



PROPAGATION OF THE ORNAMENTAL TULIP TREE (LIRIODENDRON TULIPFERA) FROM SEEDS

Aktam Nurniyozov ¹,

Rasuljon Khaydaraliyev ^{2 * +}

¹ Samarkand state University of Veterinary medicine, livestock and biotechnology, PhD, Faculty of biotechnology. Mirzo Ulugbek 77, Uzbekistan, Samarkand
nurniyozovaxtam@gmail.com

² Samarkand state University of Veterinary medicine, livestock and biotechnology, 1st year master's degree in Biotechnology (by product types). Mirzo Ulugbek 77, Uzbekistan, Samarkand
rasuljonxaydaraliyev@gmail.com

* Correspondence: Rasuljon Khaydaraliyev, rasuljonxaydaraliyev@gmail.com

+ This author contributed equally to this work.

Abstract

Tulip tree (*Liriodendron tulipifera*) is a member of the Magnolia family and is one of the largest native trees in the eastern United States, reaching a height of 20-58 m, a trunk diameter of 3 m, and an average height of 21 to 30 m. Tulip tree seeds are 2.5-3.5 cm and have a deep dormancy, so it takes a long time to grow. To propagate *liriodendron* from seed, only freshly picked seeds are suitable. Seeds are sown in substrate at the end of autumn and placed in a cool dark environment. Germination rate is about 15%. Seedlings are transplanted into small pots or containers. For planting in spring, it is necessary to stratify the seeds keep the seeds in a moist environment to accelerate their germination and treat the seeds before planting. Also, in nature seeds almost always have low viability, usually only around 10%. After germination from seeds growth in the first year usually 15 cm to 40 cm. In the second year, growth accelerates.

Keywords: Tulip tree, magnolia, stratification, seed.

1. Introduction.

Global climate change is affecting the natural reproduction of many ornamental plants and causes their numbers to decline. Landscape plants give people a good mood and are of great importance in cleaning the air, reducing loud noise and temperature on hot summer days, keeping it moist. Also, its medicinal properties cannot be replaced by other products. The tulip tree (*Liriodendron tulipifera*) is a member of the Magnolia family and is one of the largest native trees in the eastern United States, reaching a height of 20-58 m, a trunk diameter of 3 m, and an average height of 21 to





30 m. Chinese liriiodendron (*Liriodendron chinense*) species is distributed in China, it is up to 15 meters tall. [1] *Liriodendron tulipifera* is a deciduous tree that grows at an average speed of 30 to 58 meters. The leaves are 4-lobed. In autumn, the leaves turn yellow and fall off. Its' body is a valuable oil, it is widely used for interior decoration of houses, furniture, construction and plywood. The tulip tree grows rapidly and is still popular today for its planted in the leading places in beautifying city streets. [2]

2. Materials and Methods

2.1. Technical characteristics of *Liriodendron tulipifera*.

Height 30-35 (58) m, fast-growing bark, light-gray branches, red-brown leaves, 4-lobed green, length 8-15 cm, width 9-18 cm, turns yellow in autumn, flowers are tulip-shaped green, yellow and orange flowers bloom from late May to July. The fruits have a conical body up to 10 cm long and there are no thorns on the branches. Non-toxic to humans, pets and livestock. It grows well in soft, well-drained soils with moderate drainage and can grow on paved areas on urban streets. Tulip tree can withstands winter cold and wind (-23.4 C -26 °C). [3] Valuable for bees and butterflies as a faunal tree (honey plant). Should be planted in avenues and large industrial areas.

Tulip tree flowers are red, orange and green-yellow in color like tulips and are about 4cm long and 6cm wide. It blooms from the end of May to July. It produces lots of pollen and nectar for bees and other pollinators.

2.2. Fruit and seeds of *Liriodendron tulipifera*.

The fruit of the tulip tree is an elongated cone and it ripens in autumn. The dome-shaped fruit consisting of wing-like parts, each wing contains a seed. The fruit consists of many winged seeds pressed together in a spiral shape. The cones turn from green to yellow to light brown when ripe. When the mature cone fruits dry on the trees, they break down and seeds dispersed by the wind. The highest prevalence occurs in October and November.

It enters the flowering period 15 years after planting. This tree lives for 250 years. In North Carolina, one large tree has been observed to produce 29,000 healthy seeds. To achieve high pollination, beehives can be placed around the tree.

To propagate liriiodendron from seed, only freshly picked seeds are needed. Seeds are sown in the substrate in the box at the end of autumn and placed in a cool environment. Germination rate is 15%. Seedlings are transplanted into small pots or containers. For planting in spring, it is necessary to stratify the seeds (keep the seeds in a moist environment to accelerate their germination and treat the seeds before planting). [4]



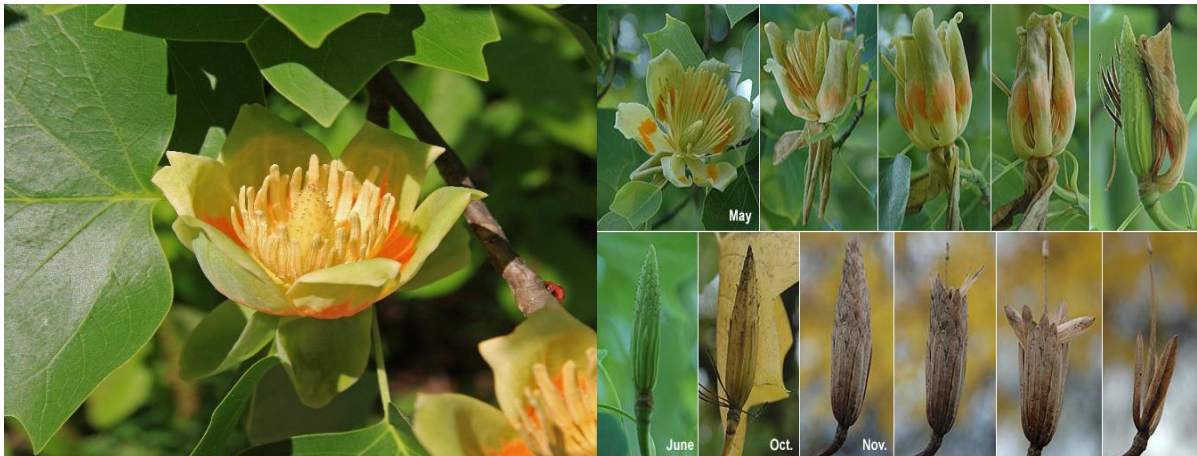


Figure 1. Tulip flower and ripe flower buds.

2.3. Seed picking process.

Tulip tree seeds can be harvested by hand from standing trees. In the southern United States, fruit maturity is determined primarily by change color, of from green to yellow. It usually happens at the end of October. At this point, the moisture content of the fruit is still high (more than 60% of fresh weight). Ripeness is guaranteed when the cones turn dark brown, but dry weather can quickly cause the cones to disintegrate and the seeds to disperse. The cone fruits are dried slowly to allow the seeds to ripen. Cones should be spread out to dry immediately after collection. [5] It is necessary to dry enough to separate the seeds from the inside of the fruit. Germination can usually take 7 to 20 days depending on temperature, humidity and cone moisture.



Figure 2. Fruit and seeds of *Liriodendron tulipifera*.

2.4. Stratification process.

Stratification of seeds (keeping seeds in a humid environment to accelerate germination and treating seeds before sowing). Tulip tree seeds are 2.5-3.5 cm and have a deep dormancy, which takes time to plant. This shows the difficulty of propagation from seeds.

To start the pretreatment process, the seeds should be soaked in water for 24 hours. [6] Then a drainage substrate is prepared in which the seeds should be mixed.



For this, wet sand works best and the most effective way is to use a 50/50 a mixture of compost (a mixture of organic fertilizer and water) and sharp sand. The selected substrate should be moist (but not wet) and checked by squeezing water out of it by hand, if it is too wet, water will come out when squeezed and the seeds will not germinate. The seeds are mixed with the substrate and placed in a transparent plastic container (taking into account the air ingress into the container) or bags and placed in the freezer. Freezer bags should be loosely tied. If the seeds are in a container, a little space should be left in the container for air exchange. Then, a date is written to the container to know when the initial idle period started. The seeds require a cold period to break their natural dormancy, which is easily achieved by placing the ready-made seeds and compost mixture in the refrigerator (at 1-5, °C for 12-16 weeks). [7]

3. Results

3.1. Planting tulip tree seedlings.

Stratification after the end of the process, the ready seeds begin to germinate in the sacks. The sprouted seeds are carefully taken out of bags or containers and sown. At these temperatures, the newly planted seeds cannot be exposed to high temperatures (above 25 °C), otherwise secondary dormancy may occur. The best way is to sow larger quantities of seeds in a well-prepared seedbed after pre-chilling and wait for the seeds to germinate. [7] Germinated seeds can be planted in a deep container or pots filled with good quality compost. Seedlings are well watered and weeded. Growth in the first year is usually from 15 to 40 cm. Growth accelerates in the second year. Considering the deep root system of *Liriodendron tulipifera*, they are grown in deeper flower pots for 2 or 3 years before planting in a permanent place. *Liriodendron tulipifera* with its root system should be planted usually from mid-November to the end of April depending on the climatic conditions of the planting area. [8]



Figure 3. Seedlings of tulip tree sprouted from seeds .



4. Discussion

Liriodendron tulipifera is an ornamental, rare, nectar-rich plant and is widely used in industry, medicine, and furniture production. From year to year, *Liriodendron* habitat is shrinking and disappearing. The natural viability of seeds is very low. In order to increase the number and preserve the species of this ornamental plant, currently, many in vitro propagation is being carried out.

The seeds of the tulip tree are dispersed by the wind after ripening. In nature, it spends the stratification process in the soil, in winter. As a result of global climate change, natural reproduction is declining. Propagating *Liriodendron tulipifera* from seed is difficult and time-consuming. The process of stratification of seeds is the main part in propagating this ornamental tree from seeds. It is not recommended to plant new seedlings sprouted from seeds directly in the planting areas. It should be grown in deeper beds for 2 or 3 years.

Currently, 50% of the world's population lives in cities, and this figure will reach 66% by 2050. Such rapid population growth suggests the need for improved urban infrastructure and the use of ornamental plants that are resistant to urban environments. According to the United Nations Convention on Biological Diversity, 34,000 species of plants are at risk of extinction in recent years.

Data Availability Statement: Data is contained within the article or Supplementary Materials.

Acknowledgments: We thank the editors and reviewers for their efforts and those who took the time to provide helpful comments to improve our work.

References

1. Phan, KL 2015. *Liriodendron chinense*. The IUCN Red List of Threatened Species 2015 : e.T31284A2803363. <http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T31284A2803363.en>
2. Alterations in population distribution of *Liriodendron chinense* (Hemsl) Sarg. And *Liriodendron tulipifera* Linn. Caused by climate change) <https://www.mdpi.com/1420-3049/17/4/4357> mdpi.com
3. Van Den Berk Baumschulen <https://www.vdberk.de/uber-uns/van-den-berk-geldern/>
4. Silvics of North America US Department of Agriculture, Agriculture Handbook 654. 405-416. Washington DC <https://play.google.com/books/reader?id=OhRAosKG6sUC&pg=GBS.PP1&hl=ru>





5. Clark F. Bryan and Stephan G. Boyce, Yellow poplar seed remains viable in the forest litter. *Journal of Forestry* 62:564-567
6. Kevin Kavanagh and TJ Carleton, Seed production and dispersal patterns in populations of *Liriodendron tulipifera* at the northern edge of its range in southern Ontario, Canada *Canadian Journal of Forest Research* September 1990
<https://doi.org/10.1139/x90-193>
7. E. T. Berdiyev, Sh. F. Gulamxodjayeva, Manzarali daraxtlarni ko'paytirish Toshkent 2020 171-173.
8. Beck Donald E and Lino Della Bianca. 1972. Growth and yield of thinned yellow-poplar. USDA Forest Service, Research paper SE.

