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Research article

BIO-EFFICACY OF INSECTICIDES AGAINST FRUIT BORER (*HELICOVERPA ARMIGERA*) IN TOMATO (*LYCOPERSICON ESCULENTUM*)

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ABSTRACT: Field experiment carried out during *kharif,* 2012 at Student's Farm, College of Agriculture, Rajendranagar, Hyderabad to evaluate the efficacy of insecticides *viz.*, emamectin benzoate 5 SG @11 g a.i. ha^{-1}, emamectin benzoate 5 SG @ 22 g a.i. ha^{-1}, profenophos 50 EC @ 500 g a.i. ha^{-1}, profenophos 50 EC @1000 g a.i. ha^{-1}, spinosad 45 SC @ 100 g a.i. ha^{-1}, bifenthrin 10 EC @ 100 g a.i. ha^{-1} and *Bacillus thuringiensis* @ 25 g a.i. ha^{-1}against tomato fruit borer (*Helicoverpa armigera*). Among all the insecticides, profenophos (1000 g a.i. ha^{-1}) was found to be the most effective one with a maximum reduction in fruit borer population (65.20%), minimum per cent of fruit damage (28.80%) and maximum yield (26.43 kg/20 m^2) followed by bifenthrin @ 100 g a.i.ha^{-1} with reduced larval population of 64.51% and damaged fruits 32.60%.
Key words: Insecticides, Bio-efficacy, Fruit borer

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important and remunerative vegetable crop grown in tropical and subtropical regions of the world for fresh market and processing, constituting an important part of our human diet. The consumption of tomato exceeds all vegetables and is next to Potato. In India, it is cultivated in an area of 865 thousand ha with an average annual production of 16826 thousand tonne and productivity of 19.5 t ha^{-1}. Andhra Pradesh ranks first in area (296.3 Thousand ha) and production (5926.2 thousand tones), while Karnataka ranks first in productivity with 34.3 t ha^{-1} (NHB 2011). Tomato is more prone to insect pests and diseases mainly due to the tenderness and softness as compared to other crops and devastated by an array of pests like jassids, aphids, tobacco caterpillar, flea beetles, spider mites, and fruit borer. However, the major economic damage is caused by the fruit borer. To control the fruit borer, different pesticides are being used in large quantities by farmers except in few cases where the crop is grown as per Good Agricultural Practices (GAP) for export purposes. As the food habits have changed and tomato is being consumed as salad, and hence food safety issues are very important. Considering the economic importance of pest and fruit, the present study was conducted to study the bio-efficacy of certain commonly used insecticides on tomato.

MATERIALS AND METHODS

Efficacy studies were conducted with selected insecticides against fruit borer *Helicoverpa armigera* on tomato (*Lycopersicon esculentum* Mill.) during *kharif* 2012 at Student's Farm, College of Agriculture, Rajendranagar, Hyderabad in a Randomized Block Design (RBD) with 8 treatments including untreated control replicated thrice with individual plot size of 20 m^2 (5mx4 m). All the test insecticides were applied as foliar sprays. The first spray was given after fruit initiation and the second spray 10 days later. The observations on pest incidence were recorded one day before spraying as pre-treatment count. Post treatment count was taken at three, five and seven days after each spraying. For recording the pest population counts, five plants were selected randomly and tagged in each plot. The data on mortality was recorded, based on the dead larvae of 3rd, 4th and 5th instars. The data on fruit damage were recorded at the time of harvest through counting of total number of fruits and number of damaged fruits and statistically analyzed with arc sine values obtained from the conversion of percentage of infestation (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Efficacy of selective insecticides against Tomato fruit borer

Seven insecticides were tested for their efficacy against fruit borer, *H. armigera* and the results on efficacy of different insecticides on fruit borer population after first spraying (Table 1 and Figure 1) indicate that all the insecticidal treatments were superior over control.

Profenophos @ 1000 g a.i. ha^{-1} recorded the highest population reduction of 33.52% and was superior to all other treatments followed by bifenthrin (32.10%) followed by emamectin benzoate, spinosad , profenophos and emamectin benzoate with population reduction of 29.21%, 28.14 % ,21.00 % and 16.16% , respectively. *Bacillus thuringiensis* was least effective with population reduction of 11.93% over check.

Data on over all efficacies of insecticides against fruit borer after first spray revealed that all the insecticidal treatments were significantly superior over control. Profenophos applied @ 1000 g a.i. ha^{-1} and bifenthrin @ 100 g a.i. ha^{-1} were most effective in reducing the larval populations of *H. armigera* with overall reduction of 52.72 and 50.36% followed by emamectin benzoate @ 22 g a.i. ha^{-1}, spinosad @ 100 g a.i. ha^{-1}, profenophos @ 500 a.i. ha^{-1} and emamectin benzoate @ 11 g a.i. ha^{-1} recorded 48.70% , 47.29%, 41.12% and 30.14% reduction of fruit borer population, respectively.. The least population reduction of 15.23% fruit borer was observed with *Bacillus thuringiensis* @ 25 g a.i.ha^{-1}.

Reduction of fruit borer population after second spray

The results on efficacy of different insecticides on fruit borer population after second spraying (Table 2 and Figure 2) showed that all the insecticidal treatments were superior over control where, profenophos @ 1000 g a.i. ha^{-1} was most effective and significantly superior over all other treatments in reducing the fruit borer population (60.13%) followed by bifenthrin @ 100 g a.i. ha^{-1} (59.59%) and emamectin benzoate @ 22 g a.i. ha^{-1} (54.95%) followed by spinosad @ 100 g a.i. ha^{-1} (52.99%), profenophos @ 500 g a.i. ha^{-1} (51.09%) and emamectin benzoate @ 11 g a.i. ha^{-1} (40.72%) reduction of fruit borer population over control. *Bacillus thuringiensis* @ 25 g a.i. ha^{-1} was least effective with population reduction of 20.86%.

The data on over all efficacy revealed that all the insecticidal treatments were superior to control. Profenophos @ 1000 g a.i. ha^{-1} was the best and superior to the remaining treatments recording 65.20% fruit borer population reduction, followed by bifenthrin @ 100 g a.i. ha^{-1} with 64.51% fruit borer population reduction and are superior to the rest of the treatments. Treatments emamectin benzoate @ 22 g a.i. ha^{-1} (62.52%), spinosad @ 100 g a.i. ha^{-1} (59.99%), profenophos @ 500 a.i. ha^{-1} (56.98%) and emamectin benzoate @ 11 g a.i. ha^{-1} (50.34%) are promising treatments which were superior to, *Bacillus thuringiensis* @ 25 g a.i. ha^{-1} which was least effective treatment recorded 30.29% population reduction.

Per cent of fruit damage and yield

The data on fruit damage at the time of harvesting and yield (Table 4 and Figure 3) showed that all the treatments proved superior with less fruit damage compared to control. Minimum fruit damage of 28.80% was observed with profenophos @ 1000 g a.i. ha^{-1} plots followed by bifenthrin @ 100 g a.i. ha^{-1} with 32.60% fruit damage, emamectin benzoate @ 22 g a.i. ha^{-1}, with 35.00%, spinosad @ 100 g a.i. ha^{-1} with 34.50%, profenophos @ 500 g a.i. ha^{-1} with 39.60 % and emamectin benzoate @ 11 g a.i. ha^{-1} with 40.06% of fruit damage, respectively. Maximum fruit damage of 48.00 per cent was recorded with the treatment *Bacillus thuringiensis* @ 25 g a.i. ha^{-1}.

Highest fruit yield of 13.21 t ha^{-1} , was recorded in profenophos @ 1000 g a.i. ha^{-1} sprayed plots. The yields obtained in the various treatment in decreasing order are bifenthrin @ 100 g a.i. ha^{-1} with 12.67 t ha^{-1} , spinosad @ 100 g a.i. ha^{-1} with 12.22 t ha^{-1}, emamectin benzoate @ 22 g a.i. $ha^{-1}$with 11.60 t ha^{-1} , profenophos @ 500 a.i. ha^{-1} with 11.21 t ha^{-1} and emamectin benzoate @ 11 g a.i. ha^{-1} with 10.82 t ha^{-1}. The lowest yield of 8.14 t ha^{-1} was recored with *Bacillus thuringiensis* @ 25 g a.i. ha^{-1}.

In both the sprays profenophos @1000 g a.i. ha^{-1} was most effective in reducing the fruit borer population followed by bifenthrin @ 100 g a.i. ha^{-1}.

The findings of the present study are in conformity with the findings of Sivakumar *et al.* (2003) who found profenophos 50 EC @ 1.5 l ha^{-1} to be superior in reducing the larval population with increased yield. Similar results were also obtained by Prasad Kumar Hedge (2006) who reported that profenophos 50 EC @ 1 l ha^{-1} was effective in reducing the incidence of brinjal shoot and fruit borer, *L. orbonalis*. .The results are in agreement with the data recorded by Rana *et al*. (2002) who reported 57.89, 75.39 and 78.43% mortality of *H. armigera* on tomato crop with profenophos 50 EC application of @ 0.025, 0.05 and 0.075%, respectively. The results of efficacy of bifenthrin are in agreement with the findings of Sinha *et al.* (2011) who found bifenthrin to be effective against fruit borer in tomato.

Similar results were also found by Dodia *et al*. (2009) against fruit borer in tomato. Murugraj *et al*.(2006) found that emamectin benzoate is highly effective in reducing the larval population of fruit borer (*H. armigera*) of tomato and fruit damage with increased yields. Studies of Suganya Kanna *et al*. (2005) against fruit borer (*H. armigera*), also reported superiority of emamectin benzoate over lamda-cyhalothrin and spinosad.

Table 1. Efficacy of insecticides against fruit borer *Helicoverpa armigera* (Hub.) on tomato after first spray

Treatment	Dosage (g a.i. ha^{-1})	Pre-treatment count (number of larvae / plant)	Mean per cent of reduction of larval population over untreated check
			Over all
T_1 Emamectin benzoate 5%SG	11	10.66	30.14[f] (33.29)
T_2 Emamectin benzoate 5 %SG	22	11.37	48.70[bc] (44.25)
T_3 Profenophos 50%EC	500	11.51	41.12[e] (39.88)
T_4 Profenophos 50%EC	1000	11.66	52.72[a] (46.55)
T_5 Spinosad 45% SC	100	10.42	47.29[cd] (43.44)
T_6 Bifenthrin 10% EC	100	10.66	50.36[b] (45.20)
T_7 *Bacillus thuringiensis* 5%WP	25	11.15	15.23[g] (22.96)
T_8 Control	--	11.53	0.00 (0.00)
S.Em	--	0.37	0.38
C.D at 5%	--	1.57	1.17
C.V.%	--	5.81	1.94

Figures in the parentheses are angular transformed values.

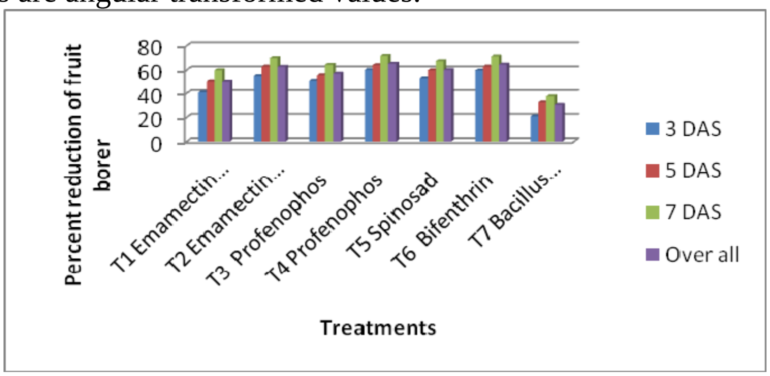

Fig1. Efficacy of insecticides against fruit borer (*Helicoverpa armigera*) after first spray

Table 2. Efficacy of insecticides against fruit borer *Helicoverpa armigera* (Hub.) on tomato after second spray

Treatment	Dosage (g a.i. ha^{-1})	Mean per cent of reduction of larval population over untreated check
		Over all
T_1 Emamectin benzoate 5%SG	11	50.34[f] (45.19)
T_2 Emamectin benzoate 5%SG	22	62.52[bc] (52.25)
T_3 Profenophos 50% EC	500	56.98[e] (49.04)
T_4 Profenophos 50% EC	1000	65.20[a] (53.85)
T_5 Spinosad 45% SC	100	59.99[cd] (50.76)
T_6 Bifenthrin 10 % EC	100	64.51[ab] (53.44)
T_7 *Bacillus thuringiensis* 5%WP	25	30.29[g] (33.38)
T_8 Control	--	0.00 (0.00)
S.Em	--	0.52
C.D at 5%	--	1.57
C.V.%	--	2.12

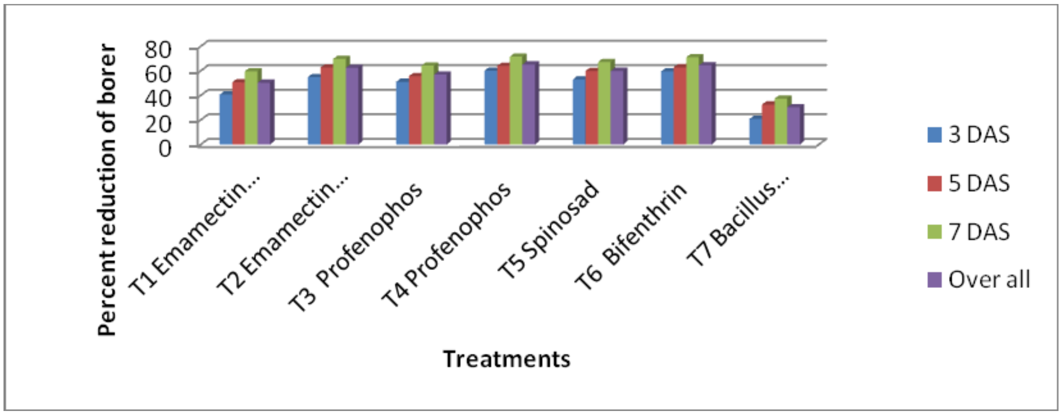

Fig.2. Efficacy of insecticides against fruit borer (*Helicoverpa armigera*) after second spray

Table 3. Per cent of damaged fruits and yield.

Treatment	**Dosage (g a.i. ha^{-1})**	**Per cent damaged fruits**	**Yield (t ha^{-1})**
T_1 Emamectin benzoate 5%SG	11	40.06 (39.26)	10.82
T_2 Emamectin benzoate 5%SG	22	35.00 (36.26)	11.6
T_3 Profenophos 50% EC	500	39.60 (38.99)	11.21
T_4 Profenophos 50% EC	1000	28.80 (32.45)	13.21
T_5 Spinosad 45% SC	100	34.50 (35.97)	12.22
T_6 Bifenthrin 10 % EC	100	32.60 (34.81)	12.67
T_7 *Bacillus thuringiensis* 5%WP	25	48.00 (43.85)	9.72
T_8 Control		68.90 (56.11)	8.14
S.Em		0.40	
C.D at 5%		1.24	
C.V.%		1.78	

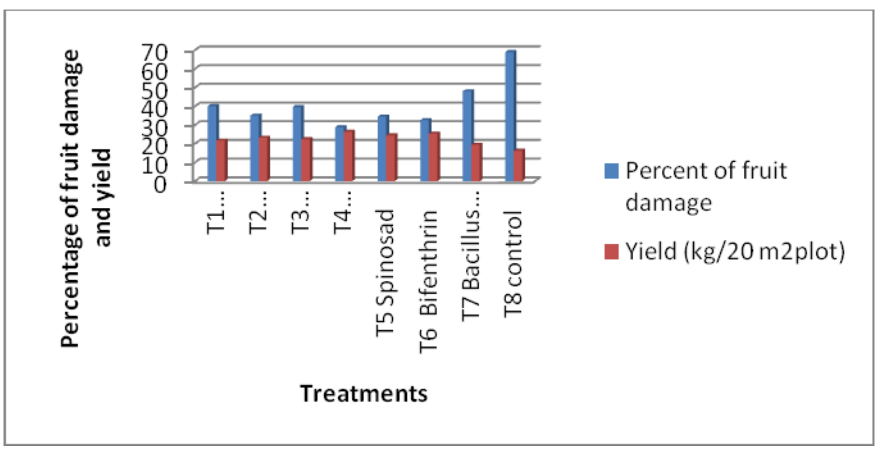

Fig.3. effect of pesticides on fruit damage and yield

REFERENCES

Dodia, D.A., Prajapati, B.G. and Acharya, S. (2009). Efficacy of insecticides against gram pod borer, *Helicoverpa armigera* Hardwick, infesting pigeonpea. Journal of Food Legumes.22(2): 144-145.

Gomez, K.A and Gomez, A.A. (1984). Statistical procedures for Agricultural Research, Second edition. John willey and Sons. New York. pp. 582.

Murugaraj,P., Nachiappan, R.M. and Selvanarayanan, V. (2006). Effiacy of emamectin benzoate (proclaim 05 SG) against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology 30(1):11-16.

National Horticultural Board. (2011). Annual report.P 170-177.

Prasad Kumar Hegde, N.K. 2006. Bio-efficacy of profenofos against brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee). Journal of Asian Horticulture; (2006). 2(3): 198-200.

Rana, B.S., Bheemanna, M., Tulasi Ram, K. and Hugar, P.S. (2002). Efficacy of Profenofos 50 EC against *Heliothis armigera* & its residue on Tomato. Indian Journal of Applied Entomology. 16(1): 67-70.

Sinha, S.R. and Vishwa Nath. (2011). Tomato fruit borer management through insecticides. Annals of Plant Protection Sciences.19 (2): 466-467.

Sivakumar, R., Nachiappan, R.M. and Selvanarayanan, V. (2003). Profenofos, a potential insecticide against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology. 27(11): 13-16.

Suganya kana, S., Chandra Bekaran, S., Raghupathy, A. and Stanly, J. (2005). Field efficacy of emamectin benzoate 5% SG against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology. 29:21-24.