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Screening of Indian mustard (*Brassica juncea* L.) genotypes against mustard aphid (*Lipaphis erysimi* Kalt.) under Terai zone of West Bengal

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Abstract

Oil seed crops plays a significant role in indian agriculture and industrial economy. Among these Indian mustard (*Brassica juncea* L.) has a vital role in terms of oil production and with other multiple benefits. Despite beneficial role, *Brassica juncea* is vulnerable to many insect pests attack especially to mustard aphid. To combat this problem host plant resistance *i.e.* growing resistant or tolerant varieties is the simple and easiest way to protect the mustard crop from insect pest attack. Varietal screening is done with 51 genotypes of Indian mustard against mustard aphid *Lipaphis erysimi* to evaluate the resistant or tolerant genotypes on the basis of aphid population density. The experiment was conducted during 2016-17 and 2017-18 in *Rabi* season at Uttar Banga Krishi Viswavidyalaya, pundibari, Cooch Behar, West Bengal. Categorization of resistant or tolerant genotypes was done on the basis of aphid infestation index (AII) scale, one germplasm was recorded as highly resistant, 20 were recorded as resistant and 30 were recorded as susceptible. None of the genotype recorded as immune and highly susceptible to aphid infestation.

Keywords: Mustard aphid, *Lipaphis erysimi*, *Brassica juncea*, aphid infestation index

1. Introduction

Oilseeds occupy a significant place in Indian agriculture and industrial economy [1]. Among the oilseed crops 30 per cent of the total oilseed production and 13 per cent of the country’s gross cropped area occupied by *Brassica* crops. Indian mustard (*Brassica juncea*) which is commonly known as mohari, rai, raya is one of the important oil seed crop grown in the country. The cultivation of indian mustard in West Bengal is about 410.793 thousand ha with total production of 419.58 thousand tones and average productivity of 1021 kg/ha, respectively [2]. A total number of 38 insect pests are reported to occur in rapeseed-mustard crop in india by (Bakhetia and Sekhon, 1989) [3]. However, (Purwar *et al.*, 2004) [4]. reported that more than 43 species of insect pests infest rapeseed- mustard crop. Based on their economic importance, the insect pests of mustard crop may be categorised in to key pest: aphid, *Lipaphis erysimi* (Kaltenbach), major pests: sawfly, *Athalia lugens proxima* (Klug), paintedbug, *Bagrada cruciferarum* Kirkaldy and leaf miner, *Chromatomyia horticola* Goureau, minor pests: Bihar hairy caterpillar, *Spilosoma obliqua* Walker, cabbage butterfly, *Pieris brassicae* Linnaeus, flea beetle, *Phyllotreta cruciferae* Goeze and green aphid, *Myzus persicae* Sulzer, new pests: leaf webber, *Crocidolomia binotalis* Zeller, borer, *Hellula undalis* Fabricius and whitefly, *Bemisia tabaci* Gennadius.

Mustard aphid *Lipaphis erysimi* (Kaltenbach) (Aphididae: Hemiptera) is the most important devastating insect pest of rapeseed-mustard crop in India [5-8] which pose a serious constraint in mustard cultivation [9, 10]. The nymphs and adults of mustard aphid cause damage to mustard plant by sucking the sap from different growth stages of plant like vegetative, flowering and pod formation stages and leaves become curled, the vigour of plant is gradually reduced and the pods do not mature when developed and eventually cannot produce healthy seeds. As a result, plant becomes stunted and deceased [11]. In North Indian rapeseed mustard crop the activity of aphid starts from November to March with peak population during mid-February to mid-March. Aphid alone causes significant reduction of seed yield and oil content of 65 to 96 and 15 per cent, respectively [12, 13]. Growing of resistant varieties may possess many advantages over chemical or insecticide control which is cost effective and environmentally safe [14]. Therefore, it is expected that the study will certainly help to select a suitable resistant genotypes which may help to overcome the problem of cultivation and expansion of one of the most important oilseeds crops in this vast agro-ecological zone.

2. Materials and Methods

The present experiment was carried out at Instructional Farm, Faculty of Agriculture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal for two successive rabi seasons of 2016-17 and 2017-18. Seeds of genotypes enlisted in (Table1). were procured from Pulse and Oil Seed Research Station, Berhampur, West Bengal sown on 10th December and 25th November during 2016-17 and 2017-18 with a seed rate of 5 kg/ha. Recommended fertilizers dose @ 80:40:40 (N: P: K kg/ha) is adopted during the crop period. The experimental design followed during the crop period is Randomized Block Design (RBD). The genotypes were replicated thrice each in 5 × 0.43 m plot with row to row 30 cm and plant to plant 10 cm spacing. Five tagged plants are selected randomly from each genotype to record the observations. Screening of mustard genotypes against mustard aphid was done on the basis of aphid population in terms of Aphid infestation index (AII) (0-5) scale presented in (Table 2.) and categorized the genotypes in to resistance or tolerance presented in (Table 3) adopted by (Bakhetia and Sandhu, 1973) [15]. An attempt was made to categorize the genotypes in to Immune (I), Highly resistant (HR), Resistant (R), Suceptible (S) and Highly susceptible (HS) presented in (Table 3).

Table 1: List of *Brassica juncea* L. (Indian mustard) genotypes

S. No.	Genotypes	S. No.	Genotypes
1.	NPJ-194	27.	SKJM-05
2.	TM-276	28.	SVJ-64
3.	Rohini	29.	Sitara-Sreenagar
4.	KMR-15-4	30.	RH-0923
5.	PR-2012-9	31.	DRMR-15-16
6.	Divya-88	32.	NPJ-198
7.	RL-JEB-52	33.	JMM-927-RC
8.	Kranti-NC	34.	DRMR-15-47
9.	DRMRIJ-15-85	35.	RGN-389
10.	RH1202	36.	RAURD-214
11.	NPJ-196	37.	DRMR-15-14
12.	RMM-09-10	38.	DRMR-4001
13.	RRN-871	39.	RGN-384
14.	KM-126	40.	NPJ-197
15.	SKM-1313	41.	RB-81
16.	RB-77	42.	NPJ-200
17.	DRMR-15-5	43.	DRMR-15-9
18.	KMR-53-3	44.	KMR-L-15-6
19.	RL-JEB-84	45.	PRD-2013-9
20.	Ganga	46.	DRMRIJ-15-66
21.	RGN-73-JC	47.	RH-1368
22.	RH-1209	48.	RH-1325
23.	PR-2012-12	49.	RGN-386
24.	RGN-385	50.	RNWR-09-3
25.	NPJ-195	51.	PRD-2013-2
26.	Maya-C		

Table 2: Based on Grade aphid infestation index classified as

Grade No	Description
0	Plants are completely free from aphid
1	Plants having 1-12 aphids per twig but no symptoms of damage
2	Plants having aphid colonies (10-25 aphids) on few twigs but no curling of shoot or leaves
3	Plants having aphid colonies on almost all twigs, leaves, starts yellowing and drying, pods are curled
4	Each and every branch of the plant is fully covered with aphids and some of the branches starts drying
5	Plant is completely dry immaturely due to aphid infestation

Table 3: Categorization of resistance /tolerance index scale against mustard aphid

Group	Percentage of Population rating	Rating Index
I	0	Immune (I)
II	Up to 1.0	Highly Resistant (HR)
III	1.1-2.0	Resistant (R)
IV	2.1-3.0	Susceptible (S)
V	Above 3	Highly Susceptible (HS)

Table 4: Number of aphids (*Lipaphis erysimi* (Kalt.) observed per top 10 cm central shoot in different mustard genotypes at 10 days interval.

S.NO.	Genotype	2016-17				2017-18				Pooled			
		50DAS	60 DAS	70 DAS	AII	50 DAS	60 DAS	70 DAS	AII	50 DAS	60 DAS	70DAS	AII
1.	NPJ-194	4.27 (2.173)	3.47 (1.987)	12.33 (3.253)	1.0	0.00	6.67 (2.660)	5.00 (2.327)	1.0	2.135 (1.09)	5.07 (2.323)	8.67 (2.790)	1.0
2.	TM-276	4.13 (2.140)	2.20 (1.630)	62.67 (7.930)	3.0	0.00	7.33 (2.763)	4.00 (2.083)	1.0	2.065 (1.07)	4.77 (2.197)	33.33 (5.007)	3.0
3.	Rohini	5.40 (2.417)	4.00 (2.103)	49.00 (6.910)	3.0	0.00	7.33 (2.763)	12.00 (3.530)	1.0	2.7 (1.21)	5.67 (2.433)	30.50 (5.220)	3.0
4.	KMR-15-4	2.87 (1.827)	3.33 (1.947)	54.67 (7.307)	3.0	0.00	9.00 (2.950)	7.33 (2.747)	1.0	1.435 (0.91)	6.17 (2.448)	31.00 (5.027)	3.0
5.	PR-2012-9	4.13 (2.113)	3.87 (2.080)	45.33 (6.767)	3.0	0.00	9.00 (2.963)	7.67 (2.710)	1.0	2.065 (1.06)	6.43 (2.522)	26.50 (4.738)	3.0
6.	Divya-88	2.87 (1.827)	2.67 (1.770)	24.00 (4.837)	2.0	0.00	9.00 (3.017)	11.67 (3.427)	1.0	1.435 (0.91)	5.83 (2.393)	17.83 (4.132)	2.0
7.	RL-JEB-52	1.87 (1.537)	3.60 (2.007)	21.00 (4.543)	2.0	0.00	7.00 (2.700)	9.00 (3.047)	1.0	0.935 (0.77)	5.30 (2.353)	15.00 (3.795)	2.0

8.	Kranti-NC	5.00 (2.313)	3.47 (1.913)	51.33 (7.183)	3.0	0.00	6.00 (2.467)	14.00 (3.703)	2.0	2.5 (1.16)	4.73 (2.190)	32.67 (5.443)	3.0
9.	DRMRIJ-15-85	4.07 (2.133)	4.07 (2.040)	31.67 (5.663)	3.0	0.00	13.33 (3.640)	19.67 (4.360)	2.0	2.035 (1.07)	8.70 (2.840)	25.67 (5.012)	2.0
10.	RH1202	3.93 (2.100)	3.67 (2.020)	41.00 (6.263)	3.0	0.00	9.00 (3.077)	7.33 (2.730)	1.0	1.965 (1.05)	6.33 (2.548)	24.17 (4.497)	2.0
11.	NPJ-196	3.33 (2.190)	2.33 (1.680)	40.00 (6.250)	3.0	0.00	9.67 (3.170)	6.67 (2.670)	1.0	1.665 (1.10)	6.00 (2.425)	23.33 (4.460)	2.0
12.	RMM-09-10	4.40 (2.203)	3.07 (1.883)	43.00 (6.260)	3.0	0.00	11.67 (3.427)	4.67 (2.220)	1.0	2.2 (1.10)	7.37 (2.655)	23.83 (4.240)	2.0
13.	RRN-871	2.73 (1.783)	3.07 (1.880)	41.67 (6.437)	3.0	0.00	14.33 (3.833)	18.67 (4.250)	2.0	1.365 (0.89)	8.70 (2.857)	30.17 (5.343)	3.0
14.	KM-126	3.67 (2.010)	4.47 (2.097)	32.00 (5.657)	3.0	0.00	11.67 (3.413)	10.67 (3.330)	1.0	1.835 (1.01)	8.07 (2.755)	21.33 (4.493)	2.0
15.	SKM-1313	4.73 (2.493)	1.53 (1.393)	50.67 (7.093)	3.0	0.00	8.33 (2.957)	6.73 (2.663)	1.0	2.365 (1.25)	4.93 (2.175)	28.70 (4.878)	3.0
16.	RB-77	4.00 .(2.083)	2.73 (1.723)	36.33 (6.047)	3.0	0.00	11.67 (3.480)	7.67 (2.813)	1.0	2 (1.04)	7.20 (2.602)	22.00 (4.430)	2.0
17.	DRMR-15-5	5.018.7 (2.303)	2.60 (1.753)	50.00 (6.960)	3.0	0.00	9.67 (3.147)	7.00 (2.620)	1.0	2.535 (1.15)	6.13 (2.450)	28.50 (4.790)	3.0
18.	KMR-53-3	7.40 (2.717)	3.13 (1.880)	69.00 (8.233)	3.0	0.00	12.33 (3.487)	14.33 (3.777)	2.0	3.7 (1.36)	7.73 (2.683)	41.67 (6.005)	3.0
19.	RL-JEB-84	5.73 (2.413)	4.40 (2.213)	39.00 (6.257)	3.0	0.00	9.67 (3.107)	6.67 (2.580)	1.0	2.865 (1.21)	7.03 (2.660)	22.83 (4.418)	2.0
20.	Ganga	3.33 (1.923)	4.13 (2.147)	22.00 (4.663)	2.0	0.00	12.33 (3.563)	9.00 (3.010)	1.0	1.665 (0.96)	8.23 (2.855)	15.50 (3.837)	2.0
21.	RGN-73-JC	5.80 (2.393)	6.00 (2.547)	43.67 (6.497)	3.0	0.00	17.67 (4.220)	16.67 (3.877)	2.0	2.9 (1.20)	11.83 (3.383)	30.17 (5.187)	3.0
22.	RH-1209	4.93 (2.277)	4.60 (2.250)	32.00 (5.667)	3.0	0.00	18.00 (4.287)	13.67 (3.743)	2.0	2.465 (1.14)	11.30 (3.268)	22.83 (4.705)	2.0
23.	PR-2012-12	5.47 (2.437)	2.33 (1.630)	27.67 (5.277)	3.0	0.00	14.00 (3.773)	15.00 (3.840)	2.0	2.735 (1.22)	8.17 (2.702)	21.33 (4.558)	2.0
24.	RGN-385	4.47 (2.200)	1.40 (1.377)	25.00 (4.923)	2.0	0.00	10.67 (3.317)	9.00 (3.070)	1.0	2.235 (1.10)	6.03 (2.347)	17.00 (3.997)	2.0
25.	NPJ-195	5.33 (2.357)	3.47 (1.987)	40.67 (6.113)	3.0	0.00	12.00 (3.540)	12.00 (3.330)	1.0	2.665 (1.18)	7.73 (2.763)	26.33 (4.722)	3.0
26.	Maya-C	5.13 (2.287)	4.47 (2.187)	59.33 (7.697)	3.0	0.00	19.33 (4.313)	14.00 (3.700)	2.0	2.565 (1.14)	11.90 (3.250)	36.67 (5.698)	3.0
27.	SKJM-05	5.13 (2.340)	2.53 (1.740)	65.00 (7.973)	3.0	0.00	22.33 (4.727)	13.00 (3.663)	2.0	2.565 (1.17)	12.43 (3.233)	39.00 (5.818)	3.0
28.	SVJ-64	5.07 (2.353)	2.33 (1.623)	38.00 (5.983)	3.0	0.00	9.67 (3.153)	5.67 (2.480)	1.0	2.535 (1.18)	6.00 (2.388)	21.83 (4.232)	2.0
29.	Sitara-Sreenagar	2.87 (1.827)	3.87 (2.083)	34.67 (5.833)	3.0	0.00	12.33 (3.503)	1.67 (1.350)	1.0	1.435 (0.91)	8.10 (2.793)	18.17 (3.592)	2.0
30.	R H – 0923	3.27 (1.923)	3.93 (2.100)	41.33 (6.327)	3.0	0.00	22.00 (4.710)	4.33 (2.160)	1.0	1.635 (0.96)	12.97 (3.405)	22.83 (4.243)	2.0
31.	DRMR-15-16	3.00 (1.860)	2.93 (1.847)	47.33 (6.260)	3.0	0.00	11.00 (3.367)	6.33 (2.607)	1.0	1.5 (0.93)	6.97 (2.607)	26.83 (4.433)	3.0
32.	JMM-927-RC	5.20 (2.387)	3.40 (1.943)	41.00 (6.360)	3.0	0.00	14.67 (3.753)	6.00 (2.510)	1.0	2.6 (1.19)	9.03 (2.848)	23.50 (4.435)	2.0
33.	DRMR-15-47	5.00 (2.333)	5.13 (2.363)	59.33 (7.727)	3.0	0.00	14.33 (3.813)	9.67 (3.107)	1.0	2.5 (1.17)	9.73 (3.088)	34.50 (5.417)	3.0
34.	RGN-389	3.67 (2.023)	3.93 (2.073)	43.67 (6.570)	3.0	0.00	21.00 (4.493)	3.33 (1.953)	1.0	1.835 (1.01)	12.47 (3.283)	23.50 (4.262)	2.0
35.	RAURD-214	7.80 (2.863)	2.80 (1.803)	59.33 (7.553)	3.0	0.00	14.33 (3.833)	9.33 (3.133)	1.0	3.9 (1.43)	8.57 (2.818)	34.33 (5.343)	3.0
36.	DRMR-15-14	6.13 (2.543)	2.60 (1.757)	71.67 (8.237)	3.0	0.00	15.67 (4.020)	30.33 (5.407)	3.0	3.065 (1.27)	9.13 (2.888)	51.00 (6.822)	3.0
37.	DRMR-4001	5.13 (2.370)	2.93 (1.793)	58.33 (7.393)	3.0	0.00	13.33 (3.470)	14.67 (3.763)	2.0	2.565 (1.19)	8.13 (2.632)	36.50 (5.578)	3.0
38.	RGN-384	7.00 (2.637)	5.27 (2.397)	43.00 (6.540)	3.0	0.00	12.33 (3.220)	8.33 (2.967)	1.0	3.5 (1.32)	8.80 (2.808)	25.67 (4.753)	2.0
39.	NPJ-197	4.60 (2.243)	2.93 (1.827)	38.33 (6.190)	3.0	0.00	12.33 (3.557)	13.67 (3.717)	2.0	2.3 (1.12)	7.63 (2.692)	26.00 (4.953)	3.0
40.	RB-81	2.60 (1.747)	2.60 (1.760)	82.67 (9.103)	3.0	0.00	13.00 (3.643)	11.33 (3.393)	1.0	1.3 (0.87)	7.80 (2.702)	47.00 (6.248)	3.0
41.	NPJ-200	5.80 (2.417)	5.00 (2.300)	85.33 (9.057)	3.0	0.00	11.67 (3.480)	10.67 (3.190)	1.0	2.9 (1.21)	8.33 (2.890)	48.00 (6.123)	3.0
42.	DRMR-15-4	6.73 (2.660)	3.67 (2.037)	63.67 (7.920)	3.0	0.00	16.67 (4.093)	8.00 (2.903)	1.0	3.365 (1.33)	10.17 (3.065)	35.83 (5.412)	3.0

43.	KMR-L-15-644.	5.47 (2.417)	2.60 (1.753)	51.33 (7.047)	3.0	0.00	13.00 (3.583)	7.00 (2.653)	1.0	2.735 (1.21)	7.80 (2.668)	29.17 (4.850)	3.0
44.	PRD-2013-9	4.87 (2.307)	3.73 (2.047)	34.00 (5.677)	3.0	0.00	8.33 (2.953)	9.33 (3.023)	1.0	2.435 (1.15)	6.03 (2.500)	21.67 (4.350)	2.0
45.	DRMRIJ-15-66	6.87 (2.657)	4.27 (2.160)	55.00 (7.313)	3.0	0.00	7.67 (2.813)	5.67 (2.480)	1.0	3.435 (1.33)	5.97 (2.487)	30.33 (4.897)	3.0
48.	RH-1368	6.20 (2.583)	2.07 (1.563)	65.00 (7.887)	3.0	0.00	16.00 (4.050)	5.33 (2.407)	1.0	3.1 (1.29)	9.03 (2.807)	35.17 (5.147)	3.0
49	RGN-386	8.27 (2.913)	2.20 (1.640)	45.67 (6.667)	3.0	0.00	9.67 (3.173)	11.00 (3.367)	1.0	4.135 (1.46)	5.93 (2.407)	28.33 (5.017)	3.0
50.	RNWR09-3	5.93 (2.483)	3.80 (2.070)	40.33 (6.290)	3.0	0.00	13.33 (3.717)	17.00 (4.127)	2.0	2.965 (1.24)	8.57 (2.893)	28.67 (5.208)	3.0
51.	PRD-2013-2	6.27 (2.470)	4.07 (2.043)	76.00 (8.570)	3.0	0.00	13.67 (3.720)	11.00 (3.323)	1.0	3.135 (1.24)	8.87 (2.882)	43.50 (5.947)	3.0
SE.m (±)		0.237	0.203	0.867	-	-	0.441	0.465	-	-	0.24	0.49	-
C.D (p=0.05)		0.665	0.568	2.433	-	-	1.237	1.304	-	-	0.58	1.37	-

DAS = Days after sowing AII = Aphid infestation index ** Figures in the parenthesis are square root transformed values

3. Results

3.1 Results

Incidence of mustard aphid was recorded at 10 days interval after initiation of aphid population *i.e* 50, 60 and 70 DAS. The population of mustard aphid on different genotypes and aphid infestation index (AII) during 2016-2017 and 2017-2018 are presented in the (Table 4.) It is revealed from the observations that during 2016-17 crop season, aphid population was low both at 50 and 60 days after sowing, however, it is increased with progress of crop age at 70 DAS. Besides, no genotype was showed to be free from aphid infestation. Genotypes NPJ 194 and NPJ 200 showed significant lowest and highest infestation of aphid with an average population of 12.33 (1.0 AII) and 85.33 (3.0 AII) per 10 cm top central shoot, respectively. In contrast to previous year, during 2017-18 all the genotypes experienced no aphid population at 50 DAS, but at 60 and 70 DAS aphid population was recorded. Genotype Sitara-Sreenagar and DRMR-15-14 showed the significant lowest and highest aphid infestation with an average population of 1.67(1.0) AII and 30.33(3.0) AII per top 10 cm central shoot, respectively. It is evident from the pooled mean data of the two years that at 70 DAS the genotypes NPJ 194 was least preferred by aphid with an average population of 8.67 (1.0 AII) per 10 cm top central shoot while DRMR-15-14 encountered with 51 aphid population (3.0 AII) per 10 cm top central shoot.

Based on pooled mean data of aphid infestation index genotypes were categorized in to resistance or tolerance which are presented in the (Table 5). Hence the genotype NPJ 194(1.0 AII) distinguished to be highly resistant genotype, while DRMR-15-14 as susceptible (3.0 AII). Whereas, twenty genotypes grouped in to resistant category and thirty genotypes were categorized in to susceptible including DRMR-15-14. Thus, a careful examination of the results indicates that the highest population pressure of aphid was observed during 2016-17 and 2017-18. However, during 2017-18 aphid population was significantly lower yet a good number of genotypes had registered 1.0 (AII), in 2016-17 except NPJ-194 none of the genotypes attained 1.0 (AII). Considering the cumulative aphid infestation index in both the years the values ranged from 1.0 to 3.0 and in pooled mean data similar trend was observed. It is evident that no genotype is immune *i.e.* free from aphid attack having AII of 0.0 values.

Table 5: Categorization of mustard genotypes for their resistance/tolerance against mustard aphid, *Lipaphis erysimi* (Kalt.)

Category of resistant	Aphid infestation Index Scale	Genotypes
Highly resistant	Up to 1.0	NPJ-194
Resistant	1.1-2.0	Divya-88 (2.0), RL-JEB-52 (2.0), DRMRIJ-1585, Ganga (2.0), RGN-385(2.0), SVJ-64(2.0), Sitara-Sreenagar(2.0), RH-0923(2.0), JMM-927-RC(2.0), RGN-389(2.0), RGN-384(2.0), PRD-2013-9(2.0), RH-1202 (2.0), KM-126 (2.0), NPJ-196 (2.0), RMM-0910 (2.0), RB-77 (2.0), RL-JEB-84 (2.0), RH-1209 (2.0), PR-2012-12 (2.0)
Susceptible	2.1-3.0	TM-276(3.0), ROHINI(3.0), KMR-1514(3.0) PR-2012-9(3.0), KRANTHI-NC(3.0), RRN-871(3.0), DRMR-15-5(3.0), KMR-533(3.0), RGN-73-JC(3.0) NPJ195(3.0),MAYA-C(3.0), SKJM-05(3.0),DRMR1516(3.0),NPJ198(3.0), DRMR-15-47(3.0),RAURD214(3.0), DRMR-15-14(3.0), DRMR4001(3.0), NPJ-197(3.0), RB-81(3.0),NPJ-200(3.0),DRMR-159(3.0), KMR-L-15-6(3.0),DRMRIJ-15-66(3.0), RH-1368(3.0),RH-1325(3.0),RGN-386(3.0), RNWR-09-3(3.0), PRD-2013-2(3.0)
Highly susceptible	Above 3	Nil

Figures in parenthesis are Aphid Infestation Index values (AII) (0-5 scale), highest aphid infestation index in each genotype were considered for categorization.

4. Discussions

The present results are supported by Jat *et al.* (2007) [16] with lowest aphid, *L. erysimi* population (16/10 cm twig) on mustard variety Varuna (T-59), while it was highest on RZM (56.00), JM-1(48.28), GM-2 (48.27), RH-30 (24.92), PCR-7 (22.06) and BIO-902 (17.67). The result obtained from the present study are in the same line with Ghadge (2013) [17] by following genotypes GM-1 and GM-3 were found to be susceptible with 4.51 and 4.48 aphid infestation index per plant, respectively. The findings made by the present author are in conformation with Jat *et al.* (2007) [16]. On the basis of resistance or suceptibility Yadav *et al.* (2017) [18] examined 240 mustard accessions revealing that 16 accessions recorded as resistant, 83 accessions falling under moderately resistant category, 102 as susceptible and 39 accessions were found to be highly susceptible. The results of the experiment are in close agreement with Sarwar (2013) [19] concluded the genotypes NM-1, NM-2 and NM-3 were resistant with no aphid population While, genotypes DLJ-3, Chaliate and E-9 showed susceptible response to aphid infestation. The results are supported by Chaudary and Patel (2016) [20] examined the following varieties NRCM 120 (1.22), NRCM 353 (1.22) and Rayad 9602 (1.23) showed lowest aphid infestation index and proved to be highly resistant (HR) while, variety Vardan (1.42) also showed lower aphid index and grouped into resistant (R), whereas varieties GM-2 (1.78), HYOLA-401 (1.69), GM-3 (1.83) and GM-1 (1.80) were categorized as susceptible and highly susceptible. On the basis of aphid infestation index Pawar *et.al* (2009) [21] concluded the genotype SKM-0401 was the least susceptible with 1.47 aphid infestation index per plant followed by the genotypes SKM-0518, SKM-0445, SKM-0301 and SKM-0533 with 1.52, 1.53, 1.57 and 1.60 aphid infestation index, respectively. Besides, the genotype SKM-0531 attains 4.54 aphid infestation index per plant was found to be most susceptible followed by the genotypes GM-1, SKM-0529, GM-2, GM-3, SKM-0507 and SKM-0109, which recorded 4.52, 4.40, 4.37, 4.29, 4.22 and 4.11 aphid infestation index per plant, respectively.

5. Conclusion

From the experimental study the results showed that none of the germplasm were found to be immune and highly susceptible. In contrast, genotype NPJ- 194 was categorised as highly resistant and remaining twenty and thirty genotypes were categorised as resistant and susceptible to aphid infestation. Thus, it can be concluded that to tackle the problem of aphid attack on mustard crop choose the resistant genotypes for cultivation which is cost effective ecologically safe and socially acceptable in contrast to chemical control.

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7. References

1. Singh I, Brar KS, Ahuja TS. Effect of irrigation on the incidence of mustard aphid, *Lipaphis erysimi* (Kat.). Indian Journal of Entomology. 1994; 56:63-66.
2. Anonymous. Screening of *Brassica* species against pests and diseases, Joint Agresco Report. 2015, 45-46.
3. Bakhetia DRC, Sekhon BS. Insect pests and their management in rapeseed- cabbage and their natural enemies. Indian Journal of Entomology. 1989; 74:236-240.
4. Purwar JP, Singh RK, Mall P. Ecofriendly management of insect pests in rapeseed- mustard. Indian Farmers Digests, 2004; 37:34-35.
5. Bakhetia DRC. The insects: In Oilseed Brassicas in Indian Agriculture. (eds) Chopra VL, Sham Prakash. Har-Anand Publications, 1991.
6. Arora R. Major insect pests of rapeseed-mustard and their management. In IPM System in Agriculture Oilseeds. (Eds) Upadhyay RK, Mukharji KG, Rajak RL. Aditya Books Pvt. Ltd., New Delhi. 1999; 5:35-75.
7. Rai BK. Pest of oilseed crops in India and their control. Indian Council of Agricultural Research, New Delhi, 1976, 121.
8. Rohilla HR, Singh H, Kelra VK, Kharub SS. Losses caused by mustard aphid, *L. erysimi* (Kalt.) in different *Brassica* genotype. Proc. 7th International Rapeseed Congress, 1987; 5:1077-1083.
9. Begum S. Insect pests of oilseed crops of Bangladesh. Bangladesh Journal of Zoology. 1995; 23:153-158.
10. Biswas GC, Das GP. Population dynamics of the mustard aphid, *Lipaphis erysimi* (kalt.)(Hemiptera: Aphididae) in relation to weather parameters. Bangladesh Journal of Entomology. 2000; 19:15-22.
11. Husain M, Begum MA. Number of insect pests attack mustard. Journal of Agriculture Research. 2009, 46,
12. Bakhetia DRC. Chemical control of *Lipaphis erysimi* (Kaltenbach) on rapeseed and mustard crop in Punjab. Journal of Research Punjab Agricultural University. 1984; 21:63-75.
13. Verma SN, Singh OP. Estimation of avoidable losses to mustard by the aphid, *Lipaphis erysimi* in Madhya Pradesh. Indian Journal of Plant Protection. 1987; 15:87-89.
14. Farooq A, Tasawar Z. Varietal Screening of *Brassica* spp. against aphids in Southern Punjab (Pakistan). Pakistan Journal of Zoology. 2007; 39:195-198.
15. Bakhetia DRC, Sandhu, RS. Differential response of *Brassica* species /varieties to aphids, *Lipaphis erysimi* (Kalt.) infestation. Journal of Research Punjab Agricultural University. 1973; 10:272-279.
16. Jat SL, Jat BL, Choudhary RK. Screening of different mustard varieties for resistance against mustard aphid, *Lipaphis erysimi* (Kalt). Indian Journal of Entomology. 2007; 36:69-72.
17. Ghadage SM. Varietal screening, bio-efficacy of biopesticides against *L. erysimi* in mustard and their toxic effect to its coccinellid predator, Ph. D. Thesis, Junagadh Agricultural University, Junagadh, Gujarat, 2013.
18. Yadav U, Kumar KR, Mishra VJ. Screening of different varieties /accessions of mustard *(Brassica juncea)* against *Lipaphis erysimi* (kalt.) under natural conditions. Plant Archives. 2017; 17:666-671.
19. Sarwar M. Study on differences in some new mustard *Brassica campestris* L. genotypes for having resistance and susceptibility feedback infected with aphid *Myzus persicae* (Sulzer) (Homoptera: Aphididae). Global Journal of Scientific Researches. 2013; 1:80-84.
20. Chaudhary RI, Patel CC. Screening of *Brassica* germplasm for resistance to mustard aphid, *Lipaphis erysimi* (kalt.) International Journal of Plant Protection. 2016; 9:62-67.
21. Pawar VR, Bapodra JG, Joshi MD, Gaikwad SE. Relative susceptibility of different genotypes of mustard against aphid, *Lipaphis erysimi* (Kaltenbach). Agricultural Science Digest. 2009; 29:230-231.