EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
TOXICOLOGY & PEST CONTROL

F

ISSN
2090-0791

WWW.EAJBS.EG.NET

Vol. 17 No. 2 (2025)

www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci.* (F. Toxicology& Pest control) *Vol.17(2) pp35-44 (2025)*
DOI: 10.21608/EAJBSF.2025.450870

Egypt. Acad. J. Biology. Sci., 17(2):35-44 (2025)

Egyptian Academic Journal of Biological Sciences
F. Toxicology & Pest Control
ISSN: 2090 – 0791
Res. Ethics No.: 03-2025-0033
http://eajbsf.journals.ekb.eg/

Gains-Losses Economic Assessment by Utilizing Three Methods to Control the Two Spotted Spider Mite, *Tetranychus. urticae* Koch on Winterstar^{TM} Cultivar of Strawberry

Mohamed A. Halawa[1]; A. A. Abdallah[2] and M. H. Mowafi[2] and E. El-Saiedy[3]
[1]European Group Agricultural Development Company, Alexandria, Cairo, Egypt.
[2]Agric. Zoology and Nematology Dept., Fac. Of Agric., Al-Azhar Univ., Cairo, Egypt.
[3]Plant Protection Dept., National Research Center, Dokki,Cairo, Egypt.
*E-mail: mohamedhalawa22590@icloud.com

ARTICLE INFO
Article History
Received:13/7/2024
Accepted:2/9/2025
Available:6/9/2025

***Keywords*:**
Tetranychus urticae; *Typhlodromips swiriskii*; *Phytoseiulus persimilis*; Strawberry; Venaldom 48%.

ABSTRACT

The efficiency of three methods (Predacious mites, *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and spraying of acaricides Venaldom 48% to control *Tetranychus urticae* Koch on WinterstarTM cultivar of strawberry was studied at El-Beheira governorate. The obtained data showed that the predatory mite, *P. persimilis* was the most effective mmethodwhere the reduction % of *T. urticae* rereached 8.85% followed by the acaricide, Venaldom 48% which achieved 67.67% of reduction while the predatory mite, *T. swiriskii* was the least effective method to cocontrol. *urticae* where the reduction percentage was 53.93%. On the other hand, the gains- losses economic were assessment to calculate the profit of strawberry yield / feddan which included local and export production where the predatory mite, *P. persimilis* method to control of *T. urtcae* achieved the highest profit (745000 L.E) followed by the predatory mite, *T. swirskii* method (679000 L.E) while the acaricide method achieved (516,600 L. E).

INTRODUCTION

Strawberry (*Fragaria ananassa*) is one of the most important crops in the world, where this status reflects the socio-economic relevance of the crop for both human nutrition and trade at different scales (Simpson (2018) & Antunes *et al.* (2020)). The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetrnychidae) is the main pest and one of the most obstacles, which effects on strawberry production in Egypt (Hassan *et al.* 2007). *T. urticae*, initially feeds on the lower leaf surface but can infest an entire plant as population density increases. Typical feeding symptoms of *T. urticae* are small, light-colored punctures, which in prolonged exposure, development into irregularly shaped, white or greyish-colored spots. Therefore, the high mite population causes significantly impacts on strawberry quality by reducing yield, fruit characteristics moreover, causes stunted growth and potentially leading to plant death as well. (Jeppson *et al.* 1975). While the traditional control strategies for two-spotted spider mite, *T. urticae* have relied on several applications of pesticides

throughout the strawberry production season resulting in high control costs and increasing the mite resistance to acaricide, many growers still rely on acaricides because of some factors like pest control effectiveness and economic considerations (Oatman *et al.* (1967) & Easterbrook *et al.* (2001). Shifeng Liu, *et al.* (2019) stated that the effectiveness and safety of the Bifenazate acaricides to control the two-spotted spider mites, and related mite species where the strawberry can be safely consumed 15 days after bifenazate application, since the residues are typically below the maximum residue limit (MRL). The half-life of bifenazate in strawberry fruits is relatively short, around 0.99 to 2.31 days, meaning it dissipates relatively quickly. So, the residues of bifenazate were effectively removed by washing after soaking and the results of dietary intake assessment indicated that potential dietary risk caused by bifenazate in strawberry were acceptable for consumers. (Eman M. Abdelmaksoud, *et al.* 2023). Pesticide residues are commonly found in exported strawberries, with multiple residues often detected. While some residues are removed through washing and processing, certain pesticides can be systemic and persist even after these treatments. The levels of these residues, however, are generally within acceptable safety limits for human consumption (Salim, *et al.* 2019). From this perspective, biological control became needed to obtain strawberry crop valid to export and safely for local consumption. The phytoseiid mites have been most widely mass-produced and sold commercially are *Phytoseiulus persimilis* Athias-Henriot and *Typhlodromips swiriskii* (athias-henriot). These predatory mites are mass-produced by biological control companies throughout the world. The specialist predatory mites *P. persimilis* feeds mainly on *T. urticae* and belongs to the specialist class of Phytoseiidae predators, as it is closely associated with its "unique" prey *T. urticae*. On the other hand, the generalist predator mite *T. swiriskii* feeds on many species of phytophagous mites and small insects and belong to generalist class of Phytoseiid predator (Abou-Awad *et al.* (2009) & Asmaa *et al.* (2022)). Total profit of strawberry crop depends on the cost of chemical and biological control. So, this study aims to evaluate three methods of *T. urticae* control on strawberries in terms of effectiveness, cost of control and their effect on gains and losses in strawberry crops.

MATERIALS AND METHODS

The evaluation of three methods to control of *T. urtcae*, releasing of the predacious mite, *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and spraying of acaricides Venaldom 48% (Bifenazate) and gains- losses economic assessment for the different control methods were conducted at Fresh-Box company in Adam village, Badr district, El-Beheira governorate.

1-Evaluating of three application methods *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and Acaricide (Venaldom 48%) to control the two-spotted spider mite, *Tetranychus urticae* Koch.

A- Mass Production of the Predatory Mites, *P. persimilis* and *T. swiriskii*;

The predatory mites were reared using modified methods of (EI-Saiedy 2003). Three polyethylene greenhouses (6 m width by 20 m length and 2.5 m high with a trapper door on one side. Roofs and all sides of the greenhouses were covered with polyethylene plastic) were established at Fresh-Box company in Adam village, Badr district, El-Beheira governorate. kidney bean seeds and Phaseolus vulgaris were cultivated in greenhouse. After two weeks from seeding, the kidney bean seedlings were artificially infested with spider mite, *Tetranychus urticae*. Leaves infested with *T. urticae* were distributed over the foliage of bean plants. The first greenhouse considers a source of spider mite only while the predacious mites *P. persimilis* and *T. swiriskii* were separately released on bean plants which artificially infested with spider mite stages in second and third greenhouse rrespectively. Plants in

greenhouses were monitored twice a week to observe the other pest or predator contamination and to keep predator-prey ratio. When the predatory mite's population was reached a highest level and starvation was happened the predatory individuals were gathering on the top of leaflet as the size of the head of a pin, it is considered an important sign predatory mites are ready to collecting.

B- Handling of the Predatory Mites:

The predatory mites (*P. persimilis* and *T. swiriskii*) can be collected by harvesting bean leaves with predators in bags for transport to the release. Bean leaves with predatory mite species were put separately in plastic bags, and then bags were put in ice box with Frozen until reaching open field.

C-Experiment Design and Sampling Procedure:

An area of four feddan was divided to four sections each section one feddan, planted with Winterstar^{TM} cultivar of strawberry. strawberry lines were left between each section to avoid the predatory mite escaping to the other one. Releasing the predatory mites was carried out on two strawberry cultivars, while the population of *T. urticae* being high on December. The releasing study lasted 21 weeks from 8th December 2023 to 29th of April 2024. The release was carried out early in the morning predatory mites, three predatory mite species *P. persimilis*, and *T. swirskii* were released in the first and second section respectively, at rate (10 predator: bean pit). Samples of 30 leaflets/ replicate were taken just before the release process as pre-count. After one week of releasing 30 strawberry leaflets were picked up and transferred to the laboratory in paper bags for 21 subsequent weeks.

D- Number of Release Times:

The predatory mite, *P. persimilis* was released one time at 1st of December 2023, while the predatory mite, *T. swirskii* was released three times at 1st , 22nd of December 2023 and 11February 2024.

E-Spraying of Acaricide, Venaldom 48%:

The third method of control was applicated in the third section of the experiment by spraying acaricide, Venaldom 48% for three times at 1st of December 2023, 6th of January and 18th of February 2024 by using 600-liter capacity motor at the recommended concentration, while the fourth section was left without any application as a control.

F- Reduction Percentages:

To evaluate the control methods of *T. urticae*, populations before and after treatments were counted on thirty leaflets of each treated and control plants. Reduction percentages were calculated according to Henderson and Tilton (1955).

2- Evaluating the Profit and losses of three application methods *P. persimilis*, *T.* and Acaricide (Venaldom 48%) to control the two-spotted spider mite, *T. urticae***.**

A-Costs of Different Methods of Control *T. urticae*:

The costs of control methods included:

1-nimbere times of application (one releas applicated for *P. persimilis* and three release applicated for *T. swiriskii*).
2-Price of predacious mites (600L.E for one release/feddan
3- Number of workers (two workers for one release).
4- Wages of workers (200L.E for each one/ day)
4-Price of acaricide
5- Number of workers for acaricide application (Two workers for one applicate).
6- Spray motor cost.

B- Profit and losses of three application methods *P. persimilis*, *T.* and Acaricide (Venaldom 48%) to control the two-spotted spider mite, *T. urticae***.**

The evaluation of profit and losses of three methods to control *T. urticae* methods depend on:

1-Local production/Feddan for each method.
2-Export production/Feddan for each method.
3-Total production/Feddan for each method.
4-Total for each method production/Feddan/ L.E. for each method.
5-Total Benefits/L. E for each method.

RESULTS AND DISCUSSION

A-Evaluating of Three Application Methods *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and Acaricide (Venaldom 48%) to Control the Two-Spotted Spider Mite, *Tetranychus urticae* Koch:

Data in Table (1) indicated that the population of *T. urticae* on Winterstar™ cultivar was affected by releasing of the predatory mite, *P. persimilis* at level 10 individual / pit during season (from December 2023 to April 2024). The population numbers of *T. urticae* were slightly decreased at the following post- counts until disappearing. The individual numbers were 16.11, 13.23, 11.11, 9.23, 7.24, 6.23, 5.12, 4.08, 3.95, 2.78, 1.15, 0.11, 0.23, 0.01, 0.02, 0, 0, 0, 0 and 0 individuals. Moreover, the reduction rates were 31.27. 50.2, 66.94, 73.41, 81.94, 86.48, 91.07, 94.14, 95.02, 96.84, 98.81, 99.91, 99.83, 99.99, 99.98, 100, 100, 100, 100, 100, 100%, at 8th , 15th, 22th , 29th of December2023, 6th, 13th , 20th , 27th of January2024, 4th, 11th, 18th, 27th of February, 3rd, 10th, 17th, 25th of March, 1st, 8th, 15th, 22nd and 29th of April 2024, respectively. On the other hand, the population of *T. urticae* was less affected by releasing *Typhlodromips swiriskii* (athias-henriot) whereas the population numbers were gradually increased after the first release until the second release at 6th of January 2024, the numbers of *T. urticae* were 16.15, 17.6, 17.78, 19.9 and 23.14 individual with reduction rate 27.52, 30.31, 44.35, 39.70, 39.27% this may due to the population of *T. urticae* in untreated area(control) was highly increased 23.1, 26.18, 33.12, 34.21, 39.5 individuals at 8th , 15th, 22nd, 29th of December and 6th of January. The second release of the predatory mite *T. swiriskii* was applicated at 6th of January and accordingly, the population of *T. urtcae* was decreased in 13rd of January and turned to slightly increased again from 20th of January until reached to the third release at 18th of February the *T. urticae* umbers in treated area were 20.35, 23.14, 25.15, 27.11 and 28.51 individuals with reduction rate ,53.53, 57.54, 61.69, 64.03 and 65.95 % while the *T. urticae* umbers in untreated area (control) were 45.4, 56.5, 68.6, 78.14, 86.8 and 94.92 individual at 13rd , 20th , 27th , 4th and 11th of February at this time the third release of the predatory mite, *T. swiriskii* was applicated So, the population of *T. urticae* was slightly increased at 18th of February and turned to gradually decreased from 25th of February to 17th of March then gradually increased from 25th of March and to 15th of April and finally, decreased from 22nd of April to end of season, the numbers of *T. urticae* were, 29.29, 28.1, 27.15, 23.23, 16.25, 17.5, 18.51, 19.32, 20.1, 13.15 and 9.41 individual with reduction rate 68.01, 74.91, 79.17, 81.06, 83.19, 81.16, 70.97, 60.05, 48.04, 56.19, -54.63 % while the numbers of *T. urticae* in untreated area were 94.92, 116.1, 135.1, 127.12, 100.2, 96.32, 66.1, 50.14, 40.1, 31.12 and 6.32 individual at 18th, 25th, of February , 3rd, 10th, 17th, 25th, of March , 1st, 8th, 15th, 22nd and 29th respectively.

The third method of control was spray of acaricide, Venaldom 48% where it was applicated for time, at 1st of December, 6th of January and 11th of February. The numbers of *T. urticae* before spray was 16.14 and 16.95 individuals in treatment and control respectively, while the population of *T. urticae* was affected after spray of acaricide, Venaldom 48% whereas the numbers of mite were 2.31, 0.95, 2.19, 4.63, 9.73, 15.92, 0.82, 4.9, 10.32, 16.92, 24.23, 30.62, 1.32, 5.91, 10.32, 16.7, 21.15, 25.07, 20.11, 17.15 and 15.12 individual with reduction rate 89.50, 96.19, 93.06, 85.79, 74.13, 63.17, 98.48, 92.5, 86.13, 79.53, 73.19, 72.3, 98.97, 95.12, 89.18, 81.79, 66.40, 47.49, 47.33, 42.13, -151.25% at 8th , 15th, 22th , 29th of December2023, 6th, 13th , 20th , 27th of January2024, 4th, 11th,

18th, 27th of February, 3rd, 10th, 17th, 25th of March, 1st, 8th, 15th, 22nd and 29th of April 2024, respectively.

Table 1: Evaluating three application methods *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and Acaricide (Venaldom 48%) to control the two-spotted spider mite, *Tetranychus urticae* Koch.

Date of sampling	Release of *Phytoseiulus persimilis*		Release of *Typhlodromips swirskii*		Acaricides (Venaldom 48 %)		Control
	Mean numbers of *T. urticae*	Reducion %	Mean numbers of *T. urticae*	Reducion %	Mean numbers of *T. urticae*	Reducion %	Mean numbers of *T. urticae*
Pre-coun.1Dec 023 **(A) (B) (C)**	17.2		16.35		16.14		16.95
8 Dec.	16.11	31.27%	16.15	27.52%	2.31	89.50%	23.1
15Dec.	13.23	50.20%	17.6	30.31%	0.95	96.19%	26.18
22Dec. **(B)**	11.11	66.94%	17.78	44.35%	2.19	93.06%	33.12
29-Dec	9.23	73.41%	19.9	39.70%	4.63	85.79%	34.21
6 Jan.2024 **(C)**	7.24	81.94%	23.14	39.27%	9.73	74.13%	39.5
13-Jan	6.23	86.48%	20.35	53.53%	15.92	63.17%	45.4
20-Jan	5.12	91.07%	23.14	57.54%	0.82	98.48%	56.5
27-Jan	4.08	94.14%	25.15	61.99%	4.9	92.50%	68.6
4 Feb.	3.95	95.02%	27.11	64.03%	10.32	86.13%	78.14
11 Feb. **(B)**	2.78	96.84%	28.51	65.95%	16.92	79.53%	86.8
18 Feb. **(C)**	1.15	98.81%	29.29	68.01%	24.23	73.19%	94.92
25 Feb.	0.11	99.91%	28.1	74.91%	30.62	72.30%	116.1
03-Mar	0.23	99.83%	27.15	79.17%	1.32	98.97%	135.1
10-Mar	0.01	99.99%	23.23	81.06%	5.91	95.12%	127.12
17-Mar	0.02	99.98%	16.25	83.19%	10.32	89.18%	100.2
25-Mar	0	100.00%	17.5	81.16%	16.7	81.79%	96.32
01-Apr	0	100.00%	18.51	70.97%	21.15	66.40%	66.1
08-Apr	0	100.00%	19.32	60.05%	25.07	47.49%	50.14
15-Apr	0	100.00%	20.1	48.04%	20.11	47.33%	40.1
22-Apr	0	100.00%	13.15	56.19%	17.15	42.13%	31.12
29-Apr	0	100.00%	9.41	-54.36%	15.12	-151.25%	6.32
Mean	4.4	88.85%	20.8	53.93%	12.4	67.67%	62.4

(A)= Time of release the predatory mite, ***Phytoseiulus*** *persimilis.*
(B)= Time of release the predatory mite, ***Typhlodromips*** *swirskii.*
(C)= Time of acaricide, Venaldom 48 % application**.**

B-Evaluating the Profit and Losses of Three Application Methods *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swiriskii* (athias-henriot) and Acaricide (Venaldom 48%) to Control the Two-Spotted Spider Mite, *Tetranychus urticae* Koch.

The Comparison between reduction Rates in three controlling methods of *T. urticae* on Winterstar^{TM} cultivars in Badr district- El-Beheira Governorate throughout strawberry cultivation at season 2023-2024 is presented in Table 2 and Figure 2. The reduction rates of the two-spotted spider mite moving stages was generaly higher throughout releasing P. *persimilis* unlike both releasing *T. swirskii* and spraying Venaldom 48% to control the *T. urticae*. At the Winterstar^{TM} cultivar, the reductions rates of *T. urticae* moving stages were

88.85, 53.93 and 67.67 % at method of releasing *P. persimilis*, releasing of *T. swirskii* and method of spraying Venaldom 48% , respectively.

Table 2: Comparison between reduction rate in three controlling methods of T. urticae on WinterstarTM cultivars in Badr district- El-Beheira Governorate..

Control methods	Reduction % of the two-spotted spider mite, T. urticae on Winterstar cultivar
Releasing of *P. persimilis*	88.85%
Releasing of *T. swirskii*	53.93%
Venaldom 48% spraying method	67.67%

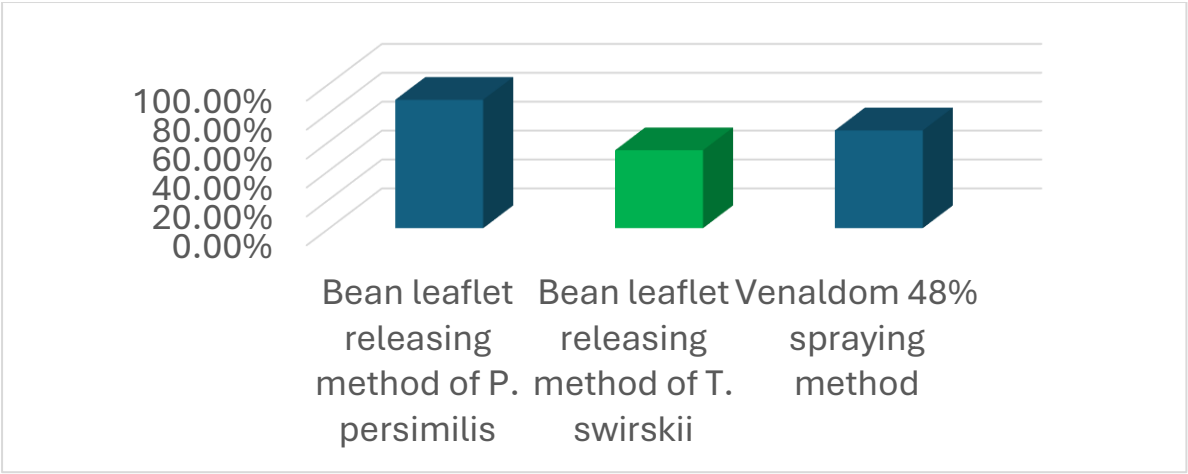

Fig. 1: Comparison between reduction rate in three controlling methods of *T. urticae* on Winterstar^{TM} cultivars in Badr district- El-Beheira Governorate.

Comparing the obtained data of reduction rates of three controlling methods of *T. urticae* Winterstar^{TM} cultivar throughout strawberry cultivation during seasons 2023-2024 it could be concluded that the *P. persimilis* provided more others reduction rate. this outcomes attributed to the predatory mite, *P. persimilis* belongs to a Type I specialized predator that primarily feeds on *T. urticae* . this mean that the predatory mite, *P. persimilis* has a strong preference and reliance on *T. urticae*.

This is contrary to the results of the predatory mite, *T. swirskii* which presented the low reduction rate, this owing to the predator belong to a Type III generalist predator because *T. swirskii* feeds on a wide variety of pests, including thrips, whiteflies, and various mite species (McMurtry *et al.*, 2013).

On the other hand, the reduction rate of spraying Venaldom 48% presented moderate reduction rate of the two-spotted spider mite, *T. urticae*. this owing to the active matter of Venaldom 48% is bifenazate which has consistent degradation of half lives in plant and soil 9.46-27.29 and 3.81- 17.24, days, respectively (Hanbing *et. al*. 2025). Actualy, 10 weeks have passed since the last application of the third applicable of Venaldom 48% which, allowed the population of the two-spotted spider mite, *T. urticae* to increase repeatedl

An assessment of strawberry production in terms of treated and untreated areas with different methods to control the two-spotted spider mite, *T. urticae* provided in Table 3 and Figure 3. The table shows that releasing both predators were succeeded to achieve more income values unlike other methods of controlling the two-spotted spider mite. The local income values were 495,000, 495,000, 466,400 and 314,600 L. E. / Feddan when applied *P.*

persimilis, *T. swirskii*, chemical control and untreated area, respectively. On the other hand, the income values of quantities, which were intended for export, were achieved 250,000, 250,000, 51,200 and 70,000 L. E. / Feddan at the same applicable methods, respectively. Accordingly, the total income values were achieved 745,000, 745,000, 517,600 and 384,600 L. E. / Feddan at the previous applicable methods, respectively. It could be concluded that the two predatory mites, *P. persimilis* and *T. swirskii* predators were provided significant income value compared with both Chemical control and untreated area. Moreover, exported value shows a significant increase as well.

The different costs appropriated to different application methods to control the two-spotted spider mite, *T. urticae* are presented in Table 4 and Figure 4. The total times costed 3000, 9000 and 6915 L. E. / Feddan at application methods *P. persimilis*, *T. swirskii*, chemical control and untreated area, respectively. These total costs excluded the flu, shipping fleet assignation, seedling costs and agricultural services.

Profits analysis of strawberry production in terms of treated and untreated\ areas with different methods to control the two-spotted spider mite, *T. urticae* are declared in Table 5 and Figure 3 The total profits were 742,000, 670,000, 510,685 and 384,600 L. E. /Feddan at application methods *P. persimilis*, *T. swirskii i*, chemical control and untreated area, respectively.

It could be concluded that the several types of profit contained in the income statement include gross profit, operating profit, taking care of production quality in terms of exaggerating production rate and minimizing maximum residue limits (MRLs) of the pesticides, which present the maximum legally allowed levels of pesticide residues in product. (Mulyadi, *et al.,* 2016) states that "the results of the transaction income, expenses, losses and profits will produce a net profit", Moreover the profitability is influenced by various factors including costs, sales and production quantities, and selling prices. In addition, the large volume of sales has an impact on the number of production volumes of production's yield or services so that the sales volume and production volume can also be a factor affecting profit. Accordingly, to obtain a certain profit the Farmers tries to obtain the certain predators to support the production's growth and meet either export and consumer's needs. In addition, the farmers should focus on quality, which can therefore be a key strategy for maximizing profits.

Table 3: An assessment of strawberry production in the terms of treated and untreated areas with different methods to control the two-spotted spider mite, *T. urticae*.

Treating methods	Strawberry Production / ton / Feddan					
	Local production/Feddan		**Export production/Feddan**		**Total production/Feddan**	
	Ton	**L.E.**	**Ton**	**L.E.**	**Ton**	**L.E.**
Phytoseiulus persimilis	22.5	495,000	2.5	250,000	25	745,000
Typhlodromips swirskii	19.5	429,000	2.5	250,000	22	679,000
Chemical control	21.2	466,400	0.8	51,200	22	517,600
Untreated area	14.3	314,600	0.7	70,000	15	384,600

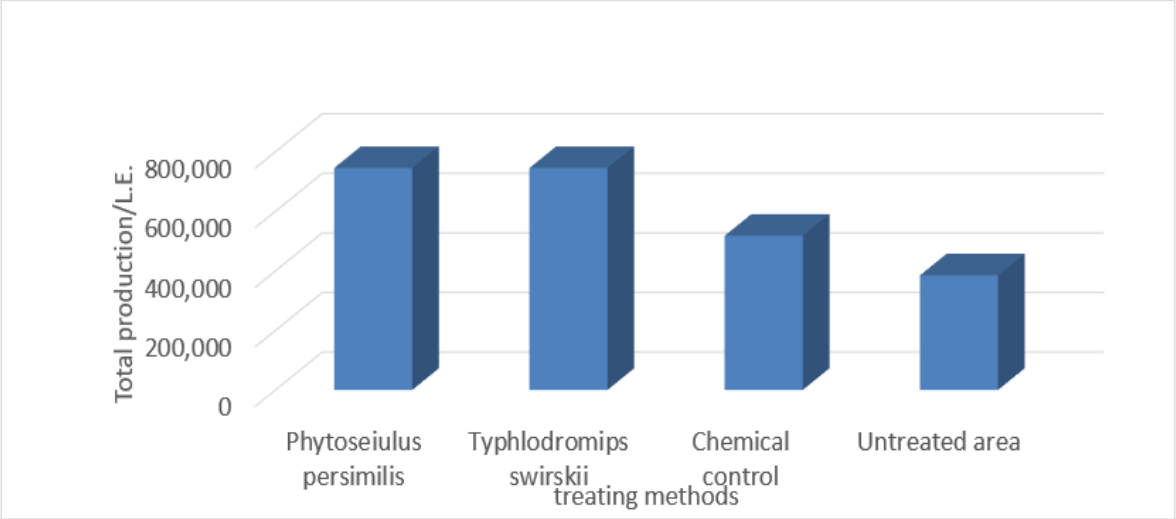

Fig.2: An assessment of strawberry production in the terms of treated and untreated areas with different methods to control the two-spotted spider mite, *T. urticae*.

Table 4: The different costs appropriated to different application methods to control the two-spotted spider mite, T. urticae.

Different application Methods	application times/ Feddan		Workers / Feddan		Total Costs/L.E.*
	No	Costs/L.E.	No	Costs/L.E.	
Phytoseiulus persimilis	1	2000	4	1000	3000
Typhlodromips swirskii	3	6000	12	3000	9000
Chemical control	3	5415	2	1500	6915
Untreated area	0	0	0	0	0

* The total costs excluded the flue, shipping fleet assignation, seedling costs and agricultural services.

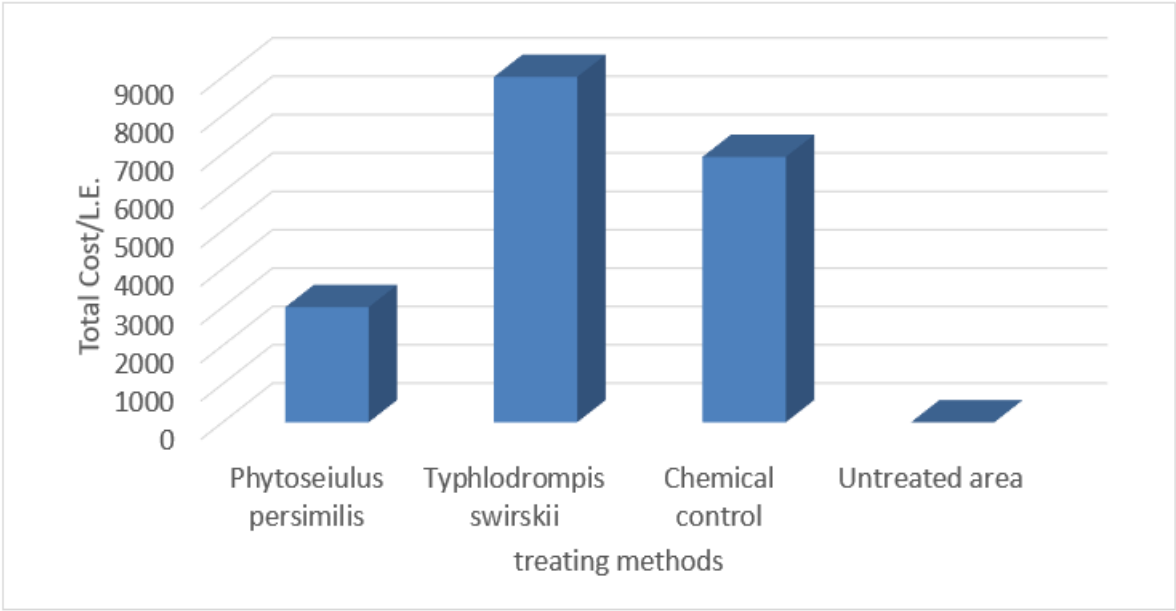

Fig. 3: The different costs appropriated to different application methods to control the two-spotted spider mite, *T. urticae*.

Table 5: Profits analysis of strawberry production in terms of treated and untreated\ areas with different methods to control the two-spotted spider mite, *T. urticae.*

Different application Methods	Total production/Feddan/ L.E.	Total production/Feddan/ L.E.	Total Benefits/L.E.
Phytoseiulus persimilis	745,000	3,000	742,000
Typhlodrompis swirskii	679,000	9,000	670,000
Chemical control	517,600	6,915	510,685
Untreated area	384,600	0	384,600

Declarations

Ethical Approval: Not applicable

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: I hereby verify that all authors mentioned on the title page have made substantial contributions to the conception and design of the study, have thoroughly reviewed the manuscript, confirm the accuracy and authenticity of the data and its interpretation, and consent to its submission.

Funding: No funding was received.

Availability of Data and Materials: All datasets analyzed and described during the present study are available.

Acknowledgment: Not applicable.

REFERENCES

Abou-Awad B. A., Metwally A. M. and Al-Azzazy M. M. (2009). Typhlodromips swirskii (Acari: Phytoseiidae): A Predator of Eriophyid and Tetranychid Mango Mites in Egyp. *ACARINES,* 3: 59-64

Antunes, M. G., Mucharreira, P. R., Justino, M. R., & Texeira Quirós, J. (2020). Total Quality Management and Quality Certification on Services Corporations. *International Journal for Quality Research,* 14(3), 847-864.

Asmaa M. Nagah, S. A. Allam, H.E. Abdelnabby, Ghada R. Mohamed and G.H. Rady (2022). *Benha Journal of Applied Sciences*, (BJAS) Vol. 7(12), 1-6.

Easterbrook, M. A., Fitzgerald, J. D., and Solomon, M. G. (2001). Biological control of strawberry tarsonemid mite Phytonemus pallidus and two-spotted spider mite Tetranychus urticae on strawberry in the UK using species of Neoseiulus (Amblyseius)(Acari: Phytoseiidae). *Experimental & Applied Acarology,* 25(1), 25-36.

El-Saiedy, E.M.A. (2003): Integrated control of red spider mite, Tetranychus urticae Egypt. J. Plant Prot. Res. Inst. (2018), 1 (2): 153-167 166 Koch on strawberry plants. Ph.D. Thesis, Fac. of Agric. Cairo Univ. 171pp

Eman M Abdelmaksoud1 , Walaa M El-Sayed1 , Shoukry A El-Refai1 , Kadry W Mahmoud1 Khaled MA Ramadan2(2023). Residue Assessment of Bifenazate, Spirodiclofen and Abamectin in Strawberry Fruits Under Field Conditions. *Arab Universities Journal of Agricultural Sciences,* 31 (1) 149-156.

Hanbing Du , Guiquan Chen , Xiufeng Duan, Xiaoyun Yang and Hanhong Xu (2025). Final Residue, Degradation Dynamics, and Dietary Risk Assessment of Bifenazate in Citrus and Soil. *Soil and Sediment Contamination: An International Journal,* 34, (3).477-492

Hassan, M.F., Ali, F.S., Hussein, A.M., and Mahgob, M.H. (2007). Control measures of Tetranychus urti cae Koch on two cucumber cultivars in plastic houses. *Acarines,* 1: 11–15.

Henderson, C. F. and Tilton, E.W. (1955). Tests with acaricides against the brown wheat mite. *Journal of Economic Entomology,* 48(2): 157-161.

Jeppson, L. R., H. H. Keifer & E.W. Baker. (1975). Mites' Injurious Economic Plants. University of California Press; Berkeley, Los Angeles, London. 614 pages.

McMurtry, J. A., De Moraes, G. J. and Sourassou, N. F. 2013. Revision of the Lifestyles of Phytoseiid Mites (Acari: Phytoseiidae) and Implications for Biological Control Strategies. ***Systematic and Applied Acarology,***48(2): 157-161.

Salim, Y. M. M., E. E. Nour El-Deen, and A. M. K. Nassar (2019). Study of Pesticides Residues in Strawberry Fruits Collected from Major Producing Governorates in Egypt. *Journal of Applied Plant Protection,* Vol. 8 (1): 1-6.

Simpson D. (2018). The economic importance of strawberry crops. In the genomes of rosaceous berries and their wild relatives 1–7. Cham, Switzerland: Springer.

Shifeng Liu, Hongru Kou, Baofeng Mu, Jinzhong Wang, Zhiyong Zhang (2019). Dietary risk evaluation of tetraconazole and bifenazate residues in fresh strawberry from protected field in North China. *Regulatory Toxicology and Pharmacology.* .Vol. 106, Pages 1-6

Oatman, E. R., McMurtry, J. A., Shorey, H. H., and Voth, V. (1967). Studies on integrating Phytoseiulus persimilis releases, chemical applications, cultural manipulations, and natural predation for control of the two-spotted spider mite on strawberries in southern California. *Journal of Economic Entomology,* 60(5), 1344-1351.

MUlyadi, S., Rahardjo, W., & Basuki, A. M. H. (2016). The Role of Parent-Child Relationship, Self-Esteem, Academic Self-Efficacy to Academic Stress. *Procedia Social and Behavioral Sciences, 217,* 603-608