

Original Research Article

Efficacy of chemical insecticides and neem products against mustard aphid, [*Lipaphis erysimi* (Kalt.)] on mustard *Brassica juncea* (L.)

Comment [w71]: delete

Abstract

A field ~~trial~~-trial was conducted at Central Research Field, SHUATS, Naini, Prayagraj during rabi 2021 in Randomized Block Design (RBD). Seven treatments were evaluated against *Lipaphis erysimi* i.e., Imidacloprid 17.8% SL @ 0.5ml/lit, Thiomethoxam 25%WG @ 4gm/lit, Neem oil 5ml/lit, Indoxacarb 14.5%SC@ 0.65ml/lit, Emamectin Benzoate 5% SG, Neem seed kernel extract (NSKE) 5% @ 5gm/lit, Spinosad 45% SC. ~~-, were evaluated against mustard aphid-Lipaphis erysimi.~~ Results revealed that, among the different treatments Imidacloprid (41.61) proved to be the most effective treatment followed by ~~th~~-Thiomethoxam (45.49), Emamectin benzoate (51.78), Indoxacarb (62.67), Spinosad (69.98), and Neem seed kernel extract (NSKE) (72.97), whereas Neem oil (78.99) was found to be least effective against this pest. The plot treated with Imidacloprid 17.8% SL showed highest yield (1:5.98), followed by Thiomethoxam 25%WG (1:5.37), Emamectin Benzoate 5% SG @ (1:5.25), Indoxacarb 14.5%SC (1:4.71), Spinosad 45% SC (1:4.45), and Neem seed kernel extract (NSKE)5% (1:3.71), Neem oil (1:3.77), as compared to control plot (1:2.8)

Comment [w72]: ~~trial~~ = Delete; trial = addition

Comment [w73]: delete

Comment [w74]: delete

Comment [w75]: delete

Comment [w76]: delete

Keywords: ~~Cost~~:Benefit ratio; Efficacy; Imidacloprid; ~~Insecticides~~-Neem products; *Lipaphis erysimi*,

1. Introduction

Mustard is a multipurpose crop and India holds a premier position in the global oil seed production accounting 19 percent of total area and 9 percent of production. Mustard is a member of Family- Brassicaceae and has been placed in the genus Brassica. Indian mustard plants which bear tiny round edible seed as well as tasty leaves. Mustard is locally called "Sarsoo", "Rai", "Raya" and "Laha". The oil obtained from the different types show slight variation in percentage. The oil content varies from 37 to 49 percent. The seed and oil are used as condiment in the preparation of pickles and for flavoring curries and vegetables. In the tanning industry, mustard oil is used for softening leather. It is also used in preparation of the

Comment [w77]: delete

hair oil, medicine etc. **Jandial et al., (2007)**. Oilseeds come next to food grains in volume and value in the country. Among the oil seed crop, rape seed and mustard play a pivotal role in agricultural economy of the world. The important rapeseed and mustard growing countries of the world are India, Canada, China, Pakistan, Poland, Bangladesh and Sweden. Indian ranks first in the world in respect of acreage accounting for 31.8 per cent of world (**Khedkar et al., 2012**) Large colonies can cause the plants to become deformed and the large colonies can cause the plants to become deformed and the leaves curled, shriveled and yellowed (METCALF, 1962). They also produce a large quantity of honey dew through both **carnicles** and anus which facilitates the growth of the fungus that makes the leaves and pods black, sooty in appearance which ultimately creates problem in photosynthesis (**Awasthi, 2002; Bakhetia and Arora, 1986; Bakhetia and Sekhon, 1989; Sahoo 2012; Mandal et al., 2012**). Mustard aphids have the capability to increase their population and spread rapidly within a very short span of time in favourable environmental condition. For this, all control measures except, chemical control are time consuming (**Sahoo 2012**). But chemical insecticides are not only toxic to natural enemies of aphid such as *Diaeretiella rapae*, *Chrysoperla zastrowi arabica*, coccinellids and syrphid flies (**Nagar et al., 2012**) but these are also responsible for environmental pollution, health hazards to human beings, toxic to pollinators, pest resurgence, development of resistance in insect-pests and residues in oil and cake (**Singh 2001**). Botanicals are, in general, more compatible with the environmental components than the synthetic pesticides, owing primarily to their susceptibility to degradation by light, heat and microorganisms. Moreover, there is no report of pest resurgence due to the use of botanicals pesticides. In view of these, sincere efforts were undertaken in this direction for assaying the insecticidal properties of different plant extracts against mustard aphid. (**Srivastava and Guleria 2003**)

Comment [w78]: References must be listed at the end of the manuscript and numbered in the order that they appear in the text. Every reference referred in the text must also present in the reference list and vice versa. In the text, citations should be indicated by the reference number in brackets [...]. **Please follow the Author guidelines.** Link is: <https://journalijpss.com/index.php/IJPSS/about/submissions>

Comment [w79]: delete

Comment [w710]: please re write this and complete the sentence

Comment [w711]: Re-write

2. Materials and methods:

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture Technology and Sciences, during the *Rabi* season of 2021, in a randomized block design with eight treatments replicated three times using variety Rohini kranti seeds in a plot size of 2m×2m at a spacing of 45cm×30cm with a recommended package of practices excluding plant protection. The soil of the experimental land was well drained and medium high. Research field situated at 25°27' North latitude 80°05' East longitudes and at an altitude of 98 meter above sea level the maximum temperature reaches upto 42°C in summer and drops down to 4°C in winter.

Comment [w712]: delete

Comment [w713]: delete

The observation on population of sucking pest were recorded visually using a magnifying lens early on ~~top-~~ 10cm ~~central~~ apical ~~shoot~~ twig per plant from five randomly selected and tagged plants in each plot. The insecticides were sprayed at recommended doses when aphids reaches its ETL(25-150 ~~aphids/10cm apical shoot~~) level. Aphids count was taken 24 hours before spraying at tagged plant at 5 tagged plants per treatment, ~~which was further converted into per plant population~~ and subsequent observation was recorded at 3rd, 7th and 14th days after spraying (DAS) on same plants.

Comment [w714]: Everywhere in the text after values of aphid population writeaphids/10cm apical shoot. For example: aphid population is 150 then it should be written as: 150 aphids/10cm apical shoot.

Comment [w715]: How you convert per plant population this not possible?

The healthy marketable yield obtained from different treatments were collected separately and weighted. The cost of insecticides used in this experiment was recorded during *Rabi* season. The cost of botanicals used was obtained from nearby market. The total cost of plant protection consisted of cost of treatment, sprayer, rent and labour charges for the spray. There are two sprays throughout the research period and the overall plant protection expenses was calculated. Total income was ~~realized~~ ~~computed~~ by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by ~~subtracting~~ ~~subtracting~~ the total cost of plant protection from the total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment.

Comment [w716]: please, write in short about the data analysis which you applied

3. Results and discussion

Effect of first spray

Efficacy of different insecticides on the population of mustard aphid (*Lipaphis erysimi*) showed that all the treatments were significantly superior in reducing the population of mustard aphid resulting in increasing the yield significantly as compared to control (Table 1). The population recorded 1DAS was in a range of 145.2 to 153.8 aphids/10cm apical shoot (Table 1). On third day after spray (DAS), the lowest population of aphids was 63.2 and 68.07 aphids/10cm apical shoot was recorded in Imidacloprid 17.8%SL and Thiomethoxam 25% WG treated plots, respectively that difference differed significantly with other treatment plots but statistically at par with each other. The lowest population was recorded in Imidacloprid 17.8% SL (29.33 aphids/10cm apical shoot) treated plots followed by Thiomethoxam 25% WG and Emamectin benzoate 5% SG with 31.73 and 35.06 aphids/10cm apical shoot, respectively on 7th day after spray. Whereas, the lowest population of aphid *Lipaphis erysimi* was observed on 14DAS and mean (1st spray) in Imidacloprid 17.8% SL (45.93 and 46.15 aphids/10cm apical shoot, respectively) followed by Thiomethoxam 25% WG (48.86 and 49.55 aphids/10cm apical shoot, respectively) and Emamectin benzoate 5% SG (53.60 and 55.59 aphids/10cm apical shoot, respectively) (Table 1). (Table 1)

Comment [w717]: delete

Comment [w718]: Please follow this way where values of aphid population are written in the text

Effect of second spray

One day prior second spray, the mean population of aphid ranged from 45.93 to 135.46 aphids/10cm apical shoot. Imidacloprid 17.8% SL treated plots recorded lowest mean population in all observations on 3rd, 7th, and 14th day after spray and mean with 43.73, 25.93, and 41.60 aphids/10cm apical shoot, respectively 37.08, followed by Thiomethoxam 25% WG (52.4, 27.86, and 44.06 aphids/10cm apical shoot, respectively 41.44).

Comment [w719]: Further, at 14DAS the lowest population of aphid was observed in Imidacloprid 17.8% SL (45.93 aphids/10cm apical shoot) followed by Thiomethoxam 25% WG (48.86 aphids/10cm apical shoot, respectively) and mean (1st spray) in and 46.15 aphids/10cm apical shoot, respectively) and Emamectin benzoate 5% SG (53.60 aphids/10cm apical shoot, respectively) (Table 1).

These results are support with Singh et al. (2014) and Dostara et al. (2017), reported that Imidacloprid 17.8% SL proved superior over other insecticides in reducing population of Mustard aphid. Vishvendra et al. (2018) found Thiomethoxam as the most effective treatment.

Comment [w720]: Write about the overall all mean population of aphid then cite the relevant references in numbered form as mentioned in author guidelines

Comment [w721]: References must be listed at the end of the manuscript and numbered in the order that they appear in the text. Every reference referred in the text must also present in the reference list and vice versa. In the text, citations should be indicated by the reference number in brackets [..]. Please follow the Author guidelines. Link is: <https://journalipss.com/index.php/IPSS/about/submissions>

Perusal of the data revealed that the yields among the treatments were found to be significant (Table 1). The highest yield was recorded in Imidacloprid 17.8% SL (22.0 q/ha), followed by Thiomethoxam 25% WG (19.75 q/ha), Emamectin benzoate 5% SG (19.75 q/ha), Indoxacarb 14.5% SC (18.33 q/ha), Spinosad 45% SC (17.16 q/ha), Neem seed

Kernel Extract (NSKE) (14.58 q/ha), and Neem oil (13.75 q/ha), as compared to control plot (10.16 q/ha). 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: 5.98) followed by Thiomethoxam 25% WG (1: 5.37), Emamectin benzoate 5% SG (1: 5.25), Indoxacarb 14.5% SC (1: 4.71), Spinosad (1: 4.45), and Neem seed Kernel Extract (NSKE) (1: 3.79), Neem oil (1: 3.77), as compared to Control (1: 2.80). The present results are similar with [Awaneesh et al. \(2014\)](#) observed highest C:B ratio in Imidacloprid. [Mokal et al. \(2018\)](#) concluded that in terms of higher cost benefit ratio Thiomethoxam was found superior. [Yadav et al. \(2018\)](#) found Emamectin benzoate as the economical treatment.

4. Conclusion: Write in brief about your findings.

Comment [w722]: delete

Comment [w723]: delete

Comment [w724]: References must be listed at the end of the manuscript and numbered in the order that they appear in the text. Every reference referred in the text must also present in the reference list and vice versa. In the text, citations should be indicated by the reference number in brackets [..]. **Please follow the Author guidelines.** Link is: <https://journalijpss.com/index.php/IJPSS/about/submissions>

TABLE 1. Efficacy of chemical insecticides and neem products against mustard aphid, [*Lipaphis erysimi* (Kalt.)]

S.No.	Treatments	Population of <i>Lipaphis erysimi</i> / 10cm apical shoot							Overall mean	Yield (q/ha)	B:C ratio
		First spray				Second spray					
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T ₁	Imidacloprid 17.8% SL @ 0.5ml/lit	153.8	63.2 ^e	29.33 ^e	45.93 ^f	43.73 ^f	25.93 ^f	41.6 ^f	41.61	22	1:5.98
T ₂	Thiamethoxam 25% WG @ 0.25g/lit	149.73	68.07 ^d	31.73 ^e	48.86 ^{ef}	52.4 ^e	27.86 ^{ef}	44.06 ^{ef}	45.49	19.75	1:5.37
T ₃	Neem oil 1500 ppm	145.2	88.2^b	84.2 ^b	79.53 ^b	73.73 ^b	75.2 ^b	73.13 ^b	78.99	13.75	1:3.7
T ₄	Indoxacarb 14.5% SC @ 0.65ml/L	152.73	81.86 ^c	63.8 ^c	55.26 ^d	64.93 ^{cd}	58.73 ^d	51.46 ^d	62.67	18.33	1:4.71
T ₅	Emamectin benzoate 5%SG @ 0.4gm/L	149.73	78.13 ^c	35.06 ^d	53.6 ^{de}	64 ^d	30.33 ^e	49.6 ^{de}	51.69	19.75	1:5.251
T ₆	Spinosad 45% SC @ 0.25ml/lit	152.46	86.46 ^b	83.93 ^b	64.06 ^c	69.4 ^{bc}	75.06 ^b	58.93 ^c	72.97	14.58	1:3.79
T ₇	Neem seed kernel extract(NSKE) @ 5gm/L	148.4	85.86 ^b	83.46 ^b	58.4 ^{cd}	67.33 ^{cd}	71.46 ^c	53.4 ^{cd}	69.98	17.16	1:4.45
T ₀	Control	146.53	127.2 ^a	130.73 ^a	135.46 ^a	140.8 ^a	145.33 ^a	151.3	138.47	10.16	1:2.8
	F-test	NS	S	S	S	S	S	S	S		
	S. Ed (±)	-----	1.75	1.20	2.83	2.43	1.57	3.18	1.35		
	C.D. (P = 0.5)	-----	3.76	2.58	6.08	5.22	3.390	6.83	2.901		

DBS=Days before spraying; DAS= Days after spraying; NS= Non-significant; S= Significant

Comment [w725]: Delete

Comment [w726]: Delete

Comment [w727]: 8

Comment [w728]: Merge the cells

Comment [w729]: Merge the cells

Comment [w730]: Merge the cells

Competing interests

Hereby authors have declared that no competing interests exist.

References:

...

Awasthi, V. B. (2002). Introduction to General and Applied Entomology. *Scientific publisher*, 66- 71 P P.

Awaneesh., Malik, Chandra, Y. P. and Kumar, A. (2014). Efficacy and economics of new insecticides for management of aphid (*Lipaphis erysimi*) in Indian mustard. *Current Advances in Agricultural Sciences*, 6(1):88-90.

Bakhetia, D. R. C. and Arora, R. (1986). Control of insect pests of toria, sarson and rai. *Indian Farming*, 36(4):41-44.

Bakhetia, D. R. C. and Sekhon, B. S. (1989). Insect pests and their management in rape seed mustard. *Journal of Oilseeds Research*, 6:269-73.

Dotasara, S. K., Agrawal, N., Singh, N., and Swami, D. (2017). Efficacy of some newer insecticides against mustard aphid *Lipaphis erysimi* Kalt. in cauliflower. *Journal of Entomology and Zoology Studies*, 5(2),654-656.

Jandial, Anil Kumar, V. K. and Parihar, S. B. S. (2007). Efficacy of different insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) on mustard under field conditions. *International Journal of Agricultural Sciences*, 3(2):90-91.

Khedkar, A., Bharpoda, T., Patel, M., and Sangekar, N. (2012). Evaluation of different botanical insecticides against aphid, *Lipaphis erysimi* (Kaltenbach) infesting mustard. *AGRES – An International e-Journal*, 35(3): 140-233.

Mandal, D., Bhowmik, P. and Chatterjee, M. L. (2012). Evaluation of new and conventional insecticides for the management of mustard aphid, *Lipaphis erysimi* Kalt. (Homoptera: Aphididae) on rapeseed (*Brassica juncea* L.) *The Journal of Plant Protection, Sciences* 4(2):37-42.

Mokal, A. J., Shinde, B.D., Naik, K. V., Sanap, P. B., Mehendale, S.K and Golvankar, G. M. (2018). Bio-efficacy of insecticides against aphids infesting chilli. *International Journal of Chemical Science*, 6(5):2821-2824.

Comment [w731]: References must be listed at the end of the manuscript and numbered in the order that they appear in the text. Every reference referred in the text must also present in the reference list and vice versa. In the text, citations should be indicated by the reference number in brackets [...]. **Please follow the Author guidelines for listing of references.**
Link is:
<https://journalijpss.com/index.php/IJPSS/about/submissions>

Comment [w732]: italic

Comment [w733]: Write abbreviation of Journal in un-italic

Comment [w734]: Un-italic

Comment [w735]: italic

Nagar, A., Singh, S. P., Singh, Y. P., Singh, R., Meena, H. and Nagar, R. (2012). Bio efficacy of vegetable and organic oils, cakes and plant extracts against mustard aphid *Lipaphis erysimi* (Kalt.). *Indian Journal of Entomology*, **74**(2): 114-119.

Sahoo, S.K. (2012). Incidence and management of mustard aphid (*Lipaphis erysimi* Kaltenbach) in West Bengal. *The Journal of Plant Protection Sciences*, **4**(1): 20-26.

Singh, P. K. (2001). Control of mustard aphid, *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae) with minimum insecticide use. *Journal of Aphidology*, **15**: 139-142.

Singh, D., Kumar, V. and Kumar, D. (2014). Inheritance of mustard aphid, *Lipaphis erysimi* (Kalt.) tolerance in Indian mustard (*Brassica juncea* (L.) Czern&Coss). *Annals of Biology*, **16** (2): 145- 148.

Srivastava, A., and Guleria S. (2003). Evaluation of botanicals for mustard aphid, *Lipaphis erysimi* (Kalt.) control in Brassica. *Himachal Journal of Agricultural Research*, **29** (4): 116-118.

Vishvendra, S. K., Sachan, S. K., Singh, G., and Singh. (2018). Bio-Efficacy of insecticides and biorational against *Lipaphis Eerysimi* (KALT.) in mustard crop. *Journal of Pharmacognosy and Phytochemistry*, **5**: 58-61.

Yadav, A.K., Singh, H., and Yadava, T.P. (2018). Virulence of *Verticillium lecanii* (Z.) against cereal aphids; does timing of infection affect the performance of parasitoids and predators. *Pest Management Science*, **69**(4):493-498

Comment [w736]: italic

Comment [w737]: italic