



## **Efficacy of Chemical Insecticides and Neem Products against Mustard Aphid, [*Lipaphis erysimi* (Kalt.)] on Mustard *Brassica juncea* (L.)**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

A field 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 @ 4 gm/lit, Neem oil 5ml/lit, Indoxacarb 14.5%SC@ 0.65 ml/lit, Emamectin Benzoate 5% SG, Neem seed kernel extract (NSKE) 5% @ 5 gm/lit, Spinosad 45% SC. Results revealed that, among the different treatments Imidacloprid (41.61) proved to be the most effective treatment followed by 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 show 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).

**Keywords:** *B ratio; efficacy; imidacloprid; neem products; Lipaphis erysimi.*

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## 1. INTRODUCTION

Mustard is a multipurpose crop and India holds a premier position in the global oil seed production accounting 19 per cent of total area and 9 percent of production. Mustard belongs to the Family- Brassicaceae and 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 hair oil, medicine etc. Jandial et al., [1]. 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. India ranks first in the world in respect of acreage accounting for 31.8 per cent of world [2] 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 anus which facilitates the growth of the fungus that makes the leaves and pods black, sooty in appearance which ultimately creates problem in photosynthesis [3,4,5,6,7]. 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 [6]. 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 [8].

### 1.1 Objectives

1. To evaluate the effect of the chemical insecticides and neem products on population of mustard aphid, *Lipaphis erysimi* (Kalt.) in mustard (*Brassica juncea*) in during Rabi season 2021.

2. To Calculate Economics of the Crop – Benefit Cost ratio [B:C ratio]

## 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 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.

The observation on population of sucking pest were recorded visually using a magnifying lens early on 10cm apical 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/10 cm apical shoot) level. Aphids count was taken 24 hours before spraying at tagged plant at 5 tagged plants per treatment subsequent observation was recorded at 3<sup>rd</sup>, 7<sup>th</sup> and 14<sup>th</sup> days after spraying (DAS) on same plants.

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 computed by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by 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.

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

$$V = (CXA) / \%a.i$$

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

S.No.	Treatments	Population of <i>Lipaphis erysimi</i> / 10 cm apical shoot							Overall mean	Yield (q/ha)	B:C ratio
		First spray				Second spray					
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T <sub>1</sub>	Imidacloprid 17.8% SL @ 0.5 ml/lit	153.8	63.2 <sup>e</sup>	29.33 <sup>e</sup>	45.93 <sup>f</sup>	43.73 <sup>f</sup>	25.93 <sup>f</sup>	41.6 <sup>f</sup>	41.61	22	1:5.98
T <sub>2</sub>	Thiamethoxam 25% WG @ 0.25 g/lit	149.73	68.07 <sup>d</sup>	31.73 <sup>e</sup>	48.86 <sup>ef</sup>	52.4 <sup>e</sup>	27.86 <sup>ef</sup>	44.06 <sup>ef</sup>	45.49	19.75	1:5.37
T <sub>3</sub>	Neem oil 1500 ppm	145.2	88.2 <sup>b</sup>	84.2 <sup>b</sup>	79.53 <sup>b</sup>	73.73 <sup>b</sup>	75.2 <sup>b</sup>	73.13 <sup>b</sup>	78.99	13.75	1:3.7
T <sub>4</sub>	Indoxacarb 14.5% SC @0.65 ml/L	152.73	81.86 <sup>c</sup>	63.8 <sup>c</sup>	55.26 <sup>d</sup>	64.93 <sup>cd</sup>	58.73 <sup>d</sup>	51.46 <sup>d</sup>	62.67	18.33	1:4.71
T <sub>5</sub>	Emamectin benzoate 5%SG @ 0.4 gm/L	149.73	78.13 <sup>c</sup>	35.06 <sup>d</sup>	53.6 <sup>de</sup>	64 <sup>d</sup>	30.33 <sup>e</sup>	49.6 <sup>de</sup>	51.69	19.75	1:5.251
T <sub>6</sub>	Spinosad 45% SC @ 0.25 ml/lit	152.46	86.46 <sup>b</sup>	83.93 <sup>b</sup>	64.06 <sup>c</sup>	69.4 <sup>bc</sup>	75.06 <sup>b</sup>	58.93 <sup>c</sup>	72.97	14.58	1:3.79
T <sub>7</sub>	Neem seed kernel extract (NSKE) @ 5 gm/L	148.4	85.86 <sup>b</sup>	83.46 <sup>b</sup>	58.4 <sup>cd</sup>	67.33 <sup>cd</sup>	71.46 <sup>c</sup>	53.4 <sup>cd</sup>	69.98	17.16	1:4.45
T <sub>8</sub>	Control	146.53	127.2 <sup>a</sup>	130.73 <sup>a</sup>	135.46 <sup>a</sup>	140.8 <sup>a</sup>	145.33 <sup>a</sup>	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; NS= Non-significant; S= Significant

### 3. RESULTS AND DISCUSSION

#### 3.1 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 1DBS was in a range of 145.2 to 153.8 aphids/10 cm apical shoot (Table 1). On third day after spray (DAS), the lowest population of aphids was 63.2 and 68.07 aphids/10 cm apical shoot recorded in Imidacloprid 17.8% SL and Thiamethoxam 25% WG treated plots, respectively that 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/10 cm apical shoot) treated plots followed by Thiamethoxam 25% WG and Emamectin benzoate 5% SG with 31.73 and 35.06 aphids/10 cm apical shoot respectively on 7th day after spray. Whereas, the lowest population of aphid was observed on 14DAS and mean (1<sup>st</sup> spray) in Imidacloprid 17.8% SL (45.93 and 46.15 aphids/10 cm apical shoot, respectively) followed by Thiamethoxam 25% WG (48.86 and 49.55, respectively) and Emamectin benzoate 5% SG (53.60 and 55.59 aphids/10 cm apical shoot respectively) (Table 1).

#### 3.2 Effect of Second Spray

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

These results are support with Singh et al. [9] and Dostara et al. [10], reported that Imidacloprid 17.8% SL proved superior over other insecticides in reducing population of Mustard aphid. Vishvendra et al. [11] found Thiamethoxam as the most effective treatment.

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 Thiamethoxam 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 Thiamethoxam 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. [12] observed highest C:B ratio in Imidacloprid. Mokal et al. [13] concluded that in terms of higher cost benefit ratio Thiamethoxam was found superior. Yadav et al. [14] found Emamectin benzoate as the economical treatment [15,16].

### 4. CONCLUSION

From the critical analysis of the present findings, it can be concluded that Imidacloprid 17.8% SL is more effective in controlling per cent population infestation of mustard aphids followed by Thiamethoxam 25% WG, Emamectin benzoate 5% SG indoxacarb 14.5%SC, Spinosad 45%SC , Need seed kernel extract 5%, Neem oil, in managing *Lipaphis erysimi*. Among the treatments studied, Imidacloprid 17.8% SL gave the highest cost benefit ratio (1:5.98) and marketing yield (22 q/ha) followed by Thiamethoxan 25% WG (1:5.37 and 19.75q/ha), Emamectin benzoate 5% SG (1:5.25 and 19.75 q/ha), indoxacarb14.5%( 1:4.71and 18.33 q/ha), Spinosad 45%SC (1:4.45 and 17.16 q/ha ),Neem seed kernel extract 5%( 1:3.79 and 14.58 q/ha) Neem oil(1:3.77and 13.75 q/ha).

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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