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POPULATION DYNAMICS OF INSECT PESTS ASSOCIATED WITH CABBAGE AND CAULIFLOWER AND FARMERS' FRIENDLY IPM

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ABSTRACT

A field survey in the farmers' fields at Gurugram in Haryana, in few blocks focused on the incidence of pests of cabbage and cauliflower during rabi, 2017-18 and 2018-19. These revealed the occurrence of *Plutella xylostella* and *Spodoptera litura.* Maximum number of larvae of *P. xylostella* and *S. litura* was recorded in Pataudi block as compared to those of Farukhnagar, Sohana and Gurugram. Seven neem-based biopesticides were evaluated along with check carbosulfan at hot spots. Data revealed that NSKE 5% was quite effective followed by Nimbicidin and Neemgold. The cost benefit ratio was maximum with NSKE (1:9.41, 1:9.53 for cabbage and cauliflower, respectively) followed by neem leaf extract (NLE) with (1:7.72 and 1:6.31). These results conclude that NSKE and NLE can be recommended against major pests of cabbage and cauliflower.

Key words: Cabbage, cauliflower, *Plutella xylostella, Spodoptera litura*, incidence, biopesticides, Nimbicidin, Neemgold, NSKE, neem leaf extract, yield, cost benefit ratio

Vegetables constitute an important part of our daily human diet. Due to high content of protein and carbohydrates, these crops are prone to attack by insect pests, and crop loss is estimated to be around 52-100% (Anuradha, 1997; Cardleron and Hare, 1986). Talekar (1992) states that the annual cost of managing these pests globally is estimated to be one billion US $. Cabbage and cauliflower are infested by a number of insect pests which can cause substantial yield losses. Among the lepidopteran pests, diamond back moth, *Plutella xylostella* and tobacco caterpillar, *Spodoptera litura* are the most important causing direct reduction in yield and indirectly in quality. Cabbage aphids *Brevicoryne brassicae* and cabbage white butterfly *Pieris brassicae* cause leaf damage up to 31% (Mochiah et al., 2011). A single factor cannot be considered to estimate the population pattern of *P. xystella* and *S. litura* on cabbage and cauliflower in Haryana. Emphasis is being given to alternative method of controlling these. Efforts are being made to bring in effective, ecofriendly IPM measures acceptable to farmers. Application of botanicals and biopesticides are effectively used against *P. xylostella* (Srinivasan and Krishna, 1991; Saravaiya, and Patel, 2005). The present study explores the insect pests associated with cauliflower and cabbage and few ecofriendly IPM measures using neem formulations in Gurugram, Haryana.

MATERIALS AND METHODS

A roving survey of Dist. Gurugram, Haryana was carried out in the infested area covering four different blocks viz. Pataudi (Uncha Majra, Bhora Kalan, Narhera, Khanpur, Mamtajpur, Baspadmka villages) Farukhnagar (Fazilpur Tajnagar, Farukhanagar, Kaliavas villages) Sohna (Baluda, Garhimurli, Sohna ki Dhani, Badshahpur villages) and Gurugram (Chandu, Garhi Harsaru, Garhi Gopalpur, Sardana villages) during rabi, 2017-18 and 2018-19. Besides, collection of insects, the farmers of each block were interviewed, and their views were noted. These identified areas were visited every week, and insects collected. Under field conditions, three seedlings of cabbage and cauliflower were kept covered with glass chimney and open end was tied with muslin cloth for aeration, and replicated thrice. After 40 days of growth, one two and four insect larvae of tobacco caterpillar, *S. litura* and diamond back moth, *P. xylostella* were put in each chimney having healthy growth of plants for observing damage symptoms in cauliflower and cabbage. A field trial was conducted against *P. xylostella* and *S. litura* in cauliflower and cabbage with eight treatments with three replications in a plots of size of 10x 10 m in block Pataudi during both the years. The objective was to evaluate the efficacy of neem formulations. Seedlings were prepared in nursery of cauliflower cv. Pusa snowball K1 and cabbage cv.

Golden Acre and seedlings were transplanted after 30 days, with sprays given by knapsack sprayer, first 30 days after transplantation and second after 15 days of first spray. Observations were recorded on the incidence of pests, and efficacy of treatments was estimated based on % yield increase over control. The treatments evaluated include: Neemazal, Neem Gold, Neemol, Nimbicidine, neem leaf extract (NLE), NSKE, Rakshak @ 5 ml/ l each and carbosulfan 2 ml/ l, along with control (without treatment). The yield data were recorded at harvest time and further subjected to cost benefit ratio.

RESULTS AND DISCUSSION

The results revealed that *P. xylostella* and *S. litura* were the major pests causing damage up to 70-80%. These were monitored in cabbage and cauliflower in four blocks i.e. Patandi, Farukhnagar, Sohna and Gurugram (Haryana) during rabi 2017-18 and 2018-19; the pooled mean number of larvae of *P. xylostella* and *S. litura* showed significant differences among four blocks; *P. xylostella* larvae on cauliflower and cabbage was 10.9 and 7.20/10 plants, respectively in Pataudi block, being maximum (Table 1). Similar trend in number of larvae of *S. litura* was observed in Pataudi (5.03 and 4.88 larvae/ 10 plants), Farukhnagar(4.25 and 3.30 larvae/ 10 plants), Sohana (3.60 and 4.13 larvae/ 10 plants) and Gurugram (2.38 and 2.78 larvae/ 10 plants). Thus, Pataudi block showed maximum incidence (Table 1). Chimney controlled plant growth technique resulted minute observations on symptoms and damage by *P. xylostella* and *S. litura*; *P. xylostella* larva is small and green, feed on leaves makes bite holes, and causes excessive defoliation on primordial, causing yield loss up to 70-80%; *S. litura* eggs are laid in clusters on under surface of leaves, and young larvae feed gregariously and skeletonize the leaves, while large larvae bore into heads, causing yield loss of 60-70%. *P. xylostella*) is an important pest and causes extensive damage to the cabbage and cauliflower (Devi et al., 1995); *S. litura* damaged seedlings, disrupts head formation. The presence of larvae of *P. xylostella* and *S. litura* causes in rejection of marketable produce (Kranz et al., 1977).

The acceptance of any of any botanical based IPM module in cauliflower and cabbage depends upon its economics; the product cost, labour charges and expenditure of application of each spray varied from Rs 2462 to Rs 6150/ ha, due to difference in cost of biopesticide, botanical preparations, and insecticides. Data given in Table 2 based on pooled analysis, reveal that NLE was at minimum cost Rs. 2462/ ha and net profit of Rs. 35261/ ha and Rs. 34018/ ha were obtained in cauliflower and cabbage, respectively with two sprays of Nimbicidine. This is followed by NSKE with net profit of Rs. 29435, 29076/ ha, respectively in cauliflower and cabbage crops; Neemazal gave minimum net profit of Rs. 14995/ ha and Rs 14627/ ha in cauliflower and cabbage, respectively. The maximum incremental cost benefit ratio of 1:9.53 and 1: 9.41 was obtained with NSKE, while in others it varied from 1: 2.98 to 1: 6.84 and 1: 2.91 to 1: 7.72, respectively in cauliflower and cabbage. Singh (2006) evaluated antifeedant process of Nimbicidine against *S. litura* larvae at high concentration and it showed more deterrency with least feeding area on leaves. Pal et al. (2015) confirmed that against *Bactrocera cucurbitae,* NSKE @ 5 ml/ l showed maximum efficacy. Nazrussalam et al. (2008) observed that NLE @ 5 ml/ l showed maximum deterrence and the highest yield of cauliflower and cabbage.

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Table 1. Incidence of *P. xystella* and *S. litura* on cauliflower and cabbage (pooled data, 2017-18 and 2018-19) at different blocks in Gurugram, Haryana

Locations (Blocks)	Cauliflower (mean/ 10 plants)		Cabbage (mean/ 10 plants)	
	P. xylostella	*S. litura*	*P. xylostella*	*S. litura*
Pataudi	10.90	5.03	7.20	4.88
Farukhnagar	6.03	4.25	5.23	3.30
Sohna	6.05	3.60	5.83	4.13
Gurugram	3.68	2.38	3.65	2.78
SEm±1	0.47	0.28	0.32	0.22
CD (p=0.05)	1.52	0.92	1.03	0.73

Table 2. Yield of cauliflower and cabbage along with benefit cost ratio obtained with biopesticides (pooled data)

Treatment	Dose (ml/ l)	No. of spray	Yield control (q/ ha)	Increased yield over control (Rs/ ha)	Price of product (Rs/ ha)	Cost of treatment (Rs/ ha)	Benefit of treatments (Rs/ ha)	Cost benefit ratio
Cauliflower								
Neem Azal	5	2	150.27	28.6	370.0	5025.0	14995	1:2.98
Neem Gold	5	2	163.77	42.1	350.0	4775.0	24695	1:5.17
Neemol	5	2	161.37	39.7	400.0	5400.0	22390	1:4.14
Nimbicidine	5	2	179.40	57.7	380.0	5150.0	35261	1:6.84
NLE	5	2	147.40	25.7	165.0	2462.0	15549	1:6.31
NSKE	5	2	168.13	46.46	215.0	3087.5	29435	1:9.53
Rakshak	2	2	154.03	32.36	367.0	4993.7	27341	1:5.47
Carbosulfan	2	2	198.80	77.13	700.0	6150.0	47841	1:7.71
Control	–	–	121.67	–	-	-	-	-
SEm±1	-	-	4.03					
CD (p=0.05)	-	-	12.20					
Cabbage								
Neem Azal	5	2	143.6	28.9	370.0	5025.0	14627	1:2.91
Neem Gold	5	2	157.1	42.4	350.0	4775.0	24057	1:5.03
Neemol	5	2	154.7	40.0	400.0	5400.0	21800	1:4.03
Nimbicidine	5	2	172.3	57.6	380.0	5150.0	34018	1:6.60
NLE	5	2	146.3	31.6	165.0	2462.0	19026	1:7.72
NSKE	5	2	162.0	47.3	215.0	3087.5	29076	1:9.41
Rakshak	2	2	151.3	36.6	367.0	4993.7	19894	1:3.98
Carbosulfan	2	2	188.7	74.0	700.0	6150.0	44170	1:7.18
Control	–	–	114.7	–	-	-	-	-
SEm±1	-	-	4.84					
CD (p=0.05)	-	-	14.66					

Labour charges Rs. 400/ day (2 No.); Machine charges Rs. 100/ day; Market price of cauliflower Rs. 700/ q; Market price of cabbage Rs.680/ q

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