The Bioscan 8(2): 579-582, 2013
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

RELATIVE EFFICACY OF BIOPESTICIDES AND NEWER INSECTICIDES AGAINST *HELICOVERPA ARMIGERA* (HUB.) IN TOMATO

S. K. JAT* AND O. P. AMETA
Department of Entomology, Rajasthan College of Agriculture,
Maharana Pratap University of Agriculture and Technology, Udaipur - 313 001
e-mail: ento89suresh@gmail.com.

KEYWORDS
Bio-pesticides and newer insecticides
Helicoverpa armigera (Hub.) and tomato

Received on :
07.12.2012

Accepted on :
07.04.2013

***Corresponding author**

ABSTRACT
Relative efficacy of biopesticides and newer insecticides against *Helicoverpa armigera* (Hub.) on tomato was evaluated in field conditions. The results showed that the three applications of flubendiamide 480 SC at 200 mL/ha was found significantly most effective, which caused highest mean reduction of population of tomato fruit borer larvae and fruit damage, 89.94 and 3.10 per cent. It was followed by spinosad 45 SC at 200 mL/ha and HaNPV at 250 LE/ha with 74.67 and 74.10 per cent mean reduction, respectively and were at par with each other and the spinosad 45 SC @ 200 mL/ha observed (4.86) per cent fruit damage followed by HaNPV 250 LE/ha, Bt @1.5 kg/ha and Beta-cyfluthrin 2.5 SC were found moderately effective treatment being 8.16, 10.14 and 6.68 per cent fruit damage, respectively. The highest marketable yield of 265.68q/ha was recorded in case of Flubendiamide 480 SC @ 200 mL/ha with highest C: B ratio of 1:2.075. It was followed by Spinosad 45 SC @ 200mL/ha (251.29 q/ha) and Beta-cyfluthrin 2.5 SC @ 750 ml/ha (238.38 q/ha).

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is one of the most popular and widely grown vegetables throughout the world ranking second in importance after potato in India. Tomato fruit borer, *Helicoverpa armigera* (Hubner) is very important pest which causes 40-50 percent damage to the tomato crop (Pareek and Bhargava, 2003). *H. armigera* is a charismatic insect pest in agriculture accounting for the consumption of over 55 percent of total insecticides used in India (Puri, 1995). The fruit borer or gram pod borer or American bollworm, *Helicoverpa armigera* (Hub.) is the most important pest infesting tomato. It has been reported on 181 cultivated and wild plant species belonging to 45 families in India (Manjunath *et al.,* 1989). It is basically a polyphagous pest. It is a serious pest of several economically important agricultural crops like cotton, tomato, pigeonpea and chickpea besides oil seeds, cereals and vegetable crops etc, but it mainly attacks tomato and chickpea. This is a key pest as it attacks fruits and makes fruits unfit for human consumption causing considerable crop loss up to 55 percent in yield (Selvanarayanan, 2000). The botanicals and bio-pesticides have given encouraging results against the insect pests of agricultural importance. To combat the problems caused by chemical insecticides it is imperative to use botanicals and bio-pesticides viz. NPV and BT against this noxious pest, so that the use of pesticides can be minimized.

MATERIALS AND METHODS

The methodology used for conducting the experiment on "Relative efficacy of biopesticides and newer insecticides against *Helicoverpa armigera* (Hub.) in tomato"was carried out at Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur during *kharif* (July to December 2011). The seeds of tomato variety, BSS-908 Priya were sown in well prepared nursery beds in third week of June and transplanting was done during the second week of August 2011 in the the plots measuring 4.6 X 3.5 m2 having row to row and plant to plant distance of 60cm and 45cm, respectively. The experiment was laid out in Randomized Block Design (RBD), each replicated thrice. To estimate the population of *H. armigera* larvae "Direct visual counting method" was used. Ten plants were randomly selected and tagged from each replication or plot. The observation was recorded by physical count of test insect. The borer infested and healthy fruits of individual plots were sorted out after each harvest and the numbers of infested and marketable fruits were recorded. The fruit infestation and larval population were recorded before and 3, 5 and 7 days after spraying of each treatments.

Statistical Analysis

The population data of *H. armigera* obtained was subjected for the conversion into per cent reduction using Henderson and Tilton (1952) formula as under:

$$\text{Per cent reduction in population} = 100\ [1 - \frac{T_a \times C_b}{T_b \times C_a}]$$

Where,

T_a = Number of insects after treatment

T_b = Number of insects before treatment

Table 1: Efficacy of newer insecticides and bio-pesticides against *H. armigera* larvae infesting tomato crop during *kharif* 2011- 12

S. No.	Treatments	Dose,mL/ ha,kg/ha	Reduction in larval population days after spray (%)								
			1st Spray			2nd Spray			3rd Spray		
			3 DAS**	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
T_1	Flubendiamide 4 80 SC	200	53.31(64.30*)	57.49(71.10)	54.29(65.90)	55.43(67.77)	60.18(75.23)	54.59(66.39)	64.21(81.01)	71.67(89.94)	65.90(83.23)
T_2	Spinosad 45 SC	200	50.32(59.21)	54.62(66.44)	49.35(57.56)	51.43(61.12)	54.67(66.55)	49.64(58.06)	59.80(74.67)	63.56(80.05)	61.14(76.67)
T_3	NPV	250	47.98(55.19)	50.06(58.75)	47.01(53.50)	49.02(57.00)	50.31(59.21)	46.18(52.07)	53.75(65.00)	59.41(74.10)	56.74(69.92)
T_4	Bt	1.5	47.27(53.95)	49.63(58.04)	46.72(52.99)	48.41(55.93)	48.53(56.15)	45.66(51.14)	47.04(53.55)	50.02(58.72)	50.78(60.03)
T_5	Beta-cyfluthrin 2.5 SC	750	49.64(58.06)	53.48(64.59)	49.03(56.99)	46.72(53.00)	51.71(61.59)	47.91(55.07)	49.68(58.12)	55.17(67.37)	53.14(64.01)
T_6	NSKE 5%	5%	41.18(43.35)	42.76(46.10)	39.69(40.80)	37.51(37.10)	39.56(40.56)	36.87(36.07)	38.89(39.42)	41.10(43.22)	39.94(41.25)
T_7	NLE 5%	5%	38.73(39.15)	39.81(41.00)	37.66(37.33)	35.54(33.85)	36.71(35.80)	34.40(31.93)	35.92(34.42)	37.53(37.12)	38.11(38.10)
S.Em+		0.92	0.73	1.01	0.92	1.01	0.94	1.03	1.09	0.99	
CD 5%			2.85	2.26	3.13	2.85	3.12	2.91	3.19	3.34	3.02

*Figure in parentheses are retransformed values; ** Days after spray

Table 2: Efficacy of newer insecticides and bio-pesticides on fruit damage caused by *H. armigera* larvae in tomato during *kharif* 2011-12

S.No	Treatments	Dose, mL/ha, kg/ha	Pretreatment fruit damage	Mean per cent fruit damage								
				1st spray			2nd spray			3rd spray		
				3 DAS**	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
T_1	Flubendiamide 480 SC	200	21.67(13.65)	16.77(8.33*)	12.73(4.86)	15.73(7.35)	14.42(6.20)	11.25 (3.81)	15.09(6.78)	13.24(5.25)	10.14(3.10)	13.76(5.68)
T_2	Spinosad 45SC	200	22.70(14.90)	18.41(10.00)	15.66(7.29)	19.54(11.20)	17.92(9.47)	14.64(6.39)	19.01(10.61)	16.59(8.16)	12.73(4.86)	16.84(8.40)
T_3	NPV	250	21.93(13.95)	21.01(12.89)	18.57(10.14)	21.62(13.58)	20.09(11.80)	18.76(10.34)	23.01(15.28)	20.61(12.39)	16.60(8.16)	19.32(10.95)
T_4	Bt	1.5	22.68(14.87)	21.38(13.29)	18.99(10.59)	21.78(13.77)	20.58(12.36)	19.55(11.20)	23.85(16.35)	21.58(13.53)	18.57(10.14)	20.97(12.81)
T_5	Beta-cyfluthrin 2.5 SC	750	21.34(13.25)	19.00(10.60)	16.64(8.20)	20.10(11.82)	22.61(14.78)	18.86 (10.45)	20.47 (12.23)	19.50(11.14)	14.98(6.68)	18.15(9.71)
T_6	NSKE	5%	22.86(15.10)	23.89(16.40)	20.87(12.70)	27.52 (21.35)	28.19 (22.31)	25.48(18.50)	29.55 (24.32)	26.03(19.25)	23.94(16.46)	27.75(21.68)
T_7	NLE	5%	22.93(15.22)	24.61(17.34)	22.05(14.09)	28.02(22.07)	29.47(24.20)	27.46(21.26)	31.67(27.56)	28.35 (22.55)	26.65 (20.12)	29.99 (24.99)
T_8	Control	-	22.59(14.78)	25.91(19.10)	30.34(25.53)	33.80(30.95)	34.82(32.60)	36.13(34.77)	37.19(36.54)	38.17(38.20)	38.84(39.33)	40.19(41.64)
S. Em+			0.53	0.37	0.31	0.35	0.36	0.32	0.38	0.34	0.30	0.39
CD (P=0.05)			1.61	1.12	0.93	1.07	1.08	0.96	1.16	1.02	0.92	1.18

* Figure in parentheses are retransformed values; ** Days after spray

Table 3: Economics and cost benefit ratio of different treatments against *H. armigera* in tomato during 2011-12

Treatments	No. of sprays	Average yield (q/ha)	Gross return (Rs.)	Increased yield over control (q/ha)	Value of increased yield over control (Rs./ha)	Management Cost (labour + insecticide) (Rs./ha)	Net profit (Rs./ha)	C:B ratio
T_1 Flubendiamide 480 SC @200ml/ha	3	265.68	398520	145.17	217755	11220	206535	1:2.075
T_2 Spinosad 45 SC @ 200ml/ha	3	251.29	376935	130.78	196170	2520	193650	1:2.056
T_3 Ha NPV @ 250LE/ha	3	226.40	339600	105.89	158835	3420	155415	1:1.843
T_4 Bt @ 1.5 kg/ha	3	217.74	326610	97.23	145845	2595	143250	1:1.781
T_5 Beta-cyfluthrin 2.5 SC @ 750ml/ha	3	238.8	357570	117.87	176805	3262	173543	1:1.943
T_6 NSKE @ 5%	3	167.25	250875	46.74	70110	2820	67290	1:1.366
T_7 NLE @ 5%	3	157.23	235845	36.72	55080	2025	53055	1:1.290
T_8 Control	0	120.51	180765	-	-	-	-	-

(1) Present price of insecticides: Flubendiamide Rs. = 160/10 ml Beta-cyfluthrin Rs. = 730/l; (2)Labour charge: 4 labour @ Rs. 135 Spinosad Rs. = 725/500 ml NSKE Rs. = 20/kg; (3)Sale price of tomato Rs. = 15/kg NPV Rs. = 600/250 LE NLE = 1 labour ; Bt Rs. = 650/l

C_a = Number of insects in untreated check after treatment

C_b = Number of insects in untreated check before treatment.

The reduction percentage figures were transferred into arc sine values and subjected to analysis of variance.

The data on percentage infestation of tomato fruits by borer was calculated at each picking by counting damage and healthy fruits in each spray application. The mean per cent fruit damage was calculated using formula:

$$\text{Mean fruit damage (\%)} = \frac{\text{Number of damaged fruits}}{\text{Total number of fruits}} \times 100$$

RESULTS AND DISCUSSION

The result of effectiveness of different insecticidal treatments against tomato fruit borer, *H. armigera* showed that all the treatments were significantly superior over control in terms of mean reduction of tomato fruit borer larvae, mean fruit damage and marketable fruit yield. Three applications of flubendiamide 480 SC at 200 mL/ha was found significantly most effective, which caused highest mean reduction of 89.94 per cent in population of tomato fruit borer larvae. It was followed by spinosad 45 SC at 200 ml/ha and HaNPV at 250 LE/ha with 74.67 and 74.10 per cent mean reduction, respectively and were at par with each other. Beta-cyfluthrin 2.5 SC at 750 mL/ha and BT at 1.5 kg/ha were found moderately effective treatment with 67.37 and 60.03 per cent mean reduction of fruit borer larvae. The efficacy of flubendiamide 480 SC at 200 mL/ha was manifested in terms of least mean fruit damage of 3.10 per cent, while, the spinosad 45 SC @ 200 mL/ha with mean fruit damage of 4.86 percent followed the above and was next in order of effectiveness. HaNPV 250 LE/ha, BT @1.5 kg/ha and Beta-cyfluthrin 2.5 SC were found moderately effective treatment with 8.16, 10.14 and 6.68 per cent mean fruit damage, respectively.

The highest marketable yield of 265.68 q/ha was recorded in case of Flubendiamide 480 SC @ 200 mL/ha with highest C: B ratio of 1:2.075. It was followed by Spinosad 45 SC @ 200mL/ha (251.29 q/ha) and Beta-cyfluthrin 2.5 SC @ 750 mL/ha (238.38 q/ha). HaNPV @ 250 LE/ha and BT @ 1.5 kg/ha, which yielded 226.40 and 217.74 q/ha, respectively.

These findings are in close conformity with the findings of Kuttalam *et al*. (2008) who reported that flubendiamide 480 SC at 48 g a. i. /ha was significantly superior in reducing *H. armigera* population and fruit damage in tomato. Similarily, the effectiveness of flubendiamide 480 SC against *H. armigera* was also reported by Ameta and Arunabh (2007) in tomato, Ameta and Kumar (2008) in chilli. Earlier, Gopalakrishnan and Ashokan (1998) reported that nuclear polyhedrosis virus significantly decreased larval count of *H. armigera* and increased fruit yield of tomato. Similarily, the effectiveness of nuclear polyhedrosis virus against *H. armigera* was also reported by Sivaprakasam (1998), Wanjari *et al*. (1998). Murray *et al*. (2005) reported that Spinosad 45SC was consistently superior to other tested insecticides against *H. armigera*.

REFERENCES

Ameta, O. P. and Arunabh, J. 2007. Evaluation of Beta- Cyfluthrin 25 SC against tomato fruit borer, *Helicoverpa armigera* (Hub.). *J. Applied Zoological Researches*. **18:** 54-58.

Ameta, O. P. and Kumar, A. 2008. Efficacy of flubendiamide against *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fab.) in chilli. *Pestology*. **32:** 26-29.

Gopalakrishnan, C. and Ashokan, R. 1998. On farm trails with HaNPV against *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae) on tomato. *Advances in IPM for Horticultural Crops. Proceedings of the First National Symposium on Pest Management in Horticultural Crops Environmental Implications and Thrusts*, Bangalore, India, 15-17 October, 1997-98, 215-217.

Henderson, C. F. and Tilton, E. W. 1952. Tests with acaricides against the brown wheat mite. *Journal of Economic Entomology*. **48:** 157-161.

Kuttalam, S., Kumar, B. V., Kumaran, N. and Boomathi, N. 2008. Evaluation of bio-efficacy of flubendiamide 480SC against fruit borer, *Helicoverpa armigera* (Hub.) in tomato. *Pestology*. **32:** 13-16.

Manjunath, T. M., Bhatnagar, V. S., Pawar, C. S. and Sithanantham, S. 1989. Economic importance of *Heliothis* spp. in India and an assessment of their natural enemies and host plants. In: *Proceedings of workshop on Biological Control of Heliothis*. Increasing the effectiveness of natural enemies (Ed. King, I.G. and Jackson, R.D.), Far Eastern Regional Research Office, United States, Department of Agriculture, New Delhi. pp. 197-228.

Murray, D. A. H., Lloyed, R. J. and Hopkinson, J. E. 2005. Efficacy of newer insecticides for management of *Helicoverpa* spp. (Lepidoptera: Noctuidae) in Australian grain crop. *Australian J. Entomology*. **44:**

62-67.

Pareek, P. L. and Bhargava, M. C. 2003. Estimation of avoidable losses in vegetables caused by borers under semi arid condition of Rajasthan. *Insect Envioronment*. **9:** 59-60.

Puri, S. N. 1995. Present status of IPM in India. *Proceeding of National Seminar on Integrated Pest Management in Agriculture*, December 29-30, 1995. Nagpur, Maharashtra.

Selvanarayanan, V. 2000. Host plant resistance in tomato against fruit borer, *Helicoverpa armigera* (Hub.). *Thesis, Annamalai University, Annamalainayar, India*.

Sivaprakasam, N. 1998. Control of tomato fruit borer, *Helicoverpa armigera* (Hub.) by nuclear polyhedrosis virus in comparison with other treatments. *Indian J. Agricultural Sciences*. **68:** 801-802.

Wanjari, R. R., More, G. D., Supare, N. R., Turkar, K. S. and Agarkar, V. K. 1998. Management of *Helicoverpa armigera* (Hub.) on chickpea with some herbal, chemical and bio-pesticides. *J. Soils and Crops*, **8:** 34-37.