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CHEMICAL MEASURES FOR CONTROLLING PESTS IN INTENSIVE PISTACHIO ORCHARDS

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ABSTRACT.

This article provides an overview of the distribution and harmful effects of sucking pests in intensive pistachio orchards. Particular attention is given to their bioecological characteristics and the damage they cause to plant growth and yield. Furthermore, the article discusses control strategies with a focus on the application of chemical methods. The biological effectiveness of insectoacaricides against the dominant pest species has been evaluated, providing a scientific basis for improving integrated pest management (IPM) programs in intensive pistachio cultivation.

INTRODUCTION.

In our Republic, a set of comprehensive measures is being implemented to intensively develop fruit growing, increase soil fertility, improve the productivity of fruit crops, enhance product quality, expand the production of processed goods, and fully meet the population's demand for fruits. Among nut-bearing trees, pistachio is considered one of the most important species. Today, great attention and interest are being paid to the development of pistachio cultivation in our country. In particular, large-scale reforms are being carried out in the agricultural sector to improve household income by developing pistachio orchards on rainfed and foothill lands that are currently underutilized.

Pistachio is highly adapted to extreme environmental conditions, withstanding temperatures from +46 °C in summer to –40 °C in winter, making it second only to almond in terms of resilience. The tree is long-lived, capable of bearing fruit for up to 300 years. Pistachio nuts are highly valued as a dietary product, containing 49–60% oil, 15–20% protein, 3–8% sugars, and a variety of micronutrients. The nuts are in high demand not only in the domestic market but also internationally. Currently, pistachio orchards in Uzbekistan cover about 30,000 hectares [8].

The pistachio tree (*Pistacia* L.), belonging to the family Anacardiaceae, is a small tree or shrub-like perennial species. Central Asia, including Uzbekistan, is considered the center of origin of pistachio. This is confirmed by the wide genetic diversity of wild pistachio forms found in this region, many of which are tolerant to cold and extreme drought, as well as resistant to diseases and insect pests. According to Academician N. I. Vavilov (1935), all cultivated pistachio varieties distributed worldwide originated from the natural pistachio forests of Central Asia [1].

The true pistachio (*Pistacia vera* L., Anacardiaceae) forms unique stands of trees and shrubs naturally adapted to arid environments. Pistachio is remarkable not only for its resistance to the hot and dry summers of foothill regions but also for its tolerance to cold. In natural pistachio groves located at altitudes of 1,500–2,000 m above sea level, trees have been observed to survive winter frosts as low as –30 °C in certain years [2].

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However, in recent years, the productivity and sustainability of pistachio orchards have been increasingly threatened by various harmful organisms, particularly insect pests. Among them, **sucking pests** such as psyllids (*Forda formicaria*) and aphids (*Slavum pistaciae*) are considered the most economically damaging. These pests weaken trees by extracting plant sap, reduce photosynthetic activity, promote the development of sooty mold through honeydew secretion, and ultimately lead to a decline in both the quality and quantity of nuts.

Therefore, studying the bioecology of these pests and developing effective control strategies, particularly under the conditions of intensive orchards, is of great importance. Among available methods, chemical control remains the most widely applied approach, although it must be integrated with biological and cultural measures to ensure ecological safety and long-term effectiveness.

Literature Review

Among nut crops cultivated in Central Asia, walnut (*Juglans regia*) and pistachio (*Pistacia vera*) occupy the largest areas. Both are affected by numerous insect pests. It has been recorded that walnut is damaged by 43 different pest species, while pistachio is attacked by 42 species [3].

Certain aphid species, such as *Forda hirsuta*, *Slavum lentiscoides*, and *Slavum mordvilkovi*, induce the formation of various types of galls on pistachio trees (*Pistacia vera*) [4]. Another serious pest of pistachio is *Eriosoma lanigerum* Hausm., which is considered one of the most harmful species. This pest is widely distributed not only in Uzbekistan but also in neighboring countries and other regions of the world [5].

In studies conducted in Iran and Turkey, the common pistachio psyllid (*Agonoscena pistaciae* Burckhardt & Lauterer) was reported as one of the most destructive pests in commercial orchards, causing severe leaf deformation, honeydew excretion, and promoting sooty mold development [10]. Similarly, *Aphis gossypii* and *Slavum pistaciae* are recognized as key pests that weaken trees by sap-feeding and reducing photosynthetic efficiency.

Scale insects, including *Ceroplastes rusci* and *Saissetia oleae*, have been documented in pistachio orchards of the Mediterranean region, where they significantly reduce tree vigor and nut yield [11]. Furthermore, spider mites (*Tetranychus* spp.) represent another group of pests that frequently cause economic damage under hot and dry conditions typical of pistachio-growing areas [12].

Recent literature emphasizes the importance of studying the **bioecology of pistachio pests** under local agroclimatic conditions. Understanding their seasonal population dynamics, reproductive potential, and host–pest interactions provides a basis for the development of effective integrated pest management (IPM) strategies. Special attention has been given to the evaluation of insecticides and acaricides, as well as the potential of biological control agents, in order to reduce environmental risks and pesticide resistance [13,14].

Research Methodology and Materials

The research was carried out at the Gallaaral Pistachio Research Station, Jizzakh region, Uzbekistan, where pistachio orchards are maintained under intensive cultivation conditions. The study aimed to identify major sucking pests, assess their population dynamics, and evaluate the effectiveness of selected insectoacaricides under field conditions.

Entomological surveys were performed regularly during the growing season. Pest species were identified using the classical entomological method described by G.Ya. Bei-Bienko, while the population density and damage level of pests were determined according to the methodology of Sh.T. Khojaev. The biological efficacy of insectoacaricides was assessed under natural infestation, with

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observations taken before and after treatment applications. Standard experimental design and statistical approaches were applied to ensure accuracy and reliability of results [6, 7, 9].

Results and Discussion

During the study, several species of gall-forming aphids were recorded on pistachio trees. *Slavum pistaciae* was observed to settle along the margins of pistachio leaves, inducing leaf curling and marginal galls. *Forda formicaria* was found to produce nut-shaped galls on the abaxial (underside) surface of pistachio leaves. In some cases, damage caused by the pistachio psyllid *Agonoscena pistaciae* was also recorded.

Our observations, conducted from March to September 2025, revealed that these aphids reproduce parthenogenetically, producing 6–7 generations per season. The first generation induced gall formation, while subsequent generations developed and survived within the galls. This continuous gall colonization significantly disrupted leaf morphology and physiological functions, thereby affecting the overall photosynthetic activity and productivity of pistachio trees.

In field trials, insectoacaricides were tested against sucking pests in pistachio orchards. The experiments were conducted on the pistachio cultivar *Sitora*, using five treatment variants with three replications.

According to the results, when Rimon Fast 10% SC was applied at a rate of 0.5 L/ha, the highest efficacy was recorded on the 7th day after spraying, reaching 93.3%. In subsequent observations, a slight decline in the biological effectiveness of the preparation was noted (Table 1).

In the treatment with Tiamectin 16.9% SC at a rate of 0.2 L/ha, the biological efficacy reached 66.5% on the 3rd day after application, 78.1% on the 7th day compared to the control, and increased to 91.0% by the 14th day.

In the treatment with Viproklem 15% WG at a rate of 0.2 kg/ha, the efficacy was 62.8% on the 3rd day, 78.6% on the 7th day compared to the control, and 88.0% on the 14th day after application.

In the treatment with Nurell Super 55% EC at a rate of 1.0 L/ha, the biological efficacy was 59.6% on the 3rd day, 76.3% on the 7th day compared to the control, and reached 87.4% by the 14th day after application.

Table 1.

Biological efficacy of different insectoacaricides against major sucking pests of pistachio (cv. Sitora).

(The field experiment was conducted at the Gallaaral Pistachio Research Station, Gallaaral District, Jizzakh Region, Uzbekistan, in 2025).

No.	Variants	Active ingredient and application rate	Average number of pests per leaf (pcs)					Biological efficacy			
			Before spraying	After spraying (days)							
				3	7	14	21	3	7	14	21
1	Rimon Fast 10% SC	Novaluron + Bifenthrin, 0.5 L/ha	10,0	3,3	0,7	1,6	1,7	67,0	93,3	84,3	83,0
2	Tiamectin 16.9% SC	Thiamethoxam + Abamectin, 0.2 L/ha	8,5	3,3	2,2	0,9	1,3	66,5	78,1	91,0	86,7

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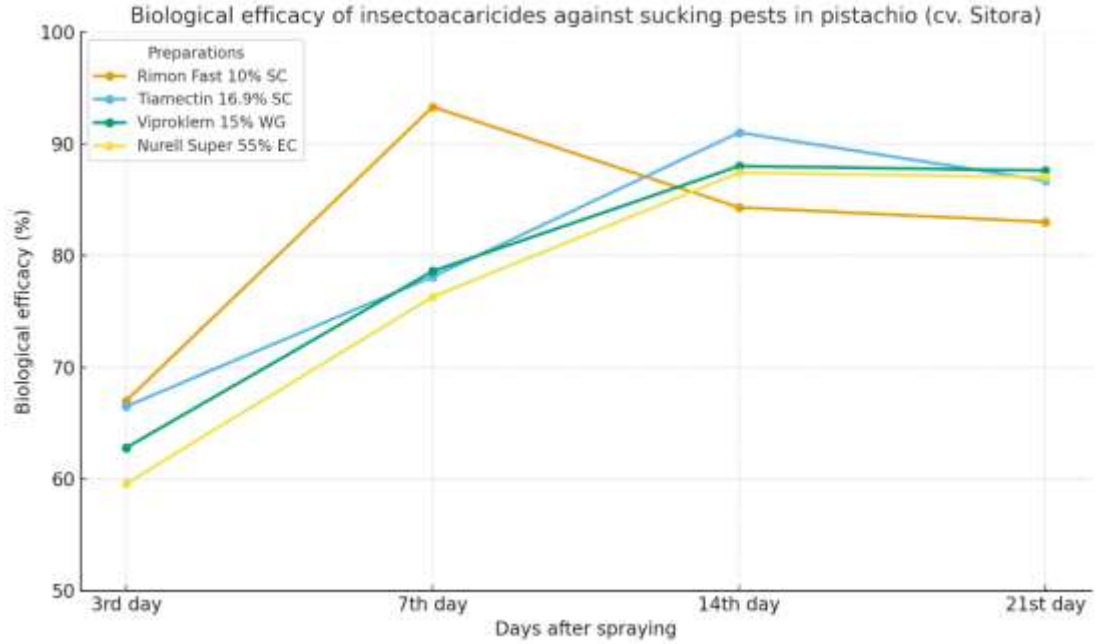
3	Viproklem 15% WG	Emamectin benzoate + Abamectin, 0.2 kg/ha	9,1	3,7	2,1	1,2	1,2	62,8	78,6	88,0	87,6
4	Nurell Super 55% EC*	Cypermethrin + Chlorpyrifos, 1.0 L/ha (standard)	7,8	4,0	2,4	1,3	1,3	59,6	76,3	87,4	87,0
5	Control (untreated)	-	9,4	10,0	15,3	20,0	25,0	-	-	-	-

*Note: Nurell Super 55% EC was used as the reference standard (control treatment).



Discussion

The results of the field experiments clearly demonstrate that different insectoacaricides varied in their effectiveness against sucking pests in pistachio orchards. Among the tested preparations, **Rimon Fast 10% SC (Novaluron + Bifenthrin)** showed the highest efficacy, reaching **93.3% on the 7th day after application**. However, a slight decline in effectiveness was observed by the 14th and 21st days, indicating that its residual activity is limited.

Tiamectin 16.9% SC (Thiamethoxam + Abamectin) also exhibited high performance, with biological efficacy increasing to **91.0% on the 14th day**, suggesting good residual action compared to Rimon Fast. Similarly, **Viproklem 15% WG (Emamectin benzoate + Abamectin)** maintained relatively stable results, achieving **88.0% efficacy on the 14th day** and remaining effective up to 21 days.

The reference standard, **Nurell Super 55% EC (Cypermethrin + Chlorpyrifos)**, demonstrated moderate effectiveness, with a maximum of **87.4% efficacy on the 14th day**, which was slightly lower than the newly tested preparations. This suggests that while Nurell Super is traditionally used

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in pest management programs, other modern insectoacaricides may provide higher and more stable control.

The untreated control variant showed a continuous increase in pest population density, confirming the necessity of chemical interventions under high infestation conditions.

Overall, the study indicates that Rimon Fast, Tiamectin, and Viproklem are effective candidates for controlling sucking pests in intensive pistachio orchards. However, their use should be incorporated into an **integrated pest management (IPM) strategy**, including rotation of active ingredients to prevent resistance development and minimize environmental risks.

CONCLUSION.

1. Timely identification of the species composition, distribution, and harmfulness of sucking and chewing pests of pistachio, as well as the implementation of appropriate control measures, is of great importance.

2. Among the most common sucking pests in pistachio orchards are the gall-forming aphids *Forda formicaria* and *Slavum pistaciae*.

3. Against gall-forming aphids of pistachio, the use of insectoacaricides from different chemical groups such as Rimon Fast 10% SC (0.5 L/ha), Tiamectin 16.9% SC (0.2 L/ha), Viproklem 15% WG (0.2 kg/ha), and Nurell Super 55% EC (1.0 L/ha) showed a high level of biological effectiveness, ranging from **87.4% to 93.3%**.

4. The timely and effective management of harmful organisms in pistachio orchards is essential for preserving yield and plays a key role in strengthening the export potential of pistachio production in our Republic.

Parthenogenetically reproducing females are protected inside galls from external factors, including natural enemies. Therefore, for effective control of these pests, it is advisable to consider their development in relation to the vegetation period of pistachio: applying entomophages or contact insecticides during the period when aphids emerge from galls, or using systemic insectoacaricides that can affect aphids living in symbiosis with plant tissues.

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