Int.J.Curr.Microbiol.App.Sci (2020) *9*(12): 1709-1718

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 12 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.912.203

Bio-efficacy of Different Insecticides against Defoliator (*Spodoptera litura)* on Sunflower

A.S. Jadhav*, D.S. Mutkule, P.K. Waykule, B.A. Thakre and A.P. Dhormare

Oilseed Research Station, Latur- 413 512, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.), India

**Corresponding author*

Keywords

Spodoptera litura, Bioefficacy, Sunflower, Insecticides

Article Info

Accepted:
14 November 2020
Available Online:
10 December 2020

A B S T R A C T

An inspection was undertaken to study the bio-efficacy of different insecticides against defoliator (*Spodoptera litura)* on sunflower under field condition during *Kharif,* 2019 at research farm of Oilseed Research Station, Latur, Maharashtra, India. The observations on total number of *Spodoptera litura* were recorded on 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.*, indoxacarb 0.019 per cent, emamectin benzoate 0.006 per cent, quinalphos 0.03 per cent, chlorantraniliprole 0.024 per cent, cypermethrin 0.03 per cent and profenophos 0.06 per cent were evaluated against *Spodoptera litura* revealed that emamectin benzoate 0.006 per cent was found most effective treatment in reducing the population of *S. litura* (0.07 and 0.00 larvae per five plants per plot at 3 days after first and second spray respectively), followed by chlorantraniliprole 0.024 per cent. Significantly higher seed yield (2846 kg/ha) of sunflower was recorded in treatment emamectin benzoate 0.006 per cent, it was followed by treatment chlorantraniliprole 18.5 per cent (2656 kg/ha). The highest ICBR (1:15.31) was recorded with treatment emamectin benzoate 0.006 per cent which was followed by cypermethrin 0.03 per cent (1:11.55).

Introduction

Sunflower (*Helianthus annuus* L.) belonging to family Compositae is one of the important oilseed crop and ranks third in area in the world. Sunflower is thermo and photo-insensitive crop. It is short durational and high yielding oilseed crop. Oil content in sunflower varies from 32 to 44 per cent. Also it contains 18 to 22 per cent of carbohydrates, 20 to 24 per cent of vitamins and 4 to 6 per cent of salts. Oil is also used for the manufacture of paints, cosmetics, soaps, etc. It is also used in the poultry, livestock rations and for the manufacture of baby foods. Karnataka state is the major producer of sunflower in the country. Maharashtra ranked third in area and production of sunflower.

In India, during 2017-18 sunflower was grown on an area of 0.33 million hectares with 0.23 million metric tonnes of production

and 0.70 metric tonnes per hectare of productivity (Anonymous, 2019) [1]. The total production of sunflower in *kharif*, 2018-19 was estimated at 0.93 lakh tonnes (4th advanced estimate, DACFW, GoI) and the production in *Kharif*, 2019-20 was estimated at 0.67 lakh tonnes (1st advanced estimate, DACFW, GoI). In India, sunflower crop is damaged by different species of insect pests of which polyphagous pests like capitulum borer (*Helicoverpa armigera* Hubner), tobacco caterpillar (*Spodoptera litura* Fab.), Bihar hairy caterpillar (*Spilosoma oblique* Walker), green semilooper (*Thysanoplusia orichalcea* Fab.), cabbage semilooper (*Trichoplusia ni* Hubner) and cutworm (*Agrotis spp*.) are considered of major economic importance (Basappa, 1998) [3].

If the defoliators (*Spodoptera litura*) attack is before flower initiation, it would affect food partitioning between stem, leaves and roots and if it is later it would affect growth of both vegetative parts and inflorescence. Bihar hairy caterpillar is highly polyphagous and occurs all over India and often reported to cause colossal damage to sunflower (Rohilla *et al*., 1981) [12]. Tobacco caterpillar may also assume injurious levels similar to Bihar hairy caterpillar. Though, different insecticides has been used against sunflower defoliators, according to several reports many of these label claimed insecticides could not gave effective results. Hence, some of the insecticides should have to be re-examined against insect-pests of sunflower.

Materials and Methods

The field experiment with sunflower crop using variety 'LSFH-171' in *Kharif*, 2019 was conducted at Oilseeds Research Station, Latur under Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.S., India. The experiment was conducted in a randomized block design (RBD) with seven treatments including untreated control with three replications. Sunflower crop was sown on 01 August, 2019 in a gross plot of 4.8 m x 4.2 m maintaining net plot of 4.2 m x 3.9 m. The row to row distance of 60 cm and plant to plant distance of 30 cm was maintained. The dose of fertilizer at the rate of 60 kg N, 30 kg P_2O_5 and 30 kg K_2O per hectare was given at the time of sowing. The crop was grown with all recommended package of practices recommended by V.N.M.K.V., Parbhani except insect-pests management. The first spray of particular insecticidal treatment was made on appearance of pest and successive spray was given at 15 days interval using manually operated knapsack sprayer. The observations on total number of *Spodoptera litura* were recorded on five randomly selected plants from each plot at one day before spray and 3, 7 and 14 days after first and second application of insecticides.

Results and Discussion

The bio-efficacy data recorded for *Spodoptera litura* during *Kharif*, 2019 on sunflower.

Sunflower defoliator (*Spodoptera litura)*

First spray

Data relating to the effect of different insecticides on population of sunflower defoliator (*Spodoptera litura*) after first spray are presented in Table 1 and depicted in Fig. 1. The results disclosed that all the insecticides were found significantly superior over untreated control in reducing population of sunflower defoliator (*Spodoptera litura*) at 3, 7 and 14 days after first application of insecticides.

At three day after first spray, treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent treated plot observed significantly lowest population of *S. litura* (0.07 larvae/five

plants/plot) which was followed by treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.13 larvae/five plants/plot) and treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.27 larvae/five plants/plot) and all these three treatments were found statistically at par with each other. The next effective treatment was treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.40 larvae/five plants/plot) which was followed by treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.53 larvae/five plants/plot). Both of these treatments were found statistically at par with each other. The highest *S. litura* population (1.27 larvae/five plants/plot) was recorded in treatment T7 i.e. untreated control. The rest of the treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (0.73 larvae/five plants/plot) was intermediate.

At seven days after first spray, significantly lowest population of *S. litura* was noted in treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent (0.13 larvae/five plants/plot) followed by treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.20 larvae/five plants/plot) which was again followed by treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.33 larvae/five plants/plot) and all these three treatments were found statistically at par with each other. The next best treatment was treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.53 larvae/five plants/plot). Treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (0.80 larvae/five plants/plot) and treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.87 larvae/five plants/plot) were next effective treatments in reducing *S. litura* population. The highest *S. litura* population of 1.53 larvae/five plants/plot was recorded in treatment T7 i.e. untreated control.

At fourteen days after first spray, significantly lowest population of *S. litura* was observed in treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent (0.20 larvae/five plants/plot) followed by treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.33 larvae/five plants/plot). Both of these treatments were found statistically at par with each other. The subsequent order of effectiveness was treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.53 larvae/five plants/plot) and treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.67 larvae/five plants/plot) and were found statistically at par with each other. The next best treatment in reducing the population of *S. litura* was treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.93 larvae/five plants/plot) which found statistically at par with treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (1.00 larvae/five plants/plot). Treatment T7 i.e. untreated control recorded the highest of 1.67 larvae/five plants/plot.

Thus after first spray, overall the plots treated with emamectin benzoate 5 SG @ 0.006 per cent recorded significantly lowest population of *S. litura* on sunflower to the tune of 0.07, 0.13 and 0.20 larvae/five plants/plot at 3, 7 and 14 days after spraying, respectively over rest of the insecticidal treatments.

Second spray

The results in concern with the effect of different insecticides on population of sunflower defoliator (*S. litura*) after second spray are presented in Table 2 and depicted in Fig. 2.

The data disclosed that all the insecticides under inspection were significantly superior over untreated control in reducing the population of defoliator (*S. litura*) on sunflower at 3, 7 and 14 days after second spray.

At three days after second spray, significantly lowest population of *S. litura* (0.00 larvae/five

plants/plot) was recorded in the plots treated with treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent which was found at par with treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.07 larvae/five plants/plot) and treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.27 larvae/five plants/plot). The next best treatment was treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.33 larvae/five plants/plot). The next effective treatments were treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.47 larvae/five plants/plot) and treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (0.60 larvae/five plants/plot) and both of these treatments were found statistically at par with each other in reducing *S. litura* population. The highest population of *S. litura* (1.13 larvae/five plants/plot) was recorded in treatment T7 i.e. untreated control.

At seven days after second spray more or less same trend was observed and the treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent observed significantly effective in minimizing *S. litura* population (0.07 larvae/five plants/plot) which was followed by treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.13 larvae/five plants/plot) and treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.33 larvae/five plants/plot). All these three treatments were found statistically at par with each other. The next best treatment was treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.40 larvae/five plants/plot). The subsequent order of effectiveness was treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.53 larvae/five plants/plot), treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (0.67 larvae/five plants/plot) and both of these treatments were found statistically at par with each other. The highest *S. litura* population of 1.30 larvae/five plants/plot was recorded in treatment T7 i.e. untreated control.

At fourteen days after second spray, significantly lowest population of *S. litura* was observed in treatment T2 i.e. emamectin benzoate 5 SG @ 0.006 per cent (0.13 larvae/five plants/plot) and was found at par with treatment T4 i.e. chlorantraniliprole 18.5 SC @ 0.024 per cent (0.20 larvae/five plants/plot). The next best treatment was treatment T5 i.e. cypermethrin 25 EC @ 0.03 per cent (0.47 larvae/five plants/plot). The subsequent order of effectiveness was treatment T1 i.e. indoxacarb 14.5 SC @ 0.019 per cent (0.53 larvae/five plants/plot), treatment T6 i.e. profenophos 50 EC @ 0.06 per cent (0.67 larvae/five plants/plot) and treatment T3 i.e. quinalphos 25 EC @ 0.03 per cent (0.80 larvae/five plants/plot). All these three treatments were found statistically at par with each other. The highest *S. litura* population (1.53 larvae/five plants/plot) was recorded in treatment T7 i.e. untreated control.

Thus, overall it was observed that the insecticidal treatments suppressed the *S. litura* population for initial period only. The population increased slowly after seven days onwards of the spray. Also, among the insecticides tested emamectin benzoate 5% SG @ 0.006 per cent was found most effective as it recorded significantly lowest population of *S. litura* on sunflower to the extent of 0.00, 0.07 and 0.13 larvae/five plants/plot at 3, 7 and 14 days after spraying, respectively over rest of the insecticides.

The above findings are in confirmity with those of Gadhiya *et al*., (2013) [4] and Naveen Kumar *et al*., (2015) [6] who found emamectin benzoate effective in management of *S. litura* on groundnut. While Tatagar *et al*., (2009) [15] found that emamectin benzoate was most effective in management of *S. litura* on chilli. Sharma *et al*., (2017) [13] found emamectin benzoate effective against *S. litura* on soybean.

Table.1 Effect of different insecticides on the larval population of sunflower defoliator (*S. litura*) (First spray)

Tr. No.	Treatment	Concentration used (%)	Mean population of *S. litura* larvae/five plants/plot			
			1 day before Spraying	Days after spraying		
				3	7	14
T1	Indoxacarb 14.5% SC	0.019	1.13 (1.27)*	0.27 (0.87)	0.33 (0.91)	**0.53 (1.02)**
T2	Emamectin benzoate 5% SG	0.006	1.07 (1.25)	0.07 (0.75)	0.13 (0.79)	**0.20 (0.83)**
T3	Quinalphos 25% EC	0.03	1.13 (1.28)	0.73 (1.10)	0.80 (1.14)	**1.00 (1.22)**
T4	Chlorantraniliprole 18.5% SC	0.024	0.93 (1.20)	0.13 (0.79)	0.20 (0.84)	**0.33 (0.91)**
T5	Cypermethrin 25% EC	0.03	1.27 (1.32)	0.40 (0.95)	0.53 (1.02)	**0.67 (1.08)**
T6	Profenophos 50% EC	0.06	1.07 (1.25)	0.53 (1.02)	0.87 (1.17)	**0.93 (1.20)**
T7	Untreated Control	-	1.00 (1.21)	1.27 (1.33)	1.53 (1.43)	**1.67 (1.47)**
	S.E ±		0.09	0.05	0.05	**0.06**
	C.D. at 5%		NS	0.15	0.16	**0.17**
	C.V. (%)		**12.56**	**8.81**	**8.69**	**9.03**

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

Table.2 Effect of different insecticides on the larval population of sunflower defoliator (*S. litura*) (Second spray)

Tr. No.	Treatment	Concentration used (%)	Mean population of *S. litura* larvae/five plants/plot			
			1 day before Spraying	Days after spraying		
				3	7	14
T1	Indoxacarb 14.5% SC	0.019	1.07 (1.24)*	0.27 (0.87)	0.33 (0.91)	**0.53 (1.02)**
T2	Emamectin benzoate 5% SG	0.006	1.07 (1.25)	0.00 (0.71)	0.07 (0.75)	**0.13 (0.79)**
T3	Quinalphos 25% EC	0.03	1.20 (1.30)	0.60 (1.04)	0.67 (1.08)	**0.80 (1.14)**
T4	Chlorantraniliprole 18.5% SC	0.024	1.27 (1.32)	0.07 (0.75)	0.13 (0.79)	**0.20 (0.83)**
T5	Cypermethrin 25% EC	0.03	1.00 (1.22)	0.33 (0.91)	0.40 (0.94)	**0.47 (0.98)**
T6	Profenophos 50% EC	0.06	0.93 (1.19)	0.47 (0.98)	0.53 (1.02)	**0.67 (1.08)**
T7	Untreated Control	-	1.00 (1.22)	1.13 (1.28)	1.30 (1.35)	**1.53 (1.43)**
	S.E. ±		0.09	0.05	0.06	**0.05**
	C.D. at 5%		NS	0.16	0.17	**0.16**
	C.V. (%)		**12.05**	**9.92**	**10.09**	**8.96**

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

Fig.1 Effect of different insecticides on the larval population of sunflower defoliator (*S. litura*) at first spray

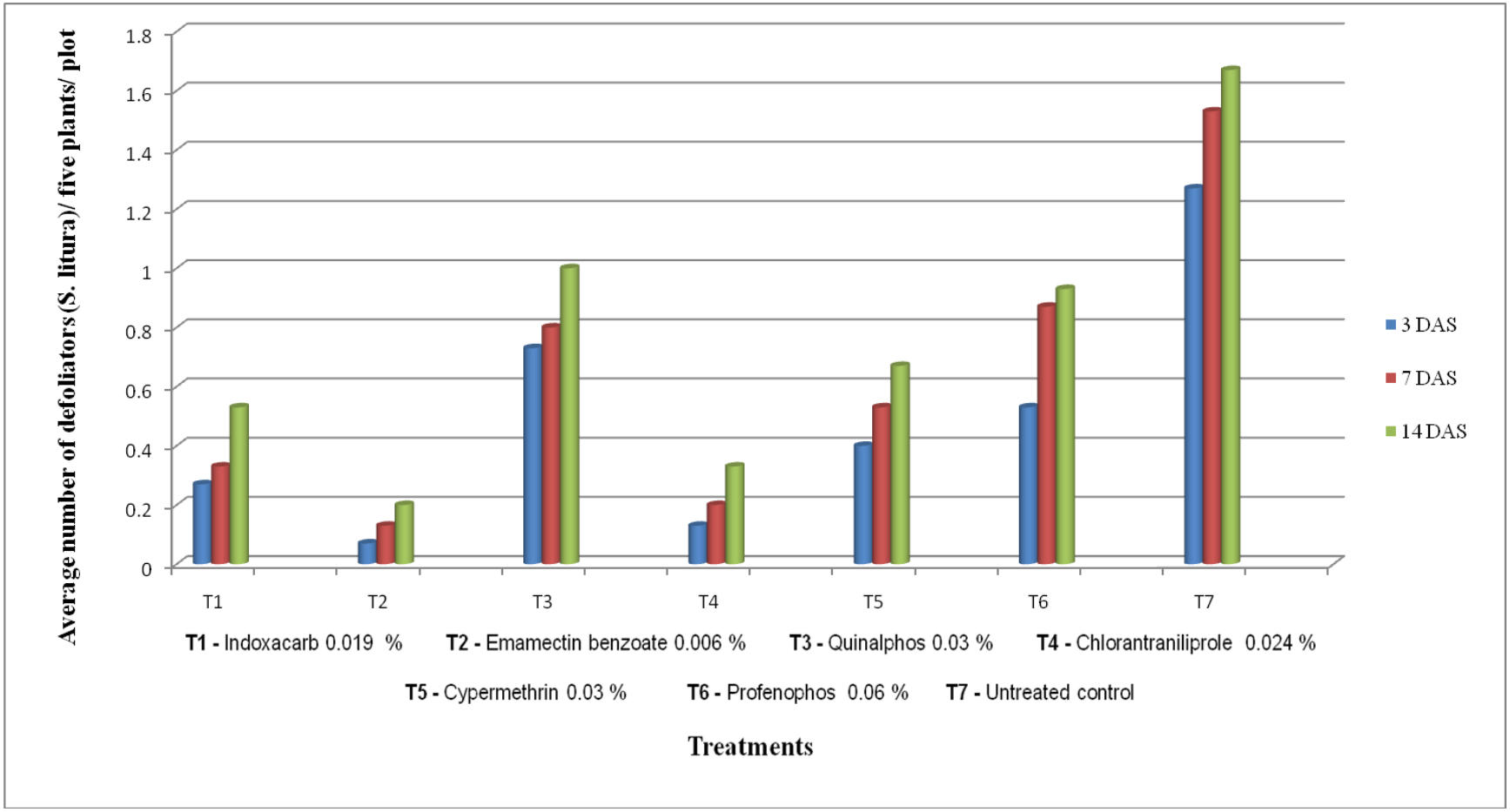
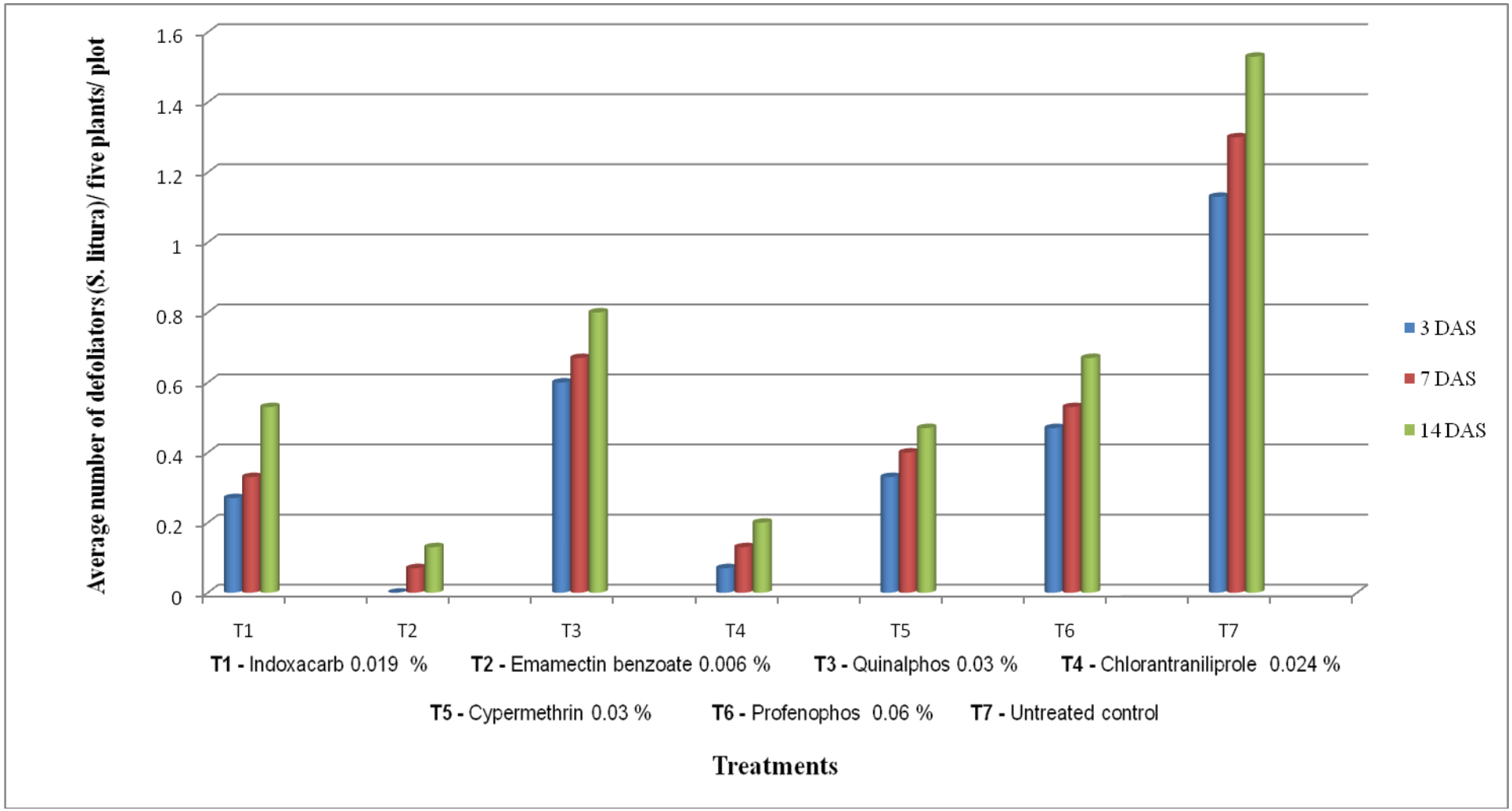


Fig.2 Effect of different insecticides on the larval population of sunflower defoliator (*S. litura*) at second spray



The next best treatment found in present study in the management of *S. litura* was chlorantraniliprole 18.5 SC @ 0.024 per cent. Gadhiya *et al*., (2013) [4] and Naveen Kumar *et al*., (2015) [6] found chlorantraniliprole effective against *S. litura* on groundnut. The effectiveness of chlorantraniliprole on soybean was also mentioned earlier by Bangale *et al*., (2019) [2] and Patil *et al*., (2014) [10]. The next effective treatment found in present study in the management of *S. litura* was indoxacarb. Ravi *et al*., (2007) [11] reported indoxacarb as an effective treatment for the management of *S. litura* on sunflower. Narayanamma *et al*., (2010) [7] found indoxacarb effective for the management of *S. litura* on castor. While indoxacarb as an effective treatment against *S. litura* was reported by Natikar *et al*., (2016) [8] and Taggar *et al*., (2011) [14] on soybean. Patra *et al*., (2016) [9] found indoxacarb effective for the management of *S. litura* on cabbage. In the present study, profenophos and quinalphos were found least effective in management of *S. litura*. Sharma *et al*., (2017) [13] found profenophos least effective in management of *S. litura* on soybean. Whereas, Bangale *et al*., (2019) [2] found quinalphos least effective in management of *S. litura* on soybean. Thus, the present finding of bio-efficacy experiment are in line with the findings of all these earlier workers.

The present study concluded that among the seven treatments, all the insecticidal treatments were effective than untreated control in reducing the *Spodoptera litura* population and emamectin benzoate 0.006 per cent was found most effective insecticide in controlling the *Spodoptera litura* population on sunflower.

References

1. Anonymous. Sunflower seed area, yield and production. Foreign Agricutural Services/USDA, Office of Global Analysis 2019. https://apps.fas.usda.gov/psdonline/circulars/production.pdf.
2. Bangale SA, Parmar GM, Dhandge SR. Bio-efficacy of different insecticides against tobacco leaf eating caterpillar, *Spodoptera litura* (Fab.) infesting soybean under field condition. J. Entomol. Zool. Studies 2019; 8(1): 10-14.
3. Basappa H. Integrated Pest Management in Sunflower in short course manual on advances in implementable pest management technology, Directorate of Oilseeds Research 1998, Hyderabad.
4. Gadhiya HA, Borad PK, Bhut JB. Effectiveness of synthetic insecticides against *Helicoverpa armigera* (Hubner) Hardwick and *Spodoptera litura* (Fabricius) infesting groundnut. Int. J. Life. Sci 2013; 9(1): 23-26.
5. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley & Sons 1984.
6. Kumar NN, Acharya MF, Srinivasulu DV, Sudarshan P. Bioefficacy of modern insecticides against *Spodoptera litura* Fabricius on groundnut. Int. J. Agric. Inn. Res 2015; 4(3): 573-577.
7. Narayanamma LV, Reddy AV, Singh TVK. Evaluation of newer insecticides for the management of defoliators and capsule borer in castor. Indian J. Pl. Protec 2010; 38(2): 144-146.
8. Natikar PK, Balikai RA, Jahagirdar S, Hosmath JA. Bio-efficacy of newer insecticide molecules against *Spodoptera litura* (Fab.) infesting soybean. Int. J. Agricult. Stat. Sci 2016; 12(1): 117-121.
9. Patra S, Das BC, Sarkar S, Samanta A. Efficacy of newer insecticides against major lepidopteran pests of cabbage. Res. On Crops 2016; 17(1): 144-150.

10. Patil MU, Kulkarni AV, Gavkare Omkar. Evaluating the efficacy of novel molecules against soybean defoliators. Int. J. Life Sci 2014; 9(1): 577-580.
11. Ravi M, Sathiah N, Panneerselvam S. Management of sunflower head borers with biopesticides and newer insecticides. Madras Agric. J 2007; 94(1-6): 42-45.
12. Rohilla HR, Singh HV, Gupta DS, Kishan S. Pest complex other than diseases of sunflower, *Helianthus annuus* in Haryana. Indian J. Plant Prot 1981; 8: 177-182.
13. Sharma AK, Kumar A, Kumhar BL. Effective control measure of tobacco caterpillar (*Spodoptera litura*) on soybean through various insecticides. Chem. Sci. Rev. Lett 2017; 6(21): 533-537.
14. Taggar GK, Cheema HK, Kooner BS. Bio-efficacy of certain insecticides against tobacco caterpillar, *Spodoptera litura* (Fabricius) infesting soybean in Punjab. Crop Research 2011; 42(1,2,3): 284-288.
15. Tatagar MH, Mohankumar HD, Shivaprasad M, Mesta RK. Bioefficacy of flubendiamide 20 WG against chilli fruit borers, *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fb.). Karnataka J. Agric. Sci 2009; 22(3): 579-581.

How to cite this article:

Jadhav, A.S., D.S. Mutkule, P.K. Waykule, B.A. Thakre and Dhormare, A.P. 2020. Bio-efficacy of Different Insecticides against Defoliator (*Spodoptera litura*) on Sunflower. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 1709-1718. doi: https://doi.org/10.20546/ijcmas.2020.912.203