International Journal of Plant & Soil Science

Volume 36, Issue 7, Page 30-34, 2024; Article no.IJPSS.117704
ISSN: 2320-7035

Comparative Efficacy of Chemicals with Biopesticides against Mustard Aphid, *Lipaphis erysimi* (Kalt.) on Mustard (*Brassica juncea* L.)

Priyanka Bhateshwar [a++] and Anoorag Rajnikanth Tayde [a#*]

[a] Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007 (U.P), India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijpss/2024/v36i74706

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/117704

Short Research Article

Received: 23/03/2024
Accepted: 27/05/2024
Published: 29/05/2024

ABSTRACT

Research experiment was carried out under the field conditions during the *rabi* season of 2023-2024 at Central research field SHUATS Prayagraj, UP, India. The management of mustard aphid, *Lipaphis erysimi* (Kalt) was done using different treatments and benefit cost ratio of all the treatments were calculated. One spray was applied to protect the crop from *Lipaphis erysimi* using randomized block design with three replications. The observation of mustard aphid, *Lipaphis erysimi* 24 hours before (Pre-treatment) and 3rd, 7th, and 14th day after spraying (Post-treatment) were recorded for computing the per cent population reduction of pest. The different chemicals and biopesticides treatments revealed that Imidacloprid 17.8% SL (87.21%) shows the highest per sent reduction and was the most effective treatment followed by Cypermethrin 10% EC (84.31%), Nisco

[++] *M.Sc. Scholar;*
[#] *Assistant Professor;*
**Corresponding author: E-mail: anurag.tayde@shiats.edu.in;*

Cite as: *Bhateshwar, P., & Tayde, A. R. (2024). Comparative Efficacy of Chemicals with Biopesticides against Mustard Aphid, Lipaphis erysimi (Kalt.) on Mustard (Brassica juncea L.). International Journal of Plant & Soil Science, 36(7), 30-34. https://doi.org/10.9734/ijpss/2024/v36i74706*

sixer plus (78.06%), *Bacillus thuringiensis* (73.02%), *Beauveria bassiana* (2×10^8 CFU/ml) (70.02%), *Verticillium lecanii* 1.15% WP (68.78%) the least per cent reduction was observed in Neem oil 5% EC (64.85%). The highest crop production, at 38.33 q/ha on average was recorded in Imidacloprid 17.8 SL with cost benefit ratio of (1:9.71) followed by Cypermethrin 10% EC 34.00 q/ha with (1:8.54) C:B ratio, Nisco sixer plus 31.66 q/ha with (1:7.22) C:B ratio, *Bacillus thuringiensis* 28.33 q/ha with (1:6.53) C:B ratio, *Verticillium lecanii* 1.15% WP 26.00 q/ha with (1:6.07) C:B ratio, *Beauveria bassiana* (2×10^8CFU/ml) 26.66 q/ha (1:6.04) C:B ratio, Neem oil 5% EC 21.66 q/ha with (1:4.64) C:B ratio and control 15.00 q/ha with (1:3.93) C:B ratio.

Keywords: Biopesticides; chemicals; imidacloprid; Lipaphis erysimi; management; Mustard aphid.

1. INTRODUCTION

"Mustard is an important oilseed crop which is grown in subtropical as well as tropical countries in the world. India is the second largest producer of this crop in the World" [1]. It belongs to the Family- Brassicaceae and genus Brassica.

"Mustard plays an important role in the oil seed economy of the country. It has 38 to 42% oil and 24% protein" [2]. "Mustard is also rich in minerals like Calcium, Manganese, Copper, Iron, Selenium, Zinc, Vitamin (A, B and C) and proteins. 1000 g mustard seed contains 508 k. cal. energy, 28.09 g carbohydrates, 26.08 g proteins, 26.08 g total fat and 12.2 g dietary fiber, 31 I.U., Vitamin A, 4.733 mg Niacin, 7.1 mg Vitamin C, 266 mg Calcium, 9.21 mg Iron, 370 mg Magnesium, 13 mg Sodium and 738 mg Potassium" [3].

"Rajasthan is the largest mustard seed producing state in India accounting for over 45 per cent share in Indian mustard seed production followed by UP (15 per cent), M.P. (11 per cent). It also account for over 40 per cent of acreage. According to latest, data released from Department of Agriculture, Govt of Rajasthan, as on 2nd Nov, 2015, area under Rape & Mustard is pegged at 11.77 lakh hectares (lh) which is l ower by 2.93 lh or 20 per cent lower compared to last years' sowing data. In 2015-16 Rabi season, Rajasthan has target to plant about 27 lakh hectares (lh) of Rape & Mustard" [4].

"More than 43 species of insect pests infest rapeseed-mustard crop in India, out of which a dozen species are considered as major pests The aphid species, viz., *Lipaphis erysimi* (Kaltenbach), *Brevicoryne brassicae* (Linnaeus) and *Myzus persicae* (Sulzer) are the key pests" [5] resulting in both qualitative and quantitative losses.

"Among all the insect pests, the mustard aphid, *Lipaphis erysimi* (Kaltenbach) (Homoptera: Aphididae) has gained the status of key pest of rapeseed-mustard in India. It feeds by sucking sap from its host and damage to the crop ranging from 9 to 96% in different agroclimatic conditions of India" [6]. "Large colonies of the aphid could cause the plant to become deformed due to curling and shrivelling of leaves. Under severe infestation, both sides of leaves are attacked. On mustard, *Lipaphis erysimi* prefers to feed on flowers as well as foliage of mustard" [7].

2. MATERIALS AND METHODS

Field experiment was carried out at the Central Research Farm of Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, U.P. during *rabi* season 2023-2024. Trail was laid out in randomised block design consisting of eight treatments including control. Each treatment was replicated thrice and MD Rani Super Gold mustard variety was sown with the spacing of 45×30 cm. Standard agronomic practices were followed to ensure a good crop stand. Seven chemicals and biopesticides viz, Nisco sixer plus, Cypermethrin 10% EC, *Bacillus thuringiensis*, Imidacloprid 17.8% SL, *Beauveria bassiana* (2×10^8 CFU/ml), *Verticillum lecanii* 1.15% WP, Neem oil 5% EC were tested along with a untreated control. The chemicals and biopesticides are sprayed at recommended doses when the aphid reaches its ETL level of 10%.

Aphid population was counted from five randomly selected plants in each plot and population per 5 plants were noted. The population of *Lipaphis erysimi* was recorded before one day spraying and on 3rd, 7th, and 14th day after insecticidal applications for one spray.

The formula given by Henderson and Tilton (1955) was used to calculate percentage reduction of pest population over control.

$$\text{Per cent population reduction} = (1 - \frac{\text{Ta}}{\text{Ca}} \times \frac{\text{Cb}}{\text{Tb}}) \times 100$$

Where,

Ta = Number of insects on treated plots after insecticidal application
Tb = Number of insects in treated plots before insecticidal application
Ca = Number of insects in untreated plots after insecticidal application
Cb = Number of insects in untreated plots before insecticidal application

Healthy mustard seeds were harvested and their weight from each treatment was expressed as marketable yield in quintal per hectare. Ultimately, the cost benefit ratio was calculated on the basis of prevailing market price of yield, insecticides and spraying cost.

$$\text{B: C Ratio} = \frac{\text{Gross returns (Rs/ha)}}{\text{Cost of plant cultivation (Rs/ha)}}$$ (Hegde et al. [8])

3. RESULTS AND DISCUSSION

The results (Table-1) after spray revealed that all the treatments were significantly superior over the control. The data on the per cent population reduction of *Lipaphis erysimi* in mustard 3rd, 7th and 14th day after spray revealed that the chemical treatments were significantly superior over control. Among all the treatments highest percent population reduction of mustard aphid was recorded in Imidacloprid 17.8% SL (87.21%) followed by Cypermethrin 10% EC (84.31%), Nisco sixer plus (78.06%), *Bacillus thuringiensis* (73.02%), *Beauveria bassiana* (2×10^8 CFU/ml) (70.02%), *Verticillum lecanii* 1.15% WP (68.78%) and Neem oil 5 % (64.85%).

The highest cost benefit ratio was recorded in Imidacloprid 17.8% SL (1:9.71) followed by Cypermethrin 10% EC (1:8.54), Nisco sixer plus (1:7.22), *Bacillus thuringiensis* (1:6.53), *Verticillium lecanii* 1.15% WP (1:6.07), *Beauveria bassiana* (2×10^8 CFU/ml) (1:6.04), Neem oil 5% EC (1:4.64) and control (1:3.93).

The data on the percent population reduction spray in Imidacloprid 17.8 SL (87.21%). Which is supported with Sreeja and Kumar [9] and Dotasara [10]. Cypermethrin 10% EC was also found to be very effective (84.31%). The same results were observed by Bandral [11]. The next best treatment found Nisco sixer plus 45 SC (78.06%) aphid/plant which lines with the finding Khandelwal and Kumar [12]. *Bacillus thuringiensis* (73.08%) is the next best treatment is found to be the next effective treatment which is in line with Sajid and Zia [13].

Table 1. Evaluation of insecticides against mustard aphid, *Lipaphis erysimi* Kalt. in mustard during *rabi* 2023- 2024

S.NO	Treatment name	Doses	% population reduction					Yield (q/ha)	B:C ratio
			1 DBS Mean	3 DAS	7 DAS	14 DAS	Mean		
T_0	Control	-	226.53	00	00	00	00	15.00	1:3.93
T_1	Nisco Sixer Plus	2 ml/lit.	229.13	76.86	77.40	79.86	78.06^c	31.66	1:7.22
T_2	Cypermethrin 10% EC	0.6 ml/lit	229.53	79.23	84.89	88.82	84.31^b	34.00	1:8.54
T_3	*Bacillus thuringiensis*	2 ml/ lit	223.86	71.20	73.10	74.95	73.08^d	28.33	1:6.53
T_4	Imidacloprid 17.8% SL	0.5 ml/lit	235.20	82.28	87.01	92.34	87.21^a	38.33	1:9.71
T_5	*Beauveria bassiana* (2x10^8 CFU/ml)	2.5 gm/lit	222.40	68.20	69.87	72.00	70.02^e	26.66	1:6.04
T_6	Neem oil 5%	5 ml/lit	227.06	62.97	64.70	66.88	64.85^f	21.66	1:4.64
T_7	*Verticillium lecanii* 1.15% WP	2 gm/lit	219.66	66.76	68.76	70.83	68.78^e	26.00	1:6.07
	F-TEST		NS	-	-	-	S		
	C.V.		3.285	-	-	-	2.04		
	CD (5%)		-	-	-	-	2.729		

DBS- Day Before Spraying, DAS- Day After Spraying, NS- Non- Significant, S- Significant

The data showed that the highest grain yield of 38.33 q/ha was registered in Imidacloprid 17.8 SL which was followed by Cypermethrin 10% EC 34.00 q/ha, Nisco sixer plus 31.66 q/ha, *Bacillus thuringiensis* 28.33 q/ha, *Beauveria bassiana* (2×10^8 CFU/ml) 26.66 q/ha, *Verticillum lecanii* 1.15% WP 26.00 q/ha, Neem oil 5% EC 21.66 q/ha. As low as 15.00 q/ha was recorded in untreated plot control. These findings are supported with Raju and Tayde [14] for Imidacloprid 17.8 SL. The findings supported with Sarkar and Kumar [15] for Cypermethrin 10% EC.

The Cost benefit ratio ranged between 1:9.71 and 1:3.93. Maximum cost benefit ratio (1:9.71) was obtained in Imidacloprid 17.8 SL treated plants, which is supported with the findings of Vishal et al*.* [16] and Ahlawat et al*.* [17], followed by cost benefit ratio (1:8.54) was recorded in Cypermethrin 10% EC treated plants, the results are similar to the findings of Singh and Kumar [18]. Nisco sixer plus also had a profitable cost benefit ratio (1:7.22) with the similar findings made by Sreeja and Kumar [9], *Bacillus thuringiensis* (1:6.53) with similar findings made by Sairam and Kumar [19], *Verticillium lecanii* 1.15% WP (1:6.07) with the similar findings made by Kumar and Kumar [20], *Beauveria bassiana* (2×10^8 CFU/ml) (1:6.04) with the similar findings made by Sarkar and Kumar [15], Neem oil 5% EC (1:4.64) with similar findings made by Aswitha and Yadav [21]. Least monetary return was obtained with control (1:3.93).

4. CONCLUSION

When it comes to managing population of *Lipaphis erysimi*, Imidacloprid 17.8% SL is more effective than Cypermethrin 10% EC, Nisco sixer plus, *Bacillus thuringiensis*, *Beauveria bassiana* (2×10^8 CFU/ml), *Verticillium lecanii* 1.15% WP, Neem oil 5%. Imidacloprid 17.8% SL had the best economic cost-benefit ratio (1:9.71) followed by Cypermethrin 10% EC (1:8.54), Nisco sixer plus (1:7.22), *Bacillus thuringiensis* (1:6.53), *Verticillum lecanii* 1.15% WP (1:6.07), *Beauveria bassiana* (2×10^8 CFU/ml) (1:6.04) and Neem oil 5% (1:4.64). Studies were needed on the future to confirm the result Therefore, additional trials must be carried out in the future to collaborate the findings that can benefit farmers in practical way for the sustainable production of mustard and avoid the losses of insect pest.

ACKNOWLEDGEMENT

The authors express his heartfelt gratitude to Dr. Anoorag R. Tayde, Assistant professor Department of Entomology, Dr. Usha Yadav Assistant professor Department of Entomology, Sam Higginbottom University of Agriculture Technology And Sciences, Prayagraj, U.P. and Nikhil Kumar, PhD Scholar Department of Entomology, Punjab Agricultural University, Ludhiana for their excellent guidance, suggestions and regular encouragement during the course of investigation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Dwivedi YK, Rana NP, Jeyaraj A, Clement M, Williams MD. Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model*.* Information Systems Frontiers. 2019;21(3):719-734.
2. Meena J, Pant H, Bahjan R. Heterosis analysis for yield and yield attributed traits in Indian mustard [*Brassica juncea (L*.) Czern and Coss]. Electronic Journal of Plant Breeding. 2015;6(4):1103-1107.
3. Dharavat N, Mehera B, Nath S, Patra SS, Rout S. Effect of sowing dates on population dynamics of mustard aphid (*Lipaphis erysimi*) in mustard (*Brassica juncea*) under Allahabad climatic condition. Advances in Life Sciences. 2016;5(20): 2278-3849.
4. Anonymous. Annual Progress Report of All India Coordinated Research Project on Rapeseed and Mustard. National Research Centre on Rapeseed Mustard, Sewar, 3213003, Bharatpur, Rajasthan. 2015-16;155.
5. Lal B, Nayak MK, Tomar DS, Thakur SR. Efficacy of newer insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) in Indian mustard under Bundelkhand Agro climatic zone of Madhya Pradesh. Journal of Entomology and Zoology Studies. 2018;6(6):400-403.
6. Singh YP, Sharma KC. Effect of sowing dates on the incidence of mustard aphid, *Lipaphis erysimi* Kaltenbach in mustard. Indian Journal of Applied Entomology. 2009;23(2):120-124.
7. Gautam MP, Singh SN, Kumar P, Yadav SK, Singh DP, Pandey MK. Mustard aphid, *Lipaphis erysimi* (Kalt) (Hemiptera:

Aphididae). The Pharma Innovation Journal. 2019;8(9):90-95.
8. Hegde, Manjunatha M, Sharanabasappa, Kalleshwaraswamy CM, Adarsha SK. Effect of Application of Bio pesticides and Insecticides. International Journal of Pure Application of Biological Sciences. 2017;5 (1):42-47.
9. Sreeja S, Kumar A. Field efficacy of selected chemicals and biopesticides against mustard aphid [*Lipaphis erysimi* (Kaltenbach)] on mustard [*Brassica juncea* (L.)] at Prayagraj (U.P.). The Pharma Innovation Journal. 2022;11(5):1706-1710.
10. Dotasara SK, Agrawal N, Singh N, Swami D. Efficacy of some newer insecticides against mustard aphid *Lipaphis erysimi* Kalt. in cauliflower. Journal of Entomology and Zoology studies. 2017;5(2):654-656.
11. Bandral RS. Field-weathered toxicity of insecticides to aphid predator, *Coccinella septempunctata* Linnaeus. Journal of Biological Control. 2006;20(1):65-68.
12. Khandelwal R, Kumar A. Evaluation of chemical insecticides along with cypermethrin and biopesticides against mustard aphid [*Lipaphis erysimi*] (Kalt.) in mustard (*Brassica juncea*). The Pharma Innovation Journal. 2022;11(10):375-378.
13. Sajid M, Zia K. In vitro efficacy of biopesticide (*Beauveria bassiana, Metarhizium anisopliae, Bacillus thuringiensis*) against mustard aphid *Lipaphis erysimi* Kalt. (Hemiptera: Aphididae). Journal Plant Protection. 2017; 1(2):85-90.
14. Raju CEP, Tayde AR. Field Evaluation of Selected Insecticides and Botanical against Mustard Aphid*, Lipaphis erysimi* (Kalt.) on Mustard*, Brassica juncea L.* International Journal of Plant and Soil Science. 2022;34(22):1188-1193.
15. Sarkar S, Kumar A. Comparative efficacy and cost benefit ratio of selected biopesticides and chemicals against mustard aphid, *Lipaphis erysimi* (Kaltenbach). The Pharma Innovation Journal. 2022;11(7):4671-4675.
16. Vishal, Singh H, Kumar A. Efficacy and economics of some newer insecticides against mustard aphid, *Lipaphis erysimi* (Kalt). Journal of Pharmacognosy and Phytochemistry. 2019;8(3):785-788.
17. Ahlawat P, Singh R, Singh, SP, Sachan SK, Singh DV, Spoorthi G, Gautam MP. Efficacy of bio pesticides and novel insecticides for control of *Lipaphis erysimi* (Kalt) on mustard crop in western U.P. Journal of Pharmacognosy and Phytochemistry. 2018;1:1814-1820.
18. Singh SA, Kumar A. Comparative efficacy and cost benefit ratio of newer insecticides and bio-pesticides against mustard aphid, *Lipaphis erysimi* (Kaltenbach) on Indian mustard in Trans Yamuna region of Prayagraj (U.P.). The Pharma Innovation Journal. 2022;11(10):300-305.
19. Sairam B, Kumar A. Field efficacy of selected bio pesticides and Fipronil against mustard aphid, *Lipaphis erysimi* (Kalt.). The Pharma Innovation Journal. 2022;11(8):1640-1644.
20. Kumar N, Kumar A. Efficacy of some bio-pesticides against mustard aphid *Lipaphis erysimi* (Kalt) in mustard (*Brassica juncea*). International Journal of Plant and Soil Science. 2023;35(16):121-127.
21. Aswitha C, Yadav Y. Comparative efficacy of botanicals, imidacloprid and cow urine against mustard aphid (*Lipaphis erysimi* Kalt.) on mustard (*Brassica juncea L.*). The Pharma Innovation Journal. 2023;12(7): 1275-1278.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/117704