BIO-EFFICACY OF NEWER INSECTICIDES AGAINST APHID, (*Aphis craccivora* KOCH) ON CLUSTERBEAN

VADJA, D. J. AND *KALASARIYA R. L.

DEPARTMENT OF ENTOMOLOGY
COLLEGE OF AGRICULTURE
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH - 362 001, GUJARAT, INDIA

E-mail:- rkalasariya@ymail.com

ABSTRACT

With a view to evaluate the bio-efficacy of newer insecticides against Aphis craccivora (Koch) in clusterbean, a field experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during kharif 2003-14. The results of relative efficacy of eleven different insecticides against aphids revealed that imidacloprid 0.006 per cent and acephate 0.15 per cent were found most effective, whereas clothianidin 0.025 per cent, difenthiuron 0.07 per cent, buprofezin 0.05 per cent and thiacloprid 0.008 per cent were found next best treatments against aphid. The highest green pod yield of cluster bean (2291 kg/ha) was recorded in the treatment of difenthiuron 0.07 per cent, which was at par with imidacloprid 0.0006 per cent (2194 kg/ha). Both these treatments also recorded higher per cent increase in yield over control i.e. 211.27 and 198.09 per cent, respectively.

KEY WORDS: Aphid, Aphis craccivora, bio-efficacy, clusterbean

INTRODUCTION

Clusterbean (*Cyamopsis tetragonaloba* (Linn.) is one of the important a leguminous vegetable crop due to its nutritional and industrial values. India accounts for 80 per cent of the total clusterbean seed produced in the world. About 70 per cent of India's production comes from Rajasthan. India produces 9.0 lakh tones of clusterbean annually. It contributes 80 per cent share in the world's total production (Anonymous, 2012a). In Gujarat State, it is mainly cultivated in Ahmadabad, Vadodara, Gandhinagar, Kheda, Surat, Navsari, Valsad, Kutch, Banaskantha, Mehsana and Sabarkantha. The estimated area under clusterbean crop for vegetable purpose in Gujarat is 1359 hectares with a production of 568 lakh MT. (Anonymous, 2012b). Such an important vegetable crop is found to be attacked by various insects and mite pests (Singh *et al*., 1981; Butani and Jotwani, 1984) during its different growth stages and causing heavy yield losses. A preliminary survey around Junagadh revealed that the aphid, *Aphis craccivora* Koch has been observed as key pest of clusterbean in this area. Many research workers had strongly advocated the chemical control measures as the most effective and economical method of insect control than any other techniques. Keeping all above factors in mind, the present investigation was undertaken to evaluate the bio-efficacy of certain insecticides against aphid of clusterbean under Junagadh conditions of Gujarat State.

MATERIALS AND METHODS

An experiment was conducted at College Farm, Junagadh Agricultural University, Junagadh during *kharif* 2013-14 in a Randomized Block Design with a view

to determine the bio-efficacy of eleven different insecticides excluding control (Table 1) against major insect pests of clusterbean. The seeds were sown in a plot size (gross) of 4.00 m x 3.00 m with spacing of 60 cm x 20 cm. Two sprays of each insecticide were given, first at 50 per cent flowering stage and second at 15 days after first spray. In order to evaluate the various insecticidal treatments for their efficacy, population of aphid was recorded from five randomly selected plants from each net plot by examining three leaves per plant (top, middle and bottom regions of plant) by counting the number of nymphs per leaf after three, five and seven days after each spray from each treatment.

The green pod yield obtained from each net plot of insecticidal treatments was converted on hectare basis and were subjected to statistical analysis. The per cent increase in yield over control was calculated by using following formula.

$$\text{Yield increase over control (\%)} = \frac{T-C}{C} \times 100$$

Where,

T = Yield of respective treatment (kg/ha)

C = Yield of control (kg/ha).

RESULTS AND DISCUSSION

First spray

Three days after first spraying

The mean per cent mortality of aphid at three day after spraying presented in Table 1 revealed that among the various insecticidal treatments, imidacloprid 0.006 per cent was found significantly most effective which recorded 89.69 per cent mortality, which was statistically at par with acephate 0.15 per cent which registered 80.45 per cent mortality. The next best treatments were clothianidin 0.025 per cent, difenthiuron 0.07 per cent, buprofezin 0.05 per cent and thiacloprid 0.008 per cent, as they registered 74.00, 72.49, 69.95 and 69.05 per cent mortality, respectively. The treatments *viz.*, cartap hydrochloride 0.1 per cent (64.11%), ethion 0.05 per cent (57.45%), spiromecifen 0.024 per cent (56.77%), abamectin 0.003 per cent (52.55%) and fenazequin 0.02 per cent (47.30%) were found less effective against this pest.

Five days after first spraying

The results presented in Table 1 indicated that the treatment of imidacloprid 0.006 per cent found significantly superior, as it recorded 91.07 per cent mortality of aphid and it was statistically at par with acephate 0.15 per cent, which registered 82.85 per cent mortality. The treatments of clothianidin 0.025 per cent, difenthiuron 0.07 per cent, thiacloprid 0.008 per cent and buprofezin 0.05 per cent found next in order, as they registered 78.15, 76.11, 72.45 and 71.45 per cent mortality, respectively. The treatments *viz.*, cartap hydrochloride 0.1 per cent (69.18%), spiromecifen 0.024 per cent (61.76%), abamectin 0.003 per cent (56.41%), ethion 0.05 per cent (55.36%) and fenazequin 0.02 per cent (45.61%) were found least effective against aphid in clusterbean.

Seven days after first spraying

The results presented in Table 1 showed that treatment of imidacloprid 0.006 per cent proved to be the most effective, as it recorded the highest per cent mortality *i.e.* 87.78 against aphid and it did not differ significantly from acephate 0.15 per cent and clothianidin 0.025 per cent, as they registered 82.10 and 80.19 per cent mortality, respectively. The next best treatments were buprofezin 0.05 per cent and difenthiuron 0.07 per cent, as they recorded 72.44 and 70.08 per cent mortality, respectively. Cartap hydrochloride 0.1 per cent (64.11%), thiacloprid 0.008 per cent (63.86%), ethion 0.05 per cent (56.07%), spiromecifen 0.024 per cent (53.37%), abamectin 0.003 per cent (48.70%) and fenazequin 0.02 per cent (39.86%) were found least effective against this pest.

Second spray

Three days after first spraying

The data on per cent mortality of aphid at three day after spraying (Table 1) revealed that the treatment of imidacloprid

0.006 per cent found statistically superior than rest of the treatments, which recorded 91.29 per cent mortality of the aphid and it did not differ significantly with acephate 0.15 per cent, which noted 81.01 per cent mortality. However, the treatments of clothianidin 0.025 per cent, difenthiuron 0.07 per cent, thiacloprid 0.008 per cent and buprofezin 0.05 per cent registered 77.81, 73.12, 72.58 and 68.25 per cent mortality, respectively. The treatments *viz.*, cartap hydrochloride 0.1 per cent (65.24%), spiromecifen 0.024 per cent (57.47%), ethion 0.05 per cent (56.40%), abamectin 0.003 per cent (54.22%) and fenazequin 0.02 per cent (46.66%) were found least effective against aphid.

Five days after first spraying

The results presented in Table 1 indicated that the treatment of imidacloprid 0.006 per cent proved to be the most effective against aphid, as it gave 91.45 per cent mortality, however it was statistically at par with acephate 0.15 per cent, which showed 83.46 per cent mortality. It was followed by clothianidin 0.025 per cent, difenthiuron 0.07 per cent, thiacloprid 0.008 per cent and buprofezin 0.05 per cent found next in order, as they registered 78.07, 76.65, 75.98 and 71.01 per cent mortality, respectively. While, the treatments of cartap hydrochloride 0.1 per cent (67.89%), spiromecifen 0.024 per cent (59.54%), ethion 0.05 per cent (52.71%), abamectin 0.003 per cent (56.74%) and fenazequin 0.02 per cent (36.61%) were found least effective for control of this pest.

Seven days after first spraying

The mean per cent mortality of aphid at seven days after spraying in different insecticidal treatments presented in Table 1 revealed that imidacloprid 0.006 per cent found significantly most effective, which recorded 87.22 per cent mortality and it was statistically at par with acephate 0.15 per cent, which registered 81.79 per cent mortality. The next best treatments were clothianidin 0.025 per cent, thiacloprid 0.008 per cent, difenthiuron 0.07 per cent and buprofezin 0.05 per cent found next in order, as they recorded 78.49, 76.53, 75.48 and 72.00 per cent mortality, respectively. The remaining treatments were found least effective against this pest.

Thus, looking to the above results of two sprays, it can be concluded that imidacloprid 0.006 per cent found most effective insecticide against aphid and it did not differ statistically from the treatment of acephate 0.15 per cent. However, it was followed by clothianidin 0.025 per cent, thiacloprid 0.008 per cent, difenthiuron 0.07 per cent and buprofezin 0.05 per cent found next in order against aphid. Further, the treatments of cartap hydrochloride 0.1 per cent, spiromecifen 0.024 per cent, ethion 0.05 per cent, abamectin 0.003 per cent, fenazequin 0.02 per cent were found less effective against this pest. Thus, the present findings are in close agreement with the research carried out by Vinod *et al.* (2012) revealed that acephate 75 % SP, clothianidin 50% WDG and imidacloprid 600% FS @ 4.66 ml/ kg gave good control up to 30 DAS as seed dressing chemical as compared to control. Yadav *et al.* (2011) showed that acephate (0.037%) and imidacloprid (0.005%) were found most effective in reducing the population of *A. craccivora*. Kalsariya *et al.* (2013) found that the treatments of imidacloprid 0.006 per cent gave good control of aphid (*A. craccivora*) on cluster bean.

Yield

Treatments wise data recorded on clusterbean green pod yield are presented in Table 2 revealed that the highest green pod yield of 2291 kg/ha was recorded in the treatment of difenthiuron 0.07 per cent and it was statistically at par with the treatment of imidacloprid 0.006 per cent, which gave 2194 kg/ha. It was followed by the treatments of clothianidin 0.025 per cent, acephate 0.15 per cent and thiacloprid 0.008 per cent, which recorded 1916, 1819 and 1805 kg/ha yields, respectively. The insecticidal treatments of fenazequin 0.02 per cent, buprofezin 0.05 per cent, abamectin

0.003 per cent, ethion 0.05 per cent and spiromesifen 0.024 per cent were ranked next in order, as they recorded 1791, 1736, 1666, 1652 and 1597 green pod yield kg/ha, respectively. The lowest yield of green pod of clusterbean was recorded in the treatment of cartap hydrochloride 0.1 per cent (1166 kg/ha).

Looking to the per cent increase in yield over control, it varied from 58.42 to 211.27 per cent in different treatments (Table 2). The maximum per cent increase in yield over control was recorded in the treatment of difenthiuron 0.07 per cent *i.e.* 211.27 per cent. The treatments found next in order in respect to the per cent increase in pod yield over control were imidacloprid 0.006 per cent, clothianidin 0.025 per cent, acephate 0.15 per cent, thiacloprid 0.008 per cent and fenazequin 0.02 per cent, as they registered 198.09, 160.32, 147.14, 145.24 and 143.34 per cent increases in yield over control, respectively. The remaining treatments of buprofezin 0.05 per cent, abamectin 0.003 per cent, ethion 0.05 per cent, spiromesifen 0.024 per cent and cartap hydrochloride 0.1 per cent recorded 135.86, 126.35, 124.45, 116.98 and 58.42 per cent increase in yield over control, respectively.

These findings are more or less in close agreement with the results reported by Kalasariya *et al.* (2013), who reported that the treatment of difenthiuron 0.05 per cent recorded the highest green pod yield *i.e.* 12050 kg/ha and found most effective and economically viable. In the present investigation, efficacy of difenthiuron pertaining to yield is comparable with the earlier results, however, the difference in yield was observed is may be due to seasonal effect.

CONCLUSION

From the results, it can be evident that imidacloprid 0.006 per cent and acephate 0.15 per cent were found most effective, whereas clothianidin 0.025 per cent, difenthiuron 0.07 per cent, buprofezin 0.05 per cent and thiacloprid 0.008 per cent were found next best treatments against aphid. The highest green pod yield of cluster bean (2291 kg/ha) was recorded in the treatment of difenthiuron 0.07 per cent, which was at par with imidacloprid 0.0006 per cent (2194 kg/ha). Both these treatments also recorded higher per cent increase in yield over control i.e. 211.27 and 198.09 per cent, respectively.

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Table 1: Efficacy of different insecticides against *A. craccivora*on clusterbean

Sr. No.	Treatments	First Spray			Second Spray		
		3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Spiromesifen 0.024%	48.89 (56.77)	51.80 (61.76)	46.93 (53.37)	49.30 (57.47)	50.50 (59.54)	47.91 (55.07)
2	Buprofezin 0.05%	56.76 (69.95)	57.70 (71.45)	58.34 (72.44)	55.70 (68.25)	57.46 (71.07)	58.05 (72.00)
3	Abamectin 0.003%	46.46 (52.55)	48.68 (56.41)	44.26 (48.70)	47.42 (54.22)	48.87 (56.74)	45.83 (51.46)
4	Difenthiuron 0.07%	58.37 (72.49)	60.74 (76.11)	56.84 (70.08)	58.77 (73.12)	61.10 (76.65)	60.32 (75.48)
5	Ethion 0.05%	49.28 (57.45)	48.08 (55.36)	48.49 (56.07)	48.68 (56.40)	46.55 (52.71)	47.70 (54.70)
6	Thiacloprid0.008%	56.20 (69.05)	58.34 (72.45)	53.04 (63.86)	58.42 (72.58)	60.65 (75.98)	60.35 (75.53)
7	Cartap hydrochloride 0.1%	53.20 (64.11)	56.28 (69.18)	53.20 (64.11)	53.87 (65.24)	55.49 (67.89)	52.61 (63.13)
8	**Clothianidin0.025%**	59.35 (74.00)	62.13 (78.15)	63.57 (80.19)	61.90 (77.81)	62.08 (78.07)	62.37 (78.49)
9	Imidacloprid 0.006%	71.27 (89.69)	72.61 (91.07)	69.54 (87.78)	72.84 (91.29)	73.00 (91.45)	69.06 (87.22)
10	Fenazaquin 0.02%	43.45 (47.30)	42.48 (45.61)	39.15 (39.86)	43.08 (46.66)	37.24 (36.61)	35.21 (33.24)
11	Acephate 0.15%	63.76 (80.45)	65.54 (82.85)	64.97 (82.10)	64.17 (81.01)	66.00 (83.46)	64.74 (81.79)
S.Em.±		3.23	3.14	3.41	3.11	2.94	2.92
C. D. at 5%		9.47	9.22	10.00	9.11	8.62	8.58
C. V.%		11.06	10.46	11.84	10.51	9.87	10.06

Figures in parentheses ( ) are retransformed values, those outside are arcsine value

DAS – Days After Spraying

Table 2: Green pod yield of clusterbean obtained in different insecticidal treatments

Sr. No.	Treatments	Yield (kg/ha)	Per Cent Increase in Yield Over Control
1	Spiromesifen 0.024%	1597	116.98
2	Buprofezin 0.05%	1736	135.86
3	Abamectin 0.003%	1666	126.35
4	Difenthiuron 0.07%	2291	211.27
5	Ethion 0.05%	1652	124.45
6	Thiacloprid0.008%	1805	145.24
7	Cartap hydrochloride 0.1%	1166	58.42
8	Clothianidin0.025%	1916	160.32
9	Imidacloprid 0.006%	2194	198.09
10	Fenazaquin 0.02%	1791	143.34
11	Acephate 0.15%	1819	147.14
12	Control	736	-
	S.Em. ±	103.33	-
	C.D. at 5%	303.08	-
	C. V. %	10.54	-

[MS received: May 5 2015] *[MS accepted: May 26, 2015]*