MANAGEMENT OF POD BUG, *Clavigralla gibbosa* Spinola ON PIGEONPEA IN NORTH GUJARAT

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ABSTRACT

The investigation on management of pod bug, Clavigralla gibbosa Spinola in pigeonpea (variety GT 101) was carried out at the Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar during 2012-13. The results revealed that imidacloprid 17.8 SL @ 0.005 per cent proved to be the most effective in reducing C. gibbosa, also recorded the highest grain yield (1421 kg/ha), per cent increase in yield over control (66.68%) and protection cost benefit ratio (1:11.83) followed by clothianidin 50 WDG @ 0.025 per cent and thiamethoxam 25 WG @ 0.008 per cent.

KEY WORDS: Clavigralla gibbosa, Economics, Pigeonpea, Pod bug,

INTRODUCTION

Pigeonpea (*Cajanus cajan* L.) Millsp. is one of the major grain legume crops of the semi-arid tropics. It is a rich source of protein as seed contains 18 to 26 per cent protein. In India, it is most widely grown as grain legume second only to chickpea (Ratnaparkhe and Gupta, 2007). India is the largest producer of pigeonpea, contributing about 90 per cent of world's total production. However, productivity is always been a concern. The low productivity may be attributed to many reasons, among which damage by insect pests is of paramount importance (Mishra *et al*., 2012).

Among the pod damaging insect pests of pigeonpea, next to pod borers, pod sucking bug, *Clavigralla gibbosa* Spinola (Hemiptera: Coreidae) has become a threat to quality grain production (Chakravarty *et al*., 2016) since both nymphs and adults feed by piercing the pod walls and extracting nutrients from the developing grains thereby resulting in premature shedding of pods, deformation of pods and shriveling of grains which results in major reduction to grain yield in pigeonpea (Srujana and Keval, 2014). Damaged seeds further do not germinate and are not acceptable for human consumption (Shanower *et al*., 1999). The losses in grain yield production due to the bug generally range between 25 to 40 per cent (Gopali *et al*., 2013). It has been shown beyond doubt that application of synthetic insecticides can keep the crop safe from insect infestation for varying periods and is quite a potent method in integrated pest management. Therefore, the present study was carried out to evaluate the effectiveness of synthetic insecticides against *C. gibbosa* in pigeonpea.

MATERIALS AND METHODS

The present investigation on management of *C. gibbosa* in pigeonpea variety GT 101 was carried out at the Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar during 2012-13. The experiment was laid in Randomized Block Design (RBD) with three replications having gross plot size 4.0 m × 3.0 m, net plot size 3.4 m × 1.8 m and spacing 60 cm × 15 cm. The crop was raised by adopting standard agronomical practices. Nine insecticides (Imidacloprid 17.8 SL @ 0.005%, Buprofezin 25 SC @ 0.025%, Thiamethoxam 25 WG @ 0.008%, Diafenthiuron 50 SC @ 0.02%, Profenophos 50 EC @ 0.05%, Acephate 75 SP @ 0.075%, Clothianidin 50 WDG @ 0.025 %, Fipronil 5 SC @ 0.005 % and Neem oil @ 0.3%) were applied at respective dose with knapsack sprayer. The first spray was given on the crop at 50 per cent pod setting stage and second spray after 15 days of first spray. The care was taken to have uniform coverage of the insecticides over crop canopy. Observations on number of nymphs per adults were recorded from five randomly selected plants from each net plot before and after 1, 3, 7 and 10 days of spraying. The yield was calculated by weighing healthy grains obtained from net plot area of each treatment at harvest. On the basis of pigeonpea grain yield harvested from various treatments under study, per cent increase in yield over control and avoidable losses due to *C. gibbosa* infestation was calculated by applying formula of Khosla (1977) given as below:

$$\text{Increase in yield over control (\%)} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

$$\text{Avoidable loss (\%)} = \frac{\text{Highest yield in plot} - \text{Yield in in treatment}}{\text{Highest yield in treated plot}} \times 100$$

In order to know the economics of different treatments evaluated against *C. gibbosa* infesting pigeonpea, protection cost benefit ratio (PCBR) was also worked out.

RESULTS AND DISCUSSION

First spray

The results on population of *C. gibbosa* per plant before spraying of insecticides summarized in Table 1 showed that the difference in *C. gibbosa* population per plant among different treatments before spray was non-significant, which indicated that *C. gibbosa* population of pod bug was uniformly distributed in whole experimental plot. Looking to the *C. gibbosa* population per plant (Table 1), at one day after application (DAT), all the treatments were significantly superior over untreated control (4.21 / plant). The lowest *C. gibbosa* population was recorded in the plots treated with imidacloprid 17.8 SL @ 0.005 per cent (1.46 / plant) and it was at par with clothianidin 50 WDG @ 0.025 per cent (1.57 / plant), thiamethoxam 25 WG @ 0.008 per cent (1.78 / plant) and profenophos 50 EC @ 0.05 per cent (2.32/plant). As far as efficacy of insecticides against *C. gibbosa* is concerned, same trend was observed at 3, 7 and 10 DAT (Table 1).

Second spray

The data (Table 1) recorded at 1 DAT indicated that imidacloprid 17.8 SL @ 0.005 per cent still remained as the best treatment, which reduces the *C. gibbosa* population up to 0.73 per plant. However, clothianidin 50 WDG @ 0.025 per cent and thiamethoxam 25 WG @ 0.008 per cent were also highly effective, as they recorded 0.78 and 0.83 *C. gibbosa* per plant and they were at par with imidacloprid. All the treatments nevertheless were significantly superior over untreated control (4.34/ plant). All the treatments were significantly superior over untreated control at 3 and 7 DAT (Table 1) and same trend was noticed in terms of efficacy of insecticides against *C. gibbosa*. At 10 DAT (Table 1), imidacloprid 17.8 SL @ 0.005 per cent proved better treatment, as it recorded only 0.40 pod bugs per plant and it was at par with clothianidin 50 WDG @ 0.025 per cent (0.52 / plant) and thiamethoxam 25 WG @ 0.008 per cent (0.65 / plant). However, all the treatments were significantly superior over untreated control (4.52 / plant).

In nutshell, it can be concluded that imidacloprid 17.8 SL @ 0.005 per cent proved to be the most effective in reducing *C. gibbosa* followed by clothianidin 50 WDG @ 0.025 per cent and thiamethoxam 25 WG @ 0.008 per cent under field condition and they were at par with each other. Srivastava and Singh (1994) and Kaushik *et al.* (2006) reported that dimethoate and λ-Cyhalothrin were better for management of *C. gibbosa*, respectively. The difference in the results may be due to uncommonness in insecticides taken for the experiment.

Grain yield

The pigeonpea grain yield (Table 2) in different treatments varied from 852 to 1421 kg/ha and significantly higher than the control plots (852.33 kg/ha). The highest grain yield of pigeonpea was recorded in the treatment of imidacloprid 17.8 SL (1421 kg/ha) and it was at par with clothianidin 50WDG, thiamethoxam 25 WG and profenophos 50 EC, which noted grain yield of 1344, 1298 and 1233 kg/ha, respectively. The remaining treatments *viz.*, diafenthiuron, acephate, fipronil, buprofezin and neem oil showed the yield in the range of 1013 to 1196 kg/ha. Srivastava and Mohapatra (2003) recorded the highest gain yield from the plot treated with dimethoate, whereas Gopali *et al*. (2013) noted the highest grain yield from methomyl treated plot. The dissimilar results might be due to the variation in insecticides, variety grown and ecological conditions.

Increase in yield over control

The results (Table 2) revealed that highest per cent increase in yield over control was observed in the treatment of imidacloprid 17.8 SL (66.68%) followed by clothianidin 50 WDG (57.72%), thiamethoxam 25 WG (52.33 %), profenophos 50 EC (44.70 %), diafenthiuron 50 SC (40.28 %), acephate 75 SP (31.33 %), fipronil 5 SC (26.59 %) and buprofezin 25 SC (24.25 %). However, the lowest increase in yield over control was obtained in the treatment of neem oil (18.89 %).

Avoidable losses

It is clear from the results (Table 2) that the maximum grain yield was obtained in the treatment of imidacloprid 17.8 SL and it proved as the best treatment. The avoidable grain yield loss due to pod bug varied from 5.37 to 40.01 per cent in various treatments. Earlier, Srivastava and Mohapatra (2003) recorded the lowest avoidable losses in grain yield in dimethoate + NSKE. The contradictory results might be due to variation in insecticides, variety grown and ecological conditions.

Economics

The economics of various treatments (Table 2) revealed that the maximum protection cost benefit ratio (PCBR) was recorded in the treatment of imidacloprid (1:11.83). It was followed by profenophos (1 : 8.83), thiamethoxam (1 : 7.05), acephate (1 : 6.43), diafenthiuron (1: 4.72), fipronil (1 : 3.61), buprofezin (1 :

3.41), clothianidin (1 : 1.91) and neem oil (1 : 1.66). The higher net profit and benefit : cost ratio was recorded from the treatment of methomyl (Gopali *et al*., 2013). The contradictory results might be due to variation in insecticides.

CONCLUSION

From the results, it can be concluded that in pigeonpea, pod bug, *Clavigralla gibbosa* Spinola can effectively be managed with the spraying of imidacloprid 17.8 SL @ 0.005, with first spray at 50 per cent pod setting stage followed by second spray at 15 days after first spray, as it was proved to be the most effective in reducing *C. gibbosa* population, also recorded the highest grain yield (1421 kg/ha), per cent increase in yield over control (66.68%) and protection cost benefit ratio (1:11.83). Clothianidin 50 WDG @ 0.025 per cent and thiamethoxam 25 WG @ 0.008 per cent were the next two best pesticides found equally effective in the management of pod bug.

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Table 1: Efficacy of insecticides against *C. gibbosa* infesting pigeonpea

Sr. No.	Treatments	Population of *C. gibbosa* Per Plant								
		Before Spray	First Spray				Second Spray			
			1 DAS	3 DAS	7 DAS	10 DAS	1 DAS	3 DAS	7 DAS	10 DAS
1	Imidacloprid 17.8 SL	*2.13 (4.04)	1.40 (1.46)	1.24 (1.04)	1.11 (0.73)	1.16 (0.84)	1.11 (0.73)	0.98 (0.46)	0.95 (0.40)	0.95 (0.40)
2	Buprofezin 25 SC	2.15 (4.12)	1.90 (3.11)	1.72 (2.46)	1.67 (2.29)	1.70 (2.39)	1.64 (2.19)	1.58 (2.00)	1.52 (1.81)	1.55 (1.90)
3	Thiamethoxam 25 WG	2.15 (4.12)	1.51 (1.78)	1.32 (1.24)	1.27 (1.11)	1.30 (1.19)	1.18 (0.89)	1.07 (0.65)	1.01 (0.52)	1.07 (0.65)
4	Diafenthiuron 50 SC	2.17 (4.21)	1.77 (2.63)	1.60 (2.06)	1.58 (2.00)	1.62 (2.12)	1.51 (1.78)	1.47 (1.66)	1.40 (1.46)	1.47 (1.66)
5	Profenophos 50 EC	2.13 (4.04)	1.68 (2.32)	1.53 (1.84)	1.48 (1.69)	1.51 (1.78)	1.42 (1.52)	1.35 (1.32)	1.27 (1.11)	1.33 (1.27)
6	Acephate 75 SP	2.17 (4.21)	1.79 (2.70)	1.68 (2.32)	1.64 (2.19)	1.66 (2.26)	1.58 (2.00)	1.49 (1.72)	1.45 (1.60)	1.47 (1.66)
7	Clothianidin 50 WDG	2.14 (4.08)	1.44 (1.57)	1.27 (1.11)	1.19 (0.92)	1.22 (0.99)	1.13 (0.78)	1.05 (0.60)	0.98 (0.46)	1.01 (0.52)
8	Fipronil 5 SC	2.14 (4.08)	1.87 (3.00)	1.70 (2.39)	1.66 (2.26)	1.68 (2.32)	1.62 (2.12)	1.53 (1.84)	1.49 (1.72)	1.49 (1.72)
9	Neem oil	2.13 (4.04)	1.96 (3.34)	1.85 (2.92)	1.79 (2.70)	1.81 (2.78)	1.72 (2.46)	1.64 (2.19)	1.60 (2.06)	1.62 (2.12)
10	Control	2.17 (4.21)	2.17 (4.21)	2.18 (4.25)	2.18 (4.25)	2.20 (4.34)	2.20 (4.34)	2.21 (4.38)	2.23 (4.47)	2.24 (4.52)
S.Em ±		0.09	0.10	0.09	0.10	0.09	0.08	0.07	0.07	0.09
CD @ 5 %		NS	0.30	0.26	0.29	0.26	0.25	0.19	0.22	0.26
CV %		7.35	10.12	9.26	10.84	9.46	9.50	7.90	9.08	10.80

**** Figures outside parenthesis are $\sqrt{X + 0.5}$ transformation values, while those in parenthesis are retransformed values.***
DAS: Day(s) after spray.
NS: Non-significant

Table 2: Impact of insecticides on pigeonpea grain yield and economics

Sr. No.	Treatments	Yield (kg/ha)	Increase in Yield Over Control (%)	Avoidable Losses (%)	PCBR
1	Imidacloprid 17.8 SL	1420.67	66.68	0.00	1 : 11.83
2	Buprofezin 25 SC	1059.00	24.25	25.46	1 : 3.41
3	Thiamethoxam 25 WG	1298.33	52.33	8.61	1 : 7.05
4	Diafenthiuron 50 SC	1195.67	40.28	15.84	1 : 4.72
5	Profenophos 50 EC	1233.33	44.70	13.19	1 : 8.83
6	Acephate 75 SP	1119.33	31.33	21.21	1 : 6.43
7	Clothianidia 50 WDG	1344.33	57.72	5.37	1 : 1.91
8	Fipronil 5 SC	1079.00	26.59	24.05	1 : 3.61
9	Neem oil	1013.33	18.89	28.67	1 : 1.66
10	Control	852.33	---	40.01	---
	SE.m ±	71.29	---	---	
	C.D. at 5%	211.73	---	---	
	C.V. %	10.59	---	---	

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