

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

ABSTRACT

A field experiment was carried out to evaluate different insecticides against aphids, *Aphis craccivora* Koch infesting dolichos bean at Vegetable Improvement Scheme, Central Experiment Station, Wakavali, during *rabi* 2022-23. After the first and second spray it was revealed that the treatment T₃ (Difenthiuron 50WP @ 1.5 gm/lit) was the most effective recording a mean number of aphids (5.94) per three leaves per plant and an 80.65% reduction compared to the untreated control. Treatments T₁ (Imidacloprid 17.8 SL @ 0.3 ml/lit) and T₆ (Azadirachtin 10000 ppm @ 3 ml/lit) also showed significant control, with per cent reductions of 74.86 and 73.98, respectively over the untreated control. Treatment T₂ (Dimethoate 30EC @ 1.0 ml/lit) showed the slightly significant result with a mean count of 9.07 aphids per three leaves per plant and 70.47 per cent reduction over untreated control.

Keywords: Dolichos bean, *Aphis craccivora*, insecticides, cumulative

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 (Anonymous, 2022). Dolichos bean is infested by numerous insect 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 include thrips, aphids and whiteflies (Jakhar *et al.* 2018). 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 (Patil *et al.*, 2016). 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 (Sharma *et al.*, 1993). 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 (Tomizawa *et al.*, 2007).

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), *Lecanicilliumlecanii* (1×10^8 cfu/ml) (5.0 ml), *Metarhizium anisopliae* (1×10^8 cfu/ml) (4.0 ml), Emamectin Benzoate 5 SG (0.5 gm), and Chlorantraniliprole 18.5 SC (0.25 ml). The untreated control served as the eleventh treatment.

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.

Result and discussion

A field experiment was carried out at Vegetable Improvement Scheme, Central Experiment Station, Wakawali, Maharashtra during *Rabi* season of 2022 - 2023 to test the efficacy of different insecticides against aphids infesting dolichos bean. Total two sprays were applied at 50 per cent flowering and 50 per cent pod filling stage of the crop.

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 T₂ (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 T₃ (Diafenthiuron 50WP @ 1.5gm/lit)with 6.22 per three leaves per plant, and was at par with the T₆ (Azadirachtin 10000 ppm) and T₁ (Imidacloprid17.8 SL@ 0.3ml/lit).At 10DAS, treatment T₃ (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 T₁ (Imidacloprid 17.8 SL@ 0.3ml/lit) and T₆ (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, T₁₁ (untreated) was recorded with 36.09 aphids per three leaves per plant, while T₃ (Diafenthiuron 50WP @ 1.5gm/lit) recorded the lowest mean number of aphids (14.38) and was at par with the treatments T₁ (Imidacloprid 17.8 SL@ 0.3 ml/lit) and T₆ (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.

Table1: 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					Overall Mean
			Pre-count	3 DAS	7 DAS	10 DAS	14 DAS	
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	Azadirachtin 10000ppm	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	<i>Lecanicilliumlecanii</i> (1 x 10 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	<i>Metarhizium anisopliae</i> (1 x 10 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 $\sqrt{x+1}$ values

DAS= Days after spraying

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 T₃ (Diafenthiuron 50WP @ 1.5gm/lit) which was considered as significantly superior over the other treatments. At 7 DAS, the treatment T₃ (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 T₁₁ (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 T₃ (Diafenthiuron 50WP @ 1.5gm/lit) and it was at par with the treatments T₆ (Azadirachtin 10000 ppm @ 3 ml/lit) and T₄ (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 T₁₁ (Untreated control). At 14 DAS, the treatment T₃ (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 T₁₁ (Untreated control) Table 2.

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				Overall mean
			3 DAS**	7 DAS	10 DAS	14 DAS	
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	Azadirachtin 10000ppm	3.0 ml	1.40 (1.54)	0.86 (0.92)	1.96 (1.72)	4.08 (2.01)	2.07
T ₇	<i>Lecanicillium lecanii</i> (1 x 10 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	<i>Metarhizium anisopliae</i> (1 x 10 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

Cumulative average of two sprays

The overall mean number of aphid per three leaves per plant after two sprays revealed that the treatment T₃ (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 T₁ (Imidacloprid 17.8 SL @ 0.3ml/lit.) with the mean number of aphids (7.72) and the per cent reduction (74.86), T₆ (Azadirachtin 10000 ppm @3 ml/lit) with the count of (7.99) and per cent reduction of (73.98) and T₂ (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 (2022) 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 (2018) 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 (2018) studied that the insecticide Imidacloprid (0.005%) was most effective with (77.64%) reduction over control. Golyankar (2019) 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 *Lecanicilliumlecanii*, and *Metarrhizium anisopliae* recorded 7.28 and 8.21 mean aphid population, respectively. Shivanand (2023) 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 (2019) who studied that the acetamiprid 20 SP @ 0.4 g/lit was found most effective against the bean aphids. Meena (2020) 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 (2017) revealed that the insecticides imidacloprid, thiamethoxam and dimethoate were found effective against the pests. Patil (2018) 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 (2015) 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).

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	Diafenthuron 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	<i>Lecanicilliumlecanii</i> 1 x 10 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	<i>Metarhizium anisopliae</i> 1 x 10 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 $\sqrt{x+1}$ values

** DAS= Days after spraying

Conclusion

In conclusion, 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.

References

- Choudhary, A. L., Hussain, A., Choudhary, M. D., Samota, R. G., and Jat, S. L. 2017. Bioefficacy of newer insecticides against aphid, *Aphis craccivora* Koch on cowpea. *Journal of Pharmacognosy and Phytochemistry*, 6(4), 1788-1792.
- Choudhary, S., Kantegari, A. R., Kumawat, K. C., and Jat, B. L. 2022. Efficacy of insecticides and biopesticides against major sucking insect pests of Indian bean *Lablab purpureus* var. *typicus*. *Indian Journal of Entomology*, 798-803.
- Golvankar, G., Narangalkar, A., Desai, V., Salvi, B., and Dhekale, J. 2019. Efficacy of different insecticides against lablab bean aphid, *Aphis craccivora* Koch. *J. Entomol. Zool. Stud*, 7, 1152-1158.
- Jakhar, Suresh and Kumar, Pawan and Nagal, Gajanand. 2017. 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*. 10. 4188-4191.
- Jakhar, S., Sharma, A., and Choudhary, P. K. (2018). Efficacy of insecticides against sucking pests of Indian bean, *Lablab purpureus* (Linn.). *Journal of Entomology and Zoology Studies*, 6, 2203-2207.
- Meena, R. K., Meena, R. K., Singh, U., Meena, M. L., and Kumar, S. 2019. Efficacy of insecticides on Bean aphid, *Aphis craccivora* Koch in Green gram. *Annals of Plant Protection Sciences*, 27(3), 342-345.
- Meena, R. K., Meena, R. K., Singh, U., Meena, M. L., and Meena, B. L. 2020. Bio-efficacy of some insecticides against bean aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae) in clusterbean. *Pesticide Research Journal*, 32(1), 159-164.
- Anonymous, 2022. *National Horticulture Board*.
- Patil V., Phalke, S and Pandav Santosh. 2018. Efficacy of different insecticides against dolichos bean Aphid, *Aphis craccivora* Koch. *Advances in Life Sciences*. 5, 8354-8356.
- Patil, V. R., and PHALKE, S. P. S. 2016. Efficacy of Different Insecticides Against Dolichos Bean Aphid, *Aphis craccivora* Koch. *Adv. Life Sci*, 5, 8354-56.

- Patil, S., Sridevi, D., Babu, T. R., and Pushpavathi, B. 2018. Field efficacy of selected insecticides against cowpea aphid, *Aphis craccivora* (Koch). *J. Entom. & Zoolog. Studi*, 6(3), 668-672.
- 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.
- Shivanand, Hongal & Maheswarappa, H and Gopal, Gurav and S.B., Gurumurthy and Raghunatha, R and Raghavendra, K and T V, Sowjanya and Bhat, Divya and Rahul, Phatak and Ashoka, N. 2023. 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*. 10.18805/LR-5068.
- Swarnalata, B., Patel, S. M., Pandya, H. V., and Patel, S. D. 2015. Bio-efficacy of insecticides against aphid (*Aphis craccivora* Koch) infesting cowpea [*Vigna unguiculata* (L.) Walp.]. *Asian Journal of Bio Science*, 2015, Vol. 10, No. 1, 83-88 ref. 22.
- Tomizawa M, Maltby D, Medzihradzky KF, Zhang N, Durkin KA, Presly J *et al*. Defining nicotinic agonist binding surfaces through photoaffinity labelling. *Biochemistry*. 2007; 46:8798-8806.

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