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Effect of Different Insecticides on Mustard Aphids, *Lipaphis erysimi* (Kalt) and Their Toxicity to the Beneficial Insects

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Abstract: Malathion 57EC and Diazinon 60EC with different doses (1 ml, 2 ml and 3 ml/L water) were tested to evaluate the effect on mustard aphids and their toxicity on the predators and other beneficial insects of mustard aphid. Malathion was more effective than Diazinon for the control of aphids and it was less toxic for the predators and other beneficial insects. The lower dose of insecticides have less adverse effect on the predators and other beneficial insects than the higher dose.

Key words: Insecticides, mustard aphids, toxicity

Introduction

Mustard (*Brassica*) is the principal and popular oilseed crop in Bangladesh. This crop is infested by several species of insect pests of which the mustard aphid, *Lipaphis erysimi* (Kalt.) is very devastating. It is the most destructive of all the pests of mustard in Bangladesh (Alam *et al.,* 1964; Ahmed *et al.,* 1977; Haque & Miah, 1979) and reduces the yield of mustard considerably. High incidence of this pest can cause complete loss of the crop. It was reported that the yield loss due to attack of aphids ranged from 8.9 to 77.5 % (Prassad and Phadke, 1983) and 8.6 to 57.5 % (Vir and Henry, 1987). In a recent study it was observed that the yield loss due to aphid infestation in mustard ranged from 87.16 to 98.16% (Anonymous, 1995) in Bangladesh. To control this pest, different kinds of insecticides are being used. Highly toxic insecticides with long residual effect are believed to hamper pollination in mustard and cause seed sterility. This pest is distributed in India, Pakistan, U.S.A. and many other countries of the world. In Bangladesh, insecticides generally control aphid. But the use of insecticides is hazardous as they leave many undesirable side effects such as development of resistance in pest populations, destruction of beneficial species, resurgence, out breaks of secondary pest and hazards to human and the environment (Luckmann and Metcalf, 1975; Hussain and Begum, 1984). So it is urgently required to find the effect of insecticides on aphids and their toxicity to the predators and other beneficial insects. Therefore, the present research work was undertaken in order to obtain information on the control of mustard aphid.

Materials and Methods

The experiment was conducted in the field of Regional Agricultural Research Station (RARS), Jamalpur during the period from November, 2000 to March, 2001. The experiment was laid out in split-plot design with three replications. The insecticide Malathion 57 EC and Diazinon 60 EC were assigned in the main plot while the doses (0 , 1, 2 and 3 ml/L water) in the subplot. The unit plot size was 2.4 x 2.0m^2 and plant spacing were 30 cm between rows and 5 cm between plants. Spraying of the insecticide was started as soon as the incidence of the insect was noticed. The plots were sprayed at an interval of 10 days till ripening of the pods. The control plots were not sprayed with any insecticide. All intercultural operations and other management were done as and when necessary. Number of aphids, predators and other beneficial insects were counted before 24 hours and after 48 hours of spray from 10 randomly selected sampling units. Each sampling unit was 10cm long tip of an inflorescence. The marketable seed yield (t/ha) from each treatment was recorded. All data were analyzed statistically and means were separated by DMRT.

Results and Discussion

There was a significant difference between the effectiveness of Malathion and Diazinon on the percent reduction of aphids (Table 1). Between the two insecticides there was no significant variation in effect on the percent reduction of predators and other beneficial insects. The percentage of reduction of predators and other beneficial insects was higher in Diazinon treated plots although it did not differ significantly.

Different doses of insecticide significantly reduced the aphid population, predators and beneficial insects. The highest percent reduction (84.43) of aphid population as observed from the dose 2ml/L water which was statistically similar to 1ml/L water and its yield (1.92 t/ha) was also the highest. The dose 3ml/L water reduced lowest (79.30) percentage of aphids. In case of predators and beneficial insects the highest percentage of reduction was observed from the dose 3ml/L water although it was statistically similar to 1ml and 2ml /L water. In all cases, the control plots increased the aphids, predators and beneficial insects. The percentage of increase of aphid population (21.87) was higher than the predators and beneficial insects. On the other hand, the percent reduction in aphid population was lower than the predators and beneficial insects. The rate of reduction of predators and beneficial insects increased with the increase in doses. In contrast, the rate of reduction of aphids decreased with the increase of insecticide doses although statistically same results were obtained from the plots treated with the dose 1ml and 2ml/L water. It might be due to increased insect resistance to the insecticide. It can be noticed that over doses may not be effective for the control of aphids but harmful for the beneficial insects.

Interaction effects: The interaction between insecticides and doses significantly reduced the aphid population, predators and beneficial insects (Table 2). The highest percentage (87.19) of reduction of aphids was observed from Malathion treated plots with the dose 2ml/L water and its yield (2.12 t/ ha) was also highest. The Diazinon treated plots with the dose 1ml/L water reduced lowest percentage (71.66) of aphids which was statistically similar to Malathion with the dose 1 ml and 3 ml/ L water and Diazinon with the dose 2ml and 3ml/L water. There was no significant difference between the lower and higher doses of both insecticides. Therefore it can be suggested here that the lower doses of either insecticides could be recommended for the chemical control of aphids in the field. The lower dose might have less adverse effect on the predators and beneficial insects.

Upadhyay and Vyas (1986) tested various systemic insecticides and Malathion against predator coccinellids *Menochilus sexmaculatus* and *Coccinella septempunctata* associated with

Table 1: Effect of insecticides on the percentage of reduction of mustard aphids and their beneficial insects

Treatment	Percentage of reduction of aphids	Percentage of reduction of beneficial insects			Yield (ton/ha)
		Lady bird beetle	Large headed flies	Honey bee	
Insecticide:					
M_1 (Malathion)	76.79 a	74.78	73.66	771.25	1.70
M_2 (Diazinon)	69.31 b	75.49	74.35	71.98	1.66
Level of significance	* *	NS	N S	NS	NS
CV (%)	7.62	4.29	4.30	5.59	13.56
Doses:					
d_0 (0 ml/ L)	+ 21.87 c	+ 16.49 b	+ 14 .78 b	+ 14.66 b	1.17 b
d_1 (1 ml/ L)	81.61ab	92.42 a	92.57 a	89.59 a	1.80 a
d_2 (2 ml/ L)	84.43 a	95.00 a	93.26 a	90.12 a	1.92 a
d_3 (3 ml/ L)	79.30 b	96.81 a	95.40 a	92.09 a	1.82 a
Level of significance	* *	**	* *	**	**
CV %	4.32	8.26	2.91	6.08	17.41

Data in a column followed by same letter(s) do not differ significantly (+) Indicates the percent increase in population

Table 2: Interaction effect between insecticides and their different doses on the percent reduction of mustard aphids and their beneficial insects

Treatments	Percentage of reduction of Aphids	Percentage of reduction of beneficial insects			Yield (ton/ ha)
		Lady bird beetle	Large headed flies	Honey bee	
M_1d_0	+ 28.53 c	+ 18.23 b	+ 13.55 b	+ 13.66 b	1.46 cd
M_1d_1	75.95 b	93.33 a	94.47 a	87.33 a	1.98 ab
M_1d_2	87.19 a	93.89 a	94.98 a	88.01 a	2.12 a
M_1d_3	75.49 b	91.74 a	94.38 a	89.48 a	1.91 ab
M_2d_0	+ 15.20 d	+ 14.75 b	+ 15.10 b	+ 15.67 b	1.28 d
M_2d_1	71.66 b	93.81 a	92.67 a	91.85 a	1.85 ab
M_2d_2	72.26 b	96.67 a	95.54 a	92.22 a	1.47 bcd
M_2d_3	73.10 b	98.67 a	90.42 a	94.69 a	1.74 abc
Level of significance	**	*	*	*	*
CV(%)	4.32	8.26	2.91	6.08	17.41

Data in a column followed by same letter(s) do not differ significantly (+) Indicates the percent increase in population

M_1= Malathion 57 EC M_2= Diazinon 60 EC d_0= 0 ml/ L water d_1= 1 ml/ L water d_2= 2 ml/ L water d_3= 3 ml/ L water

Table 3: Effect of insecticides on net return and benefit cost ratio of mustard production

Treatment	Yield (t/ha)	Add. yield over control (t/ ha)	Add. income over control (Tk.)	Cost of insecticide (Tk.)	Net income (Tk.)	BCR
M_1d_0	1.46 cd	-	-	-	-	-
M_1d_1	1.98 ab	0.52	7280.00	1548.00	5732.00	3.70
M_1d_2	2.12 a	0.66	9240.00	2536.00	6704.00	2.64
M_1d_3	1.91 ab	0.45	6300.00	3524.00	2776.00	0.79
M_2d_0	1.28 d	-	-	-	-	-
M_2d_1	1.85 ab	0.57	7980.00	2709.92	5270.00	1.94
M_2d_2	1.47 bcd	0.19	2660.00	4859.84	-2199.84	-0.45
M_2d_3	1.74 abc	0.46	6440.00	7009.76	-569.76	-0.08

Means in a column followed by same letter(s) are not significantly different (P> 0.05) M_1= Malathion 57 EC M_2= Diazinon 60 EC d_0= 0 ml/ L water d_1= 1 ml/ L water d_2= 2 ml/ L water d_3= 3 ml/ L water Malathion 57 EC @ Tk. 25.00/ 100 ml Diazinon 60 EC @ Tk. 68.00/ 125 ml Labour cost @ Tk. 70/ day Price of mustard Tk. 14/ Kg

sucking insects (*Aphis craccivora* and *Empoasca kerri*) and found that Malathion was the least toxic to those predators. A considerable number of bean aphids might die at the lower dose than at the modest dose of 0.05% of Diazinon, Nogos and Malathion in which case the predator *M. sexmaculatus* could be saved from their harmful effects. Islam and Sardar (1997) showed that Diazinon was more toxic to the predator, *M. sexmaculatus* than Malathion and very little difference was observed between the reduction percentage of aphids by these two insecticides. Ahmed *et al.* (1977) showed that after 96 hours of spray Malathion (0.05) reduced 83.2% of mustard aphids. Horn (1983) reported that the number of aphid increased markedly on Kale treated with Carbaryl, which may have been due to elimination of predators and competitors and the lowest aphid densities were observed after treatment with Malathion. Islam *et al.* (1990) conducted an experiment in the field of mustard crop for the control of *L. erysimi* with 8 insecticides and strongly suggested that Malathion will be very effective in controlling the mustard aphid in addition to Carbosulfan. The results of the present research work are in good agreement with the findings of the above authors.

Effect of insecticides on the yield of mustard: It was observed that the tested insecticides with different doses produced significant reduction in the number of aphids and their beneficial insects (Table 1 and 2). Seed yield varied significantly due to the use of chemicals. The highest seed yield (1.92 ton/ha) was recorded from the plots treated with the dose 2 ml/L water and it was found statistically similar to those of 1 ml/L water (1.80 ton/ha) and 3 ml/L water (1.82 ton/ha) (Table 1). This observation corroborates with the findings of Bakhetia *et al.* (1986), Kalra and Gupta (1986), Shriram *et al.* (1985) and Verma (1978), who tested Malathion, Oxydemeton methyl and Dichlorvos against mustard aphid.

The interaction effects of insecticides and their different doses had also significant positive effect on the yield (Table 3). The highest seed yield (2.12 ton/ha) was recorded in the Malathion treated plots with the dose 2 ml/L water which was found statistically similar to those of Malathion and Diazinon treated plots with the dose 1 ml and 3 ml/L water. Obviously the lowest yield was

obtained from the untreated plots.

Malathion treated plots with the dose 2 ml/L water provided the maximum net return (TK. 6704/ ha) while that of Malathion with the dose 3 ml/L water gave the lowest net return (Tk. 2776/ha) (Table 3). The second highest net return (TK. 5732/ ha) was recorded from Malathion with the dose 1 ml/L water treated plots. Malathion treated plots with the dose 1 ml/L water offered the highest benefit cost ratio (3.70) while the dose 3 ml/L water had the lowest value (0.79). Rouf and Kabir (1997) obtained the highest benefit cost ratio with Malathion treated plots, while Ripcord treated plots showed the lowest.

Although the dose 2ml/L water of Malathion gave the highest yield, it failed to offer the highest BCR possibly due to the higher amount of insecticides used. Since the cost of Malathion is two times lower than Diazinon, it provided the highest BCR.

From the results it can be concluded that aphids are soft bodied insects. So, Malathion being a contact poison may reduce aphid infestation with optimum dose. Diazinon being a contact poison with local penetration properties and longer residual action might be more toxic to the predator compared to Malathion. Over doses is nothing but wastage of money and harmful for predators. Farmers should very much aware of insecticides used. They need to apply appropriate doses of insecticides and appropriate training in related areas.

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