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Evaluation of efficacy of different insecticides against *Spodoptera litura* L. on castor (*Ricinus communis* L.) under laboratory conditions

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Abstract
The efficacy of insecticides against *Spodoptera litura* L. in the laboratory condition during 2015. The variety GCH-7 was sown in plots and ten treatments were evaluate *viz*; Buprofezin 25 EC, Novaluron 10 EC, Chlorpyriphos 20 EC, Dichlorvos 76 EC, Deltamethrin 2.8 EC, Emamectin benzoate 5 SG, Chlorantraniliprole 20 EC, Azadirachtin 1500 ppm, Cyantraniliprole 25 EC, Bifenthrin 10 EC and untreated control in three replications. The order of effectiveness of different insecticides based on persistant toxicity was chlorpyriphos 0.05 percent ≥ dichorvos 0.05 percent > emmamectin benzoate 0.0025 percent > deltamethrin 0.001 percent > bifenthrin 0.005 percent > Azadirachtin 0.15 percent > novaluron 0.01 percent > cyantraniliprole 0.01 percent > chlorantraniliprole 0.02 percent > buprofezin 0.025 percent.

Keywords: Efficacy, insecticides, *Spodoptera litura*, castor

Introduction
Castor bean (*Ricinus communis* L.) is non-edible oil seed crop with enormous significance. India is the world's largest producer of castor contributing to around 85 percent of world's total. The crop is attacked by number of insect pests and the magnitude of insect pest problem is quite high in Southern India where castor is grown mainly as rain fed crop, resulting in lower seed yields. Among the various pests attacking the crop, castor leaf eating caterpillar, *Spodoptera litura* Fabricius is an important polyphagous, obiquitous, multivoltine crop pest. The host range of *S. litura* covers at least 120 species. The loss caused by *S. litura* in different castor cultivars has been estimated to the tune of 12.0 to 23.50 percent under Junagadh condition (Anonymous, 1986) [1]. It is serious pest, larvae cause complete defoliation at blossoming and vegetative stage (Lakshminarayan, 2003; Sarma *et al.*, 2005) [8, 10]. As *S. litura* is one of the important pest and causes considerable damage to the crop.

Materials and Methods
The experiment was conducted at the Department of Agricultural Entomology, Navsari Agricultural University, Navsari during 2015. It was laid out in Completely Randomized Design (C.R.D.) with eleven treatments *Viz*; Buprofezin 25 EC, Novaluron 10 EC, Chlorpyriphos 20 EC, Dichlorvos 76 EC, Deltamethrin 2.8 EC, Emamectin benzoate 5 SG, Chlorantraniliprole 20 EC, Azadirachtin 1500 ppm, Cyantraniliprole 25 EC, Bifenthrin 10 EC and untreated control in three replications.

Application of Insecticides
First, potter tower sprayer, petridish, measuring equipments etc. were cleaned by using acetone before treatment then 100 ml water was taken and preparation of insecticidal solution. After that, uniformly ten second instar larvae were selected. The one ml of requisite concentration of various formulations/insecticides was directly sprayed on test larvae under potter's tower at a pressure of 340 g/cm^2. In case of control, the larvae were sprayed with water. Petri dishes containing the treated larvae were dried for about two minutes then petri dishes containing the treated larvae were transferred individually to another Petri-dish (15 cm diameter × 2 cm height) with wetted blotting paper. The fresh food was provided to insecticide treated larvae. The food was replaced every day. The potter tower sprayers, Petri-dish, measuring equipments etc. were cleaned by using acetone after every treatment.

Method of Observation

To evaluate the effect various insecticides on second instar larvae mortality data was recorded after 1, 2, 3 and 5 days of application of treatment. The larvae not showing any response to touch of brush were considered dead. The data so obtained on larva counts were summed up and utilized for calculation of mortality. The percent mortality was corrected by using Abbotts formula (Abbott, 1925) [2].

$$P = \frac{P' - C}{100 - C} \times 100$$

Where,

P = Corrected mortality percentage in the tested second instars larvae.

P' = Observed mortality percentage in the tested second instars larvae.

C = Percent mortality in control.

The zero and cent percent values was removed by using the following formula (Bartlett, 1947) [3].

For zero percent = 1/4n × 100

For cent percent = (1 – 1/4n) × 100 Where,

n = number of larvae per treatment.

The statistical analysis was done as per Steel and Tory (1980)

Result and Discussion

Dichlorvos 0.05 percent and chlorpyriphos 0.05 percent gave cent percent mortality at first, second, third and fifth day after spraying. While chlorantraniliprole 0.02 percent and cyantraniliprole 0.01 percent registered cent percent reduction in *S. litura* larval population at fifth day after treatment due to different kind of mode of action. Emmamectin benzoate 0.0025 percent also gave cent percent mortality at third and fifth day after spraying. Delamethrin 0.001 percent and bifenthrin 0.005 percent provided 89.26 percent mortality at fifth day after application. Azadirachtin 1500 ppm proved 82.22 percent moderately effective at fifth day after application. buprofezin 0.025 percent was found least effective 44.80 percent amongst the tested insecticides.

Present finding was more or less agreement with the result of Kumawat and Singh (2001) [7] observed that the chlorpyriphos 20 EC (3ml/l) as a good treatment against *S. litura*. Gedia *et al.* (2008) [6] studied that the chlorpyriphos 20 EC 0.05 percent and 0.025 percent provided 53.6 percent and 27.6 percent mortality, respectively in castor at Junagadh, Gujarat. Mandal (2012) [9] reported that the higher effectiveness of cyantraniliprole @ 105 and 90 g a.i./ha against the leaf eating caterpillar, *S. litura* in tomato field condition. Bharpoda *et al*. (2012) [4] at Anand, Gujarat recorded that the higher larval mortality in cyantraniliprole 10 OD @ 75, 90 and 105 g a.i./ha at first, third, fifth and seven days after spraying in cotton. Gadhiya *et al.* (2014) [5] reported that the chlorantraniliprole 20 SC @ 0.006 percent was found effective in protecting the groundnut crop from the infestation of *S. litura* (Fabricius) and *Helicoverpa armigera* (Hubner) which was closely confirmed by present studies.

Table 1: Efficacy of different insecticides against *S. litura* on castor

Sr. No.	Treatment	Concentration (%)	Corrected mortality of *S. litura* (%) Days after spraying						
			1	2	3	5	P	T	PT
1	Buprofezin 25 EC	0.025%	9.10 f (2.50)	26.57 f (20.00)	35.90 e (34.44)	44.80 e (49.63)	5	26.64	133.20
2	Novaluron 10 EC	0.01%	28.78 e (23.33)	46.92 e (53.33)	53.92 d (65.19)	55.42 d (67.78)	5	52.40	262.00
3	Chlorpyriphos 20 EC	0.05%	80.90 a (97.50)	80.90 a (97.50)	80.90 a (97.50)	80.90 a (97.50)	5	97.50	487.50
4	Dichlorvos 76 EC	0.05%	80.90 a (97.50)	80.90 a (97.50)	80.90 a (97.50)	80.90 a (97.50)	5	97.50	487.50
5	Deltamethrin 2.8 EC	0.001%	66.15 bc (83.33)	68.86 bc (86.67)	71.22 b (89.63)	70.88 b (89.26)	5	87.22	436.10
6	Emamectin benzoate 5 SG	0.0025%	68.86 b (86.67)	71.57 b (90.00)	80.90 a (97.50)	80.90 a (97.50)	5	92.92	464.60
7	Chlorantraniliprole 20 SC	0.02%	9.10 f (2.50)	9.10 g (2.50)	24.20 f (17.04)	80.90 a (97.50)	5	29.89	149.45
8	Azadirachtin 1500 ppm	0.15%	33.21 d (30.00)	54.78 d (66.67)	62.92 c (79.26)	65.28 c (82.22)	5	64.54	322.70
9	Cyantraniliprole 25 EC	0.01%	9.10 f (2.50)	9.10 g (2.50)	31.52 e (27.41)	80.90 a (97.50)	5	32.48	162.40
10	Bifenthrin 10 EC	0.005%	63.44 c (80.00)	54.78 c (83.33)	68.51 b (86.30)	65.28 b (89.26)	5	84.72	423.60
11	Control	-	9.10 (2.50)	9.10 (2.50)	9.10 (2.50)	9.10 (2.50)	5	10.00	2.00
S. Em.± T			5.34	6.11	7.28	4.56			
C.D. at 5% T			3.91	4.19	4.57	3.61			
C.V. %			5.54	5.19	4.95	3.26			

* Figures are angular transformed values; Figures in parentheses are original values.

P= Period of time, T= Average toxicity of the insecticides, PT= Persistent toxicity

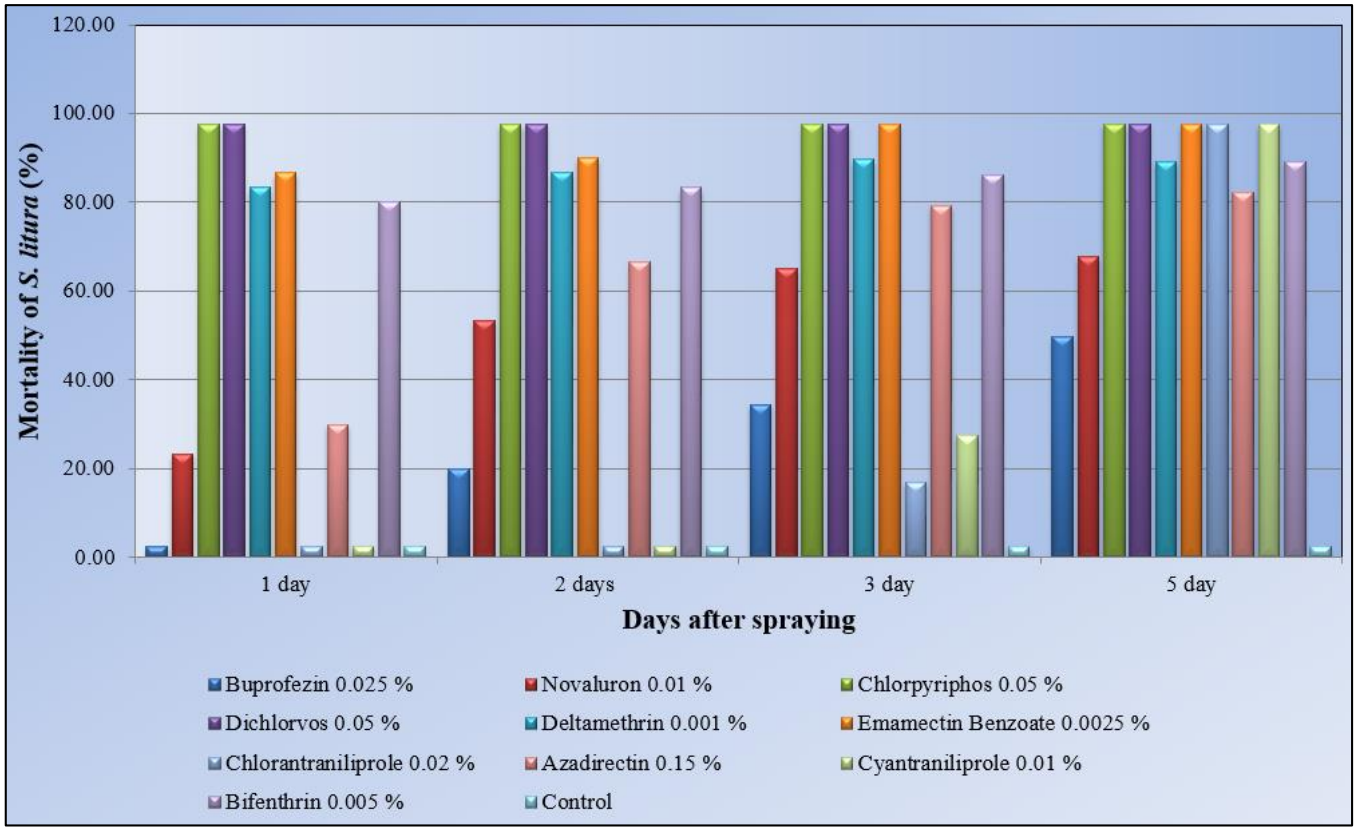

Fig 1: Efficacy of different insecticides on *S. litura* on castor

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