



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.1.204>

EVALUATION OF DIFFERENT MUSTARD VARIETIES FOR RESISTANCE AGAINST MUSTARD APHID UNDER PROTECTED CONDITIONS

Lal Bahadur Singh^{1*}, Aditya Kumar¹, Rama Sharma¹, Amit Bagri¹ and Navneet Raj Rathore²

¹Department of Entomology, A.K.S. University, Satna - 485 001 (M.P.), India.

²Department of Statistics, M.G.C.G.V.V., Chitrakoot, Satna (M.P.), India.

*Corresponding author E-mail : drlbsingh07@gmail.com

(Date of Receiving-13-12-2023; Date of Acceptance-17-03-2024)

ABSTRACT

The investigation was carried out in the net house of the Faculty of Agriculture Science and Technology, AKS University, Satna (M.P.) to assess the resistance of various mustard varieties against mustard aphid (*Lipaphis erysimi* Kalt.). None of the tested varieties exhibited resistance to aphids. Rohini and Pusa-26 varieties showed moderate resistance to mustard aphids. Pusa mahak, Tejasui, Sarita-333 and RVM-2 were moderately susceptible, while Kranti and Kala Sona were deemed susceptible to aphid infestation. Rohini was identified as the least preferred host for mustard aphids, while Kranti and Kala Sona were identified as the most preferred hosts. In terms of yield reduction caused by aphid infestation, Kranti exhibited the lowest yield and the highest yield loss. Conversely, Rohini produced the highest yield and experienced the least yield loss, making it a suitable choice for commercial mustard cultivation in Madhya Pradesh.

Key words : Evaluation, Mustard variety, *Lipaphis erysimi*, Protected condition.

Introduction

Indian mustard, scientifically known as *Brassica juncea* Linn., commonly referred to as sarson or rai (Hindi), mohari (Marathi) and Sasive (Kannada), is one of the important edible oilseed crops cultivated in the country. Mustard holds a significant place in the human diet, with oil content ranging from 32-40% and protein content ranging from 15-17% (Anonymous, 2021).

Throughout its growth cycle, from germination to harvest, the mustard crop faces challenges from insect pests and diseases. According to Sachan and Purwar (2007), some of the insect species that attack mustard include the mustard aphid (*Lipaphis erysimi*), mustard sawfly (*Athalia proxima*), painted bug (*Bagrada cruciferum*), leaf miner (*Chromatomyia horticola*) and Bihar hairy caterpillar (*Spilarctia oblique*).

Among these pests, the mustard aphid is particularly damaging, causing yield losses ranging from 24.5 to 68.00 per cent (Kular and Kumar, 2011; Sharma *et al.*, 2019; Kumar, 2017), with reported oil losses of 3.38 to 8.14 per cent (Sharma, 2019), resulting in a staggering 97.40 per

cent yield loss. *Crocidolomia binonalis* is another significant pest responsible for yield reductions ranging from 13.2 to 81.3 per cent (Parmar *et al.*, 2007). The mustard sawfly has been recorded to cause losses of 15.50 per cent (Divakaran and Babu, 2016).

Various techniques have been adapted to manage insect pests in mustard crops, with chemical control being widely employed. However, pesticides have drawbacks, including adverse effects on natural enemies and environmental pollution. Consequently, utilizing resistant varieties is considered the safest approach for pest control (Dash and Konarand, 2019). Resistant plants offer inherent insect control, attributed to factors such as non-preference, antibiosis, and insect tolerance, which are all biochemical in nature (Kher and Rataul, 1991). Among the different control methods, varietal tolerance has been prioritized in Integrated Pest Management programs. In light of these considerations, the present study was initiated.

Materials and Methods

The experiment was conducted in net house of Faculty

of Agriculture Science and Technology, AKS University, Satna (M.P.), which is located at 24° 34' North in longitude from 80° 49' east at an altitude of 324m above sea level using Complete Randomized Design (CRD), during *Rabi* season from November 2022 to February, 2023. Eight varieties were evaluated for their resistance against aphid infestation under protected condition. Each variety was considered as an individual treatment. The tested varieties were RVM-2, PM-26, SARITA-333, KALA SONA, TEJA-SUI, RH-747, SHRADDHA and PUSA MAHAK. The crop was directly seeded with 15cm plant to plant and 30cm row to row spacing and grown with proper doses of manures and fertilizers. Intercultural operations such as irrigation, weeding and mulching were done as and when necessary. The crops were harvested at full maturity stage starting from 25th February, 2023.

Pure culture preparation

A laboratory reared a pure culture of *Lipaphis erysimi* was collected from farmer fields in the Satna district. The rearing process followed to Johnson's method (Huges and Woolcock, 1965) with two individuals of *L. erysimi* placed in a petri dish lined with sterilized tissue paper to maintain the required moisture level at an average laboratory temperature of 28°C. The mustard aphid was provided with fresh leaves of the host crop daily for nourishment. Only new emerged progeny were retained, and the parental line was consistently discarded through multiple cycles to maintain the purity of the stock culture of aphid species.

Inoculation of Stock culture

In the experiment, the mustard crop was inoculated with aphids from the pure culture, after 30 days of sowing. Two individual aphids were inoculated on each plant, and the confinement of aphid species to their respective plants was ensured using insect netting with a mesh size of 2mm.

Data collection and calculation

To collect data, six plants were randomly chosen and tagged per plot, and then multiplied by the total number of plants per plot. Data collection commenced 40 days after sowing and was conducted weekly. Various parameters were assessed, including the number of aphid-infested plants, branches, inflorescences, pods, total yield (in grams) per plot and yield loss.

Percentage of aphid infested plants

The number of aphid infested plants was counted among the total plants per plot and the percentage of plant infestation by aphids was calculated using the following formula:

$$\% \text{ aphid infested plant} = \frac{\text{No. of aphid infested plant}}{\text{Total no. of plant/plot}} \times 100$$

Percentage of aphid infested branches

Similarly, the number of aphid infested branches was counted among the total branches, and the percentage of branch infestation by aphids was calculated using the formula:

$$\% \text{ aphid infested branch} = \frac{\text{No. of aphid infested branch}}{\text{Total no. of branch/plot}} \times 100$$

Percentage of aphid infested inflorescences

The total number of aphid infested and un-infested inflorescence at flowering were counted from six randomly selected plants of three rows. Consequently, the percentage of infested inflorescences by aphids was calculated using the following formula:

$$\% \text{ aphid infested inflorescence} = \frac{\text{No. of aphid infested inflorescence}}{\text{Total no. of inflorescence/plot}} \times 100$$

Percentage of aphid infested pods

Similarly, the total number of aphid infested and un-infested pods were counted among six randomly selected plants from three rows, and the percentage of pod infestation by aphids was calculated using the formula:

$$\% \text{ aphid infested pod} = \frac{\text{No. of aphid infested pod}}{\text{Total no. of pod/plot}} \times 100$$

Results and Discussion

Occurrence of aphid infested plants among various mustard varieties

Statistically significant variations were observed in the incidence of aphid infested plants throughout the growing season were represented in Fig. 1. At 40 DAS, the incidence of aphid infested plants among eight mustard varieties ranged from 2.02 to 14.88%. The highest incidence of plant infestation was recorded in the variety Kranti, which was statistically similar to that of Kala Sona, Tejasui and Pusa Mahak. On the other hand, the lowest incidence of aphid infested plants was recorded in the variety Rohini, which was also statistically similar to Pusa-26 (3.12%).

More or less similar trends of results in terms of incidence of per cent aphid infested plants among all mustard varieties were also observed and recorded at 47, 54, 61, 68 and 75 DAS, but per cent incidences were increased with the increase of the plant ages (Fig. 1).

From the above findings, it was revealed that among the eight varieties of mustard, none was found to be highly

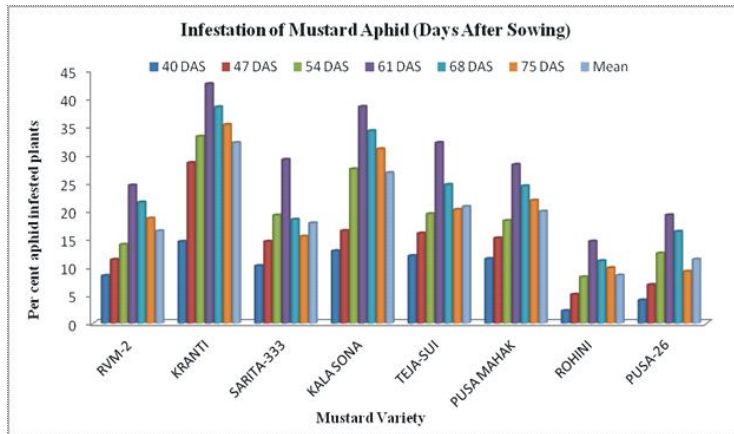


Fig. 1 : Incidence of mustard aphid infested plants among mustard varieties.

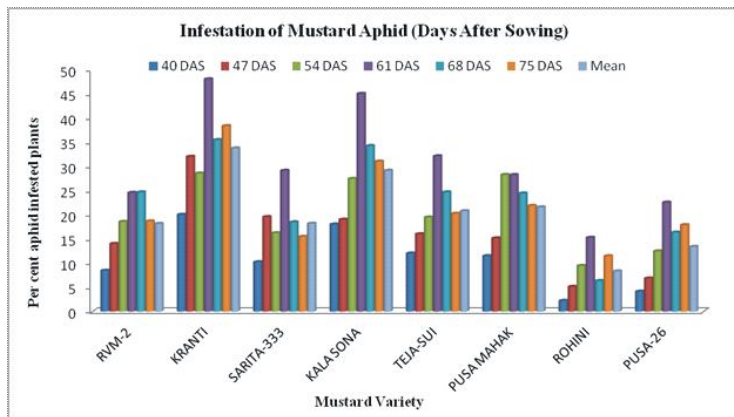


Fig. 2 : Incidence of mustard aphid infested branch among mustard varieties.

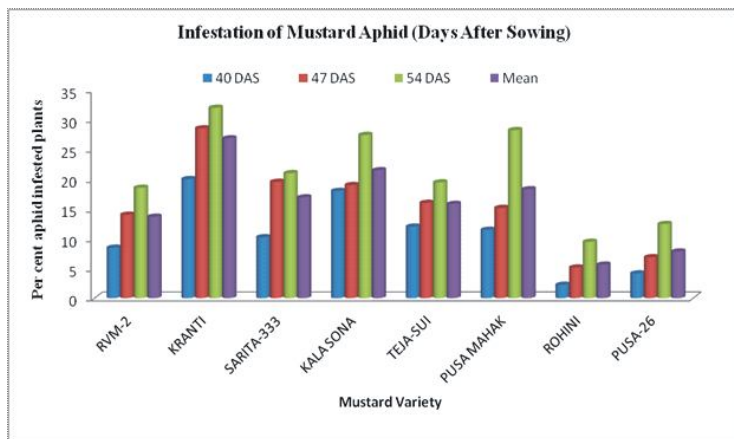


Fig. 3 : Per cent mustard aphid infested inflorescences among mustard varieties.

resistant to mustard aphid. The variety Rohini can be regarded as moderately resistant to mustard aphid. The varieties RVM-2, Sarita-333 and Pusa Mahak can be considered as moderately susceptible; Kranti, Kala Sona and Tejasui can be graded as susceptible to aphid infestation. The aphid infestation showed a sharp rise and reached the peak at 61 days after sowing. During this timeframe, nearly all mustard varieties had blossomed

and initiated pod development. As per Ghadage (2012) and Singh (2013), this phase is opportune for assessing mustard's susceptibility to mustard aphids, as the physiological state of the mustard plant might be more conducive to aphid infestation.

Occurrence of aphid infested branch among various mustard varieties

Statistically significant variations were observed in the incidence of aphid infested branch presented in Fig. 2. At 40 DAS, the incidence of aphid infested branch among eight mustard varieties was ranged from 2.21% to 20%. The highest incidence of infested branch was recorded in the variety Kranti, which was statistically similar to those of Kala Sona (18.08%), Pusa Mahak (17.45%). On the other hand, the lowest incidence of aphid infested branch was recorded in the variety Rohini and Pusa-26 (2.21% and 4.12%, respectively).

More or less similar trends was observed in the per cent aphid infested branch among eight mustard varieties recorded at 47, 54, 61, 68 and 75 DAS. The mean incidence of aphid infested branch among all mustard varieties was ranged from 9.30% to 33.72% (Fig. 2), where the highest incidence of infested branch was recorded in the variety Kranti, which was statistically similar to that of Kala Sona (18%) followed by Tejasui (12%). On the other hand, the lowest incidence of aphid infested branch was recorded in the variety Rohini, which was statistically identical to that of Pusa-26 (4.12%).

The percentage of infested branches increase sharply as the plants aged, reaching its peak at 61 days after sowing and then gradually declined. This finding is consistent with the results reported by Islam (1991) and Ansary *et al.* (2007).

Occurrence of aphid infested inflorescence among the various mustard varieties

There were significant differences observed in the incidence of aphid infested inflorescence among eight mustard varieties shown in Fig. 3. At 40 DAS, the incidence of aphid infested inflorescence was ranged from 2.18 to 23.24%, where the highest incidence was recorded in the variety Kranti, which was statistically similar to that of Kala Sona (22.22%). On the other hand, the lowest incidence of aphid infested inflorescence was recorded in the variety Rohini, which was statistically similar to that of Pusa-26 (5.23%).

More or less similar trends of results in terms of incidence of per cent aphid infested inflorescences among

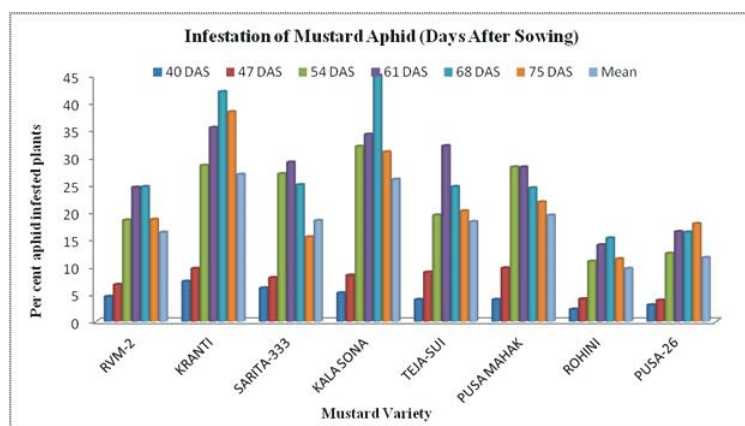


Fig. 4 : Per cent mustard aphid infested pod among mustard varieties.

all mustard varieties were also observed at 47 and 54 DAS, but per cent incidences were increased with the increase of the plant ages. The mean incidence of aphid infested inflorescence among eight mustard varieties was ranged from 5.59 to 26.85%.

Considering the incidence of aphid infested inflorescence, the varieties Rohini and Pusa-26 can be identified as least preferred host to mustard aphid, which might be due to rind hardness of the branch. Other varieties can be categorized as moderately preferred; Kranti, Pusa Mahak and Kala Sona can be classified as most preferred host to aphid. The per cent of infested inflorescence was sharply increased with the increase of the plant ages. This result was in harmony with those reported by Ansary *et al.* (2007) and Ghadage (2012).

Occurrence of aphid infested pod among various mustard varieties

There were significant variations observed in the incidence of aphid infested pod among all the mustard varieties tested in the present trial and presented in Fig. 4. At 40 DAS, the incidence of aphid infested pod was ranged from 2.21 to 7.33%, where the highest incidence was recorded in the variety Kala Sona followed by Kranti and the lowest was recorded in the variety Rohini, which might be due to toughness of the siliqua.

Similar trends in the per cent of aphid infested pod were also found in all the observations having increasing the incidences with the increase of the plant ages (Fig. 4). The highest range of incidence of aphid infested pod was observed at 61 DAS (except Kranti and Kala Sona varieties, 42.12 and 45%, respectively) and the incidence was ranged from 14 to 35.45%.

The mean incidence of aphid infested pod among these varieties was ranged from 9.67 to 26.89%, where the highest incidence was recorded in the variety Kranti, which was statistically similar to that of Kala Sona

(25.98%). On the other hand, the lowest incidence was recorded in variety Rohini (9.67%) followed by Pusa-26 (11.66%). This result was in agreement with those of Islam (1991).

Effect of aphid infestation on yield and yield loss among the mustard varieties

Significant variations were recorded in terms of yield and yield loss among eight mustard varieties. The highest yield was recorded in the variety Rohini (588.56 kg/ha), which was statistically different from other varieties and the lowest yield was found in the variety Kranti (422 kg/ha).

Considering the yield loss caused by aphid infestation among eight mustard varieties, the maximum yield loss (58.12%) was calculated in the variety Kranti, which was statistically identical with that of Kala Sona (55%), Tejasui (52.88%) and Pusa Mahak (52.12%). Conversely, the minimum yield loss (12.42%) was calculated in Rohini, which was statistically similar with that of Pusa-26 (18.64%), RVM-2 (19.78%) and Sarita-333 (22.46%).

This finding revealed that the higher aphid infestation was in variety Kranti produced lowest yield and caused maximum yield loss. Conversely, the least aphid infested variety Rohini produced highest yield and caused minimum yield loss. This result was in agreement with those of Begum (1995) and Ansary *et al.* (2007), who found that higher aphid population increased yield loss markedly.

Conclusion

Based on findings of the present investigation, it may be concluded that among eight varieties of mustard only Rohini and Pusa-26 showed the best performance against Aphid infestation of plant, branch, inflorescences and pod under protected condition. On the other hand, Kranti and Kala Sona showed the lowest performance in aphid infestation followed by Tejasui may be identified as most susceptible to *L. erysimi*. The variety, Rohini was the least susceptible and may be recommended for commercial cultivation of mustard in Madhya Pradesh.

References

- Anonymous (2021). Worldwide oilseed production 2020/2021,
- Ansary, M.S., Hussain B. and Qazi N.A. (2007). Influence of abiotic environment on the population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) on *Brassica* germplasm. *J. Biol. Sci.*, **7**(6), 993-996.
- Begum, S. (1995). Population activities of mustard aphids in relation to different sowing time. Annual Research Report 1994-95. *Entomol. Div.*, BARI, Joydebpur, Gazipur. Pp. 33-34.

- Dash, L. and Konarand A. (2019). Population dynamics and efficacy of some insecticides against mustard Sawfly, *Athalia lugens proxima* (Klug.) on mustard. *Int. J. Curr. Microbiol. Appl. Sci.*, **8(8)**, 2998-3004.
- Divakaran, M. and Babu K.N. (2016). Encyclopedia of food and health. *Science Direct*, 9-19.
- Ghadage, S.M. (2012). Varietal screening, bio efficacy of biopesticides against *Lipaphis erysimi* (Kaltenbach) in mustard and their toxic effect to its *coccinellid* predator (*Doctoral Dissertation*). Junagadh Agricultural University, Junagadh.
- Huges, R.D. and Woolcock L.T. (1965). A modification of johnsons method of rearing aphids, for ecological studies. *N. Zealand J. Agricult. Res.*, **8(3)**, 728- 736.
- Islam, N. (1991). Effect of sowing time on the abundance of mustard aphid, *Lipaphis erysimi* (Kalt.) on the infestation and yield of mustard. *Annual Research Report (1990-91)*. *Entomol. Div.*, BARI, Joydebpur , Gazipur. pp. 28-29.
- Kher, S. and Rataul H.S. (1991). Investigations on the mechanism of resistance in *Oleiferous Brassicae* against mustard aphid, *Lipaphis erysimi* (Kaltenbach). *Indian J. Entomol.*, **53**, 141- 154.
- Kular, J.S. and Kumar S. (2011). Quantification of avoidable yield losses in oilseed *Brassica* caused by insect pests. *J. Plant Prot. Res.*, **51(1)**, 38-43.
- Kumar, S. (2017). Assessment of avoidable yield losses in crop *brassica* spp. by insect-pests. *J. Entomol. Zool. Stud.*, **5(3)**, 1814-1818.
- Parmar, G.M., Kapadia M.N., Jadav N.B. and Zizala V.J. (2007). Avoidable losses due to *Lipaphis erysimi* (Kalt.) in mustard. *Asian J. Biolog. Sci.*, **2(2)**, 73-75.
- Sachan, G.C. and Purwar J.P. (2007). Integrated Insect Pest Management. *Entomology: novel Approaches*, 399-423.
- Sharma, D., Yadav S. and Yadav S. (2019). Population dynamics of mustard aphid, *Lipaphis erysimi* Kalt in various *Brassica* spp. *Int. J. Curr. Microbiol. Appl. Sci.*, **8(2)**, 2952-2959.
- Sharma, M. (2019). Screening of different mustard varieties for their susceptibility to the painted bug. *J. Entomol. Zool. Stud.*, **7(6)**, 878-881.
- Singh, A.P. (2013). Varietal reaction of *brassica* spp. against mustard aphid, *L. erysimi* Kalt. *J. Exp. Zool.*, **16(1)**, 131-133.