EFFECTIVENESS OF SOME INSECTICIDES AGAINST *Bemisia tabaci* (Genn) INFESTING SQUASH PLANTS

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**ABSTRACT:** The aim of this study was to investigate the efficiency of four pesticides against the white fly, *Bemisia tabaci*, infesting squash plants during the two growing seasons, 2017 and 2018, under field conditions. Results showed that the reduction percentages of the white fly, *B. tabaci* populations on squash plant during season 2017 caused by Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *Beauveria bassiana* were 86, 81.5, 72.25 and 86.66%, respectively, as mean residual effect. While, the initial reduction percentages for these pesticides were 98, 96, 93 and 0%, respectively. The general mean percentages of reduction caused by Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana* were 92, 88.75, 82.63 and 90.33%, respectively. The efficiency of the tested pesticides on white fly could be arranged according to their percentages of reduction in infestation in the follows order: Lambda cyhalothrin > *B. bassiana* > Thiamethoxam > Azadirachtin, respectively. Results also showed that all the tested pesticides significantly decreased the number of the white fly, *B. tabaci* in an irregular way compared to the untreated control. Results also cleared that all the tested pesticides caused decrease in white fly populations till 11th day after treatment. The general mean numbers of the white fly, *B. tabaci* were 18.4, 27.6, 35.8 and 20 individuals/sample for Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana*, respectively, comparing with 211.6 individuals/sample in control group.

**Key words:** White fly, squash, Lambda cyhalothrin, Thiamethoxam, Azadirachtin, *B. bassiana*.

**INTRODUCTION**

Vegetables are grown extensively in Egypt, and essential for a healthy and balanced diet, as well as adding variety, interest and flavor to the menu. But vegetables also attract a wide range of pests and diseases, and require intensive pest management.

About 87% of the farmers who grow vegetables in Egypt use pesticides (*Dinham, 2003*). Many of them spray the same wide range of pesticides on all vegetables and ignore pre-harvest intervals (*Ntow et al., 2006*). Sometimes farmers spray pesticides one day before harvest to sell ‘good-looking’ vegetables. This practice, in particular, exposes consumers to pesticides. Pesticides applied to food crops in the field can

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the plant vigor. Chlorotic spots appear at feeding sites on the leaf surface, followed by wilting and resulting leaf shedding. Such damage to foliage at the early stages of plant growth, affects development of the reproductive structures and consequently the yield may be greatly reduced. However, direct damage due to feeding would not appear to have been a matter of much concern, as reflected by the general lack of attention to this aspect in the literature.

Heavy colonization of *B. tabaci* can cause serious indirect damage to this crop due to honeydew excreted by all insect stages, particularly the late nymphal instars. Accumulation of honeydew on leaf or on fruit surfaces encourages growth of sooty moulds, which affect yield both in quantitative and qualitative terms (Basu, 1995).

The notoriety of *B. tabaci* as a pest obscured by its role as an efficient vector of a large number of important diseases of tomato in the tropical and subtropical parts of the world. The prevalence and distribution of *B. tabaci* viral maladies have increased during the past decade and the impact has often been devastating (Basu, 1995).

Due to virus diseases enormous yield loss of tomato is recoded all over the world described yellow leaf curl symptom in tomato leaves caused by a virus transmitted by white fly (*B. tabaci*) in Israel which was extensively studied by Cohen and Nitzany (1966) and named the virus as Tomato yellow leaf curl virus (TYLCV).

The white fly population during growing period of tomato plants contributes to the spread of virus in the field. TYLCV is not mechanically transmitted and genetic resistance in cultivated varieties is absent. Brunt et al., (1990) suggested that control of *B. tabaci* could be possible to a good extent by growing tomato seedling in insect proof net house. For profitable cultivation of tomato in Bangladesh, management of white fly is urgently needed. Among the various control practices in tomato plant to suppress the prevalence of white fly insecticides are the mostly used.

The synthetic pyrethroids are powerful contact insecticides with a quick knockdown effect, a highly deserved quality to inactivate vector individuals within the period required for virus transmission. Basu (1995) found that foliar sprays of a synthetic pyrethroid reduced the number of nymphs and adults of *B. tabaci* as a chemical measure to restrain tomato leaf curl virus disease.

Occurrence of white fly is very common in summer squash. But in recent years the problem has increased manifold. To combat the disease problem disseminating by white fly there is no effective management package or resistant variety available at present. Therefore, developing a sound and effective management package for white fly is urgently needed. Under the existing circumstances combination of physical and chemical approaches seem to be a better option for the management of white fly as reported by Basu (1995) in Bangladesh.

So that, the aim of this work was investigating the efficiency of Lambda cyhalothrin, Thiamethoxam, Azadirachtin and Beauveria bassiana against white fly infesting squash plants. During the seasons of (2017, 2018).

**MATERIALS AND METHODS**

**Tested Insecticides**

**Lambda cyhalothrin** (Lambda 5% EC)  
(obtained from Kafr El-Zayat Company for Pesticides and Chemicals 61 Al-Hussein Street, Mohandessin-Giza-Egypt)

**Thiamethoxam** (Actara25% wg)  
(obtained from Syngenta Agro Company 4 Yanbu Street - Dokki - Giza – Egypt)

**Azadirachtin** (Neem 1% EC)  
(obtained from Misr Agricultural Development Company (Hisham Abu Hussein), Kilo 89, Cairo Alexandria Desert Road - Sadat City)

**Beauveria bassiana** (Biovar)  
Obtained from bio insecticides production unit (BPU). Plant protection institute (PPRI) 7st. Dokky, Giza

**Field Studies**

The field studies were done to investigate the efficiency of some pesticides against white fly infesting squash plants.
The experiment was carried out at El-Ibrahimiya city during seasons of 2017 and 2018. Experiments were set at a randomized block design.

An area of 5 Kirate (875m²) was divided into 5 equal plots (4 treatments of pesticides and one as control). Motor sprayer was used to spray the tested pesticides with the recommended field rates. 30 leaves were taken at random from each plot. Counts of white fly were made just before treatment then after, 3, 7 and 14 days post treatment.

The reduction percentages of white fly population were calculated according to Henderson and Tilton (1955).

\[
\text{Reduction (\%)} = 1 - \frac{A \times C}{B \times D} \times 100
\]

Where:
A= number of individuals in treatment after application.
B= number of individuals in treatment before application.
C= number of individuals in control before application.
D= number of individuals in control after application.

**Statistical Analysis**

Data obtained were statistically analyzed. Duncans Multiple Range-test was used to determine the significant differences between the mean values of treatments according to Snedecor and Cochran (1989).

**RESULTS**

**Efficacy of the Tested Insecticides Against White fly, *Bemisia tabaci* Under Field Conditions**

**First season (2017)**

Results presented in Table 1 show that the mean number of *Bemisia tabaci* on squash plant decreased after treatment with all examined insecticides comparing with check control. The general mean numbers of *B. tabaci* individuals/30 leaves were 23.4, 35.2, 52.2 and 23.75 in cases of Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *Beauveria bassiana*, respectively, compared to the untreated control which was higher (218.4 individuals/30 leaves) than that of the sprayed plots.

As shown in Table 2, reduction percentages of *B. tabaci* on squash plant during season 2017 caused by Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana* reached 86, 81.5, 72.25 and 86.66 respectively, as mean residual reduction percentages. While, the initial reduction percentages for these treatments were 98, 96, 93 and 0%, respectively. The general mean percentages of reduction caused by Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana* were 92, 88.75, 82.63 and 90.33%, respectively. The tested white fly could be arranged according to their percentages of reduction in infestation in the follows order: Lambda cyhalothrin > *B. bassiana* > Thiamethoxam > Azadirachtin, respectively (Table 2).

**Second season (2018)**

Results tabulated in Table 3 show that all the tested pesticides significantly decreased the number of *B. tabaci* in an irregular way compared to the untreated control. Results also cleared that all white fly caused decrease till 11th day after treatment. The general mean numbers of *B. tabaci* were 18.4, 27.6, 35.8 and 20 individuals/sample for Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana*, respectively, comparing with 211.6 individuals/30 leaves in control.

Results presented in Table 4 indicate that the mean initial reduction percentages of *B. tabaci* population on squash plant after 24 hr., caused by Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana* were 100, 99, 95 and 0.0%, respectively. On the other hand, the mean reduction percentages of residual effect were 90.5, 86.5, 81.75 and 90.33% for the same tested white fly, respectively. While, the mean reduction percentages of accumulation effect (general effect) were 95.25, 92.75, 88.38 and 92.67% for Lambda cyhalothrin, Thiamethoxam, Azadirachtin and *B. bassiana*, respectively.
Table 1. Effect of the tested compounds against white fly, *Bemisia tabaci*, on squash plant at Elm-Ibrahimiya, Sharkia Governorate during summer season of 2017

| Tested compound               | Population No. before treatment | Mean No. of *Bemisia tabaci* after treatment (in days) (30 leaves) | General mean |
|-------------------------------|-------------------------------|---------------------------------------------------------------|--------------|
|                               |                               | 1 3 7 11 14                                                   |              |
| Lambda cyhalothrin 5% EC      | 254                           | 4 3 11 44 55                                                  | 23.4         |
| Thiamethoxam 25% wg           | 267                           | 11 21 24 56 64                                                | 35.2         |
| Azadirachtin 1% EC            | 270                           | 16 44 56 68 77                                                | 52.2         |
| *Beauveria bassiana*          | 249                           | 0.0 15 14 11 55                                               | 23.75        |
| Control                       | 256                           | 233 245 207 202 205                                           | 218.4        |
| LSD                           | 1.49                          | 1.48 0.64 1.84 1.14 1.49                                       |              |

Table 2. Reduction percentages of *Bemisia tabaci* caused by the tested compounds on squash plant at Elm-Ibrahimiya, Sharkia Governorate during summer season of 2017

| Tested compound               | Initial effect (%) | Reduction (%) of *Bemisia tabaci* after different periods (in days) (30 leaves) | Mean residual effect (%) | General reduction effect (%) |
|-------------------------------|---------------------|---------------------------------------------------------------------------------|--------------------------|----------------------------|
|                               |                     | 3 7 11 14                                                                        |                          |                            |
| Lambda cyhalothrin 5% EC      | 98                  | 99 95 78 72                                                                      | 86                       | 92                        |
| Thiamethoxam 25% WG           | 96                  | 92 89 75 70                                                                      | 81.5                     | 88.75                     |
| Azadirachtin 1% EC            | 93                  | 83 74 68 64                                                                      | 72.25                    | 82.63                     |
| *Beauveria bassiana*          | 0.0                 | 94 93 95 72                                                                      | 86.66                    | 90.33                     |

Table 3. Effect of the tested compounds against white fly *Bemisia tabaci* on squash plant at Elm-Ibrahimiya, Sharkia Governorate during summer season of 2018

| Tested compound               | Population No. before treatment | Mean No. of *Bemisia tabaci* after treatment (in days) (30 leaves) | General mean |
|-------------------------------|---------------------------------|---------------------------------------------------------------|--------------|
|                               |                                 | 1 3 7 11 14                                                   |              |
| Lambda cyhalothrin 5% EC      | 217                             | 0 3 12 35 42                                                  | 18.4         |
| Thiamethoxam 25% WG           | 227                             | 2 8 18 42 68                                                  | 27.6         |
| Azadirachtin 1% EC            | 205                             | 10 15 44 58 52                                                | 35.8         |
| *Beauveria bassiana*          | 216                             | 0.0 11 18 17 34                                               | 20           |
| Control                       | 197                             | 206 195 217 229 211                                            | 211.6        |
| LSD                           | 1.19                            | 1.26 2.57 1.40 1.68 1.39                                         |              |
Table 4. Reduction percentages of *Bemisia tabaci* caused by the tested compounds on squash plant at Elm-Ibrahimiya, Sharkia Governorate during summer season of 2018

| Tested compound          | Initial effect (%) | Reduction (%) of *Bemisia tabaci* after different periods (in days) 30 leaves | Mean residual effect (%) effect (%) |
|--------------------------|--------------------|--------------------------------------------------------------------------------|-------------------------------------|
|                          |                    | 3  | 7  | 11 | 14                |                                      |
| Lambda cyhalothrin 5% EC| 100                | 99 | 95 | 86 | 82                | 90.5                                | 95.25                               |
| Thiamethoxam 25% WG      | 99                 | 96 | 93 | 84 | 73                | 86.5                                | 92.75                               |
| Azadirachtin 1% EC       | 95                 | 93 | 81 | 76 | 77                | 81.75                               | 88.38                               |
| Beauveria bassiana       | 0.0                | 95 | 93 | 93 | 85                | 90.33                               | 92.67                               |

**DISCUSSION**

White fly has complex morphological traits depending on host biotypes, cultivars and environmental conditions (Legg, 1999). On this respect, white fly has an ability to adapt new environment and damage new hosts at different geographic regions (Basu, 1995). Heavy infestation leads to stunting and reducing vigor and growth of plants. There are different controlling strategies that have been adopted to control white fly on tomato since decades viz; biological control, cultural control, mechanical and chemical control (Jesse et al., 2007). The current results were confirmed by those of El-Naggar and Zidan (2013) who showed the effect of imidacloprid and thiamethoxam against sucking insect pest like white fly, jassids and aphids and reported the maximum reduction percentage at 40 days. Jamshid et al. (2015) compared the effect of datura alba 5% and *B. hystophorous* 5% with Imidacloprid 250g/acre against white fly on tomato and cotton and repoted that datura alba and *B. hystophorous* were more effective against white fly. Asi et al. (2008) tested confidor and polo against white fly, jassids and thrips were found them very effective on cotton and tomato crop comparing with Cascade at the interval of 24, 48 and 72 and 168 hrs.

Das and Islam (2014) found that imidacloprid, fipronil and buprofezin were exhibited high efficacy against white flies and jassids while, thiamethoxam + emamectin benzoate showed moderate efficacy.

Also, results of the current study are in conformity with those of Horowitz et al. (1998), Natwick (1999), Natwick and Deeter (2001), Parrish and Assial (2001) and Aslam et al. (2003) who observed significant mortality of white fly with the application of acetamiprid.

The tested insecticides showed variable effects on whiteflies and this may be due to the great variability in neonicotinoids characteristics influencing the movement in plant tissues such as water solubility which greatly affecting their toxicity especially on piercing sucking insect pests such as whiteflies (Cloyd and Bethke, 2011). The tested neonicotinoid insecticide also variably reduced whiteflies populations on squash either during first or second season. Based on the results obtained, it was noticed that the percentage reduction of whiteflies populations were higher in first season than second season. This may be due to the high temperature during the first cropping season. As revealed by Zheng and Liu (1999) who stated that when the surrounding temperature increase, the hydrolysis of neonicotinoid insecticides will increase and subsequently affect the toxicity levels.

Dey et al. (2005), Preetha et al. (2009), Yasmin et al. (2009), Raghuraman and Birah (2011) and Shinde et al. (2011) reported that imidacloprid is effective against whiteflies. Similarly Muhammad et al. (2005) also reported that imidacloprid and thiomethoxam are effective in controlling the white fly population. Naik and Shekharappa (2009),
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Meade and Bruce (1991) reported that *B. bassiana* and *Verticillium lecaniiito* be effective in managing the white fly population in okra. Similar to the present study, Muhammad et al. (2009) also reported imidacloprid and diafenthiuron to be effective against whiteflies.

On the other hand, flubendiamide and chlorantraniliprole showed low effect against white fly. While Liu (2004) reported that the spiromesifen showed excellent promise as a foliar spray against white fly infesting melons and collards. According to Nauen and Konanz (2005), the spiromesifen considered as an option for control management of white fly, *Bemisia* spp. in cotton. Palumbo (2009) revealed that the spray application of spiromesifen provided residual control of white fly, *B. tabaci* on spring cantaloupes. Al-Kherb (2011) showed the highest efficacy against white fly in cucumber and tomato with thiamethoxam which is partially agreed with the above results.

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فياللاة بعض المبيدات على الذبابة البيضاء التي تسبب الكوسنة

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تهدف هذه الدراسة إلى دراسة فعالية أربعة من مبيدات الأفات على الذبابة البيضاء التي تسبب نباتات الكوسنة خلال موسم 2017 و2018 تحت ظروف الجمل، أظهرت النتائج أن نسبة الخضوع في تعداد الذبابة البيضاء على نباتات الكوسنة خلال موسم 2017 بواسطة مبيدات ليمدا ويكازار والدي وميوبور كانت 87,25 , 81,50 و82,76 % على التولي و 94,66 و96 % على التولي وكأن المتوسط للمثير بواسطة لميادا ويكازار ودي وميوبور هي 92 , 88,75 و83,33 % على التولي، لذلك يمكن ترتيب المبيدات المحذرة من التزايد طبقاً لنسب الخضوع في تعداد الذبابة البيضاء كالتالي لميادا < ميوبور < إكترار < ودي، كما أظهرت النتائج أن المبيدات المحذرة احتفظت خصوصي في تعداد الذبابة البيضاء مقاومة بالكنترول، كما أظهرت النتائج أن المبيدات المحذرة احتفظت متوسط اعداد الذبابة البيضاء حتى اليوم الحادي عشر من المعاملة، وكان المتوسط العام لعداد الذبابة البيضاء هو 87,6 , 30,30 و 0,20 فرد لكل غنيه لمبيدات لميادا، اكترار، دي وميوبور على التولي مقارنة ب 211,6 فرد في تجربة المقارنة.

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