

Journal of Plant Protection and Pathology

Journal homepage & Available online at: www.jppp.journals.ekb.eg

Impact of some Pesticides on Population of *Tetranychus Urticae* on *Viola Odorata*

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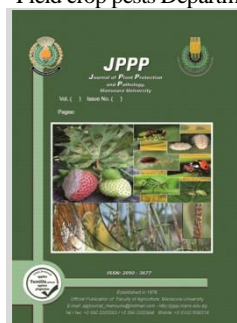


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ABSTRACT

The current study carried out to evaluate the effect of three pesticides (Biokiller2, Techno oil and Everken 1.8% EC) against *Tetranychus urticae*. The study carried out in tow regions (Al-Gharbia and Kafr El-Sheikh) in two governorates in Egypt during two seasons (2022 – 2023). Results cleared that, in the first season Techno oil achieved the highest reduction after 10 days of application with 100% followed by Biokiller2 with 98.4% reduction in Kafr El-Sheikh. Similarly, in Al-Gharbia region Techno oil had the strongest effect with 100% reduction followed by Biokiller2 with 98.8% at the same time. During the second season after 10 days of exposure, Biokiller2 had the strongest effect with 96.7% reduction in Kafr El-Sheikh region while in Al-Garbia region techno oil had the strongest effect with 100% reduction followed by Biokiller2 with 99.7%.

Keywords: Biokiller2, Techno oil, Abamectin, *Beauveria bassiana*, violet, reduction

INTRODUCTION

The two-spotted spider mite *Tetranychus urticae* is one of the most important agricultural pests, not only because its damage but also because of its wide host range (Migeon *et al.*, 2010). *T. urticae* infects many crops such as soybeans, cotton, vegetables, legumes and other important crops (Gallo *et al.* 2002). (Van Leeuwen *et al.* 2015) reported that *T. urticae* is a very dangerous pest of cucumber and more than 200 other plants such as eggplant, pepper, tomato rose and carnation. Two-spotted mites regularly feed on mesophyll cells of the underside of leaves, which is a way of UV rays (Ohtsuka & Osakabe, 2009; Bensoussan *et al.* 2016). Therefore, the mites cause mechanical damage in the form of the cells. Damaged organ is dull in color and becomes darker regarding to the increasing of numbers of necrotic cells. In addition, food intake affects the cell contents, as a result of lower concentrations of nitrogen, phosphorus and protein. Cell Physiology, reducing photosynthesis and injecting phytotoxic chemicals substances thereby reducing yields (Johnson & Lyon 1991). If there were more than 90 adults of mites on one plant leaves, the mites may cause severe economic losses during harvest (Assis *et al.* 2018).

Green pesticides which extracted from plants increasingly popular, Plant extracts are considered safer than synthetic pesticides. Examples formulas which include jojoba oil, black cumin oil, and citric acid, these compounds are classified as phytochemicals. Jojoba oil at different temperatures has a good miticidal effect on mite mortality of adult female of two-spotted (Isman 2006 and 2007).

Entomopathogenic fungi (EPF) such as *Beauveria bassiana* are widely used to control two-spotted spider mites (Chandler *et al.*, 2005; Mianania *et al.* 2008; Zhang *et al.*,

2018). Interestingly, fungal infection not only causes death of *H. urticae* female all time but also significantly reduces the fertility of surviving individuals (Shi and Feng, 2009). Entomopathogenic fungi evolved to kill arthropods (insects, ticks, and mites).

The use of bacteria to control the *T. urticae* is one of the research areas to develop an effective method for the control of the two-spotted spider mite.

Chandler *et al.*, 2005 and Marcic, 2012 studied the effect of *B. bassiana* on two-spots spider and observed that the effect was reducing the damage of two-spotted spider mites on tomato plants and reduced the number of adults. Based on the use of fungal fermentation products: mirabamectin and abamectin, these compounds are produced by soil fungi of the actinomycete group: *Streptomyces hygrosopicus* subsp. *aureolacrimosus* (Jensen) and *Streptomyces avermitilis*. Abamectin is a commercially product using widely for controlling of two-spotted spider mites in many varieties of vegetables, fruits, and ornamental plant species. In recent years, resistance to the chemical substances has been observed in populations of two-spotted spider mites all over the world (Monteiro *et al.*, 2015; Memarizadeh *et al.*, 2013; Ilias *et al.*, 2017; Xu, *et al.*, 2018; Díaz-Arias, 2019). Resistance to abamectin and cross-resistance to both substances has been observed in European (Herron *et al.*, 2021). The objectives of the current study were to investigate the effect of some acaricide on populations of *T. urticae* on *V. odorata* plant productivity.

MATERIALS AND METHODS

Tested plant

Violet

The experiment was conducted at Kafr El-Sheikh governorate region (31°11' 26.5' N 31° 03' 18.3' E) and Al-

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DOI: 10.21608/jppp.2024.270663.1217

Gharbia governorate region (30° 59' 23.6" N 30° 53' 18.6" E) with the *Viola odorata* violet variety as susceptible to *Tetranychus urticae* Koch. An area of about 4200 m² was divided into 16 plots, arranged in complete randomized block design, with 4 replicates. Seedlings of *V. odorata* variety were sown on 15th of November 2022. This variety of violet can stay in the same field for several years, farmers in Egypt used to keep the same plants in the field for 3 – 5 years and take four cuts every year. The first cut at the end of May, second cut at the end of July, the third cut at the end of October and the fourth cut at December. Farmers in Egypt used to plant corn as an intercrop of violet to give shadow and protect violet from the high temperature in summer. All agricultural practices were followed with the exception of pesticides, rather than the insecticides tested.

Pesticides

The field recommended rates of the following insecticides were used against *T. urticae* using a commercial formulation of each. Bio killer2 (*Beauveria bassiana*), Techno oil (plant extracts) and Everken (Abamectin 1.8 EC). All the tested compounds were performed on recommended time, Bio Killer2 and Techno oil had been sprayed one hour before sun set while Everken 1.8% had been sprayed at midday, and the check plots were sprayed with only water. Knapsack sprayer (20 L volume) was used.

Sampling

Counted *T. urticae* on 20 violet plants per replicate were selected randomly one, three, seven, and ten days after spraying.

The percentage reduction of *T. urticae* population for all treatments in the two growing seasons, were calculated using Henderson and Tilton’s formula (1955) as follows:

$$\text{Reduction (\%)} = 1 - \left(\frac{\text{No. in check before}}{\text{No. in check after}} \times \frac{\text{No. in treated after}}{\text{No. in treated before}} \right) \times 100$$

Statistical analysis

Statistical analysis was performed using one-way ANOVA. The means were compared using Duncan’s Multiple Range Test (Duncan, 1955) at a 5% probability level. All analyses were conducted by “SPSS” computer software package version 23.

RESULTS AND DISCUSSION

Results

Kafr El-Shikh region

Data in Table (1) showed the effect of the acaricides Bio killer2, Techno oil, and Everken 1.8% achieved reduction after 24 h of treatment with 46.7, 72.5%, and 77.6%, respectively. There were significant differences between the treatments. Techno oil had the strongest effect after 10 days of treatment with the highest percentage of reduction 100%. On the other hand, during the second season, same acaricides (Bio killer2, Techno oil, and Everken 1.8%) achieved a reduction of 84.6%, 51%, and 89.5% after 24 h of spraying, respectively. After 10 days of spraying Biokiller2 achieved the highest reduction with 96.7% and there were significant differences between treatments in the second season Table (2). The overall average reduction during the first season against *T. urticae* population was 78.7, 86.1 and 80.5% by Bio killer2, Techno oil, and Everken 1.8%, respectively. While overall average reduction for the second season against *T. urticae* population was 84.3, 55 and 89.9% by Bio killer2, Techno oil, and Everken 1.8% respectively, Fig. (1).

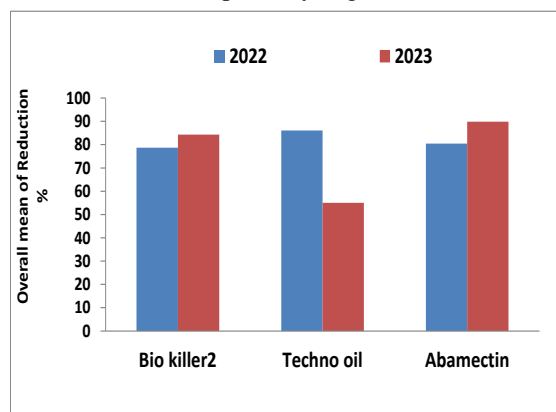


Fig. 1. Overall mean reduction of *Tetranychus urticae* on violet during two seasons in Kafr El-Sheikh.

Table 1. Effect of some insecticide on populations of *Tetranychus urticae* on violet during 2022 season

Governorate	insecticide	Mean Befor spraying	After 24 hours		3 days		7 days		10 days		Overall mean	Overall mean of Reduction %
			Mean	Reduction %	Mean	Reduction %	Mean	Reduction %	Mean	Reduction %		
Kafr El - Shikh	Bio killer2	33.60	15.2b	46.7	6.56b	78.3	2.04b	91.5	0.55b	98.4	6.09b	78.7
	Techno oil	1.20	0.18d	72.5	0.18d	83.4	0.10b	88.3	0.00c	100	0.12c	86.1
	Abamectin	13.11	2.38c	77.6	3.14c	77.4	2.00b	73.2	0.79b	93.9	2.08bc	80.5
	control	19.89	16.86a	-	17.88a	-	14.05a	-	19.58a	-	17.09a	-
Mean ±SE	-	8.66±1.91	-	6.94±1.74	-	4.54±1.71	-	5.23±2.15	-	6.35±1.87	-	-
F	-	228.97	-	386.29	-	9.24	-	7615.06	-	18.49	-	-
P	-	0.001	-	0.001	-	0.002	-	0.001	-	0.001	-	-
Al-Gharbia	Bio killer2	11.95	2.06b	84.6	1.19bc	91.8	0.09c	99.4	0.04c	99.8	0.85b	93.9
	Techno oil	1.54	0.84b	51	0.92c	50.6	0.11c	94.2	0.00c	100	0.47b	73.9
	Abamectin	6.89	0.88b	89.0	2.32b	72.2	1.34b	84.1	0.52b	93.9	1.27b	84.8
	Control	7.62	8.49a	-	9.21a	-	9.31a	-	9.46a	-	9.12a	-
Mean ±SE	-	3.07±0.84	-	3.41±0.89	-	2.71±1.00	-	2.51±1.04	-	2.92±0.94	-	-
F	-	80.49	-	97.49	-	226.89	-	878.29	-	140.01	-	-
P	-	0.001	-	0.001	-	0.001	-	0.001	-	0.001	-	-

Al-Gharbia data in Table (1) showed the effect of the pesticides Bio killer2, Techno oil, and Everken 1.8% After 24 h of spraying all tested components achieved reduction percentages of 84.6, 51%, and 89.0%, respectively. There were significant differences between treatments. The highest percentage of reduction of *T. urticae* population was recorded by Techno oil after 10 days with 100% for the first season. On the other hand, in the second season, pesticides caused a reduction of *T. urticae* population 24 hours after spraying by 82.7%, 79%,

and 73%, respectively. The highest reduction percentage was 100% by Techno oil 10 days after spraying, and there were significant differences between the treatments in the second season Table (2). The overall average reduction against *T. urticae* population was 93.9, 73.9 and 84.8% by Bio killer2, Techno oil, and Everken 1.8%, respectively in the first season. While the overall average reduction in *T. urticae* population was 92.5, 90.9 and 80.1% by Bio killer2, Techno oil, and Everken 1.8%, respectively in the second season Fig. (2).

Table 2. Effect of some insecticide on populations of *Tetranychus urticae* on violet during 2023 season

Governorate	insecticide	Mean Befor spraying	After 24 hours		3 days		7 days		10 days		Overall mean	Overall mean of Reduction %
			Mean	Reduction %	Mean	Reduction %	Mean	Reduction %	Mean	Reduction %		
Kafr El Shikh	Bio killer2	17.61	6.13b	64.3	2.21bc	87.2	2.05b	89	0.73c	96.7	2.78b	84.3
	Techno oil	1.21	1.79c	46	1.59c	52	1.83b	66	3.36b	56	2.14b	55
	Abamectin	11.11	2.43c	77.6	2.54b	97.7	1.26b	89.3	0.64c	95.3	1.72b	89.9
	Control	20.85	20.31a	-	20.37a	-	22.04a	-	25.53a	-	22.06a	-
	Mean ±SE	-	7.67±1.94	-	6.67±2.04b	-	6.79±2.30	-	7.57±2.74	-	7.18±2.25	-
	F	-	456.85	-	1171.67	-	681.77	-	1466.61	-	122.06	-
	P	-	0.001	-	0.001	-	0.001	-	0.001	-	0.001	-
Al-Gharbia	Bio killer2	9.70	2.06b	82.7	1.19bc	88.4	0.09bc	99.3	0.04bc	99.7	0.85bc	92.5
	Techno oil	1.71	0.44c	79	0.23c	87.3	0.06c	97.1	0.00c	100	0.18c	90.9
	Abamectin	6.45	2.13b	73	1.80b	73.5	1.52b	80.3	0.50b	93.5	1.49b	80.1
	Control	7.26	8.86a	-	7.64a	-	8.66a	-	8.57a	-	8.43a	-
	Mean ±SE	-	3.37±0.85	-	2.71±0.766	-	2.58±0.93	-	2.27±0.94	-	2.74±0.87	-
	F	-	72.30	-	81.60	-	233.07	-	765.25	-	133.19	-
	P	-	0.001	-	0.001	-	0.001	-	0.001	-	0.001	-

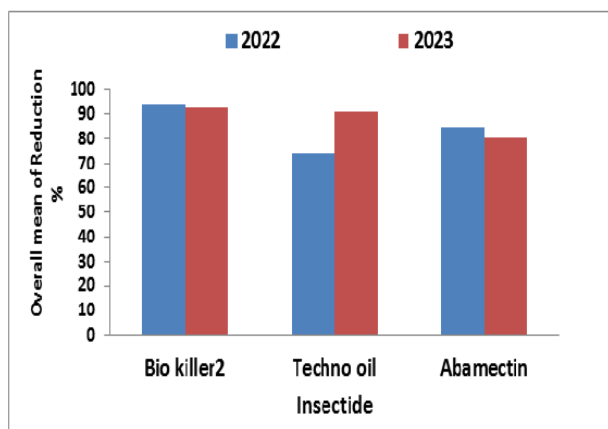


Fig. 2. Overall mean reduction of *Tetranychus urticae* on violet during two seasons in Al-Gharbia.

Discussion

Results obtained from current study cleared that, all tested compounds had acaricidal activity against *Tetranychus urticae* during two seasons. Biokiller2 is biological acaricide which consist of (*Beauveria bassiana*) fungi achieved the highest reduction after 24 h of spraying, while after 10 days of treatment techno oil was the strongest component with 100% reduction in Kafr El-Sheikh region during the first season. In Al-Gharbia Governorate region Biokiller2 was the strongest component after 24 h of exposure with 11.95% reduction, while after 10 days of exposure techno oil was the strongest component with 100% reduction. Overall reduction Biokiller2 was the strongest component with 93.3% reduction.

For the second season in Kafr El-Sheikh Biokiller2 was the strongest compounds with 96.7% reduction after 10 days of treatment. While in Al-Gharbia governorate region techno oil was the best after 10 days of exposure with 100% reduction, while overall reduction Biokiller2 achieved the highest reduction with 92.5%.

In agreement with current study, Sayed-Talebi, 2014 studied the effect of *B. bassiana* against *T. urticae* on cucumber as a host plant on all stages and found that, it has a mortality effect and also effected on reduction. Yucil, 2021 reported that, the two isolates of *B. bassiana* (BGF14 and BCA32) had potentials on *T. urticae* population and can be recommended as promising bio control agent in controlling of *T. urticae*. (Canassa *et al.*, 2020) suggested that, tested *B. bassiana* may be used as root inoculants of strawberries to protect against foliar pests, spider mites and also against pathogenic fungi without harming naturally predatory mites. evaluated the virulence of 6 Jordanian isolates in addition to a commercial isolate of *B. bassiana* either alone or combined with sub-lethal doses of plant essential oils for effective mite control in laboratory against two spotted spider mite to identify the most virulent isolates and the most potent oils before their combined application. They also found that combining pine oil or rosemary oil with *B. bassiana* always resulted a higher mortality than either each one alone. They reported that, the mortality from the combined application of *B. bassiana* with pine oil was 87%. They indicated that *B. bassiana* can be used with sub-lethal doses of pine or rosemary oils for effective and sustainable control of the two spotted spider mite. They also reported that, reduction in acaricidal applications would bring about

the benefits of decreased resistance development, human health hazards and environmental contamination.

Abouelatta *et al.* (2022) studied the effect of techno oil against some stored product insects and found that techno oil has insecticidal activities. Also in agreement with this study techno oil is an effective vegetable oil such as acaricide and pesticide (Esmail *et al.*, 2020). It is also a non-ionic surfactant bio activator, as water source extracted from a plant source used for agricultural and chemical purposes. Techno oil eliminates fungi such as chitin; waxes (paraffin). Techno oil is a product that contains glutamic acid (El-Khaiat *et al.*, 2016). Esmail *et al.*, (2020) tested the effectiveness of Techno oil against *Bemisia tabaci* in potato specie Hatma in Qaha, Qalubiya Governorate in autumn 2017 and recorded the death after 14 days later. They also found that, Techno oil mortality rate after 14 days was 67.9%. They also studied the effect on fertility and recorded 100% reduction in *Bemisia tabaci* on potatoes. In the same field a study of the impact of Techno oil on *T. urticae* also recorded that after 14 days Techno oil mortality rate was 65.97% and 100 % reduction. Also in agreement with current study vegetable oil includes oils extracted from plant seeds, leaves, stems or flowers contain fatty acids and other lipids. Other common fatty acids in vegetable oils are palmitic, steric, linoleic and oleic acid. They used in food and feed products (Esmail *et al.*, 2020). Many vegetable oils are approved from EPA regulations and some are sold for natural production (Carlos *et al.*, 2006).

Finally, regarding to current study biological control and green acaricides can be used as an efficient alternatives of chemical acaricides.

ACKNOWLEDGEMENT

The authors extend their appreciation to the Deanship of Hashem Brothers for Essential Oils and Aromatic Products (69 Abd El-Monem Riad St. Giza, Egypt)

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تأثير فاعلية بعض المبيدات ضد (العنكبوت الأحمر) *Tetranychus urticae* على نبات البنفسج *Viola odorata*

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² مركز البحوث الزراعية – معهد بحوث وقاية النباتات – قسم آفات الحبوب والمواد المخزونة – سخا – مصر

³ مركز البحوث الزراعية – معهد بحوث وقاية النباتات – قسم مكافحة الحويبة – سخا – مصر

⁴ مركز البحوث الزراعية – معهد بحوث وقاية النباتات – قسم آفات محاصيل الحقل – سخا – مصر

المخلص

أجريت دراسة لتقييم تأثير ثلاثة مبيدات (Everken 1.8% EC و Techno Oil •Biokiller2) ضد العنكبوت الأحمر *Tetranychus urticae*. أجريت الدراسة على مناطق بمحافظتين في مصر (الغربية و كفر الشيخ) خلال موسمين (2022 – 2023). أوضحت النتائج أنه في الموسم الأول حقق نكبو أول أعلى خفض في التعداد بعد 10 أيام بنسبة 100% يليه Biokiller2 بنسبة خفض 98.4% في كفر الشيخ. بينما في محافظة الغربية كان نكبو أول التأثير الأقوى بنسبة تخفيض 100% يليه Biokiller2 بنسبة 98.8% في نفس الوقت. خلال الموسم الثاني وبعد 10 أيام من المعاملة، كان لـ Biokiller2 التأثير الأقوى بنسبة خفض في التعداد 96.7% في منطقة كفر الشيخ بينما في محافظة الغربية كان نكبو أول أقوى تأثير بنسبة خفض 100% يليه Biokiller2 بنسبة 99.7%.