Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(6): 268-271
© 2017 JEZS
Received: 23-09-2017
Accepted: 25-10-2017

Maruthi MS
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Hanumanthaswamy BC
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Sharanabasappa
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Nagarajappa Adivappar
Zonal Agricultural and Horticultural Research Station, Shivamogga, Karnataka, India

Correspondence
Maruthi MS
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Evaluation of safer insecticides against *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae) on capsicum under naturally ventilated polyhouse condition

Maruthi MS, Hanumanthaswamy BC, Sharanabasappa and Nagarajappa Adivappar

Abstract
An experiment was conducted under naturally ventilated polyhouse condition at Zonal Agricultural and Horticultural Research Station Navile, Shivamogga, Karnataka, India during *kharif* of 2015 using capsicum hybrid Indra to test the efficacy of safer insecticides against *Spodoptera litura*. All the insecticidal treatments were significantly superior to untreated control in checking the *S. litura* larval population and the fruit damage due to *S. litura* under naturally ventilated polyhouse condition. The present study indicated that the treatment of chlorantraniliprole 18.5 SC was effective by recording minimum larval population with lowest fruit damage over all other treatments. The next best treatment was cyantraniliprole 10.26 OD. The order of moderate effective treatments were Flubendiamide 480 SC > Emamectin benzoate 5 SG > Spinosad 45 SC > Novaluron 10 EC > Indoxacarb 15.8 EC.

Keywords: capsicum, insecticides, polyhouse, *Spodoptera litura*

1. Introduction
Capsicum is a genus of plants from the nightshade family (*Solanaceae*) native to the Central America, where it was cultivated for thousands of years by the people of the tropical America, and is now cultivated worldwide. Nutritionally, it is rich in vitamins particularly, vitamin A and vitamin C. Often the productivity of capsicum is very low due to several factors. Among them, insect pests cause severe loss. It is attacked by various insect and mite pests from seedling to fruiting stage. It was reported that a total of 293 insects and mite species attacking the Capsicum crop in the field as well as in storage (Anon, 1987) [1]. The damage caused by *Spodoptera litura* (Fabricius) during flowering and fruit formation is the most concern and farmers everywhere feel the need to protect such high value crops from any type of damage caused by insect pests. They often use synthetic insecticides indiscriminately and insect develop resistance to insecticides is very common in the tropics. To control lepidopteron pests efficiently, some new pesticides with novel modes of action have been developed recently. The new pesticides with novel modes of action and high selectivity are highly effective against lepidopteron pests. They are safer to non-target organisms and quickly degrade to non-toxic products.

2. Material and Methods
The trial was conducted under naturally ventilated polyhouse condition during *kharif* 2015 at Zonal Agricultural and Horticultural Research Station Navile, Shivamogga, Karnataka, India. The experiment was laid out in Randomized Complete Block Design (RCBD) with eight treatments replicated thrice in 4m x 1m plot size with a spacing of 60 cm x 30 cm. The capsicum hybrid 'Indra' was raised as per the recommended package of practices except plant protection measures. The treatments were imposed by using Knapsack sprayer @ 400-450 liters of spray solution/ha depending on stage of the crop. The crop received a total of 2 sprays, the first being given when the fruit borer infestation was noticed and the second spray was given 20 days after the first spray on need basis. To compare the efficacy of treatments, both recommended insecticides as well as untreated control were maintained.

Observations were recorded on the number of larvae per plant and per cent fruit damage per plant on 5 randomly selected plants per plot on one day before, 2, 5 and 10 days after each spray. The data were converted to square root and arc sin transformation before statistical analysis.

Table 1: List of different molecules of safer insecticides used for management of *Spodoptera litura* (Fabricius)

Tr. No.	Treatments	Trade name	Dosage
T1	Novaluron 10 EC	Rimon	1.00 ml/l
T2	Indoxacarb 15.8 EC	Ammate	0.40 ml/l
T3	Spinosad 45 SC	Tracer	0.25 ml/l
T4	Chlorantraniliprole 18.5 SC	Coragen	0.10 ml/l
T5	Cyantraniliprole 10.26 OD	Benevia	0.10ml/l
T6	Flubendiamide 480 SC	Fame	0.20 ml/l
T7	Emamectin benzoate 5 SG	Proclaim	0.30 g/l
T8	Untreated control	-	-

3. Results and Discussion

The safer insecticides were tested for their efficacy against *S. litura* on capsicum under naturally ventilated polyhouse condition revealed that all the insecticidal treatments were significantly superior to untreated control in checking the larval population and per cent fruit damage.

At two days after first spray, from the results it was observed that there was a significant difference among the treatments. The lowest larval population was recorded in the treatment chlorantraniliprole 18.5 SC (0.33 larva/ plant) and found to be superior over other treatments, which was followed by cyantraniliprole 10.26 OD (0.53 larva/ plant) found to be the next best treatment and it was on par with emamectin benzoate 5 SG and flubendiamide 480 SC which recorded 0.60 and 0.67 larvae per plant respectively. The treatment spinosad 45 SC recorded 0.73 larva per plant found to be next succeeding treatment and on par with novaluron 10 EC with 0.87 larva per plant and indoxacarb 15.8 EC with 0.93 larva per plant. However, the highest larval population was recorded in untreated control (2.27 larvae/ plant).

At five days after first spray, the difference in the larval population of *Spodoptera litura* among the treatments were significant. Among the treatments, a significant lower population was observed in chlorantraniliprole 18.5 SC (0.20 larva/ plant) and found to be superior over other treatments. This was followed by cyantraniliprole 10.26 OD (0.33 larva/ plant) found to be the next best treatment and it was on par with flubendiamide 480 SC, emamectin benzoate 5 SG and spinosad 45 SC, which recorded 0.40, 0.40, and 0.53 larva per plant respectively. Further, novaluron 10 EC and indoxacarb 15.8 EC recorded the larval population of 0.60 and 0.67 larvae per plant, respectively and these were on par with each other. However, the highest population was recorded in untreated control (2.40 larvae/ plant).

Almost similar trend was recorded on ten days after first spray, chlorantraniliprole 18.5 SC recorded least number of larva per plant (0.13) and it was followed by cyantraniliprole 10.26 OD, flubendiamide 480 SC, emamectin benzoate 5 SG and spinosad 45 SC which recorded 0.20, 0.27, 0.33 and 0.40 larva per plant, respectively and these were on par with each other. Further, novaluron 10 EC and indoxacarb 15.8 EC recorded larval population of 0.47 and 0.53 respectively and these were on par with each other. However, untreated control remained inferior by recording highest larval population (2.67 larvae/ plant).

When the larval population reached the ETL second spray was taken up *i.e.*, 20 days after first spray (Table 6).

Similar trend was observed in the second spray. Among the treatments a day prior to second spray significantly lower population was noticed in chlorantraniliprole 18.5 SC and cyantraniliprole 10.26 OD. Two days after second spray, among the different insecticidal molecules, the lesser (0.27 larva/ plant) incidence was recorded in chlorantraniliprole 18.5 SC and found to be superior over other treatments. This was followed by cyantraniliprole 10.26 OD (0.33 larva/ plant) and it was on par with emamectin benzoate 5 SG (0.40 larva/ plant), flubendiamide 480 SC (0.47 larva/ plant) and spinosad 45 SC (0.53 larva/ plant). The treatment novaluron 10 EC (0.60 larva/ plant) was found to be next succeeding treatment and on par with indoxacarb 15.8 EC (0.67 larva/ plant). However, the highest larval population was recorded in untreated control (2.87 larvae/ plant).

Five days after second spray, the larval population varied between 0.13 to 2.93 larvae per plant. Among the treatments, a significant lower population was observed in chlorantraniliprole 18.5 SC which recorded 0.13 larvae per plant. Next best treatments were cyantraniliprole 10.26 OD, flubendiamide 480 SC and emamectin benzoate 5 SG which recorded 0.27, 0.27 and 0.33 larva per plant, respectively and were on par with each other. Further, spinosad 45 SC, novaluron 10 EC and indoxacarb 15.8 EC recorded 0.40, 0.40 and 0.47 larva per plant, respectively. However, significantly highest larval population was recorded in untreated control (2.93 larvae/ plant).

Ten days after spray, the treatment chlorantraniliprole 18.5 SC and cyantraniliprole 10.26 OD were continued to retain their supremacy over all the treatments with lower larval population of 0.07 and 0.13 larva per plant, respectively and were on par with each other. Treatments flubendiamide 480 SC, emamectin benzoate 5 SG, spinosad 45 SC, novaluron 10 EC and indoxacarb 15.8 EC were recorded 0.20, 0.27, 0.33 and 0.40 larvae per plant, respectively. However significantly highest larval population was observed in untreated control (3.33 larvae/ plant).

The insecticides in the decreasing order of their efficacy were Chlorantraniliprole 18.5 > SC Cyantraniliprole 10.26 OD > Flubendiamide 480 SC > Emamectin benzoate 5 SG > Spinosad 45 SC > Novaluron 10 EC > Indoxacarb 15.8 EC.

Data pertaining to percent pod damage was presented in table no 3. Significantly lower per cent fruit damage was recorded in chlorantraniliprole 18.5 SC (11.01% mean per cent fruit damage per plant). The next best treatments were cyantraniliprole 10.26 OD (12.25% mean per cent fruit damage per plant), flubendiamide 480 SC (13.46% mean per cent fruit damage per plant), emamectin benzoate 5 SG (13.83% mean per cent fruit damage per plant) and spinosad 45 SC (14.42% mean per cent fruit damage per plant) followed by novaluron 10 EC and indoxacarb 15.8 EC with 15.74 and 16.93 mean per cent fruit damage per plant, respectively. However, the plot without any treatment *i.e.*, control recorded significantly higher per cent fruit damage (36.12% mean per cent fruit damage per plant).

The present investigation is in close agreement with Meena *et al*. (2014) [4] who reported that chlorantraniliprole provide excellent activity against lepidopteran pests with lower LD50 > 5000 mg/kg in rat. This insecticidal chemistry has a promise to help to replace older more toxic methods of control. Further, Hosamani *et al*. (2008) [2] also reported that, chlorantraniliprole @ 40 g a.i. ha^{-1} resulted in minimum larval population of *S. litura*, *S. exigua* and *H. armigera* with minimum foliage and fruit damage which was on par with its next lower dosage. The application of chlorantraniliprole @ 40 g a.i. ha^{-1} resulted highest green chilli fruit yield. Patel *et*

al. (2012) [5] reported that cyantraniliprole@ 105 and 90 g a.i. ha^{-1}recorded higher per cent larval mortality of *Spodoptera litura* in cotton than the rest of treatments. Further, Yadav *et al*. (2012)[6] also reported that cyantraniliprole at the rate of 70 and 80 g a.i. ha^{-1} was found to be most effective in reducing the *S. litura* population in table grapes. Meena *et al*. (2012) [3] reported that flubendiamide @ 60 g a.i. ha^{-1} followed by flubendiamide @ 48 g a.i. ha^{-1} registered its superiority over rest of treatments by recording maximum reduction in mean larvae per plant as well as lowest fruit damage.

Table 2: Evaluation of insecticides against larvae of *Spodoptera litura* on capsicum under naturally ventilated polyhouse condition during 2015

Tr. No.	Treatments	Dose ml or g/l	Larval population per plant								Mean larval population per plant	Per cent reduction of larvae over control
			I Spray				II Spray					
			1 DBS	2 DAS	5 DAS	10 DAS	1 DBS	2 DAS	5 DAS	10 DAS		
T_1	Novaluron 10 EC	1.00	2.27 (1.66)	0.87 (1.17)^{b}	0.60 (1.05)^{bc}	0.47 (0.98)^{bc}	1.33 (1.35)$_{b}$	0.60 (1.05)^{b}	0.40 (0.95)^{b}	0.33 (0.91)^{bc}	0.55	79.93
T_2	Indoxacarb 15.8 EC	0.40	2.20 (1.64)	0.93 (1.2)^{b}	0.67 (1.08)^{b}	0.53 (1.02)^{b}	1.40 (1.37)$_{b}$	0.67 (1.08)^{b}	0.47 (0.98)^{b}	0.40 (0.94)^{b}	0.61	77.74
T_3	Spinosad 45 SC	0.25	1.93 (1.55)	0.73 (1.1)^{b}	0.53 (1.02)^{bcd}	0.40 (0.94)^{bcd}	1.33 (1.37)$_{b}$	0.53 (1.01)^{bc}	0.40 (0.94)^{b}	0.27 (0.87)^{bcd}	0.48	82.48
T_4	Chlorantraniliprole 18.5 SC	0.10	2.13 (1.61)	0.33 (0.91)^{c}	0.20 (0.83)^{d}	0.13 (0.79)^{d}	1.00 (1.22)$_{b}$	0.27 (0.87)^{c}	0.13 (0.79)^{c}	0.07 (0.75)^{d}	0.19	93.06
T_5	Cyantraniliprole 10.26 OD	0.10	2.07 (1.6)	0.53 (1.02)^{bc}	0.33 (0.91)^{cd}	0.20 (0.83)^{cd}	1.07 (1.25)$_{b}$	0.33 (0.91)^{bc}	0.27 (0.87)^{bc}	0.13 (0.79)^{cd}	0.30	89.05
T_6	Flubendiamide 480 SC	0.20	2.00 (1.58)	0.67 (1.07)^{bc}	0.40 (0.94)^{bcd}	0.27 (0.87)^{bcd}	1.20 (1.30)$_{b}$	0.47 (0.98)^{bc}	0.27 (0.87)^{bc}	0.20 (0.84)^{bcd}	0.38	86.13
T_7	Emamectin benzoate 5 SG	0.30	2.20 (1.64)	0.60 (1.05)^{bc}	0.40 (0.98)^{bcd}	0.33 (0.91)^{bcd}	1.27 (1.33)^{b}	0.40 (0.95)^{bc}	0.33 (0.91)^{bc}	0.27 (0.87)^{bcd}	0.40	85.40
T_8	Untreated control	_	2.20 (1.64)	2.27 (1.66)^{a}	2.40 (1.70)^{a}	2.67 (1.78)^{a}	2.93 (1.85)^{a}	2.87 (1.84)^{a}	2.93 (1.85)^{a}	3.33 (1.96)^{a}	2.74	-
	SE.m±	_	0.09	0.07	0.07	0.06	0.07	0.06	0.05	0.05	-	-
	CD % 0.05	_	0.28	0.20	0.20	0.17	0.2	0.17	0.15	0.14	-	-
	CV (%)	_	10.09	9.90	10.72	9.53	8.74	8.92	8.36	7.99	_-__	-

DBS: Days before spraying; **DAS:** Days after spraying; values in the parentheses are $\sqrt{x+0.5}$ transformation; Means followed by same letters do not differ significantly by DMRT (P=0.05)

Table 3: Evaluation of insecticides against fruit damage due to *Spodoptera litura* on capsicum under naturally ventilated polyhouse condition during 2015

Tr. No.	Treatment details	Dose ml or g / l	Per cent fruit damge								Mean per cent fruit damage per plant	Per cent reduction of fruit damage over control
			I Spray				II Spray					
			1 DBS	2 DAS	5 DAS	10DAS	1 DBS	2 DAS	5 DAS	10 DAS		
T_1	Novaluron 10 EC	1.00	24.43 (29.56)	21.59 (27.70)^{bc}	18.22 (25.16)^{bc}	14.51 (22.40)^{b}	19.46 (26.19)$_{b}$	17.73 (24.91)^{b}	12.91 (21.06)^{bc}	09.48 (17.89)^{b}	15.74	56.42
T_2	Indoxacarb 15.8 EC	0.40	24.21 (29.42)	22.89 (28.59)^{b}	19.12 (25.93)^{b}	15.58 (23.26)^{b}	20.21 (26.59)$_{b}$	18.10 (25.14)^{b}	14.79 (22.59)^{b}	11.10 (19.47)^{b}	16.93	53.13
T_3	Spinosad 45 SC	0.25	22.88 (28.59)	20.55 (26.97)^{bc}	17.00 (24.2)^{bc}	12.38 (20.44)^{bc}	18.79 (25.69)$_{b}$	15.28 (22.89)^{bc}	12.51 (20.62)^{bcd}	08.82 (17.25)^{bc}	14.42	60.07
T_4	Chlorantraniliprole 18.5 SC	0.10	23.55 (29.05)	18.02 (25.13)^{bc}	13.31 (21.36)^{c}	07.44 (15.75)^{d}	16.48 (23.95)$_{b}$	13.02 (21.08)^{c}	08.98 (17.4)^{d}	05.33 (13.27)^{d}	11.01	69.51
T_5	Cyantraniliprole 10.26 OD	0.10	23.07 (28.72)	18.20 (25.22)^{bc}	15.17 (22.92)^{bc}	08.23 (16.58)^{cd}	17.62 (24.76)$_{b}$	14.39 (22.25)^{bc}	10.85 (19.08)^{cd}	06.67 (14.91)^{cd}	12.25	66.08
T_6	Flubendiamide 480 SC	0.20	23.21 (28.81)	19.74 (20.72)^{bc}	15.84 (23.45)^{bc}	09.76 (18.19)^{bcd}	17.88 (25.00)$_{b}$	15.00 (22.66)^{bc}	12.21 (20.44)^{bcd}	08.30 (16.72)^{bc}	13.46	62.74
T_7	Emamectin benzoate 5 SG	0.30	24.54 (29.65)	21.11 (27.34)^{bc}	16.02 (23.59)^{bc}	10.20 (18.49)^{bcd}	18.32 (25.28)^{b}	15.02 (22.79)^{bc}	11.99 (20.25)^{bcd}	08.63 (17.04)^{bc}	13.83	61.71
T_8	Untreated control	_	23.66 (29.12)	26.11 (30.74)^{a}	30.45 (33.51)^{a}	34.33 (35.89)^{a}	36.35 (37.69)^{a}	38.25 (38.22)^{a}	40.87 (39.76)^{a}	43.73 (41.42)^{a}	36.12	-
	SE.m±	_	1.62	1.38	1.35	1.44	1.40	1.31	1.15	0.93	-	-
	CD @ 0.05	_	4.92	4.17	4.10	4.36	4.26	3.99	3.50	2.81	-	-
	CV (%)	_	9.54	8.76	9.38	11.92	9.16	9.23	8.90	8.16	-	-

DBS: Days before spraying; DAS: days after spraying; values in the parentheses are arcsine transformation; Means followed by same letters do not differ significantly by DMRT (P=0.05)

4. References

1. Anonymous. Literature survey of insect pests of pepper. ARDC Prog. Rep., 1987, 77-78.
2. Hosamani AC, Sharanabasappa M, Bheemanna AG, Sreenivas, BK, Suresh Sheevaleela, Patil BV. Bioefficacy of chlorantraniliprole against chilli fruit borer complex in irrigated chilli ecosystem. Pesticide Research Journal. 2008; 20(2):210-217.
3. Meena, UP, Kulkarni AV, Omkar gavkare. Bioefficacy of flubendiamide 39.35 % SC against chilli fruit borer (*Spodoptera litura*). Indian Journal of Plant Protection. 2012; 40(3):214-220.
4. Meena, UP, Kulkarni AV, Omkar gavkare. Evaluating the efficacy of novel molecules against soybean defoliators. The bioscan. 2014; 9(1):577-580.
5. Patel RD, Bharpoda TM, Borad PK. Larvicidal efficacy of cyantraniliprole against s*podoptera litura* (fabricius) in cotton. An International e-Journal. 2012; 1(4):530-533.
6. Yadav DS, Kamte AS, Jadhav RS. Bio-efficacy of cyantraniliprole, a new molecule against *Scelodonta strigicollis* Motschulsky and *Spodoptera litura* Fabricius in grapes. Pest Management in Horticulture Ecosystem. 2012; 18(2):128-134.