J. of Plant Protection and Pathology, Mansoura Univ., Vol. 16 (4):219 - 224, 2025

Journal of Plant Protection and Pathology

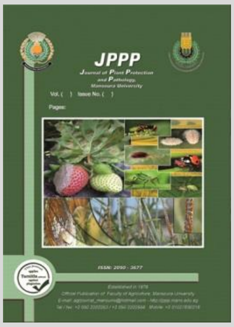
Journal homepage & Available online at: www.jppp.journals.ekb.eg

Influence of Two Phytoseiid Predacious Mites on Population Density of the Two-Spotted Spider Mite, *Tetranycus urticae* Koch on Eggplant *(Solanum melanogena* L.) in Protected Cultivation (Acar: Tetranychidae: Phytoseiidae)

Cross Mark

Fouly, A. H.[1]; T. E. Ata[2*]; S. S. Awadalla [3] and Eman A. Marouf [2]

[1]Dept. of Agric. Zoology, Fac. Agric., Mansoura Univ.
[2]Dep. of Plant Pro. Fac. Agric. Damietta Univ.
[3]Dep. of Econ. Ent. Fac. Agric. Mansoura University.



ABSTRACT

One greenhouse located in the Faculty of Agriculture, Mansoura University was used to achieve this study, over two consecutive seasons 2023 and 2024. The aim of the experiments was to investigate the role of predacious mites in regulating the population density of the two-spotted spider mite (TSSM), *Tetranychus urticae* Koch, which attacks eggplant (*Solanum melanogena* L.) under protected cultivation conditions. The results indicated that the two species of predacious mites, *Euseius scutalis* (A.-H.) and *Amblyseius swirskii* A.-H., influenced significantly on the numbers of (TSSM) on eggplant. The findings clearly showed synchronization between the population of (TSSM) and the two predacious mites, with an increase in *T urticae* numbers being followed by a rise in the predator populations. However, a decrease in (TSSM)did not result in a corresponding decrease in predator numbers. This can likely be attributed to the presence of other insect species (prey) inhabiting the tested plants, which these predators may prefer.

Keywords: *Amblyseius swirskii, Euseius scutalis, Tetranycus urticae,* greenhouse.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is a widely cultivated vegetable crop, thriving in a wide range of climate globally (Kashyap *et al*., 2003). It is recognized as a rich source of essential vitamins and minerals, contributing to human nutrition (Kalloo, 1993; Matsubara *et al*., 2005).

T. urticae Koch ranks among the most harmful mite species, attacking numerous economically significant plants and causing severe yield reductions (Azouz *et al*., 2014).

Predators from the Phytoseiidae family (Berlese) play a crucial role in suppressing agricultural pests such as mites and insects across a variety of crops (Bounfour & McMurtry, 1987; McMurtry & Croft, 1997; Fouly *et al*., 2014; Al-Shammery, 2018). As one of the most prevalent predacious mite groups found on plants, Phytoseiidae contribute significantly to the natural regulation of some pest mites and insects. Several species within this family have been commercially mass-reared for use in biological control programs targeting pest mites, thrips, and whiteflies (Moraes & McMurtry, 1981). These mites are widespread, comprising three subfamilies and over 2,000 identified species worldwide (Kostiainen & Hoy, 1996; McMurtry & Croft, 1997). Differences in prey selection behavior influence food intake both quantitatively and qualitatively, ultimately affecting reproductive success. If such behavioral traits have a genetic basis, natural selection is likely to favor genotypes that optimize reproductive potential. As a result, phytoseiid mites are expected to exhibit selective feeding preferences rather than consuming all available food sources indiscriminately (Van Lenteren, 1986). The biological control of thrips using predacious mites was initially introduced in European greenhouse-grown sweet pepper crops affected by the onion thrips (*Thrips tabaci* Lindeman) (Thripidae). The commercial application of *Amblyseius cucumeris* (Oudemans), *A. barkeri* Hughes, and *A. fallacies* Garman began in the Netherlands in 1985. By that time, predator releases covered approximately 25% of the country's greenhouse sweet pepper production (De Klerk & Ramakers, 1986; Al-Shammery, 2018).

Euseius scutalis is a well-known generalist predacious mite belonging to the Phytoseiidae family, commonly distributed across Middle Eastern countries such as Lebanon, Iran, Egypt, and Jordan, as well as North Africa. This species is frequently found on various host plants, including different *Citrus* species (Porath & Swirski, 1965; Bounfour & McMurtry, 1987; Fouly *et al*., 2011). Studies have demonstrated that *E. scutalis* preys on spider mites and targets the eggs as well as mobile stages of *Bemisia tabaci* (Swirski *et al*., 1967; Meyerdirk & Coudriet, 1986; Nomikou *et al*., 2001; Al-Shammery, 2011; Fouly *et al*., 2013). As a generalist predator, its diet includes spider mites along with various other prey species (McMurtry, 1992).

Amblyseius swirskii (A.-H.) is a generalist predacious mite widely used for controlling *Bemisia tabaci* and many species of thrips in the protected cultivation crops (Nomikou *et al*., 2001; Messelink *et al*., 2006; Winner *et al*., 2008). Commercially produced *A. swirskii* can be introduced into crops using various release methods, most of which involve distribution from multiple point sources. One common method involves slow-release sachets small breeding units hung on plants that gradually produce predacious mites over several weeks. Alternatively, predaceous mites, typically mixed with a bran or vermiculite carrier, can be placed in small piles on leaves or the substrate. Another method

[*] **Corresponding author.**
E-mail address: drtarekata@du.edu.eg
DOI: 10.21608/jppp.2025.369005.1327

involves broadcasting the mites across the crop using air-blast techniques (Opit *et al*., 2005). To ensure even predator distribution, the release strategy should consider how far the mites can travel from their release site. Predacious mites generally disperse between plants through both ambulatory (walking) and aerial movement (Croft & Jung, 2001). In open field crops, aerial dispersal allows for rapid movement across the field (Croft & Jung, 2001; Jung, 2005). However, in greenhouse environments, where wind speeds are typically low, mites primarily rely on ambulatory movement for dispersal (Zemek & Nachman, 1999).

The present study aims to assess the impact of two species of predacious phytoseiid mites, *A. swirskii* and *E. scutalis*, on the population density of (TSSM), on eggplant grown in greenhouse conditions.

MATERIALS AND METHODS

Area of study:

To conduct this study, a greenhouse located at the Faculty of Agriculture, Mansoura University, in Mansoura, Egypt, was used during the two consecutive seasons 2023 and 2024. The greenhouse was planted with eggplant (*Solanum melongena*). The seedlings were transplanted into 40 cm diameter pots in the beginning of March of the two years of study, using a soil mix consisting of equal proportions of clay soil, peat moss, and sand (w/w). The plants were artificially infested with tw3o-spotted spider mites after 40 days from plantation.

Culture of (TSSM):

Tetranycus urticae was collected from infested eggplant grown in the farm of the Fac. Agric., Damietta Univ. The mites were then reared in the lab. on hibiscus leaves (*Hibiscus rosa-sinensis* L.) to sustain their population.

Rearing of spider mite:

Petri dishes (12 cm in diameter) served as observation platforms for studying mites in the laboratory (Zhang *et al.,* 1999). Hibiscus leaf discs were placed upside down on moistened cotton pads (10 cm in diameter, 1 cm thick) that were fully saturated with water. To prevent mite escape, the leaf edges were enclosed with wet cotton. The leaves were inspected every 5 days and replaced with fresh leaves when overcrowding occurred or as required.

Stock colonies of predaceous mites:

Amblyseius swirskii and *E. scutalis* stock culture was initiated using gravid female individuals was obtained from leaves of wild castor in Damietta during months of Feb. and March. The leaf samples were placed on paper sheets and transported to the Plant Protection Laboratory at the Faculty of Agriculture, Damietta University, where they were examined directly under a stereomicroscope. The predacious mites were reared on freshly harvested hibiscus leaves, which were positioned upside down on moistened cotton pads inside plastic trays. To maintain adequate moisture levels, water was added as necessary. (TSSM) was provided daily in sufficient quantities as the primary food source for the predators.

Experiment procedure:

Release of *Amblyseius swirsiki* and *Euseius scutalis*:

Amblyseius swirskii and *E. scutalis* were prepared for the release process. Adult predacious mites were placed in small sachets with date palm pollen and stored in a cool location until their release on plants on the same day.

Sampling methods and assessment:

To study the levels of mite pest infestation and predator populations on the plants, the following procedures were carried out:

To monitor the population dynamics of mite pests and predators, the numbers of (TSSM) and its predators were systematically observed, counted, and documented weekly on 15 plant leaves, with one leaf selected per plant. A leaf from each selected plant was collected, individually packed in labeled plastic bags, and immediately transported to the laboratory for analysis. Changes in the pest population were considered indicative of the impact of predacious mites. Additionally, the influence of weather conditions from the seven days preceding each inspection was also examined.

Evaluation was conducted 6 days after the release of the predacious mites, and subsequent evaluations were made every 6 days. In each plot, the lower, middle, and upper parts of randomly selected plants were assessed visually, with 15 leaves being examined. The number of (TSSM) and the motile stages and eggs of the predacious mites were counted to quantify the effect of *A. swirskii* and *E. scutalis* releases on the population of (TSSM)**.**

Statistical analysis:

The obtained data were analyzed using ANOVA test and partial regression analysis in SAS (Statistical Analysis System). Mean differences were evaluated using Duncan multiple range test in SAS program (SAS, 2003).

RESULTS AND DISCUSSION

Population fluctuation relationship between *Tetranychus urticae* and two predacious mites inhabiting eggplant:

The results presented in Table (1) and Figure (1) illustrate the occurrence impact of the two predacious mites, *Amblyseius swirskii* and *Euseius scutalis* as well as their combination on the population density of (TSSM), in comparison to a control group.

Table 1. Average numbers of *Tetranychus urticae* subjected to the application of each of *Amblyseius swirski* and *Euseius scutalis* as well as acombination of both predators

Year	*A. swriskii & E. scutalis*	*A. swiriski*	*E. scutalis*	Control	LSD (0.05)
1st	458.6±96.4	505.8±97.3	794.4±120.3	2006.9±217.4	408.3
2nd	486.3±96.3	506.4±100.1	738.8±117.5	1937.6±199.6	374.7

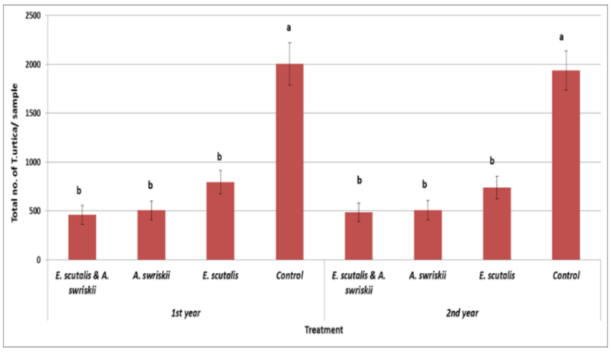


Figure 1. Seasonal average number of *Tetranychus urticae* per 15 eggplant leaves during 2023 and 2024 under greenhouse conditions

Statistical analysis revealed significant differences in the population densities of (TSSM) across the various treatments. The population of (TSSM) significantly decreased in the presence of the two predacious mites.

The highest effect of the predacious mites on the average numbers of (TSSM) was clearly observed in the case of release the combination of both predators, where the average number of (TSSM) was 458.6 and 486.3 individuals during the 1st and 2nd year, respectively. These numbers were followed by when the predacious mite *A. swirskii* was singly applied, where the average numbers of (TSSM) were 505.8 and 506.4 individuals during the 1st and 2nd year, respectively.

On the other hand, applying *E. scutalis* alone also affected the population density of (TSSM), where the average numbers of (TSSM) were 794.4 and 738.8individuals during the 1st and 2nd year, respectively.

In contrast, the population density of (TSSM) was significantly higher in the control, where (TSSM) averaged 2006.9 and1937.6 individuals during the 1st and 2nd year, respectively.

Population density of *Tetranychus urticae* in the absence of predacious mites:

Data presented in Figure (2) illustrated the population density of (TSSM) on eggplant in the control group (without predacious mites). Throughout the planting season, the population density of (TSSM) continued to rise. In the first year of the study, the peak population was recorded on June 30th, with an average of 3,412 individuals per sample. However,

In the second year, a similar trend was observed; although the highest population of spider mites was recorded on June 30th was slightly lower with an average of 3,167 mite individuals per sample, respectively.

These results indicated that in the absence of predacious mites, (TSSM) population continued to grow throughout the entire planting season on eggplant. Although the peak population in the second year was lower than that in the first year, where the overall trend of population increase over the season remained consistent. This suggests that (TSSM) can thrive and proliferate when natural predators were absent.

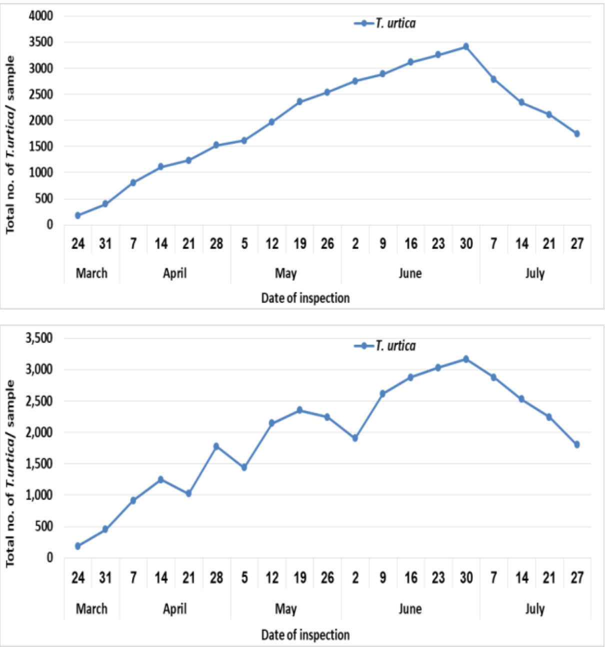


Figure 2. weekly total numbers of the *Tetranychus urticae* per 15 eggplant leaves during 2023 and 2024 under greenhouse conditions

Impact of *Amblyseius swirskii* on the population density of *Tetranychus urticae*:

Data presented in Figure (3) illustrate the interaction between (TSSM) and *A. swirskii* on eggplant. The highest weekly population of (TSSM) was recorded on April 21st, with 1,254 individuals per sample. Following this peak, it was noticed that the population of the predacious mite *A. swirskii* increased, resulting in a considerable decline in the number of (TSSM). The population of *A. swirskii* fluctuated throughout the planting season, with the highest count recorded on June 2nd, at 117.00 individuals per sample in the first year.

In the second year, the highest weekly population of (TSSM) was observed on April 14th, with 1,244 individuals per sample. Similarly, after this peak, the population of *A. swirskii* grew, leading to a direct reduction in (TSSM) numbers. The population of *A. swirskii* fluctuated during the planting season, with the highest count recorded on July 14th, at 102 individuals per sample.

The data indicate that in the absence of predacious mites at the beginning of the planting season, the population of (TSSM) continued to increase. However, as the population of the predacious mite, ,*A. swirskii* grew the population of (TSSM) decreased throughout the entire season on eggplant.

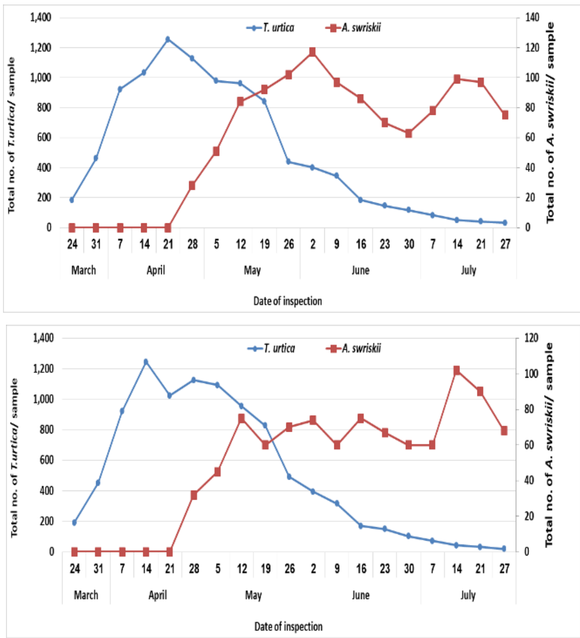


Figure 3. weekly total numbers of the *T. urticae* and its predacious mite, *A. swriskii* per 25 eggplant leaves during 2023 and 2024 under the greenhouse condition

Impact of *Euseius scutalis* on the population density of *Tetranychus urticae*:

Data presented in Figure (4) illustrate the relationship between population density of both (TSSM) and *E. scutalis* on eggplant. It was noticed that the highest weekly population of (TSSM) was recorded on April 21st, with an average of 542.00 individuals per sample. Following this peak, the population of the predacious mite *E. scutalis* increased, leading to a considerable reduction in the number of (TSSM) individuals. The population of *E. scutalis* fluctuated throughout the planting season, with the highest count recorded on June 30th, reaching 133.00 individuals per sample in the first year. In the second year, the highest weekly population of (TSSM) was observed on May 12th, with 1,597 individuals per sample. After this peak, the population of *E. scutalis* accordingly fluctuated throughout the planting season, with the highest count recorded on June 30th, reaching 98.00 individuals per sample.

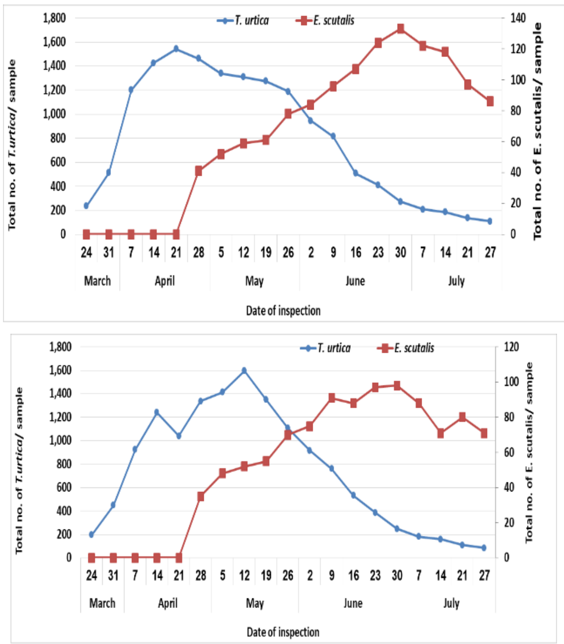


Figure 4. weekly total numbers of *Tetranychus urticae* and its predacious mite, *Euseius scutalis* per 15 eggplant leaves during 2023 and 2024 under greenhouse conditions

Impact of *Amblyseius swirskii* and *Euseius scutalis* on the population density of *Tetranychus urticae*:

Data presented in Figure (5) illustrate the relationship between (TSSM) and the combination of predators, *A. swirskii* and *E. scutalis* on eggplant. The highest weekly number of (TSSM) was recorded on April 21st, with 1367 individuals per sample.

Following this, the population of the predacious mites increased, leading to a decrease numbers of (TSSM) individuals. The number of *E. scutalis* and *A. swirskii* fluctuated during the plantation and the highest number recorded in July 14th and 21st, with 97 and 105 individuals per sample for the two predators respectively, in the 1st year.

In the 2nd year the highest weekly number of (TSSM) was recorded on April 14th, with 1241 individuals per sample.

Following this, the population of the predacious mites increased, leading to a decrease numbers of (TSSM) individuals. The number of *E. scutalis* and *A. swirskii* fluctuated during the plantation and the highest number recorded in June 16th with 81 and 78 individuals per sample for the two predators respectively.

The obtained results clearly show that an increase in the number of (TSSM) is followed by a rise in the population of associated predators. However, a decrease in the number of (TSSM) did not lead to a decrease in predator numbers. This could be attributed to the presence of other insect species (prey) on the plants that these predators may prefer.

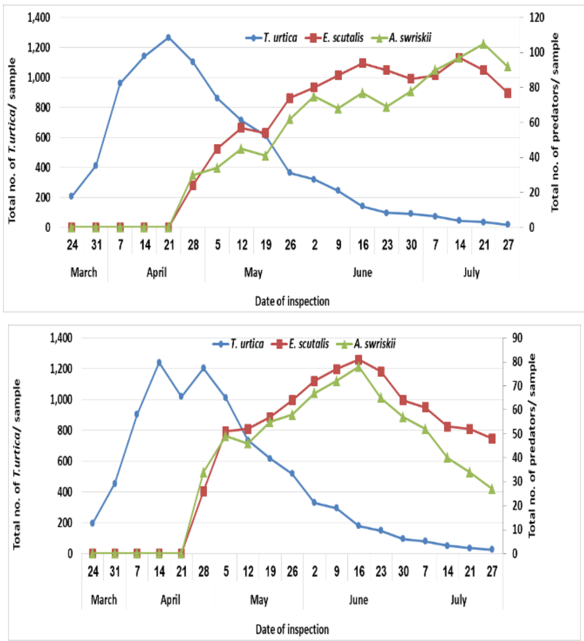


Figure 5. weekly total numbers of the *T. urticae* and its predacious mites, *A. swirskii* and *E. scutalis* per 25 eggplant leaves during 2023 and 2024 under the greenhouse condition

The influence of predacious mites on population density of *T. urticae*:

Statistical analysis showed the relationship between the average numbers of (TSSM) and associated predators on eggplant (Table 1). The simple correlation analysis showed that the relation between the populations activity of (TSSM) and *A. swirskii* is positively non-significant (r. = 0.091), this means that the predators prefer to feed on this prey.

While the relation between the population activity of (TSSM) and the predacious mite, and *E. scutalis* were negative and non-significant, with correlation coefficient values (r.) were -0.220 respectively this means that the predators does not prefer to feed on this insect.

While the relation between the population activity of (TSSM) and the predacious mite, and *E. scutalis* were negative and non-significant, with correlation coefficient values (r.) were -0.220 respectively this means that the predators does not prefer to feed on this insect.

The above mentioned data in Table (2) statisticaly showed that there were significant negative relations between *T. urtica* populations and the two predacious mites, *E. scutalis* and *A. swriskii* in all treatments during the two tested years-experiments.

Table 2. Simple correlation coefficient, partial regression values and explained variance (E.V.) between the weekly mean numbers of *Tetranychus urtica* and the two predacious mites on eggplant during 2023 and 2024

Year	Predacious mite species		Simple correlation analysis		Multiple partial regression analysis		
			r.	P.	b.	p.	E.V.
2023	*Amblyseius swriskii*		-0.497	0.031	-5.098	0.031	24.70%
	Euseius scutalis		-0.556	0.014	-6.18	0.014	30.90%
	Combined effect	*Amblyseius swriskii*	-0.767	0.000	-6.979	0.319	59.00%
		Euseius scutalis	-0.750	0.000	-1.798	0.788	
2024	*Amblyseius swriskii*		-0.545	0.016	-7.071	0.016	29.70%
	Euseius scutalis		-0.337	0.158	-4.691	0.158	11.40%
	Combined effect	*Amblyseius swriskii*	-0.413	0.079	37.24	0.004	59.00%
		Euseius scutalis	-0.548	0.015	-40.83	0.001	

Therefore, the results indicated that the influence of the presence of different predators on *T. urtica* population could be seen by the results of partial regression values in (Table 2). It was observed that the explained variance of predacious mites affecting *T. urtica* population activity was 24.7, 30.9 and 59.0 % in the first year, while these values were 29.7, 11.4 and 59.0% in the second year. Accordingly, the results showed that the decline in *T. urtica* numbers may be due to the increase in predacious mites numbers that feed on nymphs and adults of *T. urtica*.

Discussion

The present results showed that the two predators, *E. scutalis* and *A. swriskii* played an important role in controlling the populations of (TSSM) on eggplant in the greenhouses. The obtained results clearly showed that an increase in (TSSM) numbers is followed by a rise in the population of associated predators. However, a decrease in (TSSM) numbers did not lead to a decrease in predator mite numbers. This could be attributed to the presence of other insect species (prey) or other alternative food sources such as pollen grains on the host plants that these predators may prefer to feed on.

Furthermore, the current findings align with previous research. Hussey (1985) documented that resistance to organic acaricides in (TSSM) was detected as early as 1949, prompting investigations into alternative control strategies, including biological control. One notable method involved the use of the phytoseiid mite, *Phytoseiulus persimilis*, an effective predator of (TSSM). In agricultural ecosystems, various natural enemies of greenhouse pests exist; however, only a limited number have proven successful in controlled environments, and even fewer have been developed for commercial use. Van Lenteren and Woets (1988) outlined the essential criteria for selecting effective biological control agents. Apart from insect predators, research has demonstrated that the predacious mite , *A. swirskii* is a potent natural enemy of *Bemisia tabaci* and *Trialeurodes vaporariorum* (Nomikou *et al*., 2001; Hoogerbrugge *et al*., 2005). This species also feeds on pollen, allowing for its early release in pollen-producing crops such as sweet pepper before pest populations emerge (Hoogerbrugge *et al*., 2005). Trials conducted in Southern Spain confirmed its efficiency in managing pests in protected sweet pepper crops (Calvo *et al*., 2006). Due to its ability to thrive on a mixed diet, including thrips (*Frankliniella occidentalis*) and greenhouse whiteflies, *A. swirskii* is considered a strong candidate for integrated pest control strategies (Messelink, 2008). However, its effectiveness in whitefly suppression on tomato crops appears to be limited due to the presence of dense trichomes on tomato leaves, which obstruct its foraging activity. Another predacious mite, *Typhlodromalus limonicus* (Garman & McGregor), has demonstrated potential in controlling whiteflies and thrips on tomato plants, though further validation in greenhouse conditions is required (van Houten *et al*., 2005). Research in Southern Spain indicated that this species could play a significant role in managing *B. tabaci* infestations in sweet pepper, cucumber, and eggplant crops (Calvo *et al*., 2008). Additionally, Tiftikçi *et al*. (2020) reported that predacious mites from the Phytoseiidae family can effectively reduce tetranychid mite populations when introduced at optimal ratios in field, greenhouse, and laboratory conditions. Their study underscored the importance of maintaining the correct predator-to-prey ratio for successful pest regulation. They also explored the role of *A. swirskii* and other predacious mites in managing (TSSM), highlighting that spider mite predation is influenced by the availability of alternative prey. This suggests that predator populations can remain stable even when primary pest populations decline.

REFERENCES

Al-Shammery K.A. (2011). Plant pollen as an alternative food source for rearing *Euseius scutalis* (Acari: Phytoseiidae). J Entomol., 8(4): 365–374. doi: 10.3923/je.2011.365.374.

Al-Shammery K.A. (2018). The availability of rearing *Neoseiulus cucumeris* (Oud.) and *Neoseiulus barkeri* (Hughes) (Acari: Phytoseiidae) on three insect egg species Egyp. J. Biol. Pest Cont., 28:79. https://DOI.org/10.1186/s41938-018-0084-6.

Azouz, H., Yassin, E., El-Sanady, Mariam and Abou-Zaid, A. (2014). Field and laboratory studies on three eggplant cultivars to evaluate their relative susceptibility to some piercing sucking pests with relation of leaf constituents. Journal of Plant Protection and Pathology, 5(11), 995-1005.

Bounfour, M. and McMurtry, J.A. (1987). Biology and ecology of *Euseius scutalis* (Athias-Henriot)(Acarina: Phytoseiidae). CABI, 55(5):1-23.

Calvo, J., Bolckmans, K., Belda, J.E. (2008). Controlling the tobacco whitefly, *Bemisia tabaci* (Genn.) (Hom.: Aleyrodidae) in horticultural crops with the predacious mite , *Amblyseius swirskii* (Athias-Henriot). J. Insect Sci., 8: 11-12.

Calvo, J., Fernández, P., Bolckmans, K., Belda, J.E. (2006). *Amblyseius swirskii* (Acari: Phytoseiidae) as a biological control agent of the tobacco whitefly, *Bemisia tabaci* (Horn.: Aleyrodidae) in protected sweet pepper crops in Southern Spain. Bulletin IOBC/WPRS 29 (4): 77-82.

Croft, B.A. and Jung, C. (2001). Phytoseiid dispersal at plant to regional levels: a review with emphasis on management of *Neoseiulus fallacis* in diverse agroecosystems. Sys. Appl. Acarol. DOI: 10.1023/a:1020406404509.

de Klerk M.L. and Ramakers P.M.J. (1986). Monitoring population densities of the phytoseiid predator, *Amblyseius cucumeris* and its prey after large scale introductions to control *Thrips tabaci* on sweet pepper. Meded. Fac. Landbouww. Rijksuniv. Gent 51(3a):1045–1048.

Fouly, A.H., Al-Daghairi, M.A., Abdel, Baky, N.F. (2011). Effect of crowding and food level on the biology of *Typhlodromips swirskii* (Acari: Gamasida: Phytoseiidae) fed on whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae). J Entomol 8(1):52–62. DOI: 10.3923/je.2011.52.62.

Fouly, A.H., Nassar, O.A., Osman, M.A. (2013). Biology and life tables of *Esieus scutalis* (A.-H.) reared on different kinds of food. J. Entomol. 10(4):199–206.

Fouly, A.H., Refaei, A.R., Ata, T.E., and Esilly, N.Y. (2024). Influence of Plant Surface on Biological Aspects of *Cydnoseius negevi* (Acari: Phytoseiidae). j. plant prot. & pathol., 15(11), 369-377.

Hoogerbrugge, H., Calvo, J., van Houten, Y., Bolckmans, K. (2005). Biological control of the tobacco whitefly, *Bemisia tabaci* with the predacious mite, *Amblyseius swirskii* in sweet pepper crops. Bulletin IOBC/WPRS 28 (1), 119-122.

Hussey, N.W. (1985). History of biological control in protected culture. In: Hussey NW, Scopes NEA (Eds) Biological Pest Control – The Glasshouse Experience, Blandford, United Kingdom, pp 11-22.

Jung, C. (2005). Some Evidences of Aerial Dispersal of Two-spotted Spider Mites from an Apple Orchard into a Soybean Field. 8, (3): 279-283. https://doi.org/10.1016/S1226-8615(08) 60246-0.

Kalloo, G. (1993). Pea: *Pisum sativum* L. Genetic improvement of vegetable crops, 409-425.

Kashyap, V., Kumar, S.V., Collonnier, C., Fusari, F., Haicour, R., Rotino, G.L. and Rajam, M.V. (2003). Biotechnology of eggplant. Sci. Hortic., *97*(1), 1-25.

Kostiainen, T. and Hoy, M.A. (1996). 4.16 genetic improvement of *amblyseius finlandicus* (phytoseiidae): selection for resistance to azinphosmethyl and dimethoate and laboratory evaluation of the selected strain. In acarology ix: proceedings (vol. 1, p. 229). Ohio biological survey.

Lenteren, J.V. and Woets, J. (1988). Biological and integrated control in greenhouses. Annu. Rev. Entomol. 33, 239-269.

Matsubara, T., Suardita, K., Ishii, M., Sugiyama, M., Igarashi, A., Oda, R. and Kato, Y. (2005). Alveolar bone marrow as a cell source for regenerative medicine: differences between alveolar and iliac bone marrow stromal cells. J. Bone Miner. Res., 20(3), 399-409.

McMurtry, J. A., and Croft, B. A. (1997). Life-styles of phytoseiid mites and their roles in biological control. Annu. Rev. Entomol., 42(1), 291-321.

McMurtry, J.A. (1992). Dynamics and potential impact of 'generalist'phytoseiids in agroecosystems and possibilities for establishment of exotic species. Exp. Appl. Acarol., 14(3), 371-382.

Messelink, G.J., van Maanen, R., van Steenpaal, S.E.F., Janssen, A. (2008). Biological control of thrips and whiteflies by a shared predator: Two pests are better than one. Biol. Control. 44, 372-379.

Messelink, G.J., van Steenpaal, S.E.F., Ramakers, P.M.J. (2006). Evaluation of phytoseiid predators for control of western flower thrips on greenhouse cucumber. BioControl 51:753–768

Meyerdirk, D.E., and Coudriet, D.L. (1986). Evaluation of two biotypes of *Euseius scutalis* (Acari: Phytoseiidae) as predators of *Bemisia tabaci* (Homoptera: Aleyrodidae). J. Econ. Entomol., *79*(3), 659-663.

Moraes, G.D., and McMurtry, J.A. (1981). Biology of Am*blyseius citrifolius* (Denmark and Muma)(Acarina-Phytoseiidae). CABI 49, (1): 29 pp.

Nomikou, M., Janssen, A., Schraag, R., and Sabelis, M. W. (2001). Phytoseiid predators as potential biological control agents for *Bemisia tabaci*. Exp. Appl. Acarol., *25*, 271-291.

Nomikou, M., Janssen, A., Schraag, R., Sabelis, M.W. (2001). Phytoseiid predators as potential biological control agents for Bemisia tabaci. Exp. App. Acarol., 25, 271-279.

Opit, G.P., Nechols, J.R., Margolies, D.C., Williams, K.A. (2005). Survival, horizontal distribution, and economics of releasing predacious mites (Acari: Phytoseiidae) using mechanical blowers. Biol. Control 33:344-351.

Porath, A. and Swirski, E. (1965). A survey of phytoseiid mites [*Acarina, Phytoseiidae*] on citrus with a description of 1 new species. Israel J. Agric. Res., 15, 87–100.

SAS Institute (2003) . SAS Statistics and graphics guide, release 9.1. SAS Institute, Cary, North.

Swirski, E., Amitai, S. and Dorzia, N. (1967). Laboratory studies on the feeding, development and oviposition of the predaceous mite,*Typhlodromus athiasae* P. & S. [Acarina, Phytoseiidae] on various kinds of food substances. Israel J. Agric. Res., 17, 213–218.

Tiftikçi, P., Kök, Ş., and Kasap, İ. (2020). Biological control of two spotted spider mites [Tetranychus urticae Koch (Acari: Tetranychidae)] using Phytoseiulus persimilis Athias-Henriot (Acari: Phytoseidae) at different ratios of release on field-grown tomatos. Biol. Cont., 151, 104404.

van Houten, Y.M., Ostlie, M.L., Hoogerbrugge, H., Bolckmans, K. (2005). Biological control of western flower thrips on sweet pepper using the predacious mites, *Amblyseius cucumeris*, *Iphiseius degenerans*, *A. andersoni* and *A. swirskii*. Bulletin IOBC/WPRS 28 (1), 283-286.

Van Lenteren, J.C. (1986). Evaluation, mass production, quality control and release of entomophagous insects. Biological Plant and Health Protection. Stuttgart, Fischer, 31-56.

Winner, D., Hoffmann, D., Schausberger, P. (2008). Prey suitability of western flower thrips, Frankliniella occidntalis and onion thrips, Thrips tabaci for predacious mite, Amblyseius swirskii. Biocontrol Sci. Tech, 18(6): 541–550.

Zemek, R., Nachman, G. (1999). Interactions in a tritrophic acarine predator–prey metapopulation system: prey location and distance moved by Phytoseiulus persimilis (Acari: Phytoseiidae). Exp. Appl. Acarol. 23:21–40.

Zhang, Y.X., Zhang, Z.Q. Lin, J.Z. (1999). Biology of *Schizotetranychus nanjingensis* (Acari: Tetranychidae) with reference to effects of temperature and importance of nests to its survival and development .Syst. and Appl. Acarol., 4:75-82.

تأثير إثنان من الأكاروسات المفترسة على الكثافة العددية للعنكبوت الأحمر ذو البقعتين على نبات الباذنجان فى الزراعة المحمية

أحمد حسن فولى[1]، طارق السيد عطا[2]، سمير صالح عوض الله[3] وإيمان عبده معروف[2]

[1] قسم الحيوان الزراعى ـ كلية الزراعة ـ جامعة المنصورة
[2] قسم وقاية النبات ـ كلية الزراعة ـ جامعة دمياط
[3] قسم الحشرات الاقتصادية ـ كلية الزراعة ـ جامعة المنصورة

الملخص

تم إجراء التجارب في صوبة زراعية تابعة لكلية الزراعة، جامعة المنصورة، على مدار موسمين متتاليين عامي 2023 و2024. كان الهدف من التجارب دراسة دور الأكاروسات المفترسة في تنظيم الكثافة العددية للعنكبوت الأحمر ذو البقعتين *Tetranychus urticae* الذي يصيب نباتات الباذنجان تحت ظروف الزراعة المحمية. أظهرت النتائج أن كلا المفترسين *Amblyseius swirskii, Euseius scutalis* كان لهما تأثير كبير على الكثافة العددية للعنكبوت الأحمر حيث أظهرت النتائج بوضوح وجود علاقة وثيقة بين الكثافة العددية للعنكبوت ذو البقعتين وكلا المفترسين، حيث تلازم زيادة أعداد العنكبوت ذو البقعتين مع زيادة في أعداد كلا المفترسين. ومع ذلك، لم يؤدي انخفاض أعداد العنكبوت ذو البقعتين إلى انخفاض مماثل في أعداد الأكاروسات المفترسة. ويُحتمل أن يكون هذا بسبب وجود أنواع أخرى من مصادر التغذية مثل الحشرات أو مصادر بديلة مثل حبوب اللقاح تتوافر على النباتات والتي قد تجد فيها هذه الأكاروسات المفترسة مصدر مناسب كغذاء.