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BIOSAFETY EVALUATION OF DIFFERENT INSECTICIDES FOR NATURAL FAUNA (PREDATORY SPIDERS) IN RICE ECOSYSTEM

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ABSTRACT

The present investigation entitled “Biosafety evaluation of different insecticides for natural fauna (Predatory spiders) in rice ecosystem” was carried out at Research cum Instructional Farm, Raipur, under College of Agriculture, Raipur (C.G.) during *Rabi* 2024-25 and 2025-26. The biosafety evaluation conducted during both the cropping seasons demonstrated that the evaluated insecticidal schedules did not exert any significant adverse effect on the populations of spiders in the rice ecosystem. Although, the untreated control plots recorded comparatively higher populations of these beneficial arthropods throughout the observation period, the differences among the insecticidal treatments were statistically non-significant. The sequential application of Pymetrozine 50 WG + Triflumezopyrim 10% SC (T_4) ranged from 5.81 recorded the significantly highest population of spiders effectively suppressed the brown planthopper population while conserving the abundance of predatory spiders. Similar observations were recorded with other insecticidal schedules. The lowest population of spiders per ten hills was recorded in the Pymetrozine 50 WG + Dinotefuran 20% SG (T_2) ranged from 4.45, which indicating that the insecticides evaluated in the present investigation were relatively safe to beneficial fauna when applied at the recommended doses. The compatibility of these insecticides with natural enemies suggests that they can be successfully integrated into Integrated Pest Management (IPM) programmes for sustainable rice production without causing serious disruption to the ecological balance of rice ecosystems. These findings further indicate that judicious use of selective insecticides can effectively manage brown planthopper while simultaneously conserving naturally occurring biological control agents.

Key words : Triflumezopyrim 10 SC, Pymetrozine 50 WG, Dinotefuran 20% SG, Spiders, Rice, Biosafety, Integrated Pest Management (IPM).

Introduction

Rice (*Oryza sativa* L.) ($2n = 24$) a cereal crop, belongs to the family Gramineae, which takes up nearly one-fifth of all cereal-covered land. One of the most popular staple meals in the world, especially in Asia, is rice. The *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice) plant is the source of this cereal grain. Known for its adaptability, rice is available in white, brown, black, and red variants, each with varying nutritional content. The largest area under paddy farming is in India, followed by China and Indonesia. The four central states of West Bengal, Punjab, Uttar Pradesh and Andhra Pradesh account for about half of India's rice production.

The other states that produce a lot of rice are Bihar, Tamil Nadu, Orissa, in sequence of significance, Telangana, Assam, Chhattisgarh, Haryana, Madhya Pradesh, Karnataka, Jharkhand and Maharashtra (Anonymous, 2022), known as the “Rice Bowl of India,” Chhattisgarh has an area of about 3.91 million hectares, produces 10.37 million tons and has a productivity of 2655 kg per hectare (Government of India – Department of Agriculture & Farmers Welfare, DA&FW, 2024). Limited irrigation (28.0%), a lack of better varieties in various ecosystems and in suitable nutrients, a number of insect pest limitations and crop management techniques are the main causes of Chhattisgarh's low rice productivity. In

Chhattisgarh, the brown planthopper can cause significant losses to the paddy crop up to 34.4% (Gangrade *et al.*, 1978). Natural enemies of paddy or rice insect pests have a wide extent of parasitoids and predators. Predation is a common phenomenon between insects. The predators make biological control cases successful. Insects such as coccinellid beetles, carabid beetles, terrestrial predatory and aquatic bugs, insectivorous birds, spiders, dragon flies are different varieties of predators (Heinrichs, 1994).

Predators and parasitoids are significant biocontrol agents. Most important predators of rice insect pest are coccinellids and spiders. Only spiders constitute 80% of the predatory fauna in the ecosystem of rice. In rice field, host insect population reduction has been reported by various species of spiders.

Research has manifested that rice ecosystems are magnificent in natural enemies and yield loss is reduced by them. (Singh, 1990). The pest's population in rice is suppressed by natural enemies are proved by ample of evidence to justify its important role in India.

In order to reduce the usage of synthetic pesticides, it is increasingly essential to look for alternate methods of controlling pests. Because they have a variety of qualities, such as toxicity to the pest, repellency, antifeedants and insect growth regulation actions against pests of agricultural importance botanical pesticides are significant options to reduce or eliminate the usage of synthetic pesticides.

Compared to synthetic pesticides, botanical pesticides have many advantages, such as: they generally have low mammalian toxicity, which means they pose little to no health risks and environmental pollution; there is virtually no risk of developing pest resistance to these products; when used in their natural forms, they pose fewer risks to non-target organisms and pest resistance has not been reported, with the exception of synthetic pyrethroids; they have no negative effects on plant growth, seed viability and grain cooking quality and they are more readily available and less expensive due to their natural occurrence.

Materials and Methods

Natural enemies : The numbers of natural enemy like wolf spider, *Pardosa pseudoannulata* on 10 randomly selected hills was recorded at each observation date and presented as average number hill. Data recorded on pest and natural enemies population and grain yields from the experiment was transformed and analyzed to draw a meaningful conclusion as suggested by Gomez and Gomez (1984).

To determine biosafety evaluation of essential oils and chemical insecticides on the population of wolf spider *Pardosa pseudoannulata* in rice field the field experiment was conducted during *Kharif* 2024-25 in a randomized block design with eight treatments and four replications. The seedling of variety Swarna was transplanted in a plot size of 20 m² with a spacing of 20×15 cm and normal agronomical practices was adopted. The knapsack sprayer and spray volume @ 500 l/ha was used with a hollow cone nozzle to impose the spray treatments. Teepol at the rate of 1ml/liter of water was added in the solution of essential oils to make the oil mixed with water.

Treatment details

Different insecticidal schedules were evaluated for their biosafety evaluation of different insecticides for natural fauna in rice ecosystem variety Shwama. Insecticides were applied two times and the first application was done at maximum tillering stage and the second application was done at maximum booting stage. Data was collected before the application and on the 1st, 3rd, 7th, 14th and 21th days after each application.

Treatment	Chemicals name	Application stage	Dose
T ₁	Triflumezopyrim 10%+Pymetrozine 50 WG	At Max. Tillering + At Max. booting	236ml/ha +300ml/ha
T ₂	Pymetrozine 50 WG+Dinotefuran 20% SG	At Max. tillering +At Max. booting	300ml/ha +200g/ha
T ₃	Triflumezopyrim 10%+ Essential oil	At Max. Tillering +At Max. booting	236ml/ha +2ml per liter
T ₄	Pymetrozine 50 WG+ Triflumezopyrim 10.6% SC	At Max. Tillering +At Max. booting	300ml/ha +236ml/ha
T ₅	Dinotefuran 20% SG+Pymetrozine 50 WG	At Max. Tillering +At Max. booting	200g/ha +300ml/ha
T ₆	Essential oil 2ml/liter+ Triflumezopyrim 10.6% SC	At Max. Tillering +At Max. booting	2ml per liter +236ml/ha
T ₇	Water spray	At Max. Tillering +At Max. booting	500liter/ha
T ₈	Untreated Control		-

Results and Discussion

The field experiment was conducted at Research Cum Instructional Farm and the laboratory studies were carried out in glass house of Department of Entomology,

College of Agriculture, IGKV, Raipur during *Kharif*, 2024-25.

Effects of different insecticide on spider population in rice ecosystem: first spray 2024-2025

Observation of spider population were recorded from the sampling of ten randomly selected hills of each treatment replication. Spider were recorded prior and post application of insecticidal treatment on the basis of visual count of number of spiders per ten hills.

First insecticidal treatment application during *kharif* 2024-25

Pretreatment observation

The data presented in table, evaluation of different insecticides for natural fauna in rice ecosystem. Result revealed that the pre- treatments observations were non-significant to each other which ranged from 2.33 to 3.33 per ten hills in the field experiment during *kharif* 2024-25. Non-significant differences among spiders population were observed among different treatments before spray.

Posttreatment observation

After 1 days of first spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 4.67-3.00 where highest spider population observed in T_8 -untreated control (4.67 spiders per ten hills) and lowest population observed in T_1 – (Triflumezopyrim 10% SC+ Pymetrozine 50 WG) 3.00 spiders per ten hills which revealed that tested insecticides were safe to natural enemy spiders.

After 3 days of first spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.33-3.00, where highest spider population observed in T_8 -(untreated control) 7.33 spiders per ten hills and lowest population observed in T_1 – (Triflumezopyrim 10% SC+ Pymetrozine 50 WG) 3.00 spiders per ten hills which revealed that tested insecticides were safe to natural enemy spiders.

After 7 days of first spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.67-3.33 where highest spider population observed in T_8 -(untreated control) 7.67 spiders per ten hills and lowest population observed in T_7 – (Water spray) 3.33 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

After 14 days of first spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.33-3.67 where highest spider population observed in T_8 -(untreated control) 7.33 spiders per ten hills and lowest population observed in T_7 – (Water spray) 3.67 spiders per ten hills

which revealed that tested insecticides were safe to natural enemy.

After 21 days of first spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 6.33-4.00 where highest spider population observed in T_4 - (Pymetrozine 50 WG + Triflumezopyrim 10% SC) 6.33 spiders per ten hills and lowest population observed in T_2 – (Pymetrozine 50 WG + Dinotefuran 20% SG) 4.00 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

Second insecticidal treatment application during *kharif* 2024-25

Pretreatment observation

The data presented in Table 1 and Fig. 1 evaluation of different insecticides for natural fauna in rice ecosystem. revealed that the pre- treatments observations were non-significant to each other which ranged from 2.33 to 3.33 per ten hills in the field experiment during *kharif* 2024-25. Non-significant differences among spiders population were observed among different treatments before spray.

Post treatment observation

After 1 days of second spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.33-5.67 where highest spider population observed in T_8 -(untreated control) 7.33 spiders per ten hills and lowest population observed in T_3 - (Triflumezopyrim 10% SC + Essential oil) 4.67 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

After 3 days of second spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.67-5.67 where highest spider population observed in T_8 -(untreated control) 7.67 spiders per ten hills and lowest population observed in T_6 – (Essential oil + Triflumezopyrim 10% SC) 5.67 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

After 7 days of second spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 7.80-5.67 where highest spider population observed in T_8 -(untreated control) 7.80 spiders per ten hills and lowest population observed in T_2 – (Pymetrozine 50 WG + Dinotefuran 20% SG) 5.67 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

After 14 days of second spray, the spider population were showed statistically non-significant difference

Table 1 : Effects of different insecticidal treatments on spider population present in the rice ecosystem during Kharif 2024-2025.

Spider Population per/10 hills														
S. no.	Treatments	Dose g a.i./ha	First spray					Second spray					Over all Mean	
			Pre Treat.	Post Treatment				Pre Treat.	Post Treatment					
				1DAS	3DAS	7DAS	14DAS		21DAS	1 DAS	3DAS	7DAS		14DAS
T ₁	Triflumezopyrim 10%SC +Pymetrozine 50 WG	236ml +300ml	2.33 (1.82)	3.00 (1.99)	5.00 (2.44)	5.33 (2.52)	5.67 (2.58)	5.67 (2.58)	5.67 (2.58)	6.67 (2.77)	7.00 (2.79)	7.33 (2.88)	5.33 (2.52)	5.17
T ₂	Pymetrozine 50 WG +Dinotefuran 20% SG	300ml +200g	2.33 (1.82)	3.42 (1.91)	4.00 (2.21)	3.33 (2.08)	3.67 (2.14)	4.00 (2.23)	5.00 (2.44)	5.33 (2.49)	5.67 (2.58)	5.00 (2.44)	6.00 (2.64)	4.44
T ₃	Triflumezopyrim 10%SC +Essential oil	236ml +2ml	3.00 (1.97)	3.67 (1.99)	4.00 (2.23)	4.67 (2.38)	5.00 (2.44)	5.33 (2.52)	4.33 (2.30)	5.67 (2.58)	6.33 (2.71)	5.67 (2.58)	4.33 (2.30)	4.72
T ₄	Pymetrozine 50 WG+ Triflumezopyrim 10% SC	300ml +236ml	2.67 (1.88)	4.00 (2.23)	4.33 (2.31)	5.33 (2.51)	5.67 (2.58)	6.33 (2.51)	5.67 (2.58)	6.00 (2.64)	6.33 (2.70)	7.33 (2.88)	8.67 (3.11)	5.72
T ₅	Dinotefuran 20%SG + Pymetrozine 50 WG	200g +300ml	2.33 (1.82)	3.33 (2.08)	4.00 (2.22)	4.67 (2.38)	5.00 (2.43)	6.00 (2.64)	5.33 (2.51)	4.67 (2.38)	5.67 (2.58)	6.33 (2.70)	4.33 (2.31)	4.81
T ₆	Essential oil+ Triflumezopyrim 10% SC	2 ml+ 236ml	2.67 (1.88)	3.67 (2.16)	3.33 (2.08)	4.00 (2.23)	4.33 (2.28)	4.67 (2.37)	4.67 (2.37)	5.33 (2.49)	6.00 (2.63)	6.33 (2.69)	5.00 (2.44)	4.64
T ₇	Water spray	500 L.	3.33 (1.99)	3.33 (2.06)	3.67 (2.15)	5.33 (2.49)	5.67 (2.57)	6.00 (2.63)	6.00 (2.63)	5.67 (2.56)	5.67 (2.57)	7.00 (2.79)	5.33 (2.51)	5.28
T ₈	Untreated Control	-	3.00 (1.97)	4.67 (2.38)	7.33 (2.88)	7.67 (2.92)	7.33 (2.88)	4.00 (2.23)	8.00 (2.88)	7.33 (2.99)	7.67 (2.85)	8.00 (2.41)	8.33 (2.47)	6.70
CD at 5%			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-

Figure in parentheses are square root transformed values), NS=Non-Significant, DAS = Days after spray, CD = Critical differences.

among the treatments with ranged from 8.00-5.00 where highest spider population observed in T₈-(untreated control) 8.00 spiders per ten hills and lowest population observed in T₂-(Pymetrozine 50 WG + Dinotefuran) 20% SG 5.00 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

After 21 days of second spray, the spider population were showed statistically non-significant difference among the treatments with ranged from 8.33-4.33 where highest spider population observed in T₈-(untreated control) 8.33 spiders per ten hills and lowest population observed in T₅ – (Dinotefuran 20% SG + Pymetrozine 50 WG) 4.33 spiders per ten hills which revealed that tested insecticides were safe to natural enemy.

Overall mean

The data revealed that after all two sprays, the overall mean of spider population ranged from 6.70 to 4.44 per ten hills across different treatments. The significantly highest spider population observed in T₈-(untreated control) 6.70 spiders per ten hills indicating it was the best treatment against spider population, followed by T₄-(Pymetrozine 50 WG + Triflumezopyrim 10% SC) 5.72, T₇- (water spray) 5.28, T₁ – (Triflumezopyrim 10% SC+ Pymetrozine 50 WG) 5.17, T₅ – (Dinotefuran 20% SG + Pymetrozine 50 WG) 4.81, T₃- (Triflumezopyrim 10% SC+ Essential oil) 4.72

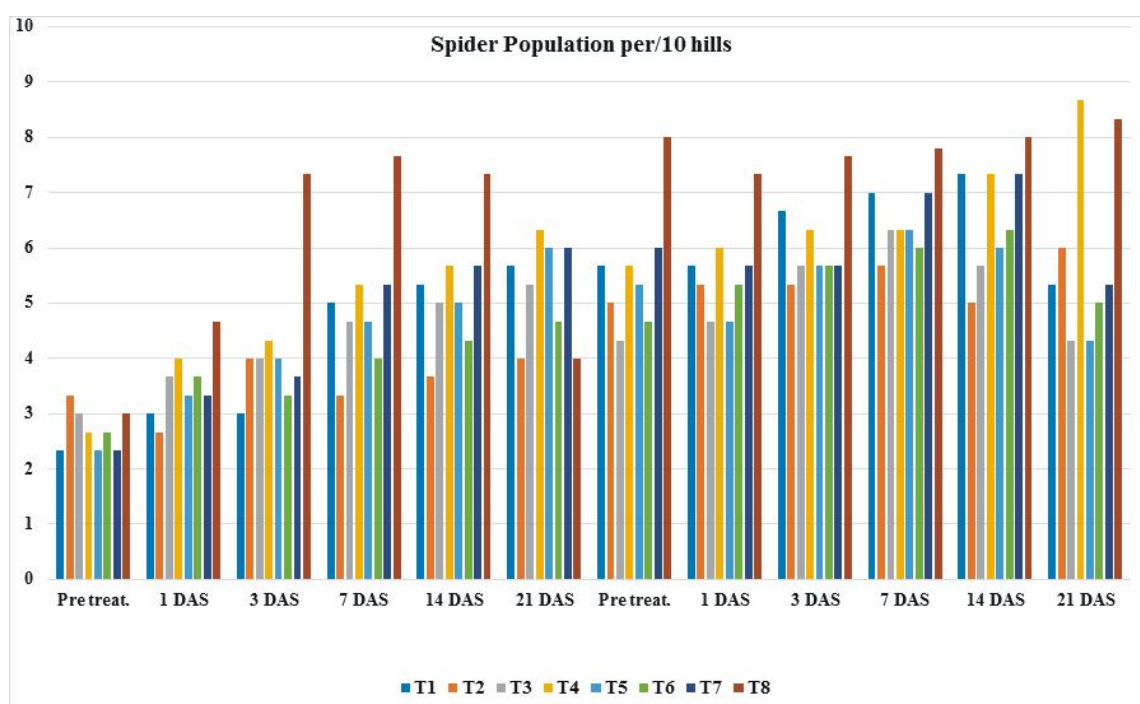


Fig. 1 : Spiders population in different insecticidal treatment during Kharif 2024-2025.

and T_6 – (Essential oil + Triflumezopyrim 10% SC) 4.64. The lowest spider population was recorded in the T_2 – (Pymetrozine 50 WG + Dinotefuran 20% SG) 4.44, which revealed that tested insecticides are safe to natural enemy.

The result of present investigation is in accordance with Shivaji (2021) reported that the given insecticidal treatments were safe to natural enemies like spiders and reported Pymetrozine 50 WG was least effective to spiders and coccinellids.

Comparable results were noted by Hurali (2019) reported that Dinotefuran 20% SG led to a lower brown planthopper population (73.49% ROC) achieving best for natural enemies.

Similarly, Ghosh (2014) also reported minimal damage in natural enemies and higher grain yield.

Conclusion

The biosafety evaluation conducted during 2024-25 cropping seasons demonstrated that the evaluated insecticidal schedules did not exert any significant adverse effect on the populations of spiders in the rice ecosystem. Although, the untreated control plots recorded comparatively higher populations of these beneficial arthropods throughout the observation period, the differences among the insecticidal treatments were statistically non-significant. The sequential application of Pymetrozine 50 WG followed by Triflumezopyrim 10% SC (T_4) effectively suppressed the brown planthopper population while conserving the abundance of predatory

spiders. Similar observations were recorded with other insecticidal schedules, indicating that the insecticides evaluated in the present investigation were relatively safe to beneficial fauna when applied at the recommended doses. The compatibility of these insecticides with natural enemies suggests that they can be successfully integrated into Integrated Pest Management (IPM) programmes for sustainable rice production without causing serious disruption to the ecological balance of rice ecosystems. These findings further indicate that judicious use of selective insecticides can effectively manage brown planthopper while simultaneously conserving naturally occurring biological control agents.

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