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# Efficacy of different insecticides against lablab bean aphid, *Aphis craccivora* Koch

**GM Golvankar, AL Narangalkar, VS Desai, BR Salvi and JS Dhekale**

**Abstract**
The present investigation was carried out to study the efficacy of different insecticides against lablab bean aphid, *Aphis craccivora* Koch. A statistically designed field experiment was conducted with Randomized Block Design with three replications and nine treatments during *Rabi* season of 2017-18 and 2018-19 at Botany farm, College of Agriculture, Dapoli with a view to test the relative efficacy of some insecticides for the control of aphid.

The results on pooled data of both of years, the overall mean aphid population of all observations revealed that the insecticidal treatments *viz.*, treatment $T_4$ (Malathion 50 EC) was significantly superior over rest of the treatments by recording 2.30 overall mean aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_4$ (Malathion 50 EC) was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) recorded with 2.83, 3.94 and 4.10 mean aphid population, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) was recorded 6.20 mean aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*Verticillium lecanii*), $T_5$ (*Beauveria bassiana*) and $T_7$ (*Metarrhizium anisopliae*) recorded 7.28, 8.13 and 8.21 mean aphid population, respectively. The maximum 31.91 aphids three leaves$^{-1}$ plant$^{-1}$ was recorded in treatment $T_9$ (Control water spray).

**Keywords:** Lablab bean aphid, *Aphis craccivora* Koch, efficacy, insecticides

## Introduction
Dolichos bean, *Lablab purpureus* (L.) Sweet commonly known as "lablab bean", "hyacinth bean", "field bean", "Indian bean" or "*Wal*" is one of the important vegetable crops grown in different parts of the country. India is recognized as a major contributor of pulses in the world having about 25 per cent share in the global production and 32 per cent of global acreage in the world. The area and production of pulses crops in the Country are 24.31 million hectares and 19.27 million tonnes, respectively with productivity of 631.9 kg ha$^{-1}$ (Anon., 2016) [1]. Maharashtra ranks first in acreage and production of pulses followed by Madhya Pradesh, Uttar Pradesh, Rajasthan, Orissa, Haryana, Gujrat, Karnataka, Tamilnadu and Andra Pradesh. In Maharashtra, the total pulse production was 34.46 lakh tonnes, which was produced from 38.26 lakh ha with an average production of 900 kg ha$^{-1}$ in the year 2015-2016 while in Konkan region total pulse area was 27.2 thousand ha which produced 16.70 thousand tonnes (Anon., 2016) [1].

Govindan (1974) [4] recorded 55 species of insects and a species of mite feeding on dolichos bean crop from seedling stage to the harvest of the crop. Among the different pests infesting the dolichos bean crop, aphid, *Aphis craccivora* Koch is the most serious pest which is a cosmopolitan in warmer regions of the world. It occurs on all the pulse crops all over the country. Both nymphs and adults suck the cell sap from leaves, petioles, tender stems, inflorescences and tender pods. Due to constant draining of sap, affected leaves get curled and plants remained stunted. In case of severe infestation, the crop withers and dries up. Continues feeding by the large population of aphids results in yellowing, curling and subsequent drying of tender pods. They also secrete the honey dew which spreads on the leaves and twigs on which there develops black sooty mould caused by fungi, *Capnodium* spp. which hampers the process of photosynthesis thereby affecting the yield adversely. Although, *A. craccivora* damages the dolichos bean from seedling to maturity stage, the highest population is seen at flowering to the pod formation stage. Singh (1978) [10] reported that it also acts as a vector for cowpea viruses in Africa. The losses in yield due to bean aphids ranged from 20 to 40 per cent (Singh and Allen, 1980) [9].

The chemical control of sucking pests have been recommended by many workers on different beans to suppress its population effectively (Patel Kshama, 2014 and Chaudhari *et al.*, 2015) [6, 3] but due to continuous and enormous use of same or similar group of pesticides caused problems of resistance, deleterious effect on parasites and predators, residue hazards to men, domestic animals and environment pollution, as such there was a renewed interest in the use of newer and safer insecticides for management of pests infesting lablab bean. Hence, the present investigation was carried out to study the efficacy of different insecticides against lablab bean aphid, *Aphis craccivora* Koch.

## Materials and Methods

A statistically designed field experiment with randomized block design was conducted during 2017-18 and 2018-19 at Botany farm, Dr. B.S.K.K.V., Dapoli.

Experimental Details

| | | |
|---|---|---|
| Location | : | Botany farm, Dr. B.S.K.K.V., Dapoli |
| Design | : | Randomized Block Design (RBD) |
| Replications | : | Three |
| Treatments | : | Nine |
| Season | : | *Rabi* 2017-18, 2018-19 |
| Crop | : | Lablab bean |
| Variety | : | Konkan *Wal* – 2 |
| Plot Size - Gross Plot | : | 3 m x 2.7 m (8.1 $m^2$) |
| Net Plot | : | 2.7 m x 2.4 m (6.48 $m^2$) |
| Spacing | : | 30 x 30 cm |
| Total Experimental Area | : | 357.54 $m^2$ (119.18 $m^2$ x 3) |

Treatment Details

| Treatments | | Insecticides | Conc. (%) | Dose |
|---|---|---|---|---|
| $T_1$ | : | Spinosad 45 SC | 0.015 | 0.3 ml $l^{-1}$ |
| $T_2$ | : | Azadirachtin 10000 ppm (1%) | 0.003 | 3 ml $l^{-1}$ |
| $T_3$ | : | Deltamethrin 2.8 EC | 0.0025 | 0.9 ml $l^{-1}$ |
| $T_4$ | : | Malathion 50 EC | 0.05 | 1ml $l^{-1}$ |
| $T_5$ | : | *Beauveria bassiana* 1.15 WP 1x$10^8$ cfu $g^{-1}$ | - | 5 g $l^{-1}$ |
| $T_6$ | : | *Verticillium lecanii* 1.15 WP 1x$10^8$ cfu $g^{-1}$ | - | 5 g $l^{-1}$ |
| $T_7$ | : | *Metarrhizium anisopliae* 1.15 WP 1x$10^8$ cfu $g^{-1}$ | - | 5 g $l^{-1}$ |
| $T_8$ | : | Emamectin benzoate 5 SG | 0.0016 | 0.32 g $l^{-1}$ |
| $T_9$ | : | Control (Water spray) | - | - |

### Method of recording observations

The observations on aphids were recorded from three leaves *i.e.* lower, middle and upper from five randomly selected plants of lablab bean. The observations were recorded at 3rd, 7th, 10th and 14th days after spraying.

Pre-treatment observation was recorded 24 hrs. before first spray. Spraying was taken as and when pest incidence was observed on lablab bean. Second spraying were done as need base spray. The data thus obtained was subjected to appropriate transformation and analyzed statistically.

### Preparation of spray solution and method of application

The actual quantity of spray volume required per treatment per plot was calibrated by using water alone. At the time of preparation of spray solution, the measured quantity of insecticide was mixed in desired quantity of water. The spray solution was thoroughly stirred with the help of wooden stick and then sprayed uniformly on the crop. The 500 liters of spray solution was used per hectare. Spraying was undertaken by using knapsack sprayer. The spraying of insecticide was done after initiation of the pest. Another application was done 15 days after first spray. Care was taken to wash the spray pump with water and soap thoroughly well before using other insecticides.

## Results and Discussion

### To study the efficacy of insecticides on aphids infesting lablab bean during *Rabi* 2017-18

The data pertaining to the efficacy of different insecticides against aphids infesting lablab bean during *Rabi* 2017-2018 at 3rd, 7th, 10th and 14th days after spraying are presented in Table 1 and graphically illustrated in Fig 1.

The mean population of aphids three $leaves^{-1}$ $plant^{-1}$ prior to application of treatments ranged from 19.15 to 20.08. However, the differences among the treatments were non-significant. This indicated that the aphid population over experimental plot was uniform.

### First spray

The data on number of aphids three $leaves^{-1}$ $plant^{-1}$ on third day after first spray revealed that minimum population of aphids (8.02) recorded in treatment $T_4$ (Malathion 50 EC) which was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) which recorded 8.90, 9.34 and 9.62 aphids three $leaves^{-1}$ $plant^{-1}$, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) was recorded 11.94 aphids three $leaves^{-1}$ $plant^{-1}$. Whereas, the treatment $T_6$ (*Verticillium lecanii*) recorded 16.02 mean aphid population which was at par with treatments $T_5$ (*Beauveria bassiana*) (16.82) and $T_7$ (*Metarrhizium anisopliae*) (16.83). The maximum (24.72) mean aphid population observed in $T_9$ (Control water spray).

The observations recorded on seventh day after first spray revealed that the treatment $T_4$ (Malathion 50 EC) which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 5.38 and 7.03 aphids three $leaves^{-1}$ $plant^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and $T_2$ (Azadirachtin 10000 ppm) which recorded 8.33, 8.46 and 10.78 mean aphid population, respectively. The treatment $T_6$ (*V. lecanii*) which was at par with treatments $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which recorded 12.85, 13.84 and 14.02 mean aphid population, respectively. The treatment $T_9$ (Control water spray) was recorded maximum (30.77) mean aphid population.

On tenth day after first spray the treatment $T_4$ (Malathion 50 EC) was found effective for minimizing mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 2.80 and 3.03 mean aphid population. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatment $T_8$ (Emamectin benzoate 5 SG) and which recorded 5.10 and 5.19 mean aphid

population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatment $T_6$ (*V. lecanii*) and noticed 8.37 and 9.04 mean aphid population. The treatment $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which was at par with each other recorded 11.08 and 11.17 mean aphid population, respectively. The highest 37.40 aphids three leaves$^{-1}$ plant$^{-1}$ was observed in treatment $T_9$ (Control water spray).

The observations recorded on fourteenth day after first spray revealed that the treatment $T_4$ (Malathion 50 EC) found to be significantly superior over rest of the treatments and which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 1.22 and 1.49 aphids three leaves$^{-1}$ plant$^{-1}$. The next best treatments was found treatment $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) which were at par with each other and recorded 2.61 and 2.75 mean aphid population, respectively. In treatment $T_2$ (Azadirachtin 10000 ppm) recorded 7.24 mean aphid population which was at par with treatments $T_6$ (*V. lecanii*) (8.01), $T_5$ (*B. bassiana*) (8.92) and $T_7$ (*M. anisopliae*) (9.14), respectively. In treatment $T_9$ (Control water spray) was observed maximum 38.87 aphids three leaves$^{-1}$ plant$^{-1}$.

**Second spray**

On 3$^{rd}$ day after second spray the treatment $T_4$ (Malathion 50 EC) was recorded least (0.00) mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 0.56 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and which recorded 2.23 and 2.60 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with followed by treatment $T_6$ (*V. lecanii*) recorded 4.25 and 5.06 mean aphid population. The treatment $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 6.16 and 6.30 mean aphid population and both treatments was at par with each other. The highest 49.08 aphids three leaves$^{-1}$ plant$^{-1}$ was observed in treatment $T_9$ (Control water spray).

The observations on 7$^{th}$ day after second spray revealed that in the treatment $T_4$ (Malathion 50 EC) observed least (0.00) aphid population and found to be significantly superior over rest of the treatments which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) recorded 0.24 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and $T_2$ (Azadirachtin 10000 ppm) which recorded 1.90, 2.07 and 3.32 mean aphid population, respectively. The treatment $T_6$ (*V. lecanii*) which was at par with treatments $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which recorded 3.55, 4.12 and 4.17 mean aphid population, respectively. The treatment $T_9$ (Control water spray) was recorded maximum (56.68) mean aphid population.

On 10$^{th}$ day after second spray the treatment $T_4$ (Malathion 50 EC) was recorded least (0.00) mean aphid population. The treatment $T_4$ (Malathion 50 EC) found effective for minimizing mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) recorded 0.02 mean aphid population. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and which recorded 0.43 and 0.50 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) and observed 1.23, 1.28, 1.47 and 1.70 aphids three leaves$^{-1}$ plant$^{-1}$, respectively. The highest 10.13 mean aphid population was observed in treatment $T_9$ (Control water spray).

The data on 14$^{th}$ day after second spray revealed that the treatment $T_4$ (Malathion 50 EC) was found significantly superior over rest of the treatments and recorded 0.03 aphids three leaves$^{-1}$ plant$^{-1}$ which was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) with 0.03, 0.21 and 0.23 mean aphid population, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 0.83, 0.91, 0.96 and 0.99 mean aphid population, respectively. In treatment $T_9$ (Control water spray) was observed maximum 6.28 aphids three leaves$^{-1}$ plant$^{-1}$.

The data pertaining to overall mean population of aphids in year 2017-2018 revealed that the treatment $T_4$ (Malathion 50 EC) was significantly superior over rest of the treatments by recording 2.18 overall mean aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_4$ (Malathion 50 EC) was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) recorded with 2.66, 3.77 and 3.93 mean aphid population, respectively. Whereas, the next best treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 5.99, 7.09, 7.92 and 8.04 mean aphid population, respectively. The maximum 31.74 aphids three leaves$^{-1}$ plant$^{-1}$ was observed in treatment $T_9$ (Control water spray).

**To study the efficacy of insecticides on aphids infesting lablab bean during *Rabi* 2018-19**

The data pertaining to efficacy of insecticides on aphids infesting lablab bean during *Rabi* 2018-2019 at 3$^{rd}$, 7$^{th}$, 10$^{th}$ and 14$^{th}$ days after spraying are presented in Table 2 and graphically illustrated in Fig 1.

The efficacy of different insecticides on aphids infesting lablab bean during *Rabi* 2018-2019 prior to application of insecticides ranged from 21.37 to 22.25 and data was statistically non-significant.

**First spray**

The data on number of aphids three leaves$^{-1}$ plant$^{-1}$ on 3$^{rd}$ day after first spray revealed that minimum population of aphids (8.62) recorded in treatment $T_4$ (Malathion 50 EC) which was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) which recorded 9.60, 10.04 and 10.32 aphids three leaves$^{-1}$ plant$^{-1}$, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) was recorded 12.68 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_6$ (*V. lecanii*) recorded 16.92 mean aphid population which was at par with treatments $T_5$ (*B. bassiana*) (17.87) and $T_7$ (*M. anisopliae*) (17.53). The maximum (25.42) mean aphid population observed in $T_9$ (Control water spray).

The observations recorded on 7$^{th}$ day after first spray revealed that the treatment $T_4$ (Malathion 50 EC) which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 5.83 and 7.58 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and $T_2$ (Azadirachtin 10000 ppm) which recorded 8.88, 9.01 and 11.41 mean aphid population, respectively. The treatment $T_6$ (*V. lecanii*) which was at par with treatments $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which recorded 13.40, 14.39 and 14.57 mean aphid population, respectively. The treatment $T_9$

(Control water spray) was recorded maximum (31.32) mean aphid population.

On 10th day after first spray the treatment $T_4$ (Malathion 50 EC) was found effective for minimizing mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 3.35 and 3.68 mean aphid population. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatment $T_8$ (Emamectin benzoate 5 SG) and which recorded 5.75 and 5.84 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatment $T_6$ (*V. lecanii*) and noticed 9.10 and 9.69 mean aphid population. The treatment $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which was at par with each other recorded 11.73 and 11.82 mean aphid population, respectively. The highest 38.05 aphids three leaves$^{-1}$ plant$^{-1}$ was observed in treatment $T_9$ (Control water spray).

The observations recorded on 14th day after first spray revealed that the treatment $T_4$ (Malathion 50 EC) found to be significantly superior over rest of the treatments and which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 1.47 and 1.84 aphids three leaves$^{-1}$ plant$^{-1}$. The next best treatments was found treatment $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) which were at par with each other and recorded 2.96 and 3.10 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) recorded 7.69 mean aphid population which was at par with treatments $T_6$ (*V. lecanii*) (8.36), $T_5$ (*B. bassiana*) (9.27) and $T_7$ (*M. anisopliae*) (9.49), respectively. In treatment $T_9$ (Control water spray) was observed maximum 39.22 aphids three leaves$^{-1}$ plant$^{-1}$.

**Second spray**

On third day after second spray the treatment $T_4$ (Malathion 50 EC) was recorded minimum (0.10) mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) and recorded 0.71 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and which recorded 2.38 and 2.75 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with followed by treatment $T_6$ (*V. lecanii*) recorded 4.50 and 5.21 mean aphid population. The treatment $T_7$ (*M. anisopliae*) and $T_5$ (*B. bassiana*) was recorded 6.45 and 6.54 mean aphid population and both treatments at par with each other. The highest 49.23 aphids three leaves$^{-1}$ plant$^{-1}$ was observed in treatment $T_9$ (Control water spray).

The observations on seventh day after second spray revealed that in the treatment $T_4$ (Malathion 50 EC) observed least (0.01) aphid population and found to be significantly superior over rest of the treatments which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) recorded 0.29 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_1$ (Spinosad 45 SC) found next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and $T_2$ (Azadirachtin 10000 ppm) which recorded 1.95, 2.12 and 3.37 mean aphid population, respectively. The treatment $T_6$ (*V. lecanii*) which was at par with treatments $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) which recorded 3.60, 4.17 and 4.22 mean aphid population, respectively. The treatment $T_9$ (Control water spray) was recorded maximum (56.73) mean aphid population.

On tenth day after second spray the treatment $T_4$ (Malathion 50 EC) was recorded least (0.01) mean aphid population. The treatment $T_4$ (Malathion 50 EC) found effective for minimizing mean aphid population which was at par with treatment $T_3$ (Deltamethrin 2.8 EC) recorded 0.29 mean aphid population. The treatment $T_1$ (Spinosad 45 SC) found to be next best treatment which was at par with treatments $T_8$ (Emamectin benzoate 5 SG) and which recorded 0.68 and 0.75 mean aphid population, respectively. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) and observed 1.53, 1.53, 1.72 and 1.95 aphids three leaves$^{-1}$ plant$^{-1}$, respectively. The highest 10.38 mean aphid population was observed in treatment $T_9$ (Control water spray).

The data on fourteenth day after second spray revealed that the treatment $T_4$ (Malathion 50 EC) was found significantly superior over rest of the treatments and recorded least (0.00) aphids three leaves$^{-1}$ plant$^{-1}$ which was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) with 0.05, 0.23 and 0.25 mean aphid population, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 0.90, 0.93, 0.98 and 1.02 mean aphid population, respectively. In treatment $T_9$ (Control water spray) was observed maximum 6.30 aphids three leaves$^{-1}$ plant$^{-1}$.

The data pertaining to overall mean population of aphids in year 2018-2019 revealed that the treatment $T_4$ (Malathion 50 EC) recorded minimum 2.42 aphids three leaves$^{-1}$ plant$^{-1}$ and found to be significantly superior over rest of the treatments and at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) recorded 3.00, 4.11 and 4.27 mean aphid population, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) was recorded 6.40 aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 7.46, 8.33 and 8.38 mean aphid population, respectively. The treatment $T_9$ (Control water spray) was recorded highest 32.08 aphids three leaves$^{-1}$ plant$^{-1}$.

**Pooled efficacy of insecticides on aphids infesting lablab bean during *Rabi* 2017-18 and *Rabi* 2018-19**

The data pertaining to the pooled mean aphid population of both years for different days and different sprays was analyzed. Similarly data on overall mean of different days and two sprays was analyzed and presented in Table 3 and graphically presented in Fig. 1.

A pre-count observation prior to application of insecticides was non-significant.

The data on overall mean aphid population of all observations revealed that the treatment $T_4$ (Malathion 50 EC) was significantly superior over rest of the treatments by recording 2.30 overall mean aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_4$ (Malathion 50 EC) was at par with treatments $T_3$ (Deltamethrin 2.8 EC), $T_1$ (Spinosad 45 SC) and $T_8$ (Emamectin benzoate 5 SG) recorded with 2.83, 3.94 and 4.10 mean aphid population, respectively. The next best treatment $T_2$ (Azadirachtin 10000 ppm) was recorded 6.20 mean aphids three leaves$^{-1}$ plant$^{-1}$. The treatment $T_2$ (Azadirachtin 10000 ppm) which was at par with treatments $T_6$ (*V. lecanii*), $T_5$ (*B. bassiana*) and $T_7$ (*M. anisopliae*) recorded 7.28, 8.13 and 8.21 mean aphid population, respectively. The maximum 31.91 aphids three leaves$^{-1}$ plant$^{-1}$ was recorded in treatment $T_9$ (Control water spray).

The present findings are more or less in conformity with the

studies carried out by the earlier workers. Yadav *et al*. (2011) [11] proved that the dimethoate, imidacloprid, thiamethoxam and acephate were the most effective treatments in controlling *A. craccivora* on cluster bean. The highest seed yield was also obtained in the plots treated with dimethoate, imidacloprid and thiamethoxam. The results revealed that imidacloprid 17.8 SL @ 25 g a.i. ha$^{-1}$ in combination with spinosad 45 SC @ 75 g a.i. ha$^{-1}$ recorded the significantly lowest aphid index and it was at par with imidacloprid 17.8 SL @ 25 g a.i. ha$^{-1}$ in combination with novaluron 10 EC @ 33.5 g a.i. ha$^{-1}$, thiamethoxam 25 WG @ 35 g a.i. ha$^{-1}$ in combination with spinosad 45 SC @ 75 g a.i. ha$^{-1}$ and thiamethoxam 25 WG @ 35 g a.i. ha$^{-1}$ in combination with novaluron 10 EC @ 33.5 g a.i. ha$^{-1}$ (Anon., 2013) [2].

Jakhar (2014) [5] evaluated that the efficacy of six insecticides against aphid, jassid and whitefly population and revealed that the imidacloprid (0.005%) most effective against all this pests. The treatment of malathion (0.05%) proved least effective. The fruit yield showed that imidacloprid treated plants yielded maximum and it was followed by malathion. The benefit cost ratio was highest in imidacloprid and lowest in thiamethoxam. Imidacloprid 17.8 SL in combination with spinosad 45 SC was the best in reducing almost all the five major insect pests, recording 2.05 aphid index, 2.21 jassids leaf$^{-1}$, 2.51 whiteflies leaf$^{-1}$, 3.01 pod borer larvae plant$^{-1}$ and 2.76 spotted pod borer larvae plant$^{-1}$ reported by Patel Kshama (2014) [6].

Shinde Poonam (2014) [8] revealed that the lowest aphid population was recorded in the treatments of *Verticillium lecanii* 7.5 g and *V. lecanii* 5 g with 33.70 and 35.28 aphids/3 leaves respectively, which were at par with each other and were superior over all other treatments. Whereas, use of insecticides for management of aphids on dolichos bean, 0.01 per cent acephate 75 SP and 0.075 per cent novaluron 10 EC recorded with 25.66 and 28.20 aphids/3 leaves, respectively, observed to be most effective treatments. The results revealed that insecticidal treatments *viz*., 0.05 per cent ednosulfan, 0.05 per cent dichlorvos + 0.1 per cent carbaryl, 0.002 per cent emamectin benzoate, 0.006 per cent cypermethrin + profanophos and 0.05 per cent dichlorvos were found to be most effective for the control of bean aphid, *A. craccivora* (Patil *et al*. 2016) [7].

**Table 1:** Efficacy of different insecticides against aphids on lablab bean during *Rabi* 2017-18

| Treatments | Mean population of aphids three leaves$^{-1}$ plant$^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre count | I$^{st}$ spray | | | | II$^{nd}$ spray | | | | Overall mean |
| | | 3 DAS | 7 DAS | 10 DAS | 14 DAS | 3 DAS | 7 DAS | 10 DAS | 14 DAS | |
| $T_1$ | 19.35 (4.48)* | 9.34 (3.21) | 8.33 (3.05) | 5.10 (2.46) | 2.61 (1.89) | 2.23 (1.78) | 1.90 (1.67) | 0.43 (1.19) | 0.21 (1.10) | 3.77 (2.05) |
| $T_2$ | 19.42 (4.51) | 11.94 (3.58) | 10.78 (3.42) | 8.37 (3.06) | 7.24 (2.87) | 4.25 (2.28) | 3.32 (2.08) | 1.23 (1.49) | 0.83 (1.35) | 5.99 (2.52) |
| $T_3$ | 19.15 (4.49) | 8.90 (3.14) | 7.03 (2.83) | 3.03 (2.00) | 1.49 (1.57) | 0.56 (1.23) | 0.24 (1.11) | 0.02 (1.01) | 0.03 (1.01) | 2.66 (1.74) |
| $T_4$ | 19.52 (4.50) | 8.02 (3.00) | 5.38 (2.51) | 2.80 (1.95) | 1.22 (1.47) | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) | 0.03 (1.01) | 2.18 (1.62) |
| $T_5$ | 19.85 (4.56) | 16.82 (4.21) | 13.84 (3.85) | 11.08 (3.47) | 8.92 (3.15) | 6.16 (2.67) | 4.12 (2.26) | 1.47 (1.57) | 0.96 (1.40) | 7.92 (2.83) |
| $T_6$ | 19.40 (4.51) | 16.02 (4.12) | 12.85 (3.71) | 9.04 (3.17) | 8.01 (3.00) | 5.06 (2.46) | 3.55 (2.13) | 1.28 (1.51) | 0.91 (1.38) | 7.09 (2.69) |
| $T_7$ | 19.20 (4.49) | 16.83 (4.22) | 14.02 (3.87) | 11.17 (3.48) | 9.14 (3.18) | 6.30 (2.70) | 4.17 (2.27) | 1.70 (1.64) | 0.99 (1.41) | 8.04 (2.85) |
| $T_8$ | 20.08 (4.58) | 9.62 (3.25) | 8.46 (3.07) | 5.19 (2.49) | 2.75 (1.93) | 2.60 (1.89) | 2.07 (1.70) | 0.50 (1.22) | 0.23 (1.11) | 3.93 (2.09) |
| $T_9$ | 19.89 (4.57) | 24.72 (5.06) | 30.77 (5.62) | 37.40 (6.19) | 38.87 (6.31) | 49.08 (7.07) | 56.68 (7.59) | 10.13 (3.34) | 6.28 (2.68) | 31.74 (5.49) |
| SE (m±) | 0.21 | 0.18 | 0.16 | 0.13 | 0.11 | 0.13 | 0.14 | 0.06 | 0.08 | 0.31 |
| CD at 0.05% | NS | 0.53 | 0.49 | 0.38 | 0.32 | 0.38 | 0.42 | 0.17 | 0.25 | 0.87 |

*Figures in parenthesis are $\sqrt{n+1}$ values (DAS- Days After Spraying)

**Table 2:** Efficacy of different insecticides against aphids on lablab bean during *Rabi* 2018-19

| Treatments | Mean population of aphids three leaves$^{-1}$ plant$^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre count | I$^{st}$ spray | | | | II$^{nd}$ spray | | | | Overall mean |
| | | 3 DAS | 7 DAS | 10 DAS | 14 DAS | 3 DAS | 7 DAS | 10 DAS | 14 DAS | |
| $T_1$ | 21.37 (4.62)* | 10.04 (3.32) | 8.88 (3.14) | 5.75 (2.59) | 2.96 (1.98) | 2.38 (1.82) | 1.95 (1.69) | 0.68 (1.29) | 0.23 (1.11) | 4.11 (2.13) |
| $T_2$ | 21.63 (4.65) | 12.68 (3.69) | 11.41 (3.51) | 9.10 (3.18) | 7.69 (2.94) | 4.50 (2.34) | 3.37 (2.09) | 1.53 (1.59) | 0.90 (1.38) | 6.40 (2.59) |
| $T_3$ | 21.37 (4.62) | 9.60 (3.25) | 7.58 (2.93) | 3.68 (2.15) | 1.84 (1.68) | 0.71 (1.29) | 0.29 (1.13) | 0.27 (1.13) | 0.05 (1.03) | 3.00 (1.83) |
| $T_4$ | 21.55 (4.64) | 8.62 (3.10) | 5.83 (2.59) | 3.35 (2.09) | 1.47 (1.56) | 0.10 (1.05) | 0.01 (1.00) | 0.01 (1.00) | 0.00 (1.00) | 2.42 (1.68) |
| $T_5$ | 22.03 (4.69) | 17.87 (4.34) | 14.39 (3.92) | 11.73 (3.56) | 9.27 (3.20) | 6.54 (2.74) | 4.17 (2.27) | 1.72 (1.65) | 0.98 (1.41) | 8.33 (2.89) |
| $T_6$ | 21.64 (4.65) | 16.92 (4.22) | 13.40 (3.79) | 9.69 (3.27) | 8.36 (3.06) | 5.21 (2.49) | 3.60 (2.14) | 1.53 (1.59) | 0.93 (1.39) | 7.46 (2.75) |
| $T_7$ | 21.45 (4.63) | 17.53 (4.30) | 14.57 (3.94) | 11.82 (3.57) | 9.49 (3.24) | 6.45 (2.73) | 4.22 (2.28) | 1.95 (1.72) | 1.02 (1.42) | 8.38 (2.90) |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_8$ | 22.25 (4.72) | 10.32 (3.36) | 9.01 (3.16) | 5.84 (2.62) | 3.10 (2.02) | 2.75 (1.93) | 2.12 (1.72) | 0.75 (1.32) | 0.25 (1.12) | 4.27 (2.16) |
| $T_9$ | 22.11 (4.70) | 25.42 (5.13) | 31.32 (5.67) | 38.05 (6.24) | 39.22 (6.33) | 49.23 (7.08) | 56.73 (7.60) | 10.38 (3.37) | 6.30 (2.68) | 32.08 (5.52) |
| SE (m±) | 0.21 | 0.17 | 0.16 | 0.12 | 0.10 | 0.13 | 0.14 | 0.05 | 0.08 | 0.31 |
| CD at 0.05% | NS | 0.52 | 0.48 | 0.36 | 0.31 | 0.38 | 0.41 | 0.16 | 0.25 | 0.87 |

*Figures in parenthesis are $\sqrt{n+1}$ values (DAS- Days After Spraying)

**Table 3:** Pooled efficacy of different insecticides against aphids on lablab bean during *Rabi* 2017-18 and 2018-19

| Treatments | Mean population of aphids three leaves$^{-1}$ plant$^{-1}$ | | |
|---|---|---|---|
| | Overall mean | | Pooled Mean |
| | 2017-18 | 2018-19 | |
| $T_1$ : Spinosad 45 SC @ 0.015% | 3.77 (2.05)* | 4.11 (2.13) | 3.94 (2.09) |
| $T_2$ : Azadirachtin 10,000 ppm @ 0.003% | 5.99 (2.52) | 6.40 (2.59) | 6.20 (2.56) |
| $T_3$ : Deltamethrin 2.8 EC @ 0.0025% | 2.66 (1.74) | 3.00 (1.83) | 2.83 (1.79) |
| $T_4$ : Malathion 50 EC @ 0.05% | 2.18 (1.62) | 2.42 (1.68) | 2.30 (1.65) |
| $T_5$ : *Beauveria bassiana* @ 5 g l$^{-1}$ | 7.92 (2.83) | 8.33 (2.89) | 8.13 (2.86) |
| $T_6$ : *Verticillium lecanii* @ 5 g l$^{-1}$ | 7.09 (2.69) | 7.46 (2.75) | 7.28 (2.72) |
| $T_7$ : *Metarrhizium anisopliae* @ 5 g l$^{-1}$ | 8.04 (2.85) | 8.38 (2.90) | 8.21 (2.88) |
| $T_8$ : Emamectin benzoate 5 SG @ 0.0016% | 3.93 (2.09) | 4.27 (2.16) | 4.10 (2.13) |
| $T_9$ : Control (Water spray) | 31.74 (5.49) | 32.08 (5.52) | 31.91 (5.51) |
| SE (m±) | 0.31 | 0.31 | 0.31 |
| CD at 0.05% | 0.87 | 0.87 | 0.89 |

*Figures in parenthesis are $\sqrt{n+1}$ values

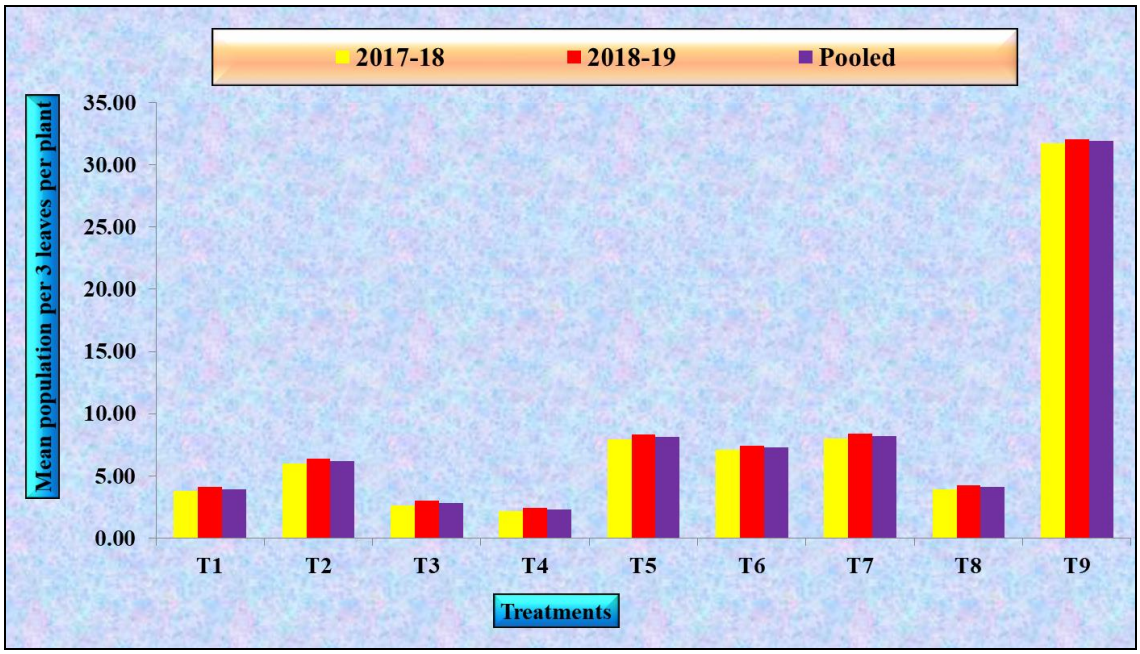


**Fig 1:** Pooled efficacy of different insecticides against aphids on lablab bean during *Rabi* 2017-18 and *Rabi* 2018-19

## Conclusion

Present study concluded that the among the different insecticides evaluated, the application of malathion 50 EC @ (0.05%) was most effective against aphids followed by deltamethrin 2.8 EC @ (0.0025%), spinosad 45 SC @ (0.015%), emamectin benzoate 5 SG @ (0.0016%). After that azadirachtin 10000 ppm (1%) @ (0.003%), *Verticillium lecanii*, *Beauveria bassiana* and *Metarrhizium anisopliae* @ 5 g l$^{-1}$ were also minimize the aphid population. When an entomopathogenic fungus is also getting favourable climatic condition then it shows most effective against aphid population.

## References

1. Anonymous. 2016; URL: www.agriindia.co.in
2. Anonymous. Study on the relative bio-efficacy of some insecticides against pests of Indian bean, Tenth meeting of Plant Protection Sub-Committee Annual Research Report: (2013-2014). Navsari Agril. University, Navsari, 2013, 2-8 (Unpublished).
3. Chaudhari AJ, Korat DM, Dabhi MR. Bio-efficacy of eco-friendly insecticides against pests of Indian bean, *Lablab purpureus* L. Karnataka J Agric. Sci., 2015; 28(2):271-273.
4. Govindan R. Insects of the field bean, *Lablab niger* var. Lignosus Medikus with special reference to the biology and ecology of the pod borer, *A. atkinsoni* Moore (Leipdoptera: Noctuidae). M. Sc. (Agri.) Thesis submitted to the UAS, Bangalore, 1974, 1-34.
5. Jakhar S. Management of sucking pests of Indian bean,

*Lablab purpureus* (Linn.) Sweet. M. Sc. (Ag.) Thesis submitted to the S. K. N. Agril. University, Jobner, Rajasthan, 2014, 83.
6. Patel Kshama B. Population dynamics and chemical control of pest complex of Indian bean [*Lablab purpureus* (L). Walp.]. M. Sc. Thesis submitted to the NAU, Navsari, Gujrat, 2014, 3-4.
7. Patil VR, Pandav SM, Phalke SH. Efficacy of different insecticides against dolichos bean aphid, *Aphis craccivora* Koch. Adv. in Life Sci. 2016; 5(19):8354-8356.
8. Shinde Poonam S. Seasonal incidence, species diversity, natural enemies and management of aphids infesting vegetables in Konkan region. Ph. D. (Ag.) Thesis submitted to the Dr. B.S.K.K.V., Dapoli, Maharashtra (Unpublished), 2014, 62-211.
9. Singh SR, Allen DJ. Pests, diseases, resistance and protection in cowpeas. Advances in Legume Sciences, 1980, 419-443.
10. Singh SR. Resistance to pests of cowpea in Nigeria. Pests of grain Legumes: Ecology and Control, 1978, 267-279.
11. Yadav SR, Kumawat KC, Khinchi SK. Efficacy of new insecticide molecules and bioagents against sucking insect pests of cluster bean, *Cyamopsis tetragonoloba* (Linn.) Taub. J Pl. Prot. and Environ. 2011; 8(1):115-122.