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Effect of newer insecticides through stem smearing against ladybird beetle in cotton ecosystem

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Abstract
The present investigation was conducted during *kharif* season of 2014-15 at Experimental farm of Department of Agriculture Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to evaluate the effects of stem smearing treatments against ladybird beetle in cotton ecosystem. Insecticides namely imidacloprid 70 WS, imidacloprid 48 FS, acephate 50 + imidacloprid 1.8 SP, clothianidin 50 WDG used in experiment. However an untreated control was recorded highest population of Ladybird beetles and amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.47 per plant.This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid 48 FS @ 1:20. The all treatment insecticides application by stem smearing of and seed treatment is found safer for maintain population of ladybird beetle in cotton ecosystem.

Keywords: Insecticides, stem smearing, natural enemies, ladybird beetle

Introduction
Cotton is one of the important cash crops cultivated in India. It is attacked by several sucking pests right from germination to picking. Among sucking pests, aphid is a major one which is naturally regulated by lady bird beetle [6]. Biological control is the action of parasitoids, population growth of any pest species is effectively predators and pathogens in maintaining other organism' scontrolled by their natural enemies [5]. The lady beetles density at a lower average than would otherwise occur [14]. The lady bird beetles, *Coccinella septumpunctata* L. (Coleoptera-Coccinellideae) is the most potential and effective predator of cotton pest. The grub and adult stages of the lady bird beetles feed voraciously on cotton pest i.e. Aphids, Jassid and White fly and cuts down its population to a great extent [13]. Farmers usually spray insecticides in their field indiscriminately even without thinking the economic return of their investment. As a result, harmful impact of insecticides on man, animal, wild life, beneficial insects and environment is posing a serious threat. It also causes insecticide resistance in insect pests, resurgence and secondary pest outbreak [14]. Keeping in view of that the present study was undertaken to study the population of LBB in relation to stem smearing of insecticides so that timely and effective management strategies for cotton pest control could be developed.

Materials and Methods
Field experiment was conducted by using variety PKV-Rajat at the experimental field of Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during kharif 2014-15 the newer group of insecticides *viz*., imidacloprid 48 FS, acephate 50+ imidacloprid 1.8 SP, clothianidin 50 WDG used for stem smearing at three different concentration of 1:5, 1:10 and 1:20 applied at 20 and 40 days after emergence with the help of stem smearing bottle and imidacloprid 70 WS used as seed treatment @ 10 g/kg. The observation on the population of ladybird beetle was recorded from 5, 10, 15 and 20 days after the treatments on three leaves (top, middle and bottom) per plant by randomly selecting five plants from each net plot and calculate population of LBB. The mean data subjected to analysis in randomized block design.

Table 1: Treatment details

T_1	:	Clothianidin 50 WDG @ 1:5 (I:W) by Stem smearing at 20 and 40 days after germination(DAG)
T_2	:	Clothianidin 50 WDG @ 1:10 (I:W) by Stem smearing at 20 and 40 days after germination(DAG).
T_3	:	Clothianidin 50 WDG @ 1:20 (I:W) by Stem smearing at 20 and 40 days after germination(DAG)
T_4	:	Acephate 50 + Imidacloprid 1.8 SP @ 1:5 (I:W) by Stem Smearing at 20 and 40 days after germination(DAG).
T_5	:	Acephate 50 + Imidacloprid 1.8 SP @ 1:10 (I:W) by Stem Smearing at 20 and 40 days after germination(DAG)
T_6	:	Acephate 50 + Imidacloprid 1.8 SP @ 1:20 (I:W) by Stem Smearing at 20 and 40 days after germination(DAG).
T_7	:	Imidacloprid 48 FS @ 1:5 (I:W) by Stem smearing at 20 and 40 days after germination(DAG).
T_8	:	Imidacloprid 48 FS @ 1:10 (I:W) by Stem smearing at 20 and 40 days after germination(DAG).
T_9	:	Imidacloprid 48 FS @ 1:20 (I:W) by Stem smearing at 20 and 40 days after germination(DAG).
T_{10}	:	Imidacloprid 70 WS @ 10 g/kg by seed treatment
T_{11}	:	Untreated control

Results

Effects of treatment on population of ladybird beetles applied at 20 DAE

The data collected number of ladybird beetles per plant, after the application of the treatments at 20 DAE and observed on 5, 10, 15, and 20 days after treatments are presented in Table-2 and discussed as follows.

A. At 5 DAT

The data presented in Table-2 was found statistically non-significant. However an untreated control was recorded highest population of LBBs (0.67/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.47 per plant.This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid 48 FS @ 1:20. The population recorded in the treatments was in the range of 0.17 to 0.87 per plant.

B. At 10 DAT

The data presented in Table-2 was found statistically non-significant. However an untreated control was recorded highest population of LBBs (0.73/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.58 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:10, clothianidin 50 WDG @ 1:10,acephate 50 + imidacloprid 1.8 SP @ 1:10, imidacloprid 48 FS @ 1:20 and imidacloprid 48 FS @ 1:10. The population recorded in the treatments was in the range of 0.20 to 0.58 per plant.

C. At 15 DAT

The data presented in Table-2 was found statistically non-significant. However an untreated control was recorded highest population of LBBs (0.65/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.51 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid 48 FS @ 1:20. The population recorded in the treatments was in the range of 0.17 to 0.51 per plant.

D. At 20 DAT

The data presented in Table-2 was found statistically non-significant. However an untreated control was recorded highest population of LBBs (0.63/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.47 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid 48 FS @ 1:20. The population recorded in the treatments was in the range of 0.12 to 0.47 per plant.

Table 2: Effects of treatment on the population of LBBs applied at 20 DAE

Treatment		Number of LBB's / plant at				
		5 DAT	**10 DAT**	**15 DAT**	**20 DAT**	**Mean**
T_1	Clothianidin 50% WDG @ 1:5 (I:W) by stem smearing	0.17 (0.81)	0.23 (0.85)	0.20 (0.83)	0.16 (0.81)	0.19 (0.83)
T_2	Clothianidin 50% WDG @ 1:10 (I:W) by stem smearing	0.25 (0.86)	0.28 (0.88)	0.26 (0.87)	0.23 (0.85)	0.26 (0.87)
T_3	Clothianidin 50% WDG @ 1:20 (I:W) by stem smearing	0.30 (0.87)	0.38 (0.93)	0.35 (0.91)	0.30 (0.87)	0.33 (0.90)
T_4	Acephate 50% +Imidacloprid 1.8% SP @ 1:5 (I:W) by stem smearing	0.18 (0.82)	0.20 (0.84)	0.17 (0.81)	0.12 (0.78)	0.17 (0.81)
T_5	Acephate 50% +Imidacloprid 1.8% SP @ 1:10 (I:W) by stem smearing	0.22 (0.84)	0.27 (0.87)	0.22 (0.84)	0.18 (0.82)	0.22 (0.84)
T_6	Acephate 50% +Imidacloprid 1.8% SP @ 1:20 (I:W) by stem smearing	0.37 (0.92)	0.43 (0.96)	0.40 (0.94)	0.37 (0.92)	0.39 (0.94)
T_7	Imidacloprid 48% FS @ 1:5 (I:W) by stem smearing	0.15 (0.80)	0.23 (0.85)	0.18 (0.82)	0.15 (0.80)	0.18 (0.82)
T_8	Imidacloprid 48% FS @ 1:10 (I:W) by stem smearing	0.21 (0.83)	0.25 (0.86)	0.22 (0.84)	0.19 (0.83)	0.22 (0.84)
T_9	Imidacloprid 48% FS @ 1:20 (I:W) by stem smearing	0.23 (0.85)	0.27 (0.87)	0.25 (0.86)	0.22 (0.84)	0.24 (0.86)
T_{10}	Imidacloprid 70% WS @ 10 g/kg by seed treatment	0.47 (0.97)	0.58 (1.03)	0.51 (1.00)	0.47 (0.97)	0.51 (0.99)
T_{11}	Untreated control	0.67	0.73	0.65	0.63	0.67

		(1.07)	(1.09)	(1.06)	(1.06)	(1.01)
	' F' test	N.S	N.S	N.S	N.S	N.S
	SE(m)±	0.089	0.073	0.079	0.088	0.082
	CD at (5%)	-	-	-	-	-
	CV (%)	17.54	13.91	15.38	17.64	16.12

Figures in parentheses are square root values √ x + 0.5,
DAE= Days after emergence, DAT = Days after treatments, I: W= Insecticides: Water

Effects of treatment on population of ladybird beetles applied 40 days after emergence.

The observations on number of ladybird beetles per plant, after the application of the treatments at 40 DAE and observed on 5, 10, 15, and 20 days after treatments are presented in Table-3 and discussed below.

A. At 5 DAT

The data presented in Table-3 was found statistically non-significant. However an untreated control was recorded highest population of LBBs i.e., 0.57 LBBs/plant. Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.39 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid 48 FS @ 1:20. The population recorded in the treatments was in the range of 0.10 to 0.39 per plant.

B. At 10 DAT

The data presented in Table-3 was found statistically non-significant. However an untreated control was recorded highest population of LBBs (0.50/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.35 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20 and imidacloprid 48 FS @ 1:20. The population recorded in the treatments was in the range of 0.07 to 0.35 per plant.

C. At 15 DAT

The data presented in Table-3 was found statistically non-significant. An untreated control was recorded highest population of LBBs (0.42/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.28 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20 and clothianidin 50 WDG @ 1:20. The population recorded in the treatments was in the range of 0.00 to 0.28 per plant.

D. At 20 DAT

The data presented in Table-3 was found statistically non-significant. Whereas an untreated control was recorded highest population of LBBs (0.37/ plant). Amongst the treatments, seed treatments with imidacloprid 70 WS at 10 g/kg recorded comparatively higher population of ladybird beetles i.e. 0.22 per plant. This was followed by treatments with acephate 50 + imidacloprid 1.8 SP @ 1:20 and clothianidin 50 WDG @ 1:20 dilution. The population recorded in the treatments was in the range of 0.0 to 0.22 per plant.

Table 3: Effects of treatment on the population of LBBs applied at 40 DAE

	Treatment	Number of LBB's / plant at				
		5 DAT	**10 DAT**	**15 DAT**	**20 DAT**	**Mean**
T_1	Clothianidin 50% WDG @ 1:5 (I:W) by stem smearing	0.13 (0.79)	0.08 (0.76)	0.00 (0.71)	0.00 (0.71)	0.05 (0.74)
T_2	Clothianidin 50% WDG @ 1:10 (I:W) by stem smearing	0.21 (0.84)	0.10 (0.77)	0.03 (0.73)	0.00 (0.71)	0.09 (0.76)
T_3	Clothianidin 50% WDG @ 1:20 (I:W) by stem smearing	0.27 (0.87)	0.23 (0.84)	0.18 (0.82)	0.12 (0.78)	0.20 (0.83)
T_4	Acephate 50% + Imidacloprid 1.8% SP @ 1:5 (I:W) by stem smearing	0.10 (0.77)	0.07 (0.75)	0.03 (0.73)	0.00 (0.71)	0.05 (0.74)
T_5	Acephate 50% + Imidacloprid 1.8% SP @ 1:10 (I:W) by stem smearing	0.15 (0.80)	0.10 (0.77)	0.05 (0.74)	0.03 (0.73)	0.08 (0.76)
T_6	Acephate 50% + Imidacloprid 1.8% SP @ 1:20 (I:W) by stem smearing	0.33 (0.90)	0.27 (0.86)	0.21 (0.84)	0.18 (0.82)	0.25 (0.86)
T_7	Imidacloprid 48% FS @ 1:5 (I:W) by stem smearing	0.12 (0.79)	0.07 (0.75)	0.00 (0.71)	0.00 (0.71)	0.05 (0.74)
T_8	Imidacloprid 48% FS @ 1:10 (I:W) by stem smearing	0.17 (0.82)	0.13 (0.79)	0.08 (0.76)	0.00 (0.71)	0.10 (0.77)
T_9	Imidacloprid 48% FS @ 1:20 (I:W) by stem smearing	0.20 (0.83)	0.16 (0.81)	0.10 (0.77)	0.05 (0.74)	0.13 (0.79)
T_{10}	Imidacloprid 70% WS @ 10 g/kg by seed treatment	0.39 (0.93)	0.35 (0.91)	0.28 (0.87)	0.22 (0.84)	0.31 (0.89)
T_{11}	Untreated control	0.57 (1.02)	0.50 (1.00)	0.42 (0.94)	0.37 (0.92)	0.47 (0.97)
	' F' test	N.S	N.S	N.S	N.S	N.S
	SE(m)±	0.080	0.065	0.064	0.050	0.060
	CD at (5%)	-	-	-	-	-
	CV (%)	16.36	13.76	14.17	11.35	13.91

Figures in parentheses are square root values √ x + 0.5,
DAE= Days after emergence, DAT = Days after treatments, I : W= Insecticides : Water

Discussion

The data on mean population of LBBs presented in Table-2 was found statistically non significance. However, an untreated control recorded highest population of ladybird beetles (0.67/plant).

Amongst the treatments seed treatment with imidacloprid 70 WS @ 10g/kg recorded comparatively higher population of LBBs i.e. 0.51/plant, followed by treatments of acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20, clothianidin 50 WDG @ 1:10 and imidacloprid @ 1:20, recording, 0.39, 0.33, 0.26 and 0.24 per plant of LBBs population, respectively.

However the data on mean population of LBBs presented in Table-3 was found statistically non significance. However, an untreated control recorded highest population of ladybird beetles (0.47/plant)

Amongst the treatments seed treatment with imidacloprid 70 WS @ 10g/kg recorded comparatively higher population of LBBs i.e. 0.31/plant, followed by treatments of acephate 50 + imidacloprid 1.8 SP @ 1:20, clothianidin 50 WDG @ 1:20 and imidacloprid @ 1:20. The population recorded in the treatments was in the range of 0.05 to 0.31 per plant.

Similar finding also confirm, seed treatment with imidacloprid not only safer for conservation of ladybird beetles but also attract more population [10]. Seed treatment with imidacloprid @ 10 g/kg was safer than foliar sprays and allowed maximum lady bird beetle adult [4]. The imidacloprid 17.8 SL @ 1:20 proved to be best in reducing the early sucking insect pests without affecting the natural predatory population like, coccinellids [1]. Non significance difference by stem smearing with monochrotophos @ 1:1, 1: 20 and imidachloprid @ 1:20, 1:40 on population of natural enemies (11). Seed Treatment with imidacloprid 70 WS @ 10 g/kg and stem smearing with imidacloprid 70 WS @ 1:20 were safer for ladybird beetles is reported [7]. Seed treatments with imidacloprid @ 10 g/kg and as stem smearing @ 1:20 were found safer for population of LBBs (12). The stem application of acephate @ 1:20 applied at 30-40 DAS and 50-60 DAS was having more number of natural enemies [8]

Conclusion

The effects of treatments against LBBs were non-significant. However an untreated control recorded highest population of ladybird beetles (0.67/plant at 20 DAE and 0.47/plant at 40 DAE). Amongst the treatments seed treatment with imidacloprid 70 WS @ 10 g/kg recorded comparatively higher population of LBBs (0.51/plant at 20 DAE and 0.31/plant at 40 DAE) and found safer followed by treatments of acephate 50 + imidacloprid 1.8 SP @ 1:20 is found safer.

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