THE EFFECTIVENESS OF SOME PESTICIDES IN THE CONTROL OF THRIPS AND RED SPIDER MITES ON STRAWBERRY PLANTS

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ABSTRACT

This study was carried out in a private farm in Wardan, Giza governorate in Egypt during 2019 season on strawberry plants. The first experiment aimed to evaluate the effectiveness of different commercial products in cultivated land including Solo 24% SC (Bifenazate), Arbus 12% SC (Chlorfenapyr + Emamectin benzoate), Concor 24% SC (Spirodiclofen), Excellent 1.9% EC (Emamectin benzoate), Top9 (Chitosan 0.1%), Biomectin 5% EC (Abamectin) and Congest 15% CS (Abamectin + Imidacloprid) in reducing the population densities of two spotted spider mite, Tetranychus urticae Koch. on strawberry plants. According to general mean percentage of reduction in population of T. urticae, data showed insignificant differences among the seven tested compounds whereas the mortality percentages were 85.94 %, 82.18%, 81.4%, 79.36%, 78.14%, 77.94% and 75.9%, respectively. From these results; it’s clear that Solo compound is the most effective compound and Congest is the lowest one. The other compounds ranged between them in controlling T. urticae under these experimental conditions.

The second experiment evaluated the effectiveness of different formulations in the nursery including Radiant (Spinetoram 12% Sc), Super Rigo (Naphthyl acetic acid – Chitosan), Top9 and Berna Star (Glyceryl stearate 32%) in reducing the population densities of western flower thrips, Frankliniella occidentalis (Pergande) on strawberry plants. According to general mean percentage of reduction in population of F. occidentalis, data showed significant differences among the four compounds. These compounds could be divided into three groups. The first group contained Radiant compound showing high mortality (63.5%). The second group contained Super Rigo and Top9 compounds showing moderate effect (46.44% & 34.3%), respectively. The third group contained Berna Star compound showing least effect (28.36%). From these results; it’s clear that the chemical compound Radiant is the most effective while the natural compound Berna Star is the lowest in controlling F. occidentalis under these experimental conditions.

Keywords: Frankliniella occidentalis, Tetranychus urticae, Strawberry, Control.

INTRODUCTION

Western flower thrips, Frankliniella occidentalis (Pergande) (Thysanoptera: Thripidae) and Tetranychus urticae Koch. (Acariformes: Tetranychidae) are serious pests infesting crops especially strawberry plants (Fragaria × ananassa Duchesne [Family: Rosaceae]. This causes substantial yield losses through direct feeding on the leaves and fruits which causes even greater losses for farmers and the economy. Insecticides therefore, play an important role in the western flower thrips-control and management. Yiğit and Erkiliç (1992) in Turkey, recommended using Azocyclotin, Bromopropylate, Dicofol and Dicofol Plus Tedradifon for controlling red spider mites. Hossain et al (2006) in Bangladesh, studied the effectiveness of four commonly used chemicals Viz., Malathion, Deltamethrin, Cypermethrin, and Sulphur against T. urticae on bean plants preserved and on excised leaf
discs. Population of mite was significantly in all treated plots lower except malathion treatment. The T. urticae population differed significantly because of different chemicals and it stayed lower up to the 4th week on plants that single-sprayed, which increased again. El-Sharabasy (2010) in Egypt, represented the potential of Artemisia judaica L. crude extracts that was evaluated for toxic and repellent effect against immature stage and adult females of T. urticae. Ethanolic leaf extraction was more effective as toxic and repellent effect against immature stage and adult females of T. urticae, followed by petroleum ether, acetone and aqueous extraction. 

Rahman et al (2011) in USA, recorded that Spinosad is highly efficacious against F. occidentalis; and it’s believed to be compatible in IPM program. These results suggest that the use of Camino Real with Spinosad applications can significantly reduce thrips populations. Abdallah et al (2014) in Egypt, controlled T. urticae with the biochemical compound Abamectin (Vapcomic) on kidney Bean (Paulista) and sugar snap pea (Snow wind) in a greenhouse at Behaira Governorate during 2013 season. The mean reduction percentage of the spider mite populations on both plant varieties by treating with Vapcomicwas (90.0%). Abou El-Ela (2014) in Egypt, investigated five acaricides, Delmite, Challenger, Vertimec, Bioca and Ortus for the control of T. urticae of cotton seedlings. At the early seedling time late season during two successive seasons 2007&2008. Results indicated that, Challenger is the most effective and Bioca is the least effective with 82.3% and 55.1% approximate reduction respectively during two successive seasons. Gomohammadi and Mohammadipour (2015) in Iran, studied five treatments and four replications on Frankliniella occidentalis in the greenhouses. The treatments were as follows: Pyrethrum, Dichlorvos, Azadirachtin, Flinicamid and control. The new insecticide and the herbal extracts, Flonicamid had acceptable control against the thrips of strawberry in the greenhouse. Bi et al (2016) in USA, determined the resistance status of these two pest species Tetranychus cinnabarinus (Boisduval) and Tetranychus urticae to commonly used chemical acaricides on strawberries as Abamectin, Spiromesifen, Etoxazole, Hexythiazox and Bifenazate. Results suggest T. urticae have developed resistance to Hexythiazox and that the T. cinnabarinus have developed resistance to Bifenazate. Gholami and Sadeqghi (2016) in Iran, recorded that mechanical, cultural, biological and chemical controls are the main strategies of the IPM program for thrips. The insecticides play an important role in the western flower thrips management. Pyridalyl, Spinosad, and botanical insecticides such as Azadirachtin and Oxymatrine are new and effective insecticides for controlling F. occidentalis. Renkema et al (2018) in Florida, carried out an experiment to compare Sulfoxaflor, Spinetoram, and the entomopathogenic nematode, Steinernema feltiae (Filipjev) applications based on thresholds of flower thrips. High and low S. feltiae rates did not reduce thrips and fruit damage. Sulfoxaflor reduced thrips by 60 to 70% compared to the Spinetoram reduction. Dry, hot, conditions likely limited effectiveness and the survival of S. feltiae. Sulfoxaflor appears to be a promising insecticide for flower thrips and may reduce reliance the strawberry producers on Spinetoram.

Therefore, this study aimed to determine the effectiveness of some formulations available in the local market for the control of strawberry pests.

**MATERIALS AND METHODS**

1. **The effectiveness of control agents against Tetranychus urticae in the production land**

To study the effectiveness of the tested products on the population of T. urticae infesting strawberry variety Festival, the area of this experiment was about (1100 m²), divided into 24 plots (each treatment replicated 3 times) for 7 treatments in addition of the control (Table 1). Strawberry plants were treated on 9th of March during season 2019 in the production land.

2. **The effectiveness of control agents against Frankliniella occidentalis in the nursery**

The other experiment to study the effectiveness of the tested products on the population of F. occidentalis infesting strawberry variety Festival, the area of this experiment was about (750 m²), divided into 15 plots (each treatment replicated 3 times) for 4 treatments in addition of the control (Table 2). Strawberry plants were treated on 14th of July during season 2019 in the nursery.

The replicates were distributed in a complete randomized block design. A knapsack sprayer was used and filled with that prepared concentration just before each treatment. Spraying was done by using a motor sprayer of 20-L capacity. Inspection of plants was carried out before spraying (zero time) and after 1, 3, 5, 7, 10 and 14 days after application.
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Table 1. Insecticides used against *Tetranychus uriticae* on Strawberry plants at Wardan, Giza governorate on spring 2019.

| Trade name   | Common name               | Chemical class                       | Rate/L. water     |
|--------------|---------------------------|--------------------------------------|-------------------|
| Concor 24% SC| Spirodiclofen             | Tetronic acid                        | 30cm²/100L        |
| Solo 24% SC  | Bifenazate                | Carbazate                            | 75cm²/100L        |
| Arbus 12% SC | Chlorfenapyr + Emamectin benzoate | Pyrrole + Avermectin | 2cm³/100L         |
| Excellent 1.9% EC| Emamectin benzoate       | Avermectin                           | 70cm³/200L        |
| Congest 15% CS | Abamectin + Imidacloprid | Avermectin-Neonicotinoid            | 35cm³/100L        |
| Biomectin 5% EC | Abamectin                | Avermectin                           | 20cm³/100L        |
| Top9         | Chitosan 0.1%             | shrimp shell waste extract           | 1000cm³/200L      |

Table 2. Insecticides used against *Frankliniella occidentalis* on Strawberry plants at Wardan, Giza governorate season 2019.

| Trade name  | Common name               | Chemical class                           | Rate/L. water     |
|-------------|---------------------------|------------------------------------------|-------------------|
| Radiant     | Spinetoram 12% Sc         | Fermentation product of *Saccharopolyspora spinosa*, an analogue Spinosad & a spinosyn | 120cm³/200L       |
| Super Rigo  | Naphthyl acetic acid – Chitosan | Plant extract (botanical)           | 125cm³/100L       |
| Berna Star  | Glyceryl stearate 32%      | Plant extract (botanical)               | 1000cm³/200L      |
| Top9        | Chitosan 0.1%              | Shrimp shell waste extract              | 1000cm³/200L      |

Sample size was 30 leaves (3/replicates). The observation of pests was carried out in the field followed by laboratory examination by inspecting 10 leaves picked at random and examined primarily by a pocket lens in the field, then transferred to the laboratory in paper pages to examine by the aid of stereomicroscope. The reduction percentages were calculated according to the equation of Henderson and Tilton (1955).

\[
\% \text{ Reduction} = \left(1 - \frac{T_a - C_b}{T_b - C_a}\right) \times 100
\]

Where:
- \(T_a\) = number of insects or mites after treatments.
- \(T_b\) = number of insects or mites before treatments.
- \(C_a\) = number of insects or mites after in control.
- \(C_b\) = number of insects or mites in control before.

For testing homogeneity of control agents, \(\chi^2\) method was used (Snedecor and Cochran 1987).

\[
\chi^2 = \sum (a_i \times p_i) - C1 \times \overline{P}/\overline{P} \times \overline{Q}
\]

Whereas \(\overline{P} = C1 / G\)

\(\overline{Q} = 1 - \overline{P}\)

RESULTS AND DISCUSSION

1. The effectiveness of control agents against *Tetranychus uriticae* in the production land

The effectiveness of different chemical compounds included Concor 24% SC, Solo 24% SC, Arbus 12% SC, Excellent 1.9%EC, Congest 15% CS, Biomectin 5% EC, and Top9 in reducing the population densities of *T. uriticae* on strawberry plants were assayed after receiving one spray of each compound during the experimental period, the results of these field experiments are tabulated in Table (3 and 4).

According to general mean percentage of reduction in population of *T. uriticae*, data in Table (4) indicated that there are insignificant differences between the seven compounds whereas \(\chi^2 = 3.75\) insignificant. So, the cheaper compound is the best choice. The mortality percentages were 85.94%, 82.18%, 81.4%, 79.36%, 78.14%, 77.94% and 75.9%, for compounds Solo, Arbus, Concor, Excellent, Top9, Biomectin and Congest, respectively. From these
results; it’s clear that Solo compound is the most effective compound and Congest is the lowest one. The other compounds ranged between them in controlling *T. urticae* under these experimental conditions.

The results obtained are in harmony with those previously reported by Yiǧit and Erkiliç (1992) in Turkey; Hossein et al (2006) in Bangladesh; El-Sharabasy (2010) in Egypt; Abdallah et al (2014) in Egypt; Abou El-Ela (2014) in Egypt and Bi et al (2016) in USA.

### Table 3. General mean percentage reduction in mean number of *Tetranychus urticae* on strawberry plants at Wardan, Giza governorate spring 2019

| Product | 1 day | 3days | 5days | 7days | 14days | General mean |
|---------|-------|-------|-------|-------|--------|--------------|
| Concor  | 61.9  | 69.3  | 87.9  | 87.9  | 100    | 81.4         |
| Solo    | 62.6  | 82.3  | 92.4  | 92.4  | 100    | 85.94        |
| Arbus   | 45.6  | 84.3  | 89.9  | 91.1  | 100    | 82.18        |
| Excellent | 49.1 | 77.7  | 83.4  | 86.6  | 100    | 79.36        |
| Congest | 49.1  | 59.3  | 85.1  | 86    | 100    | 75.9         |
| Biomectin | 58.9 | 71.7  | 79.3  | 79.8  | 100    | 77.94        |
| Top9    | 49.1  | 81.8  | 80.4  | 79.4  | 100    | 78.14        |

### Table 4. Chi square ($\chi^2$) analysis for the change by the infestation of *Tetranychus urticae* on Strawberry plants at Giza governorate on spring 2019.

| Product | % corrected (ai) | R 100% | Pi (ai/R) | ai Pi |
|---------|------------------|--------|-----------|-------|
| Solo    | 85.94            | 100    | 0.859     | 73.8  |
| Arbus   | 82.18            | 100    | 0.821     | 67.5  |
| Concor  | 81.4             | 100    | 0.814     | 66.3  |
| Excellent | 79.36 | 100    | 0.793     | 62.9  |
| Top9    | 78.14            | 100    | 0.781     | 61    |
| Biomectin | 77.94 | 100    | 0.779     | 60.7  |
| Congest | 75.9             | 100    | 0.759     | 57.6  |
| Total   | C1=560.8         | G=700  | 5.6       | 449.8 |

$\chi^2=3.75$ non sig.

2. **The effectiveness of control agents against *Frankliniella occidentalis* in the nursery**

The effectiveness of different chemical compounds included Radiant, Super Rigo, Berna Star and Top9 in reducing the population densities of *F. occidentalis* on strawberry plants were assayed received one spray of each compound during the experimental period, the results of these field experiments are tabulated in Table (5 and 6).

According to general mean percentage of reduction in population of *F. occidentalis* data in Table (6), there were significant differences among the four compounds whereas $\chi^2=29.5$ at 0.01. These compounds could be divided to three groups. The first group contained on Radiant showing high mortality (63.5%). The second group contained on Super Rigo and Top9 showing moderate effect (46.44% & 34.3%), respectively. The third group contained on Berna Star showing least effect (28.36%). From these results; it’s clear that the chemical compound Radiant is the most effective while the natural compound Berna Star is the lowest in controlling *F. occidentalis* under these experimental conditions.

These results are in line with Rahman et al (2011) in USA; Golmohammadi and Mohammadipour (2015) in Iran; Gholami and Sadeghi (2016) in Iran and Renkema et al (2018) in Florida.

Further work can be carried out to determine which pesticides are better to use especially when there is no significant difference in their effectiveness, this includes residual effect as well as comparison of PHI.
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Table 5. General mean percentage of reduction in mean number of Frankliniella occidentalis on strawberry plants at Wardan, Giza governorate on summer 2019

| Product     | 1 day | 3days | 5days | 7days | 14 days | General mean |
|-------------|-------|-------|-------|-------|---------|--------------|
| Radiant     | 20    | 45    | 63.3  | 89    | 100     | 63.5         |
| Super Rigo  | 9.1   | 25.6  | 33.3  | 70    | 94.2    | 46.44        |
| Top9        | 0     | 1     | 14.4  | 56    | 100     | 34.3         |
| Berna Star  | 0     | 1     | 2.2   | 45    | 93.6    | 28.36        |

Table 6. Chi square ($\chi^2$) analysis for the change by the infestation of F. occidentalis on Strawberry plants at Wardan, Giza governorate on summer 2019

| Product       | % corrected (a) | R (100%) | P (ai/R) | ai (ai/R) |
|---------------|-----------------|----------|----------|-----------|
| Radiant       | 63.5            | 100      | 0.635    | 40.3      | a          |
| Super Rigo    | 46.44           | 100      | 0.464    | 21.5      | b          |
| Top9          | 34.3            | 100      | 0.343    | 11.8      | c          |
| Berna star    | 28.36           | 100      | 0.284    | 8.1       |            |
| Total         | C=172.6         | G=400    | 1.726    | 81.7      |            |

$\chi^2=29.5$ sig. at 0.01

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تقييم كفاءة بعض المبيدات في مكافحة التربس والعنكبوت الأحمر علي نباتات الفراولة

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الموجز

أجريت هذه الدراسة في واردان بمحافظة الجيزة في مصر خلال موسم 2019 علي نباتات الفراولة. تهدف التجربة الأولي إلى تقييم كفاءة مختلفة المركبات التجارية في قمع العنكبوت الأحمر عبر تخفيف الكثافة العددية للعنكبوت الأحمر على نباتات الفراولة. وفقا للنسبة المئوية العامة لتخفيض أعداد العنكبوت الأحمر، أظهرت النتائج فروق غيرمعنوية بين المركبات السبع المختبرة حيث كانت نسبة الموت هي %85.94، %82.18، %81.4، %79.36، %78.14، %77.94، %77.94. و%75.9 على التوالي. يتضح من هذا أن المركب الكيميائي سولو هو المركب الأكثر فعالية بينما المركب كونجست هو الأقل فعالية، تتراوح الكثافة العددية بنسبة 18% إلى 36% تحت ظروف هذه التجربة.

الكلمات المفتاحية: تربس الأزهار الغربي، العنكبوت الأحمر، الفراولة، المكافحة