Magnolia wufengensis ‘Jiaolian’: A New *Magnolia* Cultivar with Lotus-shaped Flowers

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Additional index words. breeding, grafting, ‘Jiaohong No.1’, ornamental tree

In 2004, a magnolia tree with flowers displaying nine evenly red tepals on the outside and inside was discovered in a secondary forest at an elevation of 4908 ft (1496 m) by Luyi Ma and his research team in Wufeng County, Hubei Province, China. Subsequently, this individual was identified as a new species in Magnoliaceae named *Magnolia wufengensis* L.Y. Ma & L.R. Wang (Ma et al., 2006a). This rare phenotype has been cultivated and named ‘Jiaohong No.1’ (Xiao et al., 2018). In the course of extensive investigations, some magnolia trees in same secondary forest with morphological characteristics similar to those of *M. wufengensis* ‘Jiaohong No.1’ displayed variations in tepal number, form and color were discovered. After the systematic specimens were gathered, the taxonomic characteristics checked, and AFLP DNA molecular mark analyzed, these trees were confirmed as a new variety of *M. wufengensis*. Compared with *M. wufengensis*, because it has more tepals, they were identified as *M. wufengensis* var. *multitepala* L.Y. Ma & L.R. Wang (Ma et al., 2006b). Among *M. wufengensis* var. *multitepala*, one phenotype was encountered with high ornamental and scientific value owing to its lotus-shaped flowers. With the further ongoing efforts of Luyi Ma and his team, this rare

phenotype has been preserved and propagated vegetatively via grafting. On 17 Oct. 2017, this phenotype was approved by the State Forestry Administration Office for the Protection of New Varieties for the release as a new cultivar *M. wufengensis* ‘Jiaolian’. The cultivar is under patent protection by Beijing Forestry University, Three Gorges University, and Wufeng Boling Magnolia Technology Development Co., Ltd (patent no. 20170114). In 2017, ‘Jiaolian’ was awarded the first prize by the Organizing Committee of the 14th China Seedling Fair. Because of the extremely limited number of remaining individuals in its natural habitat, ‘Jiaolian’ has been cultivated and introduced to preserve the *M. wufengensis* germplasm.

Origin

The cultivar ‘Jiaolian’ is named for its flower shape and color, which resembles a lotus flower (lian means lotus in Chinese). Tracing its origin to a secondary forest in Wufeng County, the first propagation and domestication process of ‘Jiaolian’ was conducted in 2009 in Yuyangguan Town, Wufeng County, Hubei Province. Because of the extremely limited number of parent trees, relative self-infertility, and low seed yield, grafting onto *Magnolia biondii* Pamp. rootstocks (nearly 2 or 3 years old) was applied as the most suitable method to preserve this cultivar.

In detail, in the autumn of 2009, branches from the parent tree were collected and grafted onto 2-year-old *M. biondii* rootstocks at the testing ground in Yuyangguan (111°48'E, 30°10'N); 31 grafted plantlets survived. In the autumn of 2011 and 2014, branches from the surviving grafted plantlets

were successively collected and more than 300 second- and third-generation grafted plantlets were cultivated. A 90% survival rate was attained for the grafted plantlets. In Spring 2011, 11 grafted plantlets flowered. The number of flowering grafted plantlets increased to 23 in Spring 2013 and to nearly 46 in Spring 2015. Thus, it took 3 to 4 years for plantlets to flower after initial propagation. The second-generation plantlets propagated by grafting flowered after 1 to 2 years. All of them maintained the identical and stable genetic traits of their mother tree. This was a remarkable milestone for the success in breeding ‘Jiaolian’.

Description and Performance

As a typical arbor species, ‘Jiaolian’ is expected to reach a mature height of 15 to 20 m (Supplemental Fig. 1A). The fragrant, lotus-shaped flowers bloom profusely before the spring foliage; the flowers are solitary at branch tips (Supplemental Fig. 1B, Fig. 1A).

The perianth is composed of 18 to 20 (rarely 24) petaloid tepals. All tepals are fleshy and obovate-oblong, 7 to 9 cm long and 4 to 5 cm broad. Flower color was described according to the Royal Horticultural Society (RHS) Color Charts, fifth edition. The outer tepals are purplish red (RHS 64D, Fig. 1B), the tepals on the inside are purplish red (RHS 75C, Fig. 1C). The tepal color is relatively stable from year to year under the changing climate and site conditions.

Mature leaves of ‘Jiaolian’ are 11.3 to 15.6 cm long with six to seven pairs of veins. The adaxial side of the leaves is green and abaxial side is covered with minute white indumentum. Leaves are elliptic, with rounded and broad apices and broad cuneate bases. Leaf margin is entire. Petiole is 3.5 to 4.8 cm long (Fig. 2A and B). The fruit is a cylindrical-like follicle embedded with yellowish-brown, broad-ovate seeds.

‘Jiaolian’ and ‘Jiaohong No.1’, another cultivar patented by Beijing Forestry University (patent no. 20120073; Xiao et al., 2018), differ in their flower and leaf morphology (Table 1, Supplemental Fig. 2). The flowers of ‘Jiaohong No. 1’ are cup-shaped and develop upright on branches, but they assume an oblique upward direction in ‘Jiaolian’. The flower bracts in ‘Jiaohong No.1’ are densely yellowish sericeous and densely white villose in ‘Jiaolian’. Furthermore, the flower of ‘Jiaohong No. 1’ is uniformly red on both sides (vs. flowers with varying color in ‘Jiaolian’) and leaves are obovate-elliptic (vs. elliptic in ‘Jiaolian’).

Dissemination of Cultivars

‘Jiaolian’ is hardy to USDA Zones 7 to 10 and is best suited to acidic to neutral fertile soil with good drainage. Regional trials have been carried out and the cultivar is favorable for propagation in Central China, Southwestern China, and Southern China, in areas with warm temperate, subtropical, or tropical climates.

Received for publication 9 Aug. 2020. Accepted for publication 10 Sept. 2020.

Published online 16 October 2020.

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Fig. 1. Morphological characters of *Magnolia wufengensis* 'Jiaolian' flowers: (A) individual flower, (B) abaxial side of tepals, and (C) adaxial side of tepals. Scale bars in B and C are 15 cm. The photographs were taken 8 Mar. 2016 at Yuyanggaun.

Characters	Jiaolian	Jiaohong No. 1 (Supplemental Fig. 2)
Flower shape	Lotus	Cup
Tepal number	18–20(–24)	9(–11)
Tepal shape	Obovate-elliptic	Broad-obovate
Tepal color	Pink to purple inside	Evenly red on both sides
Flower bearing direction	Oblique upward	Upright
Flower bud	Densely white villose	Densely yellowish sericeous
Leaf shape	Elliptic	Obovate-elliptic

The cultivar generally requires full-sun conditions and is slightly shade-tolerant. Propagation by single-bud grafting is generally conducted in autumn using *M. biondii* as the rootstock. A planting distance of 2 to 3 m is recommended for large plantlets. Winter or early spring is suitable for transplanting large plantlets; it is important to note that soil balls are required to avoid damage to the roots. Appropriate transplanting and fertilizing depth contribute to fewer tillers and a

good growth rate. Top fertilizer application is of critical importance before and after flowering. Based on the yearly growth cycle of 'Jiaolian', the best times for top dressing are in late February and late May, which will promote flower opening and flower bud initiation, respectively. In times of drought, irrigation is necessary to retain soil moisture.

Pruning and trimming are best conducted in autumn or winter when the leaves have

Fig. 2. Morphological characters of *Magnolia wufengensis* 'Jiaolian' foliage: (A) adaxial side of a leaf, and (B) abaxial side of a leaf. The photographs were taken 8 July 2016 at Yuyanggaun.

fallen. Tillers need to be cut at their first emergence.

Availability

Cultivar Jiaolian is maintained by the Beijing Forestry University (Beijing, China), Three Gorges University (Yichang, China), and Wufeng Boling Magnolia Technology Development Co., Ltd. (Yichang, China). A field-planted breeding material for 'Jiaolian' is maintained by Wufeng Boling Magnolia Technology Development Co., Ltd. Requests for the cultivar should be addressed to the coauthor Dr. Zhonglong Zhu (E-mail: 515813518@qq.com or thefuturehero@163.com).

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Supplemental Fig. 1. Morphological characters of *Magnolia wufengensis* 'Jiaolian' flowers: (A) whole tree, (B) flowers on tree. The photographs were taken 8 Mar. 2018 at Yuyanggaun.

Supplemental Fig. 2. Morphological characters of *Magnolia wufengensis* 'Jiaohong No.1' flowers: (A) flowers on tree, (B) individual flower, (C) adaxial side of a leaf, and (D) abaxial side of a leaf. The photographs of flowers were taken on 12 Mar. 2018 at Yuyanggaun, and the photographs of the leaf were taken 14 July 2018 at Yuyanggaun.