

Efficacy of Some Newer Insecticides Against Major Insect Pests of Soybean [*Glycine max* (L.) Merrill]

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ABSTRACT

The present investigation titled “Efficacy of some newer insecticides against major insect pests of soybean [*Glycine max* (L.) Merrill] and their natural enemies” was conducted during the Kharif 2024-25 at the experimental field of the Department of Entomology, ICAR-National Soybean Research Institute, Indore, Madhya Pradesh (India). The study aimed to evaluate the effectiveness of selected insecticides, alongside their impact on natural enemies. Efficacy trials involving nine insecticidal treatments indicated that *M. sojae* was most effectively controlled by Thiamethoxam 75% SG, resulting in the lowest stem tunnelling, followed by Flubendiamide 39.35% SC. *O. brevis* was best managed by Thiacloprid 21.7% SC, which was very effective with the minimum plant infestation after the first and second spray. *C. acuta* and *S. litura* were best controlled by Spinetoram 11.7% SC, with the lowest larval population, followed by Tetraniliprole. In terms of natural enemies' conservation, Spinetoram and Indoxacarb 14.8% SC supported the highest population, while Acetamiprid and Emamectin benzoate 5% SG recorded the lowest. The study provides important insights for integrated pest management in soybean agroecosystems.

Keywords: Efficacy of newer insecticides, Major insect pest of soybean, Natural enemies

1 | INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] belongs to the family Fabaceae, one of the most important economic oilseed and legume in the world, in terms of total production and international trade. It is considered “Wonder Crop” and “Golden bean” of the 20th century and “Miracle Crop” of the 21st century owing to its good quality vegetable protein and edible oil. It is an excellent source of protein (40%) and edible oil (20%), carbohydrates (30%) and fibre (5%). Soybean oil contains about lecithin (0.5-1.0%) which is essential for building up of human nerve tissues. Due to high protein content, soybean is known as “poor man’s meat”. It is a native of China and was introduced in India subcontinent about 1000 AD (Hymowitz and Kaizuma, 1981). The global soybean production reached 385.524 million metric tonnes in the year 2021-22, with Brazil leading (144 MMT), followed by the USA (119.88 MMT), Argentina (52 MMT), China (19 MMT) and India (11.2 MMT), (Anonymous, 2024). In the 2023-24, India cultivated soybean in 13.26 million hectares area, with a productivity of 985 kg/ha and a total production of 13.06 million tonnes. Madhya Pradesh is known as “Soya State”- and contributes significantly to soybean production in the country with 5.749 MMT productions during 2022-23 from 5.97 Mha (Khound *et al.*, 2024). In short period of time soybean become a, major *Kharif* crop in Madhya Pradesh, Maharashtra, Rajasthan, North Karnataka, etc.

However, the soybean crop facing huge problems and challenges for decreasing yield at farmer’s field. More than 270 insect pests have been recorded to infest different stages of soybean crop in India (Lutytska, 2019), while in Madhya Pradesh over 99 insect pests found on soybean (Gangrade, 1976). About 15-25% of soybean output lost due to insect pests (Biwas, 2013). Girdle beetle, *Oberiopsis brevis* (Sweden board), stem fly, *Melanagromyza sojae* (Zehnter), tobacco caterpillar, *Spodoptera litura* (Fabricius), semiloopers, *Gesonía gemma*, *Diachrysia orichalcea* and *Chrysodeixis acuta* (Walker) and sucking insect pests like white fly, *Bemisia tabaci* (Gennadius) and aphid, *Aphis glycine* are a few of them that are important. Seasonal incidence studies help in planning need-based application of insecticides as it clearly reveals the insect’s peak activity free period during growth. Evaluating the most effective chemical solutions for current pest control issues involves assessing the efficacy of new insecticides, which is determined by identifying dosage required to achieve optimal pest control.

2 | MATERIALS AND METHODS

A field experiment to evaluate the efficacy of some newer insecticides against major insect pests of soybean [*Glycine max* (L.) Merrill] and their natural enemies was conducted at ICAR-National Soybean Research Institute, Indore, (MP), during kharif-2024. All recommended agronomic package of practices were followed for raising of crops. The crop was

sown in randomized block design with nine treatments and an untreated control replicated thrice. The plot size was 20.25m². treatments were (T₁) Imidacloprid 17.8% SL 100ml /ha (T₂) Thiamethoxam 75% SG 125g /ha (T₃) Acetamiprid 20% SP 100g /ha (T₄) Emamectin benzoate 5% SG 200g /ha (T₅) Spinetoram 11.7% SC 450ml /ha (T₆) Thiacloprid 21.7% SC 750ml /ha (T₇) Flubendiamide 39.35% SC 150ml /ha (T₈) Indoxacarb 14.8% SC 333ml /ha (T₉) Tetraniliprole 18.18% SC 1000ml /ha and Untreated (control) (T₁₀).

Method of application of insecticides: All the insecticides were applied in the form of foliar spray with the help of knapsack sprayer. Spray fluid was prepared by mixing a measured quantity of water and insecticides. All necessary care was taken to prevent the drift of insecticides to reach the adjacent plots. The first application was given at 50 days after sowing and second spray was given at 10 days interval.

Method of recording observations:

Stem fly: Infestation of stem fly was recorded from 3 randomly selected plants in each plot, uprooted and split up vertically to observe the infestation. Stem tunnelling was expressed in per cent.

$$\text{Tunnelling (\%)} = [\text{Tunnelling length (cm)} \div \text{Total plant height (cm)}] \times 100$$

Girdle beetle: - The observation of girdle beetle was recorded by counting the total number of healthy and girdled plants in a one-meter row length at three randomly selected places.

$$\text{Infestation (\%)} = [\text{No. of girdled plants} \div \text{Total no. of observed plants}] \times 100$$

Larval population:- Observation of larval population was recorded in one meter row length (MRL) by shaking the plants on white paper from three places, and the mean was calculated.

Natural enemies:- The population of natural enemies (spiders and entomopathogenic fungi) was recorded in one meter row length (MRL) by shaking the plants on a white paper sheet from three places, and the mean was calculated.

3 | RESULTS AND DISCUSSION

On the basis of the average of seven observations recorded at 1, 3, 7, and 10 days after the first and second spray, there was observed that all the insecticides significantly reduced the stem tunnelling by *Melanagromyza sojae* compared to the untreated control. The mean of stem tunnelling in treated plots ranged from 2.31 to 10.41, whereas the untreated control (T₁₀) exhibited a much highest mean of 20.88. Among the treatments, Thiamethoxam 75% SG (T₂) was found to be the most effective, with the lowest stem tunnelling value with 2.31, followed by Flubendiamide 39.35% SC (T₇) and Acetamipride 20% SP (T₃). The maximum stem tunnelling (20.88) was recorded in the untreated control, underscoring the significant efficacy of insecticides in controlling stem fly damage. The observed reduction in stem tunnelling was highest for Thiamethoxam, which showed a reduction of 80.5%, followed by Flubendiamide and Acetamiprid (69.2%).

On the basis of the average of observations recorded at 1, 3, 7, and 10 days after the first and second spray, it was observed that all the insecticides significantly reduced the plant infestation caused by *Oberopsis brevis* compared to the untreated control. The plant infestation percentage in treated plots ranged from 1.14% to 2.69%, while the untreated control (T₁₀) exhibited 6.20% infestation. Tetraniliprole 18.18% SC (T₉) was the most effective treatment, with the lowest infestation of 1.14%, followed by Indoxacarb 14.8% SC (T₈) at 1.25% and Thiacloprid 21.7% SC (T₆) at 1.22%. The maximum infestation (10.20%) was recorded in the untreated control plot. The observed reduction in infestation was highest for Tetraniliprole, showing a reduction of 81.7%, followed by Indoxacarb (79.5%) and Thiacloprid (81.4%). These results confirm the efficacy of the insecticides in controlling *Oberopsis brevis* infestation.

On the basis of the average larval population recorded at 1, 3, 7, and 10 days after the first and second spray, it was observed that all insecticides significantly reduced the larval population of *Chrysodeixis acuta* compared to the untreated control. The mean of larval population in treated plots ranged from 0.18 to 8.41 larvae per meter row length, while the untreated control exhibited 11.66 larvae per meter row length after the first spray and 5.89 larvae per meter row length after the second spray. Tetraniliprole 18.18% SC (T₉) was the most effective treatment, with the lowest larval population (0.18 larvae per meter row length after the second spray), followed by Indoxacarb 14.8% SC (T₈) and Thiacloprid 21.7% SC (T₆). The maximum larval population was observed in the untreated control plots. The reduction in larval population was highest for Tetraniliprole (96.5 at 10 DAT), followed by Indoxacarb (92.7) and Thiacloprid (91.5). These results confirm the efficacy of the insecticides in managing *Chrysodeixis acuta* infestation.

On the basis of the average defoliation caused by *Spodoptera litura* recorded at 1, 3, 7, and 10 days after the first and second spray, it was observed that all insecticides significantly reduced defoliation compared to the untreated control. The defoliation in treated plots ranged from 0.72 to 4.11, while the untreated control exhibited 5.38 defoliation after the first spray and 3.66 after the second spray. Spinetoram 11.7% SC (T₅) was the most effective treatment, with the lowest defoliation (1.37 after the 1st spray and 0.72 after the 2nd spray), followed by Tetraniliprole 18.18% SC (T₉) (1.66 after the 1st spray and 0.94 after the 2nd spray) and Indoxacarb 14.8% SC (T₈) (1.61 after 1st spray and 0.94 after the 2nd spray). The maximum defoliation was observed in the untreated control plots. The reduction in defoliation was highest for Spinetoram (85.1 at 10 DAT), followed by Tetraniliprole (82.0) and Indoxacarb (78.1). These results confirm the efficacy of the insecticides in managing *Spodoptera litura* infestation.

3.1 | Effects of some newer insecticides on natural enemies

On the basis of the average natural enemy population recorded at 1, 3, 7, and 10 days after the first and second spray, it was observed that all insecticides significantly reduced the

population of natural enemies compared to the untreated control. The mean of population of natural enemies in treated plots ranged from 0.22 to 3.73 per meter row length, while the untreated control exhibited 3.83 natural enemies per meter row length after the first spray and 2.16 per meter row length after the second spray. Spinetoram 11.7% SC (T5) exhibited the highest mean population of natural enemies (3.73 after the first spray and 1.55 after the second spray), followed by Flubendiamide 39.35% SC (T7) (3.01 after the first spray and

0.22 after the second spray). The lowest population was recorded in treatments such as Acetamiprid 20% SP (T3), Emamectin Benzoate 5% SG (T4) and Thiamethoxam 75% SG after the first and second spray. These results confirmed the varying levels of impact insecticides have on natural enemies, with some insecticides having a lesser impact, such as Spinetoram and Tetraniliprole, which provide effective pest control with minimal disruption to beneficial insects.

Table 1. Efficacy of newer insecticides against stem fly (percent stem tunnelling) infesting soybean during *Kharif*, 2024

S. No	Treatments	First Spray					Second Spray				
		1DBT	3DAT	7DAT	10DAT	Mean	1DBT	3DAT	7DAT	10DAT	Mean
T1	Imidacloprid 17.8% SL	14.00 (21.97)	7.08 (15.44)	6.25 (14.48)	7.77 (16.19)	7.03	7.77 (16.19)	6.13 (14.33)	9.64 (18.09)	9.89 (18.33)	8.55
T2	Thiamethoxam 75% SG	14.33 (3.85)	3.01 (1.82)	2.85 (1.79)	4.80 (2.3)	3.55	4.80 (2.3)	2.42 (1.71)	2.09 (1.60)	2.42 (1.69)	2.31
T3	Acetamiprid 20% SP	14.67 (22.52)	4.82 (12.68)	7.2 (15.56)	8.8 (17.26)	6.94	8.8 (17.26)	6.53 (14.81)	6.20 (14.41)	6.53 (14.81)	6.42
T4	Emamectin benzoate 5% SG	15.00 (22.79)	6.63 (14.92)	4.42 (12.14)	11.14 (19.50)	7.40	11.14 (19.50)	3.85 (11.31)	3.51 (10.80)	3.85 (11.31)	3.74
T5	Spinetoram 11.7% SC	15.33 (23.05)	7.32 (15.70)	10.48 (18.89)	6.96 (15.29)	8.25	6.96 (15.29)	5.46 (13.51)	5.13 (13.09)	5.79 (13.93)	5.46
T6	Thiacloprid 21.7% SC	15.59 (23.26)	7.99 (16.42)	7.13 (15.48)	16.10 (23.66)	10.41	16.10 (23.66)	6.66 (14.96)	6.33 (14.57)	6.66 (14.96)	6.51
T7	Flubendiamide 39.35% SC	14.00 (21.97)	7.68 (16.09)	3.73 (11.14)	8.66 (17.12)	6.69	8.66 (17.12)	3.02 (10.01)	2.69 (9.43)	3.02 (10.01)	2.91
T8	Indoxacarb 14.8% SC	14.33 (22.24)	8.04 (16.47)	4.09 (11.67)	10.80 (19.19)	7.64	10.80 (19.19)	3.76 (11.18)	3.45 (10.71)	3.79 (11.22)	3.66
T9	Tetraniliprole 18.18% SC	14.67 (22.52)	6.95 (15.29)	6.88 (15.21)	8.26 (16.70)	7.36	8.26 (16.70)	6.37 (14.62)	6.03 (14.22)	6.37 (14.62)	6.26
T10	Untreated control	15.00 (22.79)	15.47 (23.16)	15.8 (23.42)	18.86 (25.74)	16.71	18.86 (25.74)	19.51 (26.21)	20.73 (27.09)	22.40 (28.25)	20.88
SEm ±		-	(0.289)	(0.235)	(0.195)	-	(0.195)	(0.153)	(0.228)	(0.199)	-
CD at 5%		-	(0.866)	(0.704)	(0.584)	-	(0.584)	(0.459)	(0.683)	(0.595)	-

*Figure in (number) here are angular transformed value.

DBT = Days before treatment DAT = Days after treatment

Table 2. Efficacy of newer insecticides against girdle beetle (percent plant infestation) infesting soybean during *Kharif*, 2024

S. No	Treatments	First Spray					Second Spray				
		1DBT	3DAT	7DAT	10DAT	Mean	1DBT	3DAT	7DAT	10DAT	Mean
T1	Imidacloprid 17.8% SL	3.47 (10.73)	3.25 (10.39)	2.3 (8.72)	3.95 (11.46)	3.16	3.95 (11.46)	2.59 (9.26)	1.92 (7.96)	2.25 (8.63)	2.25
T2	Thiamethoxam 75% SG	4.53 (12.29)	3.69 (11.07)	3.24 (10.37)	4.84 (12.71)	3.92	4.84 (12.71)	2.69 (9.43)	1.69 (7.46)	2.02 (8.17)	2.13
T3	Acetamiprid 20% SP	5.00 (12.92)	2.51 (9.11)	3.62 (10.97)	4.24 (11.88)	3.45	4.24 (11.88)	1.84 (7.80)	1.51 (7.05)	1.84 (7.80)	1.73
T4	Emamectin benzoate 5% SG	3.72 (11.13)	2.65 (9.37)	2.69 (9.44)	3.86 (11.34)	3.06	3.86 (11.34)	1.99 (8.10)	1.32 (6.60)	1.65 (7.39)	1.65
T5	Spinetoram 11.7% SC	3.88 (11.37)	3.26 (10.40)	3.07 (10.09)	3.88 (11.36)	3.40	3.88 (11.36)	1.93 (7.98)	1.59 (7.25)	1.93 (7.98)	1.81
T6	Thiacloprid 21.7% SC	3.51 (10.80)	2.55 (9.19)	2.18 (8.49)	2.94 (9.88)	2.55	2.94 (9.88)	1.89 (7.89)	1.22 (6.34)	1.55 (7.16)	1.55
T7	Flubendiamide 39.35% SC	4.16 (11.77)	2.95 (9.88)	3.09 (10.12)	3.89 (11.38)	3.31	3.89 (11.38)	2.28 (8.68)	1.61 (7.30)	1.95 (8.02)	1.94
T8	Indoxacarb 14.8% SC	4.13 (11.73)	2.25 (8.63)	2.99 (9.96)	3.59 (10.92)	2.94	3.59 (10.92)	1.58 (7.23)	1.25 (6.42)	1.58 (7.23)	1.47
T9	Tetraniliprole 18.18% SC	3.82 (11.27)	2.14 (8.42)	2.60 (9.28)	3.34 (10.53)	2.69	3.34 (10.53)	1.48 (6.98)	1.14 (6.14)	1.81 (7.73)	1.48
T10	Untreated control	5.53 (13.61)	6.53 (14.81)	6.20 (14.42)	7.20 (15.56)	6.64	7.20 (15.56)	8.20 (16.64)	8.53 (16.98)	10.20 (18.63)	8.97
SEm ±		-	(0.184)	(0.168)	(0.127)	-	(0.127)	(0.126)	(0.062)	(0.115)	-
CD at 5%		-	(0.551)	(0.502)	(0.382)	-	(0.382)	(0.382)	(0.186)	(0.346)	-

Figure in (number) here are Angular transformed value.

DBT = Days before treatment DAT = Days after treatment

Table 3. Efficacy of newer insecticides against semilooper (l/mrl) infesting soybean during *Kharif*, 2024

S. No	Treatments	First Spray					Second Spray				
		1DBT	3DAT	7DAT	10DAT	Mean	1DBT	3DAT	7DAT	10DAT	Mean
T1	Imidacloprid 17.8% SL	8.00 (2.87)	6.44 (2.63)	4.11 (2.12)	14.66 (3.89)	8.40	14.66 (3.89)	0.97 (1.21)	0.3 (0.87)	0.8 (1.14)	0.69
T2	Thiamethoxam 75% SG	12.00 (3.49)	6.00 (2.55)	4.00 (2.11)	15.22 (3.96)	8.41	15.22 (3.96)	0.78 (1.13)	0.67 (1.07)	0.77 (1.12)	0.74
T3	Acetamiprid 20% SP	13.00 (3.57)	4.88 (2.31)	3.67 (2.03)	15.00 (3.92)	7.85	15.00 (3.92)	0.67 (1.05)	0.5 (0.98)	0.5 (0.98)	0.55
T4	Emamectin benzoate 5% SG	12.67 (3.62)	6.42 (2.62)	5.00 (2.3)	12.55 (3.61)	7.99	12.55 (3.61)	0.63 (1.06)	0.57 (1.03)	0.60 (1.05)	0.6
T5	Spinetoram 11.7% SC	9.33 (3.13)	3.22 (1.91)	2.22 (1.65)	9.44 (3.14)	4.96	9.44 (3.14)	0.77 (1.11)	0.6 (1.03)	0.57 (1.01)	0.64
T6	Thiacloprid 21.7% SC	12.00 (3.53)	5.66 (2.44)	4.00 (2.11)	14.44 (3.85)	8.03	14.44 (3.85)	0.43 (0.96)	0.40 (0.94)	0.40 (0.94)	0.41
T7	Flubendiamide 39.35% SC	11.33 (3.39)	4.66 (2.27)	3.33 (1.94)	10.44 (3.3)	6.14	10.44 (3.3)	0.6 (1.03)	0.50 (1.00)	0.53 (1.00)	0.55
T8	Indoxacarb 14.8% SC	9.00 (3.07)	5.22 (2.35)	4.00 (2.08)	7.78 (2.87)	5.66	7.78 (2.87)	0.45 (0.97)	0.32 (0.9)	0.3 (0.92)	0.35
T9	Tetraniliprole 18.18% SC	11.67 (3.45)	2.55 (1.74)	2.00 (1.58)	10.88 (3.37)	5.14	10.88 (3.37)	0.27 (0.85)	0.0 (0.71)	0.27 (0.85)	0.18
T10	Untreated control	13.67 (3.76)	10.33 (3.29)	9.33 (3.13)	15.33 (3.96)	11.66	15.33 (3.96)	7.11 (2.75)	5.78 (2.50)	4.78 (2.28)	5.89
SEm ±		-	(0.359)	(0.532)	(0.230)	-	(0.230)	(0.164)	(0.358)	(0.308)	-
CD at 5%		-	(0.72)	(1.07)	(0.46)	-	(0.46)	(0.33)	(0.72)	(0.62)	-

*Figure in (number) here are square root transformed value.

DBT = Days before treatment DAT = Days after treatment

Table 4. Efficacy of newer insecticides against tobacco caterpillar (l/mrl) infesting soybean during *Kharif*, 2024

S. No	Treatments	First Spray					Second Spray				
		1DBT	3DAT	7DAT	10DAT	Mean	1DBT	3DAT	7DAT	10DAT	Mean
T1	Imidacloprid 17.8% SL	2.22 (1.6)	1.89 (1.5)	1.55 (1.4)	2.89 (1.8)	2.11	2.89 (1.8)	1.22 (1.2)	1.1 (1.23)	1.2 (1.27)	1.17
T2	Thiamethoxam 75% SG	3.22 (1.9)	2.55 (1.7)	2.33 (1.6)	3.55 (2.0)	2.81	3.55 (2.0)	2.0 (1.58)	1.85 (1.5)	2.18 (1.64)	2.01
T3	Acetamiprid 20% SP	4.22 (2.1)	3.55 (1.9)	2.88 (1.8)	4.77 (2.2)	3.73	4.77 (2.2)	2.55 (1.7)	2.22 (1.6)	1.89 (1.53)	2.22
T4	Emamectin benzoate 5% SG	3.33 (1.9)	2.66 (1.7)	2.44 (1.7)	3.51 (1.9)	2.87	3.51 (1.9)	2.33 (1.6)	1.83 (1.5)	1.5 (1.41)	1.88
T5	Spinetoram 11.7% SC	1.44 (1.3)	1.33 (1.3)	1.00 (1.22)	1.78 (1.5)	1.37	1.78 (1.5)	0.83 (1.1)	0.67 (1.0)	0.67 (1.07)	0.72
T6	Thiacloprid 21.7% SC	4.89 (2.2)	3.89 (2.0)	3.22 (1.9)	5.22 (2.3)	4.11	5.22 (2.3)	3.00 (1.86)	2.67 (1.7)	2.33 (1.68)	2.66
T7	Flubendiamide 39.35% SC	2.67 (1.7)	2.33 (1.6)	2.00 (1.56)	3.00 (1.86)	2.44	3.00 (1.86)	1.67 (1.46)	1.5 (1.39)	1.67 (1.46)	1.61
T8	Indoxacarb 14.8% SC	1.67 (1.4)	1.5 (1.41)	1.33 (1.3)	2.00 (1.56)	1.61	2.00 (1.56)	1.00 (1.22)	0.87 (1.1)	0.97 (1.21)	0.94
T9	Tetraniliprole 18.18% SC	2.11 (1.5)	1.44 (1.3)	1.11 (1.24)	2.44 (1.6)	1.66	2.44 (1.6)	1.00 (1.22)	0.93 (1.1)	0.9 (1.14)	0.94
T10	Untreated control	5.67 (2.48)	5.33 (2.41)	5.00 (2.34)	5.83 (2.51)	5.38	5.83 (2.51)	4.22 (2.17)	3.55 (2.0)	3.23 (1.93)	3.66
SEm ±		-	(0.295)	(0.298)	(0.344)	-	(0.344)	(0.237)	(0.336)	(0.250)	-
CD at 5%		-	(0.59)	(0.60)	(0.69)	-	(0.69)	(0.48)	(0.68)	(0.50)	-

Figure in (number) here are square root transformed value.

DBT = Days before treatment DAT = Days after treatment

Table 5. Effect of newer insecticides on natural enemies (per meter row length) infesting soybean during *Kharif*, 2024

S. No	Treatments	First Spray					Second Spray				
		1DBT	3DAT	7DAT	10DAT	Mean	1DBT	3DAT	7DAT	10DAT	Mean
T1	Imidacloprid 17.8% SL	2.67 (1.77)	2.33 (1.68)	2.17 (1.63)	2.67 (1.77)	2.39	2.67 (1.77)	0.2 (0.83)	0.33 (0.91)	0.17 (0.81)	0.23
T2	Thiamethoxam 75% SG	3.0 (1.86)	2.0 (1.56)	1.83 (1.51)	2.33 (1.68)	2.05	2.33 (1.68)	0.83 (1.15)	0.83 (1.15)	0.73 (1.1)	0.79
T3	Acetamiprid 20% SP	2.5 (1.71)	1.83 (1.53)	1.73 (1.49)	2.17 (1.63)	1.91	2.17 (1.63)	1.00 (1.22)	0.83 (1.15)	0.83 (1.15)	0.88
T4	Emamectin benzoate 5% SG	3.0 (1.87)	2.33 (1.68)	2.17 (1.63)	2.67 (1.77)	2.39	2.67 (1.77)	0.83 (1.15)	0.52 (1.0)	0.00 (0.71)	0.45
T5	Spinetoram 11.7% SC	4.33 (2.15)	3.87 (2.08)	3.67 (2.04)	3.67 (2.04)	3.73	3.67 (2.04)	1.67 (1.46)	1.67 (1.46)	1.33 (1.34)	1.55
T6	Thiacloprid 21.7% SC	3.4 (1.97)	2.4 (1.68)	1.93 (1.54)	2.07 (1.59)	2.13	2.07 (1.59)	0.83 (1.15)	1.00 (1.22)	0.7 (1.09)	0.84
T7	Flubendiamide 39.35% SC	3.67 (2.02)	2.97 (1.86)	2.77 (1.8)	3.3 (1.95)	3.01	3.3 (1.95)	0.00 (0.71)	0.00 (0.71)	0.67 (1.08)	0.22
T8	Indoxacarb 14.8% SC	2.73 (1.79)	2.0 (1.56)	1.87 (1.52)	2.27 (1.66)	2.04	2.27 (1.66)	2.00 (1.58)	1.33 (1.34)	2.00 (1.58)	1.77
T9	Tetraniliprole 18.18% SC	2.83 (1.81)	2.17 (1.63)	2.0 (1.58)	2.43 (1.71)	2.2	2.43 (1.71)	2.00 (1.58)	1.67 (1.46)	2.00 (1.58)	1.89
T10	Untreated control	4.07 (2.13)	3.4 (1.97)	3.33 (1.95)	3.69 (2.05)	3.47	3.69 (2.05)	2.33 (1.68)	2.17 (1.63)	2.00 (1.58)	2.16
SEM ±		-	(0.106)	(0.073)	(0.093)	-	(0.093)	(0.287)	(0.285)	(0.319)	-
CD at 5%		-	(0.317)	(0.22)	(0.277)	-	(0.277)	(0.58)	(0.57)	(0.64)	-

Figure in (number) here are square root transformed value.

DBT = Days before treatment DAT = Days after treatment

4 | CONCLUSION

Among the insecticides tested, Tetraniliprole 18.18%SC and Indoxacarb 14.8% SC emerged as highly effective against multiple pests with minimal impact on natural enemies, offering promising options for integrated pest management (IPM). The study emphasizes the need to incorporate weather-based forecasting and eco-friendly insecticide selection into pest control strategies to ensure effective and sustainable management of soybean pests while preserving beneficial insect populations.

REFERENCES

- Anonymous, 2024. The Soybean Processors Association of India (SOPA). 2021-2022 World Soybean Production. (Accessed on 04 December 2024).
- Anonymous, 2021-22. SOPA, Soybean Processors Association of India (<https://www.sopa.org>).
- Anonymous, 2023. SOPA, Soybean Processors Association of India (<https://www.sopa.org>).
- Biswas, G.C. (2013). Insect pests of soybean (*Glycine max* L.), their nature of damage and succession with the crop stages. *J. Asiat. Soc. Bangladesh, Sci*, **39**(1):1-8
- Gangarde, G.A. (1976). Assessment of effect on yield and quality of soybean caused by major arthropod pests. Terminal technical report on the project, *ed. JNKVV* 143-143
- Hymowitz, T. and Kaizuma, N.1981. Soybean Seed Protein Electrophoresis Profiles from 15 Asian Countries or Regions: Hypotheses on Paths of Dissemination of Soybeans from China. *Economic Botany*, **35**(1), 10–23.
- Khound, D., Sathish , P., Kant, R. and Meitei, S. 2024. Agricultural Statistics at a Glance2023. Economics, Statistics & Evaluation Division, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India. <https://desagri.gov.in/wpcontent/uploads/2024/09/Agricultural-Statistics-at-a-Glance-2023.pdf> (Accessed on 04 December 2024).