



Short Note

Screening of rapeseed-mustard genotypes against aphid (*Lipaphis erysimi* Kalt.)

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Abstract

A field experiment was conducted to screen thirty rapeseed-mustard genotypes against mustard aphid (*Lipaphis erysimi*) during Rabi 2021-22 at Agricultural Research Station, Jodhpur. These genotypes consisted of seven species of rapeseed-mustard i.e. *Brassica juncea* (10), *B. rapa* var. Yellow Sarson (10), *B. nigra* (1), *B. rapa* var. Toria (2), *B. carinata* (2), *B. tournefortii* (3) and *Eruca sativa* (2). The experimental results depicted that genotypes TM 108-1, Kranti, Bio 902, MYS 152, YSH 401 and NRCYS 05-02 were found to be resistant; genotypes viz., TM 267-3, TM 316, TM 304-1, RH 749, PM 31, GDM 4, RMYS 1, RMYS 2, RMYS 3, MYS 180, MYS 183, Jhumka, Pitambari, Tapeshwari, Bhawani, Pusa Swarna, Pusa Aaditya, MBT 27, MBT 4, and GP 115-1 were moderately resistant, while LS-FF 57, MN 1, Karantara, and RTM 1351 were found as tolerant.

Keywords: *Brassica* species, *Lipaphis erysimi*, screening, resistant, tolerant

Introduction

Oilseed crops are one of the most important crops in the world. In India, among the different oilseed crops, rapeseed-mustard is an important group of crops which occupies around 23.3 % area (6.69 mha) and 26.8 % (10.11 mt) production of total oilseeds and contributes around 24.4 % of total vegetable oil production during 2020-21 (Choudhary *et al.*, 2023). There are seven species of rapeseed-mustard grown in India viz., Indian mustard (*Brassica juncea*), *B. rapa* var. Yellow Sarson, *B. nigra*, *B. rapa* var. Toria, *B. campestris*, *B. tournefortii* and *Eruca sativa*. The main problem that limits the production and productivity of rapeseed-mustard crops includes biotic and abiotic factors. More than three dozen of insect pests are known to be associated with rapeseed-mustard. Among them, the mustard aphid [*Lipaphis erysimi* (Kalt)] is the most important limiting factors in lowering the grain yield of these crops (Meena *et al.*, 2019). It may cause a yield loss ranging from 35.4 to 96.0 % in favorable conditions (Sahoo, 2012) and can reduce 5-6 % oil content (Shylesha *et al.*, 2006). Hence, for the efficient, economical and environment friendly management of mustard aphid, growing of resistant varieties is most effective and cheapest method. This may lead to increase production in aphid-infested areas and to save environment from insecticidal residues. In the areas where yield fluctuates greatly due to the insect pest incidence and control by insecticides is not beneficial and found costly, growing

of resistant varieties of rapeseed-mustard could be a option for increasing the productivity of these crops. Our concerned efforts are needed to tackle this cause by identifying suitable genotypes through germplasm screening. The identified genotypes may be used in crossing programme for establishing a sound breeding strategy and developing resistant/tolerant varieties. Therefore, the present study was performed to identify resistant /tolerant genotypes in different species of *Brassica*.

Materials and Methods

A field experiment was conducted to screen thirty rapeseed-mustard genotypes against mustard aphid (*Lipaphis erysimi*) at research farm of Agricultural Research Station, Mandor, Jodhpur during Rabi 2021-22. The experiment was laid out in randomized complete block design with three replications in the plot of 0.6 m × 4 m and spacing between row to row and plant to plant was 30 cm × 10 cm, respectively. The experimental material consisted of seven species of rapeseed-mustard i.e. *B. juncea* (10), *B. rapa* var. Yellow Sarson (10), *B. nigra* (1), *B. rapa* var. Toria (2), *B. carinata* (2), *B. tournefortii* (3) and *Eruca sativa* (2) (Table 1). These genotypes were sown in two rows and were allowed to have natural infestation of aphids in the plots where no insect pest control measures were used.

The observations of aphid were recorded on 10 cm

Table 1: Genotypes of different species of rapeseed-mustard

Species	Genotypes	Source	Species	Genotypes	Source
<i>B. juncea</i>	TM 108-1	BARC, Mumbai	<i>B. rapavar.</i> Yellow Sarson	RMYS-1	ARS, Mandor
	TM 267-3			RMYS-2	
	TM 316			RMYS-3	
	TM 304-1			MYS-152	
	Kranti	DRMR, Bharatpur		MYS-180	
	Bio-902			MYS-183	
	RH-749			Jhumka	DRMR, Bharatpur
	PM 31			NRCYS 05-02	
	GDM-4			Pitambari	
	LS-FF-57	ARS, Mandor		YSH-401	CCSHAU, Hisar
<i>B. nigra</i>	MN-1	ARS, Mandor	<i>B. tournefortii</i>	MBT-27	ARS, Mandor
<i>B. rapa</i> var. Toria	Tapeshwari	DRMR, Bharatpur		MBT-4	
	Bhawani		GP 115-1		
<i>B. carinata</i>	Pusa Swarna		<i>Eruca sativa</i>	Karantara	DRMR, Bharatpur
	Pusa Aaditya			RTM 1351	

Table 2: Grading and resistance/tolerance categories based on aphid population index in rapeseed-mustard

Aphid Population Index (API)	Grade	Resistance Category
No or < 20 aphids on the inflorescences of test plants	1.0	Resistant (R)
Upto 25% inflorescences have 21-100 aphids on the test plants	2.0	Moderately resistant (MR)
Upto 50% of inflorescences have 101-250 aphids across test plants	2.5	Tolerant (T)
Upto 75% inflorescences have 251-500 aphids across test plants	3.5	Susceptible (S)
100% of inflorescences have > 500 aphids across test plants	5.0	Highly susceptible (HS)

terminal inflorescence at weekly intervals (Starting from initial incidence i.e. 62 DAS to maturity of the crop) on five randomly selected plants from each plot. The genotypes were categorized into five grades (Table 2) based on aphid population index (API) given by Dhillon *et al.* (2018).

Results and Discussion

The field screening of different genotypes of rapeseed-mustard against aphid was conducted and reported that the initiation occurred in first week of January 2022 (1st SMW). The data on the mean numbers of aphids/plant were recorded from the time of buildup of the aphid population (62 DAS) till the maturity of the crop (Table 3, 4 and 5). The low aphid population/plant was observed in the genotypes Kranti (15.5), Bio 902 (16.3) and TM 108-1 (17.1) therefore these genotypes were categorized as resistant (Table 6). Morphological characters of the plants *viz.*, wide canopy, early flowering, and alternate pod arrangement with continuous space between the pods could be the reason for less preference by the aphid. Likewise, in *Brassica rapa* var. Yellow Sarson the genotypes YSH 401 (16.9), MYS 152 (17.8) and NRCYS 05-02 (20.0) were categorized as resistant (Table 6). The

less damage by aphid in these genotypes may be due to some unique characters *viz.* short pod length, thick pods and alternate arrangement of pods. Similarly, Islam *et al.* (2017) have also been reported comparatively less aphid infestation in *Brassica rapa*.

Further, the genotypes *viz.* PM 31 (28.5), TM 316 (33.9), TM 267-3 (35.3), TM 304-1 (37.9), GDM 4 (54.2) and RH 749 (67.6) in Indian mustard; RMYS 1 (41.3), RMYS 2 (21.3), RMYS 3 (38.9), MYS 180 (20.4), MYS 183 (31.1), Jhumka (35.0) and Pitambari (28.3) in yellow sarson; Tapeshwari (40.5) and Bhawani (42.6) in *B. rapa* var. Toria; Pusa Swarna (34.3) and Pusa Aaditya (37.4) in *B. carinata* and MBT 27 (54.1), MBT 4 (66.0) and GP 115-1 (42.3) in *B. tournefortii* were identified as moderately resistant on the basis of mean aphid population/ plant. Hossain *et al.* (2015) have also been reported moderately resistant varieties in rapeseed-mustard.

There was only one genotype LS-FF 57 in Indian mustard that was more preferred by the aphid with mean population 214.9 aphids/plant and categorized as tolerant. This genotype has some morphological features *viz.* high density of pods in bunches, bright color of flowers and

Table 3: Screening of Indian mustard (*B. juncea*) genotypes against aphid

Genotypes	Mean population of mustard aphid/plant									Mean
	1 Jan (62 DAS)	8 Jan (69 DAS)	15 Jan (76 DAS)	22 Jan* (83 DAS)	29 Jan (90 DAS)	5 Feb (97 DAS)	12 Feb (104 DAS)	19 Feb (111 DAS)	26 Feb (118 DAS)	
TM 108-1	0.0 (0.7)	9.3 (3.1)	22.1 (4.4)	49.3 (6.8)	37.8 (6.2)	26.6 (5.2)	6.7 (2.7)	2.0 (1.6)	0.3 (0.9)	17.1 (4.2)
TM 267-3	30.8 (5.6)	32.6 (5.7)	42.3 (6.5)	59.4 (7.7)	48.0 (6.9)	41.7 (6.5)	27.9 (5.3)	22.3 (4.8)	12.3 (3.5)	35.3 (6.0)
TM 316	33.8 (5.9)	34.3 (5.9)	47.1 (6.9)	56.9 (7.5)	43.3 (6.6)	35.3 (5.9)	25.7 (5.1)	19.8 (4.4)	9.2 (3.1)	33.9 (5.9)
TM 304-1	35.0 (6.0)	36.6 (6.1)	45.0 (6.5)	61.2 (7.8)	50.6 (7.1)	43.5 (6.6)	28.4 (5.4)	25.5 (5.1)	15.6 (4.0)	37.9 (6.2)
RH 749	42.2 (6.4)	44.5 (6.7)	74.7 (8.6)	104.5 (10.2)	94.5 (9.7)	82.7 (9.1)	73.9 (8.6)	62.2 (7.9)	29.1 (5.4)	67.6 (8.2)
PM 31	17.6 (4.2)	23.5 (4.9)	34.9 (5.9)	52.4 (7.2)	42.9 (6.6)	33.2 (5.8)	22.7 (4.8)	19.3 (4.4)	10.3 (3.2)	28.5 (5.4)
LS-FF-57	89.3 (9.5)	149.3 (12.2)	224.7 (14.9)	283.8 (16.8)	279.3 (16.7)	264.9 (16.3)	249.3 (15.8)	233.0 (15.3)	160.7 (12.7)	214.9 (14.7)
Kranti (NC)	0.0 (0.7)	4.0 (2.1)	22.1 (4.8)	45.1 (6.8)	35.3 (6.0)	20.4 (4.6)	11.1 (3.4)	1.4 (1.4)	0.4 (0.9)	15.5 (4.0)
Bio 902 (ZC)	0.0 (0.7)	4.5 (2.2)	21.9 (4.5)	51.3 (7.2)	35.2 (6.0)	25.1 (5.0)	6.4 (2.6)	1.9 (1.6)	0.1 (0.8)	16.3 (4.1)
GDM 4 (LR)	47.5 (6.9)	53.3 (7.3)	65.2 (8.1)	87.8 (9.4)	81.0 (9.0)	60.7 (7.8)	39.2 (6.3)	33.2 (5.8)	19.8 (4.5)	54.2 (7.4)
SEm±	0.3	0.3	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.2
CD (p=0.05)	0.8	1.0	2.1	1.6	1.0	0.8	0.9	0.8	0.9	0.7

*Peak population week; DAS = Days after sowing; Figures in the parentheses are square root transformed values

Table 4: Screening of *B. rapa* var. Yellow Sarson genotypes against aphid

Genotypes	Mean population of mustard aphid/plant									Mean
	1 Jan (62 DAS)	8 Jan (69 DAS)	15 Jan (76 DAS)	22 Jan* (83 DAS)	29 Jan (90 DAS)	5 Feb (97 DAS)	12 Feb (104 DAS)	19 Feb (111 DAS)	26 Feb (118 DAS)	
RMYS 1	37.4 (6.1)	46.4 (6.8)	53.3 (7.3)	58.2 (7.6)	55.5 (7.4)	49.1 (7.0)	40.5 (6.3)	21.4 (4.6)	9.7 (3.1)	41.3 (6.4)
RMYS 2	19.4 (4.4)	23.5 (4.9)	29.2 (5.4)	34.1 (5.8)	29.8 (5.5)	24.2 (4.9)	17.5 (4.2)	11.8 (3.4)	1.5 (1.4)	21.2 (4.6)
RMYS 3	34.8 (5.9)	45.3 (6.7)	51.7 (7.2)	56.2 (7.5)	53.6 (7.3)	48.6 (6.9)	38.3 (6.2)	19.9 (4.5)	1.9 (1.5)	38.9 (6.2)
MYS 152	6.8 (2.7)	14.4 (3.8)	25.6 (5.1)	42.0 (6.4)	36.4 (6.0)	22.1 (4.7)	7.6 (2.8)	3.4 (1.9)	1.8 (1.5)	17.8 (4.2)
MYS 180	7.8 (2.8)	20.8 (4.6)	26.3 (5.1)	45.7 (6.7)	39.8 (6.3)	26.2 (5.1)	9.5 (3.1)	6.4 (2.5)	1.3 (1.2)	20.4 (4.5)
MYS 183	24.2 (4.9)	31.6 (5.6)	41.1 (6.4)	49.7 (7.0)	44.8 (6.7)	40.6 (6.3)	32.2 (5.7)	13.3 (3.7)	2.1 (1.5)	31.0 (5.6)
Jhumka	23.8 (4.9)	37.1 (6.1)	46.5 (6.8)	53.4 (7.3)	51.8 (7.2)	44.9 (6.7)	37.3 (6.1)	18.4 (4.3)	1.9 (1.5)	35.0 (5.9)
YSH 401(NC)	2.8 (1.8)	10.4 (3.3)	30.0 (5.4)	34.5 (5.9)	30.0 (5.5)	24.2 (4.9)	9.8 (3.2)	8.6 (3.0)	1.8 (1.5)	16.9 (4.1)
NRCYS 05-02 (ZC)	4.4 (2.2)	14.1 (3.8)	33.1 (5.7)	37.6 (6.1)	32.5 (5.7)	26.9 (5.1)	17.4 (4.2)	11.5 (3.4)	2.0 (1.5)	19.9 (4.5)
Pitambari (LR)	16.9 (4.1)	27.2 (5.2)	37.6 (6.1)	46.1 (6.8)	40.1 (6.3)	36.6 (6.0)	32.4 (5.7)	15.7 (3.9)	1.6 (1.4)	28.2 (5.3)
SEm±	0.3	0.2	0.4	0.4	0.3	0.4	0.3	0.3	0.2	0.2
CD (p=0.05)	0.8	0.6	1.1	1.2	0.8	1.2	0.8	0.9	0.5	0.5

*Peak population week; DAS = Days after sowing; Figures in the parentheses are square root transformed values

Table 5: Screening of *B. nigra*, *B. rapa* var. *Toria*, *B. carinata*, *B. tournefortii* and *E. sativa* genotypes against aphid

Genotypes	Mean population of mustard aphid/plant									Mean
	1 Jan (62 DAS)	8 Jan (69 DAS)	15 Jan (76 DAS)	22 Jan* (83 DAS)	29 Jan (90 DAS)	5 Feb (97 DAS)	12 Feb (104 DAS)	19 Feb (111 DAS)	26 Feb (118 DAS)	
MN 1	0.0 (0.7)	63.4 (7.9)	145.5 (12.04)	233.3 (15.2)	227.9 (15.0)	224.9 (14.9)	205.7 (14.3)	180.4 (13.4)	119.8 (10.9)	155.7 (12.4)
Tapeshwari	26.1 (5.1)	39.6 (6.3)	51.93 (7.22)	57.6 (7.6)	56.7 (7.5)	51.8 (7.2)	44.0 (6.6)	34.0 (5.8)	2.2 (1.6)	40.4 (6.4)
Bhawani	30.7 (5.5)	42.8 (6.5)	53.13 (7.25)	59.2 (7.7)	57.9 (7.5)	52.7 (7.2)	47.7 (6.9)	37.2 (6.1)	1.6 (1.4)	42.5 (6.5)
Pusa Swarna	0.0 (0.7)	21.2 (4.6)	40.13 (6.29)	71.3 (8.4)	56.6 (7.5)	49.8 (7.0)	39.5 (6.3)	27.2 (5.2)	2.4 (1.7)	34.2 (5.9)
Pusa Aaditya	0.0 (0.7)	22.3 (4.7)	46.20 (6.78)	75.4 (8.6)	61.2 (7.7)	55.8 (7.5)	43.8 (6.6)	29.1 (5.4)	2.1 (1.5)	37.3 (6.1)
MBT 27	0.0 (0.7)	34.5 (5.8)	70.27 (8.37)	99.8 (10.0)	89.0 (9.4)	82.8 (9.1)	66.2 (8.1)	42.6 (6.5)	1.8 (1.5)	54.1 (7.3)
MBT 4	0.0 (0.7)	39.2 (6.2)	77.53 (8.80)	111.8 (10.5)	103.8 (10.1)	100.2 (10.0)	94.6 (9.7)	66.1 (8.1)	0.8 (1.1)	66.0 (8.1)
GP 115-1	0.0 (0.7)	27.2 (5.2)	66.87 (8.13)	75.0 (8.6)	67.7 (8.2)	59.7 (7.7)	49.2 (7.0)	33.9 (5.7)	1.1 (1.2)	42.3 (6.5)
Karantara	47.2 (6.9)	83.9 (9.1)	110.27 (10.50)	157.4 (12.5)	150.5 (12.2)	140.6 (11.8)	133.8 (11.5)	124.8 (11.1)	69.1 (8.3)	113.1 (10.6)
RTM 1351	43.6 (6.6)	68.9 (8.2)	92.40 (9.57)	156.6 (12.5)	150.7 (12.2)	143.2 (11.9)	135.4 (11.6)	130.3 (11.4)	71.0 (8.3)	110.2 (10.5)
SEm±	0.3	0.3	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.2
CD (p=0.05)	0.8	1.0	2.1	1.6	1.0	0.8	0.9	0.8	0.9	0.6

*Peak population week; DAS = Days after sowing; Figures in the parentheses are square root transformed values

Table 6: Categorization of genotypes of different *Brassica* sp. against mustard aphid

Genotypes	Aphid Population Index (API)	Grade	Resistance Category
TM 108-1	17.13	1.0	Resistant (R)
TM 267-3	35.27	2.0	Moderately Resistant (MR)
TM 316	33.93	2.0	Moderately Resistant (MR)
TM 304-1	37.93	2.0	Moderately Resistant (MR)
RH 749	67.59	2.0	Moderately Resistant (MR)
PM 31	28.54	2.0	Moderately Resistant (MR)
LS-FF-57	214.91	2.5	Tolerant (T)
Kranti	15.53	1.0	Resistant (R)
Bio 902	16.29	1.0	Resistant (R)
GDM 4	54.19	2.0	Moderately Resistant (MR)
RMYS 1	41.27	2.0	Moderately Resistant (MR)
RMYS 2	21.26	2.0	Moderately Resistant (MR)
RMYS 3	38.94	2.0	Moderately Resistant (MR)
MYS 152	17.81	1.0	Resistant (R)
MYS 180	20.44	2.0	Moderately Resistant (MR)
MYS 183	31.09	2.0	Moderately Resistant (MR)

Jhumka	35.04	2.0	Moderately Resistant (MR)
YSH-401	16.93	1.0	Resistant (R)
NRCYS 05-02	19.99	1.0	Resistant (R)
Pitambari	28.29	2.0	Moderately Resistant (MR)
MN 1	155.65	2.5	Tolerant (T)
Tapeshwari	40.48	2.0	Moderately Resistant (MR)
Bhawani	42.57	2.0	Moderately Resistant (MR)
Pusa Swarna	34.27	2.0	Moderately Resistant (MR)
Pusa Aaditya	37.36	2.0	Moderately Resistant (MR)
MBT 27	54.13	2.0	Moderately Resistant (MR)
MBT 4	66.01	2.0	Moderately Resistant (MR)
GP 115-1	42.33	2.0	Moderately Resistant (MR)
Karantara	113.10	2.5	Tolerant (T)
RTM 1351	110.27	2.5	Tolerant (T)

dense branching in the plants which may be favorable for aphid. Maurya *et al.* (2018) reported that Pusa Jagnath (9.1 aphids/plant) and RLM-619 (100.8 aphids/plant) were highly tolerant and susceptible, respectively to mustard aphid. Similarly, the genotypes MN 1 (155.6) in *B. nigra* and Karan tara (113.1) and RTM 1351 (110.2) in *E. sativa* were also found as tolerant (Table 6). The genotypes of *B. nigra* and *E. sativa* had some morphological and environmental reasons that favored aphid infestation on the plants such as late flowering, bright yellow flower color, siliqua in bunches, late maturity.

Mean population of aphid on different *Brassica* species genotypes (Table 3, 4 and 5) revealed that none of the genotype was found completely free from aphids. The aphid incidence was comparatively low in *B. rapa* var. Yellow Sarson. These results are in contradiction with Dey *et al.* (2005) who reported that all the cultivars were infested with light to moderate levels of aphid infestation while mustard cultivars of *B. rapa* were more susceptible to *L. erysimi* attack.

Conclusion

TM 108-1, Kranti and Bio 902 of *B. juncea* and MYS 152, YSH-401, NRCYS 05-02 of *B. rapa* var. Yellow Sarson were identified as resistant genotypes. Likewise, genotypes *viz.*, TM 267-3, TM 316, TM 304-1, RH 749, PM 31, GDM 4 of *B. juncea*; RMYS 1, RMYS 2, RMYS 3, MYS 180, MYS 183, Jhumka, Pitambari of *B. rapa* var. Yellow Sarson; Tapeshwari, Bhawani of *B. rapa* var. Toria; Pusa Swarna, Pusa Aaditya of *B. carinata* and MBT 27, MBT 4, and GP 115-1 of *B. tournefortii* were reported as moderately resistant. Hence, these genotypes may be used in future breeding programmes to develop aphid tolerant varieties.

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