

## INSECTICIDAL EFFICIENCY OF SOME CHEMICAL COMPOUNDS ON THE WHITEFLY, *Bemisia tabaci* (Gennad.) INFESTING COTTON PLANTS AND ITS ASSOCIATED NATURAL ENEMIES

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### ABSTRACT

Several problems in controlling pests as well as pollution have been risen from the intensive use of insecticides. Therefore, this work was carried out at Sakha Agricultural Research Station during 2001 cotton growing season to evaluate the initial and residual effect of two chitin synthesis inhibitors (diafenthiuron and buprofezin), one conventional insecticides (Triazophos), two dinitromethelin derivative (Confidor and Best) and one insect growth regulator (Thiamethoxam) against cotton whitefly *Bemisia tabaci* (adult and immature stage) and their associated natural enemies summarized results showed the following:

Confidor and Best induced the highest initial reduction giving 84.2 and 82.7% respectively against immature stage of the whitefly, the rest of tested compound were ranged from (75.4 to 77.3 % reduction). Where Buprofezin and Confidor induced the highest residual activity on immature stage of whitefly, (73.77 and 72.9% reduction). For the effect on the mature stages Confidor and Best induced the highest initial and residual activity giving 81.8 and 80.6% and 71.5 and 67.5%, respectively. The other tested compounds caused initial activity ranged between (64.7 to 75.5% reduction), while they caused residual activity ranged between (47.6 to 61.8% reduction).

As for the side effect on the associated natural enemies, all tested compounds had no effect on all tested enemies (true spiders, *Coccinella undecimpunctata*, *Chrysoperla carnea* and *Paederus alfieri*).

### INTRODUCTION

At the past whitefly, *Bemisia tabaci* (Gennad.) has been considered a relatively insignificant member of the complex insect pests which attack cotton in Egypt, but recently this pest has become well known as a significant factor in the production of cotton. Control measures of whitefly are difficult because the immature stages develop on the undersides of the leaves and applications are usually ineffective in delivering control agents to the leaf undersides and lower leaf surfaces. Also there are several generations of *B. tabaci* in a season and its population appear to build resistance to conventional insecticides quickly (Akey *et al.*, 1992). Damage to cotton is predominately a result of honeydew produced by the insect and associated fungal growth that causes sticky cotton and lint staining which greatly reduces cotton grade (Perkins, 1987). During the past few years, control of whitefly *B. tabaci* has been based on conventional insecticides such as O.P., carbamates and pyrethroids compounds. However, these compounds were not efficient in controlling the pest, probably because of development of resistance. The introducing of IGRs compounds for controlling such pest was necessarily to overcome such phenomena. Several authors as. Radwan *et al.* (1985 a and b), Radwan *et al.* (1990), Ohno, (1992), Karkor *et al.* (1995), Awad *et al.*, (1996), El-Khawalka *et al.* (1996) and El-Hamady (1997) studied the effect of different products on whitefly population density.

The present work aimed to study the effect of six compounds belong to different chemical groups against whitefly and their side effect on natural enemies to avoid the problems of insecticides used.

## MATERIALS AND METHODS

The experiment was conducted during 2001 cotton growing season at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, to determine the efficiency of certain chemical treatments against cotton whitefly *Bemisia tabaci*, and their associated natural enemies. The field was cultivated with Giza 86 cotton variety. Every compound treatment comprised 4 replicates 1/100 feddan each. Plots were isolated from each other by unplanted corridors (in width). The chemicals were sprayed once on August 2001. Samples of 30 cotton leaves were randomly collected from the inner rows of each plot including the untreated check to estimate the population counts of whitefly. The upper and lower surfaces of the leaf were inspected immediately in the field and the number of adults were recorded. The same samples were taken to the laboratory to count the number of alive immature stages of whitefly using binocular microscope. Sampling and counting were made just before treatment, then after 2, 5, 10 and 15 days of spraying. Percent of reduction in infestation was estimated, using Henderson and Tilton (1955) equation, to determine the initial effect (after 2 days of spraying) and the residual effect (after the next dates) of the tested compounds.

The chemicals used and their rates of application were as follows:

1. Buprofezin (Applaud), 5% E.C. at 600 ml/fed. 2-[1,1-dimethylethyl] iminotetrahydro-3-(1-methyl ethyl)-5 phenyl-4-7, 3-5-thiadiazin 4-one].
2. Diafenthiuron (polo), 50% E.C. at 300 g/fed. N-[2-6 bis] (1-methylethyl-4-phenoxyphenyl)-N-(1,1-dimethylethyl) thiourea.
3. Imidacloprid (Confidor): 35% SCA dintro methelein derivative = 1-(6-chloro-3-pyridinyl) methyl-4, 5-dihydro-N-nitro-1H-imidazole-2-amine, at 75 ml/100 L.
4. Triazophos (Hostathion): 40%, EC an organophosphate compound = O, O-diethyl O-1-phenyl-1-H-1,2,4-triazol-3-yl phosphosothioate, at 1 litre/fed.
5. Thiamethoxan (Actar): IGR 25% WG at 20 gm/100 L.
6. Imidacloprid (Best): IGR 25% WP at 75 gm/100 L.

## RESULTS AND DISCUSSION

Data in Table (1) show the effect of the six tested compounds sprayed on cotton plants, against mature stages of *B. tabaci* as initial and residual activity. Concerning the initial effect (during the first two days after spraying), Confidor was the most effective toxicant giving 81.8% reduction in infestation. The other chemicals induced 80.6 to 64.7% reduction and could be arranged descendingly according to their initial activity as follows: Best (80.6%), Triazophos (75.5%), Diafenthiuron (72.4%), Buprofezin (70.5%), Thiamethoxan (64.7%). On the other hand, Confidor and Best showed the longest residual effect (during the next 13 days post treatment) recording 71.5 and 67.5% reduction in mature population, respectively. The descending order of residual activity of the rest toxicants was Buprofezin (61.8%), Thiamethoxan (53.6%), triazophos (48.9%) and Diafenthiuron (47.6%).

Table (1): Effect of various pesticides against mature stages of whitefly *B. tabaci* at the tested rates during 2001 season.

| Treatment    | Rate/fed.    | No. of whitefly mature stages/120 leaves. |        |        |         |         | % reduction |        |         |         | Residual effect | General mean |
|--------------|--------------|---|--------|--------|---------|---------|-------------|--------|---------|---------|-----------------|--------------|
|              |              | Before spray                              | 2 days | 5 days | 10 days | 15 days | IK          | 5 days | 10 days | 15 days |                 |              |
| Imidacloprid | 75 gm/100 L  | 737                                       | 157    | 199    | 197     | 128     | 80.6        | 73.1   | 65.7    | 63.7    | 67.5            | 70.8         |
| Confidor     | 75cm3/100 L  | 740                                       | 148    | 178    | 156     | 122     | 81.8        | 76.0   | 73.0    | 65.5    | 71.5            | 74.1         |
| Buprofezin   | 600 cm3/fed. | 642                                       | 208    | 182    | 200     | 143     | 70.5        | 71.8   | 60.1    | 53.4    | 61.8            | 64.0         |
| Thiamethoxam | 20 gm/100 L  | 675                                       | 261    | 284    | 253     | 159     | 64.7        | 58.1   | 51.9    | 50.7    | 53.6            | 56.4         |
| Diafenthuron | 300 gm/fed.  | 492                                       | 149    | 192    | 213     | 148     | 72.4        | 61.1   | 44.5    | 37.1    | 47.8            | 53.8         |
| Triazophos   | 1 L./fed.    | 487                                       | 131    | 175    | 198     | 152     | 75.5        | 64.2   | 47.9    | 34.7    | 48.9            | 55.8         |
| Untreated    | -            | 477                                       | 523    | 479    | 372     | 228     |             |        |         |         |                 |              |

Table (2): Effect of various pesticides against immature stages of whitefly *B. tabaci* at the tested rates during 2001 season.

| Treatment    | Rate/fed.    | No. of whitefly mature stages/120 leaves. |        |        |         |         | % reduction |        |         |         | Mean of residual effect | General mean |
|--------------|--------------|---|--------|--------|---------|---------|-------------|--------|---------|---------|-------------------------|--------------|
|              |              | Before spray                              | 2 days | 5 days | 10 days | 15 days | IK          | 5 days | 10 days | 15 days |                         |              |
| Imidacloprid | 75 gm/100 L  | 562                                       | 140    | 218    | 190     | 98      | 82.7        | 65.6   | 65.9    | 65.1    | 65.5                    | 69.8         |
| Confidor     | 75cm3/100 L  | 577                                       | 131    | 128    | 170     | 92      | 84.2        | 80.3   | 70.3    | 68.0    | 72.9                    | 75.7         |
| Buprofezin   | 600 cm3/fed. | 458                                       | 161    | 86     | 144     | 69      | 75.41       | 83.32  | 68.18   | 69.8    | 73.77                   | 74.18        |
| Thiamethoxam | 20 gm/100 L  | 571                                       | 187    | 246    | 211     | 106     | 77.3        | 61.7   | 62.7    | 62.8    | 62.40                   | 66.1         |
| Diafenthuron | 300 gm/fed.  | 488                                       | 155    | 117    | 215     | 83      | 77.0        | 77.8   | 53.6    | 64.5    | 65.3                    | 68.2         |
| Triazophos   | 1 L./fed.    | 428                                       | 149    | 151    | 192     | 90      | 75.8        | 68.7   | 54.7    | 57.9    | 60.3                    | 64.3         |
| Untreated    | -            | 453                                       | 653    | 510    | 449     | 226     |             |        |         |         |                         |              |

Table (3): Number of natural enemies per 100 cotton plant.

| Treatment    | Rate/fed.    | After spray  |     |    |        |     |    |        |     |    |         |     |    |         |     |    |
|--------------|--------------|--------------|-----|----|--------|-----|----|--------|-----|----|---------|-----|----|---------|-----|----|
|              |              | Before spray |     |    | 2 days |     |    | 5 days |     |    | 10 days |     |    | 15 days |     |    |
|              |              | T.S          | A.P | T  | T.S    | A.P | T  | T.S    | A.P | T  | T.S     | A.P | T  | T.S     | A.P | T  |
| Imidacloprid | 75 gm/100 L  | 11           | 8   | 17 | 1      | 3   | 14 | 10     | 3   | 13 | 8       | 3   | 11 | 13      | 1   | 14 |
| Confidor     | 75 cm3/100 L | 14           | 11  | 25 | 8      | 1   | 9  | 10     | 3   | 13 | 4       | 6   | 10 | 8       | 1   | 9  |
| Buprofezin   | 600 cm3/fed. | 11           | 11  | 22 | 17     | 5   | 22 | 5      | 6   | 11 | 5       | 1   | 6  | 8       | 5   | 13 |
| Thiamethoxam | 20 gm/100 L  | 9            | 12  | 21 | 9      | 6   | 15 | 9      | 7   | 16 | 7       | 3   | 10 | 9       | 4   | 13 |
| Diafenthuron | 300 gm/fed.  | 17           | 8   | 25 | 7      | 3   | 10 | 8      | 7   | 15 | 8       | 3   | 11 | 7       | 4   | 11 |
| Triazophos   | 1 L./fed.    | 18           | 11  | 29 | 5      | 2   | 7  | 6      | 3   | 9  | 11      | 4   | 15 | 7       | 7   | 14 |
| Untreated    | -            | 8            | 14  | 20 | 12     | 8   | 20 | 11     | 5   | 16 | 6       | 2   | 8  | 10      | 4   | 14 |

Where

TS = true spider

(AP= another predators (*Coccinella undecimpunctata*, *Chrysoperla carnea*, and *Paederus affierii*).

Regarding the effect against the immature stages, data in Table (2) showed that Confidor recorded the highest initial reduction (84.2%) followed descendingly by Best (82.7%), Thiamethoxam (77.3%), Diafenthuron (77.0%), Triazophos (75.8%), and Burprofezin (75.41%). Meanwhile, Burprofezin recorded the highest residual activity (73.77%), followed descendingly by Confidor (72.9%), Best (65.5%), diafenthuron (65.3%), Thiomethoxam (62.4%) and Triozophos (60.3%)

These results are in harmony with those of Nassef (2002) who found that alternative insecticides or that belonging to new chemical groups (dinitromethelin derivative) were effective for controlling whitefly *B. tabaci*. The results of Williams *et al.* (1997) indicated that *B. tabaci* populations throughout Arizona are susceptible to Confidor during 1995 and 1996 cotton seasons.

Data presented in Table (3) elucidate the side effect of the tested compounds on natural enemies when sprayed on cotton plants for controlling mature and immature stages of whitefly. Data indicated that the population density of true spiders was high than the other studied natural enemies (*Coccinella undecimpunctata*, *Chrysoperla carnea* and *Paederus affierii*). All tested compounds had no clear effect on all tested enemies.

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### التأثير الإبادى لبعض المركبات على الذبابة البيضاء فى حقول القطن والأعداء الحيوية المصاحبة لها

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تم إجراء هذا البحث بمحطة البحوث للزراعية بسخا لدراسة التأثير الإبادى الفورى والأثر الباقى لسنة من المركبات المختلفة على الأطوار الكاملة وغير الكاملة للذبابة البيضاء فى حقول القطن لسنة ٢٠٠١م وشملت المركبات المستعملة اثنين من مثبطات الكيتين ومبيد يتبع مجموعة المبيدات الفوسفورية العضوية ، ومركب من مشتقات الداينتروميثيلين بالإضافة إلى اثنين من منظمات النمو. وتم دراسة التأثير الجانبى على الأعداء الحيوية المصاحبة.

أوضحت النتائج بالنسبة للأطوار الغير كاملة للحشرة أن مركبى كونفيدور وبسنت قد أعطيا أعلى تأثير فورى بعد ٢ يوم من المعاملة (٨٤,٢% ، ٨٢,٧% إنخفاض) على الترتيب. كما أعطى كل من مركب كونفيدور وأبلود أعلى نسبة خفض بالنسبة للتأثير المتبقى بعد ١٥ يوم (٧٣,٧٧% ، ٧٢,٩% إنخفاض) على الترتيب. كما وضح من النتائج أن مركب كونفيدور وبسنت أعطيا أعلى نسبة خفض فى كل من الإبادة الفورية والأثر الباقى وذلك بالنسبة للطور الكامل للحشرة حيث كان الإنخفاض (٨١,٨% ، ٨٠,٦%) وذلك فى الإبادة الفورية ، (٧١,٥% ، ٦٧,٥%) وذلك فى الأثر الباقى على الترتيب.

وبالنسبة لباقى المركبات فقد تراوحت نسبة الخفض فى الإبادة الفورية بين (٦٤,٧% إلى ٧٥,٥%) بينما كانت تتراوح نسبة الإنخفاض من (٤٧,٦% إلى ٦١,٨%) وذلك فى الأثر الباقى. وبالنسبة للتأثير الجانبى على الأعداء الحيوية المصاحبة لآفة فإن جميع المركبات المختبرة لم يكن لها تأثير واضح على كل من العنكبوت المفترس والرواغة ولبر العيد وأسد المن.