



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(5): 331-337
Received: 15-03-2026
Accepted: 18-04-2026

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Efficacy of different insecticides against aphid infesting Okra

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i5Sd.5592>

Abstract

To study the efficacy of different insecticides against aphid infesting Okra the experiment was undertaken at Vegetable Improvement Scheme, Central Experiment Station, Wakawali under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the summer, 2023-24 and summer, 2024-25. Experiment was laid out in Randomized Block Design with eight treatments and three replications. Three foliar sprays of the insecticide treatments viz., Fenprothrin 30% EC, Fluxametamide 10% w/w EC, Tolfenpyrad 15% EC, Chlorantraniliprole 09.30% + Lambda-Cyhalothrin 04.60 ZC, Emamectin benzoate 05% SG, Azadirachtin (10000 ppm) and *Metarhizium anisopliae* (Metschnikoff) were applied at fortnight interval initiating the first when sufficient aphid incidence was noticed at 30th days after sowing along with untreated Control. The pooled results revealed that, the significant difference was found in aphid population among the treatments. The data recorded on overall mean of three sprays revealed that all the treatments recorded a significantly lower population of aphid than untreated control. The minimum population of aphid was observed in treatment Tolfenpyrad 15% EC (1.39/three leaves) with highest (86.31) per cent reduction over untreated control which was found significantly superior than other treatments.

Keywords: Efficacy, Aphid, Tolfenpyrad

Introduction

In India, vegetables have occupied the important place in human diet. Among different vegetables okra, (*Abelmoschus esculentus* L. Moench) belonging to Malvaceae family is an important annual vegetable crop widely cultivated round the year in India. The attack of sucking pest complex and mite pests is one of the significant factors limiting okra cultivation, they damage the crop by sucking cell sap and devitalize the plant. The sugary substance 'honey dew' secreted by sucking pests also causes major problem leads to reduction in photosynthetic activity of plant. In sucking pests' aphid, leafhopper, white fly, and mites pose a major threat to the okra production. Aphids is a major sucking pest causes heavy damage in okra, cause yellowing, stunted growth, curling and crinkling of leaves). Leaf hopper (*Amrasca bigutulla bigutulla*) is a very destructive pest. In the early stages of the crop, leaf hoppers are a significant pest that weaken and reduce yield by sucking sap from the plants. It was reported that failure to control them in the early stages resulted in a yield loss of 54.04%. (Chaudhary and Dadeech, 1989) [6]. As many as 72 species of insects have been recorded on okra (Srinivas Rao and Rajendran, 2003) [1]. Efficacy testing of different insecticides against Okra pests is useful for determining which insecticides are most effective in controlling pests, allowing for the development of more targeted and sustainable pest management strategies. These pesticidal solutions are easily available, easy to use and very effective than any other methods. Hence, an attempt is made to study the efficacy of the important insecticides against aphid infesting Okra.

Material and Method

A field experiment was laid out in Randomized Block Design in Summer season for the two successive years, i.e., 2023-24 and 2024-25 at Center Experiment Station, Wakawali running under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli to study Efficacy of different

insecticides against aphid infesting Okra. Konkan bhendi genotype is planted at distance of 45 x 30 cm. Three foliar sprays of the insecticide treatments at fortnight interval were conducted initiating the first when sufficient pest incidence noticed at 30th days after sowing. 500 liters of water per hectare was used as diluent to mix insecticides for foliar spray applications. Hand operated Knapsack Sprayer with hollow cone nozzle was used for foliar spray applications.

Method of recording observations

The observations were taken as a pre count before one day to spraying of experiment plot and one, three, seven, ten and fourteen days after spraying as post count. Observations of 14th day were treated as pre count for next foliar spray application. The number of nymph and adults of aphid were recorded from three leaves (from top, middle and bottom) of selected plant for taking observations.

$$\text{Per cent reduction over untreated control} = \left[1 - \frac{\text{No of pests in treatment plot}}{\text{No of pests in control plot}} \right] \times 100$$

Table 1: Treatment details

Treatment No.	Treatment	Concentration (%)	Quantity per Liter of water (ml/gm)
T ₁	Fenpropathrin 30% EC	0.01	0.33 ml
T ₂	Fluxametamide 10% w/w EC	0.008	0.8 ml
T ₃	Tolfenpyrad 15% EC	0.003	2.00 ml
T ₄	Chlorantraniliprole 09.30% + Lambda-Cyhalothrin 04.60 ZC	0.005	0.4 ml
T ₅	Emamectin benzoate 05% SG	0.001	0.27 gm
T ₆	Azadirachtin (10000 ppm)	-	3.00 ml
T ₇	<i>Metarhizium anisopliae</i> (Metschnikoff)	-	5.00 gm
T ₈	Untreated control	-	-

Results and Discussion

The observation of the aphid's population on the Okra was recorded one day before spraying and 1,3, 7, 10 and 14 days after each spray. Data recorded on aphids' population during Summer 2023-24 are presented in (Table 02)

Summer 2023-24

Overall mean of three sprays

The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.47/ three leaves / plant) which was found significantly superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (2.22/ three leaves / plant). It was followed by T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (3.20 / three leaves / plant), T₁-Fenpropathrin 30% EC (3.95/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (4.71/ three leaves / plant), T₅ - Emamectin benzoate 05% SG (5.19/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (6.04 / three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (9.99/ three leaves / plant).

The ascending order of aphid population were T₃-Tolfenpyrad 15% EC, T₂-Fluxametamide 10% w/w EC, T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC, T₁-Fenpropathrin 30% EC, T₆ -Azadirachtin (10000 ppm), T₅ - Emamectin benzoate 05% SG, T₇ -*Metarhizium anisopliae* (Metschnikoff) and T₈ Untreated control.

Per cent reduction over untreated control

The data revealed that, highest per cent reduction of aphid population over untreated control was observed in T₃-Tolfenpyrad 15% EC (85.28) It was followed by T₂-

Fluxametamide 10% w/w EC (77.77), T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (67.96), T₁-Fenpropathrin 30% EC (60.46), T₆ -Azadirachtin (10000 ppm) (52.82), T₅ -Emamectin benzoate 05% SG (48.04) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (39.53).

Summer 2024-25

The observation of the aphid's population on the Okra was recorded one day before spraying as pre count and 1,3, 7, 10 and 14 days after each spray. Data recorded on aphid population during Summer 2024-25 are presented in (Table 03)

Overall mean of three sprays

The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.31/ three leaves / plant) which was found significantly superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (1.91/ three leaves / plant). It was followed by T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.67/ three leaves / plant), T₁-Fenpropathrin 30% EC (2.76/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (3.59/ three leaves / plant), T₅ - Emamectin benzoate 05% SG (4.00/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (5.23/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (10.33/ three leaves / plant).

The ascending order of aphid population were T₃-Tolfenpyrad 15% EC, T₂-Fluxametamide 10% w/w EC, T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC, T₁-Fenpropathrin 30% EC, T₆ -Azadirachtin (10000 ppm), T₅ - Emamectin benzoate 05% SG, T₇ -*Metarhizium anisopliae* (Metschnikoff) and T₈ Untreated control.

Table 2: Efficacy of insecticides against aphid infesting Okra during Summer 2023-24

Tr. No.	Mean no. of aphids / three leaves / plant															Over all Mean	Percent reduction over untreated control	
	I Spray						II Spray					III Spray						
	Pre count	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS			14 DAS
T ₁	8.27 (2.95)*	3.93 (2.11)	3.20 (1.91)	2.40 (1.70)	3.20 (1.92)	4.20 (2.14)	3.80 (2.07)	3.33 (1.96)	2.93 (1.85)	4.13 (2.11)	5.40 (2.43)	5.07 (2.35)	4.73 (2.29)	3.87 (2.09)	4.13 (2.15)	4.87 (2.31)	3.95 (2.11)	60.46
T ₂	6.20 (2.58)	3.13 (1.90)	1.73 (1.49)	1.47 (1.39)	1.87 (1.52)	2.67 (1.78)	2.47 (1.72)	1.93 (1.56)	1.47 (1.38)	2.47 (1.72)	3.20 (1.91)	2.73 (1.79)	2.20 (1.64)	1.60 (1.44)	1.93 (1.56)	2.40 (1.69)	2.22 (1.65)	77.77
T ₃	7.27 (2.78)	2.20 (1.63)	1.33 (1.35)	1.13 (1.28)	1.47 (1.40)	2.13 (1.62)	1.93 (1.55)	1.53 (1.43)	0.93 (1.19)	1.60 (1.45)	2.13 (1.62)	1.53 (1.43)	1.13 (1.28)	1.07 (1.25)	0.73 (1.16)	1.13 (1.26)	1.47 (1.40)	85.28
T ₄	7.07 (2.73)	3.40 (1.97)	2.27 (1.66)	1.93 (1.56)	2.80 (1.81)	3.80 (2.07)	3.13 (1.91)	2.87 (1.83)	2.40 (1.69)	3.53 (2.01)	4.47 (2.20)	4.00 (2.08)	3.60 (2.01)	2.67 (1.77)	3.20 (3.90)	3.93 (2.09)	3.20 (1.92)	67.96
T ₅	6.80 (2.70)	5.53 (2.45)	4.27 (2.18)	3.33 (1.96)	4.47 (2.23)	6.13 (2.57)	4.87 (2.31)	4.47 (2.22)	4.20 (2.16)	5.53 (2.45)	6.93 (2.70)	6.67 (2.68)	5.13 (2.37)	4.67 (2.27)	5.90 (2.41)	6.33 (2.61)	5.19 (2.38)	48.04
T ₆	6.67 (2.67)	4.50 (2.23)	3.93 (2.10)	2.93 (1.85)	4.13 (2.11)	5.33 (2.41)	4.33 (2.19)	3.93 (2.10)	3.67 (2.03)	4.87 (2.30)	6.27 (2.60)	5.93 (2.53)	4.93 (2.33)	4.07 (2.13)	6.12 (2.34)	6.87 (2.71)	4.71 (2.28)	52.82
T ₇	5.47 (2.44)	5.20 (2.39)	4.67 (2.27)	4.00 (2.11)	5.20 (2.39)	7.13 (2.76)	6.13 (2.57)	5.80 (2.50)	5.67 (2.46)	6.53 (2.65)	7.87 (2.88)	7.67 (2.83)	6.13 (2.58)	5.60 (2.45)	6.13 (2.57)	6.80 (2.70)	6.04 (2.55)	39.53
T ₈	6.00 (2.54)	6.27 (2.60)	6.80 (2.70)	7.53 (2.81)	8.07 (2.92)	9.47 (3.15)	9.73 (3.20)	10.33 (3.28)	10.80 (3.36)	11.47 (3.46)	12.73 (3.61)	13.07 (3.67)	12.27 (3.55)	11.53 (3.46)	10.47 (3.31)	9.27 (3.12)	9.99 (3.24)	-
SE±	0.15	0.11	0.10	0.12	0.13	0.12	0.12	0.10	0.15	0.14	0.20	0.19	0.12	0.12	0.07	0.13	0.05	-
C.D @5%	N. S	0.34	0.29	0.36	0.40	0.37	0.35	0.31	0.44	0.44	0.59	0.58	0.35	0.35	0.21	0.38	0.16	-

*Figures in the parentheses are $\sqrt{n+0.5}$ transformed value DAS- Days After Spraying

T₁ -Fenprothrin 30% EC @ 0.33ml /lit

T₂ -Fluxametamide 10% w/w EC @ 0.8 ml / lit

T₃ -Tolfenpyrad 15% EC @ 2.00 ml / lit

T₄ -Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC @ 0.4 ml/ lit

T₅ -Emamectin benzoate 05% SG @ 0.27 gm / lit

T₆ -Azadirachtin (10000 ppm) @ 3.00 ml / lit

T₇ -*Metarhizium anisopliae* (Metschnikoff) @ 5.00 gm / lit

T₈ -Untreated control

Table 3: Efficacy of insecticides against aphid infesting Okra during Summer 2024-25

Tr. No.	Mean no. of aphids / three leaves / plant																Over all Mean	Percent reduction over untreated control
	I Spray						II Spray					III Spray						
	Pre count	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS		
T ₁	8.33 (2.97)*	5.07 (2.36)	3.27 (1.94)	2.20 (1.48)	2.73 (1.65)	3.07 (1.74)	2.33 (1.68)	1.33 (1.31)	0.93 (1.19)	2.13 (1.72)	3.47 (1.98)	3.27 (1.93)	2.60 (1.76)	2.27 (1.65)	2.53 (1.74)	4.20 (2.16)	2.76 (1.80)	73.28
T ₂	10.27 (3.27)	4.93 (2.33)	2.93 (1.85)	1.80 (1.34)	1.87 (1.35)	2.00 (1.41)	1.73 (1.49)	1.33 (1.34)	0.87 (1.15)	1.60 (1.45)	2.40 (1.70)	1.80 (1.52)	1.47 (1.40)	1.07 (1.23)	0.93 (1.19)	1.93 (1.55)	1.91 (1.55)	81.51
T ₃	8.93 (3.07)	4.13 (2.15)	2.07 (1.60)	1.20 (1.10)	1.13 (1.02)	1.33 (1.13)	1.20 (1.30)	0.87 (1.16)	0.60 (1.04)	1.07 (1.25)	1.53 (1.42)	1.20 (1.29)	0.80 (1.14)	0.67 (1.08)	0.53 (1.02)	1.27 (1.33)	1.31 (1.34)	87.31
T ₄	8.33 (2.97)	5.00 (2.34)	3.00 (1.87)	2.07 (1.44)	2.40 (1.54)	3.00 (1.73)	2.40 (1.70)	1.87 (1.76)	1.33 (1.35)	2.67 (1.77)	4.13 (2.15)	3.00 (1.87)	2.33 (1.68)	2.13 (1.62)	1.60 (1.44)	3.07 (1.89)	2.67 (1.78)	74.15
T ₅	7.73 (2.85)	6.67 (2.67)	4.00 (2.12)	2.73 (1.65)	3.40 (1.83)	4.13 (2.02)	3.73 (2.06)	2.53 (1.74)	1.93 (1.53)	3.87 (2.09)	5.20 (2.38)	4.87 (2.31)	3.93 (2.10)	3.27 (1.94)	4.00 (2.11)	5.73 (2.49)	4.00 (2.12)	61.27
T ₆	8.93 (3.07)	5.40 (2.43)	4.07 (2.14)	3.00 (1.73)	3.40 (1.84)	3.53 (1.88)	3.07 (1.88)	1.87 (1.54)	1.40 (1.36)	3.27 (2.14)	5.13 (2.37)	4.40 (2.21)	3.53 (1.99)	3.00 (1.87)	3.47 (1.99)	5.27 (2.40)	3.59 (2.02)	65.24
T ₇	7.60 (2.84)	7.20 (2.77)	4.53 (2.24)	3.67 (1.91)	4.27 (2.06)	5.20 (2.24)	4.87 (2.30)	4.07 (2.12)	3.67 (2.04)	5.27 (2.40)	6.60 (2.66)	6.27 (2.60)	5.67 (2.47)	5.20 (2.39)	5.20 (2.39)	6.80 (2.69)	5.23 (2.39)	49.37
T ₈	8.80 (3.04)	9.27 (3.12)	9.47 (3.15)	9.73 (3.12)	10.07 (3.17)	10.27 (3.20)	10.13 (3.26)	9.47 (3.15)	12.20 (3.56)	12.87 (3.65)	12.40 (3.59)	11.53 (3.46)	11.00 (3.37)	9.93 (3.22)	8.00 (2.92)	8.60 (3.02)	10.33 (3.29)	-
SE±	0.12	0.07	0.07	0.08	0.11	0.17	0.10	0.16	0.12	0.10	0.10	0.12	0.15	0.12	0.08	0.09	0.04	-
C.D at 5%	N. S	0.21	0.20	0.24	0.34	0.50	0.32	0.48	0.36	0.30	0.31	0.37	0.46	0.37	0.23	0.28	0.11	-

* Figures in the parentheses are $\sqrt{n+0.5}$ transformed value DAS- Days After Spraying

T₁ -Fenprothrin 30% EC @ 0.33ml /lit

T₂ -Fluxametamide 10% w/w EC @ 0.8 ml / lit

T₃ -Tolfenpyrad 15% EC @ 2.00 ml / lit

T₄ -Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC @ 0.4 ml/ lit

T₅ -Emamectin benzoate 05% SG @ 0.27 gm / lit

T₆ -Azadirachtin (10000 ppm) @ 3.00 ml / lit

T₇ -*Metarhizium anisopliae* (Metschnikoff) @ 5.00 gm / lit

T₈ -Untreated control

Per cent reduction over untreated control

The data revealed that, highest per cent reduction of aphid population over untreated control was observed in T₃-Tolfenpyrad 15% EC (87.31). It was followed by T₂-Fluxametamide 10% w/w EC (81.51), T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (74.15), T₁-Fenpropathrin 30% EC (73.28), T₆ -Azadirachtin (10000 ppm) (65.24), T₅ -Emamectin benzoate 05% SG (61.27) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (49.37).

Pooled (Summer 2023-24 and Summer 2024-25)

The pooled data pertaining to the efficacy of different insecticides against aphids' population on the Okra during both the years at one day before first spraying and 1, 3, 7, 10 and 14 days after each spray are presented in (Table 04)

First spray

- One day before spraying (pre-count):** The data revealed that, aphid population at one day before first spraying ranging from 6.53 to 8.30 aphid / three leaves / plant and it was statistically non-significant.
- One day after spraying (1 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (3.17/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (4.03/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (4.20/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (4.50/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm) (4.95/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (6.10/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (6.20/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (7.77/ three leaves / plant).
- Three days after spraying (3 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.70/ three leaves / plant) which was superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (2.33/ three leaves / plant) which was found statistically at par with T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.63/ three leaves / plant). It is followed by T₁-Fenpropathrin 30% EC (3.23/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (4.00/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (4.13/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (4.60/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (8.13/ three leaves / plant).
- Seven days after spraying (7 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.17/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (1.63/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.00/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (2.30/ three leaves / plant). It is followed by T₆ -Azadirachtin (10000 ppm) (2.97/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (3.03/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (3.83/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (8.63/ three leaves / plant).
- Ten days after spraying (10 DAS):** The minimum

population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.30/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (1.87/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.60/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (2.97/ three leaves / plant). It is followed by T₆ -Azadirachtin (10000 ppm) (3.77/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (3.93/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (4.73/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (9.07/ three leaves / plant).

- Fourteen days after spraying (14 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.73/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (2.33/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (3.40/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (3.63/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm) (4.43/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (5.13/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (6.17/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (9.87/ three leaves / plant).

Second spray

- One day after spraying (1 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.57/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (2.10/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.77/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (3.07/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm) (3.70/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (4.30/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (5.50/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (9.93/ three leaves / plant).
- Three days after spraying (3 DAS):** The data on Three days after spraying indicated that, significant difference was found among the different treatments. All the treatments recorded a significantly lower population of aphid than untreated control. The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.20/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (1.63/ three leaves / plant). Next best treatment was observed T₁-Fenpropathrin 30% EC (2.33/ three leaves / plant) which was found statistically at par with T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.37/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm) (2.90/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (3.50/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (4.93/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (9.90/ three leaves / plant).
- Seven days after spraying (7 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (0.77/ three leaves / plant) which was found statistically

at par with T₂-Fluxametamide 10% w/w EC (1.17/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (1.87/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (1.93/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (2.53/ three leaves / plant) and T₅ -Emamectin benzoate 05% SG (3.07/ three leaves / plant). It is followed by T₇ -*Metarhizium anisopliae* (Metschnikoff) (4.67/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (11.50/ three leaves / plant).

- **Ten days after spraying (10 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.33/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (2.03/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (3.10/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (3.13/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm) (4.07/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (4.70/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (5.90/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (12.17/ three leaves / plant).
- **Fourteen days after spraying (14 DAS):** The minimum population of aphid was observed in T₃-Tolfenpyrad 15%

EC (1.83/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (2.80/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (4.30/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (4.43/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (5.70/ three leaves / plant) and T₅ -Emamectin benzoate 05% SG (6.07/ three leaves / plant). It is followed by T₇ -*Metarhizium anisopliae* (Metschnikoff) (7.23/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (12.57/ three leaves / plant).

Third spray

One day after spraying (1 DAS): The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.37/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (2.27/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (3.50 / three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (4.17/ three leaves / plant). It is followed by T₆-Azadirachtin (10000 ppm) (5.17/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (5.77/ three leaves / plant) and T₇ - *Metarhizium anisopliae* (Metschnikoff) (6.97/ three leaves / plant). The maximum population of aphid was observed in T₈- untreated control (12.30/ three leaves / plant).

Table 4: Efficacy of insecticides against aphid infesting Okra (Pooled of Summer 2023-24 and Summer 2024-25)

Tr. No.	Mean no. of aphids / three leaves / plant																Over all Mean	Percent reduction over untreated control
	I Spray						II Spray					III Spray						
	Pre count	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS		
T ₁	8.30 (2.97)*	4.50 (2.24)	3.23 (1.93)	2.30 (1.67)	2.97 (1.86)	3.63 (2.02)	3.07 (1.88)	2.33 (1.68)	1.93 (1.55)	3.13 (1.88)	4.43 (2.22)	4.17 (2.16)	3.67 (2.04)	3.07 (1.89)	3.33 (1.96)	4.53 (2.24)	3.35 (1.96)	67.02
T ₂	8.23 (2.95)	4.03 (2.12)	2.33 (1.68)	1.63 (1.46)	1.87 (1.53)	2.33 (1.68)	2.10 (1.61)	1.63 (1.46)	1.17 (1.28)	2.03 (1.59)	2.80 (1.81)	2.27 (1.66)	1.83 (1.53)	1.33 (1.35)	1.43 (1.39)	2.17 (1.63)	2.06 (1.60)	79.72
T ₃	8.10 (2.93)	3.17 (1.91)	1.70 (1.48)	1.17 (1.29)	1.30 (1.34)	1.73 (1.49)	1.57 (1.43)	1.20 (1.30)	0.77 (1.12)	1.33 (1.35)	1.83 (1.53)	1.37 (1.36)	0.97 (1.21)	0.87 (1.17)	0.63 (1.06)	1.20 (1.30)	1.39 (1.37)	86.31
T ₄	7.70 (2.86)	4.20 (2.17)	2.63 (1.77)	2.00 (1.58)	2.60 (1.76)	3.40 (1.97)	2.77 (1.81)	2.37 (1.69)	1.87 (1.54)	3.10 (1.90)	4.30 (2.18)	3.50 (1.99)	2.97 (1.86)	2.40 (1.70)	2.40 (1.70)	3.50 (1.99)	2.93 (1.85)	71.16
T ₅	7.27 (2.78)	6.10 (2.56)	4.13 (2.15)	3.03 (1.88)	3.93 (2.10)	5.13 (2.37)	4.30 (2.19)	3.50 (2.00)	3.07 (1.88)	4.70 (2.28)	6.07 (2.55)	5.77 (2.50)	4.53 (2.24)	3.97 (2.11)	4.67 (2.27)	6.03 (2.55)	4.60 (2.26)	54.72
T ₆	7.80 (2.88)	4.95 (2.33)	4.00 (2.12)	2.97 (1.86)	3.77 (2.05)	4.43 (2.22)	3.70 (2.04)	2.90 (1.84)	2.53 (1.73)	4.07 (2.13)	5.70 (2.49)	5.17 (2.38)	4.23 (2.17)	3.53 (2.00)	4.23 (2.18)	6.07 (2.56)	4.15 (2.16)	59.15
T ₇	6.53 (2.65)	6.20 (2.59)	4.60 (2.26)	3.83 (2.08)	4.73 (2.29)	6.17 (2.57)	5.50 (2.45)	4.93 (2.32)	4.67 (2.26)	5.90 (2.53)	7.23 (2.78)	6.97 (2.72)	5.90 (2.53)	5.40 (2.42)	5.67 (2.48)	6.80 (2.70)	5.63 (2.47)	44.58
T ₈	7.40 (2.81)	7.77 (2.87)	8.13 (2.94)	8.63 (3.01)	9.07 (3.09)	9.87 (3.22)	9.93 (3.23)	9.90 (3.21)	11.50 (3.46)	12.17 (3.56)	12.57 (3.60)	12.30 (3.57)	11.63 (3.46)	10.73 (3.35)	9.23 (3.12)	8.93 (3.07)	10.16 (3.26)	-
SE±	0.07	0.08	0.06	0.08	0.09	0.10	0.09	0.10	0.11	0.09	0.13	0.11	0.12	0.07	0.05	0.08	0.04	-
C.D@ 5%	N. S	0.23	0.19	0.25	0.26	0.30	0.26	0.31	0.34	0.28	0.40	0.33	0.35	0.20	0.14	0.23	0.11	-

* Figures in the parentheses are $\sqrt{(n+0.5)}$ transformed value DAS- Days After Spraying

T₁ -Fenpropathrin 30% EC @ 0.33ml /lit

T₂ -Fluxametamide 10% w/w EC @ 0.8 ml / lit

T₃ -Tolfenpyrad 15% EC @ 2.00 ml / lit

T₄ -Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC @ 0.4 ml/ lit

T₅ -Emamectin benzoate 05% SG @ 0.27 gm /lit

T₆ -Azadirachtin (10000 ppm) @ 3.00 ml / lit

T₇ -*Metarhizium anisopliae* (Metschnikoff) @ 5.00 gm / lit

T₈ -Untreated control

Three days after spraying (3 DAS): The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (0.97/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (1.83/ three leaves / plant). Next

best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.97/ three leaves / plant) which was found statistically at par with T₁-Fenpropathrin 30% EC (3.67/ three leaves / plant) and T₆ -Azadirachtin (10000 ppm)

(4.23/ three leaves / plant). It is followed by T₅ -Emamectin benzoate 05% SG (4.53/ three leaves / plant) and T₇ - *Metarhizium anisopliae* (Metschnikoff) (5.90/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (11.63/ three leaves / plant).

Seven days after spraying (7 DAS): The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (0.87/ three leaves / plant) which was found statistically at par with T₂-Fluxametamide 10% w/w EC (1.33/ three leaves / plant). Next best treatment was observed T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.40/ three leaves / plant) which was found statistically at par with T₁-Fenprothrin 30% EC (3.07/ three leaves / plant). It is followed by T₆-Azadirachtin (10000 ppm) (3.53/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (3.97/ three leaves / plant) and T₇ - *Metarhizium anisopliae* (Metschnikoff) (5.40/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (10.73/ three leaves / plant).

Ten days after spraying (10 DAS): The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (0.63/ three leaves / plant) which was superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (1.43/ three leaves / plant). It is followed by T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.40/ three leaves / plant), T₁-Fenprothrin 30% EC (3.33/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (4.23/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (4.67/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (5.67/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (9.23/ three leaves / plant).

Fourteen days after spraying (14 DAS): The minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.20/ three leaves / plant) which was superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (2.17/ three leaves / plant). It is followed by T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (3.50/ three leaves / plant), T₁-Fenprothrin 30% EC (4.53/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (6.07/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (6.03 / three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (6.80/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (8.93/ three leaves / plant). Overall mean of three sprays the minimum population of aphid was observed in T₃-Tolfenpyrad 15% EC (1.39/ three leaves / plant) which was found significantly superior than other treatments. Next best treatment was observed T₂-Fluxametamide 10% w/w EC (2.06/ three leaves / plant). It was followed by T₄ -

Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (2.93/ three leaves / plant), T₁-Fenprothrin 30% EC (3.35/ three leaves / plant), T₆ -Azadirachtin (10000 ppm) (4.15/ three leaves / plant), T₅ -Emamectin benzoate 05% SG (4.60/ three leaves / plant) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (5.63/ three leaves / plant). The maximum population of aphid was observed in T₈-untreated control (10.16/ three leaves / plant).

The ascending order of aphid population were T₃-Tolfenpyrad 15% EC, T₂-Fluxametamide 10% w/w EC, T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC, T₁-Fenprothrin 30% EC, T₆ -Azadirachtin (10000 ppm), T₅ -Emamectin benzoate 05% SG, T₇ -*Metarhizium anisopliae* (Metschnikoff) and T₈ Untreated control.

Per cent reduction over untreated control

The data revealed that, highest per cent reduction of aphid population over untreated control was observed in T₃-Tolfenpyrad 15% EC (86.31). It was followed by T₂-Fluxametamide 10% w/w EC (79.72), T₄ - Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC (71.16), T₁-Fenprothrin 30% EC (67.02), T₆ -Azadirachtin (10000 ppm) (59.15), T₅ -Emamectin benzoate 05% SG (54.72) and T₇ - *Metarhizium anisopliae* (Metschnikoff) (44.58).

The results of present study are similar with the findings of the following workers. Kalyan *et.al* (2014) [7] evaluated the relative efficacy of different doses of tolfenpyrad 15 EC against aphids in cotton and noted that among the treatments, tolfenpyrad, 150 and 125 a.i./ha were found superior over to acetamiprid 20 SP, imidacloprid 17.8 SL and thiamethoxam 25 WG in controlling population of aphids. Mallick *et al.* (2016) [2] found that tolfenpyrad 15% EC @ 125 and 150g a.i./ha has better performance against aphids (*Aphis gossypii*). Gaikwad *et al* (2020) [3] studied efficacy of chemicals, botanicals and biorational-insecticides against aphid on okra and revealed that most superior treatment for management of aphid on okra was thiamethoxam 25 WG followed by emamectin benzoate 5 SG, NSKE 5%, neem oil 0.2%, Dashparni ark 0.6%, *Verticillium lecanii* 0.4% and *Metarhizium* + *Beauveria bassiana* 0.4%. *Beauveria bassiana* 0.4%, Biomix 0.3%, Karanj oil 0.5% and Eucalyptus oil 0.2% which was statistically at par with each other. Saini *et al.* (2023) reported that the treatment Lambda-cyhalothrin 4.6% + Chlorantraniliprole 9.3% @1 ml and Fipronil 5% SC @ 2 ml/liter were found next in order of effectiveness, while, Neem gold 2% @ 2 ml/liter and Neem oil 3% @3 ml/liter were comparatively least effective in population reduction of sucking insect pests. Timke *et.al* (2024) [5] revealed that lambda cyhalothrin 5 EC was found less effective in controlling aphid (*Aphis gossypii* Glover) population in cotton.

Table 5: Effect of different insecticidal treatments on the yield of Okra during Summer 2023-24, Summer 2024-25 and pooled

Sr. No.	Treatment	(Yield (q/ ha))		
		Summer 2023-24	Summer 2024-25	Pooled
T ₁	Fenprothrin 30% EC @ 33 ml/lit	100.91	98.44	99.67
T ₂	Fluxametamide 10% w/w EC @ 0.8 ml/lit	120.22	119.93	120.08
T ₃	Tolfenpyrad 15% EC @ 2.00 ml/lit	114.73	117.86	116.30
T ₄	Chlorantraniliprole 09.30% + Lambda-Cyhalothrin 04.60 ZC @ 0.4 ml/lit	130.49	129.56	130.02
T ₅	Emamectin benzoate 05% SG @ 0.27 gm/lit	105.34	102.92	104.13
T ₆	Azadirachtin (10000 ppm) @ 3.00 ml/lit	96.56	93.27	94.92
T ₇	<i>Metarhizium anisopliae</i> (Metschnikoff) @ 5.00 gm/lit	90.12	88.42	89.27
T ₈	Untreated control	82.54	80.48	81.51
	SE	0.07	0.10	0.07
	CD@5%	0.20	0.29	0.20

Conclusion

From the pooled results it is concluded that, the significant difference was found in aphid population among the treatments. The data recorded on overall mean of three sprays revealed that all the treatments recorded a significantly lower population of aphid than untreated control. The minimum population of aphid was observed in treatment Tolfenpyrad 15% EC with highest (86.31) per cent reduction over untreated control which was found significantly superior than other treatments. Next best treatment was observed Fluxametamide 10% w/w EC with (79.72%) It was followed by Chlorantraniliprole 09.30% +Lambda-Cyhalothrin 04.60 ZC with (71.16%), Fenpropathrin 30% EC (67.02%), T₆ -Azadirachtin (10000 ppm) (59.15%), Eamectin benzoate 05% SG (54.72%) and T₇ -*Metarhizium anisopliae* (Metschnikoff) (44.58%).

References

1. Srinivasa RN, Rajendra R. Joint action potential of neem with other plant extracts against the leaf hoppers, *Amrasca devastans* (Distant) on okra. Pest Manage Econ Zool. 2003;10:131-136.
2. Mallick S, Chand P, Mandal SK. Tolfenpyrad 15% EC, a new pyrazole insecticide, against sucking pests of okra and its impact on natural enemies. Indian J Entomol. 2016;78(1):51.
3. Gaikwad BB, Bhosle BB, Bhede BV. Evaluation of different bio-pesticides against aphid on okra. J Entomol Zool Stud. 2020;8(3):339-345.
4. Saini A, Kumar R, Kumar, Mishra SK, Mishra AK, Tiwari B, *et al.* Efficacy of novel insecticides against sucking insect pests of okra *Abelmoschus esculentus* (L.) Moench. Pharma Innov J. 2023;12(7):1451-1454.
5. Timke SH, Kadam JR, Aher SD. Efficacy of newer insecticides against aphids (*Aphis gossypii* Glover) in Bt cotton. J Entomol Zool Stud. 2024;12(5):46-49.
6. Chaudhary HR, Dadeech. Incidence of insects attacking okra and the avoidable losses caused by them. Ann Arid Zone. 1989;28(3):305-307.
7. Kalyan RK, Saini DP, Babu SR, Urmila. Evaluation of different doses of Tolfenpyrad against aphids and thrips in cotton. J Cotton Res. 2014;28(2):293-296.