

Quercus texana ‘Jin Fen Shi Jia’: A New Colored Landscape Tree

Hainan Sun, Xiaoyun Dong, Yunzhou Lv, and Libing Huang
Jiangsu Academy of Forestry, Nanjing 211153, China

Keywords. landscape application, Nuttall oak, *Quercus texana*, seasonal leaf color

Quercus L. is an important tree of the family Fagaceae, and widely distributed in Asia, Africa, Europe, and the Americas (Jiang et al. 2019). There are ~500 species, which can be generally divided into two subgenera and eight sections (Chassé 2018). The section *Lobatae* is naturally distributed in North America, Central America, and Colombia in South America. There are reports of breeding horticultural cultivars from tree species of this section in Europe and the United States. These cultivars include different leaf colors and tree shapes, such as *Quercus coccinea* ‘Splendens’, *Quercus palustris* Pacific Brilliance™ ‘PWJR08’ (bright red leaves in autumn), *Quercus texana* ‘New Madrid’ (red leaves in spring), *Quercus rubra* ‘Aurea’ (yellow leaves in spring), *Q. texana* Highpoint® ‘QNFTA’, *Q. palustris* Green Pillar® ‘Pringreen’ and *Quercus phellos* Hightower® ‘QPSTA’ (have narrow crown and are densely branched), and *Q. palustris* ‘Green Dwarf’ (low tree-shape) (Iqbal et al. 2017; Lancaster 1977; Russell et al. 2021; Torres-Miranda et al. 2011). *Q. texana*, also known as Nuttall’s oak, is a medium-sized deciduous tree with rapid growth, strong adaptability, and high ornamental value (Costello et al. 2011). It belongs to the section *Lobatae*, which are native to the Mississippi River Basin in the southeastern United States (Barrón et al. 2017; Manos et al. 1999; Sargent 1918). The trunk of *Q. texana* is upright with a tower-shaped crown. The leaves of *Q. texana* are simple, with lobed and toothed margins, broad and rounded lobes, and leaf length of 10 to 15 cm. The leaves are green and give dense shade in summer, and then turn bright red or reddish-brown in autumn; the leaves remain until late in the year on the twigs. *Q. texana* is commonly used for landscaping purposes and timber production, fuel wood, firewood, and charcoal. The species is known for its straight grain, resistance to fungal decay, and overall durability, making it a desirable species for industrial applications such as flooring, paneling, and furniture (Wang et al. 2022).

Received for publication 6 Apr 2023. Accepted for publication 27 Jun 2023.

Published online 23 Aug 2023.

This research was funded by the Central Finance Forestry Science and Technology Extension Project Su(2022)TG01], the Independent Research Project of Jiangsu Academy of Forestry (ZZKY202104), and the Jiangsu Province Innovation and Extension Project of Forestry Science and Technology [LYKJ(2022)13]. L.H. is the corresponding author. E-mail: Huanglib@163.com.

This is an open access article distributed under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

This species is often chosen for landscape applications because of its adaptable nature, rapid growth rate, and beautiful foliage. In recent years, researchers have been working to produce improved cultivars of *Q. texana*, and various new cultivars have been created with enhanced characteristics such as greater biotic and abiotic resistance, improved growth rate, and desirable foliage shapes and colors.

In China, some institutes have conducted systematic research since the 1990s on the introduction and cultivation of *Q. texana*. After screening, we selected some cultivars and provenances with good growth and strong adaptability (Chen et al. 2013). Now there are five cultivars of *Q. texana* authorized by the National Forestry and Grassland Administration (China): cultivars Yan Yu (red leaves in autumn), Long Xiang No. 7 and Long Xiang No. 10 (yellow leaves in spring), and Long Xiang No. 3 and Long Xiang No. 8 (red leaves in spring). The new cultivars possess excellent ornamental features and provide more options in landscape applications.

Origin

There are more than 100 species of native oak trees in China, which are mostly used for afforestation in mountainous areas. However, there are not many cultivars with colored leaves in these species and the color of leaves in autumn and winter is not ideal for the landscape. A number of scientific research institutes and enterprises have introduced a variety of oak trees from the southeastern region of the United States since the late 1990s. By systematic research on introduction and cultivation, a group of tree species with good growth and strong adaptability has been selected that has obvious and colorful colors in autumn, such as *Q. texana* and *Quercus shumardii*. *Q. texana* is often used for water source protection, shading, and landscaping, and has important ecological functions and environmental protection values. After more than 10 years of observation, *Q. texana* was proven to adapt to the natural conditions of the Yangtze River Delta plain area, as they grow rapidly, bloom and bear fruit normally, and have the ability to resist waterlogging. It has become a vital landscape tree species with colorful leaves in the Yangtze River Delta area.

We collected and sowed the seeds every year, and until now, a large number of seedlings of *Q. texana* have been obtained. After observation of the traits of these seedlings, we found that the individual leaf color of some offspring changed greatly, and was different from that of the mother. and these obvious variations

are often stable. In a batch of seedlings sown in 2016, we found a mutant individual plant that had yellow-white leaf color at the end of the growing season, rose-red leaf color during the autumn color discoloration period, and medium-sized branches in the current year (Fig. 1). When the buds of *Q. texana* sprouted in the spring of 2018, we collected branches from the mutant seedling, and grafted by hardwood grafting using 1- to 2-year-old *Q. texana* seedlings as rootstocks. A total of 12 plants were grafted and 10 plants of this clone were obtained. In the spring of 2019, branches were collected from these to continue grafting, and 20 plants with mutant traits were obtained. After 3 years of field observation, the characteristics of the 30 grafted plants are as follows: mature leaves show chlorophyll loss and yellow-white spots in late summer or early autumn (or late summer) and rose-red characteristics in autumn. *Q. texana* is a deciduous tree that can grow up to 30 m tall. In the spring, the new leaves emerge a bright green color, which gradually darkens as they mature. During the summer months, the leaves are a deep, glossy green color with a smooth texture. As autumn approaches, the leaves begin to change color to shades of orange and red. Compared with the typical *Q. texana* grown in Nanjing, China, the features of the cultivar Jin Fen Shi Jia meets the distinctness, uniformity, and stability requirements of new cultivars in *Quercus*. It was named ‘Jin Fen Shi Jia’ and obtained the National Plant Variety Protection Right (China, Variety right number: 20210719) in 2021.

Description

Q. texana Jin Fen Shi Jia new cultivar. Deciduous tree with a straight main trunk. The main branches are obliquely spreading, and the current year’s branches are moderately anthocyanin-colored (appeared purple). The leaves are obovate, sprout in early April, and fall in mid-December in Nanjing, China. The leaf width is 4 to 10 cm and the length is 10 to 15 cm. The leaf base is wedge-shaped, and the apex is gradually pointed, where the margin has three to five moderately lobed serrations. The leaves of ‘Jin Fen Shi Jia’ go through a range of color changes throughout the growing season. They are green and dark green in spring and summer (Fig. 1A and B). At the end of the growing season (early autumn or late summer), the leaves gradually lose the green color, becoming yellow-white (Fig. 1C and D). In autumn, the leaves turn a rose-red color (Fig. 1D). Compared with the typical *Q. texana* grown in Nanjing, China, the changes in leaf color characteristics are specific. The leaf of *Q. texana* is dark green, and there is no significant color change between spring and summer (Fig. 1E and F), importantly, the leaf color does not show an obvious loss of green in early autumn (or late summer) at the end of the growing season (Fig. 1G and J). In autumn, *Q. texana* leaves gradually turn red or reddish-brown (Fig. 1H), which is different from the rose-red leaves of the cultivar Jin Fen Shi Jia. The leaf

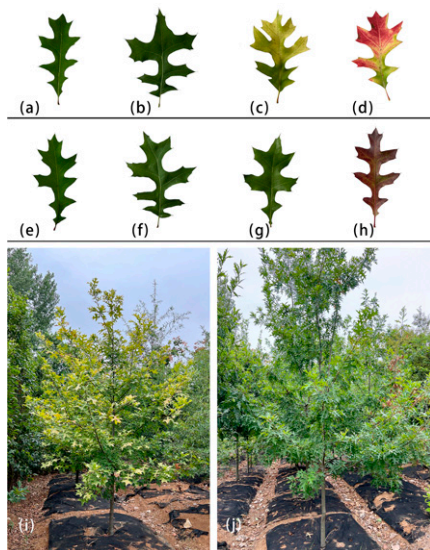


Fig. 1. The characteristics of the new *Quercus texana* cultivar Jin Fen Shi Jia and typical *Q. texana* grown in Nanjing, China. Seasonal leaf color changes of the new cultivar Jin Fen Shi Jia (A–D) and *Q. texana* (E–H), respectively, the four leaves' color features of spring (A, E), summer (B, F), early autumn (C, G), and autumn (D, H). The trees of the new cultivar Jin Fen Shi Jia (I) and *Q. texana* (J) in early autumn, respectively. The leaves of the new cultivar gradually lose green color, whereas the typical *Q. texana* grown here does not show an obvious loss of green color of leaves.

color of *Q. texana* begins to turn red in November each year, and the leaves begin to fall in February of the following year, which is later than the cultivar Jin Fen Shi Jia. Through 3 years of observation and according to the testing guidelines for new cultivars of *Quercus* L. (China), this cultivar Jin Fen Shi Jia has more than two specific traits (leaf color in early autumn or late summer and leaf color in autumn), and these traits are consistent and stable, which meets the requirements for a new cultivar.

Propagation, Cultivation, and Application

Cleft grafting is a common propagation method for cultivars of *Q. texana*. The steps followed were 1) Select a healthy rootstock: choose a healthy, disease-free *Q. texana* rootstock that is 1 to 2 years old. 2) Collect scion

wood: Collect scion wood from a healthy and mature cultivar branch of the plant to be propagated before the leaves emerge in spring. The scion should be ~3 to 4 cm long. 3) Make a grafting cut, split the upper end of the rootstock ~4 to 5 cm. The wedge of the scion was ~3 to 4 cm long (Kumar 2011). 4) Join the scion and rootstock: Insert the scion into the grafting port so that the cambium layers of the scion and rootstock are in contact with each other. Secure the scion wood onto the rootstock with grafting tape. 5) Protect the graft: Cover the graft with a plastic bag or grafting wax to prevent moisture loss. 6) Monitor the graft: Check the graft periodically for signs of growth or disease until the interface heals and new shoots grow.

After successful grafting, they can be transplanted. During transplantation, it is recommended to plant the tree immediately and water it sufficiently to establish roots. When using large seedlings (larger than 2 m) for afforestation, it is advisable to transplant them with a soil ball and prune their branches to increase the survival rate. The recommended planting density for nursery cultivation is 2 m × 3 m in the early stages, followed by gradual thinning to cultivate large-scale greening seedlings; they can be planted in hilly and plain areas. The tree prefers deep, loose, and fertile soil with a pH range of 4.5 to 5.5. After planting, apply appropriate amounts of organic and compound fertilizers such as base fertilizers. During high-temperature and drought conditions, supplemental irrigation should be provided to the roots and surrounding areas. In low-temperature environments (lower than -5°C), appropriate measures should be taken to protect the tree from cold.

Q. texana is a popular autumn and winter deciduous tree species that is widely used in urban green spaces and landscape design because of its high ecological and economic value. In urban landscape gardening, it can be planted in prominent locations to serve as a focal point to contrast with surrounding lawns or shrubs, showcasing its individual beauty. When used as a street tree, it can effectively enhance the ornamentation of the road. It can also be alternately mixed with other tree species as a street tree, providing year-round visual interest.

Availability

The plant material of 'Jin Fen Shi Jia' is available through Jiangsu Academy of Forestry. Contact Libing Huang (Huanglib@163.com) for inquiries.

References Cited

- Barrón E, Averyanova A, Kvaček Z, Momohara A, Pigg KB, Popova S, Postigo-Mijarra JM, Tiffney BH, Utescher T, Zhou ZK. 2017. The fossil history of *Quercus*, p 39–105. In: Gil-Pelegrín E, Peguero-Pina J, Sancho-Knapik D (eds). Oaks physiological ecology. Exploring the functional diversity of genus *Quercus* L. Tree Physiology, 7. Springer, Cham, Switzerland. https://doi.org/10.1007/978-3-319-69099-5_3.
- Chassé B. 2018. Updated classification of oaks: A summary. International Oaks. 29:11–18.
- Chen Y, Sun H, Wang S, Shi X. 2013. Growth performances of five North American oak species in Yangzi River Delta of China. Forest Research. Beijing. 26:344–351.
- Costello LR, Hagen BW, Jones KS. 2011. Oaks in the urban landscape: Selection, care, and preservation. UCANR Publication 3518. University of California Agriculture and Natural Resources, Richmond, CA.
- Iqbal J, Dutt V, Ahmad H, Bhat G, Ganie M, Wagay S, Mir R, Parray P, Ahmad S. 2017. Status, distribution and utilization of oak (*Quercus* spp.) in western Himalayan (Kashmir valley). Indian For. 143:1–5.
- Jiang Y, Liu W, Wang G, Zhou X, Li Q. 2019. Research advances in germplasm resource and utilization of *Quercus* L. Acta Sericologica Sinica. 4:577–585.
- Kumar, G. 2011. Propagation of plants by grafting and budding. A Pacific Northwest Extension Publication. PNW496. University of Oregon, Corvallis, OR.
- Lancaster C. 1977. Trees for ornamental use. Scientia Hort. 29:85–89.
- Manos PS, Doyle JJ, Nixon KC. 1999. Phylogeny, biogeography, and processes of molecular differentiation in *Quercus* subgenus *Quercus* (Fagaceae). Mol Phylogenet Evol. 12:333–349.
- Russell R, Jablonski EJ, Coombes AJ. 2021. New and lesser-known oak cultivars. International Oaks. 32:113–124.
- Sargent CS. 1918. Notes on North American trees. I. *Quercus*. Bot Gaz. 65:423–459.
- Torres-Miranda A, Luna-Vega I, Oyama K. 2011. Conservation biogeography of red oaks (*Quercus*, section *Lobatae*) in Mexico and Central America. Am J Bot. 98: 290–305.
- Wang Y, Xu C, Wang Q, Jiang Y, Qin L. 2022. Germplasm resources of oaks (*Quercus* L.) in China: Utilization and prospects. Biology (Basel). 12:76.