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ASSESSMENT OF SELECTED ECOFORMS OF PISTACIA VERA L. FOR PRODUCTIVITY, DROUGHT TOLERANCE, DISEASE AND PEST RESISTANCE (FOOTHILL AREAS OF JIZZAKH REGION, REPUBLIC OF UZBEKISTAN)

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Abstract
Pistachio (Pistacia vera L.) has been utilized by humans for various purposes since ancient times. In Central Asian countries, particularly in Uzbekistan, the pistachio industry is developing rapidly, mainly due to the growing global demand for pistachio nuts. Selection and propagation of high-yielding and high-quality pistachio genotypes are essential for sustainable production. Scientific research in this field contributes to the establishment of high-yielding and stress-tolerant pistachio plantations in the future.

Keywords: Mountain and foothill regions, irrigation, rainfed lands, forest reclamation, nut crop, pistachio, drought, heat tolerance, breeding.

Introduction

In the mountainous and foothill regions of Central Asia, where there is no artificial irrigation system, species of the genus Pistacia grow successfully on rainfed lands,

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fulfilling important forest reclamation and ecological functions while producing valuable nut crops. The pistachio belongs to the family Anacardiaceae and the genus Pistacia L., which comprises up to 20 species naturally distributed across the Mediterranean region, Transcaucasia, Iran, Central Asia, Afghanistan, Pakistan, China, the United States, and Mexico. Among them, only Pistacia vera L. produces edible nuts.

The pistachio tree (P.vera L.) has long been highly valued by humans for its remarkable ability to grow under harsh environmental conditions such as drought and high temperatures, to prevent soil erosion in mountainous and foothill regions, and to provide fuelwood. However, the main reason for its extensive cultivation and research attention has been its economically valuable nuts. Humanity has utilized the products of this species for more than two millennia.

The kernels of Pistacia vera L. contain 40–60% oil (and in some cases even more), 15–20% protein, 3–8% sugar, and a wide range of microelements. Owing to its exceptional drought and heat tolerance, deep root system, and unique physiological and anatomical adaptations, the pistachio can thrive even in arid and hot climatic zones with low soil moisture.

Pistachio forests in Central Asia-particularly in Uzbekistan's mountainous and foothill areas-represent not only valuable biodiversity but also an important genetic resource. Consequently, these natural pistachio populations have long served as essential breeding material for researchers engaged in pistachio selection and improvement programs. These stands provide a basis for selecting high-yielding and high-quality genotypes suitable for establishing future productive pistachio plantations [1, 2, 4].

Material and Methods

The assessment of yield potential, drought tolerance, and resistance to major diseases and pests in Pistacia vera L. was conducted in accordance with the methodology described by Chernova and Olekhnovich [3].

Nut (seed) characteristics were analyzed based on the procedure recommended by Turkish scientists [5], ensuring standardized evaluation of kernel quality and morphological traits.

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Result and Discussion

In pistachio (Pistacia vera L.) trees, nut size-specifically seed dimensions-is a critical trait alongside resistance to diseases, pests, and drought. In the present study, these traits were evaluated for their magnitude, stability, and tolerance to environmental stressors. For this purpose, nuts from selected mother trees were analyzed at the Pistachio Research and Experimental Station in Jizzakh region (Table 1). The experimental orchard, where wild pistachio trees are cultivated, lacks an artificial irrigation system and is situated on typical calcareous gray-brown soils at an altitude of 750 m above sea level.

Table 1. Breeding Evaluation of Selected Pistachio Ecoforms at the Experimental Station (According to the Turkish Method) (2021–2023)

№	Ecoform name	Seed size (cm)	Weight of 100 seeds (g)	Number of seeds per 100 g	Quality grade
1	Galina	2.0×1.0×1.0	101.2	98.8	2
2	Chernova	1.9×1.0×1.0	90.5	110.5	3
3	JBM-1	2.0×1.3×1.3	122.4	81.7	1
4	JBM-2	1.9×1.3×1.3	125.0	80.0	1
5	JBB-1	2.1×1.3×1.2	134.5	74.3	1
6	JBB-2	2.3×1.2×1.3	148.7	67.2	1
7	JBB-3	2.1×1.2×1.2	116.5	85.8	1
8	JBB-4	2.2×1.3×1.2	124.7	80.2	1
9	Nargiz-1	2.1×1.2×1.2	133.6	74.8	1
10	Nargiz-2	2.2×1.3×1.3	138.1	72.4	1

According to the data presented in Table 1, the highest 100-seed weights were observed in the JBB-2 and Nargiz-2 genotypes, measuring 148.7 g and 138.1 g, respectively. The lowest 100-seed weight was recorded in the Chernova genotype at 90.5 g. Due to its high productivity and stable annual yield, the Chernova genotype is considered promising. Genotypes JBB-1, JBB-2, Nargiz-1, and Nargiz-2, which exhibited superior 100-seed weights, were also rated highly.

In pistachio trees, yield and tolerance to biotic and abiotic stresses are key varietal traits. Although all trees are grown under similar conditions, they may differ in productivity or susceptibility to diseases and pests. Therefore, evaluating each genotype for these characteristics is essential. Determining the yield performance of our eco-forms,

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assessing their tolerance to drought, diseases, and pests, and evaluating promising genotypes for varietal traits are crucial steps toward assigning official cultivar status to these eco-forms in the future.

The yield performance and environmental stress tolerance indices of pistachio trees currently under evaluation at the Pistachio Scientific and Experimental Station are presented in Table 2.

Table 2. Evaluation of Productivity and Resistance of Selected Pistachio Ecoforms to Environmental Factors (2021–2023)

№	Ecoform code	Average yield per tree (kg)	Drought tolerance (score)	Disease resistance (score)	Pest resistance (score)
1	Galina	12,6	5	5	4
2	Chernova	14,0	5	5	4
3	JBM-1	8,2	5	4	4
4	JBM-2	7,9	5	4	4
5	JBB-1	12,3	5	4	4
6	JBB-2	13,5	5	5	4
7	JBB-3	10,4	5	4	4
8	JBB-4	11,8	5	4	4
9	Nargiz-1	10,7	5	5	4
10	Nargiz -2	13,1	5	5	4

According to Table 2, the pistachio genotypes selected from the Pistachio Scientific and Experimental Station exhibited high drought tolerance, with all genotypes rated 5 points. Regarding disease resistance, the Galina, Chernova, JBB-2, Nargiz-1, and Nargiz-2 genotypes received the highest rating of 5 points, while the remaining genotypes were rated 4 points. The predominant disease observed was cylindrosporiosis (Cylindrosporium pistaciae). In terms of pest resistance, all genotypes were rated 4 points, with minor infestations primarily by the scale insect (Anapulvinaria pistaciae).

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Conclusion

In Uzbekistan, natural forests and protective plantations of Pistacia vera cover more than 50,000 hectares. One of the primary objectives of pistachio research is to identify ecoforms of P.vera L. that are drought-tolerant, disease- and pest-resistant, highly productive, and possess superior nut quality, and to evaluate and select them for cultivar development. Establishing pistachio orchards based on existing and promising eco-forms provides a reliable guarantee of high yield. Therefore, in the context of the ongoing restoration of pistachio cultivation in Uzbekistan, it is recommended to implement systematic measures to develop the sector and apply scientific advancements in practical production.

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