Original Research Article

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

Abstract

A field trail 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 thiomethoxam (45.49), Emamectin benzoate (51.78), Indoxacarb (62.67), Spinosad (69.98), 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), 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), Neem seed kernel extract (NSKE)5% (1:3.71), Neem oil (1:3.77), as compared to control plot (1:2.8)

Key words: Cost-Benefit ratio, Efficacy, Imidacloprid, Insecticides, *Lipaphis erysimi*,

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 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

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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 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)**

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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 $25^0$27" North latitude $80^0$05" East longitudes and at an altitude of 98 meter above sea level the maximum temperature reaches upto 42^0C in summer and crops down to 4^0C in winter.

The observation on population of sucking pest were recorded visually using a magnifying lens early on top 10cm central apical shoot 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) 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 3, 7 and 14 days after spraying 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 realized by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by substracting 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.

Results and discussion

Efficacy of different insecticides on the population of mustard aphid 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. The population recorded 1DBS was in a range of 145.2 to 153.8 (Table 1). On third day after spray lowest population of 63.2 and 68.07 was recorded in Imidacloprid 17.8 SL and Thiamethoxam 25% WG treated plots, respective that difference significantly with other treatment plots but statistically at par with each other. The lowest population was recorded in Imidaloprid 17.8% SL (29.33) treated plots followed by Thiomethoxam 25% WG and Emamectin benzoate 5% SG with 31.73 and 35.06 respectively on 7th day after spray. Lowest population of *Lipaphis erysimi* was observed on 14DAS and mean (1^{st} spray) in Imidacloprid 17.8% SL (45.93 and 46.15, respectively) followed by Thiomethoxam 25% WG (48.86 and 49.55, respectively) and Emamectin benzoate 5% SG (53.60 and 55.59, respectively). (Table 1)

One day prior second spray, the mean population ranged from 45.93 to 135.46. Imidacloprid 17.8% SL treated plots recorded lowest mean population in all observations on 3^{rd}, 7^{th}, 14^{th} day after spray and mean with 43.73, 25.93, 41.60 and 37.08 followed by Thiomethoxam 25% WG (52.4, 27.86, 44.06 and 41.44). 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 reducinng population of Mustard aphid. **Vishvendra *et al.* (2018)** found Thiomethoxam as the most effective treatment.

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The yields among the treatments were significant. 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), 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), Indoxacrb 14.5% SC (1: 4.71), Spinosad (1: 4.45), 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 *e al.* (2018)** found Emamectin benzoate as the economical treatment.

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

S.No.	Treatments	Population of *Lipaphis erysimi* / 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		

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