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Bio-efficacy of insecticide pre mix (Chlorpyrifos 50% + Cypermethrin 5% EC) against ground nut leaf miner in Konkan region

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Abstract

The present investigation was carried out to study the bio-efficacy of insecticide pre-mix (Chlorpyrifos 50% + Cypermethrin 5% EC) against ground nut leaf miner in *Konkan* region during *summer* season of 2019 and 2020 at Regional Fruit Research Station, Vengurla, Dist. Sindhudurg, (M.S.).

There were eight treatments *viz.*, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 375 + 37.5 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha, Chlorpyrifos 50% EC @ 225 g a.i./ha, Chlorpyrifos 50% EC @ 600 g a.i./ha, Cypermethrin 10% EC @ 60 g a.i./ha, Deltamethrin 2.8% EC @ 12.5 g a.i./ha and untreated control tested against leaf miner infesting ground nut. The results of two sprays against leaf miner infesting ground nut revealed that the lowest leaf miner damage was recorded by the treatments Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha, Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha and Deltamethrin 2.8 EC @ 12.5 g a.i./ha after two sprays during 2019. Whereas, in year 2020 the leaf miner damage was lowest in the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha, Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha, Deltamethrin 2.8% EC @ 12.5g a.i./ha and Chlorpyrifos 20% EC @ 225 g a.i./ha after second spray.

Results on yield basis proved that the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha recorded maximum yield 2175 Kg per ha and 2205 Kg/ha during both the years.

Keywords: Bio-efficacy, pre-mix insecticide, leaf miner, groundnut

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oil, food and feed legume crop of the world. It is ranked fourth in the importance of edible oil and third in vegetable protein. (IOPEPC 2017) [4]. The majority of production takes place in Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Madhya Pradesh in India, where it accounts for around 90% of the total crop. Gujarat is a major groundnut growing state with an area of around 16.77 lakh hectares, producing 30.48 lakh tons and producing productivity (Anon., 2019) [2].

Out of all the factors that contribute to the low productivity of groundnuts, the most serious threat to the production of groundnuts is the vulnerability and widespread spread of insect pests. The most significant crop-damaging insects are leaf miner (*Aproaerema modicella* Deventer), Tobacco caterpillar (*Spodoptera litura* Fab), aphid (*Aphis craccivora* Koch), thrips (*Thrips palmi* Karni, *Scirtothrips dorsalis* H., *Caliothrips indicus* Calhin), jassids (*Empoasca kerri* Pruthi) and white flies (*Bemisia tabaci* G.). In groundnut, the damage was 24% to 92% for leaf miner, 13% to 71%, 16% to 42%, 17% to 40%, and 9% to 22% due to various insect pests such as tobacco leaf-eating caterpillar, leaf-eating aphids, leaf-eating thrips, and leaf-eating jassids reported by Amin (1987) [1]. Groundnut yield was reduced by 48.57 percent in pod and 42.11 percent in fodder due to major insect pests (Dabhade *et al.*, 2012) [3].

Different techniques have been used to control insects, but the chemical method is the most effective method for controlling insects because it works quickly, efficiently and can be adapted to different situations. Various insecticides have been suggested and used to control groundnut insects.

Many of these labels claim that insecticides cannot deliver effective results, according to various reports. Thus, these label-claimed insecticides, as well as some brand-new pre-mixed

insecticides, were tested against groundnut leaf miner.

Materials and Methods

A field trial was carried out in *summer* 2019 and 2020 in the *Konkan* region to determine the bio-effectiveness of an insecticidal pre mix (Chlorpyrifos 50%+ Cypermethrin 5% EC) against groundnut leaf miner. The details of the experiment are as follows:

Table 1: Experimental details

Location	: Regional Fruit Research Station, Vengurla, Dist. Sindhudurg, (M.S.)
Years	: Summer 2019 and Summer 2020
Plot size	: Total plot size- 311.04 m ² (Size of individual plot- 3.6 x 3.6 m)
Spacing	: 30 cm x 15 cm
Date of sowing	: Summer 2019- 08.01.2019 Summer 2020- 15.01.2020
Date of harvest	: Summer 2019- 04.05.2019 Summer 2020- 09.05.2020
Design	: Randomized Block Design (R.B.D.)
Replications	: Three (3)
No. of treatments	: Eight (8)

Table 2: Treatment details

Sr. No.	Treatments	Dosage (g a.i./ha)	Formulation (g. or ml/ha)	Dilution in water (l/ha)
T ₁	Chlorpyrifos 50% EC + Cypermethrin 5% EC	375 + 37.5	750	500
T ₂	Chlorpyrifos 50% EC + Cypermethrin 5% EC	500 + 50	1000	500
T ₃	Chlorpyrifos 50% EC + Cypermethrin 5% EC	625 + 62.5	1250	500
T ₄	Chlorpyrifos 20% EC	225	1125	500
T ₅	Chlorpyrifos 50% EC	600	1200	500
T ₆	Cypermethrin 10% EC	60	600	500
T ₇	Deltamethrin 2.8% EC	12.5	500	500
T ₈	Untreated control	-	-	

Cultural operations

Agronomic practices: All agronomic practices like ploughing, harrowing, fertilizer application and irrigation were done as per the recommendations given for the *Konkan* region of Maharashtra.

Spray volume: 500 l ha⁻¹.

Time of application of insecticides: The treatments were applied as need base application as and when incidence of Leaf miner was noticed and reached ETL.

Mode of application: The insecticides were applied using Knapsack sprayer with hollow cone nozzle. The quantity of insecticide to be applied per plot was calculated on the basis of total spray volume of 500 l ha⁻¹. The sprayer was washed with soap and water after application of each treatment to avoid mixing of traces of previous dose/insecticide.

Number of sprays: Two sprays each was applied during *summer* 2019 and *summer* 2020.

Date of sprays

Summer 2019 - 20/02/2019- and 20/03/2019

Summer 2020 – 21.02.2020 and 21/03/2020

Methodology of recording observations

For recording observations of leaf miner, ten plants per treatment were randomly selected and tagged. The observations on total number of leaves per plant and number of damaged leaves due to leaf miner of the same plant were recorded.

The leaves showing the symptoms of mines/leaf folds were treated as damaged leaves due to leaf miner. The percent leaf

damage due to leaf miner was calculated by using following formula;

$$\text{Per cent leaf damage (\%)} = \frac{\text{No. of mined leaves per plant}}{\text{Total no. of leaves per plant}} \times 100$$

Observations were recorded a day prior to insecticide application as pre-treatment and 5 and 10 days post-treatment as post-treatment. The average percent leaf damage was averaged across 10 randomly selected plants, converted into arc sine transformation, and statistically analyzed.

Results and Discussion

The data on percent leaf damage by leaf miner infesting groundnut during *summer* 2019 and *summer* 2020 is presented in Table 3 and 4.

Bio-efficacy of insecticide pre mix (Chlorpyrifos 50% + Cypermethrin 5% EC) against groundnut leaf miner during *summer* 2019

First spray: The data on percent leaf damage by groundnut leaf miner a day before insecticide application ranged from 12.40 to 19.16 percent. There is no significant difference among the different treatments since uniform distribution of leaf miner.

The leaf miner infestation at five days after first spray was ranged between 8.75 to 19.44 percent. The treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a.i./ha recorded minimum infestation of 8.75 percent and it was significantly superior over rest of the treatments but it was at par with the treatments Chlorpyrifos 50% EC @ 600 g a.i./ha and Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha which recorded 9.37 and 10.26 percent leaf miner

infestation, respectively.

The treatments Deltamethrin 2.8% EC @ 12.5 g a.i./ha, Cypermethrin 10% EC @ 60 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 375 + 37.5 g a.i./ha and Chlorpyrifos 20% EC @ 225 g a.i./ha were found next effective treatments and recorded leaf miner infestation of 11.63, 12.18, 12.34 and 12.89 percent at five days after spraying.

On tenth day after first spray, a slight reduction of leaf miner population was observed in all insecticidal treatments over untreated control. The treatments, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a.i./ha emerged as best treatment and recorded 8.67 percent leaf miner damage and it was at par with all the other remaining treatments and recorded significantly lower leaf miner damage ranging from 9.59 to 12.07 percent whereas, untreated control recorded 21.10 percent leaf damage.

Second Spray

Data on percent leaf damage by groundnut leaf miner a day before second spray and 5 and 10 days after second spray is presented in Table 3.

The leaf miner damage a day before second spray was significantly lower (10.60 to 14.45%) in all the treatments except the treatments Deltamethrin 2.8 EC and untreated control which recorded higher damage of 16.10 and 17.60 percent respectively.

Five days after second spray, the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a.i./ha registered least leaf miner damage of 6.39 percent and it was at par with Chlorpyrifos 50% EC @ 600 g a.i./ha and Chlorpyrifos 50% EC + Cypermethrin 5% EC 500 + 50 g a.i./ha which recorded 7.05 and 7.60 percent leaf miner infestation respectively. The remaining treatments recorded significantly lower damage over untreated control.

The lowest leaf miner damage was recorded by the treatments Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha, Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha and Deltamethrin 2.8 EC @ 12.5 g a.i./ha and all the treatments were at par with each other at ten days after second spray. The leaf miner damage in all above treatments was 5.77, 6.58, 7.95 and 8.38 percent respectively.

Bio-efficacy of insecticide pre mix (Chlorpyrifos 50% + Cypermethrin 5% EC) against ground nut leaf miner during summer 2020

First spray

The data on groundnut leaf miner damage a day before first spray, 5 days after first spray and 10 days after first spray is presented in Table 4.

The data on percent leaf damage by groundnut leaf miner a day before insecticide application ranged from 11.65 to 18.21. There is no significant difference among the different treatments since uniform distribution of leaf miner in different treatments.

At five days after first spray, the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha recorded minimum (9.23%) damage of groundnut leaf miner and this treatment was significantly superior over rest of the treatments except the treatments Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha and Deltamethrin 2.8% EC @ 12.5 g a.i./ha which recorded 11.16, 11.33 and 11.43 percent leaf damage, respectively.

On tenth day after first spray, reduction of leaf miner infestation

was observed in all the insecticidal treatments except untreated control. The treatment, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha emerged as best treatment and recorded 8.81 percent leaf miner damage and it was at par with all other remaining treatments except T₁ and T₆ which recorded leaf damage of 12.02 and 12.07 respectively. The untreated control recorded highest leaf damage of 21.43 percent.

Second spray

The data on leaf miner damage in groundnut a day before second spray was in the range of 10.17 to 11.36 percent. The data on leaf miner damage was found to be non-significant indicating the uniform distribution of leaf miner damage in all treatment plots of the field experiment.

At five days after second spray, the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha registered least damage (7.30%) of leaf miner and it was at par with Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC 500 + 50 g a.i./ha and Deltamethrin 2.8% EC @ 12.5g a.i./ha, which recorded 9.13, 9.33 and 9.42 percent leaf miner damage, respectively.

At ten days after second spray, the leaf miner damage was lowest (6.81%) in the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha and the treatment was significantly superior over rest of the treatments except the treatments Chlorpyrifos 50% EC @ 600 g a.i./ha (7.69%), Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha (8.85%), Deltamethrin 2.8% EC @ 12.5g a.i./ha (9.39%) and Chlorpyrifos 20% EC @ 225 g a.i./ha (9.82%) which were at par with each other.

The reports from the earlier studies of Mandal *et al.* (2012)^[5] revealed that out of eight insecticide treatments Chlorpyrifos (93.50%) found to be most effective treatment followed by chlorpyrifos + cypermethrin (92.76%), thiamethoxam (90.70%) and imidacloprid (90.46%) and dichlorvos (82.81%) showed least effective against mustard aphid, *Lipaphis erysimi* K. on rapeseed. Sharma *et al.* (2012)^[6] suggested that the three sprays of chlorpyrifos 50% EC + cypermethrin 5% EC @ 0.01% active substance in 15 days intervals was found to be the most economical, resulting in brinjal has been infested by *Leucinodes orbonalis* on shoot (2.15%) and fruit (12.95%) at a minimum level.

The present findings are in conformity with Shivaleela and Chowdary (2020)^[7]. They proved that the out of seven insecticides tested chlorpyrifos 50% EC + cypermethrin 5% EC @ 1000 + 100 g a.i./ha was recorded minimum larval population per plant both in diamond back moth and *Spodoptera exigua* and found to be superior treatments over the rest. Whereas, the treatments chlorpyrifos 50% + cypermethrin 5% EC @ 1000 ml/ha and its next lower dosage treatment @ 750 ml/ha were on par with each other which recorded lower larval population and aphids in cabbage.

Yield

The pod yield of the groundnut in the years 2019 and 2020 is presented in Table 5.

From the Table 5 it can be revealed that the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha recorded maximum yield of 2175 Kg per ha which was significantly superior over rest of the treatments. The next best treatment was Chlorpyrifos 50% EC @ 600 g a.i./ha which recorded 2083.33 Kg/ha pod yield and it was at par with the treatment Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha and recorded 2066.67 Kg yield per hectare in the year 2019. In 2020, the treatment Chlorpyrifos 50% EC +

Cypermethrin 5% EC @ 625 + 62.5 g. a. i./ha recorded maximum yield of 2205 Kg/ha and found to be significantly superior over rest of the treatments under study. The next best treatments were Chlorpyrifos 50% EC @ 600 g a.i./ha, Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 500 + 50 g a.i./ha and Deltamethrin 2.8% EC @ 12.5g a.i./ha which recorded 2116.67, 2108.33 and 2046.67 Kg pod yield per hectare and all these three treatments were at par with each other. The present findings are corroborative with the results of Mandal *et al.* (2012) [5]. They proved that the highest yield of

rapeseed was recorded from chlorpyrifos + cypermethrin (18.45 q/ha) treated plot.

Chlorpyrifos 50% EC + cypermethrin 5% EC @ 2000 ml/ha recorded minimum head damage (2.29% and 2.54%) with highest yield of cabbage (23.81 q/ha and 22.86 q/ha) in the years 2015-16 and 2016-17, respectively. The next best treatment at all doses followed by Chlorpyrifos 50% EC + cypermethrin 5% EC was Cypermethrin 10% EC @ 760 g a.i./ha reported by Shivaleela and Chowdary (2020) [7].

Table 3: Bio-efficacy of Chlorpyrifos 50% EC + Cypermethrin 5% EC against Groundnut leaf miner (Summer 2019)

Treatments	Percent leaf damage by leaf miner					
	First Spray			Second Spray		
	DBS	5 DAS	10 DAS	DBS	5 DAS	10 DAS
T ₁	17.05 (24.39)*	12.34 (20.57)	11.62 (19.93)	13.92 (21.91)	9.31 (17.77)	9.75 (18.20)
T ₂	12.40 (20.61)	10.26 (18.68)	10.96 (19.33)	10.60 (19.00)	7.60 (16.01)	7.95 (16.38)
T ₃	13.63 (21.67)	8.75 (17.21)	8.67 (17.13)	9.39 (17.84)	6.39 (14.64)	5.77 (13.90)
T ₄	17.13 (24.45)	12.89 (21.04)	11.85 (20.14)	14.45 (22.34)	10.24 (18.66)	8.80 (17.26)
T ₅	13.98 (21.96)	9.37 (17.82)	9.59 (18.04)	10.96 (19.34)	7.05 (15.40)	6.58 (14.87)
T ₆	16.60 (24.05)	12.18 (20.42)	12.07 (20.33)	13.56 (21.61)	9.50 (17.95)	9.03 (17.48)
T ₇	19.16 (25.96)	11.63 (19.94)	11.41 (19.74)	16.10 (23.66)	8.95 (17.41)	8.38 (16.83)
T ₈	18.90 (25.70)	19.44 (26.16)	21.10 (27.35)	17.60 (24.81)	19.13 (25.93)	20.77 (27.11)
S.E. ±	1.39	0.80	1.06	1.41	0.80	1.04
CD @5%	NS	2.38	3.14	4.19	2.39	3.08
C.V.%	10.21	6.83	9.07	11.46	7.71	10.11

* Figures in parentheses are arc sine transformed values
DBS – Day before spraying DAS – Days after spraying

Table 4: Bio-efficacy of Chlorpyrifos 50% EC + Cypermethrin 5% EC against Groundnut leaf miner (Summer 2020)

Treatments	Percent leaf damage by leaf miner					
	First Spray			Second Spray		
	DBS	5 DAS	10 DAS	DBS	5 DAS	10 DAS
T ₁	13.32 (21.41)*	11.83 (20.12)	12.02 (20.29)	11.36 (19.70)	10.96 (19.33)	10.38 (18.80)
T ₂	18.21 (25.26)	11.33 (19.67)	10.86 (19.24)	11.34 (19.68)	9.33 (17.79)	8.85 (17.31)
T ₃	11.65 (19.96)	9.23 (17.69)	8.81 (17.27)	10.89 (19.27)	7.30 (15.67)	6.81 (15.13)
T ₄	12.99 (21.12)	11.97 (20.24)	11.85 (20.14)	11.34 (19.68)	9.93 (18.37)	9.82 (18.27)
T ₅	13.19 (21.29)	11.16 (19.52)	9.68 (18.13)	10.17 (18.60)	9.13 (17.58)	7.69 (16.10)
T ₆	13.77 (21.78)	12.39 (20.61)	12.07 (20.33)	10.76 (19.15)	10.40 (18.82)	10.05 (18.48)
T ₇	13.59 (21.63)	11.43 (19.76)	11.41 (19.74)	11.28 (19.63)	9.42 (17.87)	9.39 (17.85)
T ₈	12.94 (21.08)	21.88 (27.89)	21.43 (27.58)	11.19 (19.64)	18.55 (25.51)	19.43 (26.15)
S.E. ±	1.59	0.80	1.03	0.56	0.89	1.06
CD @5%	NS	2.39	3.01	NS	2.63	3.14
C.V.%	12.72	6.64	8.83	5.04	8.15	9.96

* Figures in parentheses are arc sine transformed values
DBS – Day before spraying DAS – Days after spraying

Table 5: Pod yield of the groundnut

Treatments	Yield Kg/ha	
	2019	2020
Chlorpyrifos 50% EC + Cypermethrin 5% EC (750 ml/ha)	1926.67	1926.67
Chlorpyrifos 50% EC + Cypermethrin 5% EC (1000 ml/ha)	2066.67	2108.33
Chlorpyrifos 50% EC + Cypermethrin 5% EC (1250 ml/ha)	2175.00	2205.00
Chlorpyrifos 20% EC (1125 ml/ha)	1891.67	1891.67
Chlorpyrifos 50% EC (1200 ml/ha)	2083.33	2116.67
Cypermethrin 10% EC (600 ml/ha)	1976.67	1976.67
Deltamethrin 2.8% EC (500 ml/ha)	2000.00	2046.67
Untreated control	1691.67	1710.00
S.E. ±	30.06	25.80
CD @ 5%	88.64	76.25
C.V.%	8.64	7.24

Conclusion

The bio-effectiveness of the pre-mix insecticide at various doses was compared with leaf miner on the groundnut crop. The

results showed that the most effective treatment for the management of leaf miner in the groundnut crop was the combination of Chlorpyrifos (50% EC) + Cypermethrin (5% EC) with different doses. In these treatments Chlorpyrifos 50% EC + Cypermethrin 5% EC @ 625 + 62.5 g a.i./ha showed minimum leaf miner population as well as helped to increase yield.

The present investigation will help to choose the effective insecticide for proper management of leaf miner and getting high returns in groundnut cultivation.

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