GAU Res. J. 1996. 22 (1) : 67-71

Bioefficacy of Synthetic and Botanical Insecticides Against Aphid, *Lipaphis erysimi* Kalt and Diamond Back Moth, *Plutella xylostella* L. Infesting Cabbage

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ABSTRACT

Field experiments were conducted during *rabi* 1993-94 and 1994-95 to find out the effective and economical insecticide(s) for the control of aphid, *Lipaphis erysimi* Kalt and diamond back moth, *Plutella xylostella* L. on cabbage. Endosulfan 0.035% (1:37.08), chlorpyriphos 0.02% (1:34.08) and Neem Seed Karnel Suspension (NSKS) 3% (1:27.58) were found effective and economical for the control of aphid and diamond back moth.

(Received on 1st December, 1995)

INTRODUCTION

Cabbage, (*Brassica oleracea* convar *capitata* var *capitata*) an important vegetable sole crop cultivated throughout India, is attacked by number of insect pests. Amongst them aphid, *Lipaphis erysimi* Kalt is the regularly occurring most serious pest. The cabbage plants heavily infested by *L. erysimi* in the early stage fail to have head formation (Ratanpara *et al.*, 1992). *Plutella xylostella* L. is an another important pest which has acquired serious dimensions and become a limiting factor for the cultivation of cabbage and cauliflower during recent years. Borad *et al.* (1991) have reported the effectiveness of synthetic insecticides, monocrotophos and dimethoate against *L. erysimi* and *Helicoverpa armigera* infesting cabbage, but no information is available on botanicals. Considering the seriousness of these two pests, the present investigation was undertaken to find out the effective synthetic and/or botanical insecticide(s) for their control.

MATERIALS AND METHODS

Field experiments were conducted in a randomised block design at college agronomy farm of Gujarat Agricultural University, Campus Anand with three replications using C. V. Sutton Express during the *rabi* 1993-94 and 1994-95. Four synthetic and three botanical insecticides were tested (Table 1). Insecticides were applied on appearance of aphid during 1993-94. Aphid counts were taken on the cabbage three leaves from randomly selected five plants in each plot prior and after 1 and 2 week(s) of spray. Due to very low infestation of *P. xylostella* in the field

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insecticides were sprayed on the cabbage plants in the field during 1994-95 and such treated leaves were brought to the laboratory and fed to diamond back moth larvae. Treated cabbage leaves with respective insecticides were given to the live larvae daily for feeding till 7 days after spray. Ten larvae were released on treated cabbage leaves for each treatment. It was repeated thrice. The observations on larval mortality were recorded after 1, 3 and 7 day(s) of spray. The data obtained were converted into percentage and subjected to analysis of variance and presented in this paper.

RESULTS AND DISCUSSION

The data on aphid populations (Table 1) revealed chlorpyriphos (0.02% and 0.04%) was most effective against aphid and showed superiority over quinalphos and three botanicals after 1 week of spray. Of course, endosulfan and phosphamidon remained equally effective as chlorpyriphos. Quinalphos showed equal aphicidal property as phosphamidon, endosulfan, Parasmani, Nimbecidine and Neem Seed Kernel Suspension (NSKS) after 1 and 2 weeks of spray. After 2 weeks of spray chlorpyriphos 0.04% did not show higher effectiveness than chlorpyriphos 0.02% but, considerably lower aphid population was observed when cabbage was sprayed with chlorpyriphos 0.04% in comparison to phosphamidon and endosulfan which were found equally effective as chlorpyriphos after 1 week of spray. Yadav *et al.* (1988) and Krishnaiah and Jagan Mohan (1983) reported the effectiveness of endosulfan and chlorpyriphos against cabbage aphid. Amongst three botanicals, Nimbecidine, Parasmani and NSKS, Parasmani could effectively checked the aphid population like chlorpyriphos 0.02%, phosphamidon, endosulfan and quinalphos after 2 weeks of their spray. Nimbecidine and NSKS sprayed cabbage plants had almost equal aphid population as plants sprayed with quinalphos, endosulfan, phosphamidon and Parasmani after 2 weeks of spray.

The larval mortality of diamond back moth (Table 1) after 1, 3 and 7 days of treatment was considerably higher in all the synthetic and botanical insecticides than water spray. However, endosulfan gave higher larval mortality than Quinalphos, Phosphamidon, Parasmani and Nimbecidine after 1 day of their spray. Of course, chlorpyriphos and NSKS were found equally effective as endosulfan. After 3 days of spray all the insecticides including botanicals could give equal larval mortality as endosulfan. However, chlorpyriphos 0.04% showed higher effectiveness than phosphamidon and Nimbecidine. Nimbecidine remained less effective than Parasmani and quinalphos. Same trend was continued after 7 days of spray however, Nimbecidine and Parasmani were found at par. Endosulfan 0.7 kg a.i./ha and chlorpyriphos 0.5 kg a.i./ha gave effective kill of the pest at I.I.H.R., (Krishnaiah and Jagan Mohan, 1983), whereas NSKS was rated quite good against *P. xylostella* (Patel *et al.*, 1993).

The effectiveness of insecticide against aphid and diamond back moth were also reflected on yield. All the synthetic insecticides and Parasmani sprayed cabbage crop could give considerable higher yield than unsprayed crop as well as NSKS and Nimbecidine sprayed crop.

TABLE 1

Efficacy of synthetic and botanical insecticides against aphid and diamond back moth and their effect on cabbage yield.

Treatment	Av. No. of aphid/leaf spray			Larval mortality (%) of P. xylostella after days(s)			Yield of marketable cabbage head (q/ha)
	Before	After week(s)					
		1	2	1	3	7	
Chlorpyriphos 0.02%	3.65 (12.89)	1.34 (1.33)	2.82 (7.56)	43.06 (46.67)	63.90 (80.00)	66.61 (83.33)	200.82
Chlorpyriphos 0.04%	4.74 (22.44)	1.07 (0.67)	2.27 (4.89)	43.06 (46.67)	66.61 (83.33)	66.61 (83.33)	228.48
Endosulfan 0.035%	3.97 (15.55)	1.68 (2.33)	3.52 (11.89)	50.83 (60.00)	55.05 (66.67)	64.61 (80.00)	194.25
Phosphamidon 0.03%	4.33 (18.45)	1.57 (2.00)	3.07 (9.02)	32.20 (30.00)	49.20 (56.67)	58.98 (73.33)	200.17
Quinalphos 0.025%	4.26 (18.67)	2.19 (4.33)	3.60 (12.55)	34.21 (33.33)	55.76 (66.67)	57.68 (70.00)	181.07
Neem Seed Kernel Suspension (NSKS) 3%	3.94 (15.11)	2.48 (5.67)	3.71 (13.33)	41.14 (43.33)	50.83 (60.00)	58.98 (73.33)	164.61
Parasmani 0.3%	4.31 (18.44)	2.25 (4.67)	3.35 (11.22)	30.78 (26.67)	57.27 (70.00)	57.27 (70.00)	190.29
Nimbecidine 0.3%	4.05 (16.11)	2.25 (4.67)	3.77 (13.76)	28.07 (30.00)	38.84 (40.00)	43.06 (46.66)	138.93
Control (water with teepol)	3.54 (12.00)	4.41 (19.33)	4.83 (22.89)	0.99 (0.00)	0.99 (0.00)	0.99 (0.00)	123.79
S. Em. +	0.33	0.21	0.25	5.24	5.66	4.79	16.09
C. D. at 5%	NS	0.64	0.74	15.58	16.81	14.24	50.64
C. V. %	14.13	17.27	12.50	26.85	20.11	15.74	16.23

*$\sqrt{X + 0.5}$ transformed values.

** Arc sin transformed values.

Figures in the parantheses are original values.

TABLE 2

Economics of various synthetic and botanical insecticides against aphid and diamond back moth infesting cabbage.

Treatments	Rate of insecticide (1 or kg/ha)	Av. cost of the insecti-cide (Rs./ha)	Total cost of plant protection (Rs./ha)	Average yield (q/ha)	Net gain over control (q/ha)	Realization over control (Rs/ha)	ICBR
Chlorpyriphos 0.02%	0.4	126	226	200.82	77.03	7703	1:34.08
Chlorpyriphos 0.04%	0.8	251	351	228.48	104.69	10469	1:29.83
Endosulfan 0.035%	0.4	90	190	194.25	70.46	7046	1:37.08
Phosphamidon 0.03%	0.4	184	284	200.17	76.38	7638	1:26.89
Qhinalphos 0.025%	0.4	140	240	181.07	57.28	5728	1:23.87
NSKS 3%	12.0	48	148	164.61	40.82	4082	1:27.58
Parasmani 0.3%	1.2	216	316	190.29	66.50	6650	1:21.04
Nimbecidine 0.3%	1.2	180	280	138.93	15.14	1514	1:05.11
Control	—	—	—	123.79	—	—	

Note : Cost of labour for spraying Rs. 100 per ha.
Price of cabbage head Rs. 1.00 per kg.

Endosulfan gave the highest (1:37.08) cost benefit ratio followed by chlorpyriphos 0.02% (1:34.08), chlorpyriphos 0.04% (1:29.83) and NSKS (1:27.58). Considering the effectiveness, economics and safety to bioagents of aphid and diamond back moth endosulfan 0.035% and NSKS 3% should be sprayed on cabbage crop.

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