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Efficacy of Some Insecticides Against Whitefly (*Bemisia tabaci* Genn.) Infesting Cotton under Field Conditions

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Abstract

Seven insecticides, viz. Megamos 20SL, Actara 25WG, Polo 500SC, Sitara 25WP, Nighaban 20EC, Thiodan 35EC and Confidor 200SL were evaluated at their field recommended doses for their efficacy against whitefly (*Bemisia tabaci* Genn.) on cotton, at the farmer's field in Dera Ghazi Khan during 2007. The insecticides were applied at ETL's of whitefly. All the test insecticides caused significant mortality of whitefly up to 7 days after treatment. However, the most effective insecticides for whitefly, up to seven days were Megamos and Confidor, while Actara remained least effective and the others showed less than 50 % mortality throughout the experiment.

Keywords: Efficacy, insecticides, *Bemisia tabaci*, *Gossypium hirsutum*.

Introduction

Cotton (*Gossypium hirsutum* L.) is one of the most important fiber and cash crop of Pakistan. In 2007 cotton crop was grown over an area of 3054 thousand hectares with production of 11655 thousand bales (Anonymous, 2008). Pakistan has made progress by increasing yield up to 641 Kg per hectare in 1992 - 2000 (Jiskan, 2001). Still the yield per hectare is less than many other cotton growing countries. Among a variety of reasons of low yield, the magnitude of insect-pests, which damage (average 5-10 percent damage) the cotton crop from sowing to maturity, plays an important role. The severe attack of insect-pests causes heavy qualitative and quantitative yield losses varying from 40-50% (Naqvi, 1976). With the increasing trend of transgenic cotton in Pakistan, the farmers are facing problems regarding sucking pest complex for which they have to adopt intensive control methods mainly relying on chemical control. Among sucking pest complex whitefly is the most notorious and key pest. Cotton whitefly (*Bemisia* ways i.e., by constantly sucking the cell sap resulting in 50% reduction in boll production, by secreting honeydews on which sooty mold develops (Ahmad *et al*., 2002) and also acting as a vector of leaf curl virus disease (CLCuV) (Nelson *et al*., 1998). The average yield loss in Pakistan caused by CLCuV was reported to be 38.7 % during 1993 (Khan and Khan, 1995), which is threatening our cotton-based economy. There are different pest control tactics, but the most common and quicker one is that of chemical control which is generally adopted by our farming community. Chemical control of the pests becomes imperative when all other control methods fail to control the target pests but on the other hand indiscriminate use of insecticides has not only caused the resistance problem in these pests but it has also polluted the environment along with other health hazards. (Bashir *et al*., 2001 & Raza and Afzal, 2000). Therefore, the judicious and effective use of chemicals at proper time is most important. Afzal *et al*. (2002) tested five insecticides under field conditions against cotton whitefly and jassid at recommended doses on variety NIAB-Karishma. For whitefly and jassid Baythroid TM 525 SC (cyfluthrin + methamidophos) proved to be the best and the Solax (alphacypermethrin) to be the least effective against the two pests. The previous investigations about the efficacy of different insecticides in controlling cotton whitefly have been done by various workers viz., Afzal *et al*., 2001; Ahmad and Hussain, 1993; Attique and Ghaffar, 1996; Natwick, 1999; Saleem *et al*., 2001; Aslam *et al*., 2003; Aslam *et al*., 2004 and Khattak *et al*., 2006. Keeping in view the above information of chemicals against different sucking insect-pests the present studies were conducted to evaluate the efficacy of some market available insecticides against cotton whitefly so that practical recommendations could be made on the basis of relative toxicity of spray.

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Materials and Methods

The experiment was conducted at the farmer's field in Dera Ghazi Khan during 2007 to test the efficacy of seven different insecticides namely, Megamos 20SL (acetamaprid), Actara 25WG (thiamethoxam), Polo 500SC (diafenthiuron), Sitara 25WP

(buprofezin), Nighaban 20EC (fenpropathrin), Thiodan 35EC (endosulfon) and Confidor 200SL (imidacloprid) against whitefly on cotton variety, CIM-496, sown on June 21, 2007. The experiment was laid out in Randomized Complete Block Design including control. The insecticides used in the present experiment were obtained from the local market and were sprayed at field recommended doses when the population of pest reached the economic threshold level. The ETL for whitefly was considered as five adults/ nymphs per leaf. There were 8 treatments including control, having 3 repeats each and 3 rows of each treatment, in each replicate. The plot size was kept as 7.5 ft x 18.0 ft. The field recommended doses of the insecticides as presented in Table 1 were sprayed with hand operated knapsack sprayer having 20 liters capacity fitted with hollow cone nozzle. The control plots were sprayed with water only. The sprayer was calibrated using simple water by calculating the amount of water required for spraying on a unit area prior to experiment. All agronomic practices like irrigation, fertilizer applications etc. were kept uniform throughout the experiment on all plots. Twelve plants were selected, at random, per treatment/plot for recording pest population early in the morning. Three leaves, one each from upper, middle and lower portions of plants were observed for the pest activity (both adults and nymphs) during every observation. To study the efficacy of different insecticides, population of whitefly was recorded by the same method a day before and 1, 3 and 7 days after treatment. Percent population mortality was corrected and calculated by using modified Abbot's formula (Flemings and Ratnakaran, 1985) as below:

$$\% \text{ Corrected mortality} = 1 - \left(\frac{\text{Post - spray population in treatment}}{\text{Pre - spray population in treatment}} \times \frac{\text{pre- spray population in control}}{\text{post-spray population in control}} \right) \times 100$$

The data collected so was subjected to analysis of variance (ANOVA) and the means were separated by DMR test ($P \leq 0.05$).

Results and Discussion

All tested insecticides (Table 1) caused significant mortality of whitefly population even 7 days after spray. Megamos was statistically highly effective with mortality of 85.09 % followed by Confidor, Sitara, Polo, Thiodan, Nighaban and Actara with mortality of 80.12%, 48.22%, 47.61%, 47.14%, 33.90% and 26.99% respectively, 1 day after spray. The mortality percentage of whitefly caused by Sitara, Polo and Thiodan were statistically at par while the Actara was least effective for whitefly control. The Megamos was again significantly ($P=0.05$) better with mortality of 74.52% than the other tested insecticides like Confidor, Sitara, Thiodan, Polo, Nighaban and Actara with mortality of 71.52%, 42.53%, 41.76%, 41.01%, 33.90% and 20.79% respectively three day after spray. The trend of whitefly reduction by the insecticides decreased and remained almost similar to the previous one with Sitara, Polo, and Thiodan remained statistically similar in their efficacy against whitefly on cotton (Table 2). The insecticides 7 days after spray showed gradual reduction in %age mortality of the whitefly population as compared to that of 1 and 3 days after spray. However, the results were almost similar with the previous ones viz., Megamos being better against whitefly with 66.69% mortality followed by Confidor (64.09%), Sitara (40.81%), Thiodan (39.62%), Polo (38.58%), Nighban (27.14%) and Actara (18.29%) respectively. Furthermore, the population of whitefly in the control plots on 7 days after spray was relatively more as compared to the control on 1 and 3 days after spray (-3.22 % mortality).

The collective results (Fig. 1) showed that all the test insecticides effectively controlled whitefly up to 7 days after spray but the most effective among all was Megamos from statistical point of view and practically from field view point Confidor was also effective causing more than 80% mortality of whitefly. The other test insecticides showed intermediate results i.e. less than 50% mortality of the test insect and were almost statistically equally effective except Nighaban and Actara. Actara remained least effective throughout the experiment.

These results are in conformity with those of Horowitz *et al*. (1998), Natwick (1999), Natwick and Deeter (2001), Parrish (2001) and Aslam *et al*. (2003) who observed significant mortality of whitefly with the application of acetamiprid. Mustafa (2000) found that Mospilan, polo and confidor resulted almost 72.76% mortality of whitefly. The finding of the present studies disagree the results of Mohan and Katiyar (2000) who stated that confidor was the most effective in suppressing the whitefly population and its continuous use resulted in increased whitefly population due to development of resistance in this pest against imidacloprid.

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Table 1. Different insecticides used against cotton whitefly (*Bemisia tabaci* Genn.) with respective doses per acre.

S. No.	Insecticides with formulation	Dose (ml or gm/acre)
1	Megamos 20SL (acetamiprid)	125
2	confidor 200SL (imidacloprid)	250
3	Actara 25WG (thiamethoxam)	24
4	Polo 500SC (diafenthiuron)	250
5	Sitara 25WP (buprofezin)	600
6	Nighaban 20EC (fenpropathrin)	125
7	Thiodan 35EC (endosulfon)	1000
8	control	-

Table 2. Mean percent mortality of whitefly after application of different insecticides on cotton.

Treatments	Mean population (leaf^{-1}) before spray	Mean % mortality of Whitefly		
		1 DAT	3 DAT	7 DAT
Megamos 20SL	6.2	85.09 a	74.52 a	66.69 a
confidor 200SL	6.2	80.12 b	71.52 b	64.09 b
Sitara 25WP	6.2	48.22 c	42.53 c	40.81 c
Polo 500SC	6.2	47.61 c	41.01 c	38.58 c
Thiodan 35EC	6.2	47.14 c	41.76 c	39.62 c
Nighaban 20EC	6.2	33.90 d	33.90 d	27.14 d
Actara 25WG	6.2	26.99 e	20.79 e	18.29 e
control	6.2	3.75 f	1.62 f	-3.22 f

Each value is a mean of three replications. Means sharing similar letters in columns are not significantly different by DMR test (P=0.05)
DAT= day after treatment.

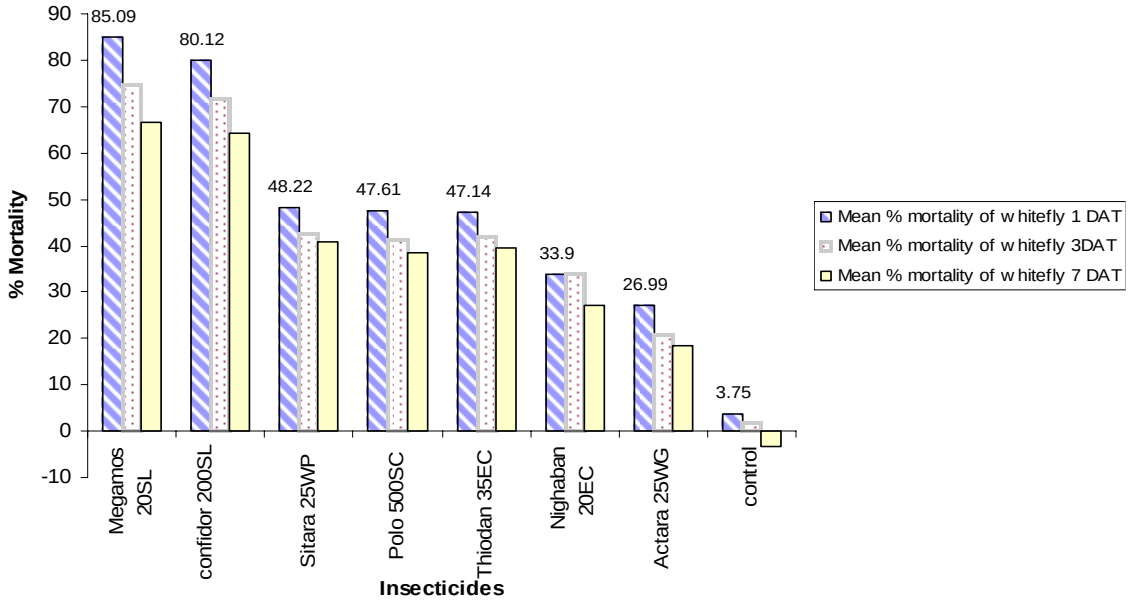

Fig.1 % Mortality of whitefly by different insecticides