An Evaluation of Thyme Extract Effects on Controlling *Aganoscena Pistaciae*

Amir Soheili (MSc)[1*], Atena Biari (MSc)[2], Mahmood Aliannejadi (BSc)[3], Elahe Asadi (MSc)[4]

[1] *MSc in Plant Pathology, Agricultural Research Center, Mehmandoost, Damghan, Iran*
[2] *MSc in Agronomy Engineering, Agricultural Research Center, Mehmandoost, Damghan, Iran*
[3] *BSc in Plant Protection, Agricultural Research Center, Mehmandoost, Damghan, Iran*
[4] *MSc in Entomology, Agricultural Research Center, Mehmandoost, Damghan, Iran*

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Corresponding Author:
Amir Soheili
Email: parsa3504@gmail.com
Tel: +98-912-5313504

Abstract

Introduction: Pistachio trees belong to the family Anacarthias. This species grows in almost tropical climates. It is worth noting that pistachio trees were planted many years ago. Destructive effects of pesticides on other creatures, poisonings caused by the usage of pesticides among people, and costs of producing chemical pesticides should be investigated thoughtfully. This paper aims to investigate thyme extract effects on controlling pests and reducing the application of chemical pesticides.

Materials and Methods: In this research, a factorial test was done with a random block design with 4 treatments in four repeats. According to the results obtained, use of water, non-use of water, and thyme had the most significant effects. Sampling was done in 4 stages after 3, 7, 14, and 21 days from scattering the solution. To prepare the extract, different analyses were made based on pesticide effects.

Results: The results showed that the response of nymphs and the egg number in pistachio trees to the application of the thyme extract and different doses of it was significant. The lowest number of nymphs and eggs was observed at dose 2.5, yet the highest number of nymphs was observed at dose 0, or when distilled water was used. Besides, the lowest number of eggs was observed at dose 2.5 with the mean being 39.87; in contrast, the highest number of eggs was observed at dose 0 when distilled water was used with 63.2 eggs.

Conclusion: The research results showed that the effects of the extract type on the number of insect nymphs and eggs were significant at the probability of 1%. Besides, the thyme extract reduced the number of nymphs and eggs compared to the control and water treatment.

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1. Introduction

Pistachio nuts belong to the genus Pistacia of the family Anacardiaceae. The species Pistacia vera is edible pistachios of the commercial type. In addition to many famous cultivars, significant populations of wild germplasm exist primarily in Central Asia, starting from Turkey to Afghanistan. Pistachios are most widely grown in Iran, Syria, Turkey, and the USA. Today, Iran is one of the major pistachio exporters in the world. Recently, Iran pistachio production has decreased significantly because of long-term drought, natural factors, traditional agriculture, and post-harvest deficiencies. Thus, other countries are capturing Iran's share of the traditional market [1]. On average, almost one third of agricultural products is wasted during planting and harvest stages by pests. The rate of pest damage is very high in undeveloped countries. For example, 40% of products is wasted by pests in Latin America. On the one hand, the use of pesticides causes a quantitative and qualitative increase in products; on the other, removal of natural pest controllers disturbs biological balance, which leads to an increase in the pest population. Accordingly, destructive effects of pesticides on other creatures, poisonings caused by the use of pesticides among people, and costs of producing chemical pesticides should be investigated comprehensively. Nowadays, chemical pesticides are the most powerful way of killing pest populations that always need pesticides to be eradicated [2]. The usual *Agonoscena pistaciae*, with the scientific name of *Aganoscena pistaciae*, of the family psyllidae, being sometimes called the 'dry extract', has been prevalent in pistachio farms. In Iran, this insect damages native pistachios. The young nymphs of this pest insert their proboscis into the plant tissue after hatching their eggs and suck the plant extract [3]. Pistachios have an important role in the agricultural economy, so many regions are interested in cultivating this plant. Besides, this plant is compatible with adverse environmental conditions, including salty water and soil, drought, and low water. This is the reason why this plant has a special position in regions with the above-mentioned specifications, with this issue being economically important [4]. Thyme is a plant with two pieces, whose name has been taken from the Greek word of thymus that means power and courage. Accordingly, this name is a symbol of medicinal and therapeutic effects of this plant. This plant belongs to the family Lamincenc, with its origin being the Mediterranean region. Thyme is a perennial plant that grows up to 40cm with sharp dark green leaves growing on its small woody stem. Besides, its fragrant

leaves are used as spices or medicines. Thyme essence with 40% of which being composed of phenol compounds (thymol and carvacrol), with these compounds having antiseptic effects. In addition, thymol, caffeic acid and tannin in essential oils can also effectively prevent the growth of bacteria and viruses. The highest amount of thymol in thyme exists in the species thymus vulgaris L. According to GC analysis, T. captantus plant contains of Carvacerol which Researchers have noted for its antimicrobial property of this compound and inhibitory activity of the thyme oil extract is probably due to the presence of these two compounds [5]. This paper aims to investigate the effects of the thyme extract on controlling nymphs and reducing the application of chemical pesticides.

2. Materials and Methods

This research has been done randomized complete block design, with four treatment and four repeats. A pistachio cultivar with an area of 4 hectares was chosen for this study. For this test, we chose 4 rows, with the type of trees being Abbas Ali, the amount of *Agonoscena pistaciae* congestion being equal in all rows, the interval between the two trees being 3- 3.5 meters and the distance between the rows was 7m, in which 44 trees were selected in each row. The sampling was done from the leaves completely randomly and separately from every row. Next, the samples were analyzed by a microscope in a laboratory, the number of eggs and nymphs were counted, and characteristics, such as the row and number of trees were noted in a table based on the obtained results. To this end, the mean of the pest population in every test unit and repeat was counted. Next, using Henderson and Tilton formula, the value of care effects was analyzed as compared to the control in every test unit. For this research, 5 controls (without the extract and water), pure water, and thyme were used, with El concentrations of this extract having been 715, 5, and 215, respectively. In every row, two trees were kept as the control (we did not apply extracted water to them), and sampling was done in 4 stages after 3, 7, 14, and 21 days from scattering the solution. To prepare the extract, based on the pesticide effect, different analyses were made [6- 8].

3. Results

Table 1 shows that the effect of the extract type on the number of egg number of nymphs was meaningful in the area with the probability of 1%. Thus, the first assumption was unacceptable, which assumed that the dose rate would not affect the number of insect eggs. However, its opposite assumption was acceptable (H_1), which assumed that different doses would affect the number of insect eggs.

Table 1- Variance analysis of effects of the dose rate and extract on the number of pest eggs and nymphs

Source of changes	Mean Square		Test F	
	Egg number	Nymph number	Egg number	Nymph number
Dose	624.24	37923	22.22**	19.29*
Extract	11605	560543.667	26.65**	50.52**

**Significant at the 0.01 level; *Significant at the 0.05 level

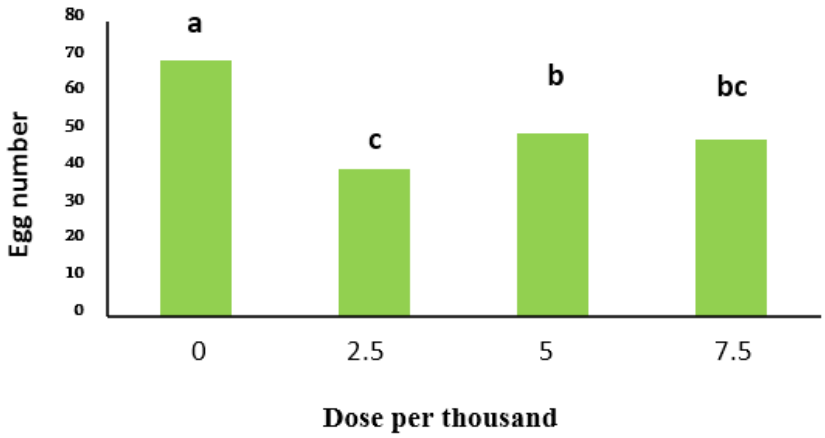

Fig. 1- Effects of the dose on the number of pest eggs

According to Fig. 1, the lowest number of eggs was observed at dose 2.5 with the mean of 39.87, and the highest number of eggs was observed at dose 0 in case of using distilled water with the number of eggs being 63.2; thus, for control purposes, doses 7.5 and 2.5 had the highest effect on the number of insect eggs.

Table 1 shows that the area of probability of 1% was meaningful among the used doses. Thus, the first assumption was unacceptable, which assumed that different doses would not affect the number of insect nymphs; in contrast, the opposite assumption (H_1) was acceptable, which indicated that different doses would affect the number of insect eggs. According to Fig. 2, the lowest number of nymphs was observed at dose 2.5 with the mean of 310.43; in contrast, the highest number of nymphs was observed at dose 0, or after using distilled water with 538.275 insect nymphs. Thus, for control purposes, doses 2.5 and 7.5 had the highest control effect on the number of insect nymphs.

Table 1 shows that the effect of the extract type on the number of insect eggs is meaningful in the area with the probability of 1%. Thus, the assumption (H_0) implying the lack of effectiveness was unacceptable, yet the opposite assumption (H_1) was acceptable. Results showed that the amount of insect eggs having been in the control, water and thyme treatments, respectively, 65, 73 and 41. According to Fig. 3, the thyme extract had a positive effect, with the remaining number of the eggs having been about 41.

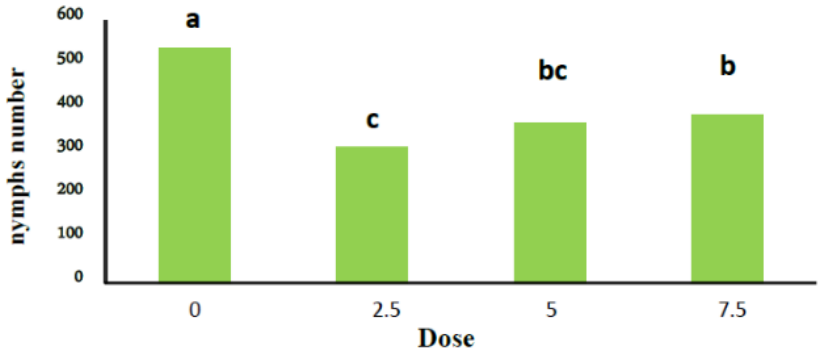

Fig 2- Effects of the dose on the number of insect larvae (nymphs)

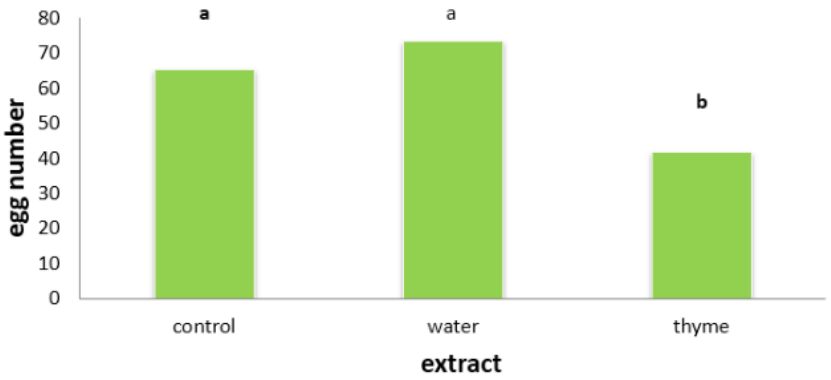

Fig 3- Effects of the extract on the number of insect eggs

Table 1 shows that the effect of the extract type on the number of insect nymphs was meaningful in the area with the probability of 1%. Thus, the assumption (H_0), based on the lack of effectiveness, was unacceptable; in contrast, the opposite assumption (H_1) was acceptable, which indicated that the extract type, as a controller, would act differently. According to Fig. 4, the highest number of insect nymphs was 565, 567 and 320, respectively in the water state, control and thyme treatment, statistically; besides, the thyme extract had a positive effect so that the remaining number of insect nymphs was 320.

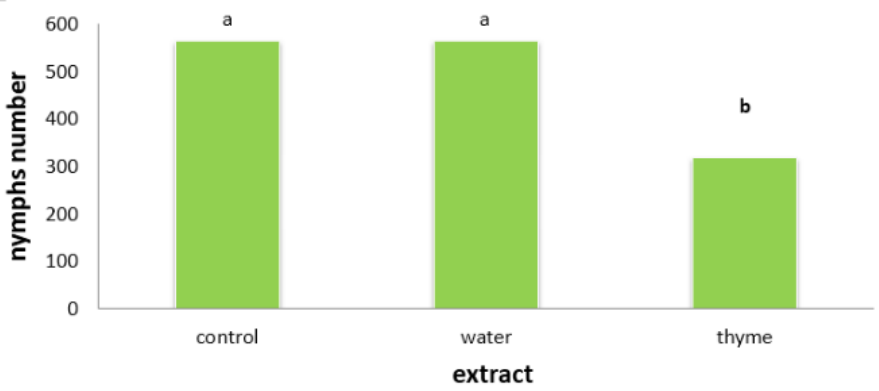

Fig 4- Effects of the extract on the number of insect nymphs

4. Discussion

Emergence of safe compounds, such as herbal extracts, has raised hopes for controlling pests. Many years ago, humans discovered antifungal and antisepticise effects of spices and fragrant plants. In ancient times, such compounds would be used for preserving agricultural products and foods. Although the continental climate in Iran is suitable for culturing these fragrant plants, in this research, it was attempted to examine anti-pesticide effects of the extract of these natural herbs. In recent years, research has investigated such herbal compounds. Some tropical regions are the major sources of herbal pesticides [9]. Some of the applications of herbal pesticides include controlling arthropod behavior, analyzing and studying pest populations, disrupting reproduction behavior of pests, fighting against pests directly, and making hygienic uses. This research attempted to determine and compare the effects of the thyme extract on pistachio *Agonoscena pistaciae*. Accordingly, the results showed that the thyme extract had a positive effect on controlling insect nymphs and eggs. Clove and thyme extracts are able to decrease mycelium and mildew growth in the presence of water, thereby strongly decreasing the sprouting spores [10- 12]. The cherish extract has breeding, anti-nutritional, and repulsive properties. This extract is sprayed on plant organs. Besides, the extract of the cherish core has positive effects on all sensitive stages of *Trialeurodes vaporariorum*, except for eggs (13). The contact toxicity of the Shirazi thyme extract and lavender has positive effects *Callosobruchus maculatus* [14]. A total of 32 oily extracts used in the food industry are effective in preventing four bacterial species of listeria monocytogenes and one species of *L.innacuc* bacteria. Among plants of anti-microbial effects, one could refer to cinnamon, thyme, cloves, sweet pepper, and oregano [15].

5. Conclusions

According to the results of this study, the thyme extract had a positive effect on controlling insect nymphs and eggs. Besides, the results showed that some doses of the thyme extract had more strong effects on controlling insect nymphs and eggs.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this article.

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