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# Evaluation of Commercial Mustard Varieties against Mustard Aphid (*Lipaphis erysimi*) Kalt in Grid Region of Madhya Pradesh, India

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## 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.

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*Keywords: Mustard; varieties; aphid; host plant resistance; Lipaphis erysimi; pesticides.*

## 1. 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 [1], the mustard aphid, *Lipaphis erysimi*; mustard sawfly, *Athalia proxima*; painted bug; *Bagrada cruciferum*; leaf minor, *Chromatomyia herticola*; 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 [2,3,4,5] and 3.38 to 8.14 percent oil loss [4] while Patel et al. [6] 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 [7]. 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.

## 2. MATERIALS 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 Bakhetia and Sandhu (1973).

## 3. RESULTS AND DISSCUSSION

The significant difference among the evaluated varieties was reported with respect to the aphid populations per plant and is presented in Tables 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 per 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*.,* [8] and Chatt et al*.* [9].

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*.* [10], Dey et al*.* [11] and Jatoi et al. [12].

**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 | 68.40 | 93.53 | 108.77 | 87.93 | 106.17 | 103.93 | 43.70 | 17.53 | 0.37 | 0.27 | 59.64 |
| | (5.09) | (8.3) | (9.7) | (10.45) | (9.4) | (10.33) | (10.22) | (6.65) | (4.24) | (0.93) | (0.86) | (7.75) |
| JM-1 | 29.23 | 35.70 | 87.20 | 121.63 | 105.30 | 85.87 | 78.20 | 38.63 | 19.37 | 2.17 | 0.13 | 54.86 |
| | (5.45) | (6.01) | (9.36) | (11.05) | (10.29) | (9.29) | (8.86) | (6.25) | (4.45) | (1.62) | (0.79) | (7.44) |
| JM-2 | 31.63 | 76.53 | 82.53 | 132.23 | 98.20 | 96.57 | 101.63 | 74.13 | 3.93 | 0.43 | 0.10 | 63.45 |
| | (5.67) | (8.78) | (9.11) | (11.52) | (9.93) | (9.85) | (10.1) | (8.64) | (2.11) | (0.96) | (0.77) | (8) |
| JM-3 | 20.47 | 35.23 | 54.30 | 114.57 | 75.77 | 97.77 | 100.87 | 64.27 | 19.57 | 1.67 | 0.90 | 53.22 |
| | (4.58) | (5.98) | (7.4) | (10.73) | (8.73) | (9.91) | (10.07) | (8.05) | (4.46) | (1.47) | (1.16) | (7.33) |
| RVM-1 | 24.23 | 49.87 | 98.47 | 117.73 | 121.50 | 125.27 | 110.53 | 68.53 | 37.17 | 8.33 | 1.17 | 69.35 |
| | (4.97) | (7.09) | (9.94) | (10.87) | (11.04) | (11.21) | (10.54) | (8.31) | (6.14) | (2.97) | (1.28) | (8.36) |
| RVM-2 | 39.13 | 83.50 | 113.40 | 125.60 | 136.37 | 144.67 | 127.93 | 89.20 | 37.57 | 0.10 | 0.03 | 81.59 |
| | (6.3) | (9.16) | (10.67) | (11.23) | (11.7) | (12.05) | (11.33) | (9.47) | (6.16) | (0.77) | (0.73) | (9.06) |
| JM-4 | 33.37 | 49.33 | 87.57 | 133.40 | 142.13 | 153.53 | 146.53 | 44.10 | 10.23 | 2.07 | 0.03 | 72.94 |
| | (5.82) | (7.05) | (9.38) | (11.57) | (11.94) | (12.41) | (12.12) | (6.68) | (3.26) | (1.6) | (0.73) | (8.57) |
| NRCDR-2 | 37.83 | 98.20 | 99.23 | 138.73 | 156.73 | 159.23 | 136.23 | 93.80 | 12.37 | 0.03 | 0.03 | 84.77 |
| | (6.19) | (9.93) | (9.99) | (11.8) | (12.54) | (12.64) | (11.69) | (9.71) | (3.57) | (0.73) | (0.73) | (9.23) |
| NRC-HB-506 | 39.53 | 54.07 | 76.40 | 143.13 | 148.60 | 157.83 | 121.60 | 78.60 | 23.57 | 1.87 | 3.73 | 77.18 |
| | (6.33) | (7.39) | (8.77) | (11.98) | (12.21) | (12.58) | (11.05) | (8.89) | (4.9) | (1.54) | (2.06) | (8.81) |
| NRC-HB-101 | 45.23 | 66.40 | 81.77 | 119.80 | 123.17 | 136.47 | 98.47 | 37.40 | 11.27 | 4.30 | 0.47 | 65.88 |
| | (6.76) | (8.18) | (9.07) | (10.97) | (11.12) | (11.7) | (9.95) | (6.15) | (3.43) | (2.19) | (0.98) | (8.15) |

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

**Continued…**

| 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 | 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 | 65.73 | 115.47 | 136.67 | 157.17 | 177.10 | 112.37 | 54.33 | 21.23 | 2.43 | 0.80 | 79.24 |
| | (5.37) | (8.14) | (10.77) | (11.71) | (12.56) | (13.33) | (10.62) | (7.4) | (4.66) | (1.71) | (1.11) | (8.93) |
| JM-1 | 21.43 | 39.63 | 92.10 | 112.17 | 155.47 | 143.20 | 91.20 | 43.43 | 21.13 | 7.23 | 0.20 | 66.11 |
| | (4.68) | (6.33) | (9.62) | (10.61) | (12.49) | (11.99) | (9.57) | (6.63) | (4.63) | (2.78) | (0.83) | (8.16) |
| JM-2 | 44.23 | 73.07 | 129.20 | 152.33 | 162.67 | 181.07 | 110.83 | 10.20 | 5.87 | 1.07 | 1.00 | 79.23 |
| | (6.69) | (8.58) | (11.39) | (12.36) | (12.77) | (13.47) | (10.55) | (3.23) | (2.49) | (1.23) | (1.17) | (8.93) |
| JM-3 | 23.53 | 37.17 | 67.37 | 125.77 | 133.43 | 163.80 | 198.23 | 46.63 | 23.17 | 12.20 | 1.67 | 75.72 |
| | (4.9) | (6.13) | (8.24) | (11.24) | (11.57) | (12.82) | (14.1) | (6.86) | (4.86) | (3.52) | (1.47) | (8.73) |
| RVM-1 | 26.20 | 51.63 | 109.83 | 129.93 | 142.20 | 158.90 | 131.07 | 70.17 | 40.50 | 4.27 | 1.83 | 78.78 |
| | (5.16) | (7.22) | (10.5) | (11.42) | (11.95) | (12.63) | (11.47) | (8.41) | (6.4) | (2.18) | (1.46) | (8.9) |
| RVM-2 | 42.17 | 79.17 | 138.70 | 159.60 | 168.27 | 174.63 | 194.37 | 143.50 | 37.60 | 1.13 | 0.00 | 103.56 |
| | (6.53) | (8.93) | (11.8) | (12.65) | (12.99) | (13.23) | (13.96) | (12) | (6.17) | (1.27) | (0.71) | (10.2) |
| JM-4 | 23.53 | 44.07 | 90.60 | 136.23 | 171.30 | 59.53 | 14.27 | 32.07 | 10.80 | 4.17 | 1.10 | 53.42 |
| | (4.9) | (6.67) | (9.54) | (11.69) | (13.11) | (7.75) | (3.82) | (5.69) | (3.36) | (2.16) | (1.23) | (7.34) |
| NRCDR-2 | 33.17 | 97.93 | 149.37 | 162.37 | 178.43 | 198.17 | 225.23 | 100.43 | 17.17 | 1.17 | 2.27 | 105.97 |
| | (5.8) | (9.92) | (12.24) | (12.76) | (13.38) | (14.09) | (15.02) | (10.04) | (4.2) | (1.27) | (1.66) | (10.32) |
| NRC-HB-506 | 31.07 | 59.63 | 117.27 | 135.17 | 166.23 | 186.67 | 190.17 | 101.13 | 44.27 | 11.07 | 5.23 | 95.26 |
| | (5.62) | (7.75) | (10.85) | (11.65) | (12.91) | (13.68) | (13.81) | (10.07) | (6.69) | (3.4) | (2.38) | (9.79) |
| NRC-HB-101 | 43.23 | 68.37 | 88.20 | 114.30 | 173.53 | 90.07 | 53.23 | 21.40 | 12.17 | 9.13 | 0.67 | 61.30 |
| | (6.61) | (8.3) | (9.42) | (10.71) | (13.19) | (9.52) | (7.33) | (4.68) | (3.55) | (3.09) | (1.07) | (7.86) |

**Continued…**

| 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 |

## 4. 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.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of this manuscript.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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