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Research Article

Effect of low lethal concentrations of Eforia on biological parameters of the predatory mite *Amblyseius swirskii*

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Abstract: The two-spotted spider mite *Tetranychus urticae* Koch (Acari: Tetranychidae) is one of the most important pests of many crops worldwide. Combined tactics for pest management have a significant special effect on reducing pesticide use and maintaining the activity of natural enemies, which is the main objective of IPM programs. The effect of low-lethal concentrations of Eforia (24.7 SC, Syngenta Co.) at LC_5, LC_{15}, and LC_{25} were investigated on biological parameters of *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) under laboratory condition at 25 ± 1 °C, 70 ± 5% RH and 16:8 (L: D) h. The data were analyzed based on a two-sex life table procedure. The results showed that Eforia caused a significant reduction in fecundity (Control: 37.17; LC_{25}: 23.04 eggs/female) and total life span (Control: 42.67 days; LC_{25}: 24.65 days). The net reproductive rate (R_0) was 22.31, 20.12, 15.14, and 14.98 eggs/individual, respectively, at control, LC_5, LC_{15}, and LC_{25}. The maximum and minimum values for the intrinsic rate of increase (r) were recorded to be 0.17 (Control, LC_5, and LC_{25}) and 0.15 (LC_{15}) day^{-1} for the treated mites. Based on the results, the application of low lethal concentrations of Eforia harms some biological parameters of this predatory mite, and the results of this study showed that Eforia may not be applied for the control of *T. urticae* pest together with *A. swirskii.*

Keywords: *Amblysseius swirskii***,** Life table, Sublethal concentration, Eforia, Two-spotted spider mite

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Introduction

The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), is an important pest that feeds on a vast array of plant species ranging from agricultural species to crops and ornamental plants worldwide in greenhouse and outdoor conditions to over 1000 host plant species (van de Vrie *et al.*, 1972; Helle and Sabelis, 1985; Zhang, 2003; Agut *et al.*, 2018; Uygun *et al.*, 2020). The feeding of *T. urticae* usually results in chlorosis, leaf and fruit deformation, and stunted plant growth, leading to reduced plant efficiency as well as diminished marketability of the final product (van Leeuwen *et al.*, 2010, 2015; Dogan *et al.*,

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2017). Due to the high fecundity, and short and fast-developing time, the spider mite develops resistance against acaricides (Van Leeuwen *et al.*, 2010). Thus, biological control of the spider mite focusing on the family Phytoseiidae as a benign method is momentum in many countries for several reasons (Ferrero *et al*., 2011; Amoah *et al*., 2016; Akyazi and Liburd, 2019). Phytoseiid mites have good potential for use against tetranychid herbivorous mites, whiteflies, and thrips in various agricultural systems in fields and greenhouses (Nomikou *et al.*, 2001; Ghazy *et al.*, 2013; Fathipour and Maleknia, 2016; Havasi *et al.*, 2019; 2020). *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) is one of the effective biological control agents of this family. This species is considered a generalist predator and readily consumes small soft-bodied pest species and pollen or plant exudates (Arthurs *et al*., 2009; Shahbaz *et al.*, 2019). This predatory mite can develop and reproduce on a wide range of pests, including mites, thrips, whiteflies, and moth eggs, as well as on various types of pollen (Messelink *et al*., 2008; Calvo *et al*., 2012; Xiao *et al*., 2012; Lopez *et al*., 2015).

It is important to remember that pesticides not only affect through their direct and acute toxicity but also chronic and changing population-dynamic parameters of arthropods (Elzen, 2001; Havasi *et al*., 2022). Low lethal effects include any adverse effects other than mortality, such as a decrease in feeding, fecundity, egg viability, the female ratio of the population, and life span (Biondi *et al*., 2013; Beers and Schmidt, 2014; Bozhgani *et al*., 2018; Havasi *et al*., 2018). Hence, reducing pesticide concentrations and using selective pesticides are necessary to protect predatory mites.

Eforia® (247% SC; Syngenta, Switzerland) consists of two chemical classes: synthetic pyrethroid (Lambda-cyhalothrin: disrupting and compromising the central nervous system) and neonicotinoid (Thiamethoxam: displays systemic activity). This pesticide acts at the level of the nervous system through contact and ingestion by pests. No data is available about the low lethal and lethal effects of Eforia on the predatory mite *A. swirskii.*

Due to the importance of *A. swirskii* for IPM programs and the possibility of pesticide application in the presence of predatory mites, studies to assess the impacts of pesticides on this predatory mite are essential for implementing IPM programs. Concerning this, the present study aimed to evaluate the low lethal effect of Eforia® on the biological performance of the predatory mite *A. swirskii* to predict its potential in the presence of one of the effective natural enemies of *T. urticae*. This information could help design a management program for *T. urticae* using fewer pesticides in the program.

Materials and Methods

Mite colony

The stock population of the two-spotted spider mite was obtained from infested greenhouses in Pakdasht (East-south of Tehran, Iran) and released on the kidney bean plants under greenhouse conditions at 30 ± 1 °C, 50 ± 5% RH and a photoperiod of 16:8 (L: D) h. The initial stock of *A. swirskii* was provided by the Insectarium Department of Islamic Azad University, Yazd Branch, and reared in the laboratory on bean plants (*Phaseolus vulgaris* var. Derakhshan, Fabaceae) infested with *T. urticae*. The predator-rearing arenas were made according to McMurtary and Scriven (1965) method, and the predator individuals were maintained for three months in a growth chamber at 25 ± 1 °C 70 ± 5% RH, and 16: 8 (L: D) h. Bean leaves infested with *T. urticae* were added daily to each arena as a food source.

Pesticide

A commercial formulation of Eforia® (247 SC) containing 141 g thiamethoxam + 106 g lambda-cyhalothrin, Syngenta Co. Switzerland, with the chemical name of 3-(2-Chloro-thiazol-5-ylmethyl)-5-methyl-[1,3,5] oxadiazinan-4-ylidene-N-nitroamine was used in the experiments.

Bioassays

Concentration-response bioassay was carried out based on the leaf-dipping method (Helle and Overmeer, 1985; Ibrahim and Yee, 2000) (the mortality covered the range of 10%–90%). The

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bean leaf discs (4 cm diameter) were submerged for 15 seconds in Eforia® solutions. The control tests were treated only with distilled water. Then, the leaf discs were dried at room temperature for about two hours and placed into Petri dishes (9 cm diameter, 1.5 cm height). Twenty same-aged (24-hour-old) adult mites (male and female, 10:10) and phytophagous mites were placed on the treated and control leaf discs for each treatment and left there for 24 hours. All Petri dishes were incubated at 25 ± 2 ºC, 70 ± 5% RH, and 16: 8 (L: D) h photoperiod. The bioassay was replicated four times with five concentrations and one control. The mortality of the mites was recorded after 24 hours. The mites were considered dead when they did not move after stimulation.

Life table assay

To evaluate the low lethal effects of Eforia® on *A. swirskii*, 80 same-aged males and females (24 h-old) were transferred to dishes containing the treated and untreated leaf discs of the bean. After 24 h, surviving females were separately moved onto untreated leaf discs (4 cm in diameter). After 24 h, one laid of eggs was saved in each experimental arena (40 replications for each concentration. In the next stage, all saved eggs were checked daily, and the development time, longevity, oviposition period, and fecundity rate were recorded until the death of the last mite. All collected same-aged eggs were transferred to a clean leaf disc for the daily check. When the individuals developed to the adult stage, the females were coupled with males selected from the stock colony in the Petri dishes to study the fecundity and reproduction parameters. A number of 15-40 prey per nymph (4-5 times per day) (Khanamani et al., 2017; Havasi et al., 2021) were added as a food source for this predatory mite's immature and adult stages, respectively. All Petri dishes were checked daily. The information on adult mites, such as survival, reproductive durations, adult longevity, fecundity, and population growth parameters, was calculated from the recorded data.

Statistical analysis

The dose-response curve was used to estimate LC_{50}, LC_5, LC_{15}, and LC_{25} for *A. swirskii* using the Probit method (SPSS, version 19.0). The original data for all individuals were analyzed according to the theoretical two-sex life table model (Chi, 1988). All life table parameters were calculated according to the theory of age–stage, two–sex life table Chi and Liu (1985) and Chi (1988) using TWOSEX-MS Chart (Chi, 2021). The variance and standard errors of the population growth parameters were estimated by the bootstrap technique (100,000 samples) (Efron and Tibshirani, 1993). The paired bootstrap test using TWO-SEX-MS Chart program was employed for the statistical differences among the means of parameters related to development, fecundity, and reproductive periods as population growth parameters (Efron and Tibshirani, 1993; Huang and Chi, 2013; Akkopru *et al*., 2015).

Results

Concentration-response bioassay

The estimated LC_{50} for the *A. swirskii* was 498.03 ppm (Based on active ingredient), where no mortality was recorded in the control treatment (50-200 ml/h = field recommended rate). The LC_5, LC_{15}, and LC_{25} values were estimated to be 64.62, 130.35, and 197.90 ppm, respectively (Table 1).

Developmental and reproductive performance

The effect of different concentrations of Eforia® on the development of offspring of the treated females is summarized in Table 2. Compared with the control treatment, some differences were observed between male and female developmental stages, such as egg and larva. The data showed that the LC_{25} concentration of Eforia caused the duration of the mentioned stages to be longer than other treatments (Table 2). Among treatments, the concentrations of LC_5 and LC_{15} decreased the adult longevity of males and females; in addition, the LC_{15} and LC_{25} concentrations significantly reduced the total lifespan of both males and females compared with the control treatment. The longest total female life span was 42.67 days for control, and the shortest 24.65 was for LC_{25} (Table 2). The same trend happened for the male adult longevity and total life span. For example, the male total life span

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was 29.50 days in the control and 25.17 days in the LC_{25} treatment (Table 2).

Compared to the control, the number of eggs laid per female was significantly decreased after the adult females were treated with LC_{15} and LC_{25} concentrations of Eforia® compared with LC_5 and control. The highest fecundity of *A. swirskii* (37.17 eggs/female) was observed in the control (Table 3). Conversely, a higher concentration (LC_{25}) resulted in the lowest fecundity. The females treated with LC_5 and LC_{15} had no significant difference in adult pre-oviposition periods, post-oviposition, and oviposition days compared to the control. The maximal oviposition days of *A. swirskii* (19.62) were observed in the control. This parameter significantly decreased in response to increasing concentrations from LC_5 to LC_{15} and LC_{15} to LC_{25} (ranging from 19.43 to 12.27 days). The mean number of eggs per female showed a declining trend for the predatory mites exposed to LC_5, LC_{15}, and LC_{25} (Table 3).

Demographic parameters

Based on the results, the gross reproductive rate (*GRR*) varied from 15.74 to 30.23 eggs/individual. The lowest values of *GRR* (15.74 eggs/individual), as well as R0 (14.98 eggs/individual), were recorded for the mites exposed to the highest acaricide concentration (Table 4). The values of the intrinsic rate of increase (*r*) and finite rate of increase (λ) were not significantly affected by the low lethal concentrations of the pesticide. The mean generation time (*T*) obtained was 18.19, 17.84, and 17.57 days for control, $LC_{15,}$ and LC_5 treatment, respectively, which was significantly different from the LC_{25} value (14.98 days) (Table 4).

Table 1 Lethal toxicity of Eforia to adult stage of *Amblyseius swirskii*.

LC_5 (95% CL[1])	LC_{15} (95% CL)	LC_{25} (95% CL)	*P*-value	Slope ± SE	χ^2 (df[2])	N[3]	df[4]
64.62 (41.61-89.12)	130.35 (95.48-165.04)	197.90 (155.07-240.34)	0.90	1.99 ± 0.17	0.58(18)	480	4

1. Confidence Limits.
2. Chi-square value (χ2) and degrees of freedom (*df*) calculated by PoloPlus 2.0.
3. 20 individuals per replicate, four replicates per concentration, and six concentrations per assay.
4. Degrees of freedom (*df*) for the concentrations of Eforia and control.

Table 2 The effect of different concentrations of Eforia on immature development (day Mean ± SE) of *Amblyseius swirskii.*

Gender	Parameters	Control	LC_5	LC_{15}	LC_{25}
Male	Egg (day)	2.10 ± 0.10b	2.00 ± 0.00b	2.00 ± 0.00b	2.50 ± 0.22a
	Larva (day)	1.00 ± 0.00b	1.00 ± 0.00b	1.00 ± 0.00b	1.17 ± 0.17a
	Protonymph (day)	2.10 ± 0.10b	2.08 ± 0.08b	2.18 ± 0.12b	2.67 ± 0.33a
	Deutonymph (day)	1.80 ± 0.13a	1.38 ± 0.14b	1.18 ± 0.12b	1.33 ± 0.21b
	Total life span (day)	29.50 ± 1.21a	27.85 ± 0.88a	26.00 ± 0.60b	25.17 ± 0.70b
Female	Egg (day)	1.83 ± 0.10b	1.83 ± 0.08b	1.91 ± 0.11b	2.38 ± 0.11a
	Larva (day)	1.08 ± 0.06b	1.00 ± 0.00b	1.00 ± 0.00b	1.19 ± 0.08a
	Protonymph (day)	2.21 ± 0.08a	2.26 ± 0.11a	2.26 ± 0.11a	2.19 ± 0.10a
	Deutonymph (day)	1.62 ± 0.10a	1.22 ± 0.09b	1.26 ± 0.09b	1.42 ± 0.10a
	Total life span (day)	42.67 ± 1.82a	40.43 ± 1.61a	35.09 ± 0.38b	24.65 ± 0.49c

The standard errors were estimated using a bootstrap technique with 100,000 resamplings. The same letter within a row indicates no significant difference between treatments based on a paired bootstrap test at the 5% significance level.

Table 3 Mean (± SE) reproductive period and total fecundity of offspring from females of *Amblyseius swirskii* for control and different concentrations of Eforia.

Parameters	Control	LC_5	LC_{15}	LC_{25}
Pre-oviposition period (day)	3.00 ± 0.15a	2.96 ± 0.15a	3.26 ± 0.11a	2.54 ± 0.18b
Oviposition days (day)	19.62 ± 1.23a	19.43 ± 1.16a	18.74 ± 0.53a	12.27 ± 0.58b
Post-oviposition period (day)	9.75 ± 0.20a	9.26 ± 0.22a	9.70 ± 0.23a	9.73 ± 0.17a
Total fecundity (eggs/female)	37.17 ± 2.51a	34.96 ± 2.43a	26.35 ± 1.25b	23.04 ± 1.41b

The standard errors were estimated using the bootstrap technique with 100,000 resamplings. The same letter within a row indicates no significant difference between treatments based on a paired bootstrap test at the 5% significance level.

The total life span of *A. swirskii* decreased from 58 days in the control to 31 days in the LC_{25} concentration treatment (Fig. 1). The maximum m_x values for *A. swirskii* were estimated to be 2.25, 1.86, 1.69, and 2.15 eggs/individual/day for the mites treated with distilled water, LC_5, LC_{15} and LC_{25} of Eforia®, respectively, which appeared on days 13, 12, 13 and 17 during the life span, respectively (Fig. 1). These data indicate that the acaricide affects the m_x dose-dependence (Fig. 1). The age-stage specific survival rates (s_{xj}) of different treatments are presented in Figure 2. Overlap between different developmental stages of *A. swirskii* in different treatments was related to the variation of the development rate of these biological stages (Fig. 2).

Table 4 The effects of different treatments of Eforia on the population parameters (Mean ± SE) of *Amblyseius swirskii.*

Parameters	Control	LC_5	LC_{15}	LC_{25}
Intrinsic rate of increase, *r* (day^{-1})	0.17 ± 0.01a	0.17 ± 0.01a	0.15 ± 0.01a	0.17 ± 0.01a
Finite rate of increase, λ (day^{-1})	1.19 ± 0.01a	1.18 ± 0.01a	1.16 ± 0.01a	1.18 ± 0.01a
Net reproductive rate, R_0 (eggs/individual)	22.31 ± 3.22a	20.12 ± 3.04a	15.14 ± 2.17b	14.98 ± 1.95b
Gross reproductive rate, *GRR* (eggs/individual)	30.23 ± 3.14a	25.97 ± 2.99b	19.78 ± 1.97c	15.74 ± 2.21d
Mean generation time, T (day)	18.19 ± 0.40a	17.57 ± 0.35a	17.84 ± 0.33a	14.98 ± 0.22b

The standard errors were estimated using the bootstrap technique with 100,000 resamplings. The same letter within a row indicates no significant difference between treatments based on a paired bootstrap test at the 5% significance level.

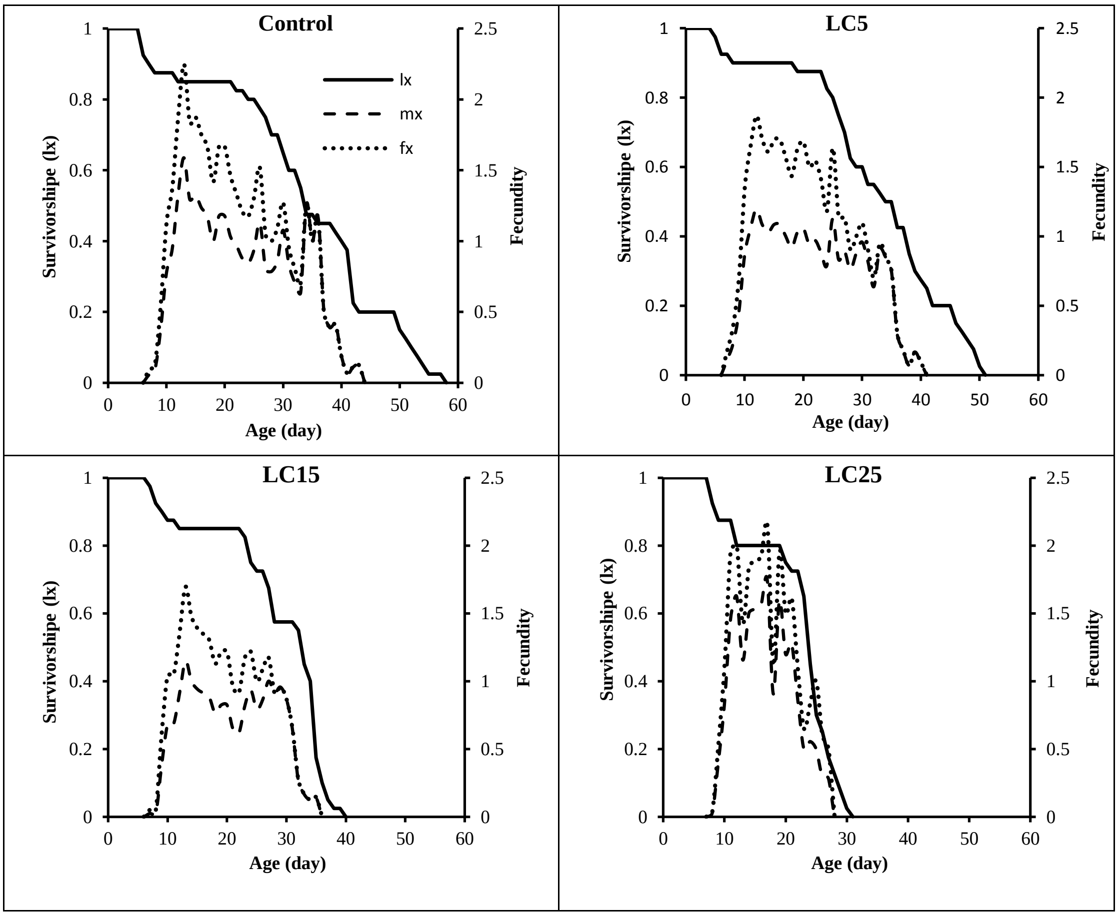

Figure 1 Age-specific survivorship (l_x), age-stage fecundity of female (f_{xj}), and age-specific fecundity (m_x) of *A. swirskii* for control and different concentrations of Eforia.

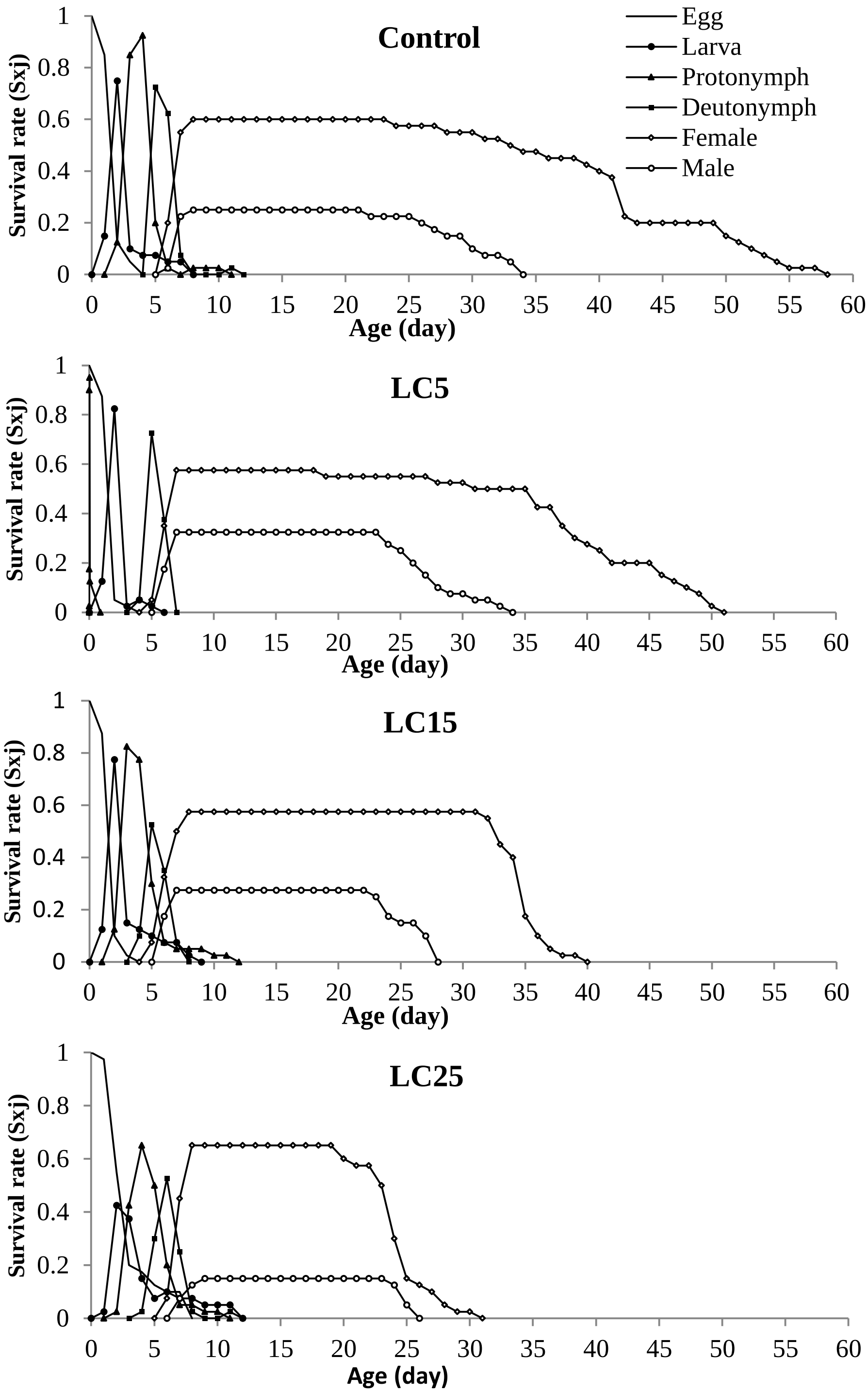

Figure 2 The Age-stage-specific survival rate (S_{xj}) of *A. swirskii* for control and different concentrations of Eforia.

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Discussion

In the IPM program, chemical control is usually considered the primary mite control strategy due to being a rapid and effective means of managing pests. The compatibility between pesticides and biological control agents is the main issue for IPM practitioners. Broad-spectrum pesticides have been widely replaced by selective, low-risk, and birational pesticides to decrease the adverse effects of pesticides on human health and the environment. This approach undoubtedly renovated IPM and biological control programs (Duso *et al.*, 2020). Predatory mites of the family Phytoseiidae are effective as biological control agents in agricultural systems (Hamedi *et al*., 2011). Several researchers have reported that the biological parameters of predatory mites of the family Phytoseiidae were affected by sublethal concentrations of pesticides (Khodayari and Hamedi, 2021; Hamedi, 2022). However, no evidence is available concerning the sublethal effects of Eforia® (a Neonicotinoid group) on the biological parameters of *A. swirskii*. In the current study, sublethal effects of low-lethal concentrations (LC_5, $LC_{15,}$ and LC_{30}) of Eforia on the biological parameters of *A. swirskii*, one of the biological control agents of *T. uritcae*, were investigated.

The data in the present study shows that sublethal concentrations of Eforia against adult predatory mites affected several aspects of the offspring's development time, including embryonic development, developmental period (pre-adult duration), adult longevity, and the total lifespan of the male and female.

Investigations into the sublethal effects will help determine its adverse impacts on biological parameters, which may also influence insect population dynamics (Stark and Banks, 2003; Havasi *et al*., 2018, 2022). Eforia concentrations caused a significant adverse effect on longevity (minimum value: LC_5 and LC_{15}) and the total life span (minimum value: LC_{15} and LC_{25} concentrations). Ghasemzadeh and Qureshi (2018) showed that the fenpyroximate (LC_{50}: 16.67 mg a. i. liter^{-1}) acaricide reduced the longevity of A. swirskii females by 23.5–15.8 days. This trend is in agreement with current data. In other studies, female longevity of *Phytoseius plumifer* (Canestrini and Fanzago), *Neoseiulus longispinosus*, *Amblyseius cucumeris* (Oudemans), *A swirskii* was reduced significantly after treatment with sublethal concentrations of fenpyroximate, acetamiprid, abamectin, and bifenazate (Cheng *et al*., 2018; Khodayari and Hamedi, 2021; Hamedi, 2022). It has been reported that pre-ovipositional periods play an important role in the intrinsic rate of increase (Tang *et al*., 2015). Our results showed that Eforia treatment (LC_5 and LC_{15}) did not affect pre-oviposition periods of the tested predatory mite despite having deleterious effects on the phytophagous mite (Bergeron and Schmidt-Jeffris, 2020). However, hexythiazox affected the fecundity and oviposition of *A. swirskii* in all tested concentrations. Both parameters showed a declining trend, which was in agreement with the studies of Havasi *et al*. (2021).

The age-specific survival and fecundity curves displayed that sublethal concentrations of Eforia caused a declining trend in offspring survival and fecundity of treated mites. It was especially noteworthy that the oviposition period and fecundity of *A. swirskii* were affected by LC_{25} treatment. This demonstrated that exposure of females to sublethal concentrations of the Eforia resulted in a lower population rate in subsequent generations. Bergeron *et al*. (2020) and Havasi *et al.* (unpublished data) carried out laboratory and field trials to assess the toxicity of cyflometofen to *A. swirskii* and *Neoseiulus californicus* (McGregor), respectively. Their results confirm our results showing the high toxicity of Eforia to *A. swirskii* female's fecundity under laboratory conditions. Also, the results reported for another neonicotinoid insecticide, acetamiprid, which lowered the fecundity of female Galendromus occidentalis (Nesbitt) drastically by > 75% and *A. swirskii* (Beers and Schmidt, 2014; Fytrou *et al*., 2017) and fenpyroximate on *A. swirskii* (Lopez *et al*., 2015). Acetamiprid is a nicotinic agonist that

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responds with nicotinic acetylcholine receptors (nACh-R) located in postsynaptic neurons, resulting in an acetylcholine degradation process delay (Tomizawa and Casida, 2005). Also, Fenpyroximate has a pyrazole chemical structure and requires contact to affect target pests (i.e., it has no systemic activity).

Life table studies can assess the effects of different variables on pest population dynamics in the current and next generations (Akca *et al*., 2015; Kheradmand *et al*., 2022; Mousavi *et al*., 2022). Different acaricide concentrations significantly affected the gross reproductive rate (GRR) among all population parameters. For (R_0), a declining trend was obtained by increasing the concentration. The mean generation time (T) is significantly decreased with LC_{25} concentration. Similar to the current results, Havasi *et al*. (2020) showed that LC_{20} concentration of thiamethoxam [second-generation Neonicotinoid] showed harmful effects on population parameters (such as *GRR*, R_0, and T) of *N. californicus* under laboratory conditions. Other studies showed reduced demographic parameters in offspring of treated *P. plumifer* with sublethal concentrations of abamectin and fenpyroximate (Hamedi *et al*., 2010, 2011).

The r parameter complements the efficacy of mortality and fecundity. Therefore, it is highly affected by survival, development time, longevity, fecundity, and sex ratio, which are influenced by climatic and nutritional conditions (Javadi Khederi and Khanjani, 2014). In the present study, the r parameter was 0.17 day^{-1} for all tested concentrations except LC_{15}. Various growth rate declines were reported for *A. swirskii* by exposure to different pesticides such as fenazaquin (Alinejad *et al*., 2014) and fenpyroximate (0.13–0.06 day^{-1}; Ghasemzadeh and Qureshi, 2018), as well as other species, for example, *N. californicus* under spirodiclofen (Maroufpoor *et al*., 2016), *P. plumifer* under fenpyroximate and abamectin (Hamedi *et al*., 2010; 2011) and *P. persimilis* under spirodiclofen (Salman and Keskin, 2019). Such changes can be attributed to the differences in species and/or genetics among predator populations, along with applying different pesticides.

No significant effect was recorded for the finite rate of increase (λ) and r, which agrees with the findings of Zanardi *et al*. (2017) for *Iphiseiodes zuluagai* (Denmark and Muma) (Acari: Phytoseiidae) treated with imidacloprid and thiamethoxam.

Generally, the pesticide's low concentrations may be combined with phytoseiid in an IPM program of *T. urticae* (Roush and Plapp, 1982; Dent, 2000) to decrease the development of resistance and adjust the predator/prey ratio. However, the exact analysis of both lethal and sublethal effects of insecticides on natural enemies should be evaluated before their integration into pest management programs (Rashidi and Ganbalani, 2018; Havasi *et al*., 2019). The witnessing during the experiments can aid us in better comprehending the total effects of Eforia on the different life stages of *A. swirskii*. Based on the results, Eforia could suppress various demographic characteristics of the predator, such as survival, fecundity, R_0, *GRR*, and T. Consequently, based on the current data, the usage of Eforia may be disruptive when this predatory mite is helpful as a biological control agent. Thus, more experiments should be conducted at large spatial and temporal levels in field and semi-field conditions.

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اثر غلظت‌های زیرکشنده افوریا بر پارامترهای زیستی کنه شکارگر *Amblyseius swirskii*

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چکیده: کنه تارتن دو لکه‌ای *Tetranychus urticae* Koch (Acari: Tetranychidae) یکی از آفات مهم با پراکندگی جهانی است که خسارت قابل‌توجهی به محصولات کشاورزی وارد می کند. تاکتیک‌های ترکیبی مدیریت آفات نه‌تنها برای کاهش بقایای آفت‌کش‌ها بلکه برای حفظ فعالیت دشمنان طبیعی اهمیت ویژه‌ای دارد. در این پژوهش، اثر غلظت‌های زیرکشنده Eforia (24.7% SC Syngenta Co.) در LC_5، LC_{15}، و LC_{25} روی پارامترهای رشدی و تولیدمثلی کنه شکارگر *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) در شرایط آزمایشگاهی (۱ ± ۲۵ درجه سلسیوس، رطوبت نسبی ۵ ± ۷۰ درصد و ۱۶ ساعت روشنایی و ۸ ساعت تاریکی) بررسی شد. داده‌ها براساس تجزیه و تحلیل جدول زندگی دوجنسی مورد بررسی قرار گرفت. نتایج نشان داد که آفت‌کش افوریا باعث کاهش معنی‌داری در باروری (شاهد: ۳۷/۱۷؛ LC_{25}: ۲۳/۰۴ نتاج/ماده) و طول عمر کل (شاهد: ۴۲/۶۷؛ ۲۴/۶۵ روز؛ LC_{25}:۲۴/۶۵ روز) شد. نرخ خالص تولیدمثلی (R_0) به‌ترتیب ۲۲/۳۱، ۲۰/۱۲، ۱۵/۱۴ و ۱۴/۹۸ تخم بر فرد به‌ترتیب در شاهد، LC_5، LC_{15} و LC_{25} بود. بیش‌ترین و کم‌ترین مقادیر برای نرخ ذاتی افزایش جمعیت ۰/۱۷(شاهد، LC_5 و LC_{25}) و ۰/۱۵ (LC_{15}) بر روز برای کنه‌های تیمار شده ثبت شد. براساس نتایج به‌دست‌آمده، استفاده از غلظت‌های زیرکشنده آفت‌کش افوریا بر برخی از پارامترهای بیولوژیکی کنه شکارگر تأثیر منفی دارد و نتایج این مطالعه نشان داد که شاید نبایستی از افوریا برای کنترل کنه *T. urticae* به‌همراه *A. swirskii* استفاده شود.

واژگان کلیدی: *Amblysseius swirskii*، جدول زندگی، غلظت زیرکشنده، افوریا، کنه تارتن دو لکه‌ای

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