

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, (T₂) 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 (**Daravathet 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 1980 kg/ha, 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 tonnes/ha 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**).

Objective:

1. To evaluate the efficacy of biopesticides on the incidence of mustard aphid (*L. erysimi*) on mustard during the *rabi* season 2023-2024.
2. 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 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: Neem oil 5% (T1), Imidacloprid 17.8 SL (T2), *Beauveria bassiana*(T3), Nisco Sixer Plus(T4), *Metarhizium anisopliae* (T5), Spinosad 240 EC+ Neem oil 5% (T6), Spinosad 45 SC(T7) and T₀- untreated control.

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 3rd, 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)**, **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* (2×10^8 CFU/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 **Dotasaraet 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 (T₂) which was followed by Spinosad 240 EC+ Neem oil 5% (T₆) 17.85 q/ha, Spinosad 45 SC (T₇) 16.35 q/ha, Neem oil 5% EC (T₁) 14.58 q/ha, *Metarhizium anisopliae* (T₅) 14.98 q/ha, Nisco Sixer Plus(T₄) 13.03q/ha, *Beauveria bassiana* (T₃) 12.55 q/ha. As low as 9.17 q/ha was recorded in untreated plot control (T₀). 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%.

Mustard over control was obtained in Imidacloprid 17.8 SL (T₂) 8.98 which was followed by Spinosad 240 EC+ Neem oil 5% (T₆) 8.68, Spinosad 45 SC (T₇) 7.18,Neem oil 5% EC (T₁) 5.41, *Metarhizium anisopliae* (T₅) 5.23,Nisco Sixer Plus(T₄) 3.86 *Beauveria bassiana* (T₃) 3.38 and lowest increased over control observed in Control (T₈).

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).

Tr. No	Treatment	Mean population of aphid / plant (10 cm top twig)				
		1DBS	After Spray			
			3 rd Day	7 th Day	14 th Day	Mean
T0	Control	180.4	192.8	201.4	148.73	180.83
T1	Neem Oil 5 %	183.8	74.33	54.46	36.93	87.38
T2	Imidacloprid 17.8 SL	173	50.4	37.46	11.4	68.06
T3	<i>Beauveria bassiana</i> 1.15% WP	197.06	89	69.73	49.86	101.41
T4	Nisco Sixer Plus	189.93	80.6	63.006	42.53	94.01
T5	<i>Metarhizium anisopliae</i>	179.2	64.93	51.4	30.73	81.56
T6	Spinosad 240 EC + Neem Oil 5%	179.8	56.6	41.4	19.66	74.367
T7	Spinosad 45% SC	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. (\pm)		2.855	2.250	1.587	
C. D. (P = 0.05)		6.12	4.82	3.4	

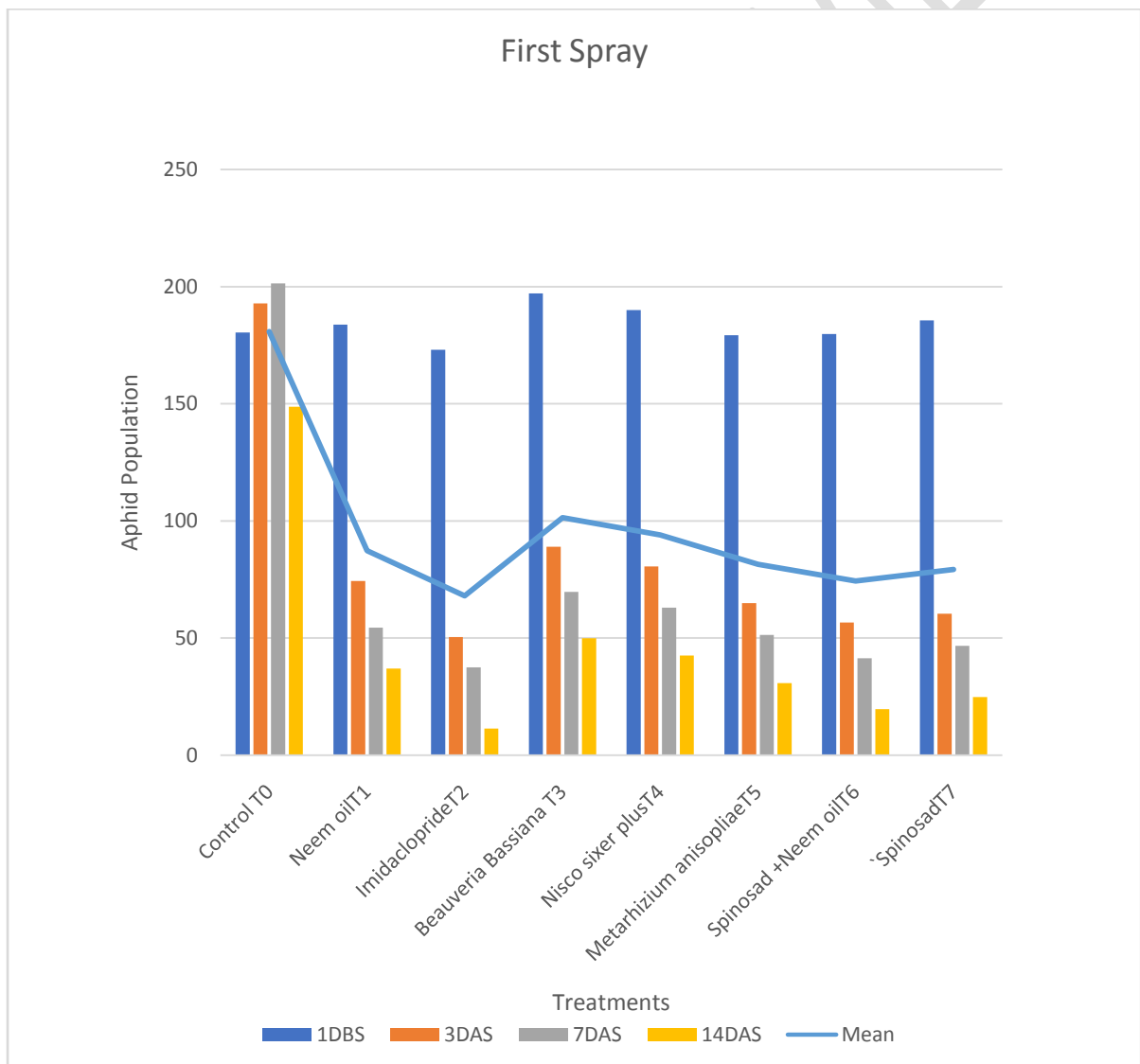


Fig. 1. The efficacy of biopesticides against mustard aphid (*L. erysimi* Kalt.) (First spray)

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

Sr. No:	Treatment	Yield of q/ha	Cost of Yield (₹)	Total cost of yield (₹)	Common cost (₹)	Treatment cost (₹)	Net Return	Total cost (₹)	B:C ratio
T ₁	Neem Oil 5 %	14.58	6500 ₹/q	94770	21749	1700	76021	23449	1:4.04
T ₂	Imidacloprid 17.8 SL	18.15	6500 ₹/q	117975	21749	960	96226	22709	1:5.19
T ₃	<i>Beauveria bassiana</i> 1.15% WP	12.55	6500 ₹/q	81575	21749	2000	59826	23749	1:3.43
T ₄	Nisco Sixer Plus	13.03	6500 ₹/q	84695	21749	1400	62946	23149	1:3.65
T ₅	<i>Metarhizium anisopliae</i>	14.98	6500 ₹/q	97370	21749	2088	75621	23837	1:4.08
T ₆	Spinosad 240 EC + Neem Oil 5%	17.85	6500 ₹/q	116025	21749	2720	94276	24469	1:4.74
T ₇	Spinosad 45% SC	16.35	6500 ₹/q	106275	21749	2100	84526	23849	1:4.45
T ₈	control	9.17	6500 ₹/q	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 anisopliae*, in managing *Lipaphis erysimi*. 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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