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Bioefficacy of Modern Insecticides against *Spodoptera litura* Fabricius on Groundnut

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***Abstract* – Investigation on Bioefficacy of nine modern insecticides under field condition against *S. litura* on groundnut revealed that emamectin benzoate 0.005 per cent, chlorpyriphos 0.05 per cent, cypermethrin 0.016 per cent and chlorantraniliprole 0.006 per cent were found to be the most effective. On the other hand, indoxacarb 0.008 per cent and spinosad 0.009 per cent were found to be the least effective.**

Looking to the efficacy of all the insecticides emamectin benzoate 0.005 per cent, chlorpyriphos 0.05 per cent, cypermethrin 0.016 per cent and chlorantraniliprole 0.006 per cent can be suggested to the farmers for the management of *S. litura* in groundnut.

***Keywords* – Bioefficacy, *Spodoptera litura*, Modern, Insecticides, Groundnut.**

I. INTRODUCTION

Groundnut (*Arachis hypogaea* Linnaeus) is a leguminous oilseed crop and its native is South America. It was first found in Brazil or Peru as early as 950 BC and later spread to Africa, North America, Europe and Asia. The major groundnut producing countries are China, Nigeria, USA, Taiwan, Indonesia, Senegal, Ghana, Argentina and Brazil. It is the most important commercial oilseed crop mostly grown in the semi-arid tropical region like India. The crop can be grown successfully in the areas receiving rainfall from 600 to 1250 mm. The best soil for the groundnut crop is sandy loam, loamy and medium black with good drainage system (Anonymous, 1990a). The groundnut has a distinct position among the oilseeds as it can be consumed and utilized in diverse ways. The chemical composition of groundnut compares favorably with that of dry fruits. Some of the nutrients like protein and thiamine are available in higher quantities in groundnut than any other dry fruits. Groundnut oil is considered as stable and nutritive as it contains just the right proportion of Oleic acid (40-50 %) and Linoleic acids (25-35 %) (Mathur and Khan, 1997). It is a rich source of edible oil (47-50 %) and high quality of protein (30%) and hence groundnut is valued both for edible oil and confectionery purposes. The groundnut kernels are consumed as raw, boiled, roasted or fried products and also used in varieties of culinary preparations like peanut butter, peanut milk, chocolates (Desai *et al*., 1999).

In India, groundnut occupies a predominant position and grown in about 4.93 million hectare with a production of 5.94 million tons and the productivity is 1144 kg/ha (Anonymous, 2010a). Among the important groundnut growing States in the country, Gujarat has a lion share. In Gujarat, groundnut is grown in about 1.90 million hectare with production of 2.66 million tons and productivity is 1395 kg/ha (Anonymous, 2010b).

In India, groundnut is grown as a rainfed crop in bulk during *kharif* season, but it is also taken during summer season, wherever the irrigation facilities are available. This crop is grown as monoculture in Saurashtra region of Gujarat State. The major groundnut growing districts in the State are Junagadh, Rajkot, Amreli, Jamnagar, Bhavnagar and Kachh, which contribute about 88% of total production of groundnut in Gujarat State (Anonymous, 1990b). The damage caused by a given species of insects depends on population of damaging stage of insect, crop growth stage of insect, cropping pattern in the area and climate etc. (Patel and Patel, 1983). As many as 52 species of insect pests are recorded infesting the groundnut crop in India. (Singh *et al.*,1990).

Among the various insect pests attacking this crop, leaf eating caterpillar, *S. litura*, commonly known as tobacco caterpillar, a polyphagous pest is found in entire groundnut growing countries in Asia, Australia and the Pacific basin (Feakin, 1973) and causes extensive damage to the crop at its initial stage. This pest now became serious one on groundnut crop in Gujarat State. Hence, this type of study is now became useful for the long term management of this pest.

As *S. litura* is one of the important pests and causes considerable damage to the crop, blanket use of insecticides have recommended for the effective and economic control of the pest in groundnut. The injudicious application of insecticides created many adverse effects resulting into environmental pollution and health hazards and development of resistance in *S. litura* to several insecticides.

II. MATERIALS AND METHODS

A field experiment was conducted to ascertain the efficacy of modern chemical insecticides against *S. litura* infesting groundnut.

The details of the treatments are mentioned as below.

Treatment		Dose/ Concentration
T_1	Chlorantraniliprole 18.5SC	0.006%
T_2	Flubendiamide 39.35SC	0.01%
T_3	Spinosad 45SC	0.009%
T_4	Novaluron 10EC	0.01%
T_5	Cypermethrin 25EC	0.016%
T_6	Chlorpyriphos 20EC	0.05%
T_7	Methomyl 40SP	0.05%
T_8	Indoxacarb 14.5SC	0.008%
T_9	Emamectin benzoate 5WDG	0.005%
T_{10}	Control	-

Application of Treatment

Observations

(a) Observations on larval population of *S. litura* was counted from the five randomly selected plant from the net

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plot area before 24 hr of spray and subsequently observations were recorded at one, three and five day after spraying.

(b) The data thus obtained were converted into per cent mortality by using the formula given by Abbott (1925) and modified by Henderson and Tilton (1955) and analyzed statistically.

$$\text{Corrected per cent mortality} = 100 \times \left(1 - \frac{T_a \times C_b}{T_b \times C_a}\right)$$

Where,

T_a = Number of larvae recorded after treatment

T_b = Number of larvae recorded before treatment

C_a = No of larvae recorded from check plot after treatment

C_b = No of larvae recorded from check plot before treatment

III. Results and Discussion

An experiment was conducted under field condition to determine the bioefficacy of modern insecticides against *S. litura* on groundnut during *kharif* 2011-12. Spraying of various insecticides at mentioned dose was done twice, first application at ETL (one egg mass or one larval mass/plant) and the second spraying was done at 15 day after first spray. The data on percentage mortality obtained after each spray are summarized in Table 1 and 2.

First Spray

The data on mortality of *S. litura* recorded at one day after first spray presented in Table 1 and depicted in Fig. 1 revealed that chlorpyriphos 0.05 per cent showed significantly the highest mortality (81.71%) and it was on par with the treatment of cypermethrin 0.016 per cent (77.42%), methomyl 0.05 per cent (73.62%), novaluron 0.01 per cent (71.79), emamectin benzoate 0.005 per cent (70.36%) and indoxacarb 0.008 per cent (68.72). Whereas, the spinosad 0.009 per cent recorded significantly the lowest mortality (51.72%) and it was on par with chlorantraniliprole 0.006 per cent (65.53%) and flubendiamide 0.01 per cent (62.11%).

The data on mortality of *S. litura* recorded at three day after first spray presented in Table 1 and depicted in Fig. 1 revealed that emamectin benzoate 0.005 per cent showed significantly the highest mortality (92.89%) and it was on par with the treatment of flubendiamide 0.01 per cent (90.66%), chlorantraniliprole 0.006 per cent (89.59%) and cypermethrin 0.016 per cent (84.01%). On the other side, spinosad 0.009 per cent recorded significantly the lowest mortality (53.36%). Among the other treatments, chlorpyriphos 0.05 per cent, novaluron 0.01 per cent, methomyl 0.05 per cent and indoxacarb 0.008 per cent remained next best treatments by recording 83.38, 77.58, 75.71 and 69.70 per cent mortality, respectively.

The data on mortality of *S. litura* recorded at fifth day after first spray presented in Table 1 and depicted in Fig. 1 revealed that significantly the highest mortality was found in emamectin benzoate 0.005 per cent (95.26%) and it was on par with the treatments of flubendiamide 0.01 per cent (92.88%), chlorantraniliprole 0.006 per cent (91.08%) and cypermethrin 0.016 per cent (86.21%) were found equally effective whereas, the spinosad 0.009 per cent showed the lowest mortality (56.51%). Among the other treatments, chlorpyriphos 0.05 per cent, novaluron 0.01 per cent, methomyl 0.05 per cent and indoxacarb 0.008 per cent, remained next best treatments as they registered 85.15, 79.08, 76.69 and 71.39 per cent mortality, respectively.

Second Spray

The data on mortality of *S. litura* recorded at one day after second spray presented in Table 2 and depicted in Fig. 2 revealed that cypermethrin 0.016 per cent showed significantly the highest mortality (82.25%) and it was at par with the treatment of chlorpyriphos 0.05 per cent (80.47%), novaluron 0.01 per cent (73.04), emamectin benzoate 0.005 per cent (72.82%) and methomyl 0.05 per cent (70.14%), while the lowest mortality was found in spinosad 0.009 per cent (45.62%) and it was at par with the treatment indoxacarb 0.008 per cent (59.70%). Among the other treatments, chlorantraniliprole 0.006 per cent and flubendiamide 0.01 per cent remained next best treatments and recorded mortality to the tune of 66.94 and 63.16 per cent mortality.

The data on mortality of *S. litura* recorded at three day after second spray presented in Table 2 and depicted in Fig. 2 revealed that emamectin benzoate 0.005 per cent significantly recorded the highest mortality (93.02%) and it was at par with the treatments flubendiamide 0.01 per cent (91.49%), chlorantraniliprole 0.006 per cent (88.31%) and cypermethrin 0.01 per cent (83.47%). The next best treatments were chlorpyriphos 0.05 per cent, methomyl 0.05 per cent, novaluron 0.01 per cent and indoxacarb 0.008 per cent, which recorded 82.72, 79.11, 74.34 and 65.81 per cent mortality, respectively. The insecticide spinosad 0.009 per cent showed the lowest mortality (53.17%).

The data on mortality of *S. litura* recorded on fifth day after second spray presented in Table 2 and depicted in Fig. 2 revealed that chlorantraniliprole 0.006 per cent significantly recorded the highest mortality (92.38%) and it was on par with the treatments emamectin benzoate 0.005 per cent (91.88%), flubendiamide 0.01 per cent (91.78%), cypermethrin 0.016 per cent (83.44%) and chlorpyriphos 0.05 per cent (82.55%). Among the other treatments, methomyl 0.05 per cent and novaluron 0.01 per cent remained next best treatments which recorded 80.55 and 77.34 per cent mortality, respectively. The lowest mortality was found in spinosad 0.009 per cent (60.41%) and it was on par with the treatment indoxacarb 0.008 per cent (68.83%).

More or less, similar findings were recorded by the various workers *viz.,* Bass (1978); Natesan and Balasubramanian (1979); Prasad *et al.* (1991); Singh and Nath (1998); Virani (2000); Munir and Saleem (2004); Hosamani *et al.* (2008); Prasad *et al.* (2007); Hosamani *et al.* (2008); Tatagar *et al.* (2009) and Satanarayana *et al.* (2010).]

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Table 1: Bioefficacy of Modern Insecticides Against *S. litura* on Groundnut During *Kharif* 2011-12

S. No.	Treatment	Concentration (%)	Corrected Per Cent Mortality of *S. litura* after First Spray		
			1 day	3 day	5 day
1.	Chloranthranilide 18.5SC	0.006%	54.05 * (65.53)	71.18 (89.59)	72.62 (91.08)
2	Flubendiamide 39.35SC	0.01%	52.01 (62.11)	72.20 (90.66)	74.52 (92.88)
3	Spinosad 45SC	0.009%	45.98 (51.72)	46.93 (53.36)	48.74 (56.51)
4	Novaluron 10EC	0.01%	57.92 (71.79)	61.74 (77.58)	62.78 (79.08)
5	Cypermethrin 25EC	0.016%	61.63 (77.42)	66.43 (84.01)	68.20 (86.21)
6	Chlorpyriphos 20EC	0.05%	64.68 (81.71)	65.94 (83.38)	67.34 (85.15)
7	Methomyl 40SP	0.05%	59.09 (73.62)	60.47 (75.71)	61.13 (76.69)
8	Indoxocarb 14.5SC	0.008%	55.99 (68.72)	56.60 (69.70)	57.66 (71.39)
9	Emamectin benzoate 5WDG	0.005%	57.01 (70.36)	74.53 (92.89)	77.42 (95.26)
		S. Em. ±	3.04	2.81	3.27
		C.D. at 5%	9.04	8.36	9.71
		C.V. %	10.36	8.46	9.59

*Arcsine transformed value. Figures in the parentheses are retransformed values

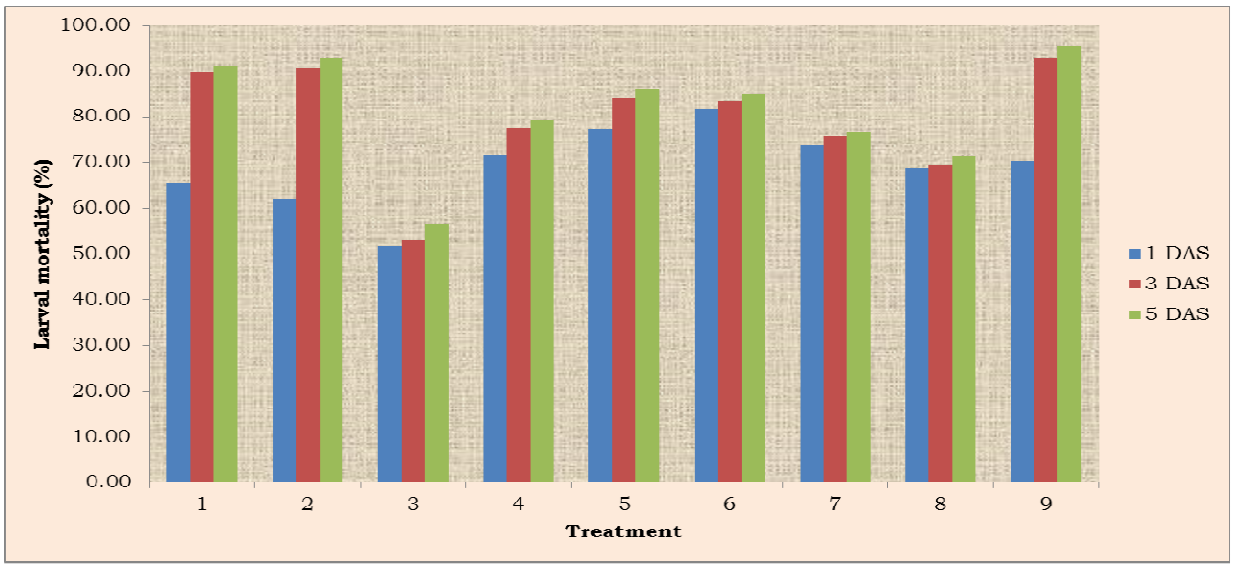

Fig.1. Bioefficacy of modern insecticides against *S. litura* on groundnut after first spray during *kharif* 2011-12
DAS = Days After Spray

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Table 2: Bioefficacy Of Modern Insecticides Against *S. litura* On Groundnut During *Kharif* 2011-12

S. No.	Treatments	Concentration (%)	Corrected Per Cent Mortality of *S. litura* after second spray		
			1 day	3 days	5 days
1	Chloranthranilide 18.5SC	0.006%	54.90* (66.94)	70.01 (88.31)	73.98 (92.38)
2	Flubendiamide 39.35SC	0.01%	52.63 (63.16)	73.04 (91.49)	73.34 (91.78)
3	Spinosad 45SC	0.009%	42.49 (45.62)	46.82 (53.17)	51.01 (60.41)
4	Novaluron 10EC	0.01%	58.72 (73.04)	59.57 (74.34)	61.57 (77.34)
5	Cypermethrin 25EC	0.016%	65.08 (82.25)	66.71 (84.37)	65.99 (83.44)
6	Chlorpyriphos 20EC	0.05%	63.77 (80.47)	65.44 (82.72)	65.31 (82.55)
7	Methomyl 40SP	0.05%	56.88 (70.14)	62.80 (79.11)	63.47 (80.05)
8	Indoxocarb 14.5SC	0.008%	50.59 (59.70)	54.22 (65.81)	56.06 (68.83)
9	Emamectin benzoate 5WDG	0.005%	58.58 (72.82)	74.68 (93.02)	73.44 (91.88)
		S. Em. ±	3.09	2.72	2.99
		C.D. at 5%	9.18	8.08	8.89
		C.V. %	10.63	8.22	8.87

*Arcsine transformed value. Figures in the parentheses are retransformed values

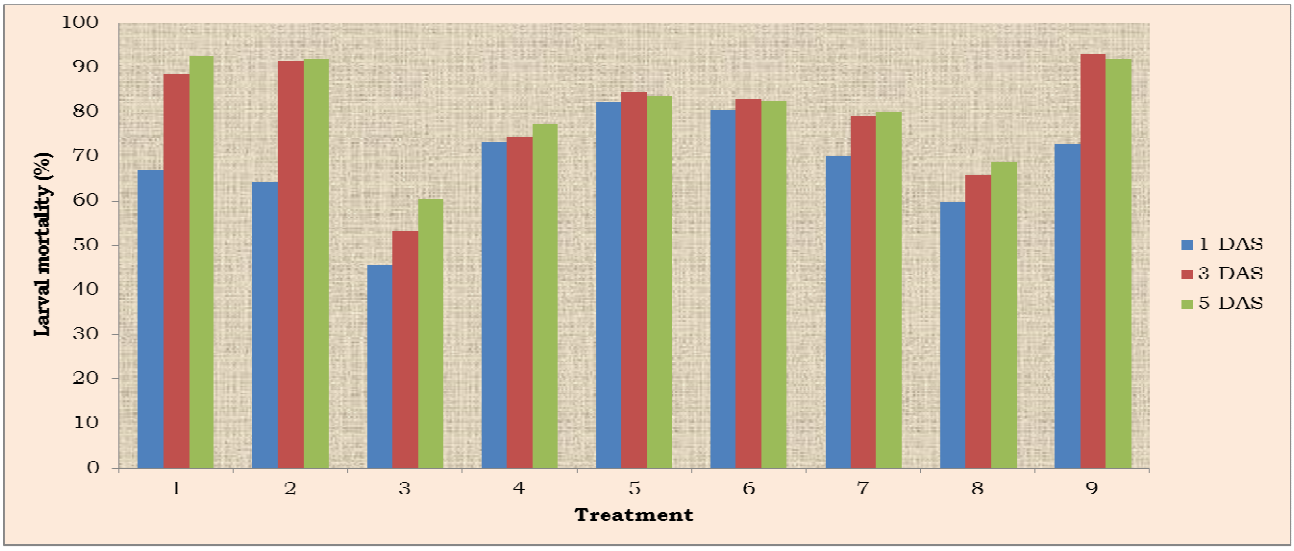

Fig.2. Bioefficacy of modern insecticides against *S. litura* on groundnut after second spray during *kharif* 2011-12
DAS = Days After Spray

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