Vegetable Science (2011) 38(2) : 162-164

Evaluation of botanical, microbial and chemical insecticide on the fruit damage inflected by fruit borer in tomato

Suresh Ram and Sunder Singh

Received : May 2010 / Accepted : Feb 2011

Abstract An experiment was carried out under field condition of Dun valley of Uttarakhand to evaluate the bio-efficacy of botanicals, microbial and synthetic insecticides either alone and in combinations on the larval population of *H. armigera* during rabi seasons of 2006-07 and 2007-08. The results revealed that, *Bt* (1g/l) + endosulfan (1ml/l) was recorded lowest fruit damage (8.50% and 7.98% in w/w and n/n, respectively) and recorded higher yield (231.03qha^{-1}) followed by, endosulfan 35 EC (2ml/l) was found 8.83% and 8.13% in w/w and n/n ,respectively with mean yield 229.24 qha^{-1} while, *Bacillus thurigiensis* var *kurstaki* (*Btk*) was recorded 10.37 and 9.10 per cent fruit damage with 224.25 qha^{-1} mean marketable yield as compared to T_8, Control with 31.09 and 31.03 per cent damage w/w and n/n with 196.97 qha^{-1} mean marketable yield of 2006-07 and 2007-08. All the botanical, microbial with endosulfan either alone or in combinations showed significantly superior over untreated check.

Introduction

Uttarakhand is endowed with soil and climatic conditions favourable for vegetable cultivation including tomato, an off-season, highly remunerative crop in mid hills and tarai bhavar region of the state. District Dehradun is a major belt of tomato production occuping 999 ha area with 16226 metric tonnes production (Anonymous, 2008) as compared to 5 thousand ha areas and 61.40 thousand tonnes production in state (Hedau *et al*. 2008). Tomato fruit borer, *H. armigera* (Hub.) is the key insect imflicting fruit damage of 33.5-55.5 per cent in the country (Singh and Chahal, 1978). Application of conventional synthetic pesticides has several ill effects on the environment. Considering this, several alternative and safe insecticides of botanical and microbial origin are there, which have records of their success against insect pests of crops. Not only they are effective against insects and safe to be used, but also they are easily biodegradable causing least harm to the ecosystem and natural enemies and some of them can be prepared by the farmers themselves and can even be applied in crude form that saves huge sum of money to purchase costly formulations available in market.

Materials and Methods

The experiment was carried out under field condition of Dun valley of Uttarakhand to evaluate the bio-efficacy of botanicals, microbial and synthetic insecticides either alone and in combinations on the larval population of *H. armigera* during 2006-07 and 2007-08. There were eight treatments comprises as T_1, NSKE 5% (a crude extract of neem seed kernels); T_2, Gronim 0.03% (a neem based formulation) @ 5 ml/l; T_3, *Bacillus thurigiensis* var *kurstaki* (a microbial insecticide) @ 2 g/l; and three combinations (a physical mixture) of bio-rationals with endosulfan i.e. T_4, *Bt* (1g/l) + endosulfan (1ml/l); T_5, Gronim (2.5ml/l) + endosulfan 35 EC (1ml/l); T_6, NSKE 2.5% + endosulfan 35 EC (1ml/l); T_7, endosulfan 35 EC (2ml/l) and T_8, Control (no protection measures). The seedlings of tomato were transplanted in well prepared field during first week of November in both the years. Plot size was kept 3.60m x 3.00m. Row to row and plant to plant distance was maintained 60cm x 50cm. The experiment was laid out in randomized block design with three replicating. Two sprays of different treatments

Sunder Singh
Entomology Research Lab,
Department of Zoology,
DAV (PG) College,
Dehradun Uttarakhand-248001

Suresh Ram
Horticulture Research and Extension Centre,
Dhakrani-248142, Herbertpur,
Dehradun (Uttranchal)

were given at 15 days intervals, when larval population of fruit borer reached above economic threshold level (ETL) i.e. 1-1.5 larvae plant^{-1}. The crop was protected from diseases through need based sprays of carbendazim (0.01%) and streptocycline (1g/10 L). The data on larval population were recorded 3, 7 and 14 days after each spraying from 5 tagged plants/plot. Data were recorded on marketable yield (q/ha).

Results and Discussion

Effect on fruit damage on weight basis**:** Minimum per cent fruit damage of tomato on weight basis was recorded in following application of Bt + endosulfan (1gm/l + 1ml/g) (8.35) which appeared best treatment followed by endosulfan 2ml/l (8.67) and Bt 2gm/l (10.67), which was found at with each other. It was followed by NSKE 5% (17.75) and Gronim (18.92) found with at effect. The combinations of both neem based pesticides with endosulfan were found statistically at par with each other, recording 20.31 and 20.99 % in Gronim + endosulfan and NSKE 5% + endosulfan ,respectively. All the treatments were found significantly superior over untreated control. During 2007-08 minimum per cent damage of tomato fruit was observed in Bt + endosulfan (8.66) followed by endosulfan (8.90) and Bt (9.40) which were found at par with each other. Among neem products the NSKE 5% showed superior over Gronim while in combinations NSKE + endosulfan also found comparatively effective. The pooled mean of per cent fruit damage (w/w) for the year 2006-2007 and 2007-08. The sub lethal doses of Bt + endosulfan showed best result (8.50) followed by endosulfan (8.83) and Bt (10.37) was found statistically at par with each other. As a neem based product NSKE 5% was recorded 17.26 per cent damage as compared to Gronim (18.09) while its combinations with endosulfan NSKE + endosulfan (19.53) also showed superiority over the combination of Gronim + endosulfan (20.24).

Table 1: Effect of botanical, microbial and chemical insecticides and their combinations on per cent fruit damage caused by *H. armigera* on weight basis

Treatments	Doses	Per cent fruit damage (W/W)		
		2006-07	2007-08	Pooled
NSKE 5%	5%	17.75 (24.91)	16.77 (23.81)	17.26 (24.15)
Gronim 0.03%	5ml/l	18.92 (25.77)	17.27 (24.58)	18.09 (24.55)
Bt	2gm/l	10.67 (19.06)	9.40 (17.55)	10.37 (17.85)
Bt + Endosulfan	1gm + 1 ml/l	8.35 (16.79)	8.66 (16.52)	8.50 (17.11)
Gronim + Endosulfan	2.5 ml + 1 ml/l	20.99 (27.24)	19.49 (26.24)	20.24 (26.19)
NSKE + Endosulfan	2.5 % + 1 ml/l	20.31 (26.77)	18.76 (5.45)	19.53 (25.65)
Endosulfan	2 ml/l	8.76 (17.22)	8.90 (16.69)	8.83 (17.35)
Control	-	31.29 (34.00)	30.89 (33.48)	31.09 (33.76)
F value		Sig	Sig	Sig
SEM±		0.50	0.33	0.46
CD 5%		1.58	1.01	1.40

Figures in parentheses are angular transformed value.

Table 2: Effect of botanical, microbial and chemical insecticides and their combinations on per cent fruit damage caused by *H. armigera* on number basis

Treatments	Doses	Fruit damage per cent(N/N)		
		2006-07	2007-08	Pooled
NSKE 5%	5%	16.32 (23.55)	15.98 (24.53)	16.63 (24.06)
Gronim 0.03%	5ml/l	17.31 (24.10)	16.68 (25.16)	17.10 (24.42)
Bt	2g/l	9.11 (17.27)	8.81 (18.77)	9.10 (17.55)
Bt + Endosulfan	1g /l + 1 ml/l	8.09 (15.97)	7.50 (16.95)	7.98 (16.40)
Gronim + Endosulfan	2.5 ml/l + 1 ml/l	19.56 (24.97)	17.83 (26.73)	18.43 (25.42)
NSKE + Endosulfan	2.5 % + 1 ml/l	18.47 (24.32)	16.98 (26.22)	17.33 (24.59)
Endosulfan	2 ml/l	8.23 (16.37)	7.95 (17.28)	8.13 (16.56)
Control	-	30.44 (33.40)	30.32 (33.88)	31.03 (33.85)
F value		Sig	Sig	Sig
SEM±		0.39	0.35	0.31
CD 5%		1.19	1.06	0.96

Figures in parentheses are angular transformed value.

Table 3: Effect of botanical, microbial and chemical insecticides and their combinations on marketable yield of tomato fruits

Treatments	Doses	Mean yield of tomato fruits(q/ha)		
		2006-07	2007-08	Pooled
NSKE 5%	5%	218.93	216.33	217.78
Gronim 0.03%	5ml/l	216.60	217.54	217.07
Bt	2gm/l	223.40	225.10	224.25
Bt + Endosulfan	1gm + 1 ml/l	232.19	229.85	231.02
Gronim + Endosulfan	2.5 ml + 1 ml/l	209.22	216.85	213.03
NSKE + Endosulfan	2.5 % + 1 ml/l	212.65	218.73	215.69
Endosulfan	2 ml/l	229.58	228.89	229.24
Control	-	195.94	198.00	196.97
F value	-	Sig	Sig	Sig
SEM±	-	1.56	1.26	1.17
CD 5%	-	4.73	3.84	3.56

Effect on per cent damage of fruits number basis **:** The results on per cent fruit damage on number basis contained in Table 1 indicates that the efficacy of sub lethal doses of Bt + endosulfan showed highest reduction in fruit damage (8.09) followed by endosulfan (8.23) and Bt (9.11). These treatments were found statistically at par with each other. While NSKE, Gronim, NSKE + endosulfan, Gronim + endosulfan was recorded significantly higher fruit damage as compared with Bt + endosulfan, endosulfan and Bt. Both neem based insecticides either alone and in combinations with endosulfan were found statistically at par with each other. All the treatments were performed significantly superior over control. While during successive season of cropping Bt + endosulfan, endosulfan and Bt were again exhibited significantly effectiveness (7.50), (7.95) and (8.81), respectively over control (30.32) as well as remaining treatments. Almost similar results were also found during this season. However, pooled mean of per cent fruit damage for both the years, 2006-07 and 2007-08, indicated that combination of Bt + endosulfan recorded 7.98% damage. Followed by endosulfan (8.13) and Bt (9.10) alone. The treatment NSKE and Gronim was equally effective resulting 16.63 and 17.10% damage and was equally at par with each other while in combinations it again showed their effectiveness with at par.

The findings of present study coincide with the results of Tomar (1998) reported that the combinations of Bt + endosulfan was found very effective in reducing per cent fruit infestation by weight in and more effective than use singly. Beside there, they are also compatible with each other Similar findings were also reported by Kumar and Sharma 2004, Sharma *et al*., 2007 and Prasad, *et al*., 2003.

Effect on mean yield of tomato**:** The maximum yield (231.02 q/ha) was obtained by the following treatment Bt + endosulfan followed by (229.24 q/ha) in endosulfan. The next highest yield was obtained in the plot treated with Bt (224.25) found significant with endosulfan. Remaining treatments were also obtained significantly higher fruit yield which were equally effective and statistically at par with each other.

Earlier Mehta *et al*., 2004 and Sharma, *et al*, 2007 also reported similar observation in maximizing higher yield of healthy fruits of Tomato.

सारांश

वर्तमान प्रयोग के परिणामों से यह प्राप्त हुआ कि बैसीलस थुरिजिंसिस (1 ग्रा./ली.) + इण्डोसल्फान (1 मिली./ली.) की आधी मात्रा वाले उपचार में सबसे कम फलों की क्षति तथा सबसे अधिक उत्पादन प्राप्त हुआ। इसके बाद इण्डोसल्फान 35 ई.सी. (2 मिली./ली.) की पूरी मात्रा वाले उपचार तथा बैसीलस थुरिजिंसिस (2ग्रा./ली.) नामक उपचार में बिना उपचार वाले फसल की अपेक्षाकृत फलों की कम क्षति तथा अधिक उत्पादन प्राप्त किये गये। समग्ररूप से समस्त उपचार बिना उपचार वाले फसल की अपेक्षा कम फलों का नुकसान तथा अधिक उत्पादन प्राप्त किये गये।

References

Anonymous (2008) Annual report of vegetable production in Dehradun district. Direcotorate of Horticulture and Food Processing, Govt. of Uttarakhand.

Hedau NK, Mahajan V, Gupt HS, Hudda KS, Prakash V and Gaihlen A (2008) Tamatar Ki Utpadan avam Nashijeev Prabandhan Takniq. In Smarika: Badalate Parivesh mein Bagvani Vikas Ke Naye Ayam: G.B.P.U.A&T, KVK, Dehradun. pp.124-128.

Kumar J and Sharma SD (2004) Efficacy of economics of *Bacillus thuringiensis* var *kurstaki* for management of *Heliothis armigera* on tomato (*Lycopersicon esculentum*) in lower Kullu valley, Himachal Pradesh. Indian Journal of Agric. Sciences.74(7): 396-398.

Mehta PK, Vaidya DN and Kashyap NP (2004) Management of tomato fruit borer, *Helicoverpa armigera* (Hub.) using insecticides and bio-pesticides. Himachal J. of Agricultural Research. 16 (1-2):50-53.

Prasad A, Jain M and Wadhwani Y (2003) Comparative field evaluation of certain insecticides against *Helicoverpa armigera*. *In: Proc. of Nat. Symp. on Frontier Areas of Entomological Research*, 5-7 Nov. held at IARI. New Delhi. p. 135.

Sharma GD, Devi N and Raj D (2007) Eco-friendly management of tomato fruit borer, *Helicoverpa armigera* (Hubner). Journal of Eco-friendly Agriculture, 2(1):41-43.

Tomar RKS (1998) Efficacy and economics of bio-pesticides and insecticidal combinations against okra shoot and fruit borer, Indian J. Ent. 60 (1): 25-28.

Singh D and Chahal BS (1978) Control of tomato fruit borer *Heliothis armigera* (Hubner) in Punjab. Haryana J. Hort. Sci. 7(3 & 4):182-186.