Evaluation of Doubled Haploid Lines of Ethiopian Mustard (Brassica carinata A. Braun) for Alternaria Blight Resistance under North Western Himalayas

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Abstract

Thirty three doubled haploids of Ethiopian mustard (Brassica carinata A. Braun) were evaluated along with mustard against Alternaria brassicae under natural epiphytotic field condition at hot spot location to identify disease resistant genotypes. Only one genotype viz., Pusa Jaikisan appeared to be moderately resistant while all remaining 32 genotypes exhibited susceptible to moderately susceptible reaction on leaves. Based upon disease reaction on pods, two genotypes viz., P-26 and P-34 appeared to be resistant while 28 genotypes exhibited moderately resistant reaction. Only 3 genotypes viz., P-89, P-62 and Pusa Jaikisan were found to be moderately susceptible to Alternaria blight.

Keywords- *Ethiopian mustard, doubled haploids, Alternaria blight, resistance*

I. INTRODUCTION

Oilseed crops are the backbone of Indian agricultural economy and occupy an important position in daily diet, being a rich source of fats and vitamins. India is the second largest rapeseed-mustard growing country and accounts for 21.7% area in the world after China. Among oilseeds, rapeseed-mustard is the second most important oilseed crop of the country after groundnut and plays a significant role in Indian oil economy by contributing about 27.8% to the total oilseed production [1].

Rapeseed-mustard in general, has shown a declining trend both in acreage and production largely due to lack of suitable cultivars for different ecosystems, fluctuations in weather conditions, cultivation in marginal and sub marginal lands and prevalence of various abiotic and biotic stresses.

Among the biotic stresses, *Alternaria* blight disease of rapeseed-mustard caused by *Alternaria brassicae* (Berk.) Sacc. has been reported from all the continents of the world causing yield losses up to 47% [2], 32.5% [3] and 10-71% [4]. It is estimated that on an average harvest seed yield losses due to blight ranged from 5 to 15 % and even reach up to 47 % [5]. Yield losses from 17-48 % due to blight have been reported in India [6]. *Alternaria* is a very destructive pathogen causing a widespread destruction in vegetables and other economically important crops [7]. Hence, the most suitable alternate way to increase productivity is by adoption of high yielding, input responsive genotypes having resistance against various biotic and abiotic stresses. Therefore, the present investigation was carried out to identify disease resistant genotypes in Ethiopian mustard.

II. MATERIAL AND METHODS

The materials for the present investigation comprised of 33 genotypes including 28 doubled haploids (DH) obtained through anther culture technique, one advanced breeding line (P-138) and four (3 mustard and 1 karan rai) check varieties *viz.*, Nav Gold, RCC-4, Pusa Jaikisan and Jayanti. The doubled haploids were obtained from the cross Jayanti x RCC-6-1 developed in the Department of Agricultural Biotechnology, CSK HPKV, Palampur. All the genotypes were raised in the field at Shivalik Agricultural Research and Extension Centre (SAREC), Kangra, for scoring disease reaction during *rabi*, 2011-12. All the genotypes were screened for reaction to *Alternaria brassicae* under natural epiphytotic field conditions and observations on disease severity were recorded on the basis of visual observations.

Data on disease severity of *Alternaria* blight on leaves was recorded on nearly 100 days after sowing on 10 leaves sampled randomly from each plot. Disease severity on pods was recorded 15 days before the crop harvest. For recording of *Alternaria* blight on pods, 10 pods per plot were sampled randomly and disease scoring was done as per the

scale [8] (Table 1 and 2) followed under AICRP (Rapeseed-mustard).

Per cent Disease Intensity (PDI) was calculated by using the given formula [9].

$$PDI = \frac{\text{Total sum of all numerical rating}}{\text{Number of observations taken} \times \text{maximum disease score}} \times 100$$

Table 1 Scale (0-9) for Rating of Genotypes for Reaction to Alternaria blight

Rating	Symptoms	
	AB on leaf	**AB on pod**
0	No infection	No infection
1	Up to 5% leaf area covered	Up to 5% pod area covered
3	>5-10% leaf area covered	>5-10% pod area covered
5	>11-25% leaf area covered	>11-25% pod area covered
7	>26-50% leaf area covered	>26-50% pod area covered
9	>50% leaf area covered	>50% pod area covered

Table 2 Categorization scale for reaction to *Alternaria* blight

Sr. No.	Category	Area infected (%)
1.	Resistant	0-10%
2.	Moderately resistant	11-25%
3.	Moderately susceptible	26-50%
4.	Susceptible	51-75%
5.	Highly susceptible	>75%

Results and Discussion

Data on field reaction of 33 genotypes for Alternaria is presented in Table 3. The reaction to Alternaria blight on leaves revealed that only one genotype viz., Pusa Jaikisan was found to be moderately resistant as the per cent disease severity ranged between 11-25 per cent (Table 4a). Twenty six genotypes *viz.*, P-12, P-23, P-24, P-26, P-31, P-33, P-34, P-39,

P-43, P-45, P-62, P-63, P-74, P-75, P-77, P-89, P-92, P-96, P-101, P-103, P-117, P-133, P-137, P-138, Nav Gold and Jayanti were found to be moderately susceptible as the per cent disease severity ranged between 26-50 per cent. Six genotypes *viz.*, P-17, P-51, P-56, P-64, P-122 and RCC-4 were found to be susceptible as the per cent disease severity ranged between 51-75 per cent (Plate I).

Table 3 Per Cent Disease Intensity and Reaction of 33 Genotypes of Brassica Carinata Against Alternaria

Sr. No.	Genotypes	AB on Leaves		AB on Pods	
		%Disease	Reaction	%Disease	Reaction
1.	P-12	42.22	MS	13.33	MR
2.	P-17	57.78	S	13.33	MR
3.	P-23	42.22	MS	13.33	MR
4.	P-24	44.44	MS	14.44	MR
5.	P-26	40.00	MS	10.00	R
6.	P-31	40.00	MS	12.22	MR
7.	P-33	40.00	MS	24.44	MR
8.	P-34	42.22	MS	10.00	R
9.	P-39	40.00	MS	13.33	MR
10.	P-43	42.22	MS	13.33	MR
11.	P-45	42.22	MS	17.78	MR
12.	P-51	57.78	S	15.56	MR
13.	P-56	53.33	S	15.56	MR
14.	P-62	37.78	MS	26.67	MS
15.	P-63	35.56	MS	24.44	MR
16.	P-64	53.33	S	17.78	MR
17.	P-74	35.56	MS	17.78	MR
18.	P-75	46.67	MS	15.56	MR

19.	P-77	42.22	MS	14.44	MR
20.	P-89	33.33	MS	31.11	MS
21.	P-92	40.74	MS	24.44	MR
22.	P-96	40.00	MS	15.56	MR
23.	P-101	40.74	MS	13.33	MR
24.	P-103	37.04	MS	17.46	MR
25.	P-117	45.68	MS	20.00	MR
26.	P-122	59.26	S	14.29	MR
27.	P-133	40.00	MS	15.56	MR
28.	P-137	40.00	MS	20.00	MR
29.	P-138	42.22	MS	17.78	MR
30.	Nav Gold	28.89	MS	24.44	MR
31.	Jayanti	42.22	MS	12.22	MR
32.	Pusa Jaikisan	24.44	MR	33.33	MS
33.	RCC-4	55.56	S	21.11	MR

MR: Moderately resistant; MS: Moderately susceptible; S: Susceptible; R: Resistant, AB: *Alternaria* blight

Table 4a Reaction of Various Genotypes of Brassica Carinata to Alternaria Blight on Leaves

Sr. No.	% Leaf area covered	Reaction	No. of genotypes	Genotypes
1.	11-25%	Moderately resistant	1	Pusa Jaikisan
2.	26-50%	Moderately susceptible	26	P-12, P-23, P-24, P-26, P-31, P-33, P-34, P-39, P-43, P-45, P-62, P-63, P-74, P-75, P-77, P-89, P-92, P-96, P-101, P-103, P-117, P-133, P-137, P-138, Nav Gold and Jayanti
3.	51-75%	Susceptible	6	P-17, P-51, P-56, P-64, P-122 and RCC-4

Table 4b Reaction f Various Genotypes of Brassica Carinata to Alternaria Blight on Pods

Sr. No.	% Pod area covered	Reaction	No. of genotypes	Genotypes
1.	0-10%	Resistant	2	P-26 and P-34
2.	11-25%	Moderately resistant	28	P-12, P-17, P-23, P-24, P-31, RCC-4, P-33, P-39, P-43, P-45, P-51, P-56, P-63, P-64, P-74, P-75, P-77, P-92, P-96, P-101, P-103, P-117, P-122, P-133, P-137, P-138, Nav Gold and Jayanti
3.	26-50%	Moderately susceptible	3	P-89, P-62 and Pusa Jaikisan

Based on reaction to *Alternaria* blight on pods revealed that twenty eight genotypes *viz.*, P-12, P-17, P-23, P-24, P-31, RCC-4, P-33, P-39, P-43, P-45, P-51, P-56, P-63, P-64, P-74, P-75, P-77, P-92, P-96, P-101, P-103, P-117, P-122, P-133, P-137, P-138, Nav Gold and Jayanti were found to be moderately resistant as the per cent disease severity ranged between 11-25 per cent (Table 4b). Three genotypes *viz.*, P-89, P-62 and Pusa Jaikisan were found to be moderately susceptible as the per cent disease severity ranged between 26-50 per cent and only two genotypes *viz.*, P-26 and P-34 appeared to be resistant as the per cent disease severity ranged between 0-10 per cent.

Different workers evaluated the rapeseed-mustard varieties/lines and our results are in accordance with those in many cases. Reference [10] found varying degree of disease severity while evaluating 26 varieties/lines of rapeseed-mustard, on

the basis of disease severity index, none was found highly resistant or resistant. While six among them appeared to be moderately resistant against the *Alternaria* blight.

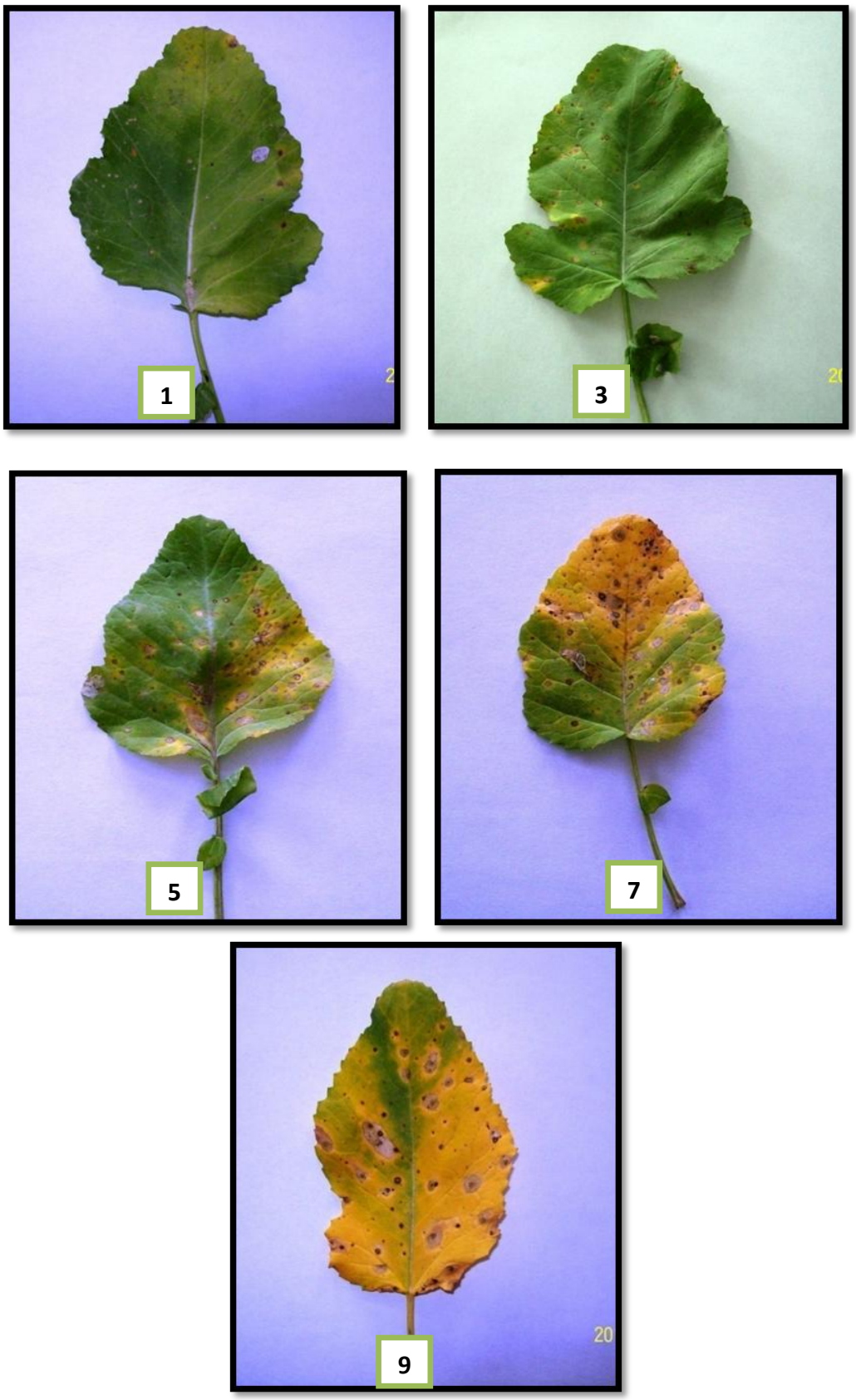

Plate I: Alteranaria Blight Reaction on a Scale of 0-9

Reference [11] also evaluated two hundred seven rapeseed-mustard genotypes for their response to *Alternaria* blight and reported only five genotypes to be resistant, 13 genotypes as moderately resistant and 16 genotypes moderately susceptible to *Alternaria* while the remaining genotypes were either susceptible or highly susceptible. Similar findings were also reported by [12], [13], [14] in rapeseed-mustard.

III. CONCLUSIONS

In present investigation, only one genotype *i.e.*, Pusa Jaikisan appeared to be moderately resistant on leaves and based upon disease reaction on pods, two genotypes *viz.*, P-26 and P-34 appeared to be resistant.

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