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Comparative efficacy of different insecticides against dusky cotton bug (*Oxycarenus* spp.) under field conditions

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Abstract
Dusky cotton bug (*Oxycarenus* spp.) has become a major insect pest for cotton crop in Pakistan. They are crushed during ginning process that stain valuable cotton lint and stained lint fetch low price in the market. The present study was designed to evaluate the efficacy of different insecticides against the dusky cotton bug (DCB) under field conditions. Seven insecticides viz. bifenthrin, fipronil, triazophos, chlorpyriphos, lambda cyhalothrin, deltamethrin + triazophos and clothianidin were sprayed in order to determine the reduction in the pest population. The experiment was conducted under Randomized Complete Block Design (RCBD) with three replications. The results revealed that most effective insecticide against dusky cotton bug was chlorpyriphos with a reduction of 96.98% in the pest population followed by triazophos (91.03%) and lambda cyhalothrin (89.27%). However among all the tested insecticides fipronil was least effective with 64.15% reduction of DCB population up to seven days. Our data will help the farmers in future to control the pest population under study.

Keywords: insecticides, efficacy, cotton, dusky cotton bug

1. Introduction
Pakistan has a diversified cropping pattern in which cotton (*Gossypium hirsutum)* holds a prominent position because it is the most preferred crop by the farming community. In terms of area, it is the second largest grown crop after wheat and cultivated on an area of 2699 thousand hectares with a yield of 11.93 million bales [1]. Pakistan is the 5th largest producer of cotton [2]; though per hectare yield is substantially low as compared to other countries [3]. Insect pest attack is the most important limiting factor that lowers the yield 5-10% and in some cases this may be extend to 40-50% [4-6]. The cotton production in the country can be increased if the insect pests are effectively managed along with adoption of recommended agronomic practices [7].
In Pakistan, commercial cultivation of *Bt* cotton approved in the year 2010 and it is reported that 85% of the cultivated area was under Bt varieties in 2011[8]. The introduction of Bt varieties have benefitted the farmers both in terms of yield and also by reducing the cost of pesticide application because of its resistance against bollworms [9]. Due to reduced application of organophosphate and pyrethroids pesticides on Bt cotton, that were previously used to control the bollworms, the problem of dusky cotton bug (DCB) emerged [10, 11].
Earlier, DCB considered as a minor pest but now it has attained the status of major pest. It is also known as cotton seed bug or cotton stainer [12]. Both mature as well as immature life stages of this pest possess the ability to damage the crop by reducing the yield, seed weight and oil contents through sucking cell sap [13]. According to estimates it can reduce yield up to 6.8%, seed weight 32% and oil contents 6% [14]. The overwintering sites of this pest are un-ginned cotton in factories and holes in the barks of different trees [7]. Sometimes, it gets crushed with the cotton thus colouring the lint that resulted into low quality as well as lowers the market value [15]. It also reduces the viability of seeds by causing huge damage to the seed embryo [16].
Cotton is not the sole crop which is affected by this pest; it also attacks other valuable crops such as persimmon, fig, dates and avocado in Israel and sunflower seeds [17]. In Pakistan, the key method to control insect pests is chemical control and 90% of farmers rely on synthetic

Insecticides because it provides a quick knock down effect as compared to other methods [18]. Keeping in view, the present study was conducted to evaluate the efficacy of different insecticides against dusky cotton bug under field conditions.

2. Materials and Methods

Seven different insecticides viz. bifenthrin, fipronil, Triazophos, chlorpyriphos, lambda cyhalothrin, deltamethrin + Triazophos and clothianidin were tested against dusky cotton bug under field conditions and compared with untreated control (Table 1). The study was conducted at Chak No. 598 TDA Hussain Abad Agricultural Farm, Muzaffargarh on Bt cotton variety MNH-992. The crop was sown on April 6, 2015 with plant to plant and row to row distance maintained at 30 cm and 75 cm. All the standard agronomic practices (hoeing, irrigation and fertilizer application) were adopted in the treated plots including control. Insecticides were sprayed by using hand operated knap-sack sprayer with hollow cone nozzle when the population of pest reached at economic threshold level (ETL). The data were collected 1 day before and then after 1, 2, 3 and 7 days of spray by counting the adults and nymphs on three opened bolls from upper portion of five randomly selected plants in each replicated plot. Data were analyzed by ANOVA and means were separated through LSD test at 5% level of significance by using Statistix software 8.1. The percent reduction in population at each interval was calculated by using the following formula;

$$\text{Percent reduction in population} = \frac{A-B}{A} \times 100$$

Where,
A= Pre-treatment population
B= Post treatment population

Table 1: Details of insecticides used in the experiment.

Sr. No	Trade Name	Common Name	Pesticide Group	Dose/Acre
1	Talstar 10%EC	Bifenthrin	Pyrethriod	250 ml
2	Fusion 50SC	Fipronil	Phenyl-Pyrazole	480 ml
3	Pelegan 40%EC	Triazophos	Organophosphate	800-1000 ml
4	Chlorpyrifos 50EC	Chlorpyriphos	Organophosphate	1000 ml
5	Zega Super 10%EC	Lambda cyhalothrin	Pyrethriod	80 ml
6	Unit Plus 360 EC	Deltamethrin + Triazophos	Mixture of organophosphate and Pyrethroids	800 ml
7	Marine 20%EC	Clothianidin	New chemistry	200 ml

3. Results and Discussion

The results revealed significant difference in population reduction of DCB among all the treatments. The mean DCB population 1 day before before and after 1, 2, 3 and 7 days of spray are represented in Table 2. Similarly, population reduction percentage after 1, 2, 3 and 7 days of spray are represented in Table 3. After 1 day of spray, the DCB population reduction in treated plots was significantly different from each other as well as from control plot. Minimum population of 1.86/boll was recorded in chlorpyriphos treated plots with percent reduction of 87.81%. While, bifenthrin was found least effective with a mean population of 8.86/boll and a reduction of 47.44%. In addition to bifenthrin, the other insecticide that showed less control on DCB population was fipronil with mean population of 10.26/boll and 47.46% reduction as compared to other tested insecticides (Table 2 & 3).

After 2 days of spray, DCB population per opened boll was non-significant in plots treated with triazophos and clothianidin that was 2.66 and 3.66/boll with a percent reduction of 81.08% and 84.03%, respectively (Table 2 & 3). DCB population in plots treated with bifenthrin and deltamethrin + triazophos was also found non-significantly different. The maximum percentage reduction of 92.13% was recorded in chlorpyriphos treated plots with minimum population mean of 1.20/boll. Fipronil and bifenthrin remained least effective with 51.2 and 52.55 percent reduction, respectively (Table 3).

After 3 days of spray, mean DCB population of 0.73, 2 and 3.13/boll recorded in chlorpyriphos, triazophos and clothianidin treated plots were non-significantly different from each other (Table 2). Lambda cyhalothrin also reduced DCB population with percent reduction of 89.27% but this reduction was less than triazophos (85.77%) and clothianidin (86.34%) and more than bifenthrin (60.49%) and fipronil (57.34%) (Table 3). DCB population mean in plots treated with bifenthirn (6.66/boll), fipronil (8.33/boll) and deltamethrin + triazophos (7.13/boll) were also found statistically at par with each other (Table 2).

Similarly after 7 days of spray, DCB population per opened boll in chlorpyriphos, Triazophos, clothianidin and lambda cyhalothrin treated plots were significantly different from each other (Table 2). Maximum DCB population reduction was observed in plots treated with chlorpyriphos (96.98%) followed by Triazophos (91.03%) and lambda cyhalothrin (89.27%) (Table 3). DCB population decrease in clothianidin treated plots was 87.78% with population mean of 2.80/boll as compared to population mean of 22.93/boll before spray. The population reduction was statistically at par in plots treated with clothianidin and lambda cyhalothrin. The least effective pesticides against DCB after 7 days of spray were fipronil and bifenthrin with population means of 7.0 and 5.73/boll and percentage reduction of 64.15 and 66.01%, respectively (Table 2 & 3).

Among all the insecticide used for the control of DCB population, chlorpyriphos was found most effective and fipronil as the least. The trend of percentage population reduction after 7 days of the spray in descending order was chlorpyriphos > Triazophos > lambda cyhalothrin > clothianidin> deltamethrin+ triazophos >bifenthrin >fipronil. Our results are in conformity with Abbas *et al* [19]. Who reported that chlorpyriphos and lambda cyhalothrin are most toxic to DCB by reducing 94.5% and 87% of the population, respectively. Similarly, Akram *et al* [13]. Reported that organophosphate group is better in controlling DCB than other pesticides due to their better contact action. Roger *et al* [20]. Found that several organophosphates and pyrethroids were effective against DCB. Sanghi *et al* [21]. Also reported high effectiveness of chlorpyriphos with 82% reduction in dusky cotton bug population as compared to other tested

insecticide. The present results showed that insecticide clothianidin belonging to new chemistry insecticides caused significant reduction of the dusky cotton bug population. These results are in full agreement with the work of Nyman *et al* [22]. Who reported that new chemistry insecticides caused maximum mortality after 24 hours of spray by inhibiting the feeding and movement of pest. In our experiment pesticide mixture deltamethrin + triazophos also showed good results that is in conformity with Ibrahim *et al*. (1993) and Smith and Brambila [17] who reported that pesticide mixture with both systemic and contact action have good results against DCB.

4. Conclusion

From the present study it is concluded that chlorpyrifos and Triazophos were highly effective as compared to the other insecticides and can be recommended to growers for the management of dusky cotton bug population in cotton.

Table 2: Mean DCB population per opened boll 1 day before and 1, 2, 3 and 7 days after spray.

Treatments		Mean DCB Population Per Opened Boll				
		1 Day Before Spray	DAYS AFTER SPRAY			
Tr. No.	Insecticides		1DAS	2DAS	3DAS	7DAS
T_1	Bifenthrin	16.86	8.86 bc	8.0 bc	6.66 bc	5.73 b
T_2	Fipronil	19.53	10.26 b	9.53 b	8.33 b	7.0 b
T_3	Triazophos	14.06	3.80 de	2.66 de	2.0 d	1.26 cd
T_4	Chlorpyriphos	15.26	1.86 e	1.20 e	0.73 d	0.46 d
T_5	Lambda cyhalothrin	21.73	5.46 cd	4.73 cd	3.86 cd	3.0 c
T_6	Deltamethrin + Triazophos	19.4	9.26 b	8.0 bc	7.13 b	6.06 b
T_7	Clothianidin	22.93	5.13 de	3.66 de	3.13 d	2.80 c
T_8	Control	19.73	17.73 a	18.93 a	20.53 a	20.86 a
	F (df=2,5)	16.16*	17.58*	23.46*	33.73*	86.96*
	P Value	0	0	0	0	0
	LSD	2.31*	3.58*	3.50*	3.25*	2.10*

Means followed by the same letters within a column are not statistically different at $p < 0.05$. *= Significant ($p < 0.05$)

Table 3: Percent reduction of DCB population after 1, 2, 3 and 7 days of spray.

Treatments		Percent reduction of DCB Population				
		1 Day Before Spray	DAYS AFTER SPRAY			
Tr. No.	Insecticides		1DAS	2DAS	3DAS	7DAS
T_1	Bifenthrin	16.86	47.44	52.55	60.49	66.01
T_2	Fipronil	19.53	47.46	51.2	57.34	64.15
T_3	Triazophos	14.06	72.97	81.08	85.77	91.03
T_4	Chlorpyriphos	15.26	87.81	92.13	95.21	96.98
T_5	Lambda cyhalothrin	21.73	74.87	78.23	82.23	89.27
T_6	Deltamethrin + Triazophos	19.4	52.26	58.76	63.24	68.76
T_7	Clothianidin	22.93	77.62	84.03	86.34	87.78
T_8	Control	19.73				

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