

Original Research Article

Comparative efficacy and economics of selected chemicals with neem oil against mustard aphid, *Lipaphiserysimi* (Kaltenbench)

ABSTRACT

The present research was carried out at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, Central Research Field, during Rabi season of the year 2023-2024. The insecticide management experiment was conducted under Randomized Block Design (RBD) with the eight treatment and three replications and undertaking two spraying with fifteen-day intervals. The insecticides tested significantly reduced the pest population compare to control. Among the eight treatments evaluated for their efficacy in field condition against mustard aphid was recorded in treatments Neem oil 5%+ Imidacloprid 17.8SL(6.95) which was the minimum aphid population, followed by Imidacloprid 17.8 SL (8.46), Neem oil5%+ Acetamiprid 20%SP(9.78), Acetamiprid 20%SP(10.45), Neem oil5%+ Cypermethrin 10%EC(11.27),Cypermethrin 10%EC(11.55), Neem oil5%(12.01). The maximum aphid population was recorded in untreated plot(23.33). Based on the result obtained in the present investigation it is concluded that Imidacloprid 17.8SL with Neem oil and chemicals combined with neem oil could be utilized as a component in Integrated Pest Management of *Lipaphiserysimi* (Kalt.) on mustard. Similarly, the result revealed that the maximum C:B was recorded by treatment Neem oil5%+ Imidacloprid17.8%SL(1:2.77) followed by Imidacloprid 17.8% SL(1:2.67) And the minimum Cost Benefit Ratio was recorded in the untreated plot(1:1.27).

Key word:Imidacloprid17.8% SL, *Lipaphiserysimi* (Kalt.),Mustard Aphid, RBD,Treatments.

1.INTRODUCTION

Indian mustard (*Brassica juncea*) is an annual growing perennial herb and is one of the important oilseed crops in the world after soybean and palm[1]. It belongs to the family (Brassicaceae) Cruciferae. *Brassica juncea* is mostly cultivated for edible vegetable oil production and have a long list of history owing to their cultivation and varied use and a major contributor in World's agricultural economy. They are widely cultivated as spices as condiments throughout the world both for human consumption and also for livestock feedings. India comes as in mustard production after China and Canada [2].

Lipaphiserysimi belongs to family Aphididae and is commonly known as mustard aphid. It is a cosmopolitan insect and found on both the leaf surfaces and in leaf folds of developing heads, on leaf stalks, and on leaf axils. They are found primarily on the growing points of the host plants, including tips, flowers and developing pods and cover the whole plant with high density [3][4] They suck sap from the hosts and infested plants become stunted and distorted. Their infestation causes wilting, yellowing and stunting of plants [5]. On the other hand, aphid produces a good amount of honey dew which facilitates the growth of the fungus that makes the leaves and pods appear dirty black and also interferes in the photosynthetic activity of the leaves [6]. It is predominant and capable of causing up to 96per cent yield losses and 5-6per cent reduction in oil content [7].

Mustard aphid causes significant yield losses in many crops in the family Brassicaceae, which includes mustards and crucifers. Continued feeding by aphids causes yellowing, wilting and stunting of plants. Severely infested plants become covered with a mass of small sticky aphids, which can eventually lead to death and decay. Mustard aphids

Comment [SK1]: The abstract provides a succinct overview of the research, highlighting the key findings and the efficacy of different treatments against mustard aphid. The combination of Neem oil 5% with Imidacloprid 17.8SL emerged as the most effective treatment, significantly reducing the aphid population and achieving the highest cost-benefit (C:B) ratio.

feed on the underside of the leaves and on the centre of the mustard head. Many controlling measures are adopted to manage the mustard aphid population below economic injury level like chemical, mechanical, physical, cultural, host plant resistance and biological control. Among these, at severe attack, chemical control is very important and provides significant control [8].

Neem is the best botanical used to control the pest. Some chemicals like Imidacloprid, Acetamiprid, cypermethrin, etc also used as efficient pest management practices. Larvae will hatch from winter eggs attached to the undersides of plant leaves. As aphids grow, they will feed on the leaves similar to other predatory bugs like thrips. Once the first signs of browning or wilting leaves appear, you can apply neem oil to your plant. Additionally, you can introduce ladybugs, which are natural predators of aphids.[9][10].

However, their heavy and extensive use has created various health and environmental problems. As we can't completely avoid chemical pesticides all of a sudden. So to avoid these problems, use of some of the environmentally safer botanicals and chemical pesticides is gaining momentum these days. In recent years various type of insecticides belonging to botanicals and chemical group were used as spray to manage pest complex. Sometimes we don't know about best insecticide for aphid control, so best one can be identified for the management of mustard aphid on mustard by potential evaluation of few selected chemicals and with neem oil through their comparative effectiveness.

2.MATERIALS AND METHODS

The field experiment was carried out the Central Research Farm of Agriculture Technology and Sciences, Prayagraj during the *rabi* season 2023-2024. Trail was laid out in Randomized Block Design with eight treatments viz., Neem oil 5%, Imidacloprid 17.8SL, Acetamiprid 20%SP, Cypermethrin 10%EC and these chemicals combined with neem oil, with three replications. For the current research Black gold mustard was used as variety and spacing 45x30cm. The recommended agronomic practices are followed. Foliar spray of different treatments was made 1000L/ha. Aphid count was taken 24 hours before spraying at 5 tagged plants per treatment, which was further converted in to per plant population and subsequent observation was recorded at 3, 7 and 14 days after spraying on same plants. The chemicals are sprayed at recommended doses when the ETL level of 10%. Spray solution will be applied with the help of hand compression sprayer. Spraying will be done at dawn and dusk time and there must not be much wind currents.

The desired concentration of insecticidal spray solution of desired concentration for each treatment will be freshly prepared each and every time at the site of experiment, just before the start of spraying operations. The quantity of spray materials required for crop should be gradually increased as the crop advanced in age.

The spray solution of desired concentration should be prepared by adopting the following formula:

$$V = \frac{(C \times A)}{(\% \text{ a.i.})}$$

Where,

V = Volume of a formulated pesticide required.

C = Concentration required.

A = Volume of total solution to be prepared.

% a.i. = Percentage of active ingredient in the formulation

Comment [SK2]: The introduction effectively sets the context by discussing the significance of Indian mustard (*Brassica juncea*) and the impact of mustard aphid (*Lipaphis erysimi*) on crop yield. It also outlines the various pest management strategies and emphasizes the importance of chemical control in severe infestations. The introduction mentions the adverse effects of heavy pesticide use and the growing interest in integrating botanicals like neem oil with chemical insecticides for more sustainable pest management.

2.1.Economics:

The marketable yield obtained from different treatments was collected and weighed. Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment should be worked out by deducting total cost of the treatment from gross returns. Total cost of production includes both cultivation as well as plant protection charges[11].

Gross return = Marketable Yield x Market price

Net return = Gross return – Total cost

C: B Ratio =(Gross return)/(Total cost of cultivation)

3.RESULTS AND DISCUSSION

The present study was under taken at Central Research Field, SHUATS, Prayagraj U.P. The data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the data was compiled. Results thus obtained are present aspects wise here undertaken at central Research Farm, SHUATS, Prayagraj, UP. The data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the data was compiled. Result thus obtained are presented aspect wise here under the observation of population of aphids (*Lipaphiserysimi*) on mustard damage percent revealed that the minimum population of aphid was recorded in T₅ -Neem oil 5%+ Imidacloprid 17.8 SL used to be recorded Lowest infestation of aphid (*Lipaphiserysimi*) population (6.95) observed with the aid of of T₃ -Imidacloprid 17.8SL(8.46), T₇ -Neem oil 5% +Acetamiprid 20%SP (9.78), T₂ -Acetamiprid 20%SP (10.45), T₆ -Neem oil 5% +Cypermethrin 10% EC(11.27), T₄ -Cypermethrin 10%EC(11.55), T₁ -Neem oil 5% (12.01). The yield among the treatments was significant. The highest yield was recorded in T₅ -Neem oil 5%+ Imidacloprid 17.8 SL(17.95q/ha) recorded with the aid of of T₃ -Imidacloprid 17.8SL(16.84q/ha), T₇ -Neem oil 5% +Acetamiprid 20%SP (16.04q/ha), T₂ -Acetamiprid 20%SP (15.01q/ha), T₆ -Neem oil 5% +Cypermethrin 10% EC(14.18q/ha), T₄ -Cypermethrin 10%EC(12.64qha), T₁ -Neem oil 5% (12q/ha) . The minimum yield was recorded in untreated plot(7.6q/ha).

In the present research work lowest population of mustard aphid was recorded in Neem oil 5%+ Imidacloprid 17.8SL(6.95).treated plot. Similar findings were also reported by Lal et al.,[7]reported that NSKE+ Imidacloprid 17.8%SL treated plot shown lowest population of mustard aphid. Similarly ,next lowest aphid population recorded in the plot treated with Imidacloprid 17.8SL(8.46). These findings also reported by Vishal et al.,[12] that Imidacloprid 17.8 SL show lowest population of mustard. Next lowest aphid population of mustard aphid was recorded in Neem oil 5% + Acetamiprid 20%SP (9.78) treated plot. Similar findings were reported by Lal et al.,[7]. Next lowest population of mustard aphid was recorded in Acetamiprid 20%SP(10.45) treated plot. Similar findings were also reported by Mishra et al.,[13]. Next lowest aphid population was recorded in Neem oil 5%+ Cypermethrin 10%EC(11.27). similar results also reported by Khandelwal and Kumar[14]. Next lowest aphid population was recorded in Cypermethrin 10%EC(11.55). Similar findings also reported by Sreeja and Kumar[15]. Neem oil (12.01) treated plot showed minimum aphid population survivability similar with the findings Mishra et al.,[13].

The data on Table.1, respect of C:B ratio revealed that the maximum return was recorded by treatment Neem oil 5% +Imidacloprid 17.8SL ie,1:2.77 followed by Imidacloprid 17.8 SL ie,1:2.67 , Neem oil 5%+Acetamiprid 20%SP ie, 1:2.46 and Acetamiprid 20%SP ie ,1:2.37. Secondly good return was received by application of Neem

Comment [SK3]: The methodology is well-detailed, explaining the Randomized Block Design (RBD) used for the experiment, the treatments applied, and the process of foliar spraying. The experiment involved eight treatments with three replications each, and observations were recorded at specified intervals after spraying. The method for preparing spray solutions and the formula for calculating the volume of pesticide required are clearly described. The economic analysis section explains how marketable yield and net returns were calculated, providing a solid basis for evaluating the cost-effectiveness of each treatment.

oil 5%+ Cypermethrin 10%EC ie,1:2.17 followed by Cypermethrin 10%EC 1:1.99. Neem oil 5% recorded less return ie,1:1.88.

The result obtained in the present experiment was found in accordance with the findings of **Mishra et al.,[13]**. The field experiment was conducted during *Rabi* season 2021-22 at the agricultural research farm of Baba Raghav Das Post Graduate College .Deoria, U.P, India. Find out the control of mustard aphid through Imidacloprid 17.8SL in mustard aphid. The result revealed that, Imidacloprid record as maximum grain yield (17.95q/ha).

The present findings in also in partial agreement with findings of **Lal et al.,[7]** an experiment was conducted during *Rabi* 2009 at farmer's field in the village of Mayapur in Bokaro district to find out the control of mustard aphid through insecticide and NSKE 5%+ Imidacloprid 17.8SL combination recorded maximum grain yield and highest cost benefit ratio.

4.CONCLUSION

From the present research it is concluded that among the treatments used chemicals is considered to have the best treatment in which Neem oil 5%+ Imidacloprid 17.8SL proved to be the best treatment in managing *Lipaphiserysimi* infestation and the highest yield was observed in this treatment. The sole usage of Neem oil didn't show any specific results. The sole usage of Cypermethrin 10%EC, Acetamiprid 20%SP, Imidacloprid 17.8SL that have different results, however Imidacloprid 17.8SL shows the better results than Neem oil. It is better to know the compatibility of the botanicals and chemical should be examined for their efficacy. The combination of chemical insecticides along with neem oil have been shown that, results in efficient management of aphid population. It may concluded that the combination of Neem oil5%+Imidacloprid 17.8SL may have best results compared to sole application. Based on the results obtained for treatment tested ,it is suggested that Imidacloprid 17.8SL combined with Neem oil5% could be utilized as a component in Integrated Pest Management of *Lipaphiserysimi* (Kalt.) on mustard.

Comment [SK4]: The results section presents the data on aphid population reduction and yield increases due to different treatments. The combination of Neem oil 5% and Imidacloprid 17.8SL resulted in the lowest aphid population and the highest yield (17.95 q/ha), confirming its superior efficacy. The discussion compares these findings with previous studies, reinforcing the reliability of the results. The C:B ratio analysis indicates that the combined treatments generally offered better economic returns than single treatments or untreated plots.

Comment [SK5]: The conclusion summarizes the findings, emphasizing that the combination of Neem oil 5% with Imidacloprid 17.8SL is the most effective in managing mustard aphid populations and enhancing yield. The recommendation to integrate this combination into Integrated Pest Management (IPM) strategies is well-founded based on the results.

Table.1.Efficacy of selected chemicals with neem oil against Mustard aphid (*Lipaphis erysimi*) population during rabi season 2023 -2024(1st and 2nd spray)

Tr. No.	Treatment	Dose	Population of Mustard aphid/ 5 selected plants										Overall Mean population	Yield (q/ha)	C:B Ratio	
			First spray					Second spray								
			1DBT	3DAT	7DAT	14DAT	Mean	1DBT	3DAT	7DAT	14DAT	Mean				
T ₁	Neem Oil 5%	1.5ml/L	23.13	15.73	14.93	15.47	15.37	15.60	11.16	8.80	6	8.65	12.01	12	1:1.88	
T ₂	Acetamiprid 20%	0.05g/L	23.47	14.67	12.53	12.93	13.38	13.28	10.11	7.55	4.93	7.53	10.45	15.01	1:2.37	
T ₃	Imidacloprid 17.8SL	0.3ml/L	23.87	10.47	9.46	11.46	10.46	11.68	9.06	6.43	3.93	6.47	8.46	16.84	1:2.67	
T ₄	Cypermethrin 10%EC	0.2ml/L	23.20	15.53	13.93	14.40	14.62	15	10.93	8.66	5.86	8.48	11.55	12.64	1:1.99	
T ₅	Neem Oil 5%+Imidacloprid 17.8SL	1.5ml+0.3ml	23.33	8.73	7.86	10.13	8.93	10.25	7.45	4.95	2.56	4.97	6.95	17.95	1:2.77	
T ₆	Neem Oil 5%+Cypermethrin 10%EC	1.5ml+0.2ml	23.93	15.07	13.66	14.26	14.33	14.46	10.63	8.38	5.68	8.22	11.27	14.18	1:2.17	
T ₇	Neem Oil 5%+Acetamiprid 20%SP	1.5ml+0.05g	22.07	13.33	12.47	12.06	12.62	13.15	9.38	6.95	4.53	6.95	9.78	16.04	1:2.46	
T ₀	Control	-	23.53	23.93	24.13	24.53	24.20	24.78	25.23	22.70	18.87	22.26	23.23	7.6	1:1.27	
F test			-	NS	S	S	S	S	S	S	S	S	S	S	-	
C.D (P=0.05)			-	---	0.54	0.47	0.56	1.15	0.63	0.79	0.90	1.11	0.48	2.69	2.76	-
CV			-	---	2.09	2.01	2.21	4.62	2.43	3.84	5.57	9.70	3.03	9.71	14.72	-
S. Ed (±)			-	---	0.25	0.22	0.26	0.54	0.24	0.37	0.42	0.52	0.23	1.14	-	-

Comment [SK6]: The tables and figures, such as the population of mustard aphid and yield data, are clearly presented and support the text effectively. The graphical representation provides a visual summary of the efficacy of different treatments, aiding in the comprehension of the results.

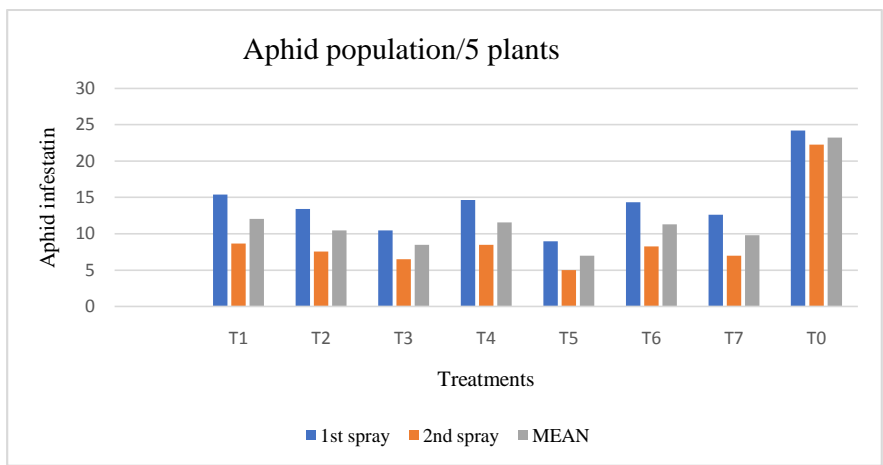


Fig.1.Graphical representation of efficacy of selected chemicals with neem oil against Mustard aphid (*Lipaphiserysimi*) population

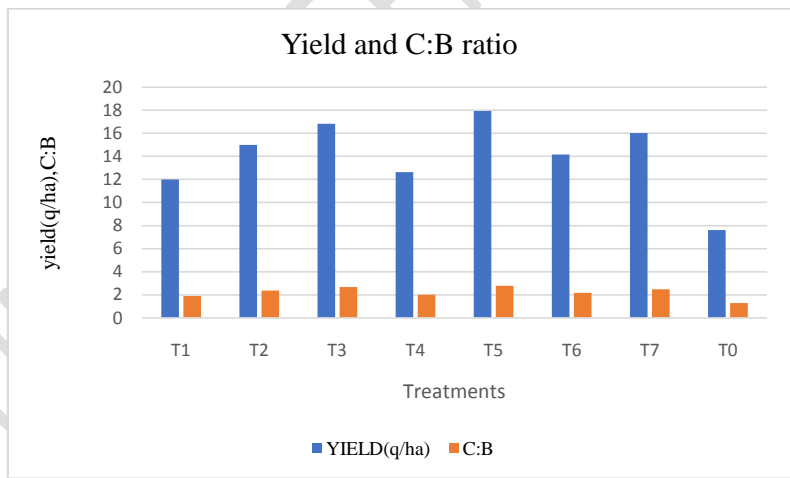


Fig.2.Graphical representation of Yield and Cost Benefit Ratio of different treatments against Mustard aphid(*Lipaphis erysimi*)

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Comment [SK7]: The article is well-structured and provides valuable insights into the comparative efficacy and economics of using neem oil combined with various chemicals against mustard aphid. The thorough methodology and detailed results offer a solid foundation for recommending the best pest management practices. Some minor improvements could be made in ensuring consistency in formatting and citation, but overall, the study is a significant contribution to the field of agricultural pest management.

Comment [SK8]: The references are relevant and include recent studies, which add credibility to the research. However, ensuring all citations are correctly formatted and complete would improve the quality.