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Bio-Efficacy of Insecticides against Diamond Back Moth *Plutella xylostella* (L.) in Cabbage (*Brassica oleracea* var. Capitata)

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A B S T R A C T

A field experiment was conducted at student's farm, college of agriculture, Rajendranagar, Acharya N.G. Ranga Agricultural University, A.P during the year 2011- 12 in a randomized block design with seven insecticidal treatments which were replicated three times and tested against DBM (*Plutella xylostella*) on cabbage. 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 $a.i.ha^{-1}$ as evaluated during Kharif, 2012 against DBM (*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%).

Introduction

Cabbage (*Brassica oleracea* var. capitata L.) is the second important cruciferous vegetable crop in the 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 (NHB 2011). Cabbage 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, F1 hybrids and suitable production technology contribute partly to the lower yields, in addition to various other factors are responsible for the low productivity among which damage 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 moths, [*Plutella xylostella* (L.)] most notorious and pernicious pest on cruciferous vegetables causing 52 percent loss in marketable produce (Krishna kumar *et al.*, 1986). 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 have 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. Hence experiments were conducted utilizing for their efficacy against DBM (*P. xylostella*).

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 m2 (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 first at head initiation and the second spray at ten days later were sprayed twice to evaluate the efficacy against *Plutella xylostella*.

The population of *Plutella xylostella* were recorded on five randomly selected plants in each head of the five selected plants in each plot. 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 (Gomez and Gomez, 1984).

Results and Discussion

Bioefficacy results against *Plutella xylostella* (Tables 1 and 2) indicate that profenophos at 1000 g a.i.ha^{-1} followed by bifenthrin at 100 g a.i.ha^{-1} recorded high per cent reduction of *P. 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 sprays.

Data on over all efficacies (Table 1 and Fig. 2) 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 *P. 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 and Fig. 2) revealed that all the insecticidal treatments were superior to control. Profenophos at 1000 g a.i.ha^{-1} was the most effective 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 in 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 in reducing the larval population (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*.

Table.1 Efficacy of insecticides against *Plutella xylostella* (L.) on cabbage after first spray

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

DAS - Days After Spraying; Figures in the parentheses are angular transformed values.

Fig.1 Efficacy of insecticides against *Plutella xylostella* after first spray

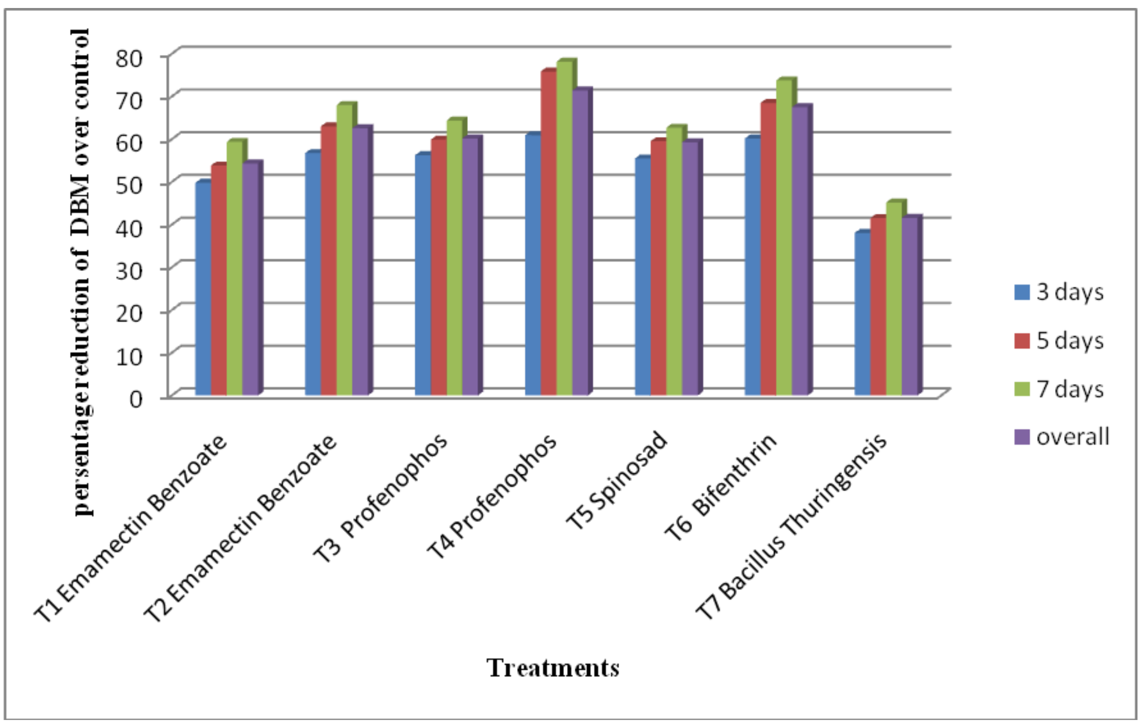
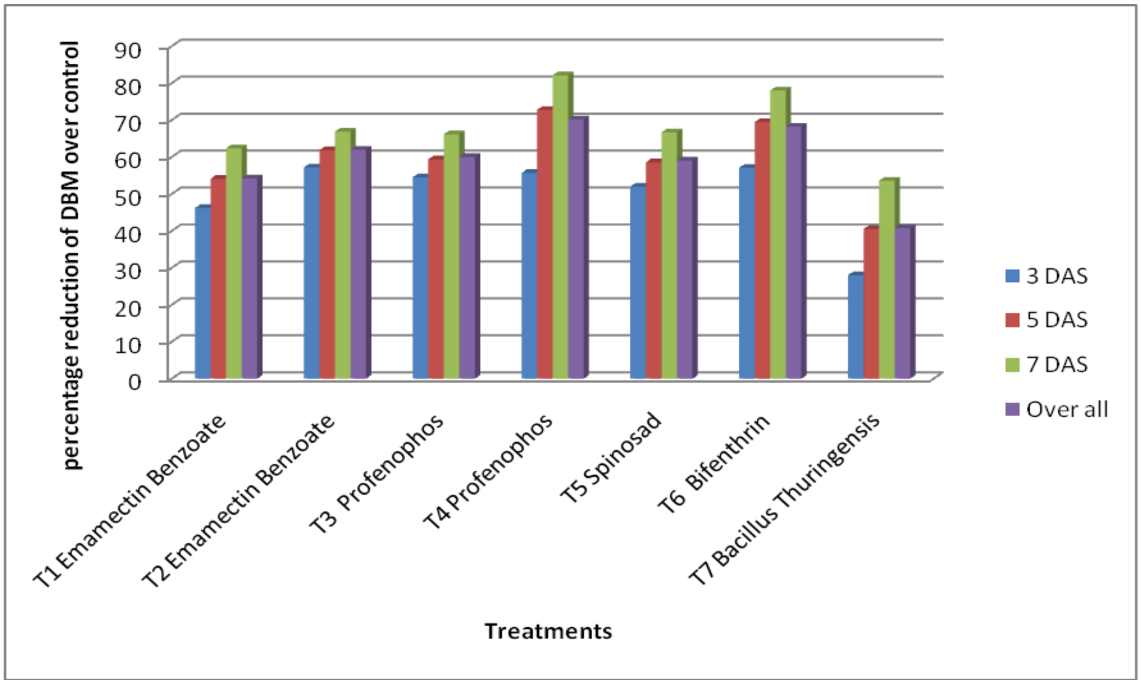


Table.2 Efficacy of insecticides against *Plutella xylostella* (L*)* on cabbage after second spray

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

DAS - Days After Spraying. Figures in the parentheses are angular transformed values.

Fig.2 Efficacy of insecticides against *Plutella xylostella* after second spray



The performance of profenophos corroborate with the results of Williamson and Murray (1993) in suppressing *P. xylostella* with profenophos at 0.30 and 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 *P. xylostella* on cabbage and Chinese kale (Calderson and Hare, 1986).

Murthy (1994) also obtained efficient control of *C. binotalis* with 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 %) and S. litura (80.06 %) on cabbage.

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