

BIO-EFFICACY OF NEWER INSECTICIDES AGAINST POD BORER COMPLEX OF PIGEONPEA [*Cajanus cajan* (L.) Millspaugh]

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ABSTRACT

The experiment on bio-efficacy of newer insecticides against pod borer complex on pigeonpea (Cajanus cajan (L.) Millspaugh) was conducted at Center of Excellence for Research on Pulses, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during Kharif 2012-13. Among the various insecticides, chlorantraniliprole @ 30 g a.i./ha was the most effective insecticide against gram pod borer and blue butterfly, while profenophos 50 EC @ 250 g a.i./ha was the most effective insecticide against tur plume moth. Chlorantraniliprole 18.5 % SC @ 30 g a.i./ha registered the lowest pod damage due to borer and pod fly and recorded the highest yield of pigeonpea.

KEY WORDS: *Cajanus cajan*, pigeonpea, pod borer complex

INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millspaugh], also known as red gram, tur or arhar, is the second most important grain legume of India after chickpea with the production of 2.65 million tonnes from 4.04 million hectares area with an average productivity of 656 kg/ha (Anonymous, 2012). In Gujarat, pigeonpea covers the area about 0.24 million hectares and production about 0.26 million tonnes with an average productivity of 1057 kg/ha (Anonymous, 2012). Nearly, 30 species of lepidopteran of six family's feeds on the reproductive stage of pigeonpea (Shanower *et al.*, 1999). Mandal *et al.* (2009) observed that pigeonpea infested with as many as 21 insect pests and 2 species of mites at different stages of crop growth in an overlapping manner. Pigeonpea is attacked by insect/pests right from sowing to harvesting

and also during the storage. Among the pod borer complex, gram pod borer (*Helicoverpa armigera* Hardwick), blue butterfly (*Euchrysops cnejus* Fabricius), tur plume moth (*Exelastis atomosa* Walsingham) and tur pod fly (*Melanagromyza obtuse* Malloch) cause heavy damage to pods resulting in extensive loss in the grain yield. Considering the seriousness of the problem, newer insecticides were evaluated in the present experiment.

MATERIALS AND METHODS

With a view to evaluate bio-efficacy of newer insecticides against pod borer complex, a field experiment was conducted in randomized block design with eleven treatments replicated thrice at Center of Excellence for Research on Pulses, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during Kharif 2012-13. The plots (Plate 1) having uniform

size (Gross: 3.00 m x 4.00 m and Net: 1.80 m x 3.00 m), with a spacing of 60 cm x 15 cm was used for the study. Various insecticides were applied at respective dose with the help of knapsack sprayer. The first application of insecticidal treatment was made at 50 per cent flowering stage. The second spray was given at fifteen days interval after first spray. For recording observations, five plants were selected and tagged with the help of white plastic label for each treatment. Number of larval population of gram pod borer, tur plume moth and blue butterfly were counted and recorded from the five tagged selected plants. Larval population was counted before spraying and 3, 5, 7 and 10 days after each spraying. At the time of harvest, 200 pods were collected randomly from the each treatment and numbers of healthy and damaged pods were counted to calculate the pod damage percentage for gram pod borer and pod fly. Yield of pigeonpea from the net plot was recorded and weighted with the help of electronic weighing balance and converted in to kg/ha. The data, thus, obtained were subjected to statistical analysis for drawing meaningful conclusion.

RESULTS AND DISCUSSION

Efficacy of eleven newer insecticides was evaluated against gram pod borer, tur plume moth and blue butterfly on pigeonpea. The results showed that the difference in larval population of gram pod borer, tur plume moth and blue butterfly per plant among different treatments before spray was non-significant, which indicated that larval population of pod borer complex was uniformly distributed in whole experimental plot (Table 1). All the tested insecticides were found significantly superior to control in reducing the larval population in pooled of two spray analysis.

The lowest larval population of gram pod borer (0.50 larvae/plant) was observed in the plots treated with chlorantraniliprole 18.5 % SC @ 30 g a.i./ha. Chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 37.5 g

a.i./ha and chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 30 g a.i./ha were also effective to control gram pod borer, which recorded 0.64 and 0.69 larvae/plant, respectively and was at par with each other and proved to be the second group of effective treatments. The remaining insecticides profenophos 50 EC @ 250 g a.i./ha (0.80 larvae/plant), indoxacarb 14.5 % SC @ 75 g a.i./ha (1.14 larvae/plant), lambda cyhalothrin 4.9 % CS @ 25 g a.i./ha (1.22 larvae/plant), *Bacillus thuringiensis* @ 750 g/ha (1.30 larvae/plant), NPV @ 450 LE/ha (1.30 larvae/plant), neem oil @ 0.5 % (1.38 larvae/plant) and NSKE @ 5 % (1.43 larvae/plant) were found less effective against gram pod borer (Table 1 and Fig. 1).

Among various treatments, profenophos 50 EC @ 250 g a.i./ha was significantly superior over rest of the treatments and recorded the lowest larval population of tur plume moth (0.33 larvae/plant). The second group of effective treatments were chlorantraniliprole 18.5 % SC @ 30 g a.i./ha (0.42 larvae/plant), chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 37.5 g a.i./ha (0.46 larvae/plant) and chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 30 g a.i./ha (0.50 larvae/plant) and were at par with each other. The remaining insecticides, indoxacarb 14.5 % SC @ 75 g a.i./ha, lambda cyhalothrin 4.9 % CS @ 25 g a.i./ha, NPV @ 450 LE/ha, NSKE @ 5 %, neem oil @ 0.5 % and *Bacillus thuringiensis* @ 750 g/ha were recorded 0.69, 0.73, 0.80, 0.85, 0.92 and 0.99 larvae/plant, respectively and were not found effective against tur plume moth (Table 1 and Fig. 1).

Among various treatments, chlorantraniliprole 18.5 % SC @ 30 g a.i./ha was significantly superior over rest of the treatments (Table 1 and Fig. 1), which recorded the lowest larval population of blue butterfly (0.33 larvae/plant). However, it was at par with treatment of profenophos 50 EC @ 250 g a.i./ha, which was recorded 0.40 larvae/plant

and proved to be the second effective treatment. The remaining insecticides chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 37.5 g a.i./ha (0.46 larvae/plant) and chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % @ 30 g a.i./ha ZC (0.54 larvae/plant), indoxacarb 14.5 % SC @ 75 g a.i./ha (0.64 larvae/plant), lambda cyhalothrin 4.9 % CS @ 25 g a.i./ha (0.96 larvae/plant), NSKE @ 5 % (1.01 larvae/plant), neem oil @ 0.5 % (1.09 larvae/plant), NPV @ 450 LE/ha (1.11 larvae/plant) and *Bacillus thuringiensis* @ 750 g/ha (1.16 larvae/plant), were less effective against blue butterfly.

The results on per cent pod damage due to gram pod borer at harvest (Table 2 and Fig. 2) showed that all the insecticides were found significantly superior over untreated control (29.12 %). Among various treatments, chlorantraniliprole 18.5 % SC @ 30 g a.i./ha registered the lowest pod borer damage (12.91 %). However, it remained at par with the treatments of profenophos 50 EC @ 250 g a.i./ha (14.78 %), chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 37.5 g a.i./ha (16.07 %) and chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 30 g a.i./ha (16.54 %) and rank second to reduce the gram pod borer infestation. The remaining insecticides viz., indoxacarb 14.5 % SC @ 75 g a.i./ha, lambda cyhalothrin 4.9 % CS @ 25 g a.i./ha, *Bacillus thuringiensis* @ 750 g/ha and NPV @ 450 LE/ha were at par with one-another and exhibited 19.27, 19.83, 20.08 and 20.78 per cent pod damage, respectively and were less effective treatments. Neem oil @ 0.5 % (21.62 %) and NSKE @ 5 % (22.58 %) were least effective treatments against gram pod borer.

The plots sprayed with chlorantraniliprole 18.5 % SC @ 30 g a.i./ha recorded lowest per cent pod damage due to pod fly (6.25 %) and was at par with the treatments of profenophos 50 EC @ 250 g a.i./ha (7.71 %), indoxacarb 14.5 % SC @ 75 g a.i./ha (8.13 %), chlorantraniliprole 9.3 % +

lambda cyhalothrin 4.6 % ZC @ 37.5 g a.i./ha (8.32 %) and chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 30 g a.i./ha (8.66 %) and proved second effective group of treatments. The remaining treatments viz., lambda cyhalothrin 4.9 % @ 25 g a.i./ha, NSKE @ 5 %, NPV @ 450 LE/ha, *Bacillus thuringiensis* @ 750 g/ha and neem oil @ 0.5 % registered 11.13, 12.31, 12.83, 13.16 and 13.49 per cent pod damage due to pod fly, respectively and were less effective against pod fly (Table 2 and Fig. 2).

Among various treatments, chlorantraniliprole 18.5 % SC @ 30 g a.i./ha recorded the highest yield of 1354.67 kg/ha and proved its superiority over all the treatments. However, it was found statistically at par with profenophos 50 EC @ 250 g a.i./ha (1286.00 kg/ha), chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 37.5 g a.i./ha (1238.00 kg/ha), chlorantraniliprole 9.3 % + lambda cyhalothrin 4.6 % ZC @ 30 g a.i./ha (1210.33 kg/ha) and indoxacarb 14.5 % SC @ 75 g a.i./ha (1134.33 kg/ha) and proved second effective group of treatments. The remaining treatments viz., lambda cyhalothrin 4.6 % CS @ 25 g a.i./ha, *Bacillus thuringiensis* @ 750 g/ha, neem oil @ 0.5 %, NPV @ 450 LE/ha and NSKE @ 5 % recorded 1108.67, 1088.67, 1074.00, 1059.00 and 1041.67 kg/ha grain yield of pigeonpea, respectively and were not more effective against pod borers. The unsprayed plots recorded low grain yield (876.33 kg/ha) of pigeonpea (Table 2 and Fig. 3).

From the above results, it can be seen that chlorantraniliprole @ 30 g a.i./ha was the most effective insecticide against pod borer complex and recorded highest grain yield of pigeonpea, while profenophos @ 250 g a.i./ha, chlorantraniliprole + lambda cyhalothrin @ 37.5 g a.i./ha, chlorantraniliprole + lambda cyhalothrin @ 30 g a.i./ha and indoxacarb @ 75 g a.i./ha were less effective and rank second in controlling the pod borer complex and yield. Efficacy of newer insecticides was also studied

by some researchers in the past. Nishantha *et al.* (2009) reported that rynaxypyr @ 40g a.i./ha proved most effective insecticide against gram pod borer and tur plume moth in pigeonpea and recorded lowest pod damage due to gram pod borer and pod fly and higher grain yield. Prajapati and Patel (2010) reported that thiodicarb, indoxacarb and spinosad exhibited the lowest pod fly damage in pigeonpea.

CONCLUSION

From the above results, it can be concluded that chlorantraniliprole @ 30 g a.i./ha was the most effective insecticide against pod borer complex and recorded highest grain yield of pigeonpea, while profenophos @ 250 g a.i./ha, chlorantraniliprole + lambda cyhalothrin @ 37.5 g a.i./ha, chlorantraniliprole + lambda cyhalothrin @ 30 g a.i./ha and indoxacarb @ 75 g a.i./ha were less effective and rank second in controlling the pod borer complex and yield.

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Table 1: Bio-efficacy of newer insecticides against pod borer complex in pigeonpea

Sr. No.	Treatments	Dose (g a.i./ha)	Larval Population of Pod Borers/Plant					
			Gram Pod Borer		Tur Plume Moth		Blue Butterfly	
			Before Spray	Pooled #	Before Spray	Pooled #	Before Spray	Pooled #
1.	Chlorantraniliprole 9.3 % + Lambda cyhalothrin 4.6 % ZC	30	1.56*(1.93)	1.09(0.69)	1.35(1.32)	1.00(0.50)	1.42(1.52)	1.02(0.54)
2.	Chlorantraniliprole 9.3 % + Lambda cyhalothrin 4.6 % ZC	37.5	1.52(1.81)	1.07(0.64)	1.38(1.40)	0.98(0.46)	1.40(1.46)	0.98(0.46)
3.	Chlorantraniliprole 18.5 % SC	30	1.54(1.87)	1.00(0.50)	1.35(1.32)	0.96(0.42)	1.38(1.40)	0.91(0.33)
4.	Lambda cyhalothrin 4.9 % CS	25	1.56(1.93)	1.31(1.22)	1.33(1.27)	1.11(0.73)	1.42(1.52)	1.21(0.96)
5.	Profenophos 50 EC	250	1.52(1.81)	1.14(0.80)	1.33(1.27)	0.91(0.33)	1.40(1.46)	0.95(0.40)
6.	Indoxacarb 14.5 % SC	75	1.56(1.93)	1.28(1.14)	1.38(1.40)	1.09(0.69)	1.45(1.60)	1.07(0.64)
7.	Neem oil 0.5 %	-	1.56(1.93)	1.37(1.38)	1.35(1.32)	1.19(0.92)	1.42(1.52)	1.26(1.09)
8.	NSKE 5 %	-	1.52(1.81)	1.39(1.43)	1.30(1.19)	1.16(0.85)	1.40(1.46)	1.23(1.01)
9.	B.t. (<i>Bacillus thuringiensis</i>)	750	1.54(1.87)	1.34(1.30)	1.33(1.27)	1.22(0.99)	1.40(1.46)	1.29(1.16)
10.	NPV (Nuclear Polyhedrosis Virus)	450 LE/ha	1.52(1.81)	1.34(1.30)	1.30(1.19)	1.14(0.80)	1.42(1.52)	1.27(1.11)
11.	Control (Untreated)	-	1.52(1.81)	1.55(1.90)	1.33(1.27)	1.35(1.32)	1.38(1.40)	1.42(1.52)
S. Em. ±			0.06	0.018	0.06	0.016	0.07	0.018
C.D. at 5 % T			NS	0.05	NS	0.04	NS	0.05
C.V. %			6.69	8.08	7.38	8.22	8.16	8.57

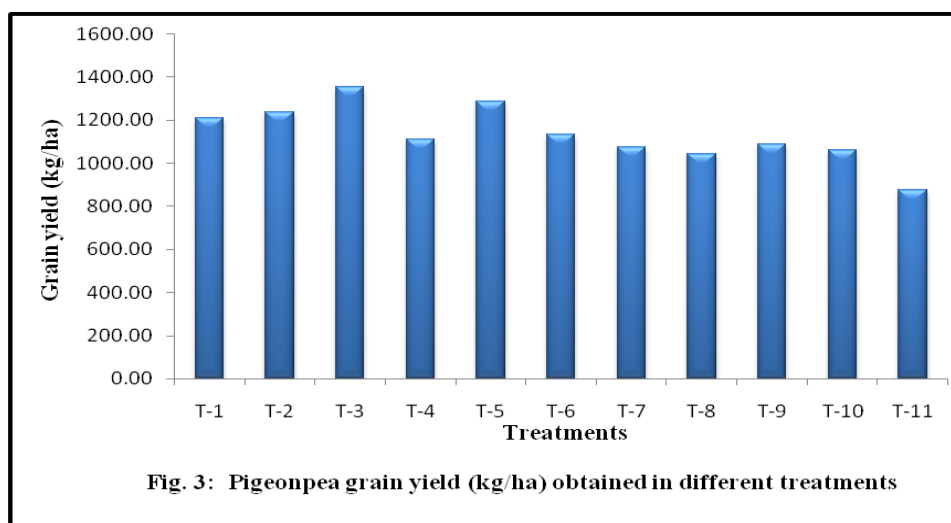
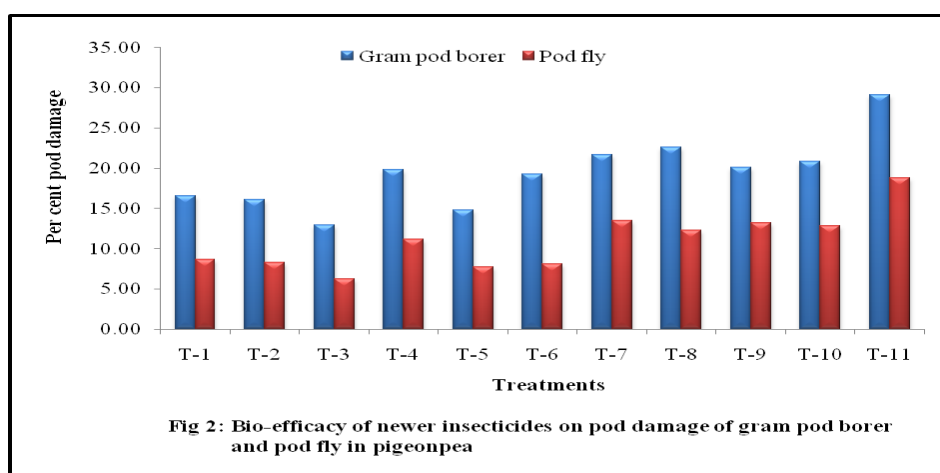
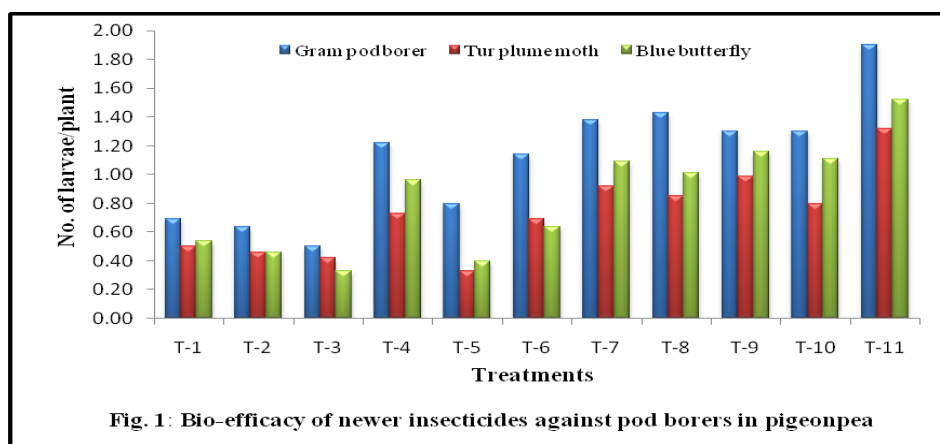
* Figures outside parenthesis are $\sqrt{x + 0.5}$ transformation values, while those in parenthesis are retransformed values
pooled after two spray application.

Table 2: Bio-efficacy of newer insecticides on pod damage of gram pod borer and pod fly in pigeonpea and Grain yield in pigeonpea

Sr. No.	Treatments	Dose (g a.i./ha)	Per Cent Damage at Harvest		Yield (kg/ha)
			Gram Pod Borer	Pod Fly	
1.	Chlorantraniliprole 9.3 % + Lambda cyhalothrin 4.6 % ZC	30	24.00*(16.54)**	17.11(8.66)	1210.33
2.	Chlorantraniliprole 9.3 % + Lambda cyhalothrin 4.6 % ZC	37.5	23.63(16.07)	16.76(8.32)	1238.00
3.	Chlorantraniliprole 18.5 % SC	30	21.06(12.91)	14.48(6.25)	1354.67
4.	Lambda cyhalothrin 4.9 % CS	25	26.44(19.83)	19.49(11.13)	1108.67
5.	Profenophos 50 EC	250	22.61(14.78)	16.12(7.71)	1286.00
6.	Indoxacarb 14.5 % SC	75	26.04(19.27)	16.57(8.13)	1134.33
7.	Neem oil 0.5 %	-	27.71(21.62)	21.55(13.49)	1074.00
8.	NSKE 5 %	-	28.37(22.58)	20.54(12.31)	1041.67
9.	B.t. (<i>Bacillus thuringiensis</i>)	750	26.62(20.08)	21.27(13.16)	1088.67
10.	NPV (Nuclear Polyhedrosis Virus)	450 LE/ha	27.12(20.78)	20.99(12.83)	1059.00
11.	Control (Untreated)	-	32.66(29.12)	25.65(18.74)	876.33
S. Em. ±			1.57	1.07	78.63
C.D. at 5 %			4.52	3.10	231.97
C.V. %			10.45	9.73	12.01

*Arc sin transformed values

** Figures in the parenthesis are retransformed values



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