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Bio-efficacy of Different Insecticides against Leaf Miner (*Aproraema modicella)* on Groundnut

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A B S T R A C T

The present field experiment were conducted to evaluate "Bio-efficacy of different insecticides against leaf mine (*Aproraema modicella*) on groundnut" under field condition during *Kharif* season of 2019 at research farm of Oilseed Research Station, Latur, Maharashtra, India. The observations on total number of leaf miner larvae were recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before and 3, 7, and 14 days after first and second application of insecticides. The treatments of different insecticides *viz.*, Chlorantranilliprole 0.0185 per cent, Indoxacarb 0.01 per cent, Emamectin benzoate 0.002 per cent, Cypermethrin 0.002 per cent, Profenophos 0.1 per cent and Quinalphos 0.005 per cent were evaluated against leaf miner (*Aproraema modicella.*) revealed that among all the insecticides chlorantranilliprole 0.0185 per cent was found most effective for managing leaf miner larvae population followed by indoxacarb 0.01 per cent, emamectin benzoate 0.002 per cent, cypermethrin 0.002 per cent, profenophos 0.1 per cent and quinalphos 0.005 per cent Significantly higher seed yield (3286 kg/ha) of groundnut was recorded in treatment chlorantranilliprole 0.0185 per cent however, it was found at par with treatment Indoxacarb 0.01 per cent (3133 kg/ha). The highest ICBR (1:5.02) was recorded with treatment chlorantranilliprole 0.0185 per cent which was followed by Indoxacarb 0.01 per cent (1:4.91).

Introduction

Groundnut, *Arachis hypogaea* L., belonging to genus Arachis tribe Aechynomenae, family Fabaceae, is a tetra foliate legume crop with yellow sessile flowers and subterranean pods. It is native of South America. It is a valuable cash crop for millions of small scale farmers in the semi-arid tropics and is the principle oilseed crop in India. Groundnut kernels are one of rich source of edible oil (43-55%), protein (25-28%) and also a valuable source of vitamins *viz.*, E, K and B (Smith, 2002; Motaphale *et al.*, 2018). Although India and China are the world's largest producers of groundnut, they

account for a small part of international trade (<4%) as most of their production is consumed domestically as groundnut oil. Export of peanuts from India and China is less than 4 per cent of world trade and 90 percent of Indian production is processed into peanut oil. *Kharif*-2018 all India groundnut acreage was 38,90,000 hectares. Five states, Gujarat (14,67,600 ha; 37.7%), Andhra Pradesh (6,60,000 ha; 17%), Rajasthan (5,49,052 ha; 14.1%), Karnataka (3,82,940 ha; 9.8%) Maharashtra (1,95,594 ha 5.0%) jointly accounted for 83.7% of the national acreage. At the national level, there was a decrease in acreage by 6.3% with respect to kharif-2017. The maximum decrease was observed for Gujarat (10.0%) while it was negligible for Andhra Pradesh (1.0%). The observed increase in acreage in Karnataka was nominal (1.3%).

A majority of groundnut farmers (51 to 67%) owned farm land smaller than two hectares. At national level, the peak period of sowing was 8 June to 5 July. The largest extent of sowing was done during 8 June to 14 June in both Rajasthan (28%) and Maharashtra (42%); and during 28 June to 5 July in Gujarat (31.2%); Andhra Pradesh (25.2%) and Karnataka (22.9%) (Arunachalam, and Zadda, Kavitha, 2012; Biradar, *et al.*, 2016).

More than 50 insects have been reported to occur on groundnut in India and few are quite destructive and reduce the yield considerably. *Aproaerema modicella* Deventer, *Amrasca biguttula biguttula*, *Spodoptera litura* Fabricus, *Helicoverpa armigera* Hubner, *Aphis craccivora* Koch, *Scirtothrips dorsalis* H. are considered as important destructive pests on groundnut (Amin and Mohammad, 1980; Singh and Sachan, 1992). Insect pests of groundnut causes damage in both field and storage conditions. Due to insect pests the annual loss estimated to be around Rs 1500 million (Mutkule, *et al*., 2018).

About 115 insect pest was reported in India, which causes damage to groundnut crop, in which only 9 species tobacco caterpillar, leaf miner, white grub, thrips, aphid, jassids, gram caterpillar, red hairy caterpillar and termites are found to be economically important. Possible yield losses due to leaf miner are estimated 49.56 per cent, Jassids 40 per cent, aphid 16-40 per cent, thrips 17-40 per cent, red hairy caterpillar 26-75 per cent.

Materials and Methods

The studies on "Bio-efficacy of different insecticides against leaf miner (*Aproraema modicella.)* on groundnut" were conducted during *Kharif* season 2019 at Oilseed Research Station, Latur, Maharashtra, India. The experiment was conducted in a randomized block design (RBD) with seven treatments including untreated control with three replications. Groundnut crop was sown on 31 Jully, 2019 in a gross plot of 4.2m x 5 m maintaining net plot of 3.6 m x 4.8 m. The row to row distance of 30 cm and plant to plant distance of 10 cm was maintained.

The dose of fertilizer at the rate of 20 kg N, 40 kg P_2O_5 and 40 kg K_2O per hectare was given at the time of sowing. The crop was grown under protective irrigation. The treatments of different insecticides *viz.*, Chlorantranilliprole 0.0185 per cent, Indoxacarb 0.01 per cent, Emamectin benzoate 0.002 per cent, Cypermethrin 0.002 per cent, Profenophos 0.1 per cent and Quinalphos 0.005 per cent were applied on appearance of lepidopteran pests and subsequent spray were given at 15 days interval using manually operated knapsack sprayer.

The observations on total number of gram pod borer larvae was recorded per five plant from each on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before treatment and 3, 7, and 14 days after first and second application of insecticides.

Results and Discussion

The bio-efficacy data regarding leaf miner *Aproraema modicella* during *Kharif* 2019 on groundnut.

Leaf miner (*Aproraema modicella)*

First spray

The effect of different insecticides on population of leaf miner larvae on groundnut after first spray are presented in Table 1 and depicted in Fig. 1.The results revealed that all the insecticides were found significantly superior over untreated control in reducing population of leaf miner larvae at 3,7, and 14 days after first spray application.

At three day after first spray, significantly minimum population of leaf miner larvae (1.71 larvae/five plant) was recorded from the plots treated with treatment T2 i.e. Chlorantranilliprole 18.5 SC @ 0.0185 per cent. The next effective treatment was treatment T4 i.e. Indoxacarb 15.8 SC @ 0.01 per cent (3.67 leaf miner larvae/ five plant) which was followed by treatment T6 i.e. Emamectin benzoate 5 WDG @ 0.002 per cent (4.00 leaf miner larvae/plant) in reducing leaf miner larvae population. Both these treatments were statistically at par with each other. The subsequent order of effectiveness was treatment T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (6.00 leaf miner larvae/plant) and treatment T5 i.e. Profenophos 50 EC @ 0.1 per cent (6.67 leaf miner larvae/plant). The next best treatment observed was treatment T1 i.e. Quinalphos 25 EC @ 0.05 per cent which recorded 7.93 leaf miner larvae/plant. These three treatments were found statistically at par with each other. Significantly highest leaf miner population (10.67 leaf miner larvae/plant) was observed in treatment T7 i.e. untreated control.

At seven days after first spray more or less same trend was observed and the treatment T2 i.e. Chlorantraniliprole 18.5 SC 0.0185 per cent observed significantly effective in minimizing leaf miner larvae population (2.33 leaf miner larvae/plant). The next effective treatment was T4 i.e. Indoxacarb 15.8 SC @0.01 per cent (4.33 leaf miner larvae/plant)which was followed T6 i.e. Emamectin benzoate 5 WDG @0.002 per cent (5.67 leaf miner larvae/plant) in reducing leaf miner larvae population. Both these T6 and T4 treatments were found statistically at par with each other.

The subsequent order of effectiveness was treatment T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (7.67 leaf miner larvae/plant). The next effective treatment was T5 i.e. Profenophos 50 EC @ 0.1 per cent (8.33 leaf miner larvae/plant). These two treatments i.e. T3 and T5 were statistically at par with each other. The subsequent order of effectiveness was treatment T1 i.e. Quinalphos 25 EC @ 0.05 per cent (8.67 leaf miner larvae/plant) and these three treatments were found statistically at par with each other. While the highest leaf miner population of 12.53 leaf miner larvae/plant was recorded in treatment T7 i.e. untreated control.

At fourteen days after first spray, significantly lowest population of leaf miner larvae (2.53 leaf miner larvae/plant) was recorded in the plots treated with treatment T2 i.e. Chlorantraniliprole 18.5 SC @ 0.0185 per cent observed significantly effective in minimizing leaf miner larvae population. The next effective treatment were treatment T4 i.e. Indoxacarb 15.8 SC @ 0.01 per cent (5.33 leaf miner larvae/plant) which was followed by treatment T6 i.e. Emamectin benzoate 5 WDG @ 0.002 per cent (6.67 leaf miner larvae/plant) in reducing leaf miner larvae population. Both these treatments were found statistically at par with each other. The next effective treatment was T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (8.67 leaf miner larvae/plant) then T5 treatment i.e. Profenophos 50 EC @ 0.1 per cent (9.67 leaf miner larvae/plant). These three treatments were found statistically at par with each other. The next effective treatment was T1 i.e. Quinalphos 25 EC @ 0.05 per cent (11.00 leaf miner larvae/plant). These T3, T5 and T1 were at par with each other. The highest population of leaf miner larvae (13.67 larvae/plant) was recorded in treatments T7 i.e. untreated control.

Thus, after first spray it can be concluded that the leaf miner larvae population was decreased for only initial three days after first spray and thereafter the

population slowly increased. Also, the plots treated with Chlorantranilliprole 18.5 SC @ 0.0185 per cent recorded significantly lowest population of leaf miner larvae on groundnut to the extent of 1.71,2.33 and 2.53 larvae/plant respectively at 3,7 and 14 days after spraying and found effective over rest of the treatments.

Second spray

The results of effect of different insecticides on population of leaf miner larvae after second spray are presented in Table 2 and Fig.2. The data revealed that similar trend was observed after second spray also and all the insecticides under investigation were observed to be significantly superior over untreated control in reducing the population of leaf miner on groundnut at 3, 7 and 14 days after second spray.

At three day after second spray, significantly minimum population of leaf miner larvae (1.93 leaf miner larvae/five plant) was recorded from the plots treated with treatment T2 i.e. Chlorantranilliprole 18.5 SC @ 0.0185 per cent. The next effective treatment was treatment T4 i.e. Indoxacarb 15.8 SC @ 0.01 per cent (3.67 leaf miner larvae/five plant) which was followed by treatment T6 i.e. Emamectin benzoate 5 WDG @ 0.002 per cent (5.00 leaf miner larvae/five plant) in reducing leaf miner larvae population. Both these treatments were found statistically at par with each other.

The subsequent order of effectiveness was treatment T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (6.33 leaf miner larvae/five plant) and treatment T5 i.e. Profenophos 50 EC @ 0.1 per cent (6.73 leaf miner larvae/five plant).These three treatments were found statistically at par with each other.

The next best treatment observed was treatment T1 i.e. Quinalphos 25 EC @ 0.05 per cent which recorded 10.33 leaf miner larvae/plant. Significantly highest leaf miner larvae population (12.33 leaf miner larvae/five plant) was observed in treatment T7 i.e. untreated control.

At seven days after first spray more or less same trend was observed and the treatment T2 i.e. Chlorantraniliprole 18.5 SC 0.0185 per cent observed significantly effective in minimizing leaf miner larvae population (2.40 leaf miner larvae/five plant). The next effective treatment was T4 i.e. Indoxacarb 15.8 SC @ 0.01 (4.80 leaf miner larvae/five plant) which was followed by treatment per cent T6 i.e. Emamectin benzoate 5 WDG @ 0.002 per cent (6.33 leaf miner larvae/five plant) in reducing leaf miner larvae population. Both these T4 and T6 treatments were found statistically at par with each other.

The subsequent order of effectiveness was treatment T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (7.67 leaf miner larvae/five plant). The next effective treatment was T5 i.e. Profenophos 50 EC @ 0.1 per cent (7.93 leaf miner larvae/five plant). These three treatments were found statistically at par with each other.

The subsequent order of effectiveness was treatment T1 i.e. Quinalphos 25 EC @ 0.05 per cent (11 leaf miner larvae/five plant). While the highest leaf miner population of 15.00 leaf miner larvae/five plant was recorded in treatment T7 i.e. untreated control.

At fourteen days after first spray more or less same trend was observed and the treatment T2 i.e. Chlorantraniliprole 18.5 SC 0.0185 per cent observed significantly effective in minimizing leaf miner larvae population (3.00 leaf miner larvae/five plant). The next effective treatment was T4 Indoxacarb 15.8 SC @ 0.01 per cent (5.67 leaf miner larvae/five plant) which was followed by treatment T6 i.e. Emamectin benzoate 5 WDG @ 0.002 per cent (7.67 leaf miner larvae/five plant) in reducing leaf miner larvae population. Both these T6 and T4 treatments were found statistically at par with each other. The subsequent order of effectiveness was treatment T3 i.e. Cypermethrin 10 EC @ 0.02 per cent (9 leaf miner larvae/five plant).

Table.1 Effect of different insecticides on the population of leaf miner (*Aproraema modicella)* on groundnut (After first spray)

Tr. No.	Treatment	Concentration used (%)	Mean population of leaf miner larvae per five plant			
			1 day before Spraying	Days after spraying		
				3	7	14
T1	Quinalphos 25 EC	0.005	12 (3.53)*	7.93 (2.90)	8.67 (3.02)	**11.00 (3.38)**
T2	Chlorantranilliprole 18.5 SC	0.0185	12.33 (3.58)	1.71 (1.49)	2.33 (1.68)	**2.53 (1.74)**
T3	Cypermethrin 10 EC	0.002	14.00 (3.80)	6.00 (2.55)	7.67 (2.84)	**8.67 (3.02)**
T4	Indoxicarb 15.8 SC	0.02	10.67 (3.34)	3.67 (2.04)	4.00 (2.20)	**5.33 (2.41)**
T5	Profenophos 50 EC	0.1	11.33 (3.43)	6.67 (2.68)	8.33 (2.96)	**9.67 (3.19)**
T6	Emamectin benzoate 5 WDG	0.002	10.67 (3.33)	4.00 (2.11)	5.67 (2.48)	**6.67 (2.67)**
T7	Untreated Control	-	9.00 (3.07)	10.67 (3.32)	12.53 (3.60)	**13.67 (3.74)**
	S.E. ±		0.161	0.124	0.133	**0.177**
	C.D. at 5%		NS	0.377	0.404	**0.538**
	C.V. (%)		**8.11**	**8.81**	**8.61**	**10.68**

*Figures in parentheses are square root(x + 0.5) transformed values. NS: Non significant

Table.2 Effect of different insecticides on the population of leaf miner (*Aproraema modicella)* larvae on groundnut (After second spray)

Tr. No.	Treatment	Concentration used (%)	Mean population of leaf miner larvae per five plant			
			1 day before Spraying	Days after spraying		
				3	7	14
T1	Quinalphos 25 EC	0.005	11.67 (3.48)*	10.33 (3.27)	11 (3.37)	**12.00 (3.54)**
T2	Chlorantranilliprole 18.5 SC	0.0185	8.33 (2.96)	1.93 (1.55)	2.40 (1.70)	**3.00 (1.86)**
T3	Cypermethrin 10 EC	0.002	12.00 (3.53)	6.33 (2.61)	7.67 (2.85)	**9.00 (3.08)**
T4	Indoxicarb 15.8 SC	0.02	10.33 (14.67)	3.67 (2.04)	4.80 (2.29)	**5.67 (2.48)**
T5	Profenophos 50 EC	0.1	14.67 (3.89)	6.73 (2.69)	7.93 (2.90)	**11.00 (3.83)**
T6	Emamectin benzoate 5 WDG	0.002	9.00 (3.00)	5.00 (2.35)	6.33 (2.60)	**7.67 (2.83)**
T7	Untreated Control	-	13.60 (3.72)	12.33 (3.58)	15.00 (3.93)	**16.67 (4.14)**
	S.E. ±		0.208	0.141	0.73	**0.171**
	C.D. at 5%		NS	0.427	0.525	**0.519**
	C.V. (%)		**10.35**	**9.43**	**10.68**	**9.739**

*Figures in parentheses are square root ($\sqrt{x+0.5}$) transformed values. NS: Non significant

Fig.1 Effect of different insecticides on the population of leaf miner larvae (After first spray)

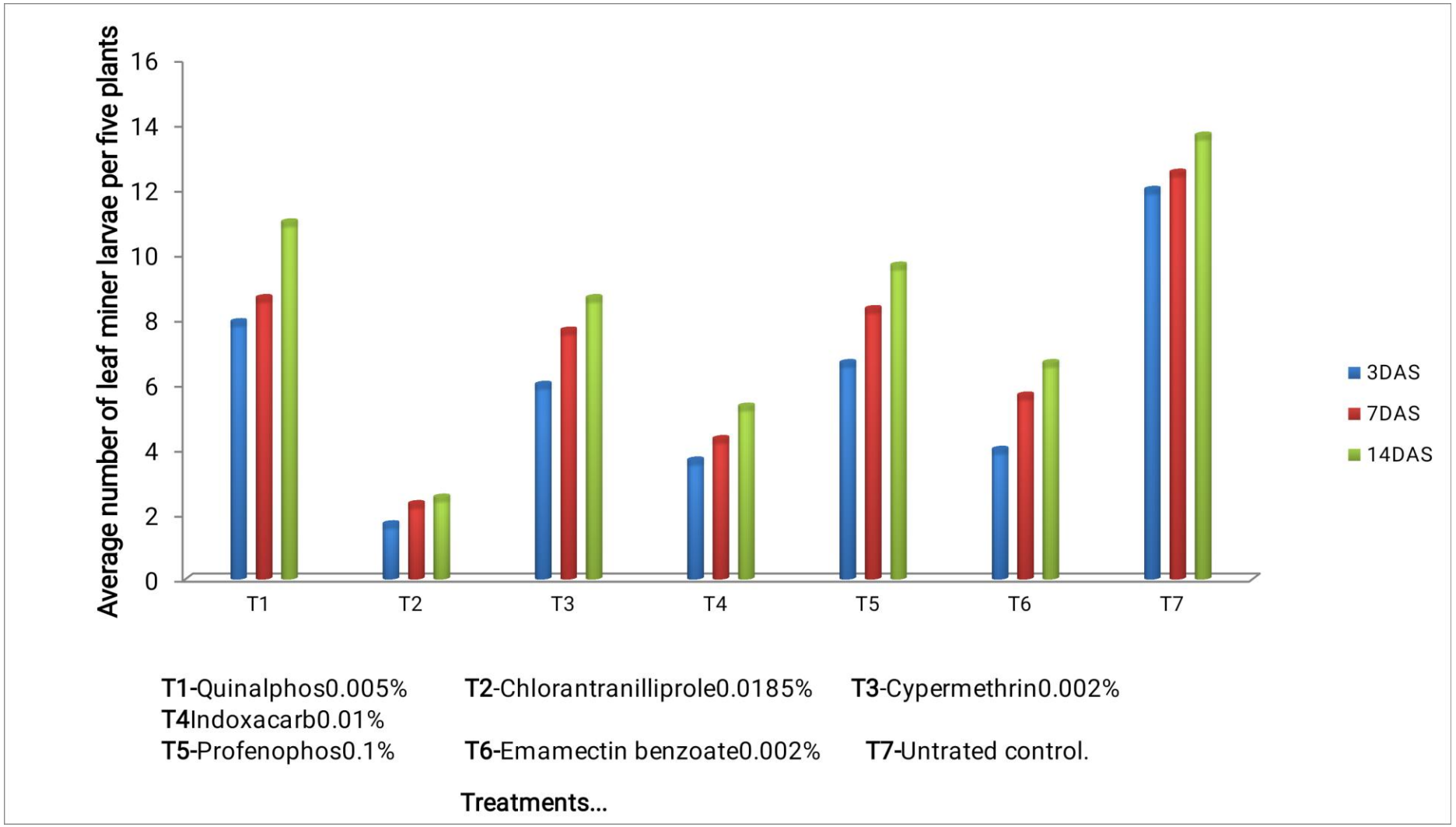
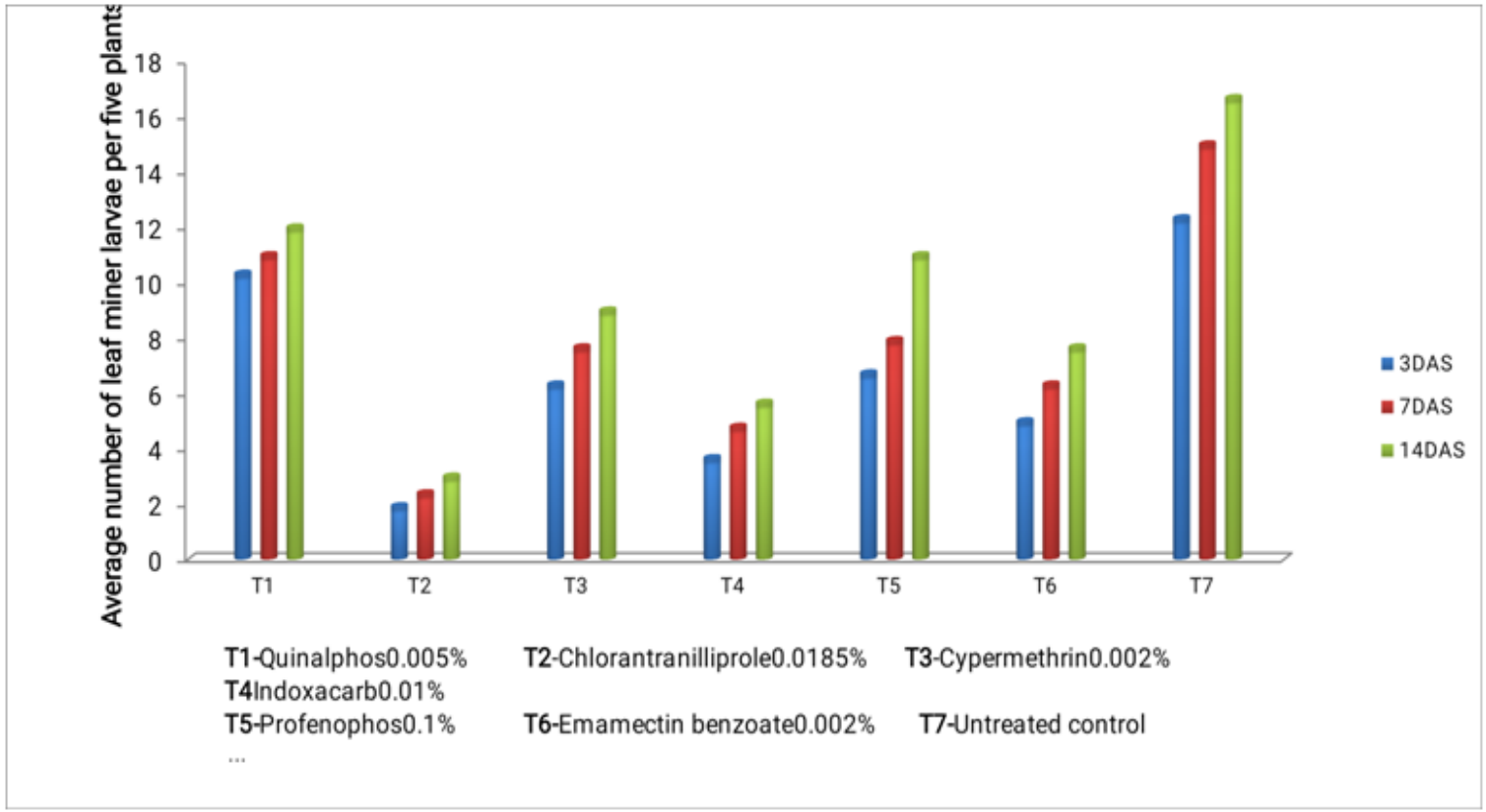


Fig.2 Effect of different insecticides on the population of leaf miner larvae (After second spray)



The next effective treatment was T5 i.e. Profenophos 50 EC @ 0.1 per cent (11.00 leaf miner larvae/five plant). These three treatments were found statistically at par with each other. The subsequent order of effectiveness was treatment T1 i.e. Quinalphos 25 EC @ 0.05 per cent (12.00 leaf miner larvae/five plant). While the highest leaf miner population of 16.67 leaf miner larvae/five plant was recorded in treatment T7 i.e. untreated control.

Thus, overall it was observed that the insecticidal treatments suppress the leaf miner larvae population for initial period only. The population increased slowly after three days onwards of the spray. Also, among the insecticides tested chlorantranilliprole 18.5 SC @0.0185 per cent was found most effective as it recorded significantly lowest population of leaf miner larvae on groundnut to the extent of 1.93,2.40 and 3.00 larvae per plant at 3,7 and 14 days after spraying, respectively over rest of the insecticides.

The present study concluded that among the seven treatments, all the insecticide treatments were more effective than control in reducing the leaf miner, (*Aproraema modicella*) and chlorantranilliprole 0.0185 per cent was found extremely effective for control of leaf miner larvae population on groundnut.

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