

FIELD EVALUATION OF THREE BIO-ACARICIDES AGAINST THE TWO-SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH AND THEIR EFFECT ON THE DOMINANT PREDATORS IN EGYPTIAN COTTON FIELDS.

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ABSTRACT

*The efficacy of three bio-acaricides i.e. Vapcomic 1.8 % EC, Ortus 5 % SC and Bioranza 10 % WP using the recommended field rate were evaluated against the two-spotted spider mite, *Tetranychus urticae* Koch and their effect on the dominant predaceous insects and mites in cotton fields was also studied. The field experiments were carried out at Zagazig district, Sharkia Governorate, on cotton seedling (early season) and flowering stage (late season) during both two cotton seasons 2005 and 2006. The obtained results cleared that, Vapcomic was the highest toxicity on *T. urticae* and predators during both seasons followed by Ortus and Bioranza. In cotton seedling stage the average reduction percentages of *T. urticae* were 86.11, 84.89 and 54.47%, during season 2005, for Vapcomic, Ortus and Bioranza, respectively, 94.98, 84.34 and 55.28 % during season 2006, respectively. In flowering stage the average reduction percentages of *T. urticae* were 92.46, 85.29 and 56.11 % during first season, for above compounds respectively, 97.8, 86.55 and 54.53 % during the second season, respectively. As for predators, the same trend of toxicity was achieved from foregoing results. Data, could be detected that Vapcomic was more effective against predators than Ortus and Bioranza, during both seasons. The percent reduction of predators recorded 85.05, 61.97 and 34.3 % during cotton seedling stage for season 2005, respectively, 55.22, 45.32 and 32.75 % during season 2006, respectively. In the flowering stage the average percent reduction of predators recorded 67.97, 52.76 and 46.40 % during season 2005, respectively, 50.3, 23.92 and 17.72 % during season 2006, respectively.*

Keywords: *Tetranychus urticae*, Abamectin, Fenpyroximate, *Metarhizium anisoplae*.

INTRODUCTION

Cotton, *Gossypium barbadense* L. is the most economic field crops in Egypt which attacked by serious pests among which are the piercing sucking insects. The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) has been recorded on more than 150 hosts of economic value such as cotton, it causes many serious injury in cotton crop all over the world such as reduction in yield quantity and

fiber quality (Jeppson *et al.*, 1973 and Wilson, 1993). It has recently become a more serious problem due to continuous using pesticide (Young-Joon *et al.*, 1993) which causes reduction in populations of their natural enemies. In addition, the rise of resistance among mite populations necessitates the use of acaricides that are compatible with Integrated Pest Management (IPM) programs. The third problem is that induced secondary pest outbreak, for example *T. urticae* assumed a secondary pest on cotton in Egypt, in 1961 as result of using methyl parathion for controlling *Spodoptera littoralis* (Boisd.), the spider mite became primary pest (Dittrich, 1988). So, a research in recent years has been turning more towards selective bio-pesticides, because they are generally perceived to be safer than synthetics (Amason *et al.* 1989).

Therefore, the aim of the present study is to evaluate the efficiency of three bio-acaricides and their effect on common predators under field condition in Egypt.

MATERIALS AND METHODS

1. Tested compounds:

1.1. Abamectin (Vapcomic 1.8% EC)

Chemical name: 5-*O*- demethylavermectin A_{1a} mixture with 5-*O*-de- methyl-25-de (1-methylpropyl)-25- (1- methylethyle) avermectin A_{1a}.

Rate: 40 cm³ / 100 L.

Basic product: Vapco.

1.2. Fenpyroximate (Ortus 5% SC)

Chemical name: 1,1- dimethylethyl (E) - 4 - [[[(1,3 - dimethyl-5-phenoxy-1H-pyrazol- 4 -yl) methylene] amino] oxy] methyl] benzoate.

Rate: 50 cm³ / 100 L.

Basic product: Nihon Nohyaku.

1.3. *Metarhizium anisopliae* Sorok. (Bioranza 10% WP) (32×10⁶ spores / ml.)

Rate: 200 gm. / 100 L.

Basic product: Insect Pathogen Unite, Plant Protection Research Institute, Agriculture Research Center, Dokki, Giza, Egypt.

2. Field experiments:

Field experiments were carried out on Cotton, *Gossypium barbadense* L. (variety Giza 85, season 2005 and Giza 89, season 2006) cultivated in Zagazig district, Sharkia Governorate during two successive seasons of 2005 and 2006. The tested compounds were applied at the recommended rate, while control was sprayed with water only using Solo sprayer (20 L.). The experiment area was 12 kirats, which divided into 3 equal plots for compounds and control. Each plot was divided into four replicates of one kirat. The replicates were distributed in a complete randomized block design. In the seedling stage, the sample size was 40 seedlings (10 seedling / replicate) and 80 leaves from each treatment (20 leaves / replicate) at late season (flowering stage). A pre-count was taken before spraying at each replicate and four times afterwards at 3,7,14 and 21 days. In the present study direct counting method in

field was adopted for counting predators in cotton fields, twenty five plants were randomly taken in each replicate (i.e. 100 plants for each treatment) (Hoda and Abdel Hafez, 1981), to avoid as much as possible the effect of drift of insecticides or the movement of predators from one plot to another, the plants were always selected with an imaginary band, ten meters wide forming a quadrangle inside the plot. These counts were taken in all plots after 3, 7, 15 and 21 days after spraying. Predators were directly counted in the field and left undisturbed on plants, with few exceptions in counting predators, generally adult forms together with some immature forms were taken into consideration. Immature stages of *Coccinella undecimpunctata* L. and *Scymnus syriacus* Mars. (Coleoptera, Coccinellidae) were counted. Immature stages of *Paederus alfieri* Koch live in the soil. So, adults were counted. The nymphs of *Orius* spp. (Hemiptera, Anthocoridae) were counted and added to the number of adults. All moving stages of predacious mites, *Euseius scutalis* (Athias-Henriot) and *Agistemus exsertus* Gonz. were counted. The counts were taken either early in the morning or later in the afternoon (5-7 pm) as it was noticed that maximum number of predators was found on cotton plants in those periods of the day rather than warmer periods around the noon (Hafez, 1960). The reduction percentages in the population density of *T. urticae* and predators were calculated according to Henderson and Tilton equation (1955).

RESULTS AND DISCUSSION

The efficacy of three bio-acaricides, i. e. Vapcomic 1.8 % EC, Ortus 5% SC and Bioranza 10% WP using the recommended field rate to control the two-spotted spider mite, *Tetranychus urticae* Koch and their side effect on common predaceous insects and mites associated with cotton plants were investigated during two successive cotton seasons 2005 - 2006 as follow:

1. Effect of the tested compounds on the motile stages of *T. urticae* during cotton seasons 2005-2006:

1.1. At early cotton season (seedling stage):

The obtained results in Table 1 cleared that, during cotton seedling stage the average reduction percentages of *T. urticae* were 86.11 ± 4.76 , 84.89 ± 3.88 and 54.47 ± 6.21 % in the first season (2005) and were 94.98 ± 3.07 , 84.34 ± 1.20 and 55.28 ± 12.37 % in the second season (2006) for Vapcomic, Ortus and Bioranza, respectively, after 21 days of spray.

1.2. At late cotton season (flowering stage):

Data presented in Table (2) indicated that, during flowering stage the average reduction percentages of *T. urticae* were recorded 92.46 ± 0.83 , 85.29 ± 1.91 and 56.11 ± 4.01 % during the first season and 97.8 ± 2.2 , 86.55 ± 0.32 and 54.53 ± 4.29 % , for the second season, for the above compounds, respectively, after 21 days of spray.

2. Effect of the tested compounds on common predaceous insects and mites in cotton fields during two cotton seasons, 2005-2006:

The predators which counted in this investigation are *Coccinella undecimpunctata* L., *Scymnus syriacus* Mars, *Paederus alfieri* Koch, *Chrysoperla carnea* Steph., *Orius* spp., *Euseius scutalis* (Athias-Henriot) and *Agistemus exsertus* Gonz.

2.1. At early cotton season (seedling stage):

The side effect of Vapcomic, Ortus and Bioranza on the common predators in cotton fields were estimated at cotton seedling stage. Its average reduction percentages of predators were 85.05 ± 3.59 , 61.97 ± 0.88 and 34.3 ± 5.56 % in season 2005 and 55.22 ± 12.13 , 45.32 ± 1.71 and 32.75 ± 1.34 % for the second season for Vapcomic, Ortus and Bioranza, respectively (Table 3).

2.2. At late cotton season (flowering stage):

The data obtained in Table 4 revealed the average reduction percentages of predators. It was 67.97 ± 11.31 , 52.76 ± 8.38 and 46.40 ± 1.31 % during season 2005 and 50.3 ± 3.06 , 23.92 ± 2.23 and 17.72 ± 2.87 % during the second season for the above tested compounds, respectively.

Generally, the obtained results in this study are agreement with those of Grafton-Cardwell and Hoy (1983) who found that abamectin was significantly toxic to the various life stage of predatory mite, *Metaseiulus occidentalis* (Nesbitt). Antonin *et al.* (1997) mentioned that Abamectin produced good results in the summer of the first year and just at flowering beginning to second year, when pneumatic sprayers adapted to this type of crop were used. The bioactivity of Abamectin after three days of application were stated, the average reduction percentages of *T. urticae* were 74.65 and 87.84 % in Lower and Upper Egypt, respectively and extended up to 7 days with range of reduction percentages of the mite infestation were recorded 46.37 and 55.42 % after that the activity slightly decreased up to three weeks recording 28.73 and 57.15 %, for above both districts (Ibrahim, 2001). Romeh and Omar (2003) stated that entomopathogenic fungi, *Metarhizium anisopliae* was more pathogenic against eggs, immatures and adult females of *T. urticae*. Wekesa *et al.* (2005) mentioned that the pathogenicity of *M. anisopliae* and *Beauveria bassiana* to adult females of *T. urticae* causing mortality percent ranged between 22.1 and 82.6 % and the lethal concentration (LC_{50}) ranged between 0.7×10^7 conidia/ml.⁻¹ and the lethal time (LT_{50}) of the two fungal varied between 4.6 and 5.8 days. Abd El Rahman *et al.* (2005) mentioned that reduction percentages of *T. urticae* infestation in cotton fields by Ortus recorded, 84.1, 81.66 and 81.04 % in seedling stage in Kafer El Shiekh, El Gharbia and Beni Sueif Governorates and 86.92, 81.5 and 87.58 % in flowering stage, respectively and reduction percentages of insect predators numbers and mites recorded 28.15, 34.05 and 31.95 % in the early season, 36.79, 23.79 and 33.80 % in the late season, for above Governorates, respectively.

In conclusion, the above mentioned results in this study for the tested compounds, Vapcomic (Abamectin), Ortus (Fenpyroximate) and Bioranza

(*Metatrhizium anisoplae*) could be used successfully in controlling the two-spotted spider mite, *T. urticae* in the presence of the predators because its low effects on the natural enemies with some notes:

Conclusively, from these results, it could be concluded that Bioranza must be used in the early season when low level of infestation of *T. urticae* to prevent mites to reach injury level and in the same time increase of predators, while the two other compounds Vapcomic and Ortus can be used when the spider mite close to injury level to suppress it and preserve enough population of predators to reestablish in the cotton fields.

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التقييم الحقلّي لثلاث مبيدات حيوية أكاروسية ضد حلم العنكبوت الأحمر ذو البقعتين وتأثيرها علي المفترسات السائدة بحقول القطن المصرية

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تم تقييم فاعلية ثلاث مبيدات حيوية أكاروسية هي فابكوميك ١.٨ ٪ و أورتس ٥٪ و بيورانزا ١٠ ٪ باستخدام المعدل الحقلّي الموصي به لمكافحة حلم العنكبوت الأحمر ذو البقعتين و مدي تأثيرها غير المباشر علي المفترسات (حشرية و أكاروسية) المتواجدة بحقول القطن و ذلك بمنطقة الزقازيق بمحافظة الشرقية أثناء طور البادرة و طور التزهير خلال موسمين متعاقبين هما ٢٠٠٥- ٢٠٠٦ . أوضحت النتائج أن مركب فابكوميك كان أكثر المركبات سمية سواء علي العنكبوت الأحمر ذو البقعتين أو علي المفترسات بحقول القطن و ذلك خلال عامي الدراسة و جاء بعدة في التأثير المميت كلا من أورتس ثم بيورانزا.

في طور البادرة أظهرت النتائج أن متوسط نسبة الخفض في تعداد حلم العنكبوت الأحمر ذو البقعتين بعد ٢١ يوم من الرش بلغت ٨٦.١١ و ٨٤.٨٩ و ٥٤.٤٧ ٪ خلال موسم ٢٠٠٥ لمركبات فابكوميك و أورتس و بيورانزا علي الترتيب، ٩٤.٩٨ و ٨٤.٣٤ و ٥٥.٢٨ ٪ خلال موسم ٢٠٠٦ للمركبات السابقة علي الترتيب، أما في طور التزهير فكان متوسط نسب الخفض في تعداد حلم العنكبوت الأحمر ذو البقعتين للمركبات السابقة هي ٩٢.٤٦ و ٨٥.٢٩ و ٥٦.١١ ٪ خلال موسم ٢٠٠٥، ٩٧.٨ و ٨٦.٥٥ و ٥٤.٥٣ ٪ خلال موسم ٢٠٠٦ علي التوالي.

و بالنسبة لتأثير هذه المركبات علي المفترسات فكان المركب الأكثر فعالية هو فابكوميك يليه أورتس ثم بيورانزا. أظهرت النتائج أن متوسط نسب الخفض في تعداد المفترسات في حقول القطن في طور البادرة بلغت ٨٥.٠٥ و ٦١.٩٧ و ٣٤.٣ ٪ خلال موسم ٢٠٠٥ للمركبات السابقة علي التوالي، ٥٥.٢٢ و ٤٥.٣٢ و ٣٢.٧٥ ٪ خلال موسم ٢٠٠٦ علي التوالي أما بالنسبة لطور التزهير فقد سجلت المركبات السابقة نسب خفض بلغت ٦٧.٩٧ و ٥٢.٧٦ و ٤٦.٤٠ ٪ خلال موسم ٢٠٠٥، ٥٠.٣ و ٢٣.٩٢ و ١٧.٧٢ ٪ خلال موسم ٢٠٠٦ علي التوالي