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 [AW1]: What month in 2024?

Comment [AW2]: Unit of measure Sq feet?

Comment [AW3]: India comes in as ____ in mustard production…?

Comment [AW4]: %

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 beidentified 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 ,Acetamiprid20%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 3,7and 14days 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 desk time and there must not be much wind currents.

Comment [AW5]: State the start and end dates of sampling e.g. November 2023 to MMMM 2024? We are presently in May Rabi season begins and ends November YY to May YY?

The desired concentration of insecticidal spray solution of desiredconcentration 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:

$$V=((C\times A)\ )/(\%\ a.i.)$$

Comment [AW6]: Maintain grammatical consistency, at one point the author writes in the past tense and then in the future tense . The past tense is preferred in scientific writing.

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

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 T_5 -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 T_3 -Imidacloprid 17.8SL(8.46), T_7 -Neem oil 5% +Acetamiprid 20%SP (9.78), T_2 -Acetamiprid 20%SP (10.45), T_6 -Neem oil 5% +Cypermethrin 10% EC(11.27), T_4 -Cypermethrin 10%EC(11.55), T_1 -Neem oil 5% (12.01) .The yield among the treatments was significant. The highest yield was recorded in T_5 -Neem oil 5%+ Imidacloprid 17.8 SL(17.95q/ha) recorded with the aid of of T_3 -Imidacloprid 17.8SL(16.84q/ha), T_7 -Neem oil 5% +Acetamiprid 20%SP (16.04q/ha), T_2 -Acetamiprid 20%SP (15.01q/ha), T_6 -Neem oil 5% +Cypermethrin 10% EC(14.18q/ha), T_4 -Cypermethrin 10%EC(12.64qha), T_1 -Neem oil 5% (12q/ha) . The minimum yield was recorded in untreated plot(7.6q/ha).

Comment [AW7]: Nothing was mentioned about the type of statistical analysis in the Methodology. What type of statistical analysis was used?

Comment [AW8]: Expand?

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

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.

Comment [AW9]: Very good results but the way it is being reported could be improved using the table more efficiently for e.g. and * showing the statistically significance levels and discussing the most t least effective formulations.

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 [AW10]: Promoting integrated pest management is excellent, however what is the statistical difference in treatment With the Neem + Imodacloprid compared to Imidacloprid alone? Compared to the other chemicals how does it compare? Is it most economical to se this combination or can another one of the chemical treatment alone be the best efficacy and economics?

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**	**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 [AW11]: Is there no C:B ratio? According to this there is no statistical significance. Maybe explain the limitations of the study to justify these statistical outcomes.

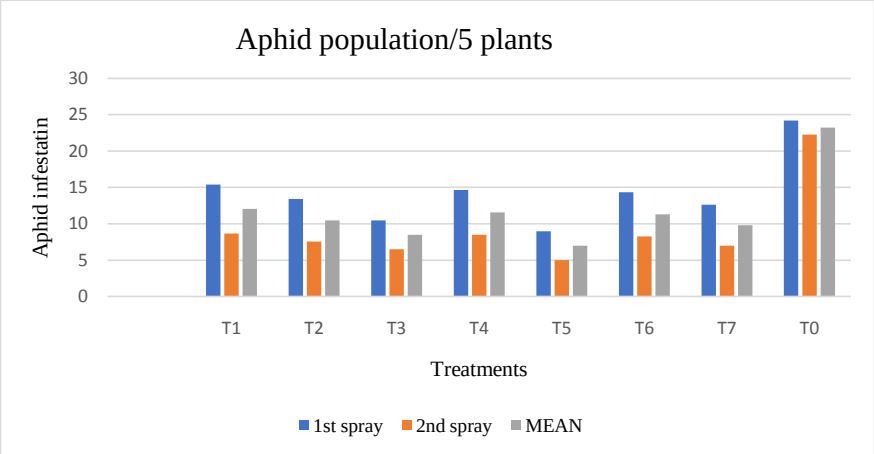
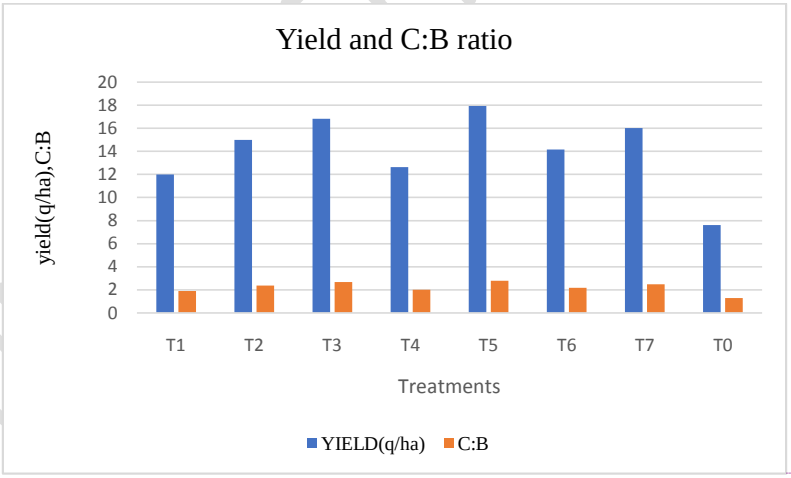


Fig.1.Graphical representation of efficacy of selected chemicals with neem oil against Mustard aphid (*Lipaphiserysimi*) population

Comment [AW12]: A good concise visual image, there is no need for a separate bar for the mean values, a SD or SEM bar on the 1st and 2nd spray would be more informative.



Comment [AW13]: Fig 2 continues from the table to show effectively that T5 was indeed the most effective treatment among the treatment groups compared also to T0, A good point to mention is that the yields were almost doubled or more compared to no treatment?

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

REFERENCE

1)**Kumar, P., Kumar, A., Kumar, S., and Kumar, P. (2014).**Effect of zinc and iron application on yield and acquisition of nutrient on mustard crop (*Brassica juncia* L.). *J. Plant Develop. Sci.*, **6**, 413-416.

2)**GOI (Government of India, 2009)** .Agriculture statistics at a glance. Agriculture statistics division, department of agricultural and cooperative., ministry agriculture, GOI, New Delhi.

3) **Nelson, E. H., and Rosenheim, J. A. (2006).** Encounters between aphids and their predators: the relative frequencies of disturbance and consumption. *Entomologia Experimentalis et, Applicata*., **118(**3), 211-219.

4) **Singh, A., Yadav, R. S., Anshuman, K., Kumar, A., Patel, V. K., Singh, A. P., and Singh, R. P. (2020)**. Effect of weed management practices on yield and economics in Indian mustard. *International Journal of Chemical Studies*, **8**(2), 1364-1367.

5) **Khan, I. A., Ahmad, M., Akbar, R., Hussain, S., Saeed, M., Farid, A., and Din, M. M. U. (2015).** Study on Aphids density and yield components of 12 brassica genotypes under field conditions in Peshawar, Pakistan. *J. Ent.Zool. Stud*, **3,** :11-15.

6) **Sharma, N., Upadhyaya, S. N., Singh, U. C., Dubey, M., and Ahmad, A. (2020).**Bio efficacy of insecticides against mustard aphid. *Journal of Entomology and Zoology Studies*, **8(**4), 97-102.

7) **Lal, B., Nayak, M. K., Tomar, D. S. and Thakur, S.R.(2018).** Efficacy of newer insecticides against mustard aphid ,*Lipaphiserysimi* (Kalt.) in Indian mustard under Bundelkhand Agro-climatic zone of Madhya Pradesh. *Journal of Entomology and zoology studys*. **6**(6): 400-403.

8) **Chaudhary, R. F., Patel, J. R., and Chaudhary, M. (2020).** Evaluation of new and conventional insecticides for the management of mustard aphid (*Lipaphis erysimi* (kalt). *Journal of Pharmacognosy and Phytochemistry*, **9**(6), 1738- 1741.

9) **Nicoletti, M., Petitto, V., Gallo, F. R., Multari, G., Federici, E., and Palazzino, G. (2012)**. The modern analytical determination of botanicals and similar novel natural products by the HPTLC fingerprint approach. *Stud. Nat. Prod.Chem*. **37**, 217–258.

10)**Venkateswarlu, B., Pirat, M., Kishore, N., and Rasul, A. (2008).** Mycorrhizal inoculation in neem (*Azadirachta indica*) enhances azadirachtin content in seed kernels. *World Journal of Microbiology and Biotechnology*, **24**, 1243-1247.

11)**Zorempuii, R., and Kumar, A. (2019).** Efficacy of certain chemicals and botanicals against aphid, *Lipaphiserysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.). *Journal of Entomology and Zoology Studies*, **7**(5), 89-93.

12) **Vishal, H. S. and Kumar, A. (2019)**. Efficacy and economics of some newer insecticides against mustard aphid, *Lipaphiserysimi*(Kalt). *Journal of Pharmacognosyand Phytochemistry*. **8**(3): 785-788.

13) **Mishra, S. K., Kumar, R., Singh, A. P., and Tiwari, D. K. Y. B. (2023).** Bio-efficacy of novel insecticides against mustard aphid (*Lipaphiserysimi*Kalt.) in mustard crop (*Brassica campestris* L.).

14) **Khandelwal, R., and Kumar, A. (2022).** Evaluation of chemical insecticides along with cypermethrin and biopesticides against mustard aphid [*Lipaphis erysimi*](Kalt.) in mustard (*Brassica juncea*).

15)**Sreeja.S.,and Kumar, A. (2022**). Field efficacy of selected chemicals and biopesticides against mustard aphid [*Lipaphiserysimi* (Kaltenbach)] on mustard[*Brassica juncea* (L.)] atPrayagraj (UP). *The Pharma Innovation Journal*, **11(**5),1706-1710.