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EFFECTIVENESS OF SOME INSECTICIDES AGAINST MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT.) (APHIDIDAE: HOMOPTERA) ON THREE DIFFERENT CROPS

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Abstract: Efficacy of five insecticides viz., Confidor 200 SL (imidacloprid) @ 100 ml / ha, Endosulfan 35 EC (endosulfan) @ 1500 ml / ha, Advantage 20 EC (carbosulfan) @ 750 ml / ha, Polo 500 SC (difenthiuron), @ 500 ml / ha and Trebon 30 EC (ethophenprox) @ 500 ml / ha was studied against mustard aphid, *Lipaphis erysimi* (Kalt.) during February 2000 on mustard (*Brassica compestris* L.), turnip (*Brassica rapa* L.) and radish *(Raphanus sativus* L.). All the tested insecticides controlled the aphids effectively on all the three crops, however Confidor, Endosulfan and Advantage application resulted in better control on mustard. On turnip and radish, Confidor was better than other insecticides. Maximum mortality (76 to 97%) of aphids resulted three days after application of most of the insecticides on mustard and turnip, whereas on radish, most of the insecticides gave higher mortality (84 to 98%) on seventh day after application. Where no insecticide was applied, aphid population increased 5.22, 5.15 and 3.74 times during the study period (10 days) on mustard, turnip and radish, respectively.

Keywords: *Brassica comprestris, Brassica rapa, Raphanus sativus, Lipaphis erysimi*, Insecticides.

INTRODUCTION

Mustard aphid, *Lipaphis erysimi* (Kalt.) is one of the serious pests of mustard (*Brassica campestris* L.), turnip (*B. rapa* L.) and radish (*Raphanus sativus* L.). Both adults and nymphs feed on leaves, inflorescence and pods, which results in pale and curled leaves, and consequently plant growth and development of flowers and pods is adversely affected. The yield may decrease up to 80 % in case of severe infestation [Atwal 1976]. Aphids also transmit plant viral diseases, e.g. turnip mosaic virus, which can be managed by effective control of aphid [Chowfla and Baruah 1990, Bedford *et al.* 1998]. Different aspects including population dynamics of aphids, its biological control agents and economic threshold level have been studied [Veda and Shaw 1988, Bath and Singh 1989, Begum and Huq 1991, Hodgson 1991, White *et al.* 1995], which provide the bases for the development of sound pest management strategies.

Aphids may have up to forty-five generations per year. Their high reproductive capacity and extensive insecticide application resulted in development of resistance against certain insecticides [Garg *et al.* 1987, Udaeen and Narang 1988, Khurana and Batra 1989, Zheng *et al*. 1997]. It forced the researchers to find out new and effective methods for its better control. Plant extracts including *neem* and tobacco have also been found

effective against aphids in the field [Endersby and Morgan 1991] and laboratory conditions [Pandey *et al.* 1988, Sweeden and McLeod 1997].
The objective of this study was to compare the efficacy of some insecticides against mustard aphid infesting mustard, turnip and radish at flowering stage.

MATERIALS AND METHODS

The studies were conducted at the Vegetable Research Farm, University of Agriculture, Faisalabad, Pakistan during February 2000 by planting each of the mustard, turnip and radish crops in the field. The trials were laid out in a Randomized Complete Block Design with three replications. Plot size for each crop was 5m x 5m with six beds in each. Plant-to-plant and row-to-row spacing was 0.3m and 0.74m, respectively for each crop.
Aphids were counted by using a white plastic sheet measuring 15.24 x 22.86 cm^2. The sheet was marked by drawing lines at 2.54 cm distance along the length and width, resulting in 54 squares of 6.45 cm^2 each. In each plot, ten main branches were randomly selected and tagged. Apical 15cm length of each branch was beaten 10 times with a stick gently against the plastic sheet in each plot of these crops, and aphids falling on the sheet were counted.
Five insecticides, viz., Confidor 200 SL (imidacloprid) @ 100 ml / ha, Endosulfan 35 EC (endosulfan) @ 1500 ml / ha, Advantage 20 EC (carbosulfan) @ 750 ml / ha, Polo 500 SC (difenthiuron), @ 500 ml / ha and Trebon 30 EC (ethophenprox) @ 500 ml / ha were applied twice at an interval of 10 days, starting from 40 – 50 % pod formation stage of the crops. Number of aphids was counted a day before treatment from 60 randomly chosen plants in the field and 1, 2, 3, 7 and 10 days after insecticides application on ten tagged plants in each plot in all three crops. Data were analyzed by calculating Analysis of Variance, and mean separation was done by Duncan's Multiple Range Test (DMR) [Little and Hill 1978] at 0.05 probability level.

RESULTS AND DISCUSSION

Data presented in the tables are average number of aphids on 15cm main branch for two insecticide applications. The mean number of aphids per branch before insecticide application was 37, 31 and 36 on mustard, turnip, and radish, respectively.

MUSTARD

Aphid population was severely suppressed by all insecticides after one day of treatment (Table 1). The mean number of aphids in treated plots was non-significantly different from each other, but was significantly less as compared to that in control plots. Aphid mortality in treated plots ranged from 65.4 to 79.4 percent. After two days of insecticide application, number of aphids was significantly lower in plots where

Advantage was applied than that in plots treated with other insecticides and control. There was no significant difference in number of aphids among other insecticidal treatments. Three day after treatment, number of aphids was also significantly lower in plots treated with Advantage than that in plot receiving other treatments. Number of aphids in plots treated with Confidor, Endosulfan and Polo was non-significantly different and lower than that in plots treated with Trebon, but higher than that in plots treated with Advantage. After seven days of treatment, the difference in number of aphids was non-significant among plots treated with Confidor, Endosulfan and Advantage, which was lower than that in plots treated with Polo and Trebon. Trebon treated plots had significantly lower number of aphids than that in Polo treated plots. After 10 days of application, number of aphids was lower and non-significantly different in plots treated with Confidor, Endosulfan and Advantage. Number of aphids was also non-significantly different in plots treated with Polo and Trebon, which had higher number of aphids than that in plots receiving other treatments.

Table 1: Mean number of aphid (*Lipaphis erysimi*) and its mortality on 15cm main branch of mustard at different intervals after insecticide treatments[+].

Treatment	Dose ml/ha	No. of Aphids (Days after Treatment)[*]				
		1	2	3	7	10
Confidor 200 SL (Imidacloprid)	100	12.8 b (65.4)[$]	6.8 b (81.6)	2.3 bc (93.4)	2.5 d (93.2)	4.0 c (89.2)
Endosulfan 35 EC (Endosulfan)	1500	12.5 b (66.2)	8.0 b (78.4)	2.6 bc (93.0)	3.6 d (90.3)	6.9 c (81.4)
Advantage 20 EC (Carbosulfan)	750	7.6 b (79.4)	4.0 c (89.2)	1.0 c (97.3)	2.7d (92.7)	5.9 c (84.1)
Polo 500 SC (Difenthiuron)	500	11.6 b (68.6)	7.3 b (80.3)	4.0 bc (89.2)	10.6 b (71.4)	13.6 b (63.2)
Trebon 30 EC (Ethophenprox)	500	8.0 b (78.4)	8.0 b (78.4)	8.8 b (76.2)	8.5 c (77.0)	11.8 b (68.1)
Control	-	49.1 a	44.2 a	79 a	195 a	193 a

+ Means followed by the same letter in columns are not significantly different (P=0.05, DMRT).
* Average of two insecticide applications.
$ Numbers in parentheses are percent mortality calculated on the basis of average number of aphids in the field before treatment, i.e. 37.

The results indicated that Advantage had quick knock down effect, as the mortality of aphids was relatively higher in this treatment than in others a day after insecticide application, and significantly higher after two and three days after treatment. No significant difference in number of aphids among Confidor, Endosulfan and Advantage after seven and ten days of application indicates that Confidor and Endosulfan are effective but slower in action than Advantage. Although, all the insecticides tested resulted in keeping the aphid population under check as compared to that in untreated plot, however Confidor, Endosulfan and Advantage also provided better control of aphids. The results indicated that Advantage should be used for quick knock down of aphids. Confidor, Endosulfan and Advantage are relatively better options for aphid control on mustard up to 10 days.

TURNIP

Number of aphids was the lowest in Trebon treated plots after one day of insecticide application (Table 2). Number of aphids varied from 8.2 to 10.4 per 15cm branch in plots receiving other treatments, which was lower than that in control plots. Two days after treatment, plots treated with Endosulfan and Trebon had non-significantly different number of aphids, which was lower than that in plots treated with other insecticides. Among the treated plots, those treated with Polo had the highest number of aphids. Number of aphids in Advantage treated plots was significantly lower than that in Polo treated plot but higher than that in plots treated with other insecticides. After three days of treatment, all insecticide treated plots had non-significantly different number of aphids and mortality in these plots ranged from 89.0 to 96.1 percent. Seven days after treatment, the number of aphids in Advantage and Polo treated plots was non-significantly different and higher than that in plots treated with Endosulfan and Trebon. Difference in number of aphids in Endosulfan and Trebon treated plots was also non-significant. Confidor treated plots had the lowest number of aphids. Ten days after treatment, Confidor treated plots had the lowest number of aphids as compared to that in plots receiving other treatments. Number of aphids in Endosulfan, Polo and Trebon treated plots was non-significantly different and higher than that in plots treated with Advantage.

Table 2. Mean number of aphid (*Lipaphis erysimi*) and its mortality on 15cm main branch of turnip at different intervals after insecticide treatments[+].

Treatment	Dose ml/ha	No. of Aphids (Days after Treatment)[*]				
		1	2	3	7	10
Confidor 200 SL (Imidacloprid)	100	8.2 d (73.5)[$]	4.0 d (87.1)	1.2 b (96.1)	3.5 d (88.7)	8.0 c (74.4)
Endosulfan 35 EC (Endosulfan)	1500	8.8 cd (71.6)	2.5 e (91.9)	2.0 b (93.5)	5.2 c (83.2)	12.6 b (59.4)
Advantage 20 EC (Carbosulfan)	750	9.3 c (70.0)	5.2 c (83.2)	1.2 b (96.1)	6.6 b (78.7)	11.0 bc (64.5)
Polo 500 SC (Difenthiuron)	500	10.4 b (66.5)	7.4 b (76.1)	3.4 b (89.0)	6.3 b (79.7)	14.3 b (53.9)
Trebon 30 EC (Ethophenprox)	500	5.0 e (83.9)	2.0 e (93.5)	2.7 b (91.3)	5.3 c (82.9)	12.8 b (58.7)
Control	-	28.3 a	44.2 a	46.6 a	134.3 a	159.6

+ Means followed by the same letter in columns are not significantly different (P=0.05, DMRT).

* Average of two insecticide applications.

$ Numbers in parentheses are percent mortality calculated on the basis of average number of aphids in the field before treatment, i.e. 31.

All the insecticides reduced the aphid population compared to that in control plots, but Confidor consistently proved better than other treatments up to 10 days after application.

RADISH

One day after application, plots treated with Endosulfan had the lowest and those treated with Confidor had the highest number of aphids (Table 3). Number of aphids in plots treated with Advantage was significantly higher than that in plots treated with Endosulfan and lower than that in plots treated with other insecticides. Polo treated plots had significantly lower number of aphids than that in plots treated with Confidor, but higher than those receiving other treatments. Two days after treatment, plots treated with Advantage had the lowest and those treated with Trebon had the highest number of aphids. Difference in number of aphids was non-significant among Confidor, Endosulfan and Polo treated plots. Three days after treatment, the number of aphids was non-significantly different among Confidor, Endosulfan and Advantage treated plots, which had significantly lower population than that in Polo and Trebon treated plots. Maximum number of aphids was present in plots treated with Trebon. Seven days after treatment, the number of aphids was non-significantly different in Polo and Trebon treated plots, and among Confidor, Endosulfan and Advantage treated plots. The number of aphids was significantly lower in plots treated with Confidor, Endosulfan and Advantage than that in plots treated with Polo and Trebon. Ten days after treatment, Confidor treated plots had the minimum number of aphids. Endosulfan and Polo treated plots had non-significant difference and higher number of aphids than that in plots treated with Confidor, and lower than that in plots treated with Advantage. Maximum number of aphids was recorded in plots receiving Trebon treatment. Although, the population of aphids was reduced in all treatments as compared to control, but application of Confidor resulted in better control of aphids on radish.

Table 3. Mean number of aphid (*Lipaphis erysimi*) and mortality on 15cm main branch of radish at different intervals after insecticide treatments[+].

Treatment	Dose ml/ha	No. of Aphids (Days after Treatment)[*]				
		1	2	3	7	10
Confidor 200 SL (Imidacloprid)	100	13.2 b (63.3)[$]	6.1 c (83.1)	1.5 d (95.8)	0.5 c (98.6)	4.1e (88.6)
Endosulfan 35 EC (Endosulfan)	1500	6.4 e (82.2)	6.2 c (87.8)	1.7 d (95.3)	2.2 c (93.9)	7.1 d (80.3)
Advantage 20 EC (Carbosulfan)	750	8.8 d (75.6)	1.6 d (95.6)	1.5 d (95.8)	2.0 c (94.4)	9.7 c (73.1)
Polo 500 SC (Difenthiuron)	500	10.5 c (70.8)	5.5 c (84.7)	6.2 c (82.8)	4.6 b (87.2)	7.8 d (78.3)
Trebon 30 EC (Ethophenprox)	500	9.4 cd (73.9)	8.4 b (76.7)	8.3 b (76.9)	5.7 b (84.2)	17.4 b (51.4)
Control	-	32.7 a	35.3 a	39.4 a	92.1 a	134.8 a

+ Means followed by the same letter in columns are not significantly different (P=0.05, DMRT).

* Average of two insecticide applications.

$ Numbers in parentheses are percent mortality calculated on the basis of average number of aphids in the field before treatment, i.e. 36.

The results indicated that Confidor, Endosulfan and Advantage application gave better control of aphids on mustard, however only Confidor proved better on turnip and radish as compared to other insecticides after ten days of application. All the tested insecticides effectively reduced aphid population as compared to un-treated plots of all three crops. On mustard and turnip, maximum mortality (89.2 to 97.3%) resulted three days after treatment with all the insecticides, except Trebon, which caused variable mortality up to ten days after application. On radish, maximum mortality was observed with Confidor, Advantage and Endosulfan after three and seven days of treatment. The results supported the findings of earlier workers [Darshan and Singh 1989], who reported that insecticides were effective for aphid control. They also obtained higher yield with monochrotophos and carbofuran application. Some other insecticides have also been found effective by many workers [Pandey *et al.* 1988, Sweeden and McLeod 1997, Bedford *et al*. 1998]. Higher persistence and effective control of mustard aphid has been reported [Udaeen and Narang 1988, Zheng *et al.* 1997] by using carbofuran and Endosulfan under field conditions [Begum *et al.* 1991, Brown *et al*. 1999].

In untreated plots aphid population increased 5.22, 5.15 and 3.74 times the population before treatment on mustard, turnip and radish, respectively over a period of 10 days. It is clear from these results that aphid population build up was slower on radish than that on mustard and turnip. This could be due to different phytochemistry of the three plant species used in the study. The maximum population increase was noted from third to seventh day on all crops. Increase in number of aphids during this period was 2.47, 2.88 and 2.33 fold on mustard, turnip and radish, respectively.

References

Atwal, A.S. (**1976**) “Agricultural pests of India and South East Asia”, Kalyani Publishers, New Delhi, India, pp. 310-311.

Bath, D.S. and Singh, D. (**1989**) “Studies on the economic threshold level of mustard aphid, *Lipaphis erysimi* (Kaltenbach) on the radish seed crop in India”, *Trop. Pest Mngt.*, 35**,** 154-156.

Bedford, I.D., Kelly, A., Secker, A., Markham, P.G., Froggatt, P. and Wright, T. (**1998**) “The effect of lambda – cyhalothrin on the aphid, *Myzus persicae,* a vector of turnip mosaic polyvirus and implications for its control”. *Proc. Brighton Crop Prot. Conf., 1998, Brighton, UK, Nov.16-19,* 3, 1065-1070.

Begum, M. and Huq, S.B. (**1991**) “Evaluation of different genotypes of Indian mustard (*Brassica juncea*) for their reaction to mustard aphid (*Lipaphis erysimi*)”, *Ind. J. Agric. Sci.,* 61**,** 210-213.

Begum, M., Hussain, M. and Talukder, F.A. (**1991**) "Relative effectiveness of some granular insecticides against mustard aphid", *Bang. J. Agric. Sci.,* 18**,** 49-52.

Brown, J.J., McCafferey, P., Harmon, B.L., Davis, J.B., Brown, A.P. and Erickson, D.A. (**1999**) "Effect of late season insect infestation on yield, yield components and oil quality of *Brassica Napus*, *B. rapa, B. juncea and Sinapis alba* in the Pacific North West region of the United States", *J. Agric. Sci.,* 132, 281-288

Chowfla, S.C. and Baruah, B.P. (**1990**) "Effect of turnip mosaic virus and its vector on growth parameters and yield of cauliflower", *Plant Dis. Res.*, 5, 229-231.

Darshan, S. and Singh, H. (**1989**) "Effectiveness of granular and foliar application of systemic insecticides in controlling mustard aphid, *Lipaphis erysimi*", *Ind. J. Ent.,* 49, 453-456.

Endersby, N.M. and Morgan, W.C. (**1991**) "Alternatives to synthetic chemical insecticides for use in crucifer crops", *Biol. Agri. & Hort.*, 8, 33-52.

Garg, P.K., Singh, S.P. and Hameed, S.F. (**1987**) "Dissipation of endo-sulfan residues in/on mustard aphid", *J. Ent. Res.*, 11, 158-160.

Hodgson, C. (**1991**) "Dispersal of apterous aphid (Homoptera: Aphididae) from their host plant and its significance", *Bull. Entomol. Res.*, 81, 417-427.

Khurana, A.D. and Batra, G.R. (**1989**) "Bioefficacy and persistence of insecticides against *Lipaphis erysimi* (Kalt.) on mustard under late sown conditions", *J. Insect Sci.*, 2, 139-145.

Little, T.M. and Hill, F.T. (**1978**) "Agricultural Experimentation: Design and Analysis", John Wiley and Sons. Inc., New York, p. 350.

Pandey, N.D., Singh, L., Singh, Y.P. and Tripathi, R.A. (**1988**) "Effect of certain plant extracts against *Lipaphis erysimi* (Kalt.) under laboratory conditions", *Ind. J. Ent.*, 49, 238-242.

Sweeden, M.B. and McLeod, P.J. (**1997**) "Aphicide persistence on spinach and mustard greens", *J. Eco. Entomol.*, 90,195-198.

Udaeen, A.S. and Narang, D.D. (**1988**) "A survey of mustard aphid, *Lipaphis erysimi* (Kalt.) for resistance to insecticides in Punjab", *J. Res. PAU*., 25, 77-80.

Veda, O.P. and Shaw, S.S. (**1988**) "Population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) and its parasite, *Diaretus rapae* M'Intosh", *Agri. Sci. Digest*, *India*, 8, 189-190.

White, A.J., Wratten, S.D., Berry, N.A. and Weigmann, U. (**1995**) "Habitat manipulation to enhance biological control of brassica pests by hoverflies (Diptera: Syrphidae)", *J. Econ. Entomol.*, 88, 1171-1176.

Zheng, B.Z., Gao, X.W., Zhao, G.Y. and Cao, B.J. (**1997**) "Insecticide resistance in turnip aphids, *Lipaphis erysimi* (Kaltenbach), from Beijing and suburbs", *Resis. Pest. Mngt.*, 9, 27-28.