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Evaluation of Different Bio and Chemical Insecticides Against Aphids, *Aphis craccivora* Koch Infesting Dolichos Bean

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was carried out to evaluation of different insecticides against *Aphis craccivora* Koch infesting dolichos bean at Vegetable Improvement Scheme. After the first and second spray it was revealed that the treatment (Diafenthiuron) was the most effective recording number of aphids

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80.65%. Treatments (Imidacloprid, Azadirachtin and Dimethoate also showed significant control, with per cent reductions of 74.86, 73.98, and 70.47%respectively. Bio insecticides *Lecanicillium lecanii* and *Metarhizium anisopliae* low significant reduction 45.98% and 29.66 %.

Keywords: Dolichos bean; Aphis craccivora; insecticides; cumulative.

1. INTRODUCTION

Lablab bean (*Lablab purpureus* L), also known as Dolichos or hyacinth bean, is a nitrogen-fixing legume from the Fabaceae family, native to Africa and widely grown in tropical regions for its nutritional value. In India, it is primarily cultivated in Maharashtra, Uttar Pradesh, and Tamil Nadu, known for enhancing soil fertility and providing high protein content. However, its yield is affected by biotic and abiotic factors. India has 2,27,780 hectares under cultivation, producing 2519.85 metric tonnes of vegetable beans, with Maharashtra contributing 29.95 metric tonnes [1]. Dolichos bean is infested by numerous insects pests that attack the crop at its various growth stages. It is often infested by a group of either pests or boring pests. Severe damage normally occurs when a large number of pests feeds on the plants. The major pests of bean are the sap sucking insects which includes the thrips, aphids and whiteflies [2]. Aphid, *Aphis craccivora* Koch, is the most damaging pest of dolichos bean in warmer regions worldwide. It infests all pulse crops across the country. Both nymphs and adults suck sap from various plant parts, causing leaf curling and stunting. Severe infestations can lead to withering and drying of the crop. Continuous feeding by large aphid populations results in yellowing, curling, and drying of tender pods. Additionally, honeydew secretion promotes the growth of black sooty mold (*Capnodium* spp.), impairing photosynthesis and reducing yield [3]. To protect the crops from aphids, insecticides are considered essential for their management. A large number of insecticides have been evaluated and recommended from time to time for their control [4]. In recent years, selective insecticides were introduced into the market instead of traditional insecticides because insect pests became resistant to conventional insecticides and are increasingly replacing the organophosphates and methyl carbamates [5].

2. MATERIALS AND METHODS

The experiment was conducted at the Vegetable Improvement Scheme, CES, Wakawali, during the *Rabi* season of 2022-23, using the Konkan Bhushan variety. The crop was sown on November 25, 2022, by the dibbling method with a spacing of 30 cm x 50 cm. The total plot size was 26 m x 15 m, with each gross plot measuring 3 m x 3 m. The experiment followed a randomized block design with 11 treatments, replicated three times. The treatments and their respective doses per liter were as follows: Imidacloprid 17.8 SL (0.3 ml), Dimethoate 30EC (1.0 ml), Diafenthiuron 50WP (1.5 gm), Acetamiprid 20 SP (0.5 gm), Thiamethoxam 25WG (0.2 gm), Azadirachtin 10000 ppm (3.0 ml), *Lecanicillium lecanii* (1 x 10^8 cfu/ml) (5.0 ml), *Metarhizium anisopliae* (1 x 10^8 cfu/ml) (4.0 ml), Emamectin Benzoate 5 SG (0.5 gm), Chlorantraniliprole 18.5 SC (0.25 ml). The untreated control served as the eleventh treatment.

2.1 Methods of Recording Observations for Aphids

The population of aphids was recorded from the randomly five selected plants from each treatment and each replication which was marked permanently. The observations of aphid population were taken from three top, middle and bottom leaves of selected plants. The population of aphid was counted early in morning one day before spraying and after spraying on 3rd, 7th, 10th and 14th day of spraying. Then the average of pest population was calculated. Then the calculated data is converted into $\sqrt{x+1}$ value and analysed further.

3. RESULTS AND DISCUSSION

3.1 First Spray

Data on the mean number of aphids per three leaves per plant in various insecticidal treatments at 3rd, 7th, 10th and 14th day after spraying (DAS) were significantly superior over untreated control are presented in (Table 1).

At 3 DAS, the treatment T_2 (Dimethoate 30EC @ 1ml/lit) was most effective and recorded 9.98 mean number of aphids per three leaves per plant, while the untreated control had the highest count of mean number of aphids (30.98). On 7th DAS, lowest infestation of aphids was recorded in

Treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) with 6.22 per three leaves per plant, and was at par with the T_6 (Azadirachtin 10000 ppm) and T_1 (Imidacloprid 17.8 SL@ 0.3ml/lit). At 10 DAS, treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) was best over the other treatments with the mean number of aphids (7.57 per three leaves per plant) and which was at par with the T_1 (Imidacloprid 17.8 SL@ 0.3ml/lit) and T_6 (Azadirachtin 10000 ppm @3 ml/lit) was recorded mean number of aphids 8.89 and 9.99 per three leaves per plant, respectively. On 14th DAS, T_{11} (untreated) was recorded with 36.09 aphids per three leaves per plant, while T_3 (Diafenthiuron 50WP @ 1.5gm/lit) recorded the lowest mean number of aphids (14.38) and was at par with the treatments T_1 (Imidacloprid 17.8 SL@ 0.3 ml/lit) and T_6 (Azadirachtin 10000 ppm @3 ml/lit) with the count of 15.53 and 17.63 mean number of aphids per three leaves per plant, respectively.

3.2 Second Spray

At 3 DAS, it was observed that the maximum mean number of aphids (22.09) recorded in the untreated control. Whereas, the minimum number of aphids (0.09) was observed in the treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) which was considered as significantly superior over the other treatments. At 7 DAS, the treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) was found to be most effective with (0.02) mean number of aphids per three leaves per plant. And the maximum incidence of aphids was recorded in treatment T_{11} (Untreated control) with (25.37). From the data of tenth day after spray, it was observed that the minimum mean number of aphids per three leaves per plant (0.96) was recorded in the treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) and it was at par with the treatments T_6 (Azadirachtin 10000 ppm @3 ml/lit) and T_4 (Acetamiprid 20 SP @ 0.5gm/lit) with (1.96 and 2.16 aphids per three leaves per plant), respectively. The highest incidence of aphids (28.33) was observed in the treatment T_{11} (Untreated control). At 14 DAS, the treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) was found to be most effective with (1.89) and the maximum incidence of aphids (35.47) per three leaves per plant was recorded in treatment T_{11} (Untreated control) (Table 2).

3.3 Cumulative Average of Two Sprays

The overall mean number of aphid per three leaves per plant after two sprays revealed that the treatment T_3 (Diafenthiuron 50WP @ 1.5gm/lit) was significantly superior over the other treatments with (5.94) per three leaves per plant and the per cent reduction of (80.65) over the untreated control. The next best treatments T_1 (Imidacloprid 17.8 SL@ 0.3ml/lit.) with the mean number of aphids (7.72) and the per cent reduction (74.86), T_6 (Azadirachtin 10000 ppm @3 ml/lit) with the count of (7.99) and per cent reduction of (73.98) and T_2 (Dimethoate 30EC @ 1.0ml/lit) with the count (9.07) and per cent reduction (70.47), respectively (Table 3).

The presented result was in conformity with the findings of Choudhary [6] studied the efficacy of some insecticides against aphid and showed that the diafenthiuron 50WP was the most effective treatment whereas, Emamectin benzoate 5SG was moderately effective and *Metarhizium anisopliae* 1.15WP and Azadirachtin 0.03EC were the least effective. Patil [7,8] who revealed that the imidacloprid 17.5 SL @ 50 g a.i./ha (56.62%) and dimethoate 30 EC @ 300 g a.i./ha (55.60%) were most effective for the control of aphids. Jakhar [2] studied that the insecticide Imidacloprid (0.005%) was most effective with (77.64%) reduction over control. Golyankar [9] studied the efficacy of insecticides and revealed that the Azadirachtin 10000 ppm recorded 6.20 mean aphids 3 leaves/plant and was at par with *Lecanicillium lecanii*, and *Metarrhizium anisopliae* recorded 7.28 and 8.21 mean aphid population, respectively. Shivanand [10] found that the least population of aphids was noticed in plots treated with imidacloprid 17.8 SL @ 0.25 ml/l (5.47±0.43 no./five leaf) with 83.06 per cent reduction of aphid population over pre-treatment count and it was at par with Dimethoate 30 EC @ 1.7 ml/l (6.27±0.76 no./five leaf) with 79.34 per cent population reduction. Meena [11] who studied that the acetamiprid 20 SP @ 0.4 g/lit was found most effective against the bean aphids. Meena [12] studied that the most effective insecticides against the aphids were imidacloprid 17.8% SL (0.33 ml/l) followed by thiamethoxam 25% WG (0.5 g/l) and Acetamiprid 20% SP (0.4g/l). Choudhary [13] revealed that the insecticides imidacloprid, thiamethoxam and dimethoate were found effective against the pests. Patil [7,8] studied that the imidacloprid 17.5 SL @ 50 g a.i./ha and dimethoate 30 EC @ 300 g a.i./ha were superior over the other treatments. Swarnalata [14] studied that the treatment imidacloprid 0.005 per cent (0.19 aphid index/plant) was found to be most effective followed by thiamethoxam 0.01 per cent (0.33 aphid index/plant) [15].

Table 1. Effect of insecticides on aphids, *A. craccivora* infesting dolichos bean after first spray

Tr. No.	Treatment	Dose/lit.	Mean no. of aphid/three leaves/plant					
			Pre-count	3 DAS	7 DAS	10 DAS	14 DAS	Overall Mean
T_1	Imidacloprid 17.8 SL	0.3 ml	26.27 (5.22) *	11.29 (3.51)	7.49 (2.91)	8.89 (3.13)	15.53 (3.94)	10.80
T_2	Dimethoate 30EC	1.0 ml	26.85 (5.28)	9.98 (3.31)	11.45 (3.53)	14.51 (3.94)	20.84 (4.57)	14.19
T_3	Diafenthiuron 50WP	1.5 gm	24.46 (5.05)	16.42 (4.17)	6.22 (2.69)	7.57 (2.92)	14.38 (3.79)	11.15
T_4	Acetamiprid 20 SP	0.5 gm	24.76 (5.08)	10.27 (3.36)	17.75 (4.33)	19.10 (4.48)	19.46 (4.41)	16.65
T_5	Thiamethoxam 25WG	0.2 gm	23.40 (4.94)	17.58 (4.31)	7.86 (2.98)	14.33 (3.90)	25.38 (5.04)	16.28
T_6	Azadirachtin10000ppm	3.0 ml	23.89 (4.99)	20.98 (4.69)	6.99 (2.83)	9.99 (3.32)	17.63 (4.20)	13.89
T_7	*Lecanicillium lecanii* ($1x10^8$cfu/ml)	5.0 ml	24.21 (5.02)	27.15 (5.31)	10.69 (3.42)	19.22 (4.46)	27.65 (5.26)	21.18
T_8	*Metarhizium anisopliae* ($1x10^8$cfu/ml)	4.0 ml	21.43 (4.74)	30.56 (5.62)	20.41 (4.63)	28.53 (5.43)	29.36 (5.42)	27.22
T_9	Emamectin Benzoate 5SG	0.5 gm	28.54 (5.44)	26.47 (5.24)	23.63 (4.96)	19.35 (4.48)	27.56 (5.25)	24.25
T_{10}	Chlorantraniliprole 18.5 SC	0.25 ml	26.67 (5.26)	21.49 (4.74)	21.51 (4.74)	26.49 (5.15)	30.02 (5.51)	24.88
T_{11}	Untreated control	-	25.26 (5.12)	30.98 (5.54)	32.02 (5.57)	35.26 (5.67)	36.09 (5.68)	33.59
S.E +		-	0.37	0.29	0.22	0.26	0.16	-
CD @ 5%		-	NS	0.87	0.64	0.76	0.47	-

** Figures in the parentheses are √x+1values* *DAS= Days after spraying*

Table 2. Effect of insecticides on aphids, *A. craccivora* infesting dolichos bean after second spray

Tr.No.	Treatment	Dose/lit.	Mean no. of aphid/three leaves/plant				
			3 DAS**	7 DAS	10 DAS	14 DAS	Overall mean
T_1	Imidacloprid 17.8 SL	0.3 ml	3.91 (2.22)*	2.87 (1.70)	4.67 (2.38)	7.09 (2.67)	4.63
T_2	Dimethoate 30EC	1.0 ml	4.13 (2.27)	2.56 (1.60)	3.24 (2.06)	5.87 (2.43)	3.95
T_3	Diafenthiuron 50WP	1.5 gm	0.09 (0.29)	0.02 (0.15)	0.96 (1.40)	1.89 (1.38)	0.75
T_4	Acetamiprid 20 SP	0.5 gm	1.13 (1.46)	0.93 (0.96)	2.16 (1.77)	4.13 (2.03)	2.08
T_5	Thiamethoxam 25WG	0.2 gm	8.04 (3.01)	6.62 (2.58)	8.22 (3.04)	9.77 (3.13)	8.16
T_6	Azadirachtin10000ppm	3.0 ml	1.40 (1.54)	0.86 (0.92)	1.96 (1.72)	4.08 (2.01)	2.07
T_7	*Lecanicilliumlecanii* ($1x10^8$cfu/ml)	5.0 ml	12.79 (3.71)	9.71 (3.12)	11.80 (3.58)	13.70 (3.71)	12.0
T_8	*Metarhizium anisopliae* ($1x10^8$cfu/ml)	4.0 ml	16.53 (4.98)	14.89 (3.86)	15.49 (4.06)	17.03 (4.13)	15.98
T_9	Emamectin Benzoate 5 SG	0.5 gm	12.98 (3.73)	14.43 (3.93)	22.40 (4.74)	23.77 (4.88)	18.39
T_{10}	Chlorantraniliprole 18.5 SC	0.25 ml	15.90 (4.11)	16.90 (4.20)	19.30 (4.40)	21.50 (4.64)	18.40
T_{11}	Untreated control	-	22.09 (4.81)	25.37 (5.14)	28.33 (5.42)	35.47 (6.04)	27.82
S.E +		-	0.04	0.07	0.14	0.16	-
CD @ 5%		-	0.11	0.22	0.41	0.48	-

**Figures in the parentheses are $\sqrt{x+1}$values* ***DAS= Days after spraying*

Table 3. Effect of insecticides on aphids, *A. craccivora* infesting dolichos bean (cumulative average of two sprays)

Tr.No.	Treatment	Dose/lit.	Mean no. of aphid/three leaves/plant					Overall mean of two sprays	Percent Reduction over untreated control
			Pre-count	3 DAS**	7 DAS	10 DAS	14 DAS		
T_1	Imidacloprid 17.8 SL	0.3 ml	26.27 (5.22) *	7.60 (2.93)	5.18 (2.49)	6.78 (2.79)	11.31 (3.51)	7.72	74.86
T_2	Dimethoate 30 EC	1.0 ml	26.85 (5.28)	7.06 (2.84)	7.01 (2.83)	8.88 (3.14)	13.36 (3.79)	9.07	70.47
T_3	Diafenthiuron 50 WP	1.5 gm	24.46 (5.05)	8.26 (3.04)	3.12 (2.03)	4.27 (2.29)	8.14 (3.02)	5.94	80.65
T_4	Acetamiprid 20 SP	0.5 gm	24.76 (5.08)	5.70 (2.59)	9.34 (3.22)	10.63 (3.41)	11.80 (3.58)	9.37	69.49
T_5	Thiamethoxam 25 WG	0.2 gm	23.40 (4.94)	12.81 (3.72)	7.24 (2.87)	11.28 (3.34)	17.57 (4.31)	12.23	60.17
T_6	Azadirachtin 10000 ppm	3.0 ml	23.89 (4.99)	11.19 (3.49)	3.93 (2.22)	5.98 (2.64)	10.86 (3.44)	7.99	73.98
T_7	*Lecanicilliumlecanii* $1x10^8$cfu/ml	5.0 ml	24.21 (5.02)	19.97 (4.44)	10.20 (3.35)	15.51 (3.92)	20.67 (4.59)	16.59	45.98
T_8	*Metarhizium anisopliae* $1x10^8$cfu/ml	4.0 ml	21.43 (4.74)	23.55 (4.95)	17.65 (4.32)	22.01 (4.65)	23.20 (4.77)	21.60	29.66
T_9	Emamectin Benzoate 5 SG	0.5 gm	28.54 (5.44)	19.73 (4.55)	19.03 (4.48)	20.87 (4.68)	25.66 (5.16)	21.32	30.57
T_{10}	Chlorantraniliprole 18.5 SC	0.25 ml	26.67(5.26)	18.69 (4.44)	19.21 (4.50)	22.89 (4.89)	25.76 (5.17)	21.64	29.53
T_{11}	Untreated control	-	25.26 (5.12)	26.54 (5.25)	28.69 (5.45)	31.79 (5.73)	35.78 (6.06)	30.71	-
S.E ±		-	0.57	0.33	0.15	0.20	0.16	-	-
CD @ 5%		-	NS	0.98	0.43	0.58	0.47	-	-

** Figures in the parentheses are √**x+1**values, ** DAS= Days after spraying*

4. CONCLUSION

It could be concluded from the above illustrated results the availability of some insecticides of different high efficacies on aphids. The study found that Diafenthiuron 50WP (1.5 gm/l) was the most effective treatment against aphids in dolichos beans. Imidacloprid 17.8 SL (0.3 ml/l) and Azadirachtin 10000 ppm (3 ml/l) also showed significant control, while Dimethoate 30EC (1.0 ml/l) was moderately effective. These findings underscore the importance of selecting potent insecticides like Diafenthiuron to effectively manage aphid infestations and improve crop yield. Integrating these treatments into broader pest management strategies is vital for the sustainable production of dolichos bean.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous, 2022. National Horticulture Board.
2. Jakhar S, Sharma A, Choudhary PK. Efficacy of insecticides against sucking pests of Indian bean, *Lablab purpureus* (Linn.). Journal of Entomology and Zoology Studies. 2018;6:2203-2207.
3. Patil VR, PHALKE SPS. Efficacy of different insecticides against dolichos bean aphid, *Aphis craccivora* Koch. Adv. Life Sci. 2016;5:8354-56.
4. Sharma HC, Singh M. Residual toxicity of insecticides on cabbage caterpillar (*Pieris brassicae*) and their dissipation on cauliflower. Indian Journal of Agricultural Sciences. 1993; 63(1):59-63.
5. Tomizawa M, Maltby D, Medzihradszky KF, Zhang N, Durkin KA, Presly J *et al*. Defining nicotinic agonist binding surfaces through photoaffinity labelling. Biochemistry. 2007;46:8798-8806.
6. Choudhary S, Kantegari AR, Kumawat KC, Jat BL. Efficacy of insecticides and biopesticides against major sucking insect pests of Indian bean *Lablab purpureus* var. typicus. Indian Journal of Entomology. 2022;798-803.
7. Patil V, Phalke S, Pandav Santosh. Efficacy of different insecticides against dolichos bean Aphid, *Aphis craccivora* Koch. Advances in Life Sciences. 2018;5: 8354-8356.
8. Patil S, Sridevi D, Babu TR, Pushpavathi B. Field efficacy of selected insecticides against cowpea aphid, *Aphis craccivora* (Koch). J. Entom. & Zoolog. Studi. 2018;6(3):668-672.
9. Golvankar G, Narangalkar A, Desai V, Salvi B, Dhekale J. Efficacy of different insecticides against lablab bean aphid, *Aphis craccivora* Koch. J. Entomol. Zool. Stud. 2019;7:1152-1158.
10. Shivanand Hongal, Maheswarappa H, Gopal Gurav, Gurumurthy SB, Raghunatha R, Raghavendra K, Sowjanya TV, Bhat, Divya, Rahul, Phatak, Ashoka N. Reflex of different pest management modules against sucking insect-pests and pod borer for the safety of beneficial insects in vegetable french bean (*Phaseolus vulgaris* L.). Legume Research - An International Journal. 2023;10:18805/LR-5068.
11. Meena RK, Meena RK, Singh U, Meena ML, Kumar S. Efficacy of insecticides on Bean aphid, *Aphis cracivora* Koch in Green gram. Annals of Plant Protection Sciences. 2019;27(3):342-345.
12. Meena RK, Meena RK, Singh U, Meena ML, Meena BL. Bio-efficacy of some insecticides against bean aphid, *Aphis cracivora* Koch (Hemiptera: Aphididae) in cluster bean. Pesticide Research Journal. 2020;32(1):159-164.
13. Choudhary AL, Hussain A, Choudhary MD, Samota RG, Jat SL. Bioefficacy of newer insecticides against aphid, *Aphis craccivora* Koch on cowpea. Journal of Pharmacognosy and Phytochemistry. 2017;6(4):1788-1792.
14. Swarnalata B, Patel SM, Pandya HV, Patel SD. Bio-efficacy of insecticides against aphid (*Aphis craccivora* Koch) infesting

cowpea [*Vigna ungiculata* (L.) Walp.]. Asian Journal of Bio Science. 2015; 10(1):83-88 ref. 22.

15. Jakhar Suresh, Kumar Pawan, Nagal Gajanand. Study of the Seasonal Incidence of Hemipteran Pests of Indian Bean, *Lablab purpureus* (L.) and its Natural Enemies in Semi-Arid Conditions of Rajasthan. Trends in Biosciences. 2017; 10:4188-4191.

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