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Efficacy of Different Insectides on Tomato Fruit Borer *Helicoverpa armigera*

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Abstract: A field experiment during Kharif 2003 and 2004 to evaluate the efficacy of six insecticides at farmers field against *Helicoverpa armigera* infesting tomato. Among the treatments imidacloprid at 0.03% proved more effective followed by deltamethrin and fluvalinate. The spraying of these insecticides on tomato resulted in significantly higher reduction of larval population. The field data showed that imidacloprid gave a significantly higher increase in yield (>78%) over control followed by deltamethrin. Imidacloprid (0.03%) avoided 46% yield loss on tomato crop.

Key words: Efficacy, insecticides, *Helicoverpa armigera*, tomato

Introduction

Tomato is an important vegetable crop grown around the world occupying the daily food regime of a majority of people. Tomato fruit borer, *Helicoverpa armigera* is an important pest which causes considerable losses in quantity as well as quality of tomato fruits (Singh and Chahal, 1978; Tewari and Moorthy, 1984; Reddy and Zehr, 2004). The monetary loss due to this pest in India has been estimated over rupees one thousand crore per year (Jayaraj *et al*., 1994) and yield losses ranged from 14-100% on different crops. Due to its economic importance considerable amount of work has been done for its control by biological means but the biological means tried so far have not been successful because the larva is the damaging stage which bores and remains inside the tomato fruit. *H. armigera* has assumed such proportions in the country for the past decade, farmers and plant protection agencies of central and state governments of India have virtually become perplexed regarding its control which ultimately lead to an array of social, economical and political problems. In past decades unreasoned and systematic calendar spraying of chemical control on tomato has been replaced by integrated pest management in India. To improve upon this problem, the most commonly method for the control of this pest is to have a film of a insecticide over foliage and fruiting bodies (Dotkhile *et al*., 1992; Sharma *et al*., 1993). The main objective of study is the determination of the efficacy of six insecticides at farmer field against *Helicoverpa armigera* infesting tomato.

Materials and Methods

A field trial was laid out in district Srinagar at farmers field for two consecutive years during Kharif 2003 and 2004 on tomato, cv. Pusa Ruby in randomised block design with seven treatments in three repeats and the plot size measuring 3×3 m^2, row to row and plant to plant distance was 75×50 cm.

Treatments

Various insecticides as per recommendations of Division of Entomology, SKUAST-K were evaluated against tomato fruit borer. The concentrations, their sources, trade names are given in

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Table 1: List of insecticides used under field conditions

Name of chemical	Trade name	Source	Concentration used
Imidacloprid 17.8% SL	Courage	Meghmani Organics Ltd., Ahmedabad 382445	0.03
Deltamethrin 2.8% EC	Decis	Bayer India Ltd., Mumbai-400076	0.01
Fluvalinate 25% EC	Mavrick	Sandoz (India) Ltd., New Delhi-110015	0.01
Fenvalerate 28% EC	Magafen	Meghmani Organics Ltd., Ahmedabad-382445	0.03
Chlorpyriphos 20% EC	Kohiban	Fungicide India Ltd., New Delhi-110049	0.05
Endosulfan 35% EC	Sholay	Fungicide India Ltd., New Delhi - 110049	0.07

Table 1 and a spray of these insecticides were applied at 35 days after transplanting. Control plots were sprayed with water only. During each harvest, borer affected and healthy fruits from the tomato plants were counted on number basis and the percent fruit damage was calculated using the cumulative data of all the pickings. Observation on population of larvae plant^{-1} were recorded 10 days after insecticidal application from selected plants. Yield of marketable fruits from different treatments were taken on whole plot basis and converted into kg ha^{-1} and the per cent retrievable loss was calculated by the following formula:

$$\text{Percent retrievable loss} = \frac{T - C}{T} \times 100$$

Where, T stands yield from treated plot and C stands for yield from the controlled plot. Data was statistically analysed as per Dospekhov (1984).

Result

Fruit Damage

All the insecticidal treatments were effective and significantly superior to control (Table 2). The per cent fruit damage in the treatments varied from 8.65 to 14.07 during 2003 and 6.80 to 14.50 during 2004. Imidacloprid at 0.03% treatment gave excellent control of tomato fruit borer on tomato followed by deltamethrin, fluvalinate and fenvalerate. Whereas two conventional insecticides viz., chlorpyriphos and endosulfan were though inferior than rest of the treatments but were quite effective than control.

Larval Population

In control, highest larval population was recorded during both the years and lowest larval population was recorded when tomato plants were sprayed with imidacloprid (0.03%) which was superior to rest of the treatments. Deltamethrin and fluvalinate were the next best treatments in reducing the larval population of tomato fruit borer.

Yield

Highest fruit yield was obtained from the treatments with imidacloprid followed by deltamethrin, fluvalinate and fenvalerate. Imidacloprid treated tomato plants recorded 86.67 and 88.23% increase in fruit yield over control during both the years. Fluvalinate and fenvalerate sprayed tomato plants were at par with each other at $p = 0.05$.

Retrievable Loss

Observations clearly revealed that retrievable loss was almost same in both the years by spraying imdacloprid, deltamethrin, fluvalinate and fenvalerate sprayed tomato plants avoided more than 30% loss.

Table 2: Efficacy of different insecticides on fruit damage(%), larval population (plant^{-1}), yield (kg ha^{-1}) and retrievable loss (%) on the incidence of *Helicoverpa armigera* during consecutive years on tomato (cv. Pusa Ruby)

		Fruit damage		Larval population		Yield		Retrievable loss	
Treatments		2003	2004	2003	2004	2003	2004	2003	2004
Imidacloprid	0.03%	8.65	6.80	0.83	0.5	28000	32000	46.43	46.87
Deltamethrin	0.01%	10.20	8.90	0.87	0.7	26667	29333	43.75	42.04
Fluvalinate	0.01%	11.58	10.14	0.90	0.8	24000	26578	37.5	36.03
Fenvalerate	0.03%	11.94	11.29	0.93	0.9	23567	24356	36.35	30.20
Chlorpyriphos	0.05%	13.47	12.80	1.00	1.0	18667	18667	19.64	8.93
Endosulfan	0.07%	14.07	14.50	1.17	1.2	17334	18667	13.46	8.93
Control		19.65	17.09	1.70	1.5	15000	17000		
p = 0.05	1.03	1.58	0.18	0.16	1061.85	903.04			

Discussion

Efficacy of insecticides is judged on the basis of its ability to protect the crop from the target pest to reduce the fruit damage, larval population and therefore directly resulted to increase in fruit yield and retrievable loss on tomato in different treatments. As expected and the observations revealed that higher the fruit damage, larval population during the season and yield decreased in turn. Data (Table 2) revealed that all the treatments were significantly superior to control at p = 0.05 and the present findings are in line with the Ulaganathan and Gupta (2004) and Lavekar *et al.* (2004) who reported that imidacloprid treatments was more effective against *H. armigera*. Further various synthetic pyrethyroids were found effective against this pest (Fitt, 1989; Puri, 1997). Therefore, it is contemplated that as compared to conventional insecticides (chlorpyriphos and endosulfan). Imidacloprid and synthetic pyrethyroids due to their quick knock down effect, low mammalian toxicity and longer persistence on the treated surface can safely be used in controlling the fruit borer infesting tomato (Mishra, 1986; Singh and Singh, 1990; Bhatt and Patel, 2002).

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