Efficacy of selected biopesticides against Mustard aphid, *Lipaphiserysimi* (Kalt.) (Hemiptera: Aphididae)

ABSTRACT

The present experiment was carried out at Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, during *Rabi* season of the year 2023-2024. The experiment was conducted under Randomized Block Design (RBD) with the eight treatments and three replications and undertaken two spraying with fourteen days interval. Neem oil 5 %, Imidacloprid 17.8 SL, *Beauveria bassiana* 1.15 % WP, Nisco Sixer plus, *Metarhizum anisopliae*, Spinosad + neem oil 5 %, Spinosad 45% SC are the treatments used in this experiment. Result show that among all the treatments, (T_2) Imidacloprid 17.8%SL and it was significantly superior over the other treatments showing 30.08/top 10cm twig and *Beauveria bassiana* recorded 69.53/top 10cm was found to be least effective against mustard aphid. The highest yield and cost benefit ratio was recorded in Imidacloprid 17.8% SL(18.5 q/ha) and (1:5.19) and lowest *beauveriabassiana* (12.55 q/ha) and (1:3.43).

Key words: Biopesticides, Imidacloprid, *Lipaphiserysimi*, Mustard aphid.

INTRODUCTION

Mustard, *Brassica juncea* (L.) is an important oilseed crop belonging to family cruciferaceae (Syn. Brassicaceae). It is self-pollinated but certain amount (2-15%) pollination occur due to insects and other factors. The origin place of mustard is China, northeastern India from where it has extended up to Afghanistan via Punjab (Kalasariya, 2019). Rapeseed-mustard is the third important oilseed crop growth in the world after soyabean (*Glycine max*) and palm oil.

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. 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 (Daravath *et al*., 2021). It also helps stimulating sweat glands and help lowering body temperature.

~~In traditional medicines, it is used to relieve the pain associated with arthritis, muscle sprains and strains. Seed paste applied on wounds whereas paste of leaf said to heal cattle wounds. The purpose of the present investigation was to determine protein, oil, carbohydrate, energy and nutritive value of the Brassica spp. Species which represent natural resources with potential economic for use in human and animal nutrition (Hossain *et al*., 2015).~~

In India, it is the second most important edible oilseeds after groundnut which shares 27.8% in the India's oilseed economy. (Bhanu *et al.*, 2019).

The estimated area, production, and yield of rapeseed-mustard in the world was 36.59 million hectares, 72.37 million tones and 1.98~~0 kg/t~~ha^{-1}, respectively, during 2018-19. Globally, India account for 19.8 and 9.8 per cent of the total acreage and production. The productivity of India is the lowest among the major mustard growing countries, the Indian average yield was only 1.4 t~~onnes/~~ha^{-1} during 2019- 20. Mustard plays an important role in the oil seed economy of the country. It has 38 to 42% oil and 24% protein. (Kalia *et al.*, 2021). The experiment was conducted on the following objectives: i) To evaluate the efficacy

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of biopesticides on the incidence of mustard aphid (*L. erysimi*), and ii) To calculate the cost benefit ratio.

Materials and Methods

Field trails were conducted to study the " efficacy of selected biopesticides against mustard aphid, *Lipaphiserysimi* (Kalt.) (Hemiptera:Aphididae)" at central research field, SHUATS, Prayagraj, U.P. during *Rabi* 2023-2024. The trail was laid out in RBD having ~~seven~~eight treatments and three replications with the plot size 2 x 2m. The experiment was carried out on Chickpea variety Pusa-362. Two rounds of spray were given at fifteen days interval using a hand operated sprayer during morning hours to avoid photo oxidation of chemicals. The treatments details are:

T_0: untreated control.
T_1: Neem oil 5%,
T_2: Imidacloprid 17.8 SL,
T_3: *Beauveria bassiana*,
T_4: Nisco Sixer Plus,
T_5: *Metarhizium anisopliae*,
T_6: Spinosad 240 EC+ Neem oil 5%, and
T_7: Spinosad 45 SC.

Observations and calculations on pest population, grain yield and B:C ratio were made on 5 randomly selected plants in each replication along with the unsprayed control. Post treatments observations on number of larvae were recorded on 3 rd, 7th and 14th days of spray and were subjected to statistical analysis.

Benefit: Cost ratio:

$$\text{Benefit: Cost Ratio} = \frac{\text{Gross return}}{\text{Total cost}}$$

Result and Discussion

In the experiment, eight different treatments, The data of the mean (3rd,7th and 14th) nymph and adult population of first spray revealed that all treatments except untreated control are effective and par with each other Among all the treatments lowest nymph and adult population of mustard aphid was recorded in Imidacloprid 17.8 SL (33.08) followed by Spinosad 240 EC+ Neem oil 5% (39.22), Spinosad 45 SC (43.95), Neem oil 5% (45.69), *Metarhizium anisopliae* (49.02), Nisco Sixer Plus (62.04), *Beauveria bassiana* (69.53) as compared to control plot (202.08) is found to be effective but comparatively superior over the control.

The data on mean nymph and adult population of first spray, overall mean revealed that the all treatment except untreated control is effective and par with each other. Among all the treatments least nymph and adult population of mustard aphid was recorded in Imidacloprid 17.8 SL (87.21%). Similar findings made by Sreeja and Kumar (2022) with (88.14%) aphids/plant and Dotasara (2017) with (87.53%) aphids/plant.

The next best treatment found Spinosad 240 EC+ Neem oil 5% (84.29%) aphid/plant which lines with the findings Sen and Kumar (2023) with (85.93%). The next best treatment found Spinosad 45 SC (78.06%) aphid/plant which lines with the finding Akhter *et al.* (2021),

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Dwivedi and Singh (2019) with (74.83%) aphid/plant. Neem oil 5% (70.25%) these results are supported by *Yadav et al*. (2021). *Metarhizium anisopliae* (69.22%) supported by ~~Sajid *et al*., (2017),~~ Tomar *et al.* (2023). Nisco Sixer Plus (70.25%) supported by Khandelwal and Kumar (2022). *Beauveria bassiana* (2×10^8CFU/ml) (64.85%) these results are support with Janu *et al.*, (2018) with. is found to least effective but comparatively superior over the control which support Dotasara *et al.*, (2017) with (73.92).

Cost benefit and mustard yield

The data also showed that the highest grain yield of 18.15 q/ha was registered in Imidacloprid 18.15 SL (T_2) which was followed by Spinosad 240 EC+ Neem oil 5% (T_6) 17.85 q/ha, Spinosad 45 SC (T_7) 16.35 q/ha, Neem oil 5% EC (T_1) 14.58 q/ha, *Metarhizium anisopliae* (T_5) 14.98 q/ha, Nisco Sixer Plus (T_4) 13.03q/ha, *Beauveria bassiana* (T_3) 12.55 q/ha. As low as 9.17 q/ha was recorded in untreated plot control (T_0). These findings are supported by Raju and Tayde (2022) with a yield of (24.6 q/ ha) for Imidacloprid 17.8 SL. The findings supported by Sen and Kumar (2023) with a yield of (17.8 q/ ha) for Spinosad 240 EC+ Neem oil 5%.

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Mustard over control was obtained in Imidacloprid 17.8 SL (T_2) 8.98 which was followed by Spinosad 240 EC+ Neem oil 5% (T_6) 8.68, Spinosad 45 SC (T_7) 7.18,Neem oil 5% EC (T_1) 5.41, *Metarhizium anisopliae* (T_5) 5.23,Nisco Sixer Plus(T_4) 3.86 *Beauveria bassiana* (T_3) 3.38 and lowest increased over control observed in Control (T_8).

When cost benefit ratio was worked out, interesting result was achieved. Among the treatments studied, the best and most economical treatment was Imidacloprid 17.8% SL (1: 5.19) followed by Spinosad 240 EC+ Neem oil 5% (1: 4.74), Spinosad 45% SC (1: 4.45), Neem oil 5% (1: 4.04), *Metarhizium anisopliae* (1:4.08), Nisco Sixer Plus(1: 3.65), *Beauveria bassiana* (1:3.43), as compared to Control (1: 2.74). These findings are supported by Ahlawat *et al*. (2018), Sen and Kumar (2023) and Akter *et al*. (2021).

Sreeja and Kumar (2022) While, the highest yield 18.15 q/ha was obtained from the treatment Imidacloprid 17.8% SL as well as B:C ratio 1: 5.20 was obtained high from this treatment. It was followed by Spinosad 45% SC (1: 4.87), Cypermethrin 10% EC (1: 4.58), Neem oil 5% (1:4.15), MECH 333 (1: 3.98), Sixer plus (1: 3.46), *Metarhizium anisopliae* (1: 3.42), as compared to Control (1: 2.74)

Table 1. Effect of aphid population during first spray at 3rd, 7th and 14th days of spraying under different treatments during Rabi season 2023-24 (1st spray).

Treatment	Mean population of aphid / plant (10 cm top twig)				
	1DBS	After Spray			
		3rd Day	7th Day	14th Day	Mean
T_0	180.4	192.8	201.4	148.73	180.83
T_1	183.8	74.33	54.46	36.93	87.38
T_2	173	50.4	37.46	11.4	68.06
T_3	197.06	89	69.73	49.86	101.41
T_4	189.93	80.6	63.006	42.53	94.01
T_5	179.2	64.93	51.4	30.73	81.56
T_6	179.8	56.6	41.4	19.66	74.367

T_7	185.6	60.4	46.66	24.8	74.368
Overall Mean	183.6	83.63	70.69	45.58	95.87
F- test	NS	S	S	S	S
S. Ed. (±)		2.855	2.250	1.587	
C. D. (P = 0.05)		6.12	4.82	3.4	

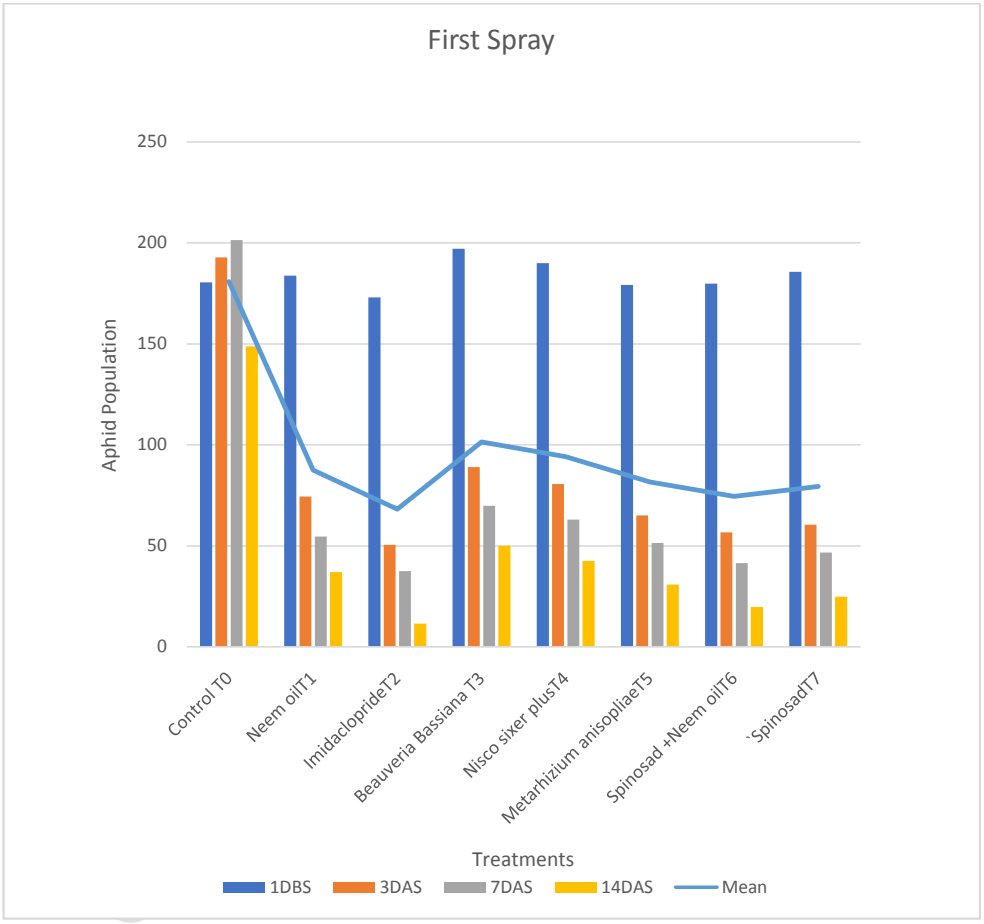

Fig. 1. The efficacy of biopesticides against mustard aphid (*L. erysimi* Kalt.) (First spray)

Table. 2. Economics of treatments and Benefit: cost ratio taken up for the management of mustard aphid during rabi season 2023-2024

Sr. No:	Yield (q/ha)	Cost of Yield (₹ q^{-1})	Total cost of yield (₹)	Common cost(₹)	Treatment cost (₹)	Net Return (₹)	Total cost	B:C ratio
T_1	14.58	6500	94770	21749	1700	76021	23449	1:4.04
T_2	18.15	6500	117975	21749	960	96226	22709	1:5.19

T_3	12.55	6500	81575	21749	2000	59826	23749	1:3.43
T_4	13.03	6500	84695	21749	1400	62946	23149	1:3.65
T_5	14.98	6500	97370	21749	2088	75621	23837	1:4.08
T_6	17.85	6500	116025	21749	2720	94276	24469	1:4.74
T_7	16.35	6500	106275	21749	2100	84526	23849	1:4.45
T_8	9.17	6500	59605	21749	-	37856	21749	1:2.74

CONCLUSION

From the critical analysis of the present findings, it can be concluded that Imidacloprid 17.8% SL is more effective in controlling per cent population reduction of mustard aphids followed by Spinosad 240 EC + Neem oil 5%, Spinosad 45 SC, Neem oil 5%, *Metarhizium anisopilae*, in managing *Lipaphiserysimi*. Among the treatments studied, Imidacloprid 17.8% SL gave the highest cost benefit ratio (1: 5.19) and marketing yield (18.15 q/ha) followed by Spinosad 240 EC+ Neem oil 5% (1: 4.74 and 17.85 q/ha), Spinosad 45SC (1: 4.45 and 16.35 q/ha), Neem oil 5%, *Metarhizium anisopilae*, Nisco Sixer Plus, *Beauveria bassiana* respectively as such more trials are required in future to validate the findings. Hence more trails are needed to be conducted in future to validate the findings which can be useful for the farmers in a feasible manner for sustainable production of mustard and to prevent the losses occurring from this insect pest infesting the crop.

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