http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (11): 1368-1370, 2001

Effect of Some Organophosphorus Insecticides on the Growth Parameter and Yield of Aphid Infested Mustard

[1]Gazi M. Akram Hossain, [2]M. Zahidul Islam, [2]M. Aftab Hossain and [2]M. Khalequzzaman
[1]Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh, Bangladesh
[2]Department of Zoology, Rajshahi University, Bangladesh

Abstract: The effect of five organophosphorus insecticides viz., phosphamidon, quinalphos, malathion, dimethoate and diazinon were studied on the growth parameters and yield of mustard. Growth parameters such as plant height, number of branches, number of pods, number of seeds per pod, viable seeds per pod and yield were found to be increased significantly with the application of insecticides both in the field and in net house conditions. The response of quinalphos was found to be comparatively more suitable for various growth parameters and yield, followed by phosphamidon, dimethoate diazinon and malathion.

Key words: Organophosphorus insecticides, growth parameter, mustard aphid, *Lipaphis erysimi*

Introduction

Mustard is the main edible oil seed crop of Bangladesh, which grows more or less in all the districts, but cultivation of mustard is more in Comilla. Other leading districts of mustard cultivation are Dhaka, Pabna and Rajshahi (Alam *et al.*, 1988). Its performance in total oil seed production is approximately 70% and more than 500 thousand hectares land is under oil seed production, yielding more than 300 thousand metric tonnes of oil seeds in Bangladesh (Anonymous, 1991).

Nearly 70% of the total edible oil requirement in Bangladesh comes from mustard oil. The total annual need of edible oil in the country is more than 400 thousand metric tonnes. Among them mustard and other oil seed crops produces only 100 thousand metric tonnes of oil. Remaining 300 thousand metric tonnes of edible oil is being imported annually either as seed or oil at the expense of nearly 1000 crores taka (Khan, 1993). Mustard suffered from the damage caused by a number of insect pests. Among them *Lipaphis erysimi* (Kaltenbach), commonly known as mustard aphid is the most destructive pest (Sharma and Khatri, 1979; Prasad and Phadke, 1983, Singh and Sachan, 1997). Both adult and nymph cause damage of mustard plant from seedling to pod formation stage by sucking the sap. Severe infestation causes curled leaf and plant failed to develop pods. Yield losses of mustard due to aphid infestation were reported to be 8.9 to 77.5% (Prasad and Phadke, 1983). High incidence of aphid in mustard may cause complete loss of this crop. In Bangladesh and other areas of Indo-pak subcontinent, foliar insecticides generally control insect pest of mustard. A wide variety of insecticides are being used to control this pest. Aphid resistant variety of mustard has yet been screened out (Phadke and Prasad, 1990; Malik, 1988). Other control methods like cultural and biological are not well known to the farmers. So, suitable insecticides for controlling the mustard aphid are very essential. Hence, an attempt was adopted to study the effect of some insecticides on the growth parameters and yield of aphid-infested mustard.

Materials and Methods

A high yielding variety of mustard commonly known as 'Safal' was selected as a test crop. The experiment was conducted in a completely randomized block design at Bangladesh Agricultural University Farm, Mymensingh, Bangladesh with four replications per treatment during November 1999 to February 2000. The unit plot size was 4×3 m^2, row-to-row spacing 0.25m, plot-to-plot distance 0.5m and 1m between the blocks. The total number of plots was 24 with 4 blocks and 6 plots in each block. The total area being 483 m^2. In the field, land was prepared with four ploughings followed by laddering and proper leveling. In the net house the pots were filled with the soil collected from the respective field of experimental site. The surface area of the soil in each plot was 0.05m^2. Experimental plot and net house were fertilized within urea, triple super phosphate and murate of potash at the rates of 260, 200 and 66kg per hectare respectively during the final land preparation. Urea was used in three split doses. Seeds of mustard crops were sown during first week of November at the rate of 7kg/ha. Field plots were irrigated after 31 days of sowing. In net house irrigation was done as per requirement. The experimental field was exposed to natural infestation and artificial infestation was done in net house. Five foliar insecticides viz. Phosphamidon (Dimecron 100EC), quinalphos (Ekalux 40EC), malathion (Fynanon 57 EC), dimethoate (Roxion 40EC) and diazinon (Diazinon 60 EC) were sprayed at the rate of 0.075% active ingredient after 60 and 75 days of sowing both in field and net house conditions. Before spraying in net house 20 aphids in each pot were supplied and covered by the nets. One control (untreated) batch was also maintained. Number of aphids was counted with the help of a magnifying glass, five days after first spraying. Second spray was done after 10 days of first spray and number of aphid was counted again after 10 days of second spray.

From each plot one meter square was selected to obtain various agronomic data such as, yield, height, number of branches per plant, number of pods per plant, number of seeds per plant and number of viable seeds per pod. Crops were harvested at mature stage. Seed weight was measured after drying the plants. The analysis of variance (ANOVA) was done according to Zar (1999).

Results and Discussion

The effect of five insecticides, viz., phosphamidon, quinalphos, diazinon, dimethoate and malathion on different crop parameters and yield in the field and in net house have been presented in Table 1 and 2 respectively.

Plant height: Quinalphos treated plots showed maximum plant height in field (130.65 cm) and in net house (76.00cm), while minimum height was observed in control untreated plots in the field (97.85cm) and in the net house (61.75cm). Phosphamidon treated plots were second in sequence, in the

Table 1: Influence of insecticides on the growth parameters and yield of aphid infested mustard in the field.

Insecticides	Doses (%)	Plant height (cm)	Branches /plant	Pods /plant	Seeds/ pod	Viable seeds /plant	Non viable seeds / plant	Seed yield (g/plant)
Phosphamidon	0.075	125.40b	5ab	48bc	29b	21b	8	1517.50b
Quinalphos	0.075	130.65a	6a	56a	34a	25a	9	1551.25a
Malathion	0.075	102.50d	4b	35e	23c	17c	6	1410.40d
Dimethoate	0.075	116.96c	5ab	46c	28b	22b	6	1440.00c
Diazinon	0.075	114.55c	5ab	42d	26b	18c	8	1420.00d
Control	-	97.85e	2c	11f	12d	14d	8	1390.50e
LSD value		3.175	1.28	3.42	1.99	2.37		20.06

Means having the same letter do not differ significantly at 5% level

Table 2: Influence of insecticides on the growth parameters and yield of aphid infested mustard in net house.

Insecticides	Doses (%)	Plant height (cm)	Branches /plant	Pods /plant	Seeds/ pod	Viable seeds /plant	Non viable seeds / plant	Seed yield (g/plant)
Phosphamidon	0.075	69.80b	4a	26ab	26ab	22b	4	2.38b
Quinalphos	0.075	76.00a	4a	29a	28a	24a	4	2.51a
Malathion	0.075	67.00b	2b	23bc	21c	18d	3	1.58d
Dimethoate	0.075	68.68b	3ab	25bc	23b	20bc	3	2.23b
Diazinon	0.075	68.50b	3ab	24bc	24b	21c	3	2.18c
Control	-	61.75c	2b	22c	17d	13e	4	1.08e
LSD value		4.038	1.076	3.339	1.506	1.634		0.065

Means having the same letter do not differ significantly at 5% level

field (125.40cm) and in net house (69.80cm). In both the cases dimethoate (116.95 and 68.68 cm) and diazinon (114.55 and 68.50 cm) treated plots computed third and fourth in order respectively. All the insecticides gave significant increase in plant height over control. In the field, dimethoate (116.95cm) and diazinon (114.55cm) showed statistically similar effects and malathion (1021.50cm) was the least, though significant over control. In net house, dimethoate (68.68cm), diazinon (85.50cm) and malathion (67.00cm) gave statistically similar effect (Table 1 and 2). These findings are similar with those of Raju *et al.* (1982), where maximum plant height was obtained in mesta with formithion. Baloch *et al.* (1989) worked with iso-xathion and observed maximum plant height in cotton. To the contrary, Ali *et al.* (1988) reported that disulfoton, monocrotophos and methyl-parathion increased the plant height in cotton variety 407/26 and carbaryl, permethrin, chlorpyrifos and monocrotophos increased plant height in another variety of cotton namely 13-557.

Number of branches: In the field, maximum and minimum number of branches was 6 and 2 whereas in net house the numbers were 4 and 2 (Table 1). As regards the response of insecticides on the number of branches, quinalphos treated plots produced the highest numbers both in the field (6 branches) and in net house (4 branches). Untreated control plots of both field and net house showed minimum numbers of branches. Phosphamidon, dimethoate, and diazinon treated plots in the fields produced similar number of branches (5 branches), while in net house, quinalphos and phosphamidon treated plots gave same number of branches (4 branches). Dimethoate and diazinon treated plots gave again same number of branches (3 branches). All the insecticides significantly ($P<0.05$) produced more branches than control. In the field, experiment performance of malathion was the least (4 branches) though significant over control. In net house, quinalphos and phosphamidon showed best effectiveness (both 4 branches) in branch production followed by dimethoate and diazinon (3 branches in each case). Malathion showed statistically same effect to control, producing 2 branches (Table 1 and 2). These findings are similar in nature to those of Baloch *et al.* (1989), who reported the increase in branches of cotton for insecticidal treatment.

Number of pods per plant: Highest number of pods was observed in quinalphos treated plots, both in the field (56 pods) and in net house (29 pods). Lowest was in control plot, both in the field (11 pods) and in net house (22 pods). In both cases formation of pods due to the effect of phosphamidon (48 and 26 pods), diazinon (42 and 24 pods) and malathion (35 and 23 pods) were second, third, and fourth in order respectively. All insecticides increased the number of pods significantly ($P<0.05$) over control. While quinalphos showed the most promising effect both in the field and in net house followed by phosphamidon (Table 1). In net house, phosphamidon, dimethoate, diazinon and malathion showed statistically similar effects in pod formation (Table 2). Lloyd and Krieg (1987) reported that malathion significantly ($P<0.05$) increased boll number per plant in cotton.

Number of seeds per plant: Maximum number of seeds per pod was found in quinalphos treated plots both in the field (34 seeds) and in net house (28 seeds). Minimum number of seeds was found in control plots both in the field (12 seeds) and in net house (17 seeds). In field experiment, dimethoate, diazinon and malathion treated plots computed third fourth and fifth in order of effectiveness respectively (Table 1). In net house diazinon, dimethoate and malathion treated plots computed second third and fourth in order of effectiveness respectively (Table 2) in seed production. All the insecticides significantly ($P<0.05$) increased the number of seeds over control both in the field and in net house. Quinalphos was significantly ($P<0.05$) superior in field and in net house (Table 1 and 2). In field experiment diazinon and dimethoate showed similar effectiveness in seed production with phosphamidon. Malathion showed statistically least (23 seeds) significant effect than other insecticides (Table 1). In net house, quinalphos and phosphamidon showed statistically similar effectiveness in seed production (Table 2). Dimethoate , diazinon malathion showed similar effectiveness as was in field trial.

Viable seeds per pod: From Table 1 and 2 it may be seen that the number of viable seeds per pod ranged from 14 to 25 in the field and 13 to 24 in net house respectively. The highest number of viable seeds was observed in quinalphos treated plots both in the field (25 seeds) and in net house (24 seeds). On the other hand lowest number of viable seeds were found in control plots both in the field (14 seeds) and in net house (13 seeds). In fields, dimethoate, phosphamidon diazinon and malathion treated plots computed second, third, fourth and fifth in order respectively (Table 1). In net house, phosphamidon, diazinon, dimethoate and malathion produced the viable seeds following the sequence of second, third, fourth and fifth respectively (Table 2). All insecticides augmented significantly ($P<0.05$) the viable seeds per pod both in the field and in net house over control. Quinalphos showed comparatively superior performance in viable seed production both in the field (25 seeds) and in net house (24 seeds). In the field study, diazinon and malathion showed statistically similar results (Table 1). Diazinon and malathion showed relatively poor response among the insecticides applied. In net house, phosphamidon showed similar effectiveness with quinalphos (Table 2). Dimethoate and diazinon also showed similar effectiveness with phosphamidon. Malathion found to be the least effective among insecticides and was also similar in effectiveness with dimethoate (Table 2).

Non-viable seeds per pod: Highest number of non-viable seeds was found in quinalphos treated plots in the fields (9 seeds), while in the net house it was with phosphamidon, quinalphos, dimethoate and control plots (each 4 seeds). In the field, phosphamidon, diazinon and control plots recorded the same (8 seeds each) number of non-viable seeds. Malathion and dimethoate treated plots also gave the same (6 seeds each) number of non-viable seeds. In net house, malathion, dimethoate and diazinon produced the same number (3 seeds) of non-viable seeds. Minimum non-viable seeds (6 seeds) were found in malathion and dimethoate treated plots. In net house, maximum non-viable seeds (4 seeds) were found in quinalphos, phosphamidon treated and control plots. Minimum number of non-viable seeds was found in malathion, dimethoate and diazinon treated plots. These findings revealed that tested insecticides have no significant effect on non-viable seed production.

Seed yield: From Table 1 and 2 it has been found that quinalphos treated plots produced the highest amount of seeds both in the field (1551.25 kg/ha) and in net house (2.51g/plant). Lowest amount of seeds were observed in the control plots both in the field (1390.50 kg/ha) and in net house (1.08/g plant). Phosphamidon, dimethoate, diazinon and malathion treated plots both in the field and in net house computed second (1517.50 kg/ha and 2.3 g/plant respectively), third (1440.00 kg/ha and 2.23 g/plant respectively) fourth (14.20 and 2.18 g/plant respectively) and fifth (1410.40 kg/ha and 1.58g/plant respectively). All the tested insecticides showed significant ($P<0.05$) increase in seed yield over control. In the field, dimethoate, diazinon and malathion showed statistically similar performance (Table 1). In net house, dimethoate showed statistically similar effectiveness to phosphamidon (Table 2). Arora *et al.* (1969) reported that dimethoate, phosphamidon and malathion significantly increased the seed yield of mustard. Singh *et al.* (1987) also reported that phosphamidon, dimethoate and other insecticides significantly increased seed yield of mustard. Begum *et al.* (1991) obtained maximum yield of mustard with the application of disulfoton at the rate of 2.0 kg a.i/ha.

The results indicated that all the characters studied significantly improved due to use of insecticides and it was recorded that quinalphos was the most effective insecticide followed by phosphamidon and dimethoate. Similar results were reported by Ganguli and Roy (1976), Singh *et al.* (1983, 1984), Vir and Henry (1987), who tested endosulfan, dimethoate, exidemeton methyl against mustard aphids on mustard. Similar to seed yield, spray at the flowering stage provided the highest yield increase for all varieties of mustard in all seasons (Rouf *et al.*, 1997). Singh *et al.* (1987) and Vir and Henry (1987) tested 0.3% dimethoate on mustard to control aphids and reported similar results. Kakar and Dorga (1979) and Vir and Henry (1987) reported that scheduled spray always provided the higher net return than any other of spray, that are in conformity with the present results.

From the above discussion it may be concluded that all the growth parameters and yield was significantly increased over control with the application of insecticides. Whereas, non-viable seeds showed insignificant effect due to insecticidal treatment. The overall growth in insecticide treated plots might be due to the control of mustard aphids, which led the plants, a healthy growth

References

Alam, S. M., T. M. Iqbal, S.M. Amin and A.M. Gaffar, 1988. Krishitattik falser utpadan O unnayan (In Bengali)., 1: 230-240.

Ali, M., A. Zahoor, M.R. Attique and W. Tayammal, 1988. Effect of some insecticides on the growth, fruit development and yield of two cotton varieties in Punjab, Pakistan. Pak. Cottons, 32: 30-36.

Anonymous, 1991. Agricultural Diary. Agricultural Information Service. Khamarbari, Farmgate, Dhaka, Bangladesh, pp:2-3.

Arora, K.S., L.M. Saini, S.R. Sandu and M. Singh, 1969. Effect of insecticides on yield and quality of Indian mustard, *Brassica juncea* (L.). Ind. J. Agric. Sci., 39: 444-447.

Baloch, A.A., B.A. Soomro and A.K. Kereo, 1989. Effect of pesticides on cotton plant growth and fructification. Sarhad J. Agric., 5: 205-207.

Begum, M., M. Hussain, and F. A. Talukder, 1991. Relative effectiveness of some granular insecticides against mustard aphid. Bangla. J. Agric. Sci., 18: 49-52.

Ganguli, R.N. and D.R. Roy, 1976. Studies on the economic preventive spray control schedule of mustard aphid (*Lipaphis erysimi* Calt.) in Tripura. Pl. Prot. Bull., 24: 55-61.

Kakar, K.L. and G.S. Dorga, 1989. Field evaluation and economics of different spray schedules for control of mustard aphids *Lyadaphis (Lipaphis) erysimi* Calt. and *Brevecoryne braddicae* L. under mid hill conditions. Ind. J. Pl. Prot., 6: 12-18.

Khan, A.A.M., 1993. Surjomukhi tel, Krishi Katha, Asshin-1400. Agricultural Information Service, Khamarbari, Farmgate, Dhaka, Bangladesh., **6**: 263-264.

Lioyd, R.W. and D.R. Krieg, 1987. Cotton development and yield as affected by insecticides, Ind. J. Entomol., 80: 854-858.

Malik, R.S., 1988. Comparative aphid tolerance in cultivated species of *Brassica*. New Botanist., 65: 113-116.

Phadke, K.G. and Y.K. Prasad, 1990. Identification of *Brassica* genotypes-least susceptible to mustard aphid, *Lipahis erysimi* (Kalt.). J. Aphidol., 1: 93-97.

Prasad, Y.K. and K.G. Phadke, 1983. Effect of mustard aphid *Lyadaphis (Lipaphis) erysimi* Calt. Infestation on the seed yield of different varieties *Brassica* species. Pranikee, 4: 283-289.

Raju, A.K., G.P. Veni and P.A. Rao, 1982. Combinations of some pesticides and urea and the control of Jassids, *Amrasca bigittula bigittula* Ishida and yield of mesta. Ind. J. Pl. Prot., 10: 56-58.

Rouf, F.M.A., K.H. Kabir and M.S. Ahmed, 1997. Economics of spray schedule in controlling aphid at different growth stages of mustard. Bangla. J. Agric. Res., 22: 117-122.

Sharma, K.C. and N.K. Khatri, 1979. Studies on biology and control of the mustard aphid (*Lyadaphis (Lipaphis) erysimi)* on mustard at Khulmaltar. Nepalese J. Agric., 13/14: 63-71

Singh, C.P. and G.C. Sachan, 1997. Economic injury levels and economics of control of the mustard aphid, *Lipaphis erysimi* (Kalt.) on mustard in tarai. India Insect Sci. Applic., 17: 243-296.

Singh, B., R. Singh and M.S. Mahal, 1983. Assessment of loss in yield of *Brassica juncea* by *Lipaphis erysimi*, II. Economics of aphid control. Ind. J. Ecol., 10: 279-284.

Singh, H., H.R. Rohilla, D.S. Gupta and T.P. Yadava, 1984. Efficacy and economics of some insecticidal granules and oxyedemeton methyl against mustard aphid, *Lipaphis erysimi*. Ind. J. Agric. Sci., 54: 496-499.

Singh, H., H.R. Rohilla, D.S. Gupta and S.S. Kharuv, 1987. Integration of chemical control of mustard aphid, *Lipaphis erysimi* Kalt. and safety of pollinators. Ann. Biol., 3: 105-106.

Vir, S. and A. Henry, 1987. Assessment of yield loss due to mustard aphid, *Lipaphis erysimi* Kalt. in some important varieties of raya. Pesticides, 21: 30-32.

Zar, J.H., 1999. Biostatistical Analysis (4th ed.). Prentice Hall Int. Inc. N.J. USA. pp: 660.