



BIO-INTENSIVE PEST MANAGEMENT OF *HELICOVERPA ARMIGERA* (HÜBNER) HARDWICK IN TOMATO UNDER MIDDLE GUJARAT CONDITIONS

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ABSTRACT

A field experiment was conducted on bio-intensive management of *Helicoverpa armigera* (Hübner) Hardwick in tomato on a farmer's field at Runaj, Sojitra taluka, Anand (Gujarat) during *rabi*, 2018-19 and 2019-20. Results revealed that there was no significant difference observed between BIPM package and chemical control with regard to number of *H. armigera* larvae/plant and fruit damage. The chemical control module recorded the highest yield (16.43 t/ha) which was at par with the yield recorded in BIPM package (16.25 t/ha). The lowest yield was recorded in untreated control (10.89 t/ha).

Keywords: BIPM, Tomato, *Helicoverpa armigera*

INTRODUCTION

Vegetables are considered as the most essential ingredient of the Indian diet. India is the second largest producer of vegetables with 11 per cent share next to China in the world. Tomato (*Lycopersicon esculentum* Mill) is cultivated in an area of about 0.78 million hectare with an annual production of 19.40 million metric tonnes and productivity of 25.0 metric tonnes per hectare (Anon., 2019). Among many factors responsible for lower yield of tomato, insect pests are the major ones that have been reported to attack tomato at all stages of the crop growth. The incidence of insect-pests may vary from season to season and crop growth stages. The population fluctuation of the insects is largely governed by different weather factors that prevail during the crop season. In India, about 16 pests reportedly feed on tomato, commencing from germination to harvesting stage which reduces its yield and degrades the quality (Butani, 1977). The major pests attacking tomatoes are fruit borer, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae), whitefly *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae), thrips, *Frankliniella occidentalis* Trybom (Thysanoptera: Thripidae), red spider mite, *Tetranychus evansi*

Baker (Acarina: Tetranychidae), leaf miner, *Liriomyza trifoli* Burgess (Diptera: Agromyzidae), cutworm, *Agrotis segetum* Denis and Schiffermuller (Lepidoptera: Noctuidae) and aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) (Sam *et al.*, 2014). Among insect pests, the damage caused by fruit borer, *H. armigera* surpasses the loss caused by all other insect pests together. It has been reported that the loss due to this pest alone ranged from 20-50 per cent. Though production of tomato has been intensified over the years, yields continue to be low due to several production constraints such as pests, diseases and environmental factors (Blay, 2005). Tomatoes being a commercial vegetable crop, the farmers have a tendency to indiscriminately use insecticides to control this destructive pest. Consequently, it has led to many problems like build up of insecticide resistance, pest resurgence, loss of natural enemies and insecticide residue in the tomato fruits.

The increasing concern for environmental safety and global demand for pesticide residue free food have raised keen interest to use eco-friendly products in pest management which are easily biodegradable and do not leave any harmful toxic residues in fruit besides conserving the natural

enemies. The use of biocontrol agents/bio-pesticides in pest management offer economically compatible and ecologically viable alternatives in managing the insect pests. Therefore, keeping these points in view, the present study on Bio-Intensive Pest Management of *Helicoverpa armigera* in tomato was carried out under middle Gujarat conditions.

MATERIALS AND METHODS

A study on bio-intensive pest management of *Helicoverpa armigera* in tomato was carried out on farmer's field at Runaj, Sojitra taluka, District Anand during the *rabi* seasons of 2018-19 and 2019-20. The experiment was laid out with hybrid variety, Alankar in Randomized Block Design (RBD) maintaining five replications. The experiment comprised of three treatments (Table 1). The treatment application was started at initial occurrence of pests. Six releases of parasitoids at weekly interval and three sprays of bio-pesticides were given during evening hours at fortnightly interval.

The treatment application was started at initial occurrence of pests. Six releases of parasitoids at weekly interval and three sprays of bio-pesticides were given during evening hours at fortnightly interval. Ten plants were randomly selected in 40m²

crop area for presence of larvae of fruit borer and also fruit damage caused by *H. armigera*. At each picking yield of marketable tomato fruits from each treatment was recorded at each picking separately. The yield obtained per plot was converted into tonnes per hectare.

RESULTS AND DISCUSSION

A field demonstration experiment was conducted in *rabi* 2018-19 and 2019-20 on farmer's field. During the experimental period, incidence of *H. armigera* incidence was recorded (Table 2). No significant difference was observed between BIPM package and chemical control with regard to the number of *H. armigera* larvae/plant and fruit damage. BIPM package was found equally effective as chemical control against *H. armigera*. The chemical control module recorded the highest yield (16.43 t/ha) which was at par with the yield recorded in BIPM package (16.25 t/ha) during the year 2018-19 and Chemical control module recorded the highest yield (17.02 t/ha) which was at par with the yield recorded in BIPM package (16.35 t/ha) during the year 2019-20 (Table 3). The lowest yield was recorded in untreated control (10.89 t/ha) and (10.93 t/ha) during 2018-19 and 2019-20, respectively. It can be concluded that BIPM package is promising in minimizing the pest damage with higher yield.

Table 1. Treatment details

Treatments : T1 = BIPM package

1. Seed bio-priming with *Trichoderma harzianum* @ 10 g/kg of seeds
2. Raising of marigold as trap crop
3. Use of NBAIR pheromone traps @ 1 trap per plot
4. *Trichogramma achaeae/Trichogramma chilonis* @ 50,000 per release (6 releases)
5. Azadirachtin 1500 ppm @ 4 ml/lit
6. *Bacillus thuringiensis* (PDBC BTG-1)
1%WP (1x10⁸) @ 5g/lit
7. *Lecanicillium lecanii* (VI-8)
1%WP (1x10⁸) @ 5g/lit for sucking pests

T2 = Chemical control

Spraying of chlorantraniliprole 18.5% SC and indoxacarb 14.5 SC

T3 = Untreated Control

Replications : Five

Table 2: Effect of different modules on incidence of *H. armigera* and yield of tomato during 2018-19

Modules/Treatments	<i>H. armigera</i> larvae/plant*	Fruit damage* (%)	Fruit yield (t/ha)
BIPM Package	1.21 (1.46)	19.70 (11.36)	16.25
Chemical Control	1.19 (1.42)	19.68 (11.34)	16.43
Untreated Control	1.70 (2.89)	29.62 (24.43)	10.89
S. Em. ±	0.07	0.76	0.68
	T		
	P	–	–
	T x P	–	–
C. D. at 5 %	0.20	2.30	2.06
	T		
	P	–	–
	T x P	–	–
C. V. %	13.76	9.31	13.24

Mean of five observations

* $\sqrt{X + 0.5}$ transformed values

** Arcsine transformed values, Figures in parentheses are retransformed values

Table 3: Effect of different modules on incidence of *H. armigera* and yield of tomato during 2019-20

Modules/Treatments	<i>H. armigera</i> larvae/plant*	Fruit damage* (%)	Fruit yield (t/ha)
BIPM Package	1.20 (0.94)	19.81 (11.49)	16.35
Chemical Control	1.18 (0.89)	19.69 (11.35)	17.02
Untreated Control	1.72 (2.46)	28.90 (23.36)	10.93
S. Em.±	0.04	0.68	0.56
	T		
	P	–	–
	T x P	–	–
C. D. at 5 %	0.11	2.05	1.73
	T		
	P	–	–
	T x P	–	–
C. V. %	12.42	8.40	13.37

Mean of five observations

* $\sqrt{X + 0.5}$ transformed values

** Arcsine transformed values, Figures in parentheses are retransformed values

More or less similar trend was observed by Karabhantanal and Awaknavar (2012) that spraying of *N. rileyi* (49.79 % decrease over control) and

HaNPV (73.08 % decrease over control) combined with NSKE were found significantly superior to all treatments. Moreover, Prabhakara and

Venkateshwarlu (2013) reported reduction in seedling death due to combined application of *Trichoderma* and *Pseudomonas*. Application of *HaNPV* resulted in lower larval population in IPM plots compared to Non-IPM plots. Fruit damage in BIPM adopted plot was 6.63 per cent as compared to the plots sprayed with chemical insecticides (10.78%) and higher CB ratio of 1:16.26 in BIPM module as compared to 1:11.53 in chemical insecticides treated plots. Similar trend were also found by Reddy and Tangtrakulwanich (2014). They developed a module of integrated pest management in tomato grower's participation and reported that petroleum oil spray, BotaniGard, neem and DiPel applied 15, 30, 45 and 60 days after transplant was a viable approach, significantly reducing the pest complex and providing a higher tomato yield compared to the growers' current practice (carbaryl or malathion, 15 applications) and control plots.

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