Taxus wallichiana var. *mairei* 'Jinxishan'

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Yew (*Taxus* L.), an ornamental plant with some natural anticancer effects, is the main genus in the Taxaceae family. Its origins can be traced back to the Tertiary Period. *Taxus* includes 15 closely related species that are primarily scattered throughout the cool and temperate regions of the Northern Hemisphere (Liu et al., 2018). The yew is an evergreen tree that is commonly used in landscaping because it is slow-growing, tolerant of stressful conditions, and usually has a long life. There are numerous garden varieties of yew and yew hybrids, and they exhibit a wide range of characteristics, including different types of growth patterns, needle sizes and colors, and aril colors. This wide range of characteristics allows a gardener or landscaper to select trees that best suit his or her purposes.

More than 70 varieties and cultivars are recognized in the species of *T. baccata* L., and they are used in many types of landscaping projects in Europe and North America (Hartzell, 1991; Yang et al., 2009). Examples include Broom-shaped 'Fastigiata', golden leaves 'Semper aurea', 'Amersfoort', dwarf type 'Foxii', and yellow aril 'Lutea'. *T. cuspidata* Sieb. et Zucc. is a yew native to

Japan, South Korea, and Manchuria. *T. cuspidata* 'Nana Aurea' is a dense evergreen tree characterized by dark-green needles. Other well-defined varieties include *T. cuspidata* 'Pyramidal', which is characterized by a pyramidal growth pattern, and *T. cuspidata* 'Luteobaccata', which is covered by yellow flesh (Takayuki et al., 1996). Since 1988, the Korea National Arboretum also has developed some cultivars from *T. cuspidata* that are small in stature and covered with attractive foliage (for example, 'Latifolia' and 'Keumbitnoeul') (Jeongho, 2009).

T. wallichiana is the most widespread species of *Taxus* in China and mainly distributed in area on the south of the Yangtze River (Zhou et al., 2009). According to the most recent description in *The Flora of China* (Flora of China Editorial Committee, 1994), it includes three varieties: var. *wallichiana*, var. *mairei* (Lemée and H. Léveillé) L.K. Fu and Nan Li, and var. *chinensis* (Pilger) Florin. Species of *T. wallichiana* var. *mairei* are native to China (Möller et al., 2007). They are evergreen trees that are small-to-medium in size. Their needles are arranged on branches in two ranks, and two inconspicuous stomatal banks are present on the underside of the needle. When ripe, at least one-half of each seed is wrapped by a fresh red conspicuous aril. This species is different from many other evergreen trees because it can be pruned to a profound extent, it breaks new buds, and it can be cut from thick old branches. *T. wallichiana* var. *mairei* is a favored plant choice for streets and ornamental gardens in China because of its beautiful tree figure and fleshy red aril.

Here we discuss 'Jinxishan', which is a new cultivar of *T. wallichiana* var. *mairei* with yellow aril. We believe that it is an interesting ornamental cultivar that will pro-

vide more choices for people to use in their gardens.

Origin

T. wallichiana var. *mairei* seeds were collected in the Fall of 1997 from mountain areas of Fujian Province, China. About 200,000 seeds were selected and sowed in the Spring of 1999 in Xishan, Wuxi, Jiangsu Province (lat. 31°35'25.09" N, long. 120°21'10.54" E). In 2006, after 7 years in the juvenile phase, the *T. wallichiana* var. *mairei* entered its mature phase. Most of the ripe aril on the trees were the usual red color, but 11 trees had ripe aril that was yellow. The color of the arils on these trees has remained stable during the past 9 years. The cultivar name, 'Jinxishan', was authorized by the Forest Variety Certification Committee of Jiangsu Province, China, in 2014.

Description

T. wallichiana var. *mairei* 'Jinxishan' is a dioecious evergreen tree with average height of 2.7 m and width of 1.8 m. Branches irregularly alternate with early deciduous bud scales. Mature needles are linear, usually having a falcate shape, 20 to 35 mm long and 2.5 to 4 mm wide, green in color [Royal Horticultural Society Green Group 135 B; Color Chart (Royal Horticultural Society, 2001)]. The abaxial surfaces of the leaves are characterized by scattered papillae in lateral rows adjacent to two pale-yellow stomatal bands. Pollen cones are a globose shape with overlapping bracts at the base.

Fig. 1. Mother tree of the new *T. wallichiana* var. *mairei* 'Jinxishan'.

Fig. 2. Yellow arils of 'Jinxishan' and red arils of *T. wallichiana* var. *mairei*.

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Table 1. Traits and pigments of yellow aril and red aril.

Division	Traits				Pigments		
	Transverse diam (mm)	Longitudinal diam (mm)	Soluble sugar (mg·g ⁻¹)	Paclitaxel (mg·g ⁻¹)	Flavanoid (μg·g ⁻¹)	Carotenoid (mg·g ⁻¹)	Taxanes (μg·g ⁻¹)
Yellow aril	8.758 a ²	10.392 a	13.33 a	0.094 a	1.69 a	0.805 a	0.326 a
Red aril	8.389 a	9.924 a	21.34 b	0.043 b	0.49 b	0.704 a	0.792 b

²Means followed by the same letter in the same column are not significantly different (Duncan's multiple range test, $P < 0.05$).

The female cone has only one ovule. Seeds are wrapped in cup-shaped arils with an exposed hard apex. Arils mature in November, and they typically have a 6-mm to 8-mm transverse diameter and an 8-mm to 11-mm longitudinal diameter. They are yellow (Yellow Group 12 A) in color (Fig. 1), which is different from the red (Red Group 40 A) arils of *T. wallichiana* var. *mairei* (Fig. 2).

Culture

For optimum results, 'Jinxishan' should be propagated in March using 12-cm to 15-cm annual or biennial cuttings and two to three compound pinnate leaves. These cuttings should be treated with 90 to 100 mg/L indolebutyric acid for 2 h and then kept in a nursery bed (humidity 70% to 80%; temperature 25 to 28 °C) in a rooting medium mixture of 37.5% peatsoil and 62.5% perlite. After the plant has taken root, 0.15% to 0.25% urea and 0.2% to 0.3% monopotassium phosphate should be sprayed every 30 d. In this way, a rooting rate of 96% ± 2% and a subsequent survival rate of 93% ± 3% can be achieved.

Comparative Data

We undertook an analysis to evaluate some traits and pigments of the new yellow arils of 'Jinxishan' in comparison with the red arils of *T. wallichiana* var. *mairei*. The pigment components were analyzed by high-performance liquid chromatography–mass spectrometry, and the research was conducted during a 3-year period (2012–15). For traits, there was no significant difference in the size of the aril between 'Jinxishan' and *T. wallichiana* var. *mairei*, but a significant decrease was observed in the soluble sugar in 'Jinxishan'. The content of flavonoid in yellow aril is three times greater than the red aril; the content of taxanes in red aril is 2.4 times greater than the yellow aril (Table 1). We presumed that flavonoid was one of the key pigments that contributes to the yellow color of aril. However, additional research is needed to corroborate these results.

Availability

Additional information on 'Jinxishan' is available on written request to the corre-

sponding author, Dr. Zhong Wang, CNBG (wangzhong19@163.com).

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