

Evaluation of commercial mustard varieties against mustard aphid (*Lipaphis erysimi*) Kalt in grid region of Madhya Pradesh, India

ABSTRACT

Field experiment was conducted at research farm, RVSKVV, Gwalior to evaluate 20 varieties of mustard against aphid *Lipaphis erysimi* Kalt. During rabi season of 2016-17 and 2017-18. The population of pest were recorded from initiation of aphid infestation at 44 DAS (Days after sowing) and continued till maturity of the crop at weekly intervals. The findings showed that the RMM-09-1-1-2 variety had the lowest mean population of plants counted on the 10 cm apical twigs of ten randomly chosen plants, followed by JM-3, JM-1, and MAYA. However, variety NRCDR-2 had the largest population, followed by RVM-2 and RGN-73.

Key words: Mustard, varieties, aphid, host plant resistance, *Lipaphis erysimi*, Pesticides

Introduction

Indian mustard, *Brassica juncea* Linn. commonly referred as sarson or rai (Hindi), mohari (Marathi) and Sasive (Kannada) is one among the important edible oilseed crops grown within the country. Mustard is an integral part of the human diet with oil content ranging from 32-40% and protein content ranging from 15-17% (Dash and Konarand 2019).

From germination to harvest, the mustard crop is plagued by insect pests and diseases. According to Sachan and Purwar (2007), the mustard aphid, *Lipaphis erysimi*; mustard sawfly, *Athalia proxima*; painted bug; *Bagrada cruciferum*; leaf minor, *Chromatomyia horticola*; and Bihar hairy caterpillar, *Spilarctia oblique* are among the insect species that attack mustard.

The mustard aphid is the most damaging insect, causing 24.5 to 68.00 percent yield loss (Parmar et al., 2007; Kular and Kumar 2011; Sharma et al., 2019; Kumar, 2017) and 3.38 to 8.14 percent oil loss (Sharma et al., 2019) while Patel et al. (2004) reporting a 97.40 percent yield loss.

Several techniques have been modified to handle insect pests on mustard crop; among these pest control methods, chemical control has been widely used for insect pest control. Pesticides have certain drawbacks, such as adverse effects on natural enemies and pollution of the environment; as a result, the safest option for pest control should be the use of resistant varieties. Plants that are immune to insect pests have the distinct benefit of providing the crop with built-in insect control. Plant resistance is caused by a variety of factors like non-preference, antibiosis, and insect tolerance, which are all biochemical in nature (Kher and Rataul 1991). Varietal tolerance has been prioritised in the Integrated Pest Management program among the various control methods. In view of the above, the present investigation was designed.

Material and methods

Field experiment was carried out for determining relative resistance of twenty genotypes Indian mustard during *rabi* season of 2016-17 and 2017-18. Seed of these genotypes were obtained from the zonal agriculture research station Morena. The experiment was carried out in Randomized block design with three replications. Screening of strains was done on the basis of aphid infestation index at the flowering and pod setting of each genotype. Aphid infestation indices were calculated as described by Bakhettia and Sandhu (1973).

RESULT AND DISSCUSSION

The significant difference among the evaluated varieties was reported with respect to the aphid populations per plant and is presented in table 1 and 2. Studies on varietal screening on mustard indicated the onset of incidence of aphid populations was started from 41 days after sowing and population prevailed till harvest of the crop.

Aphid infestation first appeared in mustard crop after 41 days after sowing at this stage aphid population per plant ranged from 19.70 to 51.83 adult/nymphs per plant and minimum population (19.70) of aphid was recorded in RMM-09-1-1-2 variety which was statistically at par with all other varieties, while maximum population (51.83) of aphid and significantly higher than all other varieties was recorded on RM-WR-09-5. After this aphid population gradually increases from next observation to continue up to 72 days after sowing at this stage highest aphid population was observed in RGN-73 variety, while the lowest population was observed in JM-3 and then aphid

population gradually decreases till the last observation at 114 days after sowing. Similar studies supported by the findings of Annu *et al.*, (2018) and Chatt *et al.*, (2005).

In the present experiment screened varieties of mustard, none of these twenty variety were found unaffected by aphid but NRC-HB-506, MAYA and KRANTI were find out the resistant variety for aphid infestation. JM-1, JM-2, RVM-1, RVM-2, JM-4, RMM-09-1-2, RM-WR-09-3, RM-WR-09-5, RH-406, RH-749, RGN-73 and KRANTI were find out the moderately resistance, while JMM-927, JM-3, NRCDR-2, NRC-HB-506 and RMM-09-7 were find out the susceptible varieties. Similar result also observed by **Chand** *et al.*, (2023) and **Dey** *et al.*, (2005).

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- 1.
- 2.
- 3.

Table 1: Aphid population on different mustard varieties during *Rabi* 2016-17.

Protected 2017												
Variety	Population count no/10cm shoot Standard week and date of observation											
	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS	86 DAS	93 DAS	100 DAS	107 DAS	114 DAS	Overall Mean
JMM-927	25.40 (5.09)	68.40 (8.3)	93.53 (9.7)	108.77 (10.45)	87.93 (9.4)	106.17 (10.33)	103.93 (10.22)	43.70 (6.65)	17.53 (4.24)	0.37 (0.93)	0.27 (0.86)	59.64 (7.75)
JM-1	29.23 (5.45)	35.70 (6.01)	87.20 (9.36)	121.63 (11.05)	105.30 (10.29)	85.87 (9.29)	78.20 (8.86)	38.63 (6.25)	19.37 (4.45)	2.17 (1.62)	0.13 (0.79)	54.86 (7.44)
JM-2	31.63 (5.67)	76.53 (8.78)	82.53 (9.11)	132.23 (11.52)	98.20 (9.93)	96.57 (9.85)	101.63 (10.1)	74.13 (8.64)	3.93 (2.11)	0.43 (0.96)	0.10 (0.77)	63.45 (8)
JM-3	20.47 (4.58)	35.23 (5.98)	54.30 (7.4)	114.57 (10.73)	75.77 (8.73)	97.77 (9.91)	100.87 (10.07)	64.27 (8.05)	19.57 (4.46)	1.67 (1.47)	0.90 (1.16)	53.22 (7.33)
RVM-1	24.23 (4.97)	49.87 (7.09)	98.47 (9.94)	117.73 (10.87)	121.50 (11.04)	125.27 (11.21)	110.53 (10.54)	68.53 (8.31)	37.17 (6.14)	8.33 (2.97)	1.17 (1.28)	69.35 (8.36)
RVM-2	39.13 (6.3)	83.50 (9.16)	113.40 (10.67)	125.60 (11.23)	136.37 (11.7)	144.67 (12.05)	127.93 (11.33)	89.20 (9.47)	37.57 (6.16)	0.10 (0.77)	0.03 (0.73)	81.59 (9.06)
JM-4	33.37 (5.82)	49.33 (7.05)	87.57 (9.38)	133.40 (11.57)	142.13 (11.94)	153.53 (12.41)	146.53 (12.12)	44.10 (6.68)	10.23 (3.26)	2.07 (1.6)	0.03 (0.73)	72.94 (8.57)
NRCDR-2	37.83 (6.19)	98.20 (9.93)	99.23 (9.99)	138.73 (11.8)	156.73 (12.54)	159.23 (12.64)	136.23 (11.69)	93.80 (9.71)	12.37 (3.57)	0.03 (0.73)	0.03 (0.73)	84.77 (9.23)
NRC-HB-506	39.53 (6.33)	54.07 (7.39)	76.40 (8.77)	143.13 (11.98)	148.60 (12.21)	157.83 (12.58)	121.60 (11.05)	78.60 (8.89)	23.57 (4.9)	1.87 (1.54)	3.73 (2.06)	77.18 (8.81)
NRC-HB-101	45.23 (6.76)	66.40 (8.18)	81.77 (9.07)	119.80 (10.97)	123.17 (11.12)	136.47 (11.7)	98.47 (9.95)	37.40 (6.15)	11.27 (3.43)	4.30 (2.19)	0.47 (0.98)	65.88 (8.15)

*Figures in parentheses indicated $\sqrt{x + 0.5}$ transformed value; DAS- Days After Sowing

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Variety	Population count no/10cm shoot Standard week and date of observation											Overall Mean
	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS	86 DAS	93 DAS	100 DAS	107 DAS	114 DAS	
RMM-09-7	34.30 (5.9)	69.80 (8.38)	69.47 (8.36)	113.20 (10.66)	127.77 (11.33)	98.30 (9.94)	104.20 (10.23)	42.07 (6.52)	14.73 (3.89)	6.73 (2.69)	1.07 (1.25)	61.97 (7.9)
RMM-09-1-1-2	19.70 (4.49)	47.23 (6.91)	72.53 (8.54)	87.30 (9.37)	99.17 (9.98)	78.77 (8.9)	87.50 (9.38)	59.90 (7.77)	18.37 (4.34)	0.43 (0.96)	0.30 (0.88)	51.93 (7.24)
RM-WR-09-3	46.37 (6.84)	79.50 (8.94)	98.90 (9.97)	94.20 (9.73)	106.93 (10.36)	93.23 (9.68)	97.30 (9.89)	34.23 (5.89)	16.70 (4.15)	0.23 (0.86)	0.03 (0.73)	60.69 (7.82)
RM-WR-09-5	51.83 (7.23)	82.93 (9.13)	109.43 (10.48)	100.80 (10.06)	118.47 (10.91)	123.07 (11.12)	99.27 (9.99)	67.43 (8.24)	27.93 (5.33)	11.17 (3.41)	0.43 (0.95)	72.07 (8.52)
RH-406	29.10 (5.44)	34.57 (5.92)	105.07 (10.27)	152.60 (12.37)	163.60 (12.81)	142.33 (11.95)	114.60 (10.73)	33.13 (5.8)	43.20 (6.61)	0.03 (0.73)	0.00 (0.71)	74.38 (8.65)
RH-749	37.50 (6.16)	73.43 (8.6)	95.63 (9.8)	140.23 (11.86)	148.20 (12.19)	126.23 (11.26)	89.40 (9.48)	46.47 (6.85)	11.17 (3.38)	7.43 (2.81)	0.67 (1.08)	70.58 (8.43)
RGN-73	33.13 (5.79)	67.13 (8.22)	106.10 (10.32)	153.80 (12.42)	164.80 (12.86)	159.87 (12.66)	96.47 (9.84)	71.87 (8.51)	31.10 (5.62)	0.30 (0.89)	0.03 (0.73)	80.42 (9)
MAYA	27.40 (5.28)	54.33 (7.4)	71.27 (8.47)	117.20 (10.85)	123.13 (11.12)	101.43 (10.1)	90.77 (9.55)	10.23 (3.27)	8.50 (2.99)	0.10 (0.77)	0.00 (0.71)	54.94 (7.45)
ROHINI	30.63 (5.58)	57.80 (7.64)	89.40 (9.48)	158.20 (12.6)	164.53 (12.85)	169.80 (13.05)	99.53 (10)	52.07 (7.25)	14.83 (3.92)	0.03 (0.73)	0.13 (0.79)	76.09 (8.75)
KRANTI	22.07 (4.75)	64.20 (8.04)	95.70 (9.81)	110.70 (10.54)	112.20 (10.62)	110.53 (10.54)	87.63 (9.39)	64.20 (8.04)	19.30 (4.45)	1.50 (1.41)	0.00 (0.71)	62.55 (7.94)
SE(m)	0.13	0.115	0.112	0.092	0.081	0.082	0.106	0.115	0.165	0.074	0.079	0.033
CD (5%)	0.37	0.33	0.319	0.264	0.231	0.233	0.304	0.329	0.473	0.213	0.225	0.096

Unprotected 2017												
Varieties	Population count no/10cm shoot Standard week and date of observation											
	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS	86 DAS	93 DAS	100 DAS	107 DAS	114 DAS	Overall Mean
JMM-927	28.37 (5.37)	65.73 (8.14)	115.47 (10.77)	136.67 (11.71)	157.17 (12.56)	177.10 (13.33)	112.37 (10.62)	54.33 (7.4)	21.23 (4.66)	2.43 (1.71)	0.80 (1.11)	79.24 (8.93)
JM-1	21.43 (4.68)	39.63 (6.33)	92.10 (9.62)	112.17 (10.61)	155.47 (12.49)	143.20 (11.99)	91.20 (9.57)	43.43 (6.63)	21.13 (4.63)	7.23 (2.78)	0.20 (0.83)	66.11 (8.16)
JM-2	44.23 (6.69)	73.07 (8.58)	129.20 (11.39)	152.33 (12.36)	162.67 (12.77)	181.07 (13.47)	110.83 (10.55)	10.20 (3.23)	5.87 (2.49)	1.07 (1.23)	1.00 (1.17)	79.23 (8.93)
JM-3	23.53 (4.9)	37.17 (6.13)	67.37 (8.24)	125.77 (11.24)	133.43 (11.57)	163.80 (12.82)	198.23 (14.1)	46.63 (6.86)	23.17 (4.86)	12.20 (3.52)	1.67 (1.47)	75.72 (8.73)
RVM-1	26.20 (5.16)	51.63 (7.22)	109.83 (10.5)	129.93 (11.42)	142.20 (11.95)	158.90 (12.63)	131.07 (11.47)	70.17 (8.41)	40.50 (6.4)	4.27 (2.18)	1.83 (1.46)	78.78 (8.9)
RVM-2	42.17 (6.53)	79.17 (8.93)	138.70 (11.8)	159.60 (12.65)	168.27 (12.99)	174.63 (13.23)	194.37 (13.96)	143.50 (12)	37.60 (6.17)	1.13 (1.27)	0.00 (0.71)	103.56 (10.2)
JM-4	23.53 (4.9)	44.07 (6.67)	90.60 (9.54)	136.23 (11.69)	171.30 (13.11)	59.53 (7.75)	14.27 (3.82)	32.07 (5.69)	10.80 (3.36)	4.17 (2.16)	1.10 (1.23)	53.42 (7.34)
NRCDR-2	33.17 (5.8)	97.93 (9.92)	149.37 (12.24)	162.37 (12.76)	178.43 (13.38)	198.17 (14.09)	225.23 (15.02)	100.43 (10.04)	17.17 (4.2)	1.17 (1.27)	2.27 (1.66)	105.97 (10.32)
NRC-HB-506	31.07 (5.62)	59.63 (7.75)	117.27 (10.85)	135.17 (11.65)	166.23 (12.91)	186.67 (13.68)	190.17 (13.81)	101.13 (10.07)	44.27 (6.69)	11.07 (3.4)	5.23 (2.38)	95.26 (9.79)
NRC-HB-101	43.23 (6.61)	68.37 (8.3)	88.20 (9.42)	114.30 (10.71)	173.53 (13.19)	90.07 (9.52)	53.23 (7.33)	21.40 (4.68)	12.17 (3.55)	9.13 (3.09)	0.67 (1.07)	61.30 (7.86)

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Variety	Population count no/10cm shoot Standard week and date of observation											
	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS	86 DAS	93 DAS	100 DAS	107 DAS	114 DAS	Overall Mean
RMM-09-7	36.20 (6.06)	72.33 (8.53)	112.53 (10.63)	137.23 (11.74)	195.20 (13.99)	207.17 (14.41)	102.07 (10.13)	47.47 (6.92)	20.13 (4.54)	17.17 (4.2)	2.07 (1.53)	86.32 (9.32)
RMM-09-1-1-2	17.27 (4.21)	32.57 (5.75)	77.20 (8.81)	92.77 (9.66)	179.17 (13.4)	123.53 (11.14)	104.17 (10.23)	72.93 (8.57)	16.23 (4.09)	8.43 (2.99)	0.33 (0.9)	65.87 (8.15)
RM-WR-09-3	44.57 (6.71)	76.73 (8.79)	125.27 (11.21)	149.23 (12.24)	176.77 (13.31)	174.17 (13.22)	111.37 (10.57)	58.47 (7.68)	16.67 (4.14)	0.23 (0.85)	0.00 (0.71)	84.86 (9.24)
RM-WR-09-5	58.23 (7.66)	79.20 (8.93)	138.63 (11.79)	168.33 (12.99)	188.80 (13.76)	201.20 (14.2)	101.57 (10.1)	89.37 (9.48)	30.13 (5.53)	11.23 (3.41)	1.37 (1.36)	97.10 (9.88)
RH-406	25.20 (5.06)	39.47 (6.32)	118.17 (10.89)	152.63 (12.37)	187.20 (13.7)	151.20 (12.32)	93.07 (9.67)	63.07 (7.97)	43.20 (6.61)	0.10 (0.77)	0.00 (0.71)	79.39 (8.94)
RH-749	38.37 (6.23)	77.23 (8.82)	98.87 (9.97)	140.17 (11.86)	165.60 (12.89)	176.30 (13.3)	194.27 (13.96)	79.17 (8.92)	13.87 (3.78)	12.17 (3.55)	2.40 (1.66)	90.76 (9.55)
RGN-73	37.23 (6.14)	75.33 (8.71)	133.70 (11.58)	153.77 (12.42)	174.37 (13.22)	194.90 (13.98)	230.27 (15.19)	117.40 (10.86)	39.43 (6.32)	3.30 (1.95)	0.87 (1.14)	105.51 (10.3)
MAYA	26.23 (5.17)	49.33 (7.05)	76.27 (8.76)	117.17 (10.85)	137.33 (11.74)	159.80 (12.66)	183.23 (13.55)	13.33 (3.71)	10.20 (3.26)	0.13 (0.79)	0.00 (0.71)	70.28 (8.41)
ROHINI	32.87 (5.78)	49.57 (7.07)	121.37 (11.04)	158.23 (12.6)	179.63 (13.42)	199.40 (14.14)	101.07 (10.08)	59.60 (7.75)	17.47 (4.24)	9.87 (3.22)	0.30 (0.89)	84.49 (9.22)
KRANTI	27.67 (5.31)	57.30 (7.6)	90.93 (9.56)	110.70 (10.54)	155.77 (12.5)	185.27 (13.63)	97.37 (9.89)	78.40 (8.88)	25.30 (5.08)	6.07 (2.56)	0.00 (0.71)	75.89 (8.74)
SE(m)	0.11	0.10	0.10	0.05	0.10	0.04	0.12	0.17	0.17	0.16	0.16	0.04
CD (5%)	0.31	0.29	0.29	0.15	0.26	0.12	0.34	0.48	0.48	0.44	0.48	0.08

Table 2: Aphid infestation index of different varieties of mustard crop aphid infestation index (0-5 scale)

S. No.	Genotypes	At full flowering stage mean	At full pod formation stage mean	Overall Mean	Grading
1	JMM-927	2.72	3.73	3.225	S
2	JM-1	1.12	2.69	1.905	MR
3	JM-2	2.3	2.32	2.31	MR
4	JM-3	3	3.37	3.185	S
5	RVM-1	2.22	1.84	2.03	MR
6	RVM-2	2.13	2.74	2.435	MR
7	JM-4	2.84	2.88	2.86	MR
8	NRCDR-2	3.16	3.11	3.135	S
9	NRC-HB-506	2.04	3.44	2.74	S
10	NRC-HB-101	0.87	1.07	0.97	R
11	RMM-09-7	2.74	3.18	2.96	S
12	RMM-09-1-1-2	1.83	2.58	2.205	MR
13	RM-WR-09-3	1.53	2.2	1.865	MR
14	RM-WR-09-5	1.66	2.1	1.88	MR
15	RH-406	2.41	2.76	2.585	MR
16	RH-749	2.12	2.81	2.465	MR
17	RGN-73	2.57	2.48	2.525	MR
18	MAYA	1.04	2.01	1.525	R
19	ROHINI	2.15	2.6	2.375	MR
20	KRANTI	1.06	1.34	1.2	R

Conclusion

Plants that are immune to insect pests have the distinct benefit of providing the crop with built-in insect control. Plant resistance is caused by a variety of factors like non-preference, antibiosis, and insect tolerance, which are all biochemical in nature.

References-

- Annu Kumari, Taraknath Goswami, Ramanuj Vishwakarma, Anil and Chandan Kishore, 2018. Evaluation of mustard germplasm against aphid *Lipaphis erysimi* (KALT.). Indian Journal of Entomology, 80(4): 1456-1459.
- Chand, Amar, S. K. Khinchi, Mandeep Redhu, Arvind, Renu Choudhary, Arjun Choudhary, and Rohit Kumar Nayak. 2023. "Screening of Mustard Varieties for Resistance Against Mustard Aphid, (Kaltenbach)". *International Journal of Environment and Climate Change* 13 (9):3475-80.
- Chatt Upadhyay, C., R. Agrawal, A. Kumar, Y.P. Singh, S.K. Roy, S.A. Khan, L.M. Bhar, N.V.K. Chakravarthy, A. Srivastava, B.S. Patel, B. Srivastava, C.P. Singh and S.C. Mehta. 2005. Forecasting of *Lipaphis erysimi* on oilseed Brassicas in India- a case study. *Crop Protection*, 24: 1042-1053.
- Dey D, Prasad SK, Trimohan. Field evaluation of mustard cultivars for resistance to *Lipaphis erysimi* (Kalt.). *Shashpa*. 2005;12(2):134-136.
- Jatoi, M.Y., Humayun, J. and Kakakhel, S.A. 2002. Relative resistance among 22 Brassica napus cultivars against turnip aphid, *Lipaphis erysimi* Kalt. *Asian Journal of Plant Sciences*, 1(5): 558-559.
- Kher, S., & Rataul, H. S. (1991). Investigations on the mechanism of resistance in oleiferous *Brassicaceae* against mustard aphid, *Lipaphis erysimi* (Kaltenbach). *Indian Journal of Entomology*, 53, 141- 154.
- Kular, J. S., & Kumar, S. (2011). Quantification of avoidable yield losses in oilseed Brassica caused by insect pests. *Journal of Plant Protection Research*, 51(1): 38-43.
- Kumar, S. (2017). Assessment of avoidable yield losses in crop brassicas by insect-pests. *Journal of Entomology and Zoology Studies*, 5(3): 1814-1818.
- Patel, S., Awasthi, A., & Tomar, R. (2004). Assessment of yield losses in mustard (*Brassica juncea* L.) due to mustard aphid (*Lipaphis erysimi* kalt.) under different thermal environments in Eastern Central India. *Applied Ecology and Environmental Research*, 2, 1-15.
- Parmar, G. M., Kapadia, M. N., Jadav, N. B., & Zizala, V. J. (2007). Avoidable losses due to *Lipaphis erysimi* (Kalt.) in mustard. *Asian Journal of Biological Sciences*, 2(2): 73-75.
- Sachan, G. C., & Purwar, J. P. (2007). Integrated Insect Pest Management. *Entomology: novel approaches*, 399-423.
- Sharma, D., Yadav, S., & Yadav, S. (2019). Population dynamics of mustard aphid, *Lipaphis Erysimi* Kalt in various Brassica spp. *International Journal of Current Microbiology and Applied Science*, 8(2), 2952-2959.

