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Impact of certain novel insecticides on coccinellid beetles under field conditions in green gram

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Abstract
An investigation was conducted to know the effectiveness of newer insecticides on Coccinellid beetles in green gram. The experiment was conducted at Crop Research Center**,** Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during *Kharif* season 2019 using Randomized Block Design with eight treatments (Emamectin benzoate, Spinosad, Chlorantroniliprole, Indoxacarb, Novaluron, Profenophos, Triazophos, and control treatment) and three replications on variety SML668. Recordings were taken at three, seven, and eleven days after the first and second pesticide application, and the data was analyzed. Among all the treatments, Novaluron 10EC @ 1 ml/ lit water was found safest with the maximum number of *C. septempunctata* followed by Profenophos 50 EC@ 1 ml/ lit, Triazophos 40 EC@ 4.0 gm per liter of water, Indoxacarb 14.5SC @ 1.0 gm per liter of water, Chlorantraniliprole 20SC @ 0.25 gm per liter of water and Spinosad 45 SC @ 0.25 ml per liter of water and Emamectin benzoate 5 SG @ 0.4 gm per liter of water. The most harmful treatment against *C. septempunctata* was recorded Emamectin benzoate 5 SG@ 0.4 gm per liter of water.

Keywords: *C. septempunctata*, green gram, novel insecticides

Introduction
Pulses are super foods that are unbelievably healthy, inexpensive, and delicious. In addition to antioxidants, they are the most essential sources of vegetable protein, high in carbohydrate, iron, potassium, folate (folic acid, one of the B vitamins), etc., and are free of cholesterol and gluten. Green gram is India's third main pulse crop among pulses, grown in almost 8% of the total pulse region of the world. Because of its supply of cheaper protein sources, its seed contains 24.7 per cent protein, it is designated as "poor man's meat". Highly effective insecticides with a novel mode of action, which are becoming increasingly relevant in agriculture as part of integrated pest control and resistance management strategies, have recently become available. Compared to the older class of compounds necessary in a few hundred grams, these insecticides are only needed in a few grams and are considered to bear greater safety/environmental risks (Wing *et al*., 2000) [9]. Insecticides used in agro-ecosystems, though, harm the target insect and have a detrimental impact on natural enemies. Over the last two decades, the number of predators has decreased dramatically, and many parasitoids have been removed from the crop ecosystem. Therefore, it is important to screen them for the protection of their natural enemies before integrating these newer insecticides into IPM programs. Biologically regulated selective insecticides can mitigate adverse effects on natural enemies (Johnson and Tabashnik, 1999) [3]. In biological regulation, Ladybird beetles are well known for their particular role in biological ecosystems (Farahi and Namghi, 2009) [1]. Coccinellids are the most likely predators of aphids, scale insects, mealy bugs, and mite pests. The systematic use of insecticides in many crop systems has a deleterious effect on coccinellids. In advanced insect pest management, bio-control agents, such as predators and parasitoids, are called essential methods. The present research was therefore undertaken to test the field effectiveness of newer insecticides with a particular mode of action, with the lowest lethal effect advantageous to natural enemies against *M. vitrata* in green gram.

Materials and Methods
During *Kharif* 2019, a field trial was performed at Crop Research Center, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, to evaluate the efficacy of insecticides against Coccinellid beetles in green gram. The crop was grown with 30cm x 10cm spacing with three replications in a randomized block design, and recorded observations of coccinellid beetles were taken one day before first spraying and three, seven

and eleven day after first and second spraying from 10 randomly selected tagged plants in the each plot of different treatments. The collected data was subjected to statistical analysis after suitable transformations.

Results and Discussions

Data referring to the impact of various treatments on the mean population of *C. septempunctata* one day before spray ranged from 4.33 to 5.67 beetles per 10 plants, with no major difference being observed for all the various treatments (Table 1). Statistically analyzed data on the mean number of *C. septempunctata* were collected three days after first spraying, and the highest population was found in Novaluron 10 EC @ 1.0 gm per liter of water (3.67 beetles per 10 plants), followed by Profenophos 50EC @ 1.0 gm per liter of water (3.63 beetles per 10 plants) while a minimum of 2.00 beetles per 10 plants were found in Emamectin benzoate 5 SG @ 0.4 gm per liter of water. Among all the treatments, the maximum number of *C. septempunctata* population was found in untreated control with 6.33 beetles per ten plants.

The mean population of *C. septempunctata* at seven days after the first spray was ranged from 1.33 to 7.00 beetles per 10 plants, with a maximum population noticed in untreated control (7.00 beetles per ten plants). Upon spraying of novel insecticides maximum beetle population was recorded with Novaluron 10 EC @ 1.0 gm per liter of water (3.33 beetles per 10 plants), followed by Profenophos 50EC @ 1.0 gm per liter of water (3.00 beetles per 10 plants) and a minimum mean population of 1.33 beetles per 10 plants was recorded with Emamectin benzoate. 5 SG @ 0.4 gm per liter of water.

Eleven days after the first spray, the same pattern was observed where the mean population of *C. septempunctata* was ranged from 1.67 to 7.33 beetles per 10 plants. Novaluron 10EC @ 1.0 gm per liter of water was found to be the least toxic to *C. septempunctata* among all insecticidal treatments with 3.67 beetles per 10 plants, followed by Profenophos 50EC @ 1.0 gm per liter of water with 3.33 beetles per 10 plants and a minimum of 1.67 beetles per ten plants Emamectin benzoate 5 SG @ 0.4 gm per liter of water, respectively. Total population *C. Septempunctata* found a maximum of 7.33 beetles per ten plants under control.

At three days after the second spraying, the mean population of *C. septempunctata* ranged from 0.67 to 7.67 beetles per ten plants, with maximum found in the control plot. Among all the insecticidal treatments, the maximum population of *C. septempunctata* was noticed in Novaluron 10 EC @ 1.0 gm per liter of water with 2.67 beetles per ten plants followed by Profenophos 50EC @ 1.0 gm per liter of water with 2.33 beetles per ten plants whereas, the minimum population of *C. septempunctata* was found in Emamectin benzoate 5 SG @ 0.4 gm per liter of water with 0.67 beetles per ten plants.

A similar trend was observed at seven days after the second spray with a mean population of *C. septempunctata* ranged from 0.33 to 8.00 beetles per ten plants, with the highest was observed with untreated control. Among all the novel insecticides, the treatment Novaluron 10 EC @ 1.0 gm per liter of water was found most safe with *C. septempunctata* population of 2.33 beetles per ten plants followed by Profenophos 50EC @ 1.0 gm per liter of water with 2.00 beetles per ten plants, respectively and the least found in the treatment Emamectin benzoate 5 SG @ 0.4 gm per liter of water with 0.33 beetles per ten plants.

At eleven days after second spraying, among all the insecticidal treatments, the least population was found in Emamectin benzoate 5 SG@ 0.4 gm per liter of water 0.00 beetles per ten plants while, maximum population was recorded with Novaluron 10 EC @ 1.0 gm per liter of water with 2.00 beetles per ten plants followed by Profenophos 50EC @ 1.0 gm per liter of water, 1.67 beetles per ten plants. The maximum *C. septempunctata* population with 8.33 beetles per ten plants was noticed in the untreated control.

Among all the treatments, the highest population of *C. septempunctata* was recorded with Novaluron 10 EC @ 1.0 gm per liter of water and followed by Profenophos 50EC @ 1.0 gm per liter of water, Triazophos 40 EC@ 4.0 gm per liter of water, Indoxacarb14.5SC @ 1.0 gm per liter of water, Chlorantraniliprole 20SC @ 0.25 gm per liter of water and Spinosad 45 SC @ 0.25 ml per liter of water, Emamectin benzoate 5 SG @ 0.4 gm per liter of water. The most harmful treatment against *C. septempunctata* was recorded Emamectin benzoate 5 SG@ 0.4 gm per liter of water. The present results are confirmed by Ilyas *et al.* (2015) [2], who stated that the natural enemies of soybean pests considered that Novaluron 10 EC @ 1000 ml/ ha to be less harmful. Similar discoveries were also made by Sahito *et al.* (2011) [8], who suggested that Profenophos was found to be less toxic to cotton's natural enemies. Patel *et al.* (2016) [7] found that various doses of chlorantraniliprole were found better for ladybird beetles and supported the current results. Kaushik *et al.* (2016) [4] found that spinosad 45 EC was mildly toxic toward natural enemies and can be used for improved pest control in the cowpea ecosystem, corroborating the current findings. Khan *et al.* (2015) [5] found that emamectin benzoate and spinosad are mildly toxic to multiple stages of *M. sexmaculatus.* Meena *et al.* (2020) reported that Emamectin benzoate 5 SG @ 0.5 gm per liter of water was observed against the larval population of *M. vitrata* and reported safer to ladybird beetles.

Table 1: Comparitive efficacy of different treatments against coccinellid populations under field conditions in green gram.

S.no	Treatments	Dose gm or ml/ hectare	Mean no. of Coccinellids /10 plants						
			First spray				Second spray		
			1 DBS	3 DAFS	7 DAFS	11 DAFS	3 DASS	7 DASS	11 DASS
1	Emamectin benzoate 5SG	200	5.33 (2.31)	2.00 (1.38)	1.33 (1.14)	1.67 (1.28)	0.67 (1.05)	0.33 (0.88)	0.00 (0.71)
2	Spinosad 45SC	125	5.00 (2.23)	2.33 (1.52)	1.67 (1.28)	2.00 (1.41)	1.00 (1.22)	0.67 (1.05)	0.33 (0.88)
3	Chlorantraniliprole 20SC	125	5.33 (2.31)	2.67 (1.63)	2.00 (1.41)	2.33 (1.52)	1.33 (1.34)	1.00 (1.22)	0.67 (1.05)
4	Indoxacarb14.5SC	500	5.67 (2.38)	3.00 (1.72)	2.33 (1.52)	2.67 (1.63)	1.67 (1.46)	1.33 (1.34)	1.00 (1.22)
5	Novaluron 10EC	500	4.33 (2.23)	3.67 (1.91)	3.33 (1.82)	3.67 (1.91)	2.67 (1.77)	2.33 (1.68)	2.00 (1.58)
6	Profenophos 50EC	500	4.67	3.33	3.00	3.33	2.33	2.00	1.67

			(2.16)	(1.82)	(1.73)	(1.82)	(1.68)	(1.58)	(1.46)
7	Triazophos 40EC	1000	5.00 (2.06)	3.00 (1.72)	2.67 (1.63)	3.00 (1.73)	2.00 (1.58)	1.67 (1.46)	1.33 (1.34)
8	Control	-	4.67 (2.16)	6.33 (2.51)	7.00 (2.64)	7.33 (2.71)	7.67 (2.86)	8.00 (2.92)	8.33 (2.97)
	SE(m)±		-	0.12	0.08	0.08	0.10	0.11	0.10
	CD at 5per cent		NS	0.36	0.25	0.25	0.31	0.32	0.32

Figures in the parenthesis are square root and square root+ 0.5 transformed values.
DBS- Days before spray, DBFS- Days after First spray, DBSS- Days after Second spray

Conclusion: It is concluded that all chemicals showed its effects on *Coccinella septempunctata* adults but Emamectin benzoate was the most toxic insecticide in our experiment and it caused highest mortality of the adults. In our experiment Novaluron was safest insecticide as caused lowest mortality of the *C. septempunctata* adults and this can be included in the integrated pest management (IPM) for the best control of insect pests.

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