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Investigating the Efficacy of Biphenazit Acaricide in the Management and Control of the *Panonychus Ulmi*

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ABSTRACT

The use of low-risk mite killers is very necessary to prevent the quantitative and qualitative damage of the *Panonychus ulmi* in apple orchards. After *Tetranychus urticae* Koch, *Panonychus ulmi* Koch has the most diversity of plant hosts on fruit trees, stone fruit trees, fruit trees, non-fruit trees, and weeds in the country. In this research, three concentrations of biphenazit were evaluated against the population of *Panonychus ulmi* on apple trees in several regions with different geographical conditions and a history of chemical control in apple orchards. Foliar spraying was done by observing the average population of 5 mites and 30% contamination of leaf samples, and the efficiency of each treatment was determined by randomly collecting 50 leaf samples on the upper surface of the leaf. According to the obtained results, concentrations of 6.0 and 7.0 ml/l of biphenazit can be used to start the infection of apple trees with an average of less than 5 European red mites. The obtained results showed that biphenazit reduces the number of natural enemies such as the age bug, predatory mites, and predatory thrips of apple trees, but does not eliminate them.

Keywords: *Panonychus ulmi*, Apple trees, Different geographical conditions, Biphenazit, Pest management.

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INTRODUCTION

Panonychus ulmi Koch, after *Tetranychus urtica* Koch, has the highest variety of plant hosts on fruit trees with seeds, kernels, fruits, non-fruits, and weeds. This pest overwinters in the form of eggs on the bark, trunk, and branches of apple trees, and the wintering of the eggs occurs gradually and simultaneously with the opening of the blossoms of the apple trees. The first generation is formed by the larval population on the upper surface of the leaf. With the completion of the developmental stages and the increase in the adult female mite population, under the influence of increasing temperature and air dryness, the generation period gradually decreases and the signs of feeding and damage of the mite intensify [1-3].

The *Tetranychus urticae* mite of apple trees and other fruit trees spends the winter as an adult in the surface layers of the soil bed of fruit orchards, the first signs of activity are mostly on the underside of the leaves of broad-leaved weeds in apple orchards. The first generation is done by spawning and the damage of this mite is observed in some apple orchards in different regions. It was introduced by Uniroyal Chemical Company in 1990 and commercialized by Crompton in 1999 [4-6].

The effect of acaricides on the nervous system, body fuel, and fats, developmental stages of the tick, physiology or structure of the tick's body, such as the effect on feeding and maintaining the body's water balance, the activity of the tick's midgut membrane. Efficacy of biphenazit in controlling the active stages and eggs of the European red mite of cherry and apple trees in the state of Michigan, Europe, and fruit orchards infected with this pest mite in Western Australia, false tartar mite in Chile, cedar tartar mite and greenhouse vegetable tartar mite in British Columbia has been declared effective [7, 8]. The evaluation of this acaricide in the control of the greenhouse rose mite in South Korea is reported in some population strains of this pest mite with the problem of resistance and lack of resistance [9-11].

The effect of biophenizide acaricide as a resistance-reducing factor in the population of *Tetranychus urticae* mites and also its low adverse effect on natural enemies such as the predatory mite *Amblyseius womersleyi* has been emphasized in laboratory conditions and can be used for integrated management [12-14]. The effectiveness of this acaricide on *Panonychus citri* and *Tetranychus urticae* on citrus trees has been effective and on their natural enemies (*Phytoseiulus persimilis* and *Neoseiulus californicus*) it has no effect [15, 16]. In this study, three concentrations of biphenazit were evaluated against the *Panonychus ulmi* population on the variety of apple trees in several regions that had different geographical conditions and histories of chemical control in apple orchards.

MATERIALS AND METHODS

A study was conducted on the effectiveness of three concentrations (0.5, 0.6, and 0.7 ml/l) of the active ingredient Bifenazate 24% SC, on the population of the active stages of the *Panonychus ulmi* of the red apple variety. The recommended concentrations of four acaricides: Spirodiclofen 240 SC, Fenproximate 5% SC, Fenazaquin 20% SC, Fenpropalrin 10% FL, and water spraying were used in the control treatment.

In terms of age, size, and variety in each region, it is almost similar to the selection and the statistical design of blocks. A row of apple trees among the rows of each treatment was not sprayed to avoid a double effect. To determine the efficiency and period of control created by each treatment on the active population of the *Panonychus ulmi*, a random collection of 50 leaves was used at intervals of one day before and 14, 7, 21, and 28 days later. The live population of *Panonychus ulmi* was counted and recorded by binocular microscope on the upper surface of the leaf, the harmful effects of the poisons on natural enemies (predator mites, spiders, and insects) compared to their records before applying the treatments and 28 days later. The Henderson-Tilton formula was used to determine the percentage of losses and statistical analysis of ANOVA (ANOVA) by SAS software, and Duncan's test was used for the grouping and efficiency of each treatment in each region.

RESULTS AND DISCUSSION

The average population of active stages of *Panonychus ulmi* was observed before spraying the treatments on apple trees in different study areas. The closest average population of *Panonychus ulmi* compared to the predicted conditions in the research method was observed on the upper surface of the leaves of apple trees. The results of statistical analysis of 7 treatments of organic acaricides from 5 chemical groups on four occasions and for 28 days of sampling were observed among different apple orchards. Statistical analysis of the average percentage of deaths of the population of active stages of *Panonychus ulmi* at the probability level of 5% ($p>0.05$) except for the next 7 days ($df = 2.6$; $F = 0.73$; $p< 0.48$), there was a significant difference between 14 days ($df = 2.6$; $F = 5.41$; $p< 0.00$), 21 days ($df = 2.6$; $F = 6.04$; $p< 0.00$), and 28 days ($df = 2.6$; $F = 3.13$; $p< 0.01$).

The effect of biphenazit concentrations was recorded 7 days later and for the concentration of 0.5 ml/l, it was 79.66% and the maximum was recorded 21 days later for the concentration of 0.7 ml/l, it was 94.33%. The next day, with a decrease in efficiency for all three concentrations of this treatment, it reached at least 44% for the concentration of 0.5 ml/l biphenazit. The highest mite loss of more than 96% was observed on the 28th day of sampling for the spirodiclofen acaricide and the trend of decreasing effect. Other treatments from the next 7 days, especially for Fenpiroximit tick killer, reached the next 21 days. Finally, with a decrease in the next 28 days, it reached less than 40% compared to the 21 days.

The trend of increasing mite losses from the effect of the acaricide spirodiclofen was similar to the concentrations of biphenazit in the apple orchard. The acaricide efficiency of fenpropatrine faced a decreasing trend until the next 28 days and compared to the two acaricides phenazoquin and phenpyroxymate, it had more losses on the *Panonychus ulmi* population. The maximum mite losses for Phenazoquine acaricide were observed as 98.04% and 95.36% for 7 and 14 days. In the next 21 and 28 days, it decreased to less than 50%. These results show that this acaricide has been used more against Panonychus ulmi. The acaricide effect of fenpiroximit was ineffective against *Panonychus ulmi* in the sampling sessions so the percentage of tick deaths did not exceed 41%.

The least (3 ticks) and the most (14 ticks) predatory mites collected from 50 leaves of apple trees from each treatment showed two species of Phytoseiidae (*Euseius finlandicus*, *Amblyseius sp.*) respectively for the concentration of 0.5 ml/l biphenazit and control treatment were observed. Positive changes in the number of predatory mites were observed only for the concentration of 0.5 ml/l biphenazit and at the turn of 28 days and compared to before foliar spraying. The effect of bad treatments on the population of Thrips in different times of sampling and by shaking the leaves on oiled white paper and compared to the time before foliar spraying, 7 days later, compared to before applying the treatments, there was a decrease and in the turn 14 and 21 days later, it was accompanied by a slight increase. The highest population of Thrips was recorded among the treatments for pyroxemia. Although the population of the hunter age before spraying was less than that of the Tris hunter, its population was observed in the treatments and sampling times, and the highest number was recorded in the control treatment. The overall adverse effect of the treatments on predatory mites was observed in 28 days compared to one day before spraying, causing more than a 50% reduction in their population. Comparison of the effect of mistreatments on the activity and population of Thrips and the age of hunters was much less compared to hunter ticks at different times of sampling. Factors such as the ability to fly, move, and find new food sources can reduce the adverse effects of foliar spray treatments on predatory insect populations **(Table 1)**.

Table 1. Comparison of the average population of natural enemies collected from 50 leaves of each treatment.

Predators / Sampling time	Orius	Thrips	Phytoseiids
One day before	2.89 ± 0.39	2.62 ± 0.26	9.62 ± 1.25
7 days after	1.50 ± 0.26	1.37 ± 0.26	5.5 ± 0.62
14 days after	1.62 ± 0.26	1.38 ± 0.18	2.50 ± 0.82
21 days after	1.62 ± 0.26	1.62 ± 0.26	4.12 ± 0.83
28 days after	1.62 ± 0.26	2.12 ± 0.35	4 ± 0.53

Panonychus ulmi was not an economic pest in the world until 1940 [17, 18]. The use of carbonic hydrochloric compounds such as DDT after World War II makes this mite appear as a pest [19] and is currently one of the most important pests of fruit trees in the world [20]. This mite creates yellow needle marks by feeding with 70 to 120 micron [8, 21] green leaf cells of fruit trees and emptying the contents of the cells. The color spreads and while causing early fall, the effects of the damage can be seen even in the following years. *Panonychus ulmi* damage can reduce branch growth, tree trunk diameter, apple size, and marketability, and leave negative effects on the chemicals inside the fruit [22].

The effect of biphenazit, a chemical compound of carbazate, on the nervous system of the control mite population, and considering that it has short-term effects on the plant, it is declared to be of low risk to the environment, natural enemies, and mammals [4]. The effects of biphenazit and fenpropathrin on the nervous system, phenazoquine and fenpiroximit on the respiratory system, and spirodiclofen on the developmental stages of the tick cause toxicity. The highest tick losses are caused by the effect of all three concentrations. Biphenazit can be seen up to 21 days later. In European countries, this acaricide has been used mostly to control mites of ornamental plants of summer and vegetable crops in greenhouse conditions [23].

The results of the efficiency of three concentrations of biphenazit acaricide on the damaging *Phytonemus pallidus* from the second week after foliar spraying had 87% control in greenhouse strawberries in Poland [24, 25]. The use of new acaricides such as biphenazit in controlling the population of *Panonychus ulmi* in Canada is associated with high efficiency and prevents the development of resistance in the pest mite population [7]. High population density of pest mites on fruit trees and lack of timely foliar spraying against them; The lack of necessary foliar spraying on all infected leaves can have negative effects on the efficiency of a newly introduced acaricide.

The results of this study showed that despite the low to high concentrations of *Panonychus ulmi* in apple orchards, with the increase in bifenazit concentrations, mite losses also increase. In this regard, the results of foliar spraying of 50 grams of the effective ingredient biphenazit compared to its lower amounts against the tartan mite (*Oligonychus coffeae* (Nietner)) in tea from 4 to 14 days later in tea gardens in eastern India caused more losses in 35 days and prevented the reactivation of this pest mite [26].

Evaluation of the effect of biphenazit concentration of 0.5 ml/l on the population of fetozoid mites caused a noticeable increase in them and concentrations of 0.6 and 0.7 ml/l with the reduction was accompanied in the apple orchard. Similar to this result, is observed in the population of Trips hunter, the age of the predator *Orius* sp. In total, more than 50% of the population of natural enemies in the next 28 days compared to the population before foliar spraying with a decrease in the apple orchard.

The laboratory results showed the lethality and sublethal effect of biphenazit acaricide compared to a plant acaricide and fungicide on the predatory mite population of *Phytoseiulus persimilis*, which showed that it is possible to use it for a combined fight against tartan mites. In another investigation, the results of the effect of one concentration of biphenazit and two organic acaricides on the population of two species of predatory ticks, *Hytoseiulus persimilis,* and *Neoseiulus californicus*, have been declared to be low-risk and safe respectively [27, 28]. The use of low-risk acaricides to prevent the quantitative and qualitative damage of *Panonychus ulmi* in apple orchards, to preserve the environment of natural enemies, to ensure the necessary quality in apple by-products such as compote, extract, fruit juice, vinegar, lavash, apple leaves, etc. is very necessary.

CONCLUSION

The effect of biophenizide acaricide as a resistance-reducing factor in the population of *Tetranychus urticae* mites and also its low adverse effect on natural enemies such as the predatory mite *Amblyseius womersleyi* has been emphasized in laboratory conditions and can be used for integrated management [12]. The effectiveness of this acaricide on *Panonychus citri* and *Tetranychus urticae* on citrus trees has been effective and on their natural enemies (*Phytoseiulus persimilis* and *Neoseiulus californicus*) it has no effect [15]. In this study, three concentrations of biphenazit were evaluated against the *Panonychus ulmi* population on the variety of apple trees in several regions that had different geographical conditions and histories of chemical control in apple orchards.

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