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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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# Bio-Efficacy of New Insecticides Against Whitefly, *Bemisia tabaci* (Genn.) on Cotton, Bt-121

Muhammad Afzal[1], Muhammad Hussnain Babar[2], Ibrar-UL-Haq[2] and Zafar Iqbal[2]
[1]Department of Zoology, Government College University, Faisalabad, Pakistan
[2]Entomological Research Institute, Faisalabad, Pakistan

**Abstract:** A study was carried out to determine the comparative efficacy of five new insecticides viz., diafenthiuron (polo 50%SC), thiamethoxam (actara 25%WG), acetamiprid (diamond 20%SP), imidacloprid (confidor 20%SL) and thiacloprid (calypso 24% OD) at field recommended doses against whitefly, *Bemisia tabaci* (Genn.) on cotton variety Bt-121 grown at farmer field on 25th May, 2009 at Chak No. 253/R.B, Faisalabad. Insecticides sprayed when population of whitefly reached to economic threshold level (ETL) i.e., 4-5/leaf. The data regarding mean number of whitefly per leaf was taken and converted in to mean percentage mortality to find out differences among the treatments. The results of present study showed that Imidacloprid, diafenthiuron, acetamiprid and thiamethoxam were most effective insecticides against whitefly up to seven days after application. While, Imidacloprid and diafenthiuron gave maximum mortality during first spray (89.52 and 85.80%) and second spray (91.67 and 87.51%) after 72 h of application.

**Key words:** Whitefly, insecticides, bio-efficacy, cotton (Bt-121)

## INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is the most important cash crop in Pakistan, which is cultivated on 2.879 million hectares and is the source of large amount of foreign exchange, contributing about 7.0% of value added in agriculture and about 1.5% of GDP and contributes about 66.50% share in national oil production (Anonymous, 2013). Last few decades bollworm attack on cotton was a serious problem but, with the introduction of Bt varieties of cotton in Pakistan, this problem has been solved to some extent and a significant change in cropping scheme in the cotton growing areas has been observed (Ahsan and Altaf, 2009; Abdullah, 2010). But the problem of sucking insect pests attack is remained unsolved still now. Among them whitefly, *Bemisia tabaci* is most destructive sucking pest (Amin *et al*., 2008).

It sucks the cell sap and deposits the droplets of honeydew on leaves, which provide a suitable condition for sooty mold development, as a result it inhibits the foliar photosynthesis and reduces yield and quality (Bohmfalk *et al*., 1996; Bi *et al*., 2001).

The conventional insecticides including OPs and carbamates have shown resistance to whitefly (Ahmad *et al*., 2010), an intensive research have been carried out for evaluating new insecticides with novel mode of action against whitefly and cause minimum health hazards to mammals and safer for natural enemies (Nauen *et al*., 1999).

Novel insecticides including growth regulators and neonicotinoids proved most effective as compared with conventional insecticides on Bt cotton against cotton white fly, so far these insecticides are considered less toxic to the predators of sucking insects pests (Aheer *et al*., 2000; Aslam *et al*., 2004; Solangi and Lohar, 2007; Asi *et al*., 2008; Frank, 2012). The neonicotinoids are a new class of insecticides, which includes the commercial products imidacloprid, acetamiprid, thiacloprid and thiamethoxam. These insecticides are important to agriculture because of their activity against sucking insects (Iwasa *et al*., 2004; Anikwe *et al*., 2009; Zhang *et al*., 2011; Carvalho *et al*., 2010).

In Pakistan, pesticides worth more than 10 billion rupees are imported, out of which about 70-80% are sprayed against cotton pests (Anonymous, 2008). It is the dire need to use the new-chemistry insecticides which are not only control the target insect pest but also safer for the beneficial insects like ladybird beetle, spider, *Chrsoperlla* spp, *Trichogramma* spp and for human being also. Present study was therefore conducted to compare the efficacy of new-insecticides at different time intervals, against whitefly, under the field conditions on cotton variety Bt-121.

## MATERIALS AND METHODS

Experiments on comparative efficacy of new insecticides against whitefly, *B. tabaci* (Genn.) on cotton (Bt-121) were conducted on field grown cotton (Bt-121) at Chak No. 253/R.B, Faisalabad. To conduct the study 6 rows of cotton crop (75 cm apart) were selected keeping the net plot size 10 x 5 m for each treatment including untreated check. Two rows were left as non-experimental area

**Corresponding Author:** Muhammad Afzal, Department of zoology, Government College University, Faisalabad, Pakistan

between the treatments. There was also distance of 2 m between the replications. The population of *B. tabaci* was recorded by leaving one row on each side of the treatment early in the morning. For this purpose 15 plants were selected randomly. Insects were counted from the upper leaf of 1st plant, middle leaf of 2nd plant and lower leaf of 3rd plant and so on (Razaq *et al*., 2003). Insecticides (Table 1) were sprayed in recommended doses when the population of whiteflies reached at economic threshold level (ETL) i.e. whitefly 4–5/ leaf, respectively (Ahmad, 1999). Insecticides were dissolved in water to prepare insecticide solutions on v/v and w/v basis. The crop was sprayed in the morning before 9 am. The data regarding the population of *B. tabaci* were recorded from each plot before spray and 24, 72 h and 1 week after application of insecticides and mean percentage mortality was calculated. The data were analyzed by using analysis of variance techniques (Steel *et al*., 1997). The treatment means were compared by applying Tukey's HSD test at 5% significance level.

## RESULTS AND DISCUSSION

After 1st spray, mean percentage mortality of whitefly was recorded at different time interval after the application of five insecticides viz. diafenthiuron (polo 50%SC), thiamethoxam (actara 25%WG), acetamiprid (diamond 20%SP), imidacloprid (confidor 20%SL) and thiacloprid (calypso 24% OD). The results in Table 2 revealed that all the treatments caused significant mortality of whitefly even at 168 hours after spray. After 24 h of spray, the mean value data revealed that confidor and Polo were proved highly effective insecticides with maximum mortality 81.88 and 80.88% which were statistically at par with other, followed by diamond (76.85%), Actara (70.80%) and calypso (67.43%), respectively. After 72 h of application the efficacy increased, where Confidor, gave maximum mortality (89.52%) followed by Polo, diamond, actara and calypso with mortality of 85.80, 83.48, 79.02 and 74.56%, respectively against whitefly. While after 7 days of application efficacy decreased and Confidor gave 78.49% mortality, followed by Polo diamond, actara and calypso with mortality of 75.57, 73.18, 66.74 and 63.83%, respectively.

The results of mean percentage mortality of whitefly after 2nd spray are presented in Table 3. The results revealed that all the treatments caused significant mortality of whitefly even at 168 hours after spray. After 24 h of spray, the mean value data revealed that confidor and Polo were proved highly effective insecticides with maximum mortality 83.87 and 81.70%, which were statistically at par with other, followed by diamond (77.86%), Actara (73.34%) and calypso (69.80%), respectively. After 72 hours of application the efficacy increased, where Confidor, gave maximum mortality (91.67%) while Polo and diamond gave 87.51 and 85.35 % mortality which were statistically at par with other, while minimum mortality was recorded in calypso i.e., 75.93% respectively. While after 7 days of application efficacy decreased and Confidor gave 79.47% mortality, followed by Polo diamond, actara and calypso with mortality of 73.19, 71.64, 68.29 and 66.47%, respectively.

Table 1: Following five selected insecticides were applied against whitefly at the recommended doses

| Common name | Trade name | Dose/acre |
|---|---|---|
| Diafenthiuron | Polo 50%SC | 200 mL |
| Thiamethoxam | Actara 25%WG | 24 gm |
| Acetamiprid | Diamond 20%SP | 125 gm |
| Imidacloprid | Confidor 20%SL | 250 mL |
| Thiacloprid | Calypso 24% OD | 250 mL |
| Check (control) | - | - |

Table 2: Comparison of mean percentage mortality of whitefly after different time intervals in 1st spray

| Treatments | ---------- Mean percentage mortality of whitefly ---------- | | | | |
|---|---|---|---|---|---|
| Trade names | Common names | After 24 h | After 72 h | After 7 days | Means |
| Diafenthiuron | Polo 50%SC | 80.88±1.02$^{a}$ | 85.80±0.95$^{b}$ | 75.57±0.69$^{b}$ | 80.75±2.95$^{a}$ |
| Thiamethoxam | Actara 25%WG | 70.80±0.56$^{c}$ | 79.02±0.39$^{d}$ | 66.74±0.92$^{c}$ | 72.19±3.61$^{bc}$ |
| Acetamiprid | Diamond 20%SP | 76.85±0.24$^{b}$ | 83.48±0.57$^{c}$ | 73.18±0.56$^{b}$ | 77.83±3.01$^{ab}$ |
| Imidacloprid | Confidor 20%SL | 81.88±0.31$^{a}$ | 89.52±0.59$^{a}$ | 78.49±0.43$^{a}$ | 83.30±3.26$^{a}$ |
| Thiacloprid | Calypso 24%OD | 67.43±0.60$^{d}$ | 74.56±0.70$^{e}$ | 63.83±0.17$^{c}$ | 68.61±3.15$^{c}$ |
| Check (Control) | - | 0.00$^{e}$ | 0.00$^{f}$ | 0.00$^{d}$ | 0.00$^{d}$ |
| LSD | | 2.0722 | 1.7067 | 1.8413 | 4.6882 |

Means sharing similar letters in each column are not different significantly (Tukey's HSD, p>0.05)

Table 3: Comparison of mean percentage mortality of whitefly after different time intervals in 2nd spray

| Treatments | ---------- Mean percentage mortality of whitefly ---------- | | | | |
|---|---|---|---|---|---|
| Trade names | Common names | After 24 h | After 72 h | After 7 days | Means |
| Diafenthiuron | Polo 50%SC | 81.70±0.70$^{a}$ | 87.51±0.81$^{b}$ | 73.19±0.58$^{b}$ | 80.80±4.15$^{ab}$ |
| Thiamethoxam | Actara 25%WG | 73.34±0.65$^{c}$ | 80.72±0.45$^{c}$ | 68.29±0.39$^{c}$ | 74.11±3.60$^{bc}$ |
| Acetamiprid | Diamond 20%SP | 77.86±0.99$^{b}$ | 85.35±0.51$^{b}$ | 71.64±0.56$^{b}$ | 78.28±3.96$^{abc}$ |
| Imidacloprid | Confidor 20%SL | 83.87±0.72$^{a}$ | 91.67±0.46$^{a}$ | 79.47±0.48$^{a}$ | 85.00±3.56$^{a}$ |
| Thiacloprid | Calypso 24%OD | 69.80±0.96$^{d}$ | 75.93±0.53$^{d}$ | 66.47±0.34$^{c}$ | 70.74±2.77$^{c}$ |
| Check (Control) | - | 0.00$^{e}$ | 0.00$^{e}$ | 0.00$^{d}$ | 0.00$^{d}$ |
| LSD | | 1.9628 | 2.0317 | 1.5300 | 5.8166 |

Means sharing similar letters in each column are not different significantly (Tukey's HSD, p>0.05)

The findings of present study showed that confidor gave the best results after 72 h of application during both spray among all the insecticides used in current study which are in accordance with the previous studies (Mohan and Katiyar, 2000; Tayyib *et al*., 2005; Mohammad *et al*., 2008; Shivanna *et al*., 2011; Shaikh and Patel, 2012; Iqbal *et al*., 2013) they found that Confidor significantly suppressed whitefly population in cotton. Khattak *et al*. (2004) also supported our study who found that Confidor and polo showed significant reduction in the whitefly population at 24, 72 h and even 120 h after spray. In current study Polo proved effective insecticide after confidor against whitefly which is matched with the previous studies conducted by Mustafa (2000) and Asi *et al*. (2008), they reported that Polo was highly effective against sucking insect pests of cotton. Abbas *et al*. (2012) also confirmed that Confidor, Actara and diamond proved to be highly effective against whitefly. But our result were contrasting with Parrish (2001) and Aslam *et al*. (2003) who observed significant mortality of whitefly with the application of acetamiprid.

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