

COMPARATIVE EFFICACY OF DIFFERENT INSECTICIDES ON SUCKING AND CHEWING INSECT PESTS OF COTTON

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ABSTRACT

Four insecticides when used alone or in combinations viz. Cypermethrin 10EC, Deltaphos 360EC (deltamethrin + triazophos), Deltaphos 360EC + Confidor 200SL (deltamethrin + triazophos + imidacloprid), Cypermethrin 10EC + Confidor 200SL (imidacloprid) were tested against sucking insect pests such as jassid, *Amrasca biguttula biguttula* Dist.; thrips, *Thrips tabaci* Genn.; whitefly, *Bemisia tabaci* Lind and spotted bollworm, *Earias insulana* Boisd. on cotton under field conditions. All insecticide whether alone or in combinations were applied at their recommended doses with the help of knapsack sprayer three times with an interval of a week. The results of the present study revealed that all insecticides or combinations were almost equally effective to control *E. insulana*. Deltaphos 360EC + Confidor 200SL combination was comparatively most effective against *A. biguttula biguttula*, *T. tabaci* and *E. insulana*. None of the insecticides or combinations was found effective for the control of *B. tabaci*.

Keywords: *Amrasca biguttula*, *Thrips tabaci*, *Earias insulana*

INTRODUCTION

Cotton occupies a unique position in most of the Asian countries. It provides fiber, food, feed and fuel. It sustains million of the people for livelihood at farms, ginning factories, textile mills, edible oil and soap industries etc. Cotton is therefore, rightly called the lifeblood of economy of many countries in Asia.

Pakistan's economy is invariably dependent on a single crop, the cotton. It is one of the most challenging and charismatic crops in Pakistan as it has the tendency to earn more than 60% foreign exchange and runs biggest textile industry of the country by providing the raw material to over 400 textile mills, 1035 ginning factories and 5000 oil expellers of Pakistan so the millions of people are employed in cotton based industries (Ahmad, 1999). Although considerable progress has been made in increasing cotton production, yet our national yield is lower than the other cotton producing countries of the world. Pakistan is the 4th largest cotton producer after USA, China and India. However, national average per hectare yield is low as compared to these countries (Khan, 1997).

Among various factors responsible for low yield, insect pests are one of the most important factors causing 30-40% yield losses (Haque, 1991). The major insect pests of cotton can be broadly divided into two groups i.e. sucking insect pests (whitefly, *Bemisia tabaci*; jassid, *Amrasca devastans* and thrips, *Thrips tabaci* etc.) and chewing insect pests or bollworms (spotted bollworm, *Earias insulana*, American bollworm, *Helicoverpa Armigera*, Pink bollworm, *Pictonifera gossipella* etc.). The sucking insect pests are injurious to cotton crop. They cause damage by sucking the sap from the under surface of the leaves, transmit viral diseases (Butler & Henneberry, 1994), cause leaf burning, drying and shedding in young plants, arrest the growth, turn leaves brown on the upper side and silvery on the underside before shedding (Munro, 1987) and ultimately terminal bud is killed (Bournier, 1994). While the chewing insect pests (*E. insulana*) after hatching, may move some distance before settling down to feed (Pearson, 1958).

To overcome the losses due to the attack of insect pests and to increase the yield it is necessary to follow intelligent control strategies. Integrated pest management is a broad ecological approach to

pest control utilizing a variety of control techniques compatible in a single management system. Among these techniques chemical control is the quickest and surest way of insect pest control. It has the advantage of speed of control whereas the biological and cultural control works over a long span of time. Pesticides are the only mean to control large-scale infestation and sudden outbreaks of pests (Afzal, 1969). The main objective of the present study is to compare the efficacy of different insecticides whether used alone or in combinations against sucking (whitefly, *B. tabaci*; jassid, *A. devastans* and thrips, *T. tabaci*) and chewing (spotted bollworm, *E. insulana*) insect pests of cotton and to sort out the most effective insecticide or combination against these insect pests.

MATERIALS AND METHOD

The materials employed in the present investigations were a field grown crop of CIM-473 cotton variety with five treatments including control viz. Deltaphos 360EC (deltamethrin + triazophos), Cypermethrin 10EC, Deltaphos 360EC + Confidor 200SL (deltamethrin + triazophos + imidacloprid), Cypermethrin 10EC + Confidor 200SL (imidacloprid) and Control.

The trials were laid out at Agriculture Experimental Research Farm of University College of Agriculture, B.Z. University Multan in randomized complete block design (RCBD) with three replicates of each. The net plot size was kept 328x328 sq. m. The crop was shown on raised beds of 76 cm width and plant-to-plant distance of 23 cm. All agronomical practices were conducted as recommended.

The spray materials were prepared according to the recommended doses in water and crop was sprayed with the help of hand operated knapsack sprayer. The data regarding the adult population of whitefly, jassid and thrips were recorded from each plot 0, 24, 48, 72, 96 and 168 hours after each spray from 5 plants taken at random. For this purpose, an upper leaf was taken from the first plant, middle from the second plant and a lower from the third plant, and so on. In case of larvae of spotted bollworm data was collected after the same time intervals but instead of leaves, number of dead larvae from the bolls of the same upper, middle and lower parts of the five randomly selected plants, in each treatment. Two more sprays following the same procedure were done on every 8th day without considering the economic threshold level (ETL) of the insect pests.

RESULTS AND DISCUSSIONS

The data obtained was analyzed using Analysis of variance (ANOVA) and means were separated using least significant difference (LSD) test at 5% level of significance.

Jassid

Our results revealed that the mixtures i.e. deltapos + confidor and cypermethrin + confidor, gave statistically equal and the best control against jassid up till 72 h after treatment while a non-significant decrease in the efficacy was observed in next 168 observing hours after treatment (tables 1-3). Our results are in partial agreement with (Aslam *et al.*, 2004) and (Mohammad *et al.*, 2008) who reported that confidor gave best control against jassid after 72 h and its efficacy persisted till 168 h after treatment. Others also reported that confidor was highly effective against jassid. (Mustafa, 1996; Hameed *et al.*, 1997; Yazdani *et al.*, 2000). Our studies are in partial conformity with that of (Mohammad *et al.*, 2005) who reported that confidor alone was most effective against cotton jassid followed by confidor + tracer. On comparing deltapos and cypermethrin, results revealed the same pattern of efficacy as in case of mixtures but comparatively deltapos proved better because its efficacy persisted longer than that of cypermethrin. Our results are in full agreement with (Mohammad *et al.*, 2005) that proved that deltapos alone gave least control against cotton jassid as compared to other insecticides up till 168 h after treatment.

Table 1. Comparative efficacies of four insecticides after first application on jassid, *A. biguttula biguttula*

Treatments	(mL/acre)	Adults jassid per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	1.33 a	0.86 b	0.93 a	1.13 a	1.26 a
cypermethrin	300	1.20 a	1.06 a	1.13 a	1.06 a	1.20 ab
deltaphos+confidor	600+300	1.13 a	0.26 c	0.33 b	0.60 b	0.80 c
cypermethrin+confidor	300+100	1.00 a	0.40 c	0.46 b	0.60 b	0.86 bc
control		1.00 a	1.00 a	1.13 a	1.20 a	1.26 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 2. Comparative efficacies of four insecticides after second application on jassid, *A. biguttula biguttula*

Treatments	(mL/acre)	Adults jassid per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	1.26 a	0.80 c	0.86 c	1.06 b	1.13 b
cypermethrin	300	1.20 ab	1.06 b	1.13 a	1.20 b	1.26 b
deltaphos+confidor	600+300	0.80 c	0.20 d	0.33 b	0.46 c	0.66 c
cypermethrin+confidor	300+100	0.86 bc	0.26 d	0.40 d	0.66 c	0.86 c
control		1.26 a	1.27 a	1.40 a	1.46 a	1.66 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 3. Comparative efficacies of four insecticides after third application on jassid, *A. biguttula biguttula*

Treatments	(mL/acre)	Adults jassid per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	1.13 b	0.72 b	1.00 b	1.20 b	1.40 b
cypermethrin	300	1.26 b	0.86 b	1.00 b	1.06 b	1.33 b
deltaphos+confidor	600+300	0.66 c	0.20 c	0.33 c	0.33 d	0.53 c
cypermethrin+confidor	300+100	0.86 c	0.13 c	0.46 c	0.60 c	0.80 c
control		1.66 a	1.73 a	1.80 a	1.86 a	2.06 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Whitefly

Our findings showed that none of the insecticides either used alone or in combinations gave a drastic control against whitefly (tables 4-6). These results are in accordance with those of (Cahill *et al.*, 1994; Singh *et al.*, 1998; Assad *et al.*, 1999; Jadhav *et al.*, 1999; Ahmad, 1999; Mushtaq Ahmad *et al.*, 2000; Mushtaq Ahmad *et al.*, 2002) that whitefly had developed resistance against cypermethrin, deltamethrin, and other conventional insecticides. All the chemicals were at par for the control of whitefly as well as there is no significant difference in effectiveness among these. In contrast (Mohammad *et al.*, 2008) reported that confidor gave 87.82% control against whitefly even 168 h after treatment.

Table 4. Comparative efficacies of four insecticides after first application on whitefly, *B. tabaci*

Treatments	(mL/acre)	Adults whitefly per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	6.26 a	6.80 b	7.06 ab	7.13 b	7.13 bc
cypermethrin	300	7.13 a	7.00 b	6.93 bc	6.86 bc	6.93 c
deltaphos+confidor	600+300	8.00 a	6.13 b	6.86 bc	6.40 c	6.93 c
cypermethrin+confidor	300+100	8.93 a	6.33 b	6.13 c	6.80 bc	0.86 bc
control		7.86 a	7.93 a	7.93 a	8.00 a	8.13 b

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 5. Comparative efficacies of four insecticides after second application on whitefly, *B. tabaci*

Treatments	(mL/acre)	Adults whitefly per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	7.13 bc	6.60 bc	7.53 b	6.86 bc	7.13 b
cypermethrin	300	6.93 c	7.13 b	7.53 b	7.06 bc	7.06 b
deltaphos+confidor	600+300	6.93 c	5.86 c	7.46 b	6.40 c	6.66 b
cypermethrin+confidor	300+100	10.00 a	6.13 c	7.66 b	7.60 ab	8.06 a
control		8.13 b	8.06 a	8.26 a	8.13 a	8.53 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 6. Comparative efficacies of four insecticides after third application on whitefly, *B. tabaci*

Treatments	(mL/acre)	Adults whitefly per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	7.13 b	7.80 a	7.73 a	7.53 b	7.93 a
cypermethrin	300	7.06 b	7.46 a	7.86 a	7.66 b	7.93 a
deltaphos+confidor	600+300	6.66 b	7.69 a	7.53 a	7.66 b	7.86 a
cypermethrin+confidor	300+100	8.06 a	7.80 a	7.73 a	8.00 b	8.20 a
control		8.53 a	8.46 a	8.60 a	8.73 a	8.73 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Thrips

Our results showed that deltaphos + confidor mixture gave maximum control against thrips for 168 h after treatment followed by cypermethrin + confidor for the same time period. Cypermethrin and deltaphos when used alone against thrips did not give good control (tables 7-9) hence did not produce statistically significant results when compared with the check.

Table 7. Comparative efficacies of four insecticides after first application on thrips, *T. tabaci*

Treatments	(mL/acre)	Adults thrips per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	11.26 a	9.13 b	9.26 b	9.53 b	10.27 a
cypermethrin	300	11.60 a	9.26 b	9.00 b	9.33 b	10.13 a
deltaphos+confidor	600+300	9.80 a	1.53 d	1.86 d	2.73 d	6.26 c
cypermethrin+confidor	300+100	9.33 a	3.66 c	4.60 c	6.40 c	8.26 b
control		10.46 a	10.47 a	10.53 a	10.93 a	11.00 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 8. Comparative efficacies of four insecticides after second application on thrips, *T. tabaci*

Treatments	(mL/acre)	Adults thrips per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	10.27 a	8.40 b	8.93 b	9.40 b	9.73 b
cypermethrin	300	10.13 a	8.66 b	8.86 b	9.00 b	9.20 b
deltaphos+confidor	600+300	6.26 c	1.53 c	2.13 d	3.06 d	4.13 d
cypermethrin+confidor	300+100	8.26 b	2.60 c	3.80 c	4.86 c	6.73 c
control		11.00 a	10.93 a	11.07 a	11.27 a	11.33 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 9. Comparative efficacies of four insecticides after third application on thrips, *T. tabaci*

Treatments	(mL/acre)	Adults thrips per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	9.73 b	7.40 b	7.93 b	8.40 b	9.20 b
cypermethrin	300	9.20 b	7.73 b	7.87 b	8.26 b	8.73 c
deltaphos+confidor	600+300	4.13 d	1.86 d	2.06 d	2.46 d	2.93 e
cypermethrin+confidor	300+100	6.73 c	3.06 c	3.53 c	4.13 c	4.86 d
control		11.33 a	11.40 a	11.47 a	11.53 a	11.73 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

The present studies are in partial agreement with (Aslam *et al.*, 2004; Mohammad *et al.*, 2005; Mohammad *et al.*, 2008) who reported that confidor alone gave better control for longest period i.e. 7 days after treatment. Our results also favour the findings of (Wahla *et al.*, 1997), who reported that confidor was excellent against thrips. Our results are in full conformity with (Mohammad *et al.*, 2005) who reported that deltaphos gave least control against thrips.

Spotted bollworm

Our results indicate that all insecticides whether used alone or in mixture controlled spotted bollworms at similar levels and no significant difference was observed among their efficacy against

spotted bollworm for 168 h after treatment. Moreover the efficacies of all insecticides gradually decreased when the same scheme of insecticides were repeated in second and third applications (tables 10-12). Our studies are in line with (Aslam *et al.*, 2004) who reported that confidor + betacyfluthrin gave maximum control against spotted bollworm whereas deltaphos did not give significant control by showing 43.13% mortality at 168 h day after treatment. Similarly findings of (Mohammad *et al.*, 2005) also support our results who reported that cypermethrin did not give significant control against spotted bollworm.

On the basis of the results obtained in the present study it can be concluded that deltaphos + confidor proved the best for the control of insect pest complex of cotton followed by cypermethrin + confidor mixture.

Table 10. Comparative efficacies of four insecticides after first application on spotted bollworm, *E. insulana*

Treatments	(mL/acre)	Adults spotted bollworm per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	1.53 a	0.20 b	0.40 bc	0.73 c	0.93 b
cypermethrin	300	1.46 a	0.33 b	0.53 b	0.86 b	0.86 b
deltaphos+confidor	600+300	1.33 a	0.13 b	0.26 c	0.60 d	0.86 b
cypermethrin+confidor	300+100	1.66 a	0.33 b	0.40 bc	0.73 c	0.93 b
control		1.66 a	1.73 a	1.66 a	1.60 a	1.73 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 11. Comparative efficacies of four insecticides after second application on spotted bollworm, *E. insulana*

Treatments	(mL/acre)	Adults spotted bollworm per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	0.93 b	0.06 b	0.20 b	0.26 c	0.66 b
cypermethrin	300	0.86 b	0.13 b	0.20 b	0.40 bc	0.60 b
deltaphos+confidor	600+300	0.86 b	0.06 b	0.20 b	0.40 bc	0.60 b
cypermethrin+confidor	300+100	0.93 b	0.13 b	0.33 b	0.53 bc	0.73 b
control		1.73 a	1.73 a	1.66 a	1.87 a	2.00 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

Table 12. Comparative efficacies of four insecticides after third application on spotted bollworm, *E. insulana*

Treatments	(mL/acre)	Adults spotted bollworm per five plants per treatment				
		0 hr	48hr	72hr	96hr	168hr
deltaphos	600	0.66 b	0.06 b	0.13 b	0.26 b	0.40 b
cypermethrin	300	0.60 b	0.13 b	0.20 b	0.33 b	0.46 b
deltaphos+confidor	600+300	0.60 b	0.00 b	0.13 b	0.26 b	0.40 b
cypermethrin+confidor	300+100	0.73 b	0.13 b	0.20 b	0.40 b	0.60 b
control		2.00 a	2.00 a	2.06 a	2.20 a	2.26 a

Means shearing a letter in common do not differ significantly at 5% probability level (DMR test)

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