

Original Research Article

**Field evaluation of selected insecticides and botanical against mustard aphid,
Lipaphis erysimi (Kalt.) on mustard, *Brassica juncea* L.**

ABSTRACT

A field ~~trial~~ was conducted at Central ~~Research~~ ~~Farm~~ [CRF], SHUATS, Naini, Prayagraj during the Rabi season. Six treatments were evaluated against *Lipaphis erysimi*. i.e. Fipronil 5% SC @ 0.5ml/lit, Difenthurion 50% WP @ 0.20g/lit, Profenophos 50% EC @ 1ml/lit, Thiamethoxam 25% WG @ 0.25g/lit, Imidacloprid 17.8% SL @ 0.5ml/lit and NSKE 5% @ 5ml/lit were evaluated against mustard aphid *Lipaphis erysimi*. Results revealed that, among the different treatments, the lowest population of mustard aphid was recorded in Imidacloprid 17.8% SL (22.82). Thiamethoxam 25% WG (33.63) was found to be the next best treatment followed by Difenthurion 50% WP (47.18), Fipronil 5% SC (54.15), and Profenophos 50% EC (60.12), whereas NSKE 5% (80.23) was found to be the least effective against this pest. The plot treated with the highest yield Imidacloprid 17.8% SL (24.6 q/ha) followed by Thiamethoxam 25% WG (21.8 q/ha), Difenthurion 50% WP (18.2 q/ha), Fipronil 5% SC (16.4 q/ha), Profenophos 50% EC (14.3 q/ha) and NSKE 5% (13.5 q/ha) as compared to the control plot (9.2 q/ha). Among the treatments, the best and most economical treatment was Imidacloprid 17.8% SL (1:7.24) followed by Thiamethoxam 25% WG (1:6.43), Difenthurion 50% WP (1:5.24), Fipronil 5% SC (1:4.64), Profenophos 50% EC (1:3.94) and NSKE 5% (1:3.90) as compared to control plot (1:2.83).

Keywords: Cost-Benefit ratio , Evaluation , Imidacloprid , Insecticides , *Lipaphis erysimi*.

INTRODUCTION

Mustard, *Brassica juncea* (L.) Czern and Coss is an important oilseed crop belonging to the family cruciferaceae (Syn.Brassicaceae). Indian mustard or brown mustard is natural amphidiploids having chromosome no (2n=36). 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, 2016**). Mustard (*Brassica spp.*) is one of the first domesticated crops which has wide dispersal, and has been grown as herb in Asia, North Africa, and Europe for thousands of years (**Mandal et al., 2018**).

It contributes about 28.6% ~~in of~~ the total oilseeds production in India, whereas it is the second most important edible oilseed after groundnut, sharing 27.8% ~~in of~~ India's oilseed economy (**Kumar et al., 2018**). Mustard plays an important role in the oil seed economy of the country. The oil contents of mustard seeds ~~varies-ranges~~ from 32 to 40 percent-%, and protein content ~~ranges~~ from 15 to 17 percent-% (**Ghule and Bagde 2016**).

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 ~~C~~Carbohydrates, 26.08 g ~~p~~Proteins, 26.08 g ~~T~~Total fat and 12.2 g ~~D~~dietary fiber, 31 I.U. ~~V~~itamin A, 4.733 mg ~~N~~iacin, 7.1 mg ~~V~~itamin C, 266 mg ~~C~~alcium, 9.21 mg ~~I~~ron, 370 mg ~~M~~agnesium, 13 mg ~~S~~odium and 738 mg ~~P~~otassium (**Daravath et al., 2016**).

Mustard production in India stands in between 8-9 million tons with a significant ~~growth~~ ~~increase~~ in between 2000 and 2019 (**Kalia et al., 2021**). It is cultivated over an area of 5.75 million ha with production and productivity of 6.80 million tonnes and 1183 ~~K~~g/ha respectively in India (**Kumar et al., 2020**). In India, ~~the~~ major production regions of ~~M~~ustard are Rajasthan, Haryana, Uttar Pradesh, and Madhya Pradesh while the major consumption (as raw pellets) regions are Rajasthan, Uttar Pradesh, Haryana, and Punjab (**Kalia et al., 2021**). Uttar Pradesh accounts for 1198.5 ha. 10.85% and 11.19% of area and production, respectively in the country with ~~the-an~~ average yield of 11.49 q/ha which is equivalent to the national average (11.17 q/ha). (**Singh et al., 2007**).

Mustard plant is attacked by a number of insect pests. (**Bakhetia, 1983**). ~~F~~found more than three dozens of insect pests, associated with various phenological stages of these crops. Among them, *Lipaphis erysimi*, commonly known as ~~the~~ mustard aphid is most destructive. It belongs to the family Aphididae of the order Homoptera. The insect is distributed to many other countries of the world. The attack is severe in those regions where the numbers of cloudy days ~~are more-is~~ ~~greater~~ during the pest activity period (**Akter et al., 2021**).

Aphids are small, soft-bodied, pearl-shaped insects that have a pair of cornicles (honey tubes)

projecting out from the fifth or sixth abdominal segment. The aphid attacks generally during December and continues till March. About 45 generations are completed in a year (**Gautam et al., 2019**).

The damage is caused by both nymph and adult stages as ~~these~~ they suck the cell sap from leaves and leaves turn yellow from green and growth of plants is stunted. It found on all parts of plant; leaves, stem, blooming flowers and silique forming inflorescence, ~~while in condition of severe attack in sevre cases~~, the plants may even die off (**Aslam and Ahmad, 2001**).

Mustard aphid is the major constraint responsible for low yield as well as low quality seed, which is considered as key factor in reducing mustard production and ~~sometime it is so severe that may can~~ cause yield loss up to 90% (**Gupta et al., 2003**). It may cause a yield losses ranging from 35.4 to 96% in favourable conditions and can reduce 5-6% oil content (**Sahoo, 2012**).

Chemical control is more accurate as it controls about 90% of the aphid population, but due to its high rate of reproduction, in a period of 2-3 weeks after treatment of insecticide, the aphid population reaches around the same number as ~~was~~ before treatment. That's why it is mandatory for insecticides to have ~~an~~ effective control over Mustard aphid population for a longer period of time (**Ahmed et al., 2018**).

Objectives:

1. To evaluate the chemical insecticides and botanicals against mustard aphid, *Lipaphis erysimi* (Kalt.) in mustard (*Brassica juncea*) during the *Rabi* season 2021.
2. To Calculate the Crop Economics of the Crop – Benefit Cost ratio [B:C ratio].

MATERIALS AND METHODS

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Reasearch 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 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 site was well drained and medium high. The ~~R~~research field situated at 25°27' North latitude 80°05' East longitudes and at an altitude of 98 ~~meter~~ metres above sea level. The maximum temperature reaches up to 42°C in summer and drops down to 4°C in the winter.

Preparation of Insecticidal spray solution:

The desired concentration of insecticidal spray solution ~~of desired concentration~~ for each treatment was 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 the crop was gradually increased as the crop advanced in age.

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

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

Where, V=Volume of a formulated pesticide is required.

C=~~Concentration required~~ Required concentration.

A= ~~Volume of total solution~~ Total volume of solution to be prepared

% a.i. = Given Percentage strength of a formulated pesticide

Data for mustard aphid was recorded on five randomly selected plants at ~~their~~ the top 10 cm of the central shoot. When the aphid population reached ~~to an~~ economic threshold level, ~~then~~ treatment of insecticides was done. Five plants from each treatment were randomly selected, tagged and the Mustard aphid population was recorded on them. Insect populations ~~was~~ were recorded 24 hours before application. Besides this, the insect pest population was recorded at time intervals of 3 days, 7 days and 14 days after treatment. The experiment was repeated twice to ~~minimize~~ minimize possible errors.

RESULTS AND DISCUSSION

The population of Lipaphis erysimi one day before the first spray was in a range of 120.2 to 136.4 aphids/ 10 cm central shoot prior to the application of treatments during *Rabi*. The chemical insecticides were more effective than the botanical. Efficacy of botanical and selected insecticides against mustard aphid populations on mustard showed that the data on the population of *Lipaphis erysimi* on three days after the first spray revealed that all the treatments were significantly superior over control. Among all the treatments, the plot treated with Imidacloprid @ 0.5ml/lit (26.46) proved to be the most effective. The next best treatment was Difenthurion at 0.25g/lit (89.53), followed by Fipronil at 0.5ml/lit (90.26), Profenophos at 1ml/lit (94.6), and @ NSKE 5%, 5 ml/lit (118.26), which was the least effective of all treatments Thiamethoxam @ 0.25g/lit (58.8) was the next best treatment followed by Difenthurion @ 0.20g/lit (89.53), Fipronil @ 0.5ml/lit (90.26), Profenophos @ 1ml/lit (94.6), @ NSKE 5% 5 ml/lit (118.26) which was least affective among all the treatments. respectively on the 7th and 14th day after

spray.

The population of *Lipaphis erysimi* one day before the second spray was in a range of 51 to 166.6 . Three days after the second spray, all the insecticidal treatments were significantly superior over the untreated control. The lowest aphids population was recorded in the treatment of Imidacloprid @ 0.5ml/lit (22.6) followed by Thiamethoxam @ 0.25g/lit (30.73), which was a standard check. The next effective treatments were Difenthurion @ 0.20g/lit (36.4), Fipronil @ 0.5ml/lit (43.46), Profenophos @ 1ml/lit (48.067) and NSKE 5% @ 5ml/lit (62.46), were which least effective as they recorded significantly higher populations than the rest of the treatments . However, it was significantly superior than untreated control. respectively on 7th and 14th day after spray.

The difference in yields among the different treatments were was significant. The highest yield was recorded in Imidacloprid 17.8% SL (24.6 q/ha) these findings were supported by Chandra *et al.*, (2014) with (24.87 q/ha) followed by Thiamethoxam 25% WG (21.8 q/ha) these findings were supported by Patel *et al.*, (2017) with (21.69 q/ha) and Chandra *et al.*, (2014) with (21.87 q/ha). The next best treatment was Difenthurion 50% WP (18.2 q/ha) these findings were supported by Sen *et al.*, (2017) with (16.17 q/ha) followed by Fipronil 5% SC (16.4 q/ha) which is in line with the similar findings of Maurya *et al.*, (2018) with (16 q/ha) and Patel *et al.*, (2017) with (16.62 q/ha). The next best treatment was Profenophos 50% EC (14.3 q/ha) which is in line with the similar findings of Jat and Singh (2005) with (14.10 q/ha) and the lowest yield was recorded in NSKE 5% (13.5 q/ha) with similar findings of Kumar *et al.*, (2020) with (13.90q/ha) as compared to control plot (9.2q/ha).

Comment [S1]: Modify sentences

Table 1. Efficacy of botanical and selected insecticides against mustard aphid *Lipaphis erysimi* (Kalt.)

S.No.	Treatments	Population of <i>Lipaphis erysimi</i> /10 cm apical twig									Yield (q/ha)	B:C ratio
		First spray				Second spray						
		3DAS	7DAS	14DAS	Mean	3DAS	7DAS	14DAS	Mean	Overall Mean		
T ₁	Fipronil 5% SC	90.26	74.86	78.33	81.15	43.66	26.33	11.46	27.15	54.15	16.4	1:4.64
T ₂	Difenthurion 50% WP	89.53	72.26	56.53	72.77	36.40	18.80	9.60	21.60	47.18	18.2	1:5.24
T ₃	Profenophos 50% EC	94.60	83.80	90.33	89.57	48.06	29.60	14.33	30.66	60.12	14.3	1:3.94
T ₄	Thiamethoxam 25% WG	58.80	39.33	50.66	49.60	30.73	14.46	7.73	17.64	33.63	21.8	1:6.43
T ₅	Imidacloprid 17.8% SL	26.46	32.86	38.26	32.53	22.60	11.53	5.20	13.11	22.82	24.6	1:7.24
T ₆	NSKE 5%	118.26	96.53	112.46	109.08	62.46	53.40	38.26	51.37	80.23	13.5	1:3.90
T ₀	Control	132.33	140.46	166.66	146.48	182.53	216.26	193.53	197.44	171.96	9.2	1:2.83
	F-test	S	S	S	S	S	S	S	S	S	----	----
	S. Ed (±)	0.35	0.39	0.35	5.28	0.36	0.30	0.24	4.77	19.65	----	----
	C.D. (P = 0.5)	0.77	0.86	0.76	19.95	0.80	0.66	0.53	18.00	68.03	----	----

REFERENCES

- Ahlawat, P., Singh, R., Singh, S. P., Sachan, S. K., Singh, S. P., Spoorthi, G. S. and Gautam, M. P. (2018)** . Efficacy of bio pesticides and novel insecticides for control of *Lipaphis erysimi* (kalt) on mustard crop in western U.P. *Journal of Pharmacognosy and Phytochemistry.*, SP1:1814-1820.
- Ahmed, S., Cheema, S. A., Zubair, M., Abbas, Q., Bashir, M. R., Malik, K., Aslam, A. and Naeem, A. M. (2018)**. Comparative efficacy of insecticides against mustard aphid in *Brassica juncea*. *International Journal of Entomology Research.* **3**(3): 34-37.
- Akter, A., Hossain, M. I., Amin, A. K. M. R. and Liza, M. M. (2021)**. Efficacy of plant derived and synthetic insecticides against mustard aphid for quality seed production. *Journal of Entomology and Zoology Studies.* **9**(4): 48-53.
- Chandra, A., Malik, 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.
- Dwivedi, S. A. and Singh, R. S. (2019)**. Evaluation of the new molecular insecticides and biopesticides against mustard aphid *Lipaphis erysimi* (Kalt.) on yield parameter in mustard. *Journal of Biopesticides.* **12**(2): 203-214.
- Gautam, M. P., Singh, S. N., Kumar, P., Yadav, S. K., Singh, D. P. and Pandey, M. K. (2019)**. Mustard aphid, *Lipaphis erysimi* (Kalt) (Hemiptera: Aphididae). A review *The Pharma Innovation Journal.* **8**(9): 90-95.
- Jat, S. L. and Singh, B. (2005)**. Relative efficacy of some newer insecticides against mustard aphid, *Lipaphis erysimi*(KALT.).*Current Agriculture.* **29**(1-2): 79-82.
- Kalia, A., Shukla, G., Mishra, D., Mishra, B. P. and Patel, R. R. (2021)**. Comparative trend analysis of mustard in Bundelkhand region, Uttar Pradesh, India. *Indian Journal of Extension Education.* **57**(1): 15-19.
- Kumar, A., Yadav, S., Kumar, Y., and Yadav, J. (2020)**. Evaluation of different botanicals for the management of mustard aphid, *Lipaphis erysimi* (Kaltenbach). *Journal of Oilseed Brassica.* **11**(1): 42-48.
- Maurya, N. K., Singh, R., Singh, J., Nigam, R., Hasan, W. and Kumar, A. (2018)**. Efficacy of novel insecticides against mustard aphid *Lipaphis erysimi* (Kaltenbach). *International Journal of Agricultural Invention.* **3**(1): 62-70.
- Patel, S. and Hasan, C. S. W. (2020)**. Relative efficacy of certain insecticides against mustard aphid in mustard ecosystem. *International Journal of Agricultural and*

- Rashid, S., Hussain, S. M., Yaqoob, M. and Ashraf, S. (2021).** Efficacy of insecticides against mustard aphid, *Brevicoryne brassicae* and their safety to coccinellid predators. *Indian journal of entomology*. **67**(10): 44-55.
- 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
- Vishvendra., Kumar, S., Sachan, S. K., Singh, G. and Rajendra, S. (2018).** Bio-Efficacy of insecticides and biorational against *Lipaphis erysimi* (KALT.) in mustard crop. *Journal of Pharmacognosy and Phytochemistry*. **5**: 58-61.
- Yadav, S. K., Singh, R. B., Gautam, M. P., Singh, G. and Giri, S. K. (2018).** Bio-efficacy of insecticides against mustard aphid (*Lipaphis erysimi* Kalt.) on mustard (*Brassica juncea* L.). *International Journal of Chemical Studies*. **6**(2): 2704-2708.
- Zorempuii, R. and Kumar, A. (2019).** Efficacy of certain chemicals and botanicals against aphid, *Lipaphis erysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.). *Journal of Entomology and Zoology Studies*. **7**(5): 89-93.