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# Evaluation of the efficiency of some pesticides in controlling mites on strawberries And reduce the economic loss in the yield

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## Abstract

**The two-spotted mite, *Tetranychus urticea,* is one of the important pests that affect strawberry plants in Iraq and continues to be present on them during most days of the year and affects the quantity and quality of the fruits produced. A study of the efficiency of treatments in *T. urticae* eggs showed that the treatment Betaloma+Vertimec was more efficient than the treatment Betaloma+Ortus with a percentage of 73.1 and 67.4%, respectively, and the percentage of the two treatments Merchant+Vertimec and Merchent+Ortus was 73.7 and 67.7%, respectively. As for the moving stages, the treatment of Betaloma+Vertimec and Merchent+Vertimec had the strongest effect than the treatment of Betaloma+Ortus and Merchent+Ortus, reaching 84.4, 87.9, 81.4, 81.7%, respectively. While the treatment of adults proved that the two treatments Betaloma+Vertimet and Merchent+Vertimec are the most efficient as they amounted to 82.9, 83.5%, respectively, and the treatments Betaloma+Ortus and Merchent+Ortus reached 81.6, 81.7%, respectively. It was observed from the study that the use of Vertimec on strawberry Mergent and Petaloma cultivars reduced the percentage of economic loss of strawberry plants infected with two-spotted mite, with a significant difference from Ortus, which amounted to 6.5 and 7.3%, respectively.**

**Key words : *Tetranychus urticea* , *Fragaria ananassa* , economic loss of strawberry**

## Introduction

Strawberry *Fragaria ananassa Duch* is one of the economically important fruit plants, as its cultivation has emerged recently and has received wide interest from farmers as it has given an important economic return and its cultivation has succeeded in many governorates of Iraq and many other countries Mainly in the United States (Banaeian et al., 2011), and the area cultivated with strawberry crop in Iraq for the year 2020 was 7 tons/dunum (Central Statistical Organization, 2020). Strawberries are infected with many fungal and bacterial diseases, and they are also infected with many other pests, the most important of which is the two-spotted mite *Tetranychus urticae*,( Dias et al., 2012). The two-spotted mite is one of the most harmful pests affecting strawberry fields And in various crops and cause damage to the plant and the economic yield (Chandler et al., 2008). A laboratory and field study was conducted in the Plant Protection Department / Ministry of Agriculture, which lasted from October 2021 to June 2022. This type of mite was used to evaluate the efficiency of using the pesticides Vertimec and Ortus in affecting it, as well as determining the economic losses it causes on the two strawberry cultivars, Merchent and Betaloma.

## Materials and Methods

### Effect of pesticides on *Tetranychus urticea* in field

A plastic house was prepared with a length of (50) meters and a width of (7) meters. Strawberry seedlings of Betaloma and Merchent cultivars were planted, at a distance of (40) cm between one plant and another, to study the effect of pesticides on controlling the two-spotted mite in the field. The treatments were distributed randomly with three replications for each treatment. The pesticides shown below were used with their concentrations and according to the approved recommendations, and a 2.5-liter hand sprayer was used to carry out the treatments. The following treatments, and the concentrations indicated with them, were distributed among the experimental units of each class by a factorial experiment, according to the CRBD complete randomized block design, as follows:

1. Ortus 5% SC (Fenpyroximate) sprayed on plants at a concentration of 0.5 ml / liter.

2. Vertimec 1.8% EC (Abamectin) sprayed on plants at a concentration of 0.5 ml/L.

3. The comparator sprayed the plants with water only.

The sampling process continued by selecting 10 plants randomly from each experimental unit in each replicate. One leaf was cut and placed in polyethylene bags and taken to the laboratory. The examination process was carried out and the contents of the leaves were calculated, including eggs, larvae, nymphs, and adult mites, and the average numbers per leaf were extracted. Samples were taken one day before the treatment and 1, 3, 7, 14, 21 and 28 days after treatment. The death rate was corrected according to the equation (Tilton and Henderson, 1955).

## Economic loss of strawberry yield caused by two-spotted mite infection

For the purpose of calculating the percentage loss in the yield of strawberry cultivars Mergent and Petaloma resulting from infection with the two-spotted mite, the experimental units cultivated with the two cultivars in each replicate of the study field were divided into four sections, The following treatments, and the concentrations indicated with them, were distributed among the experimental units of each class by a factorial experiment, according to the CRBD complete randomized block design, as follows:

1- The plants of the first section were left to become infected with mites naturally without being subjected to control operations.

2- The plants in the second section were treated with Vertimec 18% EC at a concentration of 0.5 ml / liter of water.

3- Plants of the third section were treated with Ortus 5% SC at a concentration of 0.5 ml / liter of water.

4- The plants of the fourth section were subjected to an intensive preventive program in order to obtain clean plants free from infection

To carry out the necessary control when any individual of the mite appears in leaf samples that are taken weekly from the experimental plants, use the mite fungicides Bifenazate 48% SC, Abamectin 1.8% EC at a concentration of 0.25, 0.3 ml / liter of water. And the two insecticides Alphacypermethrin 5% EC, Confidate 20% SL at a concentration of 0.5 and 1.5 ml / liter of water, respectively and alternately to avoid the occurrence of resistance

in mites and insect pests towards any of these pesticides. A 2.5 liter manual sprayer was used to carry out the treatments. Strawberry fruits were harvested for each experimental unit in each replicate isolated separately for the two cultivars, as well as for the sections infected with mites and the two treatments of Vertimec and Ortus. And the healthy one from infection twice a week, when it reached the appropriate size for marketing throughout its growing season, and it was weighed and the production rate per plant was extracted by dividing the total weight by the total number of plants, After taking the weights of the yield of the two cultivars for healthy and infected plants, the percentage of economic loss in yield due to infection with mites was estimated by using the analytical methods used by Jundeko (1973) in the greenhouse conditions and by making some modifications in accordance with the type of plant and pest as follows:

The percentage of loss in yield components =

Actual loss/expected production in the absence of injury x 100

True loss = Yield amount of healthy plants (expected production) – Yield amount of infected plants (real production).

For the purpose of converting the expected production, the real production and the real loss into the corresponding area per dunum, the planting distances and the rate of the number of plants (plant density / dunum) were adopted as a basis for this purpose, as follows:

Dunum area = 2500 square meters

The length of the corridor = 10 m, the width of the corridor = 1 m

the area of the corridor = 10 square meters

The number of marshals per dunum = 2500 \ 10 = 250 mars

The distance between one plant and another = 0.4 m, the number of plants in each meadow planted on both sides is 50 plants

The number of plants per dunum = 50 x 250 = 12,500 plants / dunum

The expected production can be calculated in kg / dunum according to the following equation:

Number of plants per dunum x expected production g/plant/1000

By the same formula, the real production is calculated as kg/dunum, and the real loss as kg/dunam.

## Results and discussion

Effect of pesticides on field *Tetranychus urticea.*

effect on eggs

Table 1 shows that the relative efficiency of the Vertimec + Betaloma treatment in tit eggs started from the first day with a death rate of 65.2%, which increased later and reached 75.5, 80.5, 69.8, 95.5% on days 5, 4, 3, and 2, respectively. It then decreased gradually until it reached its lowest level on the 28th day, at 26.6%. As for the Ortus + Betaloma treatment, the rate on the first day was 30.9%, then it increased later, reaching 61.7, 82.5, 90.7, 95.7% for days 2, 3, 4, and 5, respectively. It then decreased gradually until it reached its lowest level on the 28th day, at 29.7%. With regard to the Merchant Vertimec + treatment, the percentage of egg death on the first day was 44%, and it continued to increase gradually and reached its highest rate on the fifth day, 97%. Then it began to decline on the seventh day, reaching 91.7%. After that, the percentage decreased and reached its lowest level on the 28th day, at 43.2%. It was noted that the relative efficiency of Ortus + Merchant treatment on *T.urticae* eggs on the first day was 59.3%.The percentage increased on the second day, reaching 65.4%, and continued to increase, reaching its highest rate on the seventh day, at a rate of 92.1%. Then, it began to decrease on the 14th day, when it reached 77.6%, and continued to decline over the days, reaching its lowest level on the 28th day, when it reached 28.1% in a similar study. Al-Saadi (2017) showed that the efficiency of Ortus pesticide in affecting eggs of two-spotted mites amounted to 81.4% after seven days of treatment.

Effect on moving stages:

Table 2 shows the relative efficacy of Vertimec + Betaloma treatment in moving stages of mites one day after spraying, which amounted to 98.1%, and gradually increased in days 2, 3, 4, 5, reaching 99.5, 99.4, 99.9, 99.9%, respectively. The death rate began to decline in the following days, reaching 95.5% on the seventh day, 88.1% on the fourteenth day, and 28.6% on the twenty-eighth day. As for the treatment Ortus + Betaloma, the percentage of killing was 85.7% after one day, then it increased on the second day, reaching 93.7%. The increase continued until the highest percentage of killing was recorded on the fifth day at 99.9%, then the effect began to gradually decrease and it was recorded on the seventh day at 96.2%, then on the 14th day it reached 85.5% and continued to decrease until it reached 23.2% on the 28th day. As for

the Merchant Vertimec + treatment, it amounted to 90.7% after one day of the treatment. It increased in subsequent days, reaching 99.7% on the fifth day. In a previous study, Al-Dahwi (2008) showed that Abamectin affected the moving stages of the two-spotted mite, and its efficiency was 92.33%.Death rates began to decrease from the seventh day and reached 98.8%, while the lowest death rate was on the 28th day at 51.1%.As for the Ortus + Merchant transaction, its efficiency reached 92.6%. After one day of the transaction, it continued to increase to the fifth day, reaching 97.6%, after which it continued to decrease, reaching its lowest level on the 28th day, when it reached 51.1%. In a previous study, Al-Musawi (2019) showed when evaluating the efficiency of Ortus pesticide in the moving stages of the two-spotted mite, its efficiency was 95.3%. The previous results converged with Al-Saadi (2017), as the percentage of the effect of the pesticide in the mobile phases amounted to 99.6%.

The effect on adults:

Table 3 shows the effect of Betaloma Vertimec + treatment on adult urticaria, as the percentage of death reached 99.6% after one day of treatment. It decreased in the following days, reaching its lowest level on the 28th day, at 27.3%. As for the treatment, Betaloma Ortus +, it achieved a death rate of 99.4%, and its high efficiency continued until the seventh day, when it reached 97.9%. The death rate began to decrease on the fourteenth day, when it reached 70%, and it continued until the 28th day, at a rate of 21.9%. With regard to the Vertimec+Merchent transaction, the relative efficiency reached 99.5%. It decreased in the following days until it reached its lowest level on the 28th day, when it reached 39.9%. With regard to the Ortus + Merchant treatment, the death rate was 99.4%. After one day of treatment, the death rate increased, reaching 97.7%, respectively. In a previous study between Jumaida (2005) the effect of Abamctin in controlling the two-spotted mite *T. urticae* on cotton plants, the average number of adult mites after 14 days of treatment was 3.22 adults/leaf, while the number was 29.89 adults/leaf in the comparison treatment. In another study conducted by Al-Saadi (2017), the superiority of Ortus pesticide in controlling two-spotted mites on strawberry fruits, as the death rate for adults reached 76.9% after 4 weeks of treatment.

Table 1 Effect of treatments on eggs of *T.urticae* mites

| Treatment | Concentration ml/L | Corrected percentage of post-treatment death in days | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1D | 2D | 3D | 4D | 5D | 7D | 14D | 21D | 28D | |
| Betaloma+ Vertimec | 0.5 | 65.2 | 75.5 | 80.5 | 96.8 | 95.5 | 92.1 | 76.1 | 49.8 | 26.6 | 73.1 |
| Merchant+ Vertimec | 0.5 | 44 | 72.3 | 74.3 | 94.6 | 97 | 91.7 | 87.6 | 59.1 | 43.2 | 73.7 |
| Betaloma+ Ortus | 0.5 | 30.9 | 61.7 | 82.5 | 90.7 | 95.7 | 86.9 | 79 | 50.3 | 29.7 | 67.4 |
| Merchant+ Ortus | 0.5 | 59.3 | 65.4 | 67.1 | 82.8 | 89.6 | 92.1 | 77.6 | 48 | 28.1 | 67.7 |
| Average | | 40.85 | 68.72 | 76.1 | 91.2 | 94.45 | 90.7 | 80 | 51.8 | 31.9 | 70.4 |
| $LSD_{50}$ | | Treatments= 3.4 | | | days= 1.2 | | | intraction=2.8 | | | |

Table 2 Effect of treatments on moving stages *T.urticae* mites

| Treatment | Concentration ml/L | Corrected percentage of post-treatment death in days | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1D | 2D | 3D | 4D | 5D | 7D | 14D | 21D | 28D | |
| Betaloma+ Vertimec | 0.5 | 98.1 | 99.5 | 99.4 | 99.9 | 99.9 | 95.5 | 88.1 | 51.3 | 28.7 | 84.4 |
| Merchant+ Vertimec | 0.5 | 90.7 | 94.8 | 97.9 | 99.4 | 99.7 | 98.8 | 89 | 70.1 | 51.1 | 87.9 |
| Betaloma+ Ortus | 0.5 | 85.7 | 93.7 | 98.3 | 99.6 | 99.9 | 96.2 | 85.5 | 50.8 | 23.2 | 81.4 |
| Merchant+ Ortus | 0.5 | 92.6 | 94 | 95.8 | 97.4 | 97.6 | 93.2 | 74.8 | 54.1 | 36.4 | 81.7 |
| Average | | 91.7 | 95.5 | 97.8 | 99.1 | 99.2 | 95.9 | 84.3 | 56.5 | 34.8 | 83.8 |
| $LSD_{50}$ | | Treatments=3.1 | | | days= 1.6 | | | intraction=2.5 | | | |

Table 3 Effect of treatments on adult *T.urticae* mites

| Treatment | Concentration ml/L | Corrected percentage of post-treatment death in days | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1D | 2D | 3D | 4D | 5D | 7D | 14D | 21D | 28D | |
| Betaloma+ Vertimec | 0.5 | 99.6 | 99.8 | 99.9 | 99.9 | 99.9 | 98.2 | 75.4 | 52.3 | 27.3 | 83.5 |
| Merchant+ Vertimec | 0.5 | 99.5 | 99.6 | 99.9 | 100 | 99.9 | 98 | 60.8 | 49.1 | 39.9 | 82.9 |
| Betaloma+ Ortus | 0.5 | 99.4 | 99.7 | 99.8 | 99.9 | 99.4 | 97.9 | 70 | 46.4 | 21.9 | 81.6 |
| Merchant+ Ortus | 0.5 | 99.2 | 99.7 | 99.9 | 99.8 | 99.9 | 98.7 | 61.1 | 45.7 | 31.8 | 81.7 |
| Average | | 99.4 | 99.7 | 99.8 | 99.9 | 99.7 | 98.2 | 66.8 | 48.3 | 30.2 | 82.4 |
| $LSD_{50}$ | | Treatments= 0.7 | | | days= 1.4 | | | intraction=1.8 | | | |

## Economic loss resulting from two-spotted mite infestation on strawberry fruits in Petaluma and Mergent cultivars

It was observed from the results of Table 4 that all treatments achieved good results in reducing the economic loss resulting from infection with the two-spotted mite, compared to the comparison treatment on strawberry cultivars Petaluma and Mergent. The economic loss on Mergent reached 6.5% for Vertimec and 9.2% for Ortus, while it was 88.6% for the comparison treatment. While on the Petaluma cultivar, it reached 7.3% for the Vertimec pesticide, while for the Ortus pesticide it reached 11.4%, while the comparison reached 90.1%. Several studies have shown that the two-spotted mite causes loss of strawberry crop and greatly affects its productivity and losses may reach 80% (Fadini et al., 2004; Moraes et al., 2008; Sato et al., 2009). Attia et al. (2013) explained that mites cause a significant loss of the annual crop of strawberries, up to 15% in the United States.

Table 4: Economic loss due to two-spotted mite infestation of strawberry fruits

| reatment | expected production g/plant | expected production kg/dunum | Actual production g/plant | Actual production kg/dunum | Actual loss g/plant | Actual loss kg/dunum | loss percentage |
|---|---|---|---|---|---|---|---|
| Merchant+ Vertimec | 630 | 7875 | 589.1 | 7363.1 | 40.9 | 511.9 | 6.5 |
| Merchant+ Ortus | 630 | 7875 | 572.1 | 7150.5 | 57.9 | 724.5 | 9.2 |
| Control | 630 | 7875 | 71.8 | 897.8 | 558.2 | 6977.2 | 88.6 |
| Betaloma+ Vertimec | 685 | 8562.5 | 635 | 7937.4 | 50 | 625.1 | 7.3 |
| Betaloma+ Ortus | 685 | 8562.5 | 606.9 | 7586.4 | 78.1 | 976.1 | 11.4 |
| Control | 685 | 8562.5 | 67.8 | 847.7 | 617.2 | 7714.8 | 90.1 |
| $LSD_{0.05}$ | - | - | 24.3 | 114.5 | 27.9 | 128.6 | 3.3 |

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