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CULTIVATION OF CATALPA (CATALPA SPP.) IN THE CONDITIONS OF KARAKALPAKSTAN

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Summary: This article presents information on studying the germination of Catalpa bignonioides seeds under laboratory conditions, growing seedlings in a greenhouse, and subsequently transplanting them into open ground.

Key words: catalpa, seeds, laboratory, germination, greenhouse, open ground.

Introduction

Karakalpakstan occupies about 40% of the territory of Uzbekistan and borders Kazakhstan and Turkmenistan. The region is part of the Aral Sea basin and is predominantly desert and arid in nature.

The climate is sharply continental and extremely dry, with hot summers and cold winters. Precipitation is minimal, and the main water source is the Amu Darya River, though in recent years, water supply has drastically decreased in the lower reaches. The soils are mainly sandy and saline and require artificial irrigation for agricultural use. Vegetation is sparse, dominated by drought-resistant species.

Therefore, cultivating a wide variety of plants adapted to such fluctuating climatic conditions is a relevant challenge today. It is crucial to select suitable introduced species and strictly follow the appropriate cultivation techniques. Planting a large number of woody plants is particularly recommended for greening cities and district centers.

One of the ornamental plants considered is catalpa. Catalpa (Catalpa genus), most commonly represented by Catalpa bignonioides Walt. (Southern catalpa), is a unique member of the Bignoniaceae family. Catalpa bignonioides, native to the southeastern United States, is widely cultivated in temperate climates worldwide as an ornamental tree.

Catalpa was introduced to Central Asia in the 1870s–1880s. Its biology and ecology were studied by N.F. Rusanov in the Tashkent oasis [7]. In Karakalpakstan, a botanical garden was established in 1959. Catalpa bignonioides was introduced into the Nukus Botanical Garden of the Karakalpak Branch of the Academy of Sciences of Uzbekistan in the 1960s [6].

Southern catalpa is a widely branched tree that grows up to 15 meters in its native habitat but reaches only 5–6 meters under cultivation [1] . The leaves are large (15–30 cm), heart-shaped, with smooth margins, and arranged oppositely. The flowers are large (up to 5 cm in diameter), white with yellow and purple spots, and gathered in 20–40 cm panicles. The fruit is a long pod-like capsule up to 40 cm long, containing numerous winged seeds.

In recent decades, interest in cultivating catalpa has grown in both scientific and practical fields — from ornamental landscaping to ecological research. This article discusses seed propagation, laboratory germination techniques, greenhouse maintenance during cold spring days, and transplantation into open soil after the establishment of warm weather.

Materials and Methods

The experiment was conducted in the laboratory, greenhouse, and experimental plots of the Biology Faculty of Karakalpak State University starting March 3, 2025. The methodology for determining seed germination was based on the procedures described by Guliya V.O. and Orlovskaya T.V. [2], with necessary modifications tailored to this species.

Results and discussion

In the first stage, catalpa seeds were removed from the pods for primary processing. For disinfection, the seeds were immersed in 70% ethanol for one minute, then rinsed three to five times with sterile distilled water. To stimulate germination, seeds were soaked in warm water for 12 hours. Seeds were then placed in sterilized Petri dishes, using moist white filter paper as the substrate. Seeds were gently spread on the wet paper using tweezers, ensuring even distribution (5 to 10 seeds per dish, spaced 0.5–1 cm apart), without embedding them into the paper. Germination was carried out continuously: under light in a light thermostat, and in darkness using a thermostat with the lights off. The temperature was maintained between 24–26 °C.
Petri dishes were inspected daily to monitor germination and remove non-viable seeds.
After one week, the first sprouts appeared, and by the tenth day, about 85% of seeds had germinated. Compared to other species we were growing simultaneously, catalpa showed a faster growth rate.
When primary roots and cotyledons developed, seedlings were carefully transferred to individual containers with a sterilized, light, and nutrient-rich substrate composed of peat and perlite in equal parts.
At this stage, seedlings underwent an acclimatization period in the greenhouse. They were gradually introduced to lower humidity, direct sunlight, and natural temperature fluctuations — a key step in preparing them for the harsh conditions of open ground in Nukus.
In late March and throughout April, the catalpa seedlings were grown in greenhouse conditions. Soil moisture was regularly maintained to avoid waterlogging, which can harm plant development. Air temperature in the greenhouse was kept between 21–24 °C, promoting active seedling growth. Over time, humidity was gradually reduced, lighting was increased, and the greenhouse was ventilated to simulate natural conditions.
Transplantation into open soil took place on May 7, 2025 (Fig. 2). After transplantation, the plants showed high survival rates — about 90% of seedlings remained viable. Key growth parameters such as height, leaf count, root development, and other morphological traits were regularly measured to evaluate adaptation to outdoor conditions.

The sequence of stages and timeframes for catalpa cultivation prior to outdoor planting is presented in Table 1.

Table 1.

Sequence of stages and timeline for catalpa cultivation before transplanting into open ground

№	Stage	Timeline	Description of Activities	Conditions/ Notes
1	Seed collection	October – November 2024	Mature pods were collected, seeds extracted and dried	Seeds retain viability for 1–2 years
2	Seed selection	December – January 2024/25	Healthy, undamaged seeds selected	Dried at room temperature for 3–5 days
3	Seed preparation	January – February 2025	Seeds soaked in warm water (40 °C) for 12 hours, sterilized in 70% ethanol, rinsed 3–5 times	Room temperature environment
4	Sowing seeds	March 3,	Seeds placed in Petri	Laboratory

		2025	dishes, 5–10 per dish using tweezers	conditions; temperature +20…+25 °C
5	Germination	7–10 days	Maintained moisture, light (12–14 hrs), and ventilation	Sprayed to avoid overwatering
6	Pricking out	March – April 2025	Seedlings transplanted to cups when 2–3 true leaves appeared	Greenhouse; roots handled carefully
7	Seedling care	April – May 2025	Regular watering and fertilization	Fertilized 1–2 times/month with compound fertilizer
8	Transplantation	Early May 2025	Seedlings transplanted into open ground	Soil was loose and mildly saline

Conclusions

Catalpa bignonioides possesses several traits that make it a promising species for urban landscaping. Its large and broad leaves form a dense canopy that provides ample shade during hot summer months, helping to reduce ground-level temperatures. At a young age, catalpa exhibits rapid growth, enabling the quick formation of green zones. Its striking morphological features make it an attractive element in landscape design. Catalpa is widely used for greening due to its size, lush flowering, and high ornamental value.

As a result of this study, a laboratory method for catalpa cultivation from seeds was developed and successfully tested, involving sterile germination conditions and gradual greenhouse adaptation. It was established that proper sterilization and temperature control significantly increase germination rates and promote the development of healthy seedlings.

Considering the ecological conditions of Karakalpakstan and catalpa's rapid growth, it is recommended for wider use in urban and suburban landscaping in the region. Careful maintenance is required during the early post-transplantation period. The results of this experiment show that pre-germination in the lab provides faster and more uniform sprouting compared to direct sowing in soil.

Further research focused on catalpa's adaptive capabilities and improvements in its cultivation techniques will help expand its application in improving the ecological environment and creating sustainable green spaces in arid climates.

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