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Field screening of mustard cultivars for resistance against aphids, *Lipaphis erysimi* (Kalt.)

Sandhya Sinha, Abhishek Shukla and RB Yadav

Abstract
The experiments were conducted in Randomized Block Design, during 2018-19 and 2019-20, to workout relative susceptibility of 45 mustard cultivars to aphids (*Lipaphis erysimi* Kalt.) on the basis of mean aphid index values, as per the methodology described by Patel *et al.*, 1995 [10]. The mean aphid index values were subjected to analysis of variance at 5% level of significance to compare different cultivars. Cultivars Durgamani (0.23), RP-9 (0.27), Aravali (0.28), RVM-2 (0.29) and RH-406 (0.31) recorded lowest mean aphid index values (more than 0.18 but less than 0.34) and were categorized as resistant. Cultivars Geeta, Jaganath, RVM-3, DRMRIJ-31, RVM-1, JTC-1, Bhagirathi, PC-5, Maya, GSL-1, Gujarat mustard-2, Ashirwad, BR-40, JM-3, Gujarat mustard-1, IJ-31, Kiran, Kranti, SEJ-2, China Kovind, Jawahar mustard-2, Jawahar mustard-1, JM-2, Shradda, GSC-7, NRCHB-101, RH-749, RGN-73, Basanti, NRCDR-2 were found to be moderately resistant.

Keywords: Screening, mustard cultivars, *Lipaphis erysimi*, mean aphid index value

Introduction
Rapeseed-mustard (Brassica *spp.*) are major *rabi* oilseed crops. During 2016-17, it was grown over an area of 60, 74,000 hectares with a production of 79, 17,000 tonne/hectare and productivity of 1134 kg / hectare. In Madhya Pradesh mustard crop is cultivated on an area of about 7, 08,000 hectares with the production of 9,20,000 tonnes / hectare and productivity of 1299 kg / hectare (Anonymous, 2019) [2].

It is an important oilseed crop extensively grown in India. It is usually rich in oil content (40%). Brassica is the main source of edible oil after groundnut in both productivity and production (Ali *et al.*, 2010) [1].

Among the biotic stresses, mustard aphid, *Lipaphis erysimi* (Kalt.) is considered as most important pest of cruciferous crops worldwide, and is a major constraint for the production of India. The infestation of *L. erysimi* varies from 10-90% depending upon the climactic conditions, and crop growth stages (Dhillon *et al*., 2018) [5]. It is a specialist type of feeder, and the oviparity (migration and host finding), viviparity (establishment and multiplication), short generation time and parthenogenesis make it difficult to control.

In case of severe infestation leaves become curled, plant fails to develop pods, and young pods, if developed, do not mature and produce unhealthy seeds (Bakhetia, 1983; Malik and Anand, 1984) [3,9]. Although several aphid management tools like adjustment of sowing dates, yellow sticky traps, biological control etc. are being talked about but it is currently being managed by insecticide applications. Due to health and environment issues with insecticides, there is an urgent need for eco-friendly approaches of pest control like host plant resistance (HPR) (Chaudhary and Patel, 2016) [4]. Hence, the present study was taken up to identify the sources of aphid resistance in different mustard cultivars that can be utilized in the breeding programmers.

Materials and Methods
Field experiments were carried out to study the mean aphid index on 45 cultivars of mustard crop at Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh during the rabi season of year of 2018-19 and 2019-20. The seeds were collected from Directorate of Rapeseed- Mustard Research (DRMR), Bharatpur, Rajasthan and Zonal Agriculture Research Station, Morena, Madhya Pradesh. The seeds were sown in Randomize Block Design (RBD) in second week of November of 2018 and 2019, with two rows of 5 m length. Row to row and plant to plant distance were 30 cm and 10 cm, respectively.

Table 1: Scoring pattern based on mean aphid index The infestation rating of mustard aphids was done on the basis of infestation in 5 randomly selected plants in each cultivar by following 0-5 index method as per the methodology described by Patel *et al.*, 1995 [10].

Grading No.	Criteria
0	Plants were completely free from aphids
1	Plants having 1-12 aphids per twig but no symptoms of damage
2	Plant having aphid colonies (13-25 aphids) on few twigs but no curling of shoot or leaves
3	Plant 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 branches start drying
5	Plant is completely dried immaturely due to aphid infestation

The mean aphid index was worked out by using following equation:

$$\text{Mean aphid index} = \frac{0N+1N+2N+3N+4N+5N}{Total\ number\ of\ aphid\ observed}$$

Where 0, 1, 2, 3, 4 and 5 are the grading numbers
N= Number of plant showing respective grading number

Statistical analysis

Construction of categorization of aphid index

The aphid index categorization had been worked out on the pointes of inflexion of the normal distribution, as μ, $\mu+\sigma$, $\mu+2\sigma$, $\mu+3\sigma$, $\mu-\sigma$, $\mu-2\sigma$, $\mu-3\sigma$ respectively. The five categories had been shown as given below:

$\mu - 3\sigma < HR < \mu - 2\sigma$

$\mu - 2\sigma < R < \mu - \sigma$

$\mu - \sigma < MR < \mu$

$\mu < MS < \mu + \sigma$

$\mu + \sigma < S < \mu + 2\sigma$

$\mu + 2\sigma < HS < \mu + 3\sigma$

Where,
μ = Mean aphid index value
σ = Standard deviation of mean aphid index value
HR= Highly resistant
R= Resistant
MR= Moderately resistant
MS= Moderately susceptible
S= Susceptible
HS= Highly susceptible

On the other hand, if the categories belong to upper side of the normal distribution and one point below of the distribution than it indicated that our aphid index should be in positively skewed direction. The mean aphid index values were subjected to analysis of variance at 5% level of significance to compare different cultivars.

Result and Discussion

Based on the two years pooled data, the categorization of various cultivars was done based on damage symptoms and mean aphid index values. No cultivars were found fit under highly resistant category (mean aphid index values less than 0.18). Lowest aphid index was recorded on five cultivars namely Durgamani (0.23), followed by RP-9 (0.27), Aravali (0.28), RVM-2 (0.29) and RH-406 (0.31), which were found under resistant category, showing mean aphid index values of more than 0.18 but less than 0.34.

Thirty cultivars namely Geeta (0.39), Jaganath (0.41), RVM-3 (0.41), DRMRIJ-31 (0.42), RVM-1 (0.42), JTC-1 (0.43), Bhagirathi (0.44), PC-5 (0.44), Maya (0.45), GSL-1 (0.46), Gujarat mustard-2 (0.46), Ashirwad (0.47), BR-40 (0.47), JM-3 (0.47), Gujarat mustard-1 (0.48), IJ-31 (0.48), Kiran (0.48), Kranti (0.49), SEJ-2 (0.49), China Kovind (0.50), Jawahar mustard-2 (0.51), Jawahar mustard-1 (0.53), JM-2 (0.54), Shradda (0.55), GSC-7 (0.57), NRCHB-101 (0.57), RH-749 (0.57), RGN-73 (0.58), Basanti (0.63), and NRCDR-2 (0.63), were found moderately resistant, showing mean aphid index values of more than 0.34 but less than 0.66.

Six cultivars namely Lakshmi (0.69), Swarn Jyoti (0.71), Varuna (0.71), Krishna (0.75), NRC-HB-506 (0.75), and BSH-1(0.80) were found moderately susceptible, showing mean aphid index values of more than 0.66 but less than 0.82.

YSH-401 (0.82), Rohini (0.84), NC-1(0.86), and Pusa Bold (0.97) were found under the susceptible category, showing values of less than 0.82 but more than 0.98. No cultivar was found under the highly susceptible category a scale of more than 0.98.

Table 2: Mean* aphid index value of mustard cultivars under field condition during 2018-19 and 2019-20 crop seasons

Sr. No.	Cultivars	Mean aphid index value		pooled
		2018-19	2019-20	
1	Aravali	0.31* (0.88)**	0.25 (0.86)	0.28 (0.88)
2	Ashirwad	0.44 (0.96)	0.50 (1.00)	0.47 (0.98)
3	Basanti	0.63 (1.04)	0.64 (1.06)	0.63 (1.06)
4	Bhagirathi	0.38 (0.92)	0.50 (1.00)	0.44 (0.96)
5	BR-40	0.43 (0.94)	0.52 (1.00)	0.47 (0.98)
6	BSH-1	0.75 (1.09)	0.85 (1.16)	0.80 (1.14)
7	China Kovind	0.51 (1.00)	0.50 (1.00)	0.50 (1.00)
8	DRMRIJ-31	0.40 (0.92)	0.45 (0.97)	0.42 (0.95)
9	Durgamani	0.22 (0.70)	0.24 (0.86)	0.23 (0.85)
10	Geeta	0.35 (0.90)	0.43 (0.96)	0.39 (0.94)
11	GSC-7	0.57 (0.99)	0.58 (1.03)	0.57 (1.03)
12	GSL-1	0.43 (0.94)	0.50 (1.00)	0.46 (0.97)
13	Gujarat mustard-1	0.47 (0.98)	0.50 (1.00)	0.48 ()0.98
14	Gujarat mustard-2	0.41 (0.93)	0.51 (1.00)	0.46 (0.97)
15	IJ-31	0.46 (0.96)	0.51 (1.00)	0.48 (0.98)
16	Jaganath	0.43 (0.94)	0.40 (0.94)	0.41 (0.95)

17	Jawahar mustard-1	0.53 (0.99)	0.54 (1.01)	0.53 (1.01)
18	Jawahar mustard-2	0.53 (0.99)	0.50 (1.00)	0.51 (1.00)
19	JM-2	0.52 (0.99)	0.56 (1.02)	0.54 (1.01)
20	JM-3	0.43 (0.94)	0.51 (1.00)	0.47 (0.98)
21	JTC-1	0.42 (0.93)	0.45 (0.97)	0.43 (0.96)
22	Kranti	0.45 (0.95)	0.54 (1.01)	0.49 (0.99)
23	Kiran	0.43 (0.93)	0.54 (1.01)	0.48 (0.98)
24	Krishna	0.74 (1.09)	0.76 (1.12)	0.75 (1.11)
25	Lakshmi	0.71 (1.08)	0.67 (1.08)	0.69 (1.09)
26	Maya	0.41 (0.93)	0.49 (0.99)	0.45 (0.97)
27	NC-1	0.83 (1.11)	0.89 (1.17)	0.86 (1.16)
28	NRCDR-2	0.60 (1.03)	0.67 (1.08)	0.63 (1.06)
29	NRCHB-101	0.55 (0.99)	0.60 (1.04)	0.57 (1.03)
30	NRC-HB-506	0.71 (1.06)	0.79 (1.13)	0.75 (1.11)
31	PC-5	0.41 (0.93)	0.47 (0.98)	0.44 (0.96)
32	Pusa Bold	0.95 (1.17)	1.00 (1.22)	0.97 (1.21)
33	RGN-73	0.52 (0.99)	0.64 (1.06)	0.58 (1.03)
34	RH-406	0.29 (0.87)	0.33 (0.90)	0.31 (0.90)
35	RH-749	0.52 (0.99)	0.62 (1.05)	0.57 (1.03)
36	Rohini	0.78 (1.09)	0.91 (1.18)	0.84 (1.15)
37	RP-9	0.30 (0.88)	0.25 (8.86)	0.27 (0.87)
38	RVM-1	0.37 (0.92)	0.47 (0.98)	0.42 (0.95)
39	RVM-2	0.30 (0.88)	0.28 (0.88)	0.29 (0.88)
40	RVM-3	0.38 (0.92)	0.44 (0.96)	0.41 (0.95)
41	SEJ-2	0.43 (0.95)	0.56 (1.02)	0.49 (0.99)
42	Shradda	0.53 (0.99)	0.57 (1.03)	0.55 (1.02)
43	Swarn Jyoti	0.69 (1.07)	0.73 (1.12)	0.71 (1.10)
44	Varuna	0.71 (1.08)	0.72 (1.10)	0.71 (1.10)
45	YSH-406	0.77 (1.13)	0.87 (1.17)	0.82 (1.14)
	SE(m)±	0.077	0.072	0.074
	C.D. at 5%	0.219	0.203	0.211

*Mean of five samples and three replications

**Figures in parentheses are square root ($\sqrt{x+0.5}$) transformed values

Table 3: Categorization of different cultivars of mustard for their susceptibility to *L. erysimi* during 2018-19 and 2019-20

S. No.	Category	MAIV*Scale and SD** (based on normal distribution values)	Cultivars
1	Highly resistant	<0.18	
2	Resistant	>0.18 but<0.34	Durgamani, RP-9, Aravali, RVM-2, RH-406
3	Moderately resistant	>0.34 but<0.66	Geeta, Jaganath, RVM-3, DRMRIJ-31, RVM-1, JTC-1, Bhagirathi, PC-5, Maya, GSL-1, Gujarat mustard-2,Ashirwad, BR-40, JM-3, Gujarat mustard-1, IJ-31, Kiran, Kranti, SEJ-2,China Kovind, Jawahar mustard-2, Jawahar mustard-1, JM-2, Shradda, GSC-7, NRCHB-101, RH-749, RGN-73, Basanti,NRCDR-2
4	Moderately susceptible	>0.66 but<0.82	Lakshmi, Swarn Jyoti, Varuna, Krishna, NRC-HB-506, BSH-1
5	Susceptible	>0.82 but<0.98	YSH-401,Rohini,NC-1,Pusa Bold
6	Highly susceptible	>0.98	

*Mean aphid index value (MAIV) = 0.50 (μ)

** Standard deviation (SD) = 0.16 (σ)

Several other workers also used the method of calculation of mean aphid index and classified mustard cultivars in to different resistance categories like Chaudhary and Patel (2016) [4] screened 60 lines of Indian mustard (*Brassica juncea* L.) for their resistance to mustard aphid, *Lipaphis erysimi* (Kaltenbach) on the basis of aphid infestation index (A.I.I.). Varieties NRCM 120, NRCM 353 and Rayad 9602 showed lowest aphid index (1.22, 1.22, and 1.23, respectively) and proved to be highly resistant (HR), Kumari *et al.* (2018) [7] evaluated seventy seven mustard germplasm against *Lipaphis erysimi*. IC491089 was tolerant had least number of aphid population (21.3-30.7 aphid/top 10 m of central shoot/plant). IC385703 was highly susceptible and had 87.0-195.3 aphid/top 10 cm of central shoot/plant. Based on aphid infestation index, 4, 3, 54 and 16 accession of mustard were categorized under tolerant, moderately tolerant, susceptible and highly susceptible categories, Khedkar *et al.* (2011) [6] screened seventeen genotypes/varieties of mustard (*Brassica juncea* L.) GM-2, GM-1 and GM-3 recorded low aphid index (1.18, 1.26 and 1.34) and provide to highly resistant. The highest (2.61) aphid index was recorded from genotype BIO-902 and was at par with varieties Pusa bold (2.52) and Krishna (2.46) followed by PM-67, Varuna and PCR-7 (2.25) and Yadav *et al.* (2017) [10] evaluated 240 B. juncea accessions for resistance/tolerance against mustard aphid. 16 accessions recorded as resistant, 83 accessions under moderately resistant category, 102 accessions as susceptible accessions were found highly susceptible.

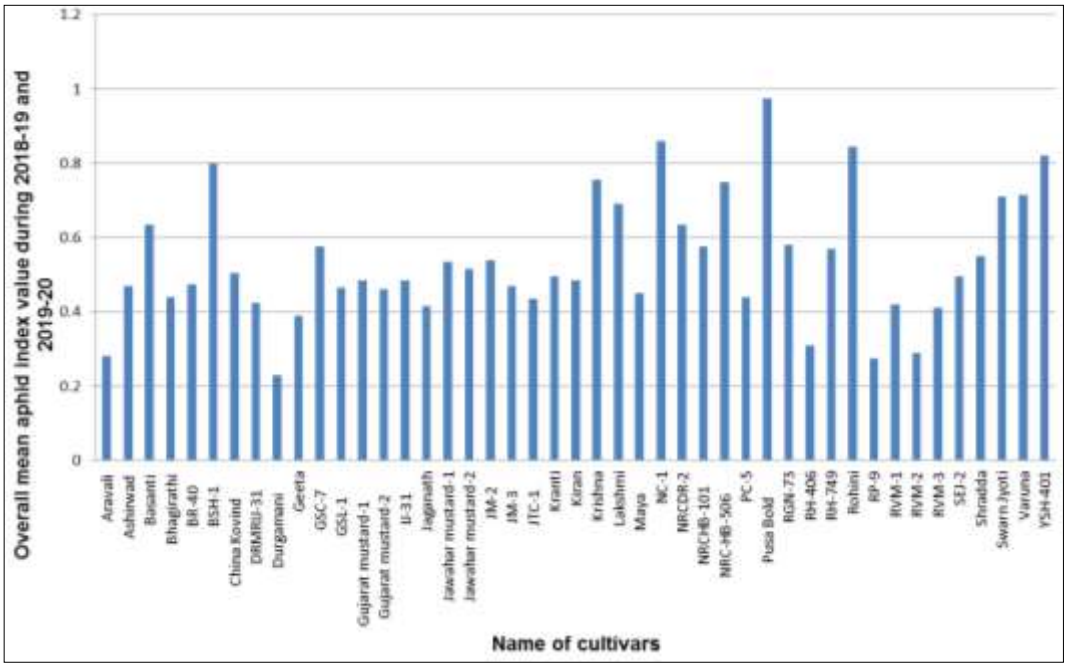

Fig 1: Mean aphid index value on different cultivars of mustard during 2018-19 and 2019-20 crop seasons

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References

1. Ali A, Rizvi PQ, Khan FR. Bio-efficacy of some plant leaf extracts against mustard aphid, *Lipaphis erysimi* Kalt. On Indian mustard, *Brassica juncea*. Journal of Plant Protection Research 2010;50:130-132.
2. Anonymous.www.indiastat.com. 2019
3. Bakhetia DRC. Losses in rapeseed and mustard due to *Lipaphis erysimi* (Kalt.) in India-a literature study. Proc Int Rapeseed Congr 1983;6:16.
4. Chaudhary RI, Patel CC. Screening of Brassica germplasm for resistance to mustard aphid, *Lipaphis erysimi* (Kalt.). International Journal of Plant Protection 2016;9(1):62-67.
5. Dhillon MK, Singh N, Tanwar AK, Yadava DK, Vasudeva S. Standardization of screening techniques for resistance to *Lipaphis eysimi* (Kalt.) in rapeseed- mustard under field conditions. Indian Journal of Experimental Biology 2018;56:674-685.
6. Khedkar AA, Patel MG, Bharpoda TM. Screening of different varieties/genotypes for their susceptibility against mustard aphid, *Lipaphis erysimi* (Kaltenbach). Current Biotica 2011;5(3):359-363.
7. Kumari A, Goswami TN, Vishwakarma R, Kishore C. Evaluation of mustard germplasm against aphid *Lipaphis erysimi* (Kalt.). Indian Journal of Entomology 2018;80(4):1456-1459.
8. Malik RS, Anand IJ. Effect of aphid infestation on the oil yielding attributes in Brassica. Journal of Oilseed Research 1984;1:147.
9. Patel MG, Patel JR, Borad PK. Comparative efficacy and economics of various insecticides against aphids, *Lipaphis erysimi* (Kaltenbach) on mustard in Gujarat. Indian Journal of Plant Protection 1995;23:217-218.
10. Yadav U, Kumar KR, Mishra UK. Screening of different varieties/accessions of mustard (*Brassica juncea*) against *Lipaphis eysimi* (Kalt.) under natural conditions. Plant Archives 2017;17(1):666-671.