resistant
1	Small circular, scattered, brown spots covering 1 to 10 percent of leaf area and infection on lower most leaves of the plant.	Resistant
2	Spots enlarging, dark brown in color covering 11 to 25 per cent of leaf area	Moderately resistant
3	Spots enlarging, dark brown in color covering 26 to 50 per cent of leaf area	Moderately Susceptible
4	Spots dark brown, coalescing, covering 51 to 75 per cent of the leaf area.	Susceptible
5	Spots uniformly dark brown, coalescing. Severe infection on all leaves infested to a greater degree covering 76 to 100 percent.	Highly susceptible

Table 2: Genotypic reaction of rapeseed and mustard against Alternaria blight under field conditions

Genotypes	First appearance of disease (Days after sowing)	Per cent disease severity		Disease Reaction
		Leaves	Pods	
TS 38	30	80.56	76.66	HS
TS 62	40	74.96	51.55	S
TS 67	42	74.67	51.06	S
TS 65	45	74.78	52.05	S
TS 50	45	70.76	41.90	S
Binoy	56	66.95	40.02	MS
Pusa Mustard 22	54	49.90	28.67	MS
Pusa mustard 26	60	45.56	26.05	MS
Pusa Bahar	60	46.67	27.85	MS
Pusa Bijoy	56	42.45	26.00	MS
Pusa Jagannath	54	46.67	27.05	MS
Pusa Mustard-27	52	23.56	11.55	MR
Pusa Mustard-25	56	25.00	13.34	MR
Pusa Mustard-28	54	25.00	15.56	MR
Pusa Bold	55	45.66	30.87	MS
Pusa Mustard -24	57	47.78	32.65	MS
Pusa Tarak	54	48.78	35.76	MS
JT-90-1	48	50.00	36.76	MS
NH1-100	47	75.00	55.55	S
PRE 2007-6	50	70.87	56.78	S
NRCHB-101	50	70.88	56.88	S
NRCDR-601	56	46.56	34.44	MS
Anuradha (Toria)	50	70.55	59.48	S
NDRE-7	48	45.55	34.47	MS
RGN-145	56	46.66	35.45	MS
NDRE-4	45	47.87	37.22	MS
NRCDR-02	46	50.00	40.45	MS
VSH-401	47	49.78	39.77	MS
SEJ-2	52	24.55	20.88	MR
Maya	50	70.78	60.65	S

them appeared to be MR against the blight. Das (2016) found none of the 134 varieties/lines of rapeseed-mustard to be highly resistant or immune to Alternaria blight under field situations, only five of them were moderately resistant. The present findings are in line with most of the studies conducted in India; so far resistant sources of rapeseed–mustard are concerned.

Alternaria blight development on rapeseed and mustard genotypes: Significant differences in the development process of Alternaria blight disease among thirty genotypes with the time interval were observed for the two components of the disease resistance *i.e.*, number of spots and size of spots on both leave and pods (Table 3).

Lowest number of spots on leaves was found in Pusa Mustard 25 (13.40) at 80 DAS and 13.24 at 60 DAS while in Pusa Mustard 28, number of spots/leaf was 14.41 at 80 DAS and 12.11 at 60 DAS. Highest number of spots/ leaf was 54.56 at 80 DAS and 35.93 at 60 DAS which was found in TS 38 which is a highly susceptible variety. In case of number of spots/pod, lowest number of spots (11.00) was observed in NRCDR 601 at 100 DAS. However, TS 38 got the highest number of spots/pod (39.35) at 100 DAS.

Regarding the size of spots (mm) on leaves, the lowest size of spot was found in genotype NRCDR 601 with 12.28 mm at 60 DAS and in Pusa Mustard 28, it was 14.81mm at 80 DAS. Largest size of spots was observed in TS 38 with 50.05mm at 60 DAS and 52.30mm at 80 DAS. In case of pods, lowest size was 12.65mm at 100 DAS in Pusa Mustard 27 while TS 38 got the largest size of spots *i.e.*, 41.07mm at 100 DAS(Table 3).

Among 30 genotypes of Indian mustard when screened against Alternaria blight, Kumar and Singh (2006) observed PR 9031(12.50mm) and PR 8988 (27.30 mm) having the highest blighted area on leaves and pods respectively. Genotype PR 9024 exhibited slow blighting in terms of area and number of spots. PR 9031 exhibited highest number of spots/cm square (9.60) on leaves and on pods (67.00). Development of disease found to be greater in later DAS (62 to 72 DAS on leaves and 100 to 110 DAS on pods).

The reduced size of spot indicated the resistance reaction, while the increased spot size indicated susceptibility. The size of spot could be used as a parameter

Table 3: Alternaria blight development on rapeseed and mustard genotypes

Genotypes	No. of spots/ leaf		No of spots/ pods	Size of spots(mm)		
				Leaves		Pods
	60 DAS	80 DAS	100 DAS	60 DAS	80 DAS	100 DAS
TS 38	35.93	54.56	39.35	50.05	52.30	44.06
TS 62	23.50	25.45	39.20	45.07	41.43	39.07
TS 67	21.61	23.49	38.41	41.66	38.21	36.08
TS 65	21.69	24.24	38.50	44.12	39.08	36.41
TS 50	20.20	22.21	36.49	37.88	26.27	33.41
Binoy	17.00	20.30	24.97	28.27	25.32	25.66
Pusa Mustard 22	15.21	19.43	26.64	27.29	26.73	27.28
Pusa mustard 26	15.35	20.44	24.57	28.16	24.41	25.21
Pusa Bahar	12.50	15.26	14.60	17.21	14.93	14.43
Puja Bijoy	16.47	20.33	25.23	28.17	26.67	25.99
Pusa Jagannath	17.19	21.39	26.99	29.32	27.67	27.29
Pusa Mustard-27	12.27	13.51	11.82	13.45	15.32	12.65
Pusa Mustard-25	13.24	13.40	16.05	16.91	15.92	16.67
Pusa Mustard-28	12.11	14.41	15.14	16.11	14.81	15.41
Pusa Bold	15.24	23.33	25.08	25.41	24.17	24.24
Pusa Mustard -24	14.16	22.33	25.08	25.16	24.66	25.24
Pusa Tarak	14.75	23.33	25.08	25.91	23.81	24.10
JT-90-1	15.17	24.27	23.15	24.77	24.27	24.57
NH1-100	23.27	27.38	32.06	30.17	37.82	31.93
PRE 2007-6	24.27	28.32	27.78	32.27	40.22	34.32
NRCHB-101	24.40	29.49	28.74	33.12	40.61	35.32
NRCDR-601	12.33	18.35	11.00	12.28	18.96	14.11
Anuradha (Toria)	32.30	50.22	38.55	43.91	48.77	41.32
NDRE-7	14.33	21.22	24.75	25.91	23.93	24.33
RGN-145	15.05	24.38	24.89	27.43	23.02	23.98
NDRE-4	17.30	25.40	26.23	29.51	25.32	26.11
NRCDR-02	17.49	25.30	25.84	28.17	25.41	25.96
VSH-401	15.65	25.38	25.33	25.99	24.30	24.60
SEJ-2	12.19	14.24	15.35	15.82	14.85	15.21
Maya	33.28	51.26	40.29	42.59	49.51	42.12
CD (5%)	**4.417**	**5.107**	**5.298**	**5.534**	**5.496**	**5.356**

of resistance (Singh and Singh, 2004). Number of spots/unit area was also an important parameter of disease development because greater number of spot covered more diseased area (Kushwaha and Narain, 2005).

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