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Short Communication

Effects of some biorational pesticides for controlling *Tetranychus turkestanni* (Acari: Tetranychidae) on ornamental plants of green landscape

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Abstract

The strawberry spider mite, *Tetranychus turkestanii* (Acari: Tetranychiidae), is an important pest of many ornamental plants planted in urban green landscapes of Ahvaz and other cities of Khuzestan province, southwest Iran. Chemical control of herbivorous pests in urban environments has many limitations and concerns due to the daily and near contact of many citizens with these ecosystems. Therefore, choosing eco-friendly pesticides with appropriate effects plays an important role in developing integrated pest management (IPM) programs for pests. This study evaluated short- and long-term effects of some biorational pesticides, including azadirachtin, etoxazole and abamectin, against the mite under field conditions. The results indicated that all pesticides successfully decreased the spider mites' density compared to the control. Nonetheless, etoxazole demonstrated significantly high short and long-term effectiveness in reducing the mite population compared to the other treatments. The findings can be used to develop the IPM program for *T. turkestanii* in urban green landscapes.

Keywords: Etoxazol, abamectin, azadirachtin, spider mite, urban pest

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گزارش گوتاه انگلیسی

اثرات برخی آفت‌کش‌های زیستی برای کنترل *Tetranychus turkestanni* (Acari: Tetranychidae) در گیاهان زینتی فضای سبز شهری

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چکیده

کنه تارتن توت‌فرنگی *Tetranychus turkestanii* (Acari: Tetranychiidae) آفت مهم بسیاری از گیاهان زینتی کاشته شده در مناظر سبز شهری اهواز و سایر شهرهای استان خوزستان و سایر استان‌های جنوب غرب ایران است. کنترل شیمیایی آفات گیاه‌خوار در فضای سبز شهری به دلیل تماس روزانه و نزدیک بسیاری از شهروندان، با محدودیت‌ها و چالش‌های فراوانی مواجه است. بنابراین، انتخاب آفت‌کش‌های سازگار با محیط زیست و با کارایی مناسب نقش مهمی در توسعه برنامه‌های مدیریت تلفیقی آفات (IPM) دارد. در این مطالعه اثرات کوتاه مدت و بلندمدت برخی از آفت‌کش‌های زیستی علیه این کنه در شرایط مزرعه مورد ارزیابی قرار گرفت. نتایج نشان داد که تمامی آفت‌کش‌ها به طور موفقیت‌آمیزی تراکم کنه‌های تارتن مذبور را در مقایسه با شاهد کاهش دادند. با این وجود، اتوکسازول اثربخشی کوتاه مدت و بلندمدت قابل توجهی در کاهش جمعیت این کنه آفت مورد مطالعه در مقایسه با سایر تیمارها نشان داد. این یافته‌ها را می‌توان برای توسعه برنامه مدیریت تلفیقی آفات *T. turkestanii* در فضای سبز شهری مورد استفاده قرار داد.

کلیدواژه‌ها: اتوگزازول، آبامکتین، آزادیراکتین، کنه تارتن، آفت شهری

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Introduction

Urban pests pose a significant challenge to preserving and growing urban green spaces. In the metropolis of Ahvaz, controlling these pests necessitates using a substantial quantity of chemical pesticides each year (Rajabpour & Yarahmadi, 2012). However, it is crucial to address the unique demands of pest control in urban settings to achieve sustainable management of pest populations while safeguarding the well-being of city residents who regularly interact with this environment. Balancing effective pest control with the health and safety of our citizens is of utmost importance (Rajabpour & Yarahmadi, 2012; Lalari Sardar-Abadi et al., 2022).

The herbivorous mite, *Tetranychus turkestani* Ugarov & Nikolskii (Acari: Tetranychidae), commonly known as the strawberry spider mite, is a polyphagous pest that poses a threat to various agricultural and ornamental plants. With a broad range of hosts, it has been documented on over 300 plant species (Popove, 1983). The mite's feeding habits and silk production have a detrimental impact on the quality and quantity of crop yields. Due to its high reproductive potential and rapid developmental rate, this pest can rapidly multiply in favorable conditions, leading to substantial commercial losses. When heavily infested, the strawberry spider mites cause leaves to wither and turn brown, ultimately resulting in their death (Dreistadt, 2016). This spider mite has been considered as important damaging pest of many ornamental plants in green landscapes of Ahwaz, especially annual flowers (Rajabpour et al., 2012). This study aimed to evaluate the short and long term effects of some biorational pesticides against *T. turkestani* under field conditions.

Materials and Methods

These experiments were performed in the green landscape of the Ahvaz metropolis (Zone 3). The mentioned green space (Ahvaz International Airport area) consisted of infested Zinnia plants, *Zinnia elegans* Jacq., to different life stages of *T. turkestanii*. The treatments used in this study are presented in Table 1.

A Matabi brand backpack sprayer with an output pressure of 20 PSI was employed to conduct the spraying. The spraying took place in August 2020, coinciding with the peak population of the spider mite on the host plant that was determined using consequent samplings. To compare the impacts of the pesticides, a control was implemented. The control solely involved spraying water without any pesticide mixture. Each plant received approximately 50 mL of the solution during treatments, ensuring comprehensive coverage of all foliage parts. Samplings were performed 1 day before treatment and 1, 7, and 14 days after treatment. In each sampling, plants were randomly chosen from each replication and three leaves were randomly taken from each. The leaves were placed in plastic bags and transferred to the laboratory. The number of different life stages of the spider mite on each leaf was separately counted under stereomicroscope.

The experiments were conducted in a completely randomized factorial design (treatments × 2 concentrations × 3 time intervals after application) with four replications. The data were analyzed using the GLM test (with SAS 9.2 software). Before statistical analysis, the data were transformed to log10 (x+1) to normalize them. The Duncan test was used for comparing means as a post-hoc test.

Results and Discussion

Table 2 displays the outcomes of the analysis of variance (ANOVA) test conducted to examine the primary factors of the experiment, which assessed the impact of pesticides on *Tetranychus turkestanii* infestation on *Z. elegans*, as well as their interaction.

Table 1. The pesticide treatments that applied against *Tetranychus turkestanii.*

Entry name	Trade name	Formulation	Company	Group	Application rate (L/1000L)
Azadirachtin	NeemAzal®	EC 1%	Zist Bani Paya	Insect growth regulator	0.5 and 1
Etoxazole	Baroque®	SC 15%	Sumitomo Chemical	Insect growth regulator	0.25 and 0.5
Abamectin	Vertimec®	EC 1.8%	Giah	SL 20%	0.5 and 1

Table 2. Analysis of variance was conducted to examine the effect of the tested pesticides on the infestation of *Zennia elegans*.

Source of variation	Degree of freedom	Sum square	Mean square	*F*	*P-value*
Insecticide treatment (T)	3	3619.7	904.9	86.1	<0.0001
Concentration (C)	1	15.1	15.1	1.4	0.0003
Days after treatment (DAT)	2	59.5	29.7	2.8	0.0654
T×C	3	5.4	1.8	0.1	0.9142
T×DAT	6	118.3	19.7	1.8	0.963
C×DAT	2	11.6	5.8	0.5	0.577
T×C×DAT	6	50.6	8.4	0.8	0.577

The findings demonstrated that all the pesticides effectively reduced the spider mite density compared to the control group. However, etoxazole exhibited significantly greater short and long-term efficacy in reducing the population of these mites compared to other treatments, as depicted in Figure 1. etoxazole miticide-insecticide, a relatively new contact pesticide belonging to the group of chitin synthesis inhibitors, effectively targets all developmental stages of the mites. Adult females that come into contact with this residue become infertile (Nauen & Smagghe, 2006). This acaricide demonstrates good persistence, does not harm vegetation, and has minimal impact on the natural enemies of mites (Karmakar & Sandip, 2013; Salman et al., 2014).

Abamectin ranked second in terms of efficiency among the tested pesticides. abamectin is a biorational insecticide-miticide derived from a type of actinomycete called *Streptomyces avermitilis* Burg. This pesticide contains 21 types of macrocyclic lactones as its active ingredients. It affects the glutamate chloride channels in invertebrates, disrupting nerve signals, while having no impact on mammals (Campbell, 2012). Although abamectin poses low risks to vertebrates, it has been reported to have high toxicity towards natural enemies. For instance, it was found to be highly toxic to mite predators such as *Stethorus punctum* LeConte (Coleoptera: Coccinellidae) (Biddinger & Hull, 1995) and *Phytoseius plumifer* Canestrini & Fanzago (Acari: Phytoseiidae) (Hamedi et al., 2011). Moreover, this acaricide has a high potential for both cross and non-cross resistance development (Sato et al., 2005).

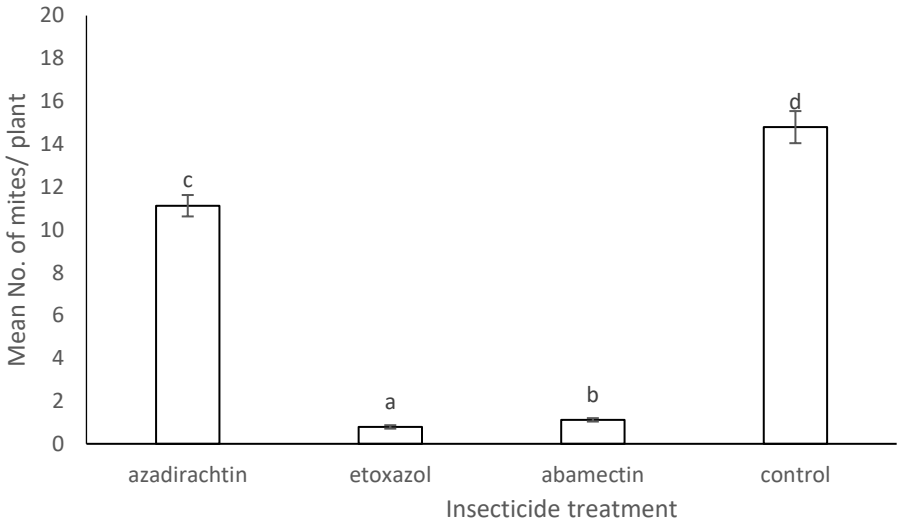

Figure 1.The mean number (±SE) of *Tetranychus turkestanii* in different pesticide treatments. The same letters indicate no significant difference at the 5% level (Duncan's test).

Azadirachtin has been documented to exhibit acaricidal effects in some mite species. For example, Bernardi et al. (2013) demonstrated its efficacy against the mite *Tetranychus urticae* Koch (Acari: Tetranychidae) while having minimal destructive effects on its predator, *Neoseiulus californicus* McGregor, and *Phytoseiulus macropilis* Banks. Other studies have shown that azadirachtin is toxic to all developmental stages of *T. urticae* mites, and adult mites tend to move away from treated surfaces (Međo et al., 2014).

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