

Original Research Article

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

ABSTRACT

A field trail was conducted at Central research farm [CRF], SHUATS, Naini, Prayagraj during *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 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), Profenophos 50% EC (60.12) whereas NSKE 5% (80.23) was found to be least effective against this pest. The plot treated with 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 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 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 the total oilseeds production in India, whereas it is the second most important edible oilseed after groundnut sharing 27.8% in 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 seed varies from 32 to 40 percent and protein content 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 Carbohydrates, 26.08 g Proteins, 26.08 g Total fat and 12.2 g Dietary fiber, 31 I.U. 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 (**Daravath et al., 2016**).

Mustard production in India stands in between 8-9 million tons with a significant growth 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 Kg/ha respectively in India (**Kumar et al., 2020**). In India, major production regions of Mustard 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 average yield of 11.49 q/ha which is equivalent to the national average (11.17q/ha). (**Singh et al., 2007**).

Mustard plant is attacked by a number of insect pests (**Bakhetia, 1983**). Found more than three dozens of insect pests, associated with various phenological stages of these crops. Among them *Lipaphis erysimi*, commonly known as 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 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 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, 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 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 botanical against mustard aphid, *Lipaphis erysimi* (Kalt.) in mustard (*Brassica juncea*) during *Rabi* season 2021.
2. To Calculate 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 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 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. 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.

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 crop was gradually increased as the crop advanced in age.

The spray solution of desired concentration was 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. = Given Percentage strength of a formulated pesticide

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

RESULTS AND DISCUSSION

The population of *lipaphis erysimi* one day before first spray was in a range of 120.2 to 136.4 aphids/ 10 cm central shoot prior to application of treatments during *Rabi*. The chemical insecticides were more effective than botanical. Efficacy of botanical and selected insecticides against mustard aphid population on mustard showed that the data on population of *Lipaphis erysimi* on three days after 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 most effective. 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 7th and 14th day after spray.

The population of *lipaphis erysimi* one day before second spray was in a range of 51 to 166.6 .

Three days after second spray, all the insecticidal treatments were significantly superior over 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 least effective as it recorded significantly higher population than rest of the treatments . however it was significantly superior than untreated control. respectively on 7th and 14th day after spray.

The yields among the different treatments were 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).

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	-----	-----

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