Open Access

International Journal of Agricultural and Applied Sciences, June 2020, 1(1): 46-48
https://www.agetds.com/ijaas
ISSN: 2582-8053
https://doi.org/10.52804/ijaas2020.1110

Research Article

Relative efficacy of certain insecticides against mustard aphid in mustard ecosystem

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ABSTRACT
Studies on the efficacy of eight insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) on *Brassica juncea* cv. Varuna as foliar spray were carried out at Norman E. Borlaug Crop Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar (India) during *Rabi* season of 2018-19. Studies revealed that after third and seventh days of spray, Dimethoate 30 EC, Thiamethoxam 25 WG and Imidacloprid 17.8 SL proved most effective against mustard aphid. The maximum seed yield of 21.69 q/ha was recorded in thiamethoxam, which remained on par with imidacloprid (21.43 q/ha) and dimethoate (20.69 q/ha). The lowest seed yield was obtained from untreated plots (10.44 q/ha).
Keywords: *Mustard, bio-efficacy, insecticides, yield, Lipaphis erysimi*

INTRODUCTION
Rapeseed-mustard is a major oilseed crop next to soybean in terms of production and ranked first in terms of oil yield among all oilseed crops in India. Its grown on an area of about 6.4 m ha with a production of 8.02 Mt and yield is 1262 kg ha-1. It has an oil content ranging from 35 to 45%. It is planted on more than 80% of oilseeds. Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana and Gujarat are the major producing states for rapeseed-mustard accounting for more than 70% of the total area in the country. Even after the availability of better production technique mustard crop is unable to give promising yield in the country. This is because mustard crop suffer heavy loss in yield due to various biotic and abiotic stress. Among the biotic factors, insect-pests are one of the most important constraints in reducing the yield (Patel and Singh, 2017). Out of many insect pests, *Lipaphis erysimi* is considered key pest which causes considerable yield losses. Both nymph and adult suck the cell sap from various tender parts of plant like leaves, inflorescence, soft stem and pods and cause economic damage. Due to heavy infestation of mustard aphid, the symptoms of yellowing, curling drying of leaves appear, resulting in development of feeble and small seeds in the pods. It also reduces the photosynthetic rate and secretes the honeydew which is responsible for sooty mould growth.(Patel *et al.*, 2017). Heavy infestation of aphid depend upon favorable weather parameters, therefore monitoring is necessary throughout the year for managing the pest. Many controlling measures are adopted to manage the mustard aphid population below economic injury level like chemical, mechanical, physical, cultural, host plant resistance and biological control. Among these, at severe attack, the chemical control is very important and provides significantly control. Therefore, the present study was undertaken to evaluate the efficacy of certain insecticides against *L. erysimi* Kalt.

MATERIAL AND METHODS
A field experiment was laid out in randomized block design (RBD) to study the efficacy of certain insecticides against mustard aphid on mustard crop during *Rabi* season, 2018-19 at Norman E. Borlaug Crop Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar (India) with nine treatments viz., 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 untreated control and replicated three times. The crop variety Varuna was sown on 28th October with plot size of 4.2m x 3m and distance between row to row and plant to plant was 30cm and 10cm, respectively. The recommended agronomic practices were followed. Foliar spray of different treatments was made in 500 ltr of water/ha. The population of mustard aphid was

recorded from 10 cm CSL (Central shoot length) on 10 randomly selected plants from each plot one day prior and three seven and ten days 10 days after insecticide application. The yield in each treatment was recorded and expressed in q/ha. The data were subjected to the analysis of variance using simple randomized block design (RBD) programme.

RESULTS AND DISCUSSION

The population of *L. erysimi*, on mustard in various treatments were recorded one day before and 3rd, 7th and 10th day after insecticide application during the crop season 2018-19. Before spray, the mean population of *L. erysimi* ranged from 40.67 to 149.0 aphids per 10 cm Central shoot length (Table 1). Subsequent to spray, aphid population was significantly decreased in all the treated plots, while significantly increased in untreated plots. Data recorded on 3rd day after spray, the *L. erysimi* population was the minimum (0.23 aphids) with Dimethoate 30 EC followed by Imidacloprid 17.8 SL (0.73 aphids) while least toxic treatments harboring highest population were Fipronil 5 SC (29.47 aphids) and Clothianidine 50 WDP (2.06 aphid). At 7th day after spray, the aphid population was again recorded minimum (0.00 aphids) with Thiamethoxam 25 WG, Imidacloprid 17.8 SL, Dimethoate 30 EC and Clothianidine 50 WDP. It was then followed by Acetamiprid 20SP (0.23 aphids), Oxy-demeton methyl 25 EC (0.40 aphids) and Acephate 75 SP (0.80 aphids). While least toxic treatments were again Fipronil 5 SC (8.73 aphids).

At 10th day after spray, the aphid population was once again recorded minimum (0.00 aphids) with thiamethoxam 25 WG, Imidacloprid 17.8% SL, Dimethoate 30 EC, Clothianidine 50 WDP, Acetamiprid 20SP, Acephate 75 SP and Oxy-demeton methyl 25 EC. Similarly previous observations, Fipronil 5 SC was once again found to be least effective with high aphid population of 1.17 aphids. The data on yield (q/ha) (Table 1) indicated that under certain insecticidal treatments, it varied significantly from 10.44 to 21.69 q/h. Maximum seed yield (21.69 q/h) was recorded from plots treated with Thiamethoxam 25 WG followed by Imidacloprid 17.8 SL(21.43 q/h). The lowest seed yield (16.62 q/h) was recorded with Fipronil 5 SC.

The order of efficacy of these treatments was 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 respectively. The effectiveness of the aforesaid insecticides against mustard aphid control on mustard crop is in close accordance with the findings of Vekeria and Patel (2000) and Choudhury and Pal (2005). A number of insecticides have been tested on rapeseed- mustard to determine the efficacy against *Lipaphis erysimi* Kalt. A large number of systemic insecticides were found very effective against sucking pest on various fruit, vegetable and field crops. These are imidacloprid, thiamethoxam, acetamiprid, clothianidin, and Dimethoate. Imidacloprid and thiamethoxam were found most effective against *Lipaphis erysimi* in field condition by Rohilla et al. (2004). Prasad and Dey (2006) reported that imidacloprid was significantly superior even after 14 days of treatment. Patel et al. (2017) evaluated seven insecticides in the field against mustard aphid and found that Imidacloprid gives maximum mortality of mustard aphid with highest yield (12.36 q ha-1).

Maurya *et al*., 2018 observed that the thiamethoxam 25% WG @100 g/ha was found most effective treatment in reducing the aphids population followed by acephate 75 SP @ 500g/ha. The pymetrozine 50 WG @ 250 g/ha was recorded less effective. Among conventional insecticides imidadoprid 17.8 SL was found more effective than dimethoate 30% EC and fipronil 5 SC.. The higher yield was obtained from thiamethoxam 25% WG @100 g/ha with (17.15 q/ha) whereas, highest cost benefit ratio is obtained from imidadoprid 17.8 SL @ 150 ml/ha with (1:9.54). Treated with 0.003% the highest mortality were observed 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 lowest 66.67% mortality recode in treated with Fipronil 5 SC (Hasan *et al*., 2018).

Thus, the present study revealed that among all the tested chemicals Dimethoate 30 EC, Thiamethoxam 25 WG and Imidacloprid 17.8 may be recommended for effective management of mustard aphid, *L. erysimi* in mustard crop. As rapeseed-mustard are consumed as vegetables in some parts of the country and also provides edible oils for humans and cakes for cattle, the application of these insecticides on these crops should be need-based.

ACKNOWLEDGEMENT

We gratefully acknowledge the G.B.P.U.A.&T., Pantnagar for providing the facilities.

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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						