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Bio-Efficacy of Insecticides Against *Plutella Xylostella (*L.*)* in Cabbage (*Brassica Oleracea Var.Capitata)*

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Abstract:
Efficacy of seven insecticides viz., emamectin benzoate 5 SG at 11 g a.i.ha^{-1}, emamectin benzoate 5 SG at 22 g a.i.ha^{-1}, profenophos 50 EC at 500 g a.i.ha^{-1}, profenophos 50 EC at 1000 g a.i.ha^{-1}, spinosad 45 SC at 100 g a.i.ha^{-1}, bifenthrin 10 EC at 100 g a.i.ha^{-1} and Bacillus thuringiensis at 5 WP at 25 g a.i.ha^{-1} was evaluated during Kharif,2012 against Plutella xylostella on cabbage. Among all the insecticides, profenophos (1000 g a.i.ha^{-1}) was found to be the most effective one with a maximum reduction in Plutella xylostella population (70.20%), followed by bifenthrin 10 EC at 100 g a.i.ha^{-1} (68.18%).

Keywords: *cabbage, insecticides, Plutella xylostella and efficacy*

1. Introduction

Cabbage (Brassica oleracea var. capitata L.) is the second important cruciferous vegetable crop in world. In India, it is cultivated in an area of 0.369 m ha with an average annual production of 7.949 m MT and productivity of 21.5 MT ha^{-1}. The major cabbage producing states are Maharashtra, Bihar, Karnataka, Orissa, West Bengal and Andhra Pradesh. West Bengal ranks first in both area and production of 0.0753 m ha and 2.087 m MT, respectively. Whereas, Orissa ranks first in productivity with 28 MT ha^{-1}(NHB 2011). It contains adequate quantities of vitamins A,B and C and minerals phosphorus, potassium, calcium, sodium and iron (Nath et al. 1984). Lack of quality seeds, improved cultivars, F_1 hybrids and suitable production technology contribute partly to the lower yields, various other factors are responsible for low productivity of which damage caused by various insect pests starting from transplanting till harvest is most significant. A host of insect pests viz., diamond back moth, (Plutella xylostella (L.)), cabbage leaf webber, (Crociodolomia rinotalis (Zell.)), tobacco caterpillar, (Spodoptera litura(Fab.)) and mustard aphid, (Brevecornyae brassicae (L.)) etc., attack the crop. Among these diamond back moth, (Plutella xylostella (L.)) has become the most notorious and pernicious pest on cruciferous vegetables causing 52 percent loss in marketable produce (Krishna kumar et al., 1986) and management of this pest has become a stupendous task and farmers apply pesticides 8 to 10 times to effectively control this pest. The crop production strategies, now-a-days has however experienced a paradigm shift from pest "control" to pest "management". As exclusion of chemical insecticides is impracticable, the use of most selective and effective insecticide is essential.

2. Materials and Methods

The experiment was laid out in a Randomized Block Design (RBD) with 8 treatments including untreated control replicated thrice with individual plot size of 20 m^2 (5mx4 m) and the insecticides viz., emamectin benzoate 5 SG at 11 g a.i.ha^{-1}, emamectin benzoate 5 SG at 22 g a.i.ha^{-1}, profenophos 50 EC at 500 g a.i.ha^{-1}, profenophos 50 EC at 1000 g a.i.ha^{-1}, spinosad 45 SC at 100 g a.i.ha^{-1}, bifenthrin 10 EC at 100 g a.i.ha^{-1} and Bacillus thuringiensis at 5 WP at 25 g a.i.ha^{-1} on cabbage at after head initiation and the second spray at 10 days after the 1st spray using knapsack sprayer to evaluate the efficacy against Plutella xylostella. The population of Plutella xylostella was recorded on five randomly selected plants per plot leaving the border rows. The population counts were recorded in each head of the five selected plants in every plot and mean number of whiteflies per five plants was calculated. The data was analyzed with arc sine values obtained from the conversion of percentage of infestation of fruits (Gomez and Gomez, 1984).The percentage reduction at three, five and seven after each spraying were pooled and transformed into arc sine values which were further subjected to statistical analysis.

3. Results and Discussion

Bioefficacy against Plutella xylostella (Table-1 and 2) show that profenophos at 1000 g a.i.ha^{-1} followed by bifenthrin at 100 g a.i.ha^{-1} were recorded high per cent reduction of Plutella xylostella population compared to emamectin benzoate 5 SG at 11 g a.i.ha^{-1}, emamectin benzoate 5 SG at 22 g a.i.ha^{-1}, profenophos 50 EC at 500 g a.i.ha^{-1}, spinosad 45 SC at 100 g a.i.ha^{-1} and Bacillus thuringiensis at 5 WP at 25 g a.i.ha^{-1} in both spray. Data on over all efficacies (Table-1) of insecticides against Plutella xylostella after first spray revealed that all the insecticidal treatments were significantly superior over control. Profenophos at

1000 g a.i.ha^{-1} followed by bifenthrin at 100 g a.i.ha^{-1} were most effective recording 71.39 and 67.49% reduction of Plutella xylostella population. Emamectin benzoate at 22 g a.i.ha^{-1}, profenophos at 500 g a.i.ha^{-1} and spinosad 100 g a.i.ha^{-1} recorded 62.59, 60.18 and 59.29% reduction of larval population but emamectin benzoate at 22 g a.i.ha^{-1} was on par with profenophos at 500 g a.i.ha^{-1} and spinosad at 100 g a.i.ha^{-1}. The data on overall efficacy (Table-2) revealed that all the insecticidal treatments were superior to control. Profenophos at 1000 g a.i.ha^{-1} was the best and superior to the remaining treatments recording 70.20% larval population reduction, followed by bifenthrin at 100 g a.i.ha^{-1} giving 68.18% larval population reduction and was superior over the other, viz., emamectin benzoate at 22 g a.i.ha^{-1} (61.97%), profenophos at 500 g a.i.ha^{-1} (60.00%), spinosad 100 g a.i.ha^{-1} (59.07%) and emamectin benzoate at 11 g a.i.ha^{-1} (54.24%) reduction of larval population over control whereas, emamectin benzoate at 22 g a.i.ha^{-1} was on par with profenophos at (500 g a.i.ha^{-1}) and spinosad 100 g a.i.ha^{-1}. Bt 25 g a.i.ha^{-1} was found to be least effective treatment in reducing the larval population recording 40.75%. The findings of the present study proved that profenofos at 1000 g a.i. ha-^{1} is an effective insecticide in controlling the Plutella xylostella.

The performance of profenophos corroborates with the reports of Williamson and Murray (1993) suppressing Pluttella xylostella with profenophos at 0.30 & 1.20 ml lt^{-1} at two weeks after spraying on cabbage. Profenophos at 0.25 – 0.5 kg a.i.ha^{-1}applied at 7-10 days intervals effectively reduced the larval population of Plutella xylostella on cabbage and Chinese kale (Calderson and Hare, 1986).

Murthy (1994) also indicated the efficient control of C. binotalis by profenophos (0.05 %); profenophos was reported to be most effective against tobacco caterpillar at 0.05 % (Prasad and Nandihalli, 1985); Murthy et al. (1997) reported profenophos @ 0.05% to be effective against S.litura at second day after spraying on cauliflower.

Srikanth et al. (2000) reported that profenophos at 0.05 % gave excellent control of C. pavonana (98.14 %); S. litura (80.06 %) on cabbage.Among all the insecticides, profenophos (1000 g a.i.ha^{-1}) was found to be the most effective one with a maximum reduction in Plutella xylostella population (70.20%), followed by bifenthrin 10 EC at 100 g a.i.ha^{-1} (68.18%).

4. References

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Annexture

Treatment	Dosage (g a.i./ha)	Pre-treatment count (number of larvae / plant)	Mean per cent of reduction of larval population over untreated check			
			3 DAS	5 DAS	7 DAS	Over all
T_1 Emamectin Benzoate 5% SG	11	29.27	49.80^{e} (44.80)	53.84^{f} (47.20)	59.38^{e} (50.41)	54.34^{f} (47.49)
T_2 Emamectin Benzoate 5% SG	22	30.13	56.75^{c} (48.88)	63.03^{c} (52.55)	68.01^{c} (55.56)	62.59^{c} (52.29)
T_3 Profenophos 50% EC	500	30.33	56.25^{cd} (48.15)	59.91^{cd} (50.72)	64.38^{cd} (53.36)	60.18^{cd} (50.87)
T_4 Profenophos 50% EC	1000	30.26	60.94^{a} (51.32)	75.84^{a} (60.58)	78.14^{a} (62.15)	71.39^{a} (57.67)

T_5 Spinosad 45% SC	100	29.40	55.48[cd] (48.15)	59.53[cde] (50.49)	62.69[de] (52.35)	59.29[cde] (50.35)
T_6 Bifenthrin 10% EC	100	29.00	60.19[ab] (50.88)	68.51[b] (55.87)	73.77[b] (59.21)	67.49[b] (55.24)
T_7 *Bacillus thuringensis* 5% WP	25	29.33	38.06[f] (38.09)	41.53[g] (40.12)	45.17[f] (43.22)	41.58[g] (40.15)
T_8 Control	--	29.31	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
S.Em	--		0.65	0.77	0.85	0.72
C.D at 5%	--		1.97	2.34	2.59	2.19
C.V.%	--		2.73	3.00	3.15	2.83

Table 1: Efficacy of insecticides against Plutella xylostella (L.) on cabbage after first spray
DAS - Days After Spraying.

Figures in the parentheses are angular transformed values.

Treatment	Dosage (g a.i./ha)	Mean per cent of reduction of larval population over untreated check			
		3 DAS	5 DAS	7 DAS	Over all
T_1 Emamectin Benzoate 5% SG	11	46.22[f] (42.83)	54.12[ef] (47.36)	62.38[ef] (52.17)	54.24[f] (47.43)
T_2 Emamectin Benzoate 5% SG	22	57.18[a] (49.13)	61.86[c] (51.86)	66.88[c] (54.87)	61.97[c] (51.93)
T_3 Profenophos 50% EC	500	54.50[abcd] (47.58)	59.37[cd] (50.40)	66.14[cde] (54.42)	60.00[cd] (50.77)
T_4 Profenophos 50% EC	1000	55.68[abc] (48.26)	72.76[a] (58.55)	82.12[a] 65.03	70.20[a] (56.93)
T_5 Spinosad 45% SC	100	52.00[de] (46.14)	58.57[de] (48.87)	66.66[cd] (54.74)	59.07[cde] (50.23)
T_6 Bifenthrin 10% EC	100	57.08[ab] (49.07)	69.48[ab] (56.48)	78.00[b] (62.05)	68.18[ab] (55.66)
T_7 *Bacillus thuringensis* 5% WP	25	28.01[g] (31.95)	40.50[g] (39.52)	53.60[g] (47.06)	40.75[g] (39.66)
T_8 Control	--	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
S.Em	--	0.60	0.70	0.82	0.60
C.D at 5%	--	1.82	2.13	2.49	1.84
C.V.%	--	2.65	2.75	2.91	2.39

Table - 2. Efficacy of insecticides against Plutella xylostella (L) on cabbage after second spray
DAS - Days After Spraying.

Figures in the parentheses are angular transformed values.