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Evaluation of newer insecticides against leaf eating caterpillar, *Spodoptera litura* (fab.) infesting capsicum under Polyhouse condition

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Abstract
The present investigation was conducted to evaluate bioefficacy of newer insecticides against leaf eating caterpillar, *Spodoptera litura* (Fab.) infesting capsicum under Polyhouse condition at Hi-Tech Floriculture and Vegetable Project, College of Agriculture, Pune during *Kharif* 2018-19. Studies indicated that all the insecticidal treatments were significantly superior over untreated control. The treatment with cyantraniliprole was observed to be the most promising for suppression of larval population by recording lowest number of 0.63 larvae per plant. This was followed by chlorantriniliprole and lufenuron; in which 0.80 and 1.09 larvae per plant were observed. The remaining treatments in order of efficacy were flubendiamide, lambda cyhalothrin, spinosad and indoxacarb; which recorded 1.34, 1.62, 1.97 and 3.22 larvae per plant, respectively, as compared to untreated control plot in which 6.69 larvae per plant were observed.
The efficacy of newer insecticides against *S. litura* in terms of per cent fruit damage revealed that cyantraniliprole was found to be effective treatment among all treatments which had recorded 11.35 per cent fruit damage per plant which was at par with chlorantriniliprole; which recorded 12.31 per cent fruit damage per plant. The next best treatments in order of efficacy were lufenuron, flubendiamide, labdacyhalothrin, spinosad and indoxacarb in which 14.15, 16.05, 18.00, 20.94 and 26.71 per cent fruit damage per plant, respectively, were reported. The untreated plot was recorded highest 35.01 per cent fruit damage per plant.

Keywords: Capsicum, bioefficacy, insecticides, leaf eating caterpillar, *S. litura* Fab

1. Introduction

Capsicum (*Capsicum annum* L.) is an important spice and vegetable crop from family Solanaceae and native of the Central America and is now cultivated worldwide (Baikar and Naik, 2016) [1]. Worldwide it is cultivated in an area of 15 lakh ha with 70 lakh tonnes of productivity (Vijayalakshmi *et al*., 2016) [2]. India is the world leader in capsicum production followed by China and Pakistan. The area under capsicum cultivation is about 0.96 million hectares with annual production of 1.05 million tonns in India (Sreenivas *et al.,* 2008) [3]. Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Maharashtra are the major capsicum producing states in the country. In Maharashtra, the crop is mainly grown in Nagpur, Chandrapur, Dhule, Nanded, Pune, Kolhapur and Amaravati districts (Guru and Patil., 2018) [4]. Capsicum crop is grown in an area of 99,300 hectares with a production of 51,214 metric tonns in Maharashtra (Patil *et al.,* 2013) [5].

It is reported that nearly twenty insect pests attack capsicum crop *viz.*, whiteflies (*Trialeurodes vaporariorum* Westwood.), aphids (*Aphis gossypii* Glov.), thrips (*Scirtothrips dorsalis* Hood.), fruit borer (*Helicoverpa armigera*) and leaf eating caterpillar, (*Spodoptera litura* Fab.). Amongst these pests, *S. litura* are very important causing maximum damage to capsicum crop (Shreenivas *et al*., 2008) [3].

Leaf eating caterpillar, *S. litura* (Fab) (Lepidoptera: Noctuidae) is a polyphagous insect pest of national importance causing economic damage to about 120 host plants such as cotton, groundnut, tobacco, rice, sunflower, tomato, brassicas and many other crops are attacked by this pest. 40-50% of yield loss were observed due to infestation of *S. litura* (Vijayalakshmi *et al.*, 2016) [2]. Recently farmer depends upon the use of chemical pesticides for the control of *S. litura*, but it had reported resistance to a wide range of conventional insecticides, which has result into sporadic out breaks of the pest led to failure of crops (Shad *et al*., 2012) [6]. Because of these reasons, the control of *S. litura* is becoming increasingly difficult.

Hence, hazardous effects of conventional insecticides in chemical control needs to use of newer insecticides which is effective and safer for human being as well as less toxic to ecosystem (Sharma and Sharma, 2018) [7]. Keeping in view the above facts, an experiment was carried out to evaluate the efficacy of some newer insecticides *viz*., cyantraniliprole, chlorantraniliprole, lufenuron, flubendamide, lambda cyhalothrin, spinosad and indoxacarb against *S. litura* infesting capsicum crop under Polyhouse condition.

2. Materials and Methods

The 45 days old seedling of capsicum variety Indra were purchased from local nursery and transplanted in experimental field on 25th June 2018 at High Tech Floriculture and Vegetable Project, College of Agriculture, Pune. All recommended practices with the object of cultivation of good capsicum crop was fallowed. The other facilities such as knapsack sprayer, bucket, chemicals required were provided by Department of Entomology, Pune. An experiment to evaluate the insecticides was laid out in randomized block design with three replications and eight treatments with plot size of 6x1 m^2. To compare the efficacy of insecticides and untreated control was maintained. Spraying of respective insecticidal treatments, were done in morning hours due to calm climate in morning to avoid drift due to heavy wind. Five plants were selected randomly from each plot which were tagged with wax coated label for subsequent replication trial then observations were recorded on basis of number of larvae per plant and per cent fruit damage per plant per treatment.
Precount of *S. litura* was recorded at one day before first spray and subsequent observations on post count were recorded at 3, 7, 10 and 14 days after each spray application in morning hours at 7.30 to 9.30 AM.

2.1 Statistical analysis of the data

Data of average population of *S. litura* larvae were transformed into square root for numbers by Poisson's formula $\sqrt{x+0.5}$ and arc sin transformation for values of fruit damage (Panse and Sukhatme, 1985) (8). The standard error (S. E) and critical difference (C.D.) at 5% level of significance were calculated, in order to ascertain the bio-efficacy of each pesticide against *S. litura*. Per cent efficacy of different treatments was worked out using formula:

$$\text{Per cent efficacy} = \left[1 - \frac{Ta}{Ca} X \frac{Cb}{Tb}\right] X100$$

Where,
Ta - Infestation in treated plot after application
Tb - Infestation in treated plot before application
Ca - Infestation in control plot after application
Cb - Infestation in control plot before application
The data on per cent infestation of leaf eating caterpillar was calculated at each picking by counting damage and healthy fruits in each spray application. The mean per cent fruit damage was calculated by using formula:

$$\text{Mean fruit damaged (\%)} = \frac{\text{No.of damaged fruits}}{\text{Total no.of fruits}} \text{ x } 100$$

3. Results

3.1 Bioefficacy of newer insecticides against larval population of *S. litura*

Overall result of three cumulative spray against larval population of *S. litura* revealed that each treatments differed significantly and presented in table 1. All the insecticidal treatments were found to be effective against *S. litura* over untreated control. The treatment with cyantraniliprole was observed to be the most promising by recording 0.63 larvae per plant. The next best treatment was chlorantriniliprole and lufenuron; in which 0.80 and 1.09 larvae per plant were observed. These were followed by flubendiamide, lambda cyhalothrin, spinosad and indoxacarb which recorded 1.34, 1.62, 1.97 and 3.22 larvae per plant, respectively. In untreated control, 6.69 larval population of *S. litura* per plant was observed.

3.2 Bioefficacy of insecticides against per cent fruit damage by the *S. litura*

Overall result of all three sprayings against fruit damage due to *S. litura* revealed that all the treatments were best for *S. litura* control and displayed in table 2. The cyantraniliprole was found to be superior treatment among all treatments which was recorded 11.35 per cent fruit damage per plant which was at par with the treatment chlorantriniliprole which recorded 12.31 per cent fruit damage per plant. This was followed by the next best treatments were lufenuron, flubendiamide, lambdacyhalothrin, spinosad and indoxacarb in which 14.15, 16.05, 18.00,20.94 and 26.71 per cent fruit damage per plant, respectively were reported. The untreated plot was recorded highest 35.01 per cent fruit damage per plant.

4. Discussion

An experiment carried out on evaluation of bioefficacy of newer chemicals against *S. litura* reported that treated plot with cyantranililiprole 10.26 OD was superior among all treatments. Remaining treatments in order of efficacy were chlorantriniliprole 18.5 SC, lufenuron 50 EC, flubendiamide 39.35 SC, lambda cyhalothrin 5 EC, spinosad 45 SC and indoxacarb 14.5 SC.
The present finding are in accordance with Bhatnagar *et al*., (2013) [9] observed that toxicity of insecticides against *S. litura* (Fab.). Indoxacarb was more toxic than cartap hydrochloride at LC_{50} value. The relative toxicity ratio of novel 50 molecules at LC_{50} value in comparison to cartap hydrochloride were flubendiamide (118.33) > indoxacarb (71). Karuppaiah and Srivastava (2013) [10] stated that studied that the order of toxicity was chlorantraniliprole > emamectin benzoate > indoxacarb > spinosad > pyridalyl > fluendiamide with the relative toxicity of 37.75, 37.75, 3.28, 1.91, 1.61 and 1.24 revealed that chlorantraniliprole (0.0001) was most effective followed by emamectin benzoate (0.0002) and indoxacarb (0.0012). The order of relative toxicity was for chlorantraniliprole, emamectin benzoate, indoxacarb, spinosad, pyridalyl and flubendamide, respectively. Patil *et al*., (2013) [10] reported the efficacy of flubendiamide 39.35 SC at two concentrations (48 and 60 g a.i./ha) against indoxacarb 14.5 SC (50 g a.i./ha) and spinosad 45 SC, (73 g a.i./ha) on *S. litura* in capsicum. The results on efficacy of insecticides used in experiment showed that maximum reduction in mean larvae per plant as well as lowest fruit damage was recorded in flubendiamide 39.35 SC @ 60 g a.i. per ha. Duraimurugan and Laxminarayana (2014) [11] observed that flubendiamide @ 48 g a.i. per ha and chlorantraniliprole @ 30 g a.i. per ha were very effective in suppressing the larval population of tobacco caterpillar. Significantly superior to emamectin benzoate and lufenuron (0.1 to 0.7 and 0.7 to

3.3 larvae per plant, respectively and untreated control 1.9 to 2.4 and 4.3 to 5.3 larvae/plant, respectively. Patra *et al.*, (2015) [12] stated that Lambda cyhalothrin 4.9 CS was more effective than spinosad 48 SC @ 80 g a.i per ha along with an untreated check to control population of *S. litura*. Maruthi *et al.*, (2017) [13] reported that the treatment with chlorantraniliprole 18.5 SC was effective by recording minimum larval population with lowest fruit damage over all other treatments. The next effective treatment was cyantraniliprole 10.26 OD. The order of moderate effective treatments were flubendiamide 480 SC, spinosad 45 SC, and indoxacarb 15.8 EC. Nayaka *et al.*, (2018) [14] stated that flubendiamide 480 SC recorded the least larval population and it was significantly superior over other treatments. Indoxacarb 14.5 SC and spinosad 45 SC were found to be the next best treatments, which recorded 0.64 and 0.68 larvae per meter row length, respectively and were on par with each other. Flubendiamide 480 SC provided consistent protection from defoliation to a soybean crop from *S. litura*.

Table 1: Bioefficacy of different treatments against larval population of *S. litura*

			Average larval population				
Tr. No.	**Treatment**	**Pre count**	**1st spray**	**2nd spray**	**3rd spray**	**Pooled mean**	**Per cent efficacy over control**
T_1	Cyantraniliprole 10.26 OD	2.78 (1.81)*	1.19 (1.30)	0.46 (0.97)	0.25 (0.86)	0.63 (1.06)	91%
T_2	Chlorantriniliprole 18.5 SC	2.50 (1.73)	1.27 (1.33)	0.68 (1.08)	0.46 (0.97)	0.80 (1.14)	87%
T_3	Lufenuron 50 EC	2.67 (1.78)	1.55 (1.43)	1.00 (1.22)	0.72 (1.10)	1.09 (1.26)	84%
T_4	Flubendiamide 39.35 SC	2.67 (1.78)	1.73 (1.49)	1.29 (1.34)	1.00 (1.23)	1.34 (1.35)	80%
T_5	Lambda cyhalothrin 5 EC	2.72 (1.80)	1.94 (1.56)	1.60 (1.45)	1.32 (1.34)	1.62 (1.45)	76%
T_6	Spinosad 45SC	2.89 (1.84)	2.22 (1.64)	1.97 (1.57)	1.74 (1.49)	1.97 (1.57)	73%
T_7	Indoxacarb 14.5 SC	2.83 (1.83)	2.93 (1.85)	3.28 (1.94)	3.45 (1.98)	3.22 (1.92)	54%
T_8	Untreated control	2.72 (1.80)	4.81 (2.32)	6.80 (2.70)	8.46 (2.99)	6.69 (2.68)	0%
	SE(m)±	0.02	0.01	0.02	0.03	0.04	
	CD	NS	0.03	0.05	0.08	0.05	
	CV	10.13	10.64	11.61	9.76	10.67	

* Figures in parenthesis are $\sqrt{x} + 0.5$ transformed values
NS- Non significant

Table 2: Bioefficacy of different treatments against per cent fruit damage due to *S. litura*

			Average% fruit damage/ 5 plant				
Tr. No.	**Treatment**	**Precount (%)**	**1st spray**	**2nd spray**	**3rd spray**	**Mean**	**Per cent efficiency over control**
T_1	Cyantraniliprole 10.26 OD	19.20 (20.59)*	10.72 (19.11)	11.78 (20.08)	11.55 (19.86)	11.35 (19.69)	47%
T_2	Chlorantriniliprole 18.5 SC	18.68 (21.65)	11.63 (19.94)	12.77 (20.94)	12.52 (20.72)	12.31 (20.54)	40%
T_3	Lufenuron 50 EC	17.90 (22.94)	13.39 (21.46)	14.67 (22.52)	14.39 (22.29)	14.15 (22.10)	31%
T_4	Flubendiamide 39.35 SC	19.46 (24.63)	15.20 (22.95)	16.63 (24.06)	16.31 (23.82)	16.05 (23.62)	26%
T_5	Lambda cyhalothrin 5 EC	20.14 (26.21)	17.08 (24.41)	18.64 (25.58)	18.29 (25.32)	18.00 (25.11)	22%
T_6	Spinosad 45SC	23.10 (27.68)	19.85 (26.46)	21.61 (27.70)	21.37 (27.54)	20.94 (27.23)	19%
T_7	Indoxacarb 14.5 SC	26.10 (31.59)	25.31 (30.21)	27.29 (31.49)	27.54 (31.65)	26.71 (31.12)	10%
T_8	Untreated control	31.48 (34.13)	33.41 (35.31)	35.29 (36.44)	36.34 (37.07)	35.01 (36.28)	0%
	SE(m)±	-	0.35	0.36	0.41	4.53	
	C.D at 5%	NS	1.08	1.11	1.26	1.15	
	CV	16.41	15.27	10.49	13.67	13.14	

* Figures in parenthesis are arc sin √percentage value
NS- Non significant

4. Conclusion
Studies on efficacy of insecticides against larval population of *S. litura* indicated that all the treatments were significantly superior over control. The treatment with cyantraniliprole was observed to be most promising over all treatments. The remaining treatments in order of efficacy were chlorantriniliprole > lufenuron > flubendiamide > lambda cyhalothrin > spinosad > indoxacarb. However, efficacy of insecticides against per cent fruit damage due to *S. litura* recorded that cyantraniliprole was most effective treatment among all treatment which was at par with chlorantriniliprole. Remaining treatments in order of efficacy were lufenuron > flubendiamide > lambda cyhalothrin > spinosad > indoxacarb.

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6. References
1. Baikar AA, Naik KV. Efficacy of insecticides against fruit borer, *H. armigera* (Hub) infesting Chilli under laboratory condition. Plant Archives. 2016; 16(2):890-892.
2. Vijayalakshmi P, Vijayalakshmi T, Naidu N. Evaluation of certain insecticide molecules against Chilli pod borer, *S. litura* in Andhra Pradesh. J Res. Angrau. 2016; 44(2):26-30.
3. Sreenivas A, Sharanabasappal G, Hosamani AC, Bheemanna M, Suresh BK, Shivaleela *et al*. Efficacy of flubendiamide 480 SC against Chilli fruit borers complex. Pesti. Res. J. 2008; 20(2):243-246.
4. Guru PN, Patil CS. Efficacy of combination product flubendiamide 240+ thiacloprid 240 (Belt expert 480SC) against Chilli fruit borers. J Ento. Zoo. Std. 2018; 6(4):616-620
5. Patil MU, Kulkarni AV, Gavkare O. Bioefficacy of flubendiamide 39.35% SC against Chilli fruit borer, *S. litura* (Fab). Asian J Bio. Sci. 2013; 8(2):241-244.

6. Shad SA, Sayyad AH, Fazal S, Saleem MA, Zaka SM, Ali M. Field evolved resistance to carbamates, Oganophosphates, Pyrethoids, and chemical insecticides in *S. litura*. J Pest. Sci. 2012; 85(1):153-162.
7. Sharma S, Sharma PC. Relative toxicity of novel insecticides against *S. litura* (Fab.) field populations. J Entomo. Res. 2018; 42(1):41-44.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Public. 4th edition, 1985, 87-89.
9. Bhatnagar S, Kumar Y, Karnatak AK. Evaluation of toxicity of indoxacarb and flubendiamide against *S. litura* (Fab.). Bioinfolet. 2013; 10(2A):394-396.
10. Karuppaiah V, Srivastava C. Relative toxicity of newer insecticide molecules against S. litura. Ann. Pl. Protec. Sci. 2013; 21(2):305-308
11. Duraimurugan P, Lakshminarayana M. Efficacy of newer insecticides against defoliators and capsule borer in castor. Indian J Plant Protect. 2014; 42(4):307-311S.
12. Patra B, Alam SK, Samanta A, Chatterjee M. Bioefficacy of lambda cyhalothrin 4.9 C against chilli thrips and fruit borers. Int. J Life Sci. 2015; 10(3):1367-1370.
13. Maruthi MS, Hanumanthaswamy BC, Sharanabasappa, Nagarajappa. Evaluation of safer insecticides against *S. litura* (Fabricius) on capsicum under naturally ventilated Polyhouse condition. J Ento. Zoo. Studies. 2017; 5(6):268-271.
14. Nayaka P, Balikai RA, Mallapur CP. Evaluation of newer insecticide molecules and poison baits against *S. litura* in soybean ecosystem. J Ento. Zoo. Std. 2018; 6(6):22-26