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Certain pesticides' relative effectiveness against mustard aphids in the mustard ecosystem

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Research Article

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ABSTRACT

During the Rabi season of 2018–19, researchers at the Norman E. Borlaug Crop Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar, India, conducted studies on the effectiveness of eight insecticides against the mustard aphid, *Lipaphis erysimi* (Kalt.), on *Brassica juncea* cv. Varuna as foliar spray. Dimethoate 30 EC, Thiamethoxam 25 WG, and Imidacloprid 17.8 SL were shown to be the most effective against mustard aphids after the third and seventh days of spraying. Thiamethoxam had the highest seed yield (21.69 q/ha), which was comparable to imidacloprid (21.43 q/ha) and dimethoate (20.69 q/ha). Untreated plots had the lowest seed yield (10.44 q/ha).

Keywords: *Lipaphis erysimi*, yield, pesticides, mustard, and bio-efficacy

INTRODUCTION

Among all oilseed crops grown in India, rapeseed-mustard ranks first in terms of oil yield and is a significant oilseed crop, second only to soybean in terms of output. Grown over an area of around 6.4 m ha, it produces 8.02 Mt and yields 1262 kg ha⁻¹. It contains between 35 and 45 percent oil. Over 80% of oilseeds are grown with it. More than 70% of the nation's land is used for rapeseed-mustard production, with the main producing states being Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana, and Gujarat. Despite the availability of improved production techniques, the nation's mustard crop is still unable to provide a good yield. This is because a variety of biotic and abiotic stresses significantly reduce the production of mustard crops. Insect pests are one of the most significant biotic variables limiting productivity (Patel and Singh, 2017). *Lipaphis erysimi* is one of the main insect pests that significantly reduces productivity. Both nymphs and adults inflict financial harm by sucking the cell sap from the plant's vulnerable portions, including as the leaves, inflorescence, soft stem, and pods. The indications of a severe mustard aphid infestation include yellowing, curling, and drying of the leaves, which leads to the formation of weak, tiny seeds in the pods. Additionally, it lowers the rate of photosynthetic activity and secretes honeydew, which promotes the formation of sooty mold (Patel and others, 2017). Strong aphid infestations are required all year long to control the pest. To keep the mustard aphid population below the threshold of economic harm, a variety of control strategies are used, including chemical, mechanical, physical, cultural, host plant resistance, and biological management. Among them, chemical control is crucial and offers a great deal of control during severe attacks. In order to assess the effectiveness of certain pesticides against *L. erysimi* Kalt, the current research was conducted.

MATERIAL AND METHODS

Fipronil 5 SC, Thiamethoxam 25 WG, Imidacloprid 17.8 SL, Acetamiprid 20 SP, Acephate 75 SP, Dimethoate 30 EC, Oxy-demeton methyl 25 EC, Clothianidine 50 WDP, and an untreated control were the nine treatments used in a field experiment conducted in a randomized block design (RBD) at G.B. Pant University of Agriculture and Technology, Pantnagar, India. On October 28, the crop variety Varuna was sowed in a 4.2 × 3 m plot with a 30 cm gap between each row and a 10 cm gap between each plant. The suggested agronomic procedures were adhered to. 500 ideal weather conditions were used for the foliar spraying of various treatments, resulting in an isltr of water/ha. Ten randomly chosen plants from each plot were used to measure the mustard aphid population at 10 cm CSL (central shoot length) one day before, three, seven, and ten days after pesticide treatment. Each treatment's yield was noted and given in q/ha. A basic randomized block design (RBD) software was used to analyze the variance of the data.

RESULTS AND DISCUSSION

During the 2018–19 crop season, the population of *L. erysimi* on mustard under different treatments was measured one day before to and on the third, seventh, and tenth days after pesticide application. Prior to spraying, the average number of *L. erysimi* aphids per 10 cm central shoot length varied from 40.67 to 149.0 (Table 1). Aphid populations considerably rose in untreated plots after spraying, whereas they dramatically reduced in all treated plots. Fipronil 5 SC (29.47 aphids) and Clothianidine 50 WDP (2.06 aphids) were the least harmful treatments with the largest population, whereas Dimethoate 30 EC had the lowest *L. erysimi* population (0.23 aphids), followed by Imidacloprid 17.8 SL (0.73 aphids). Thiamethoxam 25 WG, Imidacloprid 17.8 SL, Dimethoate 30 EC, and Clothianidine 50 WDP were used to record the lowest number of aphids (0.00 aphids) on the seventh day after spraying. Acetamiprid 20SP (0.23 aphids), Oxy-demeton methyl 25 EC (0.40 aphids), and Acephate 75 SP (0.80 aphids) came next. Fipronil 5 SC (8.73 aphids) was once again the least harmful therapy. With thiamethoxam 25 WG, imidacloprid 17.8% SL, dimethoate 30 EC, clothianidine 50 WDP, acetamiprid 20 SP, acephate 75 SP, and oxy-demeton methyl 25 EC, the aphid population was once again observed at a minimum (0.00 aphids) on the tenth day after spray. Fipronil 5 SC was once again shown to be least efficient with a large aphid population of 1.17 aphids, which is consistent with earlier findings. The yield (q/ha) data (Table 1) showed that it varied greatly from 10.44 to 21.69 q/h under specific insecticidal treatments. Plots treated with Thiamethoxam 25 WG had the highest seed output (21.69 q/h), followed by Imidacloprid 17.8 SL (21.43 q/h). Fipronil 5 SC had the lowest seed production (16.62 q/h). Dimethoate 30 EC > thiamethoxam 25 WG > Imidacloprid 17.8 SL > Acetamiprid 20SP > Oxy-demeton methyl 25 EC > Clothianidine 50 WDP > Acephate 75 SP > Fipronil 5 SC were the therapies' respective order of effectiveness. The results of Vekeria and Patel (2000) and Choudhury and Pal (2005) closely align with the efficacy of the aforementioned pesticides against mustard aphid control on mustard crops. The effectiveness of many pesticides against *Lipaphis erysimi* Kalt has been studied on rapeseed mustard. Many systemic insecticides have been shown to be very efficient against sucking pests on a variety of field crops, fruits, and vegetables.

These include clothianidin, acetamiprid, thiamethoxam, imidacloprid, and dimethoate. Rohilla et al. (2004) discovered that imidacloprid and thiamethoxam were most effective against *Lipaphis erysimi* in field conditions. Imidacloprid was much better even after 14 days of therapy, according to Prasad and Dey (2006). When Patel et al. (2017) tested seven insecticides against mustard aphids in the field, they discovered that imidacloprid had the greatest yield (12.36 q ha⁻¹) and maximum mustard aphid mortality. The most successful treatment for lowering the aphid population, according to Maurya et al. (2018), was thiamethoxam 25% WG @100 g/ha, followed by acephate 75 SP @ 500 g/ha. Pymetrozine 50 WG @ 250 g/ha was shown to be less effective. Imidacloprid 17.8 SL was shown to be more effective than fipronil 5 SC and dimethoate 30% EC among conventional insecticides. Thiamethoxam 25% WG @100 g/ha with (17.15 q/ha) produced the maximum yield, whereas imidacloprid 17.8 SL @ 150 ml/ha with (19.54) produced the highest cost-benefit ratio. When treated with 0.003%, the highest mortality rate was 100% (Dimethoate 30 EC, Chlorantraniliprole 18.5 SC, Lambda cyhalothrin 5EC, Imidacloprid 70 WG, Cypermethrin 10 EC), followed by 93.33% (Thiamethoxam 25 WG, Fenpyroximate 5 SC), 80% (Acetamiprid 20 SP, Pyriproxyfen 10 EC), and the lowest mortality rate was 66.67% (Hasan et al., 2018). Therefore, among all the compounds examined, Dimethoate 30 EC, Thiamethoxam 25 WG, and Imidacloprid 17.8 may be suggested for efficient control of the mustard aphid, *L. erysimi*, in mustard crops. The use of these pesticides on these crops should be determined by necessity, as rapeseed and mustard are used as vegetables in certain regions of the nation and provide edible oils for people and cakes for cattle.

Table 1: Bio-efficacy of insecticides against mustard aphid, *L. erysimi* (Kalt.)

Treatment	Dosages	Aphid Population (Number)				Yield (q/ha)
		Before spray	After spray			
			3DAS	7 DAS	10 DAS	
Fipronil 5 SC	2 ml /liter	70.00	29.47	8.73	1.17	16.62
Thiamethoxam 25 WG	0.25g /liter	61.50	0.90	0.00	0.00	21.69
Imidacloprid 17.8 SL	0.25ml/liter	45.57	0.73	0.00	0.00	21.43
Acetamiprid 20SP	0.15g/liter	40.67	0.93	0.23	0.00	20.24
Acephate 75 SP	1ml/liter	43.50	2.33	0.80	0.00	20.17
Dimethoate 30 EC	1ml/liter	64.33	0.23	0.00	0.00	20.69
Oxy-demeton methyl 25 EC	1ml/liter	84.17	1.77	0.40	0.00	20.41
Clothianidine 50 WDP	0.3 g /liter	149.0	2.06	0.00	0.00	19.35
Control		59.00	84.17	65.73	27.23	10.44
CD at 5%		50.87	43.01	33.22	13.85	5.42
Sem		11.06	9.35	7.22	3.01	1.18
CV		48.35	205.99	257.02	286.36	18.60
DAS: Day after spray						

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