

Management of sucking insect pests infesting clusterbean, *Cyamopsis tetragonoloba* (Linnaeus) Taubert

S. T. PAWAR¹, P. S. PATEL², B. C. PATEL³, SUSHMA DEB⁴ AND F. K. CHAUDHARY⁵

Department of Agricultural Entomology, C. P. College of Agriculture
S. D. Agricultural University, Sardarkrushinagar- 385 506 (Gujarat)

Received : 03 February, 2017

ABSTRACT

The investigation was carried out at Centre of Excellence for Research on Pulses, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *kharif* 2011. Among the eleven treatments, imidacloprid 17.8 SL @ 0.005 per cent and acetamiprid 20 SP @ 0.004 per cent were found most effective against *Empoasca kerri*, while acetamiprid 20 SP @ 0.004 per cent and thiamethoxam 25 WG @ 0.0084 per cent showed higher efficacy against *Acaudaleyrodes rachipora*. The highest grain yield (679.33 kg/ha) and per cent increase in yield over control (159.16%) was recorded in the plots treated with acetamiprid 20 SP @ 0.004 per cent leading to highest economic return (1:97.58).

Key words : Bio-efficacy, insecticides, *Empoasca kerri*, *Acaudaleyrodes rachipora*, clusterbean, yield

Clusterbean, *Cyamopsis tetragonoloba* (Linnaeus) Taubert is an important seed as well as vegetable crop also called as *guar* represents its derivation from sanskrit word '*Gauaaha*' which means cow fodder or fodder of the livestock. In India, it is estimated to be cultivated in 42.55 lakh hectare with production and productivity of 24.14 lakh tonnes and 567 kg/ha, respectively. India accounts for 80 per cent of the total *guar* production in the world. In Gujarat, it is cultivated in 2.98 lakh hectare with a production of 1.79 lakh metric tonnes and productivity of 600 kg/ha (Anonymus, 2009). There are many factors responsible for low productivity of which infestation by insect pests is major one. Whitefly, *Acaudaleyrodes rachipora* Singh; leafhopper, *Empoasca kerri* Pruthi and thrips, *Megaleurothrips usitatus* Karny are major sucking pests which cause damage to the clusterbean under north Gujarat condition (Pawar, 2012). The information on management of sucking pests of clusterbean is scanty in North Gujarat Agro Climatic Zone. Hence, the present investigation was carried out to find out the efficacy of different insecticides against major sucking pests of clusterbean.

MATERIALS AND METHODS

The investigation on bio-efficacy of insecticides against sucking pests infesting clusterbean was carried out under North Gujarat conditions at Centre of Excellence for Research on Pulses, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *kharif* 2011. Eleven insecticides (Imidacloprid 17.8 SL @ 0.005%, Thiamethoxam 25 WG @ 0.0084%, Acephate 75 SP @ 0.075%, Acetamiprid 20 SP @ 0.004%, Dimethoate 30 EC @ 0.03%, Triazophos 40 EC @ 0.05%, Clothianidin 50 WDG @ 0.025%, Diafenthiuron 50 EC @ 0.02%, Neem oil @ 0.5%, NSKE @ 5%, *Verticillium lecanii* @ 2.5 g/L) were tested against sucking insect pests of clusterbean (cv. GG-1) using Randomized Block Design (RBD) with three replications, gross plot size 4.00 x 2.25 m, net plot size 3.40 x 1.35 m and spacing of 45 x 15 cm.

Five plants from each net plot were selected randomly and tagged in each plot to record the population of sucking pests before spray as well as 1, 3, 7 and 10 days after spraying of insecticides. Number of *E. kerri* (nymphs and adult) and *A. rachipora* (adult and pupa) were counted separately from three leaves one each from top, middle and bottom region per plant at weekly interval during morning hours starting from two weeks after sowing till maturity of crop.

¹ P.G. Student, ^{2 & 5} Associate Professor, ³ Agril. Officer,

⁴ Assistant Professor

The grain yield obtained per plot was converted into kilogram per hectare and subjected to statistical analysis. On the basis of clusterbean yield harvested from the various treatments under study, the increase in yield over control as well as avoidable losses due to insect pests were calculated by following formula (Khosla, 1977).

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

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

Efforts were also made to work out protection cost benefit ratio (PCBR) from the experimental data to assess economics of the different insecticidal treatments.

RESULTS AND DISCUSSION

The results pertaining to population of *E. kerri* and *A. rachipora* in different treatments recorded at different periods showed that all the treatments were found significantly superior over control in reducing the insect population.

Efficacy of insecticides against *E. kerri*

The data presented in Table 1 clearly indicated that significantly lowest *E. kerri* population was recorded in the plots treated with imidacloprid 17.8 SL @ 0.005 per cent (1.50/leaf) and was at par with acetamiprid 20 SP @ 0.004 per cent (1.64/leaf) after 1 day of spraying. Plots treated with diafenthiuron 50 EC @ 0.02 per cent, clothianidin 50 WDG @ 0.025 per cent and thiamethoxam 25 WG @ 0.0084 per cent registered 2.15 to 2.43 hoppers per leaf and were equally effective against *E. kerri*. Further, acephate 75 SP @ 0.075 per cent (3.06) and triazophos 40 EC @ 0.05 per cent (3.21) were found moderately effective in reducing the *E. kerri* population on clusterbean. Among the treatments evaluated, *V. lecanii* @ 2.5g/lit. and neem oil @ 0.5 per cent showed higher population of *E. kerri* (3.45).

Third day after spray (Table 1), again imidacloprid 17.8 SL @ 0.005 per cent registered the lowest (0.48) *E. kerri* population and it was at par with clothianidin 50 WDG @ 0.025 per cent (0.69) and acetamiprid 20 SP @ 0.004 per cent (0.75). In rest of treatments viz., thiamethoxam 25 WG @ 0.0084 per cent,

acephate 75 SP @ 0.075 per cent, neem oil @ 0.5 per cent, NSKE @ 5 per cent and *V. lecanii* @ 2.5 g/lit the leafhopper population was noted with a range of 2.15 to 2.72 per leaf. The treatment of dimethoate 30 EC @ 0.03 per cent (2.78) was found least effective with higher population of *E. kerri*.

The same trend was followed after 7 days of spraying (Table 1). Imidacloprid 17.8 SL @ 0.005 per cent was most effective treatment with minimum (0.12), while dimethoate 30 EC @ 0.03 per cent was least effective with maximum (2.81) *E. kerri* population in clusterbean. Acetamiprid 20 SP @ 0.004 per cent (0.30) and clothianidin 50 WDG @ 0.025 per cent (0.37) were equally effective with imidacloprid, whereas diafenthiuron 50 EC @ 0.02 per cent (0.60) was found to be moderately effective against *E. kerri*.

After 10 days of spray (Table 1), plots treated with imidacloprid 17.8 SL @ 0.005 per cent exhibited lowest (0.05) population of *E. kerri* which was at par with acetamiprid 20 SP @ 0.004 per cent (0.25), diafenthiuron 500 EC @ 0.2 per cent (0.30) and clothianidin 50 WDG @ 0.025 per cent (0.33). Treatment with thiamethoxam 25 WG @ 0.0084 per cent (1.78) and acephate 75 SP @ 0.075 per cent (1.96) found to be moderate in effectiveness against *E. kerri*. Among the treatments evaluated, *V. lecanii* @ 2.5 g/lit. (2.46) and dimethoate 30 EC @ 0.03 per cent (2.60) showed higher leaf hopper population, hence found least effective against the pest.

Efficacy of insecticides against *A. rachipora*

The data on efficacy of various treatments after 1 day of spraying (Table 2) clearly revealed that lowest population of *A. rachipora* (1.17/leaf) was found in plots treated with acetamiprid 20 SP @ 0.004 per cent and it was at par with clothianidin 50 WDG @ 0.025 per cent (1.35) and thiamethoxam 25 WG @ 0.0084 per cent (1.58). Higher population of whitefly (3.79) was recorded in the plots treated with *V. lecanii* @ 2.5 g/lit and it was at par with dimethoate 30 EC @ 0.03 per cent, NSKE @ 5 per cent and neem oil @ 0.5 per cent with *A. rachipora* population ranged from 3.00 to 3.45 per leaf.

After 3 days of spraying (Table 2), acetamiprid 20 SP @ 0.004 per cent (0.71) once again showed higher effectiveness against *A. rachipora* and it was at par with thiamethoxam 25 WG @ 0.0084 per cent (0.80) and clothianidin 50 WDG @ 0.025 per cent (1.22). The treatments viz., diafenthiuron 50 EC @ 0.02 per cent, acephate 75 SP @ 0.075 per cent, imidacloprid 17.8 SL @ 0.005 per cent and triazophos

Table 1 Efficacy of insecticides against *E. kerri* infesting clusterbean during *kharif*, 2011

Insecticides	Concentration (%)	No. of leaf hopper /leaf (day after spray)				
		Before spray	1	3	7	10
Imidacloprid 17.8 SL	0.005	2.30 (4.64)	1.41 (1.50)	0.98 (0.48)	0.78 (0.12)	0.74 (0.05)
Thiamethoxam 25 WG	0.0084	2.29 (4.74)	1.71 (2.43)	1.62 (2.15)	1.50 (1.76)	1.50 (1.78)
Acephate 75 SP	0.075	2.34 (4.98)	1.88 (3.06)	1.72 (2.47)	1.60 (2.09)	1.57 (1.96)
Acetamiprid 20 SP	0.004	2.24 (4.52)	1.46 (1.64)	1.11 (0.75)	0.89 (0.29)	0.86 (0.25)
Dimethoate 30 EC	0.03	2.27 (4.65)	1.94 (3.27)	1.81 (2.78)	1.82 (2.81)	1.76 (2.60)
Triazophos 40 EC	0.05	2.33 (4.93)	1.92 (3.21)	1.79 (2.72)	1.67 (2.29)	1.62 (2.12)
Clothianidin 50 WDG	0.025	2.33 (4.93)	1.63 (2.18)	1.08 (0.69)	0.93 (0.37)	0.91 (0.33)
Diafenthiuron 50 EC	0.02	2.32 (4.88)	1.62 (2.15)	1.25 (1.08)	1.04 (0.60)	0.89 (0.30)
Neem oil	0.5	2.85 (4.74)	1.98 (3.45)	1.72 (2.47)	1.67 (2.29)	1.66 (2.28)
NSKE	5	2.35 (5.02)	1.94 (3.27)	1.75 (2.56)	1.63 (2.16)	1.61 (2.11)
<i>Verticillium lecanii</i>	2.5 g/lit.	2.35 (5.02)	1.98 (3.45)	1.79 (2.72)	1.68 (2.34)	1.72 (2.46)
Control	-	2.26 (4.84)	2.38 (5.16)	2.32 (4.88)	2.35 (5.02)	2.37 (5.13)
S. Em. ±		0.05	0.06	0.07	0.08	0.07
C. D. at 5 %		NS	0.17	0.21	0.24	0.20
C. V. %		5.79	5.75	8.01	9.64	8.42

Figures in parentheses are retransformed values, those outside are $\sqrt{X + 0.5}$ values.

40 EC @ 0.05 per cent recorded whitefly population ranged from 1.64 to 2.34 per leaf and were equally effective against *A. rachipora*. However, higher population of *A. rachipora* was recorded in the treatment of *V. lecanii* @ 2.5g/lit. (3.45) followed by dimethoate 30 EC @ 0.03 per cent (2.82).

After 7 days of spraying, acetamiprid 20 SP @ 0.004 per cent (0.41) was most effective (Table 2) against *A. rachipora*. However, thiamethoxam 25 WG @ 0.0084 per cent (0.53) and clothianidin 50 WDG @ 0.025 per cent (0.81) were also equally effective with acetamiprid. Spray of diafenthiuron 50 EC @ 0.2 per cent, acephate 75 SP @ 0.075 per cent and imidacloprid 17.8 SL @ 0.005 per cent in clusterbean

proved moderately effective and registered 1.33 to 1.93 whiteflies per leaf. Higher (2.91) population of *A. rachipora* was noted in the plots treated with dimethoate 30 EC @ 0.03 per cent and it was at par with *V. lecanii* @ 2.5g/lit., neem oil @ 0.5 per cent, NSKE @ 5 per cent and triazophos 40 EC @ 0.05 per cent which showed the whitefly population in the range of 2.13 to 2.78 per leaf.

The results obtained after 10 days of spraying were almost similar to the results obtained during seven days after spraying (Table 2). Acetamiprid 20 SP @ 0.004 per cent (0.19), thiamethoxam 25 WG @ 0.0084 per cent (0.32) and clothianidin 50 WDG @ 0.025 per cent (0.53) treated plots exhibited significantly lower

Table 2 Efficacy of insecticides against *A. rachipora* infesting clusterbean during *kharif*, 2011

Insecticides	Concentration (%)	No. of whitefly/leaf (day after spray)				
		Before spray	1	3	7	10
Imidacloprid 17.8 SL	0.005	2.45 (5.50)	1.68 (2.32)	1.64 (2.19)	1.56 (1.93)	1.44 (1.58)
Thiamethoxam 25 WG	0.0084	2.43 (5.40)	1.44 (1.58)	1.14 (0.80)	1.01 (0.53)	0.90 (0.32)
Acephate 75 SP	0.075	2.42 (5.36)	1.69 (2.38)	1.58 (2.01)	1.44 (1.58)	1.34 (1.30)
Acetamiprid 20 SP	0.004	2.45 (5.52)	1.29 (1.17)	1.10 (0.71)	0.95 (0.41)	0.83 (0.19)
Dimethoate 30 EC	0.03	2.45 (5.50)	1.87 (3.00)	1.82 (2.82)	1.84 (2.91)	1.81 (2.78)
Triazophos 40 EC	0.05	2.46 (5.55)	1.74 (2.55)	1.68 (2.34)	1.62 (2.13)	1.58 (2.02)
Clothianidin 50 WDG	0.025	2.45 (5.51)	1.36 (1.35)	1.31 (1.22)	1.14 (0.81)	1.01 (0.53)
Diafenthiuron 50 EC	0.02	2.43 (5.45)	1.66 (2.27)	1.46 (1.64)	1.35 (1.33)	1.3 (1.25)
Neem oil	0.5	2.41 (5.31)	1.99 (3.45)	1.81 (2.76)	1.70 (2.40)	1.66 (2.28)
NSKE	5	2.43 (5.40)	1.93 (3.24)	1.80 (2.73)	1.69 (2.38)	1.59 (2.05)
<i>Verticillium lecanii</i>	2.5 g/lit.	2.47 (5.65)	2.07 (3.79)	1.99 (3.45)	1.81 (2.78)	1.71 (2.44)
Control	-	2.49 (5.70)	2.51 (5.81)	2.48 (5.65)	2.44 (5.47)	2.49 (5.73)
S. Em. $\pm$		0.06	0.07	0.08	0.07	0.06
C. D. at 5 %		NS	0.20	0.24	0.22	0.19
C. V. %		6.40	6.81	8.73	8.66	7.70

Figures in parentheses are retransformed values, those outside are $\sqrt{X + 0.5}$ values.

population of the *A. rachipora* and were on par to each other. The highest (2.78) population of the *A. rachipora* was observed in dimethoate 30 EC @ 0.03 per cent treatment which was at par with *V. lecanii* @ 2.5g/lit. (2.44) and neem oil @ 0.5 per cent (2.28).

Imidacloprid 17.8 SL @ 0.005 per cent recorded minimum leaf hopper population and proved to be most effective treatment against leafhopper. Acetamiprid 20 SP @ 0.004 per cent, clothianidin 50 WDG @ 0.025 per cent and diafenthiuron 50 EC @ 0.02 per cent were found next best alternatives against *E. kerri*. In case of *A. rachipora*, acetamiprid

20 SP @ 0.004 per cent and thiamethoxam 25 WG @ 0.0084 per cent and clothianidin 50 WDG @ 0.025 per cent were found effective. Early reports of Patel (2006) support the present findings who recorded imidacloprid @ 0.005 per cent as the most effective insecticide in reducing the population of leafhopper in cowpea. Similarly, Jyothirmai *et al.* (2002) also observed that the application of imidacloprid 200 SL @ 0.01 per cent as foliar spray drastically reduced the *E. kerri* infestation on groundnut. Earlier, the efficacy of acetamiprid 20 SP was studied by Patil *et al.* (2001), Baskaran *et al.* (2003) and Singh and Kumar (2005) against

Table 3 Effect of insecticides on grain yield, avoidable losses due to sucking pests and PCBR in clusterbean during *kharif*, 2011

Insecticide	Concentration (%)	Grain yield (kg/ha)	Increased in yield over control (%)	Avoidable loss (%)	PCBR
Imidacloprid 17.8 SL	0.005	545.00	108.01	19.77	1 : 70.95
Thiamethoxam 25 WG	0.0084	569.33	117.17	16.19	1 : 52.71
Acephate 75 SP	0.075	551.67	110.30	18.79	1 : 66.89
Acetamiprid 20 SP	0.004	679.33	159.16	0.00	1 : 97.58
Dimethoate 30 EC	0.03	292.33	11.57	56.96	1 : 9.34
Triazophos 40 EC	0.05	390.00	48.85	42.59	1 : 28.43
Clothianidin 50 WDG	0.025	630.00	140.45	7.26	1 : 14.82
Diafenthiuron 50 EC	0.02	621.00	137.02	8.58	1 : 48.86
Neem oil	0.5	398.00	51.90	41.41	1 : 8.93
NSKE	5	387.00	47.70	43.03	1 : 11.58
<i>Verticillium lecanii</i>	2.5 g/lit	392.00	34.35	48.18	1 : 18.93
Control	-	262.00	-	61.43	-
S. Em. $\pm$		9.38	-	-	-
C. D. at 5%		27.51	-	-	-
C. V. %		3.43	-	-	-

sucking pests of cotton. They recorded the acetamiprid 20 SP as the most promising insecticide in reducing the sucking pest incidence. These results corroborate the results of present investigation. The results are also in agreement with that of Patil *et al.* (2007) who mentioned that two sprays of clothianidin 50 WDG @ 20 and 25 g a.i./ha rendered very good protection to cotton crop against the leafhopper and whitefly in early season.

Impact on grain yield

The data (Table 3) on clusterbean grain yield revealed that the highest (679.33 kg/ha) grain yield was recorded in the treatment of acetamiprid 20 SP @ 0.004 per cent and was followed by clothianidin 50 WDG @ 0.025 per cent (574.67), thiamethoxam 25 WG @ 0.0084 per cent (569.00), diafenthiuron 50 EC @ 0.02 per cent (557.67), acephate 75 SP @ 0.075 per cent (551.67) and imidacloprid 17.8 SL @ 0.005 per cent (545.00).

Avoidable loss in yield due to pests

The avoidable losses in clusterbean yield varied from 7.26 to 56.96 per cent in different treatments (Table 3). However, it was recorded lowest (7.26%) in the

treatment of clothianidin 50 WDG @ 0.025 per cent followed by diafenthiuron 50 EC @ 0.02 per cent (8.58%).

Increase in yield over control

The highest (159.16%) increase in yield over control was observed in plot treated with acetamiprid 20 SP @ 0.004 per cent (Table 3) followed by clothianidin 50 WDG @ 0.025 per cent (119.33%), thiamethoxam 25 WG @ 0.0084 per cent (117.17%) and diafenthiuron 50 EC @ 0.02 per cent (112.85%), however, the lowest increase in yield over control was obtained in treatment of dimethoate 30 EC @ 0.03 per cent (11.57%).

Economics

The highest (1:97.58) return was obtained with the treatment of acetamiprid 20 SP @ 0.004 per cent followed by imidacloprid 17.8 SL @ 0.005 per cent (1:70.95), acephate 75 SP @ 0.075 (1: 66.89). Among the treatments, the least (1:9.34 and 1: 8.93) returns were obtained with the treatments of dimethoate 30 EC @ 0.03 per cent and neem oil @ 0.5 per cent, respectively (Table 3).

In nutshell, spraying of acetamiprid 20 SP @ 0.004 per cent in *kharif* clusterbean crop proved best in

terms of efficacy against sucking insect pests leading to higher grain yield, per cent increase over control as well as higher economic return.

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