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ЭКОЛОГИЧЕСКАЯ РОЛЬ ВЫРАЩИВАНИЯ ЗАСУХОУСТОЙЧИВОГО ФИСТАШКОВОГО ДЕРЕВА (PISTACIA VERA L.) В ПРЕДГОРЬЯХ ТУРКМЕНИСТАНА

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Аннотация: В статье излагаются новые научные данные о биоэкологических особенностях фисташкового дерева (*Pistacia vera* L.), произрастающего в природных условиях Туркменистана, а также о его экологическом значении на глобальном и региональном уровнях. Основная цель исследовательской работы заключается в изучении и сравнительном анализе экологической устойчивости фисташки настоящей, встречающейся в дикорастущем виде и выращиваемой в культуре в предгорьях Южного и Восточного Туркменистана. Результаты проведенных научных исследований свидетельствуют о высокой стратегической роли фисташковых экосистем в сохранении почвенного покрова в аридных зонах, предотвращении эрозионных процессов и обеспечении биологического разнообразия. Кроме того, в работе раскрываются научные основы экологической роли фисташкового дерева в поддержании экологического равновесия в регионе и достижении целей устойчивого развития.

Ключевые слова: *Pistacia vera* L., биоэкологические особенности, экологическое значение, дикорастущая и культурная фисташка, предгорья, экологическая устойчивость.

ECOLOGICAL ROLE OF CULTIVATING DROUGHT-RESISTANT PISTACHIO TREES (PISTACIA VERA L.) IN THE FOOTHILLS OF TURKMENISTAN

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Abstract:The article presents new scientific data on the bio-ecological characteristics of the pistachio tree (*Pistacia vera* L.) growing in the natural conditions of Turkmenistan, as well as its ecological significance at both global and regional levels. The main objective of the research is to study and compare the ecological resilience of wild-growing and cultivated common pistachio (*Pistacia vera* L.) in the foothills of Southern and Eastern Turkmenistan. The results of the conducted scientific research demonstrate the vital strategic role of pistachio ecosystems in preserving soil cover in arid zones, preventing erosion processes, and maintaining biological diversity. Furthermore, the paper reveals the scientific foundations of the ecological role of the pistachio tree in maintaining regional ecological balance and achieving the Sustainable Development Goals (SDGs).

Keywords: *Pistacia vera* L., bio-ecological characteristics, ecological significance, wild and cultivated pistachio, foothills, ecological resilience.

In the section titled "Environmental Protection and Ecological Policy of Turkmenistan" of the "National Program for the Socio-Economic Development of Turkmenistan for 2022–2052: The Revival of the New Epoch of the Powerful State," special emphasis is placed on the necessity of expanding forest zones in our country [2]. It should also be noted that the National Forest Program of Turkmenistan for 2026–2030 is currently in effect. In this vital document, significant importance is attached to creating new forest zones and systematically tending to existing ones in accordance with all established standards, with the aim of ensuring sustainable development and ecological well-being in our country during the specified period [1].

In Independent, Permanently Neutral Turkmenistan, nature conservation, as well as the careful preservation and enrichment of the flora, is one of the priority areas of

state policy. At the present time, as the scale of nationwide tree-planting campaigns—which have become a noble tradition in our country—continues to expand, interest in drought-adapted tree species, primarily the pistachio, is also growing.

The pistachio (*Pistacia vera* L.) is a fruit-bearing tree that grows wild in the foothills and low mountains of Central Asia. Out of nearly 20 species in the genus *Pistacia*, the common pistachio is the only one capable of adapting to the region's arid and hot climate. It covers an area of approximately 300 thousand hectares in the south of Central Asia [7]. This article analyzes the significance of cultivating pistachios in the foothills for soil protection, sustaining wildlife habitats, and greening arid lands.

We conducted scientific research and observation activities to determine the distribution, bio-ecological characteristics, and ecological significance of the pistachio tree in the foothills of Turkmenistan. These studies were carried out within the pistachio tree (*Pistacia vera* L.) biocenosis.

The following objectives were set in our scientific research:

1. To study and scientifically assess the current state of the distribution habitats of the natural population of the pistachio tree (*Pistacia vera* L.) growing in the foothills of Turkmenistan.
2. To study the biological and ecological characteristics of the pistachio tree.
3. To determine the indicators of phenological observations regarding the seasonal and annual growth dynamics of the pistachio tree when cultivated in the foothills.
4. To develop the scientific foundations for cultivating the pistachio tree in the foothills of Turkmenistan and to identify its ecological significance.

During the course of our scientific research, literature data and field research observations were collected and analyzed regarding pistachio trees growing within the territory of the Kopetdag State Nature Reserve—extending from the eastern edge of Kopetdag to the interfluve of the Sumbar and Chandyr rivers—as well as the pistachio woodlands distributed within the Koytendag State Nature Reserve, the Kushka pistachio woodland east of Serhetabat (formerly Kushka), and the Pulhatyn pistachio

woodland located within the Badhyz State Nature Reserve. The research and observation activities were conducted using generally accepted methods in biology and ecology [10]. Throughout the study, analyses and comparisons were carried out based on phenological observations of the development of both natural and artificial populations of pistachio woodlands in the foothills. We studied the ecological characteristics of the natural and artificial populations of the pistachio tree in the foothills of Turkmenistan and gathered new scientific data on its ecological significance.



Figure 1. The Pistachio Tree (Pistacia vera L.) and Its Fruit

In the conducted scientific research, the ecological significance of both wild and cultivated pistachio trees (Pistacia vera L.) in the foothills and hilly areas of Turkmenistan was analyzed. New scientific data were obtained based on studying the distribution, reserves, biological and ecological characteristics, past and present conditions, and growth rates of the natural populations of this species.

The fruits, leaves, and bark of the pistachio tree serve as an important food source for numerous animals and birds. This helps them survive safely through the winter season or during unfavorable periods of food scarcity. Furthermore, pistachio trees contribute to the preservation of biodiversity in nature, prevent species extinction, and

ensure the self-regulating capacity of the ecosystem, as pistachio woodlands constitute one of the most vital links in this chain. Regarding the atmosphere and the surrounding environment, the primary function performed by the pistachio tree is aimed at maintaining air purity. Like all plants, the pistachio tree absorbs harmful carbon dioxide from the air through the process of photosynthesis and contributes to regulating the atmospheric gas balance. By ensuring the continuous release of pure oxygen into the environment, it maintains the ecological cleanliness of the air.

It should be specially noted that the leaves of the pistachio tree trap airborne dust, fine microparticles, and certain harmful substances on their surface, thereby aiding in the filtration and purification of the air.

In the arid and hot natural-climatic conditions of Turkmenistan's foothill zones—Kopetdag, Badhyz, and Karabil—the conservation and widespread artificial cultivation of the common pistachio (Pistacia vera L.) hold particular significance for ensuring regional ecological balance. By developing a powerful root system that penetrates deep soil layers (up to 10–15 meters), this xerophytic plant reliably anchors the soil cover on mountain slopes and hills against water and wind erosion, serving as a primary means of combating desertification.

Pistachio woodlands absorb atmospheric precipitation, slow down surface mudflow runoff, and regulate the regional hydrological regime by replenishing groundwater reserves. Furthermore, group cultivation of pistachio trees prevents excessive heating of the air and soil during the summer months, moderates the local microclimate, and creates a stable habitat for the rare flora and fauna of Kopetdag and Badhyz. Thus, expanding pistachio plantations on a scientific basis in rainfed and hilly lands with limited irrigation opportunities is strategically vital not only for obtaining high-quality produce, but also from the standpoint of improving the country's natural environment and conserving biodiversity.

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