International Journal of Agricultural and Applied Sciences, December 2024, 5(2): 84-89
https://www.agetds.com/ijaas
ISSN: 2582-8053
https://doi.org/10.52804/ijaas2024.5214

Research Article

OPEN ACCESS

Effects of Aphids on The Growth of Different Varieties of Indian Mustard

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(Received: 10/08/2024; Revised: 10/11/2024; Accepted: 30/11/2024; Published: 10/12/2024)

ABSTRACT
The purpose of the experiment was to determine the prevalence of mustard aphids on various varieties of mustard in the field in Jassowala, Dehradun, Uttarakhand, from January to April of 2022. Three replications and a randomised complete block design were used to set up the experiment. The tolerant variations of eight mustard types, including T_1 (RH7859), T_2 (RH781), T_3 (RH785), T_4 (VARDHAN), T_5 (RH7847), T_6 (RH9006), T_7 (RH8546), and T_8 (VARUNA), were assessed against aphid infestation on plants, leaves, inflorescence, and pods. Regarding aphid infestation on plants, leaves, inflorescence, and pod, T_8 (VARUNA) was shown to be the most favoured host out of the eight varieties of mustard, whereas T_1 (RH7859), performed as the least preferred variety. T_1 (RH7859), the variety most vulnerable to aphids, yielded the lowest seed yield per plot and T_8 (VARUNA) seed yield with the least amount of aphid infestation. According to the study, the T_8 (VARUNA) produced the maximum yield and showed the least amount of aphid infestation. On the other hand, T_1 (RH7859), yielded the fewest seeds and displayed the most aphid infestation.
Keywords: Aphid, Mustard, Growth, Yield, Oilseeds

INTRODUCTION

Oilseeds are of nutritional importance and have been cultivated all over the world because of their great utilization in the agricultural system. Different oilseed crops are soybean, rapeseed, mustard, groundnut, peanut, cotton and sunflower considered important sources of edible oil in India (Anonymous, 2012). Indian mustard has been considered an essential oilseed crop since ancient times. The mustard crop is the main source of income for small farmers as this crop is commonly grown in the rain-fed region of the country and provides livelihood security (Jaglan *et.al.* 1988).

Different species of mustard are (*Brassica juncea*, *Brassica campestris*, and *Brassica napus* L.) grown in the Indian subcontinent. *Brassica napus* (Rapeseed-mustard) is regarded as the third most important oilseed crop around the world after soybean and palm oil. Around the world, 37.07 million hectares are used to grow rapeseed and mustard, with a yield of 73.27 million tons and productivity of 1976 kg per hectare (Thakur *et. al.*, 2009). On the other hand, 8.03 million tons of rapeseed are produced in India annually on 6.36 million hectares of land, with a yield of 1262 kg per hectare (Rangre *et. al.*, 2002).

India's rapeseed mustard productivity is still lower than the global average (1976 kg ha^{-1}). The states of Rajasthan, M.P., U.P., Haryana, and Gujarat comprise almost 86% of the total area planted with rapeseed. 32 thousand hectares of mustard are planted in Punjab, where it is produced on 41.8 thousand tons of grain and yields 1306 kg/hectare (FAO, 2004).

Numerous pests, such as the sawfly (*Athalia lugens* Kiug) and the mustard aphid (*Lipaphis erysimi* Kalt), are associated with the harvesting of mustard (Singh P and NB Singh, 2004). When there are only one or more females, the reproduction rates can range from 59 puppies each day to 76188 puppies overall (Singh P and NB Singh, 2005). Aphids cause stunting in plants, wilting of flowers, and obstruction of pod formation when they inhale sap from leaves, stems, inflorescences, and pods (Atwal and Dhaliwal 1997; Begum 1995 and Basky Z and Fónagy A 2007).

Effective methods of controlling agricultural crop pest insects other than pesticides are now very difficult to come across. To identify the mustard kinds that are susceptible to aphid infestation, an experiment was carried out with the following goals in mind.

To identify and study the life cycle of aphids on Indian mustard.

To observe or identify the infestation of aphids on Indian mustard and damage caused by aphids.

MATERIALS AND METHODS

The purpose of the experiment was to ascertain the incidence of mustard aphids on several mustard cultivars between January and April of 2022. The materials and techniques used to experiment are listed below. The three separate seasons at the experimental site were the pre-monsoon period, or hot season, from March to April, the monsoon season from May to October, and the winter season, which lasted from November to February. The climate at the location was subtropical. In Dehradun, Uttarakhand, meteorological data for temperature, relative humidity, and rainfall were collected for the experiment (Panda *et. al.*, 2004.). The experimental area's soil, which is alluvial and fertile, is a part of Dehradun. This particular plot contains rocky, sandy, clayey, and clayey elements. Its pH is 7.8, and its accessible K_2O, S and N contents are low (105.48 kg ha^{-1}, 8.39 kg ha^{-1}, 196.75 kg ha^{-1}, 11.86 kg ha^{-1}), organic carbon is at 0.40%, and available Zn is at 0.47 ppm (Bajia R. and Singh NN 2014.). The corresponding crop season rainfall in 2022 was 49.80 mm. In the soil testing lab, the properties of the soil beneath the experimental plot were examined.

Three replications were used in the Randomized Complete Block Design (RCBD) experiment having eight treatments- T_1(RH7859), T_2(RH781), T_3(RH785), T_4(VARDHAN), T_5 (RH7847), T_6 (RH9006) , T_7 (RH8546) and T_8 (VARUNA). The experiment was designed to disseminate all of the results of treatments. Each experiment has 24 plots with a size of 2.0 m 1.0 m. Urea, TSP, MoP, Gypsum, Zinc sulphate and borax were used as fertilisers for N, P, K, S, Zn and B, respectively. During the final preparation of the land, the complete amount of TSP, MoP, Gypsum, Zinc sulphate and borax was applied. At final ground preparation and 30 days after seed sowing, urea was applied in two equal instalments. Table 1 shows the fertilizer dose and manner of application (Anonymous, 1995).

Table 1. Dose and method of application of fertilizers in a mustard field.

Fertilizers	Dose(kg/ha)	Application (%)	
		Basal	Top Dressing
Urea	280	150	130
TSP	180	180	-
MP	100	100	-
Gypsum	180	180	-
Zinc Sulphate	100	100	-
Borax	100	100	--

The parameters which were measured at various time intervals which are -Total number of infested plants/plot, Total number of branch/plant, Total number of infested branch/plant, Total number of Aphid, Total number of silique/plants, Total number of infested silique/plants, Total number of seeds/silique, Weight of seeds/plant, Weight of silique/plants.

OPSTAT software was used to analyze and interpret the data. The data collected on various parameters was subjected to analysis of variance (ANOVA), significance level of 5% (Gomez KA and Gomez AA, 1984).

Figure 1. Experimental plot at the research field.

RESULTS AND DISCUSSION

Eight mustard varieties were evaluated against mustard aphids in the Rabi (winter) season of 2022 in the experimental field of Dehradun. The varieties are T1 (RH7859), T2 (RH781), T3 (RH785), T4 (VARDHAN), T5 (RH7847), T6 (RH9006), T7 (RH8546), and T8 (VARUNA). The study was carried out from January 1 to April 30, 2022, to identify the susceptible varieties against mustard aphids. The following subsections contain a presentation and discussion of the study's findings.

Effect of Aphids on Growth of Mustard Plants

Total number of infested plants/plots, Total number of branch/plant (%), Total number of infested branch/plant (%), Total number of aphids on mustard varieties etc are an important morphological characteristic of any crop and may vary from variety to variety under different stages. The effect of different aphids on a total number of infested plants/plots was studied in a mustard crop periodically at 20, 40, 60 and 80 days after sowing (DAS) during the year 2022 and is presented in Table 2 and Figure 2. The total number of infested plants/plots was observed to increase from 20 to 80 days. Significant variation was observed among the different varieties of mustard against infestation of aphids on them. The T1 treatment defined the highest number of infested

plants/plots as compared to other treatments. The T8 treatment had the lowest infestation at intervals of 20-80 days. At 80 days, a 50% infestation of aphid was evaluated. The data revealed that mustard crops easily get infested by aphids. The variety RH7859 of the mustard crop easily gets affected by aphids. With the increase in the number of day intervals, the infestation also increases. A significant incremented pattern is observed in all growth stages. The total number of branches/plants is an important morphological characteristic of any crop and may vary from variety to variety under different stages. Significant variation was observed among the different varieties of mustard with a total number of branches/plants. The T8 and T4 treatments defined the highest total number of branches/plants as compared to other treatments. The T8 and T4 treatments defined 21.67% of the total number of branches/plants at 80 days. The treatment had the lowest total number of branches/plants at intervals of 20-80 days. The data revealed that the mustard crop had a large number of branches/plants. The mustard varieties VARUNA and VARDHAN had a high number of branches/plants. With the increase in the number of day intervals, the total number of branches/plants also increases. A significant incremented pattern is observed in all growth stages of mustard varieties. This suggests that the improper application of fertilizer doses decreased the total number of branches/plants in the mustard varieties. The total number of infested branches/plants was observed to increase from 20 to 80 days. Significant variation was observed among the different varieties of mustard with a total number of infested branches/plants. The T1 treatment defined the highest total number of infested branches/plants as compared to other treatments. The T8 treatment had the lowest total number of infested branches/plants at intervals of 20-80 days. At the 80 days 24.33% of the highest number of infested branches/plants was evaluated. The variety RH7859 of the mustard crop had a high number of infested branches/plants. With the increase in the number of day intervals, the total number of infested branches/plants also increases. A significant incremented pattern is observed in all mustard varieties. This suggests that the proper application of fertilizer doses had increased the total number of infested branches/plants in the mustard varieties. The total number of aphids was observed to increase from 20 to 80 days. Significant variation was observed among the different varieties of mustard with a total number of aphids. The T1 treatment defined the highest total number of aphids as compared to other treatments. The T1 treatment defined 19.67% of the total number of aphids at 80 days. The T8 treatment had the lowest total number of aphids at intervals of 20-80 days. At 80 days, 7.33% of the total number of aphids was evaluated. The data revealed that the mustard crop had a large number of aphids. The variety RH7859 of the mustard crop had a high total number of aphids. With the increase in the number of days intervals the total number of infested branches/plants also increases and a significant incremented pattern is observed in all mustard varieties. This suggests that the improper application of fertilizer doses had increased the total number of aphids in the mustard varieties. A similar result was obtained by Chandra et. al. (2013). The incidence of Lipaphis erysimi appeared on mustard commenced from 2nd S.W. and gradually reached its peak of 207.22, 262.89 aphid/10 cm central twig in 5 standard weeks, thereafter population started to decline significantly and reached its lowest 2.56, 0.44 in 6th S.W. during 2007-2008 and 2008-2009 crop seasons, respectively. The highest population of *L. erysimi* was observed in 4th and 5th S.W. from PRKS-14 (126.11 aphids) and PR-2006-14 (207.22 aphids), respectively during 2007- 2008 with the lowest zero from PBC-2005-3. Whereas during the 2008-2009 crop season, it was highest as on Ashirvad (174.00 aphid), Ashirvad (360.56 aphid) and lowest as on PRKS-28 (1.11 aphid), PRKS- 28 (4.11aphid) in 4th and 5th S.W., respectively. After the 5th S.W., the population of *L. erysimi* gradually declined due to an increase in temperature (Hasan and Singh, 2011).

The total number of silique/plants, total number of infested silique/plants, total number of seeds/silique, weight of seeds/plant and weight of silique/plant of any crop may vary from variety to variety under different stages. The total number of silique/plants was studied in mustard crop varieties periodically at 20, 40, 60 and 80 days after sowing (DAS) during the year 2022 and is presented in Table 3 and Figure 3. The total number of silique/plants was observed to increase from 20 to 80 days. Significant variation was observed among the different varieties of mustard with a total number of silique/plants. The T8 treatment defined the highest total number of silique/plants as compared to other treatments. The T8 treatment defined 8.67% of the total number of silique/plants at 80 days. The T1 treatment defined the highest total number of infested silique/plants as compared to other treatments. The T1 treatment defined 6.67% of the total number of infested silique/plants at 80 days. The T8 treatment had the lowest total number of infested silique/plants at intervals of 20-80 days. The data revealed that the mustard crop had a large number of infested silique/plants. The variety RH7859 of the mustard crop had a high total number of infested silique/plants. The less fertilizer dose application, not proper dose management causes the higher total number of infested silique/plants on mustard crop. With the increase in the number of days intervals, the total number of infested siliques/plants also increases. A significant incremented pattern is observed in all mustard varieties. This suggests that the improper application of fertilizer doses had increased the total number of infested siliques/plants in the mustard varieties. The T8 treatment defined the highest total number of seeds/siliques as compared to other treatments. The T8 treatment defined 14.99% of the total number of seeds/siliques at 80 days. The T1 treatment had the lowest total number of infested silique/plants at

intervals of 20-80 days. The data revealed that the mustard crop (T8) had a large number of seeds/siliques. The weight of seeds/plants of any crop may vary from variety to variety under different stages. The weight of seeds/plant was studied in mustard crop varieties periodically at 20, 40, 60 and 80 days after sowing (DAS) during the year 2021-22 and is presented in Table 3 and Figure 3. The weight of seeds/plant was observed to increase from 20 to 80 days. Significant variation was observed among the different varieties of mustard with the weight of seeds/plant. The T8 treatment defined the highest weight of seeds/plants as compared to other treatments. The T8 treatment defined 2.79 % of the total weight of seeds/plant at 80 days. The T1 treatment had the lowest weight of seeds/plant at intervals of 20-80 days. Significant variation was observed among the different varieties of mustard with the weight of silique/plant but the T8 treatment defined the highest weight of silique/plant (3.83%) as compared to other treatments. The T1 treatment had the lowest weight of silique/plant (3.43%) at intervals of 20-80 days. The data revealed that the mustard crop had the large weight of silique/plant. The variety RH7859 of the mustard crop had the low weight of silique/plant. The less fertilizer dose application, not proper dose management causes the more weight of silique/plant on the mustard crop. With the increase in the number of day intervals the weight of silique/plant also increases. A significant incremented pattern is observed in all mustard varieties. This suggests that the improper application of fertilizer doses had decreased the weight of silique/plant in the mustard varieties. Findings of this experiment are in accordance with the results obtained by Rana and Pachauri, 2001) and Guohuai et al., (2002). Based on the intrinsic rate of increase 'rm' it can be concluded that B. juncea was the most suitable oleiferous Brassica for *L. erysimi* while development on E. sativa was least suitable. The field condition prevailing in the year 2008-09 was most suitable but 15^0C temperature and 6h light duration was least suitable for *L. erysimi* growth and development (Hasan and Singh, 2015).

Table 2. Effect of Aphids on Growth of Mustard Plants

Treatment	Total number of infested plants /plot	Total number of branch /plant	Total number of infested branch /plant	Total number of aphids on mustard varieties
1	44.670±0.279	17.000±0.114	24.330±0.570	19.670±0.071
2	34.000± 0.849	18.000±0.349	20.000±0.428	13.000±0.200
3	37.670±0.504	19.670±0.301	23.000±0.044	14.670±0.253
4	43.330±0.011	21.670±0.553	23.670±0.417	18.330±0.069
5	25.670±0.427	17.330±0.316	19.330±0.251	7.670±0.076
6	34.670±0.812	19.670±0.348	20.670±0.398	13.670±0.128
7	40.670±1.037	20.670±0.344	23.330±0.218	15.670±0.106
8	24.670± 0.203	21.670±0.485	18.330±0.008	7.330±0.170
C.D.	1.851	1.18	0.948	0.484
SE(m)	0.604	0.385	0.309	0.158

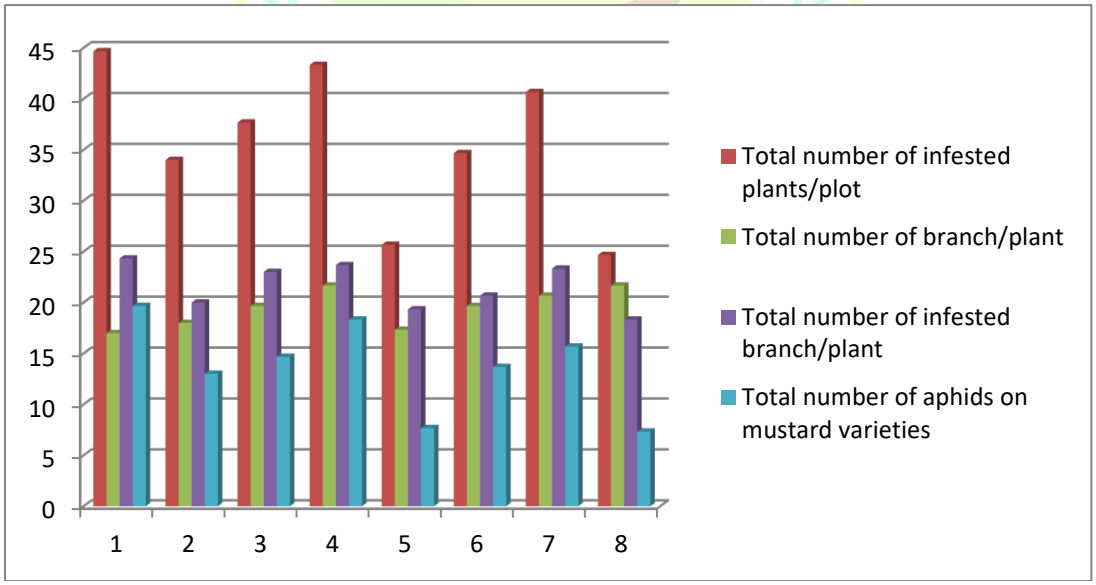

Fig 2. Effect of Aphids on Growth of Mustard Plants

Table 3. Effect of Aphids on Growth of Mustard Plants

Treatment	Total number of silique/ plants	Total number of infested silique /plants	Total number of seeds /silique	Weight of seeds/plant	Weight of silique/plant
1	4.330±0.026	6.670±0.059	9.670±0.149	2.240±0.027	3.430±0.035
2	5.670±0.071	2.670±0.067	12.670±0.056	2.250±0.045	3.550±0.035
3	6.670±0.036	4.330±0.002	13.330±0.038	2.280±0.006	3.580±0.064
4	7.330±0.070	5.670±0.043	14.670±0.362	2.360±0.049	3.600±0.009
5	5.330±0.011	2.670±0.001	10.670±0.217	2.290±0.026	3.640±0.072
6	6.330±0.089	3.670±0.044	13.670±0.306	2.590±0.018	3.710±0.042
7	7.670±0.000	5.330±0.042	14.670±0.275	2.700±0.027	3.760±0.033
8	8.670±0.113	1.670±0.006	14.99±0.362	2.790±0.015	3.830±0.094
C.D.	0.203	0.126	0.635	0.094	0.174
SE(m)	0.066	0.041	0.204	0.031	0.057

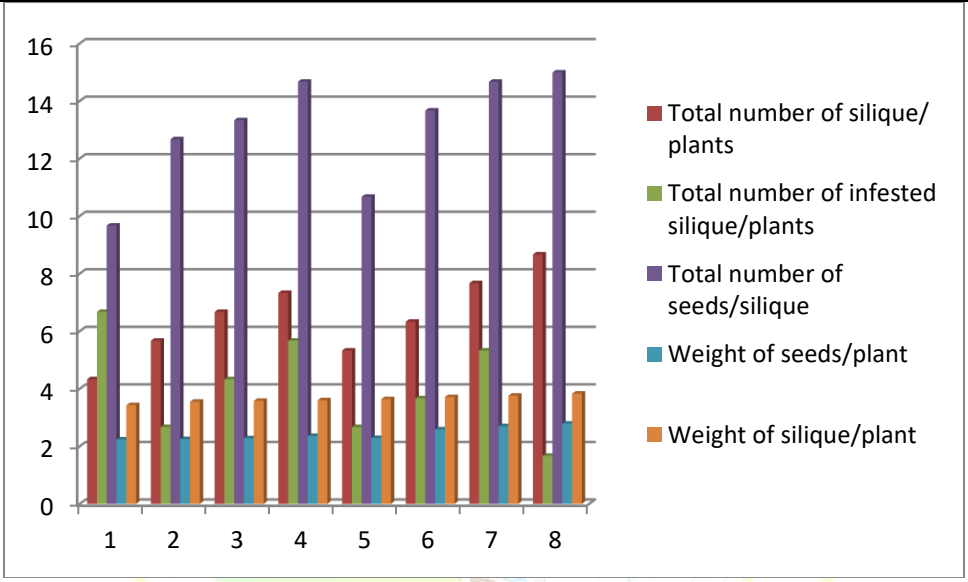

Fig 3. Effect of Aphids on Growth of Mustard Plants

CONCLUSION

The study's findings suggest that T_8 (VARUNA) had a lower incidence of mustard aphid infestation. In T_8, a lower aphid infestation was correlated with increased branch/plant numbers. According to this study, all of the types were essentially aphid-infested and prone to aphid attacks, yet T_8 was determined to be less susceptible. The findings underscore the importance of selecting mustard cultivars with enhanced resistance to aphids. The study provides a foundation for future research and cultivar development aimed at mitigating the impact of Aphids on mustard crops. Sustainable and environmentally friendly pest management practices, including the identification of resistant cultivars, are crucial for ensuring the productivity and quality of Indian mustard crops. Continued efforts in this direction can contribute significantly to the development of resilient agricultural systems.

CONFLICT OF INTEREST

The author here declares that there is no conflict of interest in the publication of this article.

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Citation: Verma, Aditi; Kaur, Ravinder; Naugain Trishala and Singh Harmandeep 2024. Effects of Aphids on The Growth of Different Varieties of Indian Mustard. *International Journal of Agricultural and Applied Sciences*, 5(2): 84-89.