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RESEARCH ARTICLE

INFLUENCE OF BIO PESTICIDES ON NATURAL ENEMIES IN MUSTARD

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Abstract: The field trial was conducted to evaluate the influence of different biopesticides against natural enemies of mustard at Research-cum-Instructional Farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (Chhattisgarh), India. The overall influence of biopesticides on the population of ladybird beetle and syrphid fly after 3 and 7 days of the first and second spraying demonstrated that the untreated control recorded the highest population. The data revealed that *Beauveria bassiana* recorded less toxic to both natural enemies among the all biopesticide treatments.

Keywords: *Beauveria bassiana*, Biopesticides, Mustard, Natural enemies

INTRODUCTION

Indian agriculture is considered the backbone of the Indian economy. One of the earliest cultivated oilseed crops of the *Rabi* season is mustard, *Brassica juncea* L, which is a member of the cruciferae plant family. According to Sanskrit texts from around 3000 BC, mustard is one of the first species ever identified Mehra (1968) and was a pioneering domestic crop. The popular term for mustard is “rai.” In Hindi, it is also known as "sarson."

Mustard has become a crucial component of the national economy, ranking second in terms of acreage only to groundnut. It is the world's second-biggest oil seed, with a volume of 68.87 million tons (Anonymous,2021).With a total land area of 6.23 mha, an output of 9.34 mt, and a productivity of 14.99 q ha^{-1}. India generated 13.14 percent of global production. Rajasthan contributes 38.07% of the country's land area and 43.69% of its output. Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, Gujarat, Assam, West Bengal, Punjab, Chhattisgarh, and Maharashtra are the leading mustard and rapeseed producing states in India. (Anonymous, 2019) Mustard is an important oilseed crop produced in both subtropical and tropical regions of the world. India is the world’s second largest producer of this crop (Vinyas, Neharkar, and Matre, 2022). 47542 hectares are under rapeseed-mustard cultivation. In Chhattisgarh, the output is 26,999 metric tons Sonvanee and Pathak (2016).

Among these several natural enemies, a few are very common: coccinellids (*Coccinella septumpunctata)*; syrphid flies (*Ischiodon scutellaris* Fabricius and *Diaeretiella rapae* MacIntosh). One of the most capable predators of the mustard aphid is the seven-spotted ladybird beetle, *C. septempuctata* L. Mathur (1983).

Mustard farming can be done in a variety of soil types, ranging from light to deep loam. However, medium-to-deep soils with sufficient drainage are best suited for growing mustard. The pH range for mustard varieties is 6.0 to 7.5. Mustard grows well in subtropical climates. Mustard is commonly grown during the *Rabi* season because it thrives in a dry, cold climate. The mustard crop requires temperatures ranging from 10 to 25 degrees Celsius. Mustard is cultivated in areas where annual rainfall ranges from 625 to 1000 mm.

Mustard protein has a well-balanced amino acid composition and is high in important amino acids. Mustard oil contains 20–28% oleic acid, 10% linoleic acid, and 30% erucic acid Sonvanee and Pathak (2016).

MATERIALS AND METHODS

The field trial was conducted to evaluate the influence of different biopesticides against natural enemies of mustard at Research-cum-Instructional Farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (Chhattisgarh).Seven treatments including control plot were evaluated in Randomized block design with three replications.

Ambikapur climate is warm during the summer and winter, with a four to five-month mansoon season. It

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receives an average annual rainfall of 1130 to 1250 mm, most of which falls between June and September. The greatest temperature in this region exceeds 42^0C, while the lowest is 2^0C.

The treatments used in experiment are T_1-Neem leaf extract, T_2- *Bacillus thuringiensis*, T_3- *Lecanicillium lacanii*, T_4- Neem oil, T_5- *Beauveria bassiana*, T_6- *Metarhizium anisopliae*, T_7- Untreated control.

Data on larva and adult population were collected by visual count technique from ten randomly selected plants from each plot of 6 × 2.7 m^2one day before three and seven days after spraying the biosecticides. The average of two sprayings will be recorded.

RESULTS AND DISCUSSION

The influence of biopesticides on the population of ladybird beetle after first and second spraying

The influence of biopesticides on ladybird beetle 1 day before and 3 and 7 days after first and second spraying is presented in Table 1 and graphically shown in Figure 1

Table 1 revealed that there was no significant difference between all treatments, including the control, one day before the first and second sprayings. The ladybird beetle population recorded three days after first spraying demonstrated that all biopesticide treatments were significant. The results as shown in Table 1, average ladybird beetle population in the untreated control recorded highest (0.53 adult/plant). It was followed by *Beauveria bassiana* (0.43 adult/plant), *Lecanicillium lecanii*(0.40 adult/plant), Neem oil and*Metarhizium anisopliae* (0.37 adult/plant), *Bacillus thuringiensis* (0.33 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.30 adult/plant).

The ladybird beetle population recorded seven days after first spraying demonstrated that the untreated control recorded the highest (0.57 adult/plant). It was followed by *Beauveria bassiana* (0.27 adult/plant),Neem oil (0.23 adult/plant), *Lecanicillium lecanii* and *Metarhizium anisopliae* (0.20 adult/plant), *Bacillus thuringiensis* (0.17 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.13 adult/plant).

The ladybird beetle population recorded three days after second spraying demonstrated that the untreated control recorded the highest (0.70 adult/plant). It was followed by *Beauveria bassiana* and neem oil (0.43 adult/plant), *Lecanicillium lecanii*and *Metarhizium anisopliae* (0.40 adult/plant), neem leaf extract (0.33 adult/plant). The lowest count among the biopesticide treatments was found in *Bacillus thuringiensis* (0.30 adult/plant).

The ladybird beetle population recorded seven days after second spraying demonstrated that the untreated control recorded the highest (0.77 adult/ plant). It was followed by *Beauveria bassiana* (0.40 adult/plant), neem oil (0.37 adult/plant),*Metarhizium anisopliae* (0.33 adult/plant), *Lecanicillium lecanii* and neem leaf extract (0.30 adult/plant). The lowest count among the biopesticide treatments was found in *Bacillus thuringiensis* (0.27 adult/plant).

The overall influence of biopesticides on the population of ladybird beetle after 3 and 7 days of the first and second spraying demonstrated that the untreated control recorded the highest (0.64 adult/plant). It was followed by *Beauveria bassiana* (0.38 adult/plant), neem oil (0.35 adult/plant), *Lecanicillium lecanii* (0.33 adult/plant), *Metarhizium anisopliae* (0.32 adult/plant), *Bacillus thuringiensis*(0.27 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.26 adult/plant). In the untreated plot, the population was observed to be rising, but in the biopesticide treatment plot, it had a somewhat negative influence on the Ladybird Beetle.

The influence biopesticides on the population of Syrphid fly after first and second spraying.

The influence of biopesticides on Syrphid fly 1 day before and 3 and 7 days after first and second spraying is presented in Table 2 and graphically shown in Figure 2.

Table 2 revealed that there was no significant difference between all treatments, including the control, one day before the first and second spraying. The results as shown in Table 2, average Syrphid fly population three days after the first spraying in untreated control recorded the highest (0.40 adult/plant). It was followed by *Beauveria bassiana* (0.27 adult/plant), *Lecanicillium lecanii*(0.23 adult/plant), Neem oil (0.20 adult/plant),*Bacillus thuringiensis* (0.17 adult/plant), *Metarhizium anisopliae* (0.13 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.10 adult/plant).

The average Syrphid fly population seven days after first spraying in untreated control recorded the highest (0.47 adult/plant). It was followed by *Beauveria bassiana* (0.23 adult/plant), *Lecanicillium lecanii* (0.20 adult/plant), Neem oil (0.17 adult/plant),*Bacillus thuringiensis* (0.13 adult/plant), *Metarhizium anisopliae* (0.10 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.07 adult/ plant).

The average Syrphid fly population three days after second spraying in untreated control recorded the highest (0.53 adult/plant). It was followed by *Beauveria bassiana* and *Lecanicillium lecanii* (0.17 adult/plant), Neem oil (0.13 adult/plant),*Bacillus thuringiensis* (0.10 adult/plant), *Metarhizium anisopliae* (0.07 adult/plant). The lowest count among the bipesticide treatments was found in neem leaf extract (0.03 adult/plant).

The average Syrphid fly population seven days after second spraying in untreated control recorded the highest (0.60 adult/plant). It was followed by *Beauveria bassiana* and *Lecanicillium lecanii*(0.13

adult/plant), Neem oil (0.10 adult/plant),*Bacillus thuringiensis* (0.07 adult/plant), *Metarhizium anisopliae* (0.03 adult/plant). The lowest count among the biopesticide treatments was found in neem leaf extract (0.00 adult/plant).

The overall influence on the population of Syrphid fly after 3 and 7 days of the first and second spraying demonstrated that untreated control recorded the highest (0.50 adult/plant). It was followed by *Beauveria bassiana* (0.20 adult/plant), *Lecanicillium lecanii* (0.18 adult/plant), Neem oil (0.15 adult/plant),*Bacillus thuringiensis* (0.12 adult/plant), *Metarhizium anisopliae* (0.08 adult/plant). The lowest count among the treatments was found in neem leaf extract (0.05 adult/ plant). In the untreated plot, the population was observed to be rising, but in the biopesticide treatment plot, it had a somewhat negative influence on the Syrphid fly.

Ranadheer *et al.* 2016 recorded that in general, the control (4.25/plant) and Neem oil (2.52/plant), found higher lady bird population. Dwivedi and Singh 2022 recorded that 1 day and after 3, 5 and 7 days of spray application. *Beauveria bassiana* and *Metarhizium anisopliae* were the most effective with less toxicity against Ladybird beetle and syrphid fly by continuously increasing population after application. According to the preceding discussion, the current work's conclusions are near consistent with the findings of previous researchers.

CONCLUSION

The overall influence of biopesticides on the population of ladybird beetle and syrphid fly after 3 and 7 days of the first and second spraying demonstrated that the untreated control recorded the highest population. The data revealed that *Beauveria bassiana* recorded less toxic to both natural enemies among the all biopesticide treatments.

Table 1. Effect of bio pesticides on the population of ladybird beetle after first and second spraying.

Tr. No.	Treatments	Average ladybird beetle population per 10 plants (Days after first spraying)			Average ladybird beetle population per 10 plants (Days after second spraying)			Overall mean population of 3 and 7 days after first and second spray.
		One day before	3 days after	7 days after	One day before	3 days after	7 days after	
T_1	Neem leaf extract	0.37 (0.92)	0.30 (0.89)	0.13 (0.79)	0.40 (0.95)	0.33 (0.91)	0.30 (0.89)	0.26 (0.87)
T_2	*Bacillus thuringiesis*	0.40 (0.95)	0.33 (0.91)	0.17 (0.81)	0.43 (0.96)	0.30 (0.89)	0.27 (0.87)	0.27 (0.88)
T_3	*Lecanicillium lacanii*	0.47 (0.98)	0.40 (0.95)	0.20 (0.83)	0.50 (1.00)	0.40 (0.95)	0.30 (0.89)	0.33 (0.91)
T_4	Neem oil	0.47 (0.98)	0.37 (0.93)	0.23 (0.85)	0.47 (0.98)	0.43 (0.96)	0.37 (0.93)	0.35 (0.92)
T_5	*Beauveria bassiana*	0.50 (1.00)	0.43 (0.96)	0.27 (0.87)	0.50 (1.00)	0.43 (0.96)	0.40 (0.95)	0.38 (0.94)
T_6	*Metarhizium anisopliae*	0.43 (0.97)	0.37 (0.93)	0.20 (0.83)	0.47 (0.98)	0.40 (0.95)	0.33 (0.91)	0.32 (0.91)
T_7	Untreated control	0.50 (1.00)	0.53 (1.02)	0.57 (1.03)	0.60 (1.05)	0.70 (1.09)	0.77 (1.12)	0.64 (1.07)
	SE±	**0.032**	**0.023**	**0.033**	**0.025**	**0.029**	**0.037**	
	CD at 5%	**N/A**	**0.073**	**0.104**	**N/A**	**0.090**	**0.114**	

Figures in parenthesis are square root transformed values $\sqrt{x+0.5}$.

Table 2. Effect of biopesticides on the population of Syrphid fly after first and second spraying.

Tr. No.	Treatments	Average Syrphid fly population per 10 plants (Days after first spraying)			Average Syrphid fly population per 10 plants (Days after second spraying)			Overall mean population of 3 and 7 days after first and second spray.
		One day before	3 days after	7 days after	One day before	3 days after	7 days after	
T_1	Neem leaf extract	0.17(0.82)	0.10(0.77)	0.07(0.75)	0.13(0.79)	0.03(0.73)	0.00(0.71)	0.05(0.74)

T_2	*Bacillus thuringiesis*	0.23(0.86)	0.17(0.82)	0.13(0.79)	0.20(0.83)	0.10(0.77)	0.07(0.75)	0.12(0.79)
T_3	*Lecanicillium lacanii*	0.27(0.87)	0.23(0.86)	0.20(0.84)	0.23(0.86)	0.17(0.81)	0.13(0.79)	0.18(0.82)
T_4	Neem oil	0.27(0.87)	0.20(0.84)	0.17(0.81)	0.27(0.87)	0.13(0.79)	0.10(0.77)	0.15(0.81)
T_5	*Beauveria bassiana*	0.30(0.89)	0.27(0.87)	0.23(0.85)	0.27(0.87)	0.17(0.81)	0.13(0.79)	0.20(0.84)
T_6	*Metarhizium anisopliae*	0.20(0.84)	0.13(0.79)	0.10(0.77)	0.23(0.85)	0.07(0.75)	0.03(0.73)	0.08(0.76)
T_7	Untreated control	0.33(0.91)	0.40(0.95)	0.47(0.98)	0.50(1.00)	0.53(1.02)	0.60(1.05)	0.50 (1.00)
	SE±	**0.025**	**0.022**	**0.042**	**0.039**	**0.051**	**0.036**	
	CD at 5%	**N/A**	**0.069**	**0.131**	**N/A**	**0.160**	**0.112**	

Figures in parenthesis are square root transformed values $\sqrt{x+0.5}$.

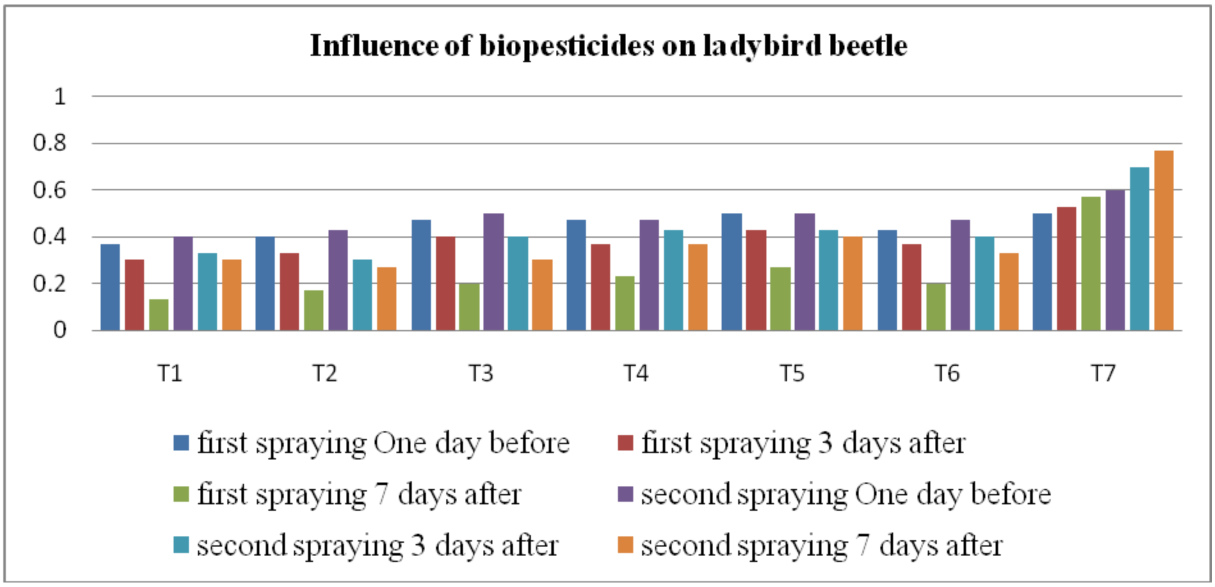

Fig. 1. Influence of biopesticide on ladybird beetle

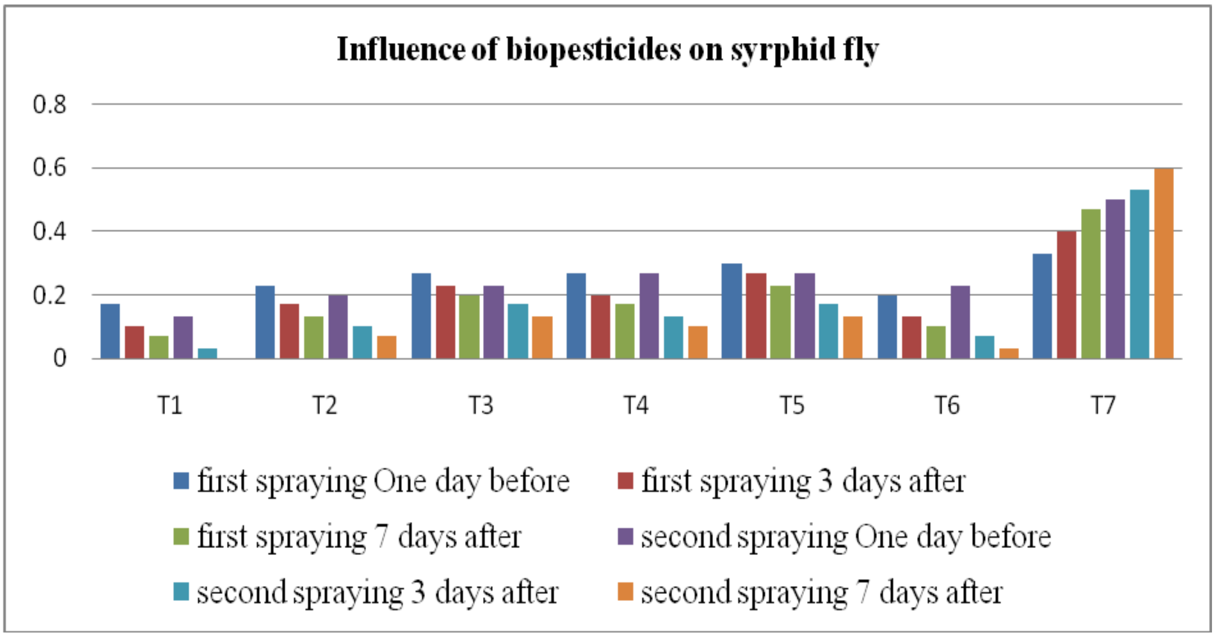

Fig. 2. Influence of biopesticides on syrphid fly

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