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Bio-efficacy of insecticides against thrips infesting bitter gourd

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Abstract
The present investigation was carried out to study the bio-efficacy of insecticides against thrips infesting bitter gourd during *rabi-summer* season of 2017-18 at Centre of Excellence for Mango, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S).
There were six insecticides tested against thrips infesting bitter gourd. The results regarding overall mean of three sprays against thrips infesting bitter gourd revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was the best treatment which recorded minimum (2.41) population of thrips and was at par with malathion 50 EC @ 0.05 per cent (2.84) and spinosad 45 SC @ 0.014 per cent (3.05). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (3.53) which was at par with treatments azadirachtin 1 EC @ 0.003 per cent (3.65) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.75). All the treatments were significantly superior over untreated control. The maximum (6.78) thrips population was observed in the untreated control.

Keywords: Bio-efficacy, insecticides, thrips, bitter gourd

Introduction
Bitter gourd is considered as a very important vegetable crop. Therefore, this crop was chosen as an experimental crop in this investigation. It is well known that the piercing sucking insects cause yield losses in vegetable crops as well as other crops (El-Khouly *et al*., 1998) [3]. Among these insect pests, certain Homoptera such as aphids and white flies, Thysanoptera such as thrips have great economic importance which cause serious damage either directly by sucking plant juice or indirectly as vectors of plant pathogenic viruses. (El-Lakwah, 2011 [2].
Thrips tabaci Lindeman (Thysanoptera: Thripidae) both the nymphs and adults lacerate the tissue and suck the sap from upper and lower surfaces of leaves, flowers and stem. In heavy thrips infestation, the leaves became slivery due to the formation of white patches or streaks which finally caused scarring and distortion of leaves and cup upward (Janu *et al*., 2017) [4]. They are susceptible to environmental changes and because of the polyphagous nature of species, one can determine their abundance by the types of plant formations. They are also essential elements of the soil, occurring at depths of 10-30 cm in the soil (Ananthakrishnan, 1984) [1].
There are several management tactics used by farmers for management of thrips in cucurbits crops. But most of the farmers are prefer the chemical management practices due to immediate effect to reduce pest pressure on crops. So, keeping all of these things in mind and present investigation was carried out to study the bio-efficacy of insecticides against thrips infesting bitter gourd during *rabi-summer* season.

Materials and Methods
A field experiment was conducted during *rabi* - *summer* season of 2017-18 to study the effectiveness of some insecticides against thrips infesting bitter gourd. The details of experiment are given below:

1. Cultural operations
The land was prepared as per the requirements of bitter gourd crop and cleared by removing the residues of the previous crop. The experiment was laid in Randomized Block Design (RBD).

The recommended dose of fertilizers for bitter gourd is 120:60:30 NPK kg/ha. Nitrogen @ 120 kg/ha was applied in three split doses *viz*., first dose of 40 per cent N at the time of sowing, second dose of 40 per cent N after 30 days of sowing and remaining 20 per cent dose of N after 60 days of sowing. Phosphorus was applied @ 60 kg/ha and potassium was applied @ 30 kg/ha, these fertilizers were applied in single dose at the time of sowing.

The experimental area was sown with good quality seed of bitter gourd (cv. Kokan Tara). The other agronomic operations and weeding were done as per recommendation.

2. Experimental details

Location	**:**	Centre of excellence for mango, College of Agriculture, Dapoli
Period of study	:	February 2018 to May 2018
Statistical design	:	Randomized Block Design (RBD)
No. of replication	:	Three
No. of treatments	:	Seven
Size of treatment plot	:	7.5 m^2
Total plot size	:	282 m^2
Date of sowing	:	22nd February 2018
Method of planting	:	On small hills
Spacing	:	1.50 m X 0.50 m
Cultivar	:	Kokan Tara

3. Treatment details

Treatment No.	Treatments	Conc. (%)
T_1	Azadirachtin 1 EC	0.003
T_2	Spinosad 45 SC	0.014
T_3	Emamectin benzoate 5 SG	0.002
T_4	Chlorantraniliprole 18.5 SC	0.005
T_5	Lambda cyhalothrin 5 EC	0.0025
T_6	Malathion 50 EC	0.05
T_7	Untreated Control	-

4. Spraying

The quantity of spray suspension required for each treatment was calibrated by spraying water over three plots in the experiment prior to the application of insecticide. Spray suspension of desired strength of each insecticide was prepared against pests infesting bitter gourd.

The insecticides were sprayed thrice. First spray of each insecticide was applied when incidence was noticed, while the other two sprays were given at an interval of 15 days with manually operated knapsack sprayer.

5. Method of recording observations

To study the efficacy of different insecticides against thrips infesting bitter gourd, the pre-treatment observations were recorded one day before each spray and subsequently post treatment observations were recorded at 3rd, 7th, 10th and 14th days after spraying. The pre-count observations were recorded one day before application of insecticides. The observations at 14th days after first and second spray were considered as pre-count observation of second and third spray. The numbers of thrips from top, middle and bottom leaf were recorded for damage of these pests.

The data thus obtained were converted to appropriate transformation and then analyzed statistically.

Results and Discussion

1. Efficacy of some insecticides against thrips infesting bitter gourd recorded at different intervals after first spray: The data pertaining to the efficacy of different insecticides against thrips infesting bitter gourd at 3rd, 7th, 10th and 14th days after first spray are presented in Table 1.

The data on mean population of thrips prior to insecticide application ranged from 10.07 to 10.54. There was no significant difference among the different treatments since uniform distribution of thrips was observed in different treatments.

The observations recorded on third day after spraying of insecticide ranged from 5.57 to 12.55. The treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was found to be most effective treatment which recorded 5.57 mean population of thrips and was at par with the treatment malathion 50 EC @ 0.05 per cent (6.03), spinosad 45 SC @ 0.014 per cent (7.19) and lambda cyhalothrin 5 EC @ 0.0025 per cent (8.13). The next effective treatments were emamectin benzoate 5 SG @ 0.002 (8.48) and azadirachtin 1 EC @ 0.003 per cent (8.53) and both were at par with each other. The maximum (12.55) thrips population was found in untreated control.

At the seventh day after first spray the minimum (4.28) thrips population recorded in the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent which was at par with treatment malathion 50 EC @ 0.05 per cent (4.86). The next effective treatment was spinosad 45 SC @ 0.014 per cent (5.64) which was at par with emamectin benzoate 5 SG @ 0.002 (6.18). The remaining effective treatments were azadirachtin 1 EC @ 0.003 per cent (6.71) and lambda cyhalothrin 5 EC @ 0.0025 per cent (7.18). The maximum (13.37) thrips population was noticed in untreated control.

The observations recorded at 10th day after first spray revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent (2.75) was found to be most effective which was at par with treatment malathion 50 EC @ 0.05 per cent (3.02) and spinosad 45 SC @ 0.014 per cent (3.07). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (3.90) which was at par with the treatments azadirachtin 1 EC @ 0.003 per cent (3.93) and lambda cyhalothrin 5 EC @ 0.0025 per cent (4.07). The maximum (8.53) thrips population was recorded in untreated plot.

At 14th day of observation, the minimum (3.08) thrips population was recorded in chlorantraniliprole 18.5 SC @ 0.005 per cent and which was at par with malathion 50 EC @ 0.05 per cent (3.87) and spinosad 45 SC @ 0.014 per cent (3.90). The treatment emamectin benzoate 5 SG @ 0.002 (4.13) was at par with the treatments *viz*., azadirachtin 1 EC @ 0.003 per cent (4.18) and lambda cyhalothrin 5 EC @ 0.0025 per cent (4.24). The maximum population (7.67) was found in untreated plot.

The result regarding overall mean population of thrips infesting bitter gourd after first spray revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was the best treatment which recorded minimum (3.92) population of thrips and was at par with malathion 50 EC @ 0.05 per cent (4.45) and spinosad 45 SC @ 0.014 per cent (4.97). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (5.67) was at par with treatments *viz*., azadirachtin 1 EC @ 0.003 per cent (5.84) and lambda cyhalothrin 5 EC @ 0.0025 per cent (5.91). All the treatments were significantly superior over untreated control. The maximum thrips population (10.53) observed in the untreated control.

2. Efficacy of some insecticides against thrips recorded at different intervals after second spray: The results regarding efficacy of some insecticides against thrips recorded at different intervals after second spray are presented in Table 2.

The observations recorded at third day after second spray indicated that the treatment chlorantraniliprole 18.5 SC @

0.005 per cent was found to be most effective treatment which recorded 2.88 mean thrips population per three leaves per plant and was at par with malathion 50 EC @ 0.05 per cent (3.48) and spinosad 45 SC @ 0.014 per cent (3.55). The next effective treatment emamectin benzoate 5 SG @ 0.002 (3.88) was at par with treatments azadirachtin 1 EC @ 0.003 per cent (4.02) and lambda cyhalothrin 5 EC @ 0.0025 per cent (4.07). The maximum (7.35) mean thrips population per three leaves per plant was noticed in untreated control.

At 7th day after second spray, the minimum population was recorded in the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent (2.45) was found to be most effective which was at par with treatment malathion 50 EC @ 0.05 per cent (3.08) and spinosad 45 SC @ 0.014 per cent (3.18). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (3.74) which was at par with the treatments *viz*., azadirachtin 1 EC @ 0.003 per cent (3.87) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.90). While, maximum (7.08) thrips population was observed in untreated control.

The observations recorded at 10th day after second spray revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent (1.90) was at par with treatments malathion 50 EC @ 0.05 per cent (2.30) and spinosad 45 SC @ 0.014 per cent (3.37). The remaining treatments in descending order of effectiveness were emamectin benzoate 5 SG @ 0.002 (2.77), azadirachtin 1 EC @ 0.003 per cent (2.98) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.17). The maximum pest population 5.93 recorded in untreated control.

At 14th day of observation, the minimum (2.08) population of thrips was recorded in chlorantraniliprole 18.5 SC @ 0.005 per cent which was at par with treatments *viz*., malathion 50 EC @ 0.05 per cent (2.43) and spinosad 45 SC @ 0.014 per cent (2.47). The remaining treatments in descending order of effectiveness were emamectin benzoate 5 SG @ 0.002 (3.27), azadirachtin 1 EC @ 0.003 per cent (3.38) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.58). The maximum (5.33) population was observed in untreated control.

The result regarding overall mean population of thrips infesting bitter gourd after second spray revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was the best treatment which recorded minimum (2.32) population of thrips and was at par with malathion 50 EC @ 0.05 per cent (2.82) and spinosad 45 SC @ 0.014 per cent (2.89). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (3.41) was at par with treatments azadirachtin 1 EC @ 0.003 per cent (3.56) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.68). All the treatments were significantly superior over untreated control. The maximum (6.42) thrips population was observed in the untreated control.

3. Efficacy of some insecticides against thrips recorded at different intervals after third spray

The results regarding efficacy of some insecticides against thrips recorded at different intervals after third spray are presented in Table 3.

After 3 days of third spray, the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was found most effective which recorded 1.77 mean thrips population per three leaves per plant and it was at par with malathion 50 EC @ 0.05 per cent (2.18) and spinosad 45 SC @ 0.014 per cent (2.28). The treatments emamectin benzoate 5 SG @ 0.002 (2.87) and azadirachtin 1 EC @ 0.003 per cent (2.92) was at par with each other, followed by lambda cyhalothrin 5 EC @ 0.0025 per cent (3.17). The maximum thrips population was noticed in untreated control (4.40).

The data at 7th day of third spray indicated that chlorantraniliprole 18.5 SC @ 0.005 per cent (1.57) was found to be most effective treatment which was at par with treatment malathion 50 EC @ 0.05 per cent (1.94) and spinosad 45 SC @ 0.014 per cent (2.00). The next effective treatment emamectin benzoate 5 SG @ 0.002 (2.07) which was at par with azadirachtin 1 EC @ 0.003 per cent (2.17) and lambda cyhalothrin 5 EC @ 0.0025 per cent (2.27). The untreated control was recorded 3.35 thrips population.

The observations recorded at 10th day after third spray revealed that chlorantraniliprole 18.5 SC @ 0.005 per cent showed better results amongst the treatments with 0.62 mean thrips population and was at par with malathion 50 EC @ 0.05 per cent (0.87) and spinosad 45 SC @ 0.014 per cent (0.88). The treatment emamectin benzoate 5 SG @ 0.002 (1.07) was at par with treatments azadirachtin 1 EC @ 0.003 per cent (1.08) and lambda cyhalothrin 5 EC @ 0.0025 per cent (1.13). Untreated plot recorded maximum (3.12) mean thrips population per three leaves per plant.

At 14th day of observation, no thrips population was recorded in chlorantraniliprole 18.5 SC @ 0.005 per cent which was at par with remaining all treatments *viz*., malathion 50 EC @ 0.05 per cent (0.02), spinosad 45 SC @ 0.014 per cent (0.03), emamectin benzoate 5 SG @ 0.002 (0.04), azadirachtin 1 EC @ 0.003 per cent (0.08) and lambda cyhalothrin 5 EC @ 0.0025 per cent (0.10). While untreated control recorded maximum (2.90) pest population.

The result regarding overall mean population of thrips infesting bitter gourd after third spray revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was the best treatment which recorded minimum (0.99) population of thrips and was at par with spinosad 45 SC @ 0.014 per cent (1.29) and malathion 50 EC @ 0.05 per cent (1.25). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (1.51) which was at par with treatments azadirachtin 1 EC @ 0.003 per cent (1.56) and lambda cyhalothrin 5 EC @ 0.0025 per cent (1.82). All the treatments were significantly superior over untreated control. The maximum (3.44) thrips population was observed in the untreated control.

4. Cumulative efficacy of different insecticides against thrips infesting bitter gourd

The data pertaining to the cumulative efficacy of different insecticides against thrips infesting bitter gourd are presented in Table 4.

The results regarding overall mean of three sprays against thrips infesting bitter gourd revealed that the treatment chlorantraniliprole 18.5 SC @ 0.005 per cent was the best treatment which recorded minimum (2.41) population of thrips and was at par with malathion 50 EC @ 0.05 per cent (2.84) and spinosad 45 SC @ 0.014 per cent (3.05). The next effective treatment was emamectin benzoate 5 SG @ 0.002 (3.53) which was at par with treatments azadirachtin 1 EC @ 0.003 per cent (3.65) and lambda cyhalothrin 5 EC @ 0.0025 per cent (3.75). All the treatments were significantly superior over untreated control. The maximum (6.78) thrips population was observed in the untreated control.

The present results are more or less supported by Dakshina Seal (2011) [5]. She revealed that spinosad, spinetoram, chlorofenapyr and formatenate hydrochloride provided a significant level (>90%) of control. Among new insecticides, rynaxypyr and cyazypyr were effective in providing 50 per cent to 65 per cent reduction of thrips (*T. palmi*) in melons.

Table 1: Efficacy of different insecticides against thrips infesting bitter gourd after first spray

Treatment	Conc. (%)	Mean population of thrips per three leaves per plant					Overall Mean
		Pre-count	3 DAS	7 DAS	10 DAS	14 DAS	
Azadirachtin 1 EC	0.003	10.20 (3.34)*	8.53 (3.09)	6.71 (2.77)	3.93 2.22)	4.18 (2.28)	5.84 (2.62)
Spinosad 45 SC	0.014	10.07 (3.31)	7.19 (2.84)	5.64 (2.57)	3.07 (2.01)	3.90 (2.21)	4.97 (2.44)
Emamectin benzoate 5 SG	0.002	10.40 (3.37)	8.48 (3.08)	6.18 (2.68)	3.90 (2.21)	4.13 (2.26)	5.67 (2.58)
Chlorantraniliprole 18.5 SC	0.005	10.40 (3.37)	5.57 (2.56)	4.28 (2.29)	2.75 (1.93)	3.08 (2.02)	3.92 (2.22)
Lambda cyhalothrin 5 EC	0.0025	10.47 (3.38)	8.13 (3.01)	7.18 (2.86)	4.07 (2.25)	4.24 (2.29)	5.91 (2.63)
Malathion 50 EC	0.05	10.03 (3.32)	6.03 (2.65)	4.86 (2.41)	3.02 (2.00)	3.87 (2.21)	4.45 (2.33)
Untreated Control	-	10.54 (3.39)	12.55 (3.67)	13.37 (3.79)	8.53 (3.08)	7.67 (2.94)	10.53 (3.40)
S.Em.±		0.14	0.16	0.11	0.08	0.07	0.11
CD (p=0.05)		NS	0.49	0.35	0.25	0.20	0.32

*Figures in parentheses are $\sqrt{X+1}$ values
DAS: Days After Sowing

Table 2: Efficacy of different insecticides against thrips infesting bitter gourd after second spray

Treatment	Conc. (%)	Mean population of thrips per three leaves per plant					Overall Mean
		Pre-count	3 DAS	7 DAS	10 DAS	14 DAS	
Azadirachtin 1 EC	0.003	4.18 (2.28)*	4.02 (2.24)	3.87 (2.20)	2.98 (1.99)	3.38 (2.09)	3.56 (2.14)
Spinosad 45 SC	0.014	3.96 (2.21)	3.55 (2.13)	3.18 (2.04)	2.37 (1.83)	2.47 (1.86)	2.89 (1.97)
Emamectin benzoate 5 SG	0.002	4.13 (2.26)	3.88 (2.20)	3.74 (2.17)	2.77 (1.94)	3.27 (2.06)	3.41 (2.10)
Chlorantraniliprole 18.5 SC	0.005	3.08 (2.02)	2.88 (1.97)	2.45 (1.85)	1.90 (1.70)	2.08 (1.76)	2.32 (1.82)
Lambda cyhalothrin 5 EC	0.0025	4.24 (2.24)	4.07 (2.25)	3.90 (2.21)	3.17 (2.04)	3.58 (2.14)	3.68 (2.16)
Malathion 50 EC	0.05	3.87 (2.21)	3.48 (2.11)	3.08 (2.02)	2.30 (1.81)	2.43 (1.85)	2.82 (1.95)
Untreated Control	-	7.67 (2.94)	7.35 (2.89)	7.08 (2.84)	5.93 (2.63)	5.33 (2.51)	6.42 (2.72)
S.Em.±		0.07	0.07	0.07	0.07	0.06	0.06
CD (p=0.05)		0.20	0.22	0.20	0.22	0.17	0.20

*Figures in parentheses are $\sqrt{X+1}$ values
DAS: Days After Sowing

Table 3: Efficacy of different insecticides against thrips infesting bitter gourd after third spray

Treatment	Conc. (%)	Mean population of thrips per three leaves per plant					Overall Mean
		Pre-count	3 DAS	7 DAS	10 DAS	14 DAS	
Azadirachtin 1 EC	0.003	3.38 (2.09)*	2.92 (1.98)	2.17 (1.78)	1.08 (1.44)	0.08 (1.04)	1.56 (1.60)
Spinosad 45 SC	0.014	2.47 (1.86)	2.28 (1.81)	2.00 (1.73)	0.88 (1.37)	0.03 (1.02)	1.29 (1.51)
Emamectin benzoate 5 SG	0.002	3.27 (2.06)	2.87 (1.97)	2.07 (1.75)	1.07 (1.44)	0.04 (1.03)	1.51 (1.58)
Chlorantraniliprole 18.5 SC	0.005	2.08 (1.76)	1.77 (1.66)	1.57 (1.60)	0.62 (1.27)	0.00 (1.00)	0.99 (1.41)
Lambda cyhalothrin 5 EC	0.0025	3.58 (2.14)	3.17 (2.04)	2.27 (1.81)	1.13 (1.46)	0.10 (1.05)	1.82 (1.68)
Malathion 50 EC	0.05	2.43 (1.85)	2.18 (1.77)	1.94 (1.72)	0.87 (1.36)	0.02 (1.01)	1.25 (1.50)
Untreated Control	-	5.33 (2.51)	4.40 (2.32)	3.35 (2.13)	3.12 (2.03)	2.90 (1.97)	3.44 (2.11)
S.Em.±		0.06	0.10	0.04	0.05	0.02	0.05
CD (p=0.05)		0.17	0.30	0.13	0.15	0.06	0.16

*Figures in parentheses are $\sqrt{X+1}$ values
DAS: Days After Sowing

Table 4: Cumulative efficacy of different insecticides against aphids infesting bitter gourd

Treatment	Conc. (%)	Mean population of aphids per three leaves per plant			Cumulative mean population
		First spray	Second spray	Third spray	
Azadirachtin 1 EC	0.003	5.84 (2.62)*	3.56 (2.14)	1.56 (1.60)	3.65 (2.16)
Spinosad 45 SC	0.014	4.97 (2.44)	2.89 (1.97)	1.29 (1.51)	3.05 (2.01)
Emamectin benzoate 5 SG	0.002	5.67 (2.58)	3.41 (2.10)	1.51 (1.58)	3.53 (2.13)
Chlorantraniliprole 18.5 SC	0.005	3.92 (2.22)	2.32 (1.82)	0.99 (1.41)	2.41 (1.85)
Lambda cyhalothrin 5 EC	0.0025	5.91 (2.63)	3.68 (2.16)	1.82 (1.68)	3.75 (2.18)
Malathion 50 EC	0.05	4.45 (2.33)	2.82 ()1.95	1.25 (1.50)	2.84 (1.96)
Untreated Control	-	10.53 (3.40)	6.42 (2.72)	3.44 (2.11)	6.78 (2.79)
S.Em.±		0.11	0.06	0.05	0.07
CD (p=0.05)		0.32	0.20	0.16	0.23

*Figures in parentheses are $\sqrt{X+1}$ values
DAS: Days After Sowing

Conclusion

Among the tested insecticides three spray of chlorantraniliprole 18.5 SC @ 0.005 per cent was found to be the best treatment followed by malathion 50 EC @ 0.05 per cent and spinosad 45 SC @ 0.014 per cent against thrips.

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