**Study of climate change and the impact of mulberry trees on atmospheric air in the southern regions of the Republic of Uzbekistan**

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***Abstract****:* Climate change has become a major environmental challenge in the southern regions of the Republic of Uzbekistan, where rising temperatures, increased aridity, and air pollution significantly affect ecosystem stability and human well-being. In this context, the mulberry tree (Morus spp.), widely cultivated in these regions, represents a valuable biological resource for mitigating adverse climatic and atmospheric impacts. This study investigates the role of mulberry trees in regulating microclimatic conditions and improving atmospheric air quality under changing climatic conditions in southern Uzbekistan. Particular attention is given to the physiological and morphological characteristics of Morus species that enhance their adaptability to drought, high solar radiation, and temperature extremes. The capacity of mulberry trees to absorb carbon dioxide, release oxygen, and capture airborne particulate matter is evaluated, highlighting their contribution to reducing atmospheric pollution. Additionally, the dense canopy structure and extensive root system of mulberry trees play a crucial role in lowering ambient temperatures, preventing soil erosion, and improving soil moisture retention. The study also considers the ecological and socio-economic benefits of mulberry cultivation, including its importance in sericulture and urban greening strategies. The findings demonstrate that mulberry trees significantly contribute to climate change mitigation and air quality improvement in the southern regions of Uzbekistan, supporting their use as an effective and sustainable component of regional environmental management and climate adaptation strategies.

**INTRODUCTION**

The mulberry tree (Morus) is one of the plants valued by humanity for its many benefits. This tree, which is mainly distributed in tropical and subtropical regions, is distinguished by its ecological and economic importance. Mulberry leaves are the main food source for silkworms, which further enhances the role of this plant in the silk industry. In addition, the fruits, leaves and wood of the mulberry tree have important uses not only in agriculture and industry, but also in medicine. This plant is also of great ecological importance in enriching the soil, reducing erosion and increasing the amount of oxygen in the atmosphere. The article analyzes in detail the biological properties of the mulberry tree, its role in the ecosystem and its benefits to humanity.

***Description of the family and species.*** The mulberry tree belongs to the Moraceae family, which includes more than 65 genera of trees and plant species. Plants of this family grow mainly in tropical and subtropical regions. Mulberry is mainly grown in the regions of East and Southeast Asia, India, and temperate and subtropical regions of Africa and North America. There are 20 species of mulberry trees in the world. Most varieties of mulberry grow in China. The mulberry tree grows quickly, is drought and cold resistant. The crown is dense, broadly rounded, oval and pyramidal in shape. It is 15–18 m tall, some are 20–25 m, and up to 1.5 m thick. Adult tall mulberry trees yield up to 20–40 kg of leaves and 50–60 kg of fruit. There are also varieties of mulberry that grow up to 300 years old and 500 years old. Five species are grown in Uzbekistan. The fruits of white mulberry (M. alba) and black mulberry (M. nigra) are consumed. The species Sershok T. (M. multicaulis), kagayama T. (M. Kagayamae) and silkworm T.i (M. bombycis) are mainly used for silkworm rearing. Mulberry is distinguished by its use in various fields and ecological significance. In many regions of our country, the mulberry tree is well suited to the climatic conditions, so its planting and development opportunities are very wide.

**EXPERIMENTAL RESEARCH**

The most popular types of mulberry trees in our country are: Morus alba (White mulberry): The most common type, its leaves are used as food for silkworms. The fruits of the white mulberry are also consumed by humans in figure-1.1.

Morus nigra (Black Mulberry): The fruits of the black mulberry are sweet and have medicinal properties. The fruits are black in color and rich in antioxidants. Morus rubra (Red Mulberry): The fruits of the red mulberry contain high amounts of vitamins and are commonly consumed as food in figures 2 and 3.

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| **FIGURE 1.** Morus alba (white mulberry) | **FIGURE 2.** Morus nigra (Black Mulberry) | |

***Morphology of Morus alba and Morus nigra.*** The morphological characteristics of mulberry trees vary depending on the species, but their common characteristics are as follows:

***Leaves, flower spikes.*** Mulberry leaves are wide, heart-shaped, and vary in length depending on the species. The color of the leaves is green, and the color and shape differ in different species. The leaves of the white mulberry are a source of food for silkworms, and the leaves of other species have medicinal properties. The mulberry tree is mainly a dioecious plant with unisexual flowers, that is, its male and female flowers are separate. The spike is dense, broadly rounded, oval and pyramidal in shape. It is 15–18 m tall, some are 20–25 m, and up to 1.5 m thick. Adult tall mulberry trees yield up to 20–40 kg of leaves and 50–60 kg of fruit. There are also varieties of mulberry that grow upwards (snake-like) and downwards (mad T.).

***Stem.*** The trunk of a mulberry tree is strong and tall. In some species, the trunk branches upwards, while the lower part is dark and flat.

***Root.*** The root system grows deep, which helps strengthen the tree and protect the soil from erosion. Its roots enrich the soil and allow the plant to grow sustainably.

***Origin and spread.*** The homeland of the white mulberry is China, and the homeland of the shotut is the legendary state of Sham - Iran and Afghanistan. The mulberry tree made a great contribution to the development of sericulture in China, and now it has become the main source of silk production throughout the world. The mulberry tree is also now widespread in several countries of the world. In particular, it is widely distributed in Japan, Korea, India, Turkey and other countries. Mulberry trees also grow and are cultivated in agricultural areas of our country.

**RESEARCH RESULTS**

The leaves, fruits, wood, roots, and other parts of the mulberry tree can be used. Each of them is used in different areas.

***Sericulture and the Role of Mulberry Trees.*** The mulberry tree (Morus spp.) represents a fundamental ecological and economic resource in the sericulture industry. Its leaves serve as the sole food source for the silkworm (Bombyx mori), providing essential nutrients required for larval growth, development, and high-quality silk production. The chemical composition of mulberry leaves—including proteins, carbohydrates, minerals, and vitamins—directly influences silkworm metabolism and silk fiber properties. Detailed studies indicate that mulberry leaves contain approximately 18–25% protein, 0.5–1.2% lipids, and 1–2% minerals, offering an optimal nutritional profile for silkworms. In addition, the presence of L-amino acids and folic acid promotes larval growth and enhances silk fiber strength. Leaf age and quality are critical factors for efficient feeding, with 7–8-week-old leaves being most suitable for larval consumption. Ecologically, mulberry trees exhibit rapid growth, drought and cold tolerance, and high foliage density, allowing multiple leaf harvests throughout the year. Different mulberry cultivars (e.g., white, black, multibranched, Kagayama, and M. bombycis) variably affect silkworm development and silk quality. Sustainable sericulture depends on proper agronomic practices, including irrigation, weed control, and pest and disease management. Therefore, mulberry trees not only provide a continuous supply of high-quality leaves but also serve as a key determinant of silk production continuity and fiber quality in the sericulture industry.

***Application of Medicine****.* Mulberry leaves and fruits (Morus spp.) have long been utilized in traditional medicine for their therapeutic properties. They have been shown to help reduce cholesterol levels, improve blood circulation, and support glycemic control in diabetes. The leaves and fruits are rich in antioxidants, vitamins, and essential minerals. Mulberry fruits are highly hydrating, containing 82.9–86.2% water, and moderately sweet, with a sugar content of 10.9–12.7%. When dried, the fruit’s juice concentration increases, and mulberry raisins contain 73.29–83.71% sugar. Additionally, mulberries are a valuable source of vitamins V, S, E, K, and RR.

In terms of mineral content, mulberries are rich in potassium, sodium, zinc, selenium, copper, phosphorus, calcium, magnesium, and iron, while their seeds contain 24–33% oil along with other nutritive compounds. Due to their high phosphorus content, mulberries are particularly beneficial for individuals engaged in intellectual work. Mulberry consumption strengthens the immune system, protects against infectious diseases, delays skin aging, and improves vision, reducing the risk of retinal damage and other ocular disorders.

The leaves and bark of the tree are also abundant in bioactive compounds. Mulberry leaves contain flavonoids, vitamins, carotenoids, essential oils, and organic acids, while the bark is rich in pigments, minerals, and various acids. In traditional medicine, mulberries have been widely used to treat a variety of ailments. Mulberry juice has been employed for blood purification and to enhance overall vitality. Leaf decoctions are used as antipyretic and thirst-quenching remedies for angina and respiratory infections.

Renowned Persian physician Avicenna (Abu Ali ibn Sina) also recognized mulberry’s medicinal properties. Decoctions made from mulberry, grapevine, and black fig leaves have been used to darken hair. Fresh juice from white mulberry leaves alleviates sore throat and toothache, while mulberry fruits and their juice reduce oral and throat swelling. Salted and dried mulberries are used to treat dysentery. Mulberry fruits act as diuretics and help remove excess fluid from the body, which is beneficial for kidney and cardiovascular health. Consuming mulberries before meals minimizes gastrointestinal irritation. Dried mulberry fruits can be prepared as decoctions or compotes to treat fatigue, support weight loss, and detoxify the body. Decoctions from the roots and bark are traditionally used to treat chronic cough, bronchitis, bronchial asthma, and hypertension, due to the presence of compounds that purify blood vessels and normalize circulation. Additionally, root decoctions serve as effective remedies for intestinal parasites.

***Food Applications.*** Mulberry fruits, particularly black and red varieties, are flavorful and rich in vitamins, making them primarily consumed in their fresh form. In addition to fresh consumption, mulberries are also utilized in food processing, including preservation and the preparation of sweets, jams, and other confectionery products. Their high nutritional value, combined with natural sweetness and bioactive compounds, makes them a versatile ingredient in both traditional and modern dietary applications.

**Construction and Industrial Applications.** Mulberry wood is lightweight, durable, and easily workable, making it suitable for a wide range of applications in construction, furniture manufacturing, and the production of various tools and implements. Its mechanical properties, combined with aesthetic appeal, allow for its use in both structural and decorative contexts. In addition, the wood’s resilience and resistance to wear contribute to its long-term performance in engineering and artisanal products.

**Ecological Applications.** Mulberry trees (*Morus* spp.) play a significant role in ecosystem management and environmental sustainability. Their extensive root systems stabilize the soil, reducing erosion and preventing land degradation, particularly on slopes and marginal lands. The roots also enhance soil structure, improve water retention, and promote infiltration, contributing to soil fertility and agricultural productivity. Mulberry foliage participates in carbon sequestration and increases atmospheric oxygen levels through photosynthetic activity, thereby mitigating greenhouse gas concentrations. Furthermore, the dense canopy provides a microhabitat for various fauna, supporting biodiversity in both natural and cultivated landscapes. These ecological functions highlight the importance of mulberry cultivation not only for agricultural and economic purposes but also for maintaining environmental balance and promoting sustainable land use practices.

**CONCLUSIONS**

The mulberry tree *(Morus spp.)* represents a multifunctional plant of substantial ecological, economic, and medicinal significance. Its leaves serve as the primary food source for silkworms, underpinning the sustainability and productivity of the sericulture industry, while the fruits, leaves, bark, and wood possess diverse applications in medicine, nutrition, construction, and industrial sectors. Mulberry trees contribute to human health through their rich content of vitamins, minerals, antioxidants, and bioactive compounds, supporting immune function, cardiovascular health, glycemic control, and overall well-being. Ecologically, mulberry cultivation enhances soil fertility, stabilizes land, reduces erosion, improves water retention, and increases atmospheric oxygen, while providing habitats for wildlife and promoting biodiversity. The species’ resilience to drought, high solar radiation, and temperature extremes, coupled with rapid growth and high foliage density, underscores its adaptability and suitability for sustainable land management. Collectively, these characteristics demonstrate that mulberry trees are integral to both environmental sustainability and socio-economic development, highlighting their value as a strategic resource in agricultural, industrial, medicinal, and ecological contexts. The findings affirm that promoting mulberry cultivation can simultaneously advance ecological conservation, climate adaptation, and economic productivity in regions such as southern Uzbekistan and similar agroecological zones.

***Conflicts of Interest*.** This section is compulsory. A competing interest exists when professional judgment concerning the validity of research is influenced by a secondary interest, such as financial gain. We require that our authors reveal any possible conflict of interest in their submitted manuscripts. If there is no conflict of interest, authors should state that The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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