

‘Yongjin’, ‘Xianguang’ and ‘Yuhuang’: Three Ornamental Cultivars of *Cinnamomum camphora*

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Cinnamomum camphora (L.) J. Presl is a typical tree species in the subtropical broad-leaved forest. It is native to China, south of the Yangtze River, southern Japan, Korea, and Vietnam, and has been introduced to many other countries (Li et al., 2013). In the 1800s, it was introduced to Australia and the southeastern United States, and has become naturalized in many areas (Natural Resources Conservation Service, 2010). Because of its broadly ovate crown and lush foliage, *C. camphora* is ideal for roadside plantings, windbreaks, and shade trees. It can also be used to extract camphor and camphor oil for pharmaceutical use and as a flavoring. At present, *C. camphora* is widely used as an important urban tree in many Chinese cities such as Hangzhou, Ningbo, and Taizhou (Zhejiang Province); Changsha and Changde (Hunan Province); Suzhou and Wuxi (Jiangsu Province); Nanchang (Jiangxi Province); and Mianyang (Sichuan Province). Therefore, breeding and selection of improved cultivars is important to enhance urban and landscape use. At the time of writing, six new cultivars were selected or bred. *C. camphora* ‘Longnaozhang L-1’ and *C. camphora* ‘Longnao 1’ can be used for the production of camphor, which have been selected or bred by the Hunan Province Xinhua Camphor Development Co., Ltd. and the Jiangxi

Province Forest Research Institute, respectively. ‘Fireworks Camphor Tree’ is the second registered ornamental cultivar of *Cinnamomum* and is characterized by its drooping branches. As leaf color is one of the most important ornamental traits of a tree species, breeding for variations in leaf colors is an important objective of new ornamental cultivars. After more than 10 years of continuous work, three cultivars: *C. camphora* ‘Yongjin’ (the first registered ornamental cultivar of *Cinnamomum*), *C. camphora* ‘Xianguang’, and *C. camphora* ‘Yuhuang’, were bred by researchers in Ningbo Forestry Bureau of Zhejiang Province and Zhejiang Agriculture

and Forestry University. These cultivars exhibit yellow or red leaves that stay on the branch for a longer period. These characteristics provide higher ornamental value to the cultivars compared with common camphor trees.

Origin

In Nov. 1998, we conducted a survey on the leaf color of roadside camphor trees in Haishu District, Ningbo, Zhejiang Province. Seeds from two superior trees were collected to raise seedlings in the following year. In May 1999, colors of the leaf, branch, and trunk were checked against the Pantone international color card C (Pantone Inc., 2008). A seedling was found obviously different from the others for its golden yellow (Pantone 101C) leaves and red (Pantone 192C) branches and trunk, and asexual propagation was then conducted. It has been found that these color traits are stable on the basis of 9-year observation. In addition, a special electrophoresis band was discovered through an intersimple sequence repeat (ISSR) analysis, suggesting that the clone was different from the others in genomic DNA (Wang et al., 2009). It was named ‘Yongjin’ (Fig. 1), and has been evaluated and registered as a new cultivar in Ningbo by the National Ministry of Forestry in China in 2009. The star-shaped flowers of *C. camphora* are borne in loose clusters, and they are bisexual and self-compatible, pollinate both by self- and cross-pollination (Fan, 2014). Therefore, the hybridization is a practicable breeding technique for this tree species. *C. camphora* ‘Xianguang’ (Fig. 2) and *C. camphora* ‘Yuhuang’ (Fig. 3) are derived from *C. camphora* ‘Yongjin’. In April 2007 and 2008, a controlled pollination was made between *C. camphora* ‘Yongjin’ (♀) and common camphor tree LBXZ#5 (♂) (Fig. 4) at the Ningbo Forestry Nursery, Zhejiang, China. A total of

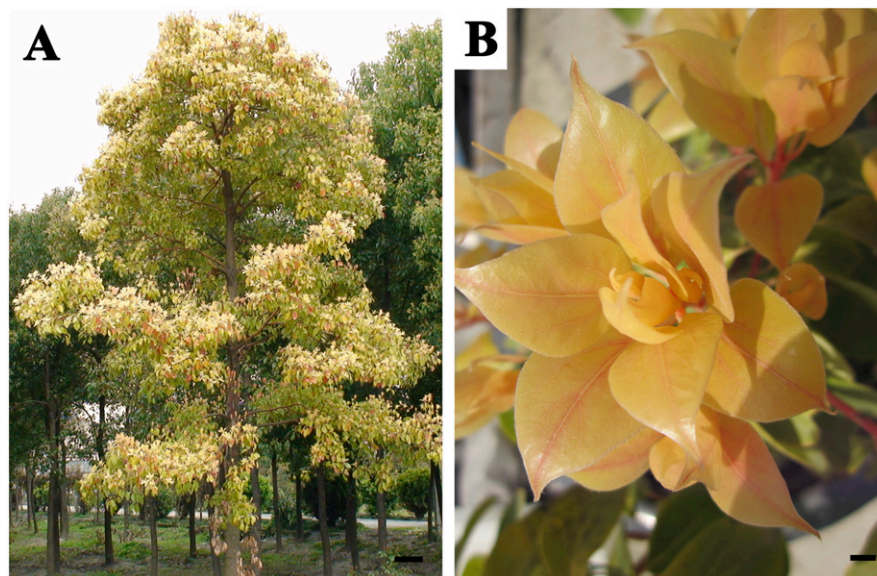


Fig. 1. *Cinnamomum camphora* ‘Yongjin’ in full sun in early April. (A) Appearance of the 10-year-old tree. Scale bar = 20 cm. (B) The current year leaves. Scale bar = 6 mm.

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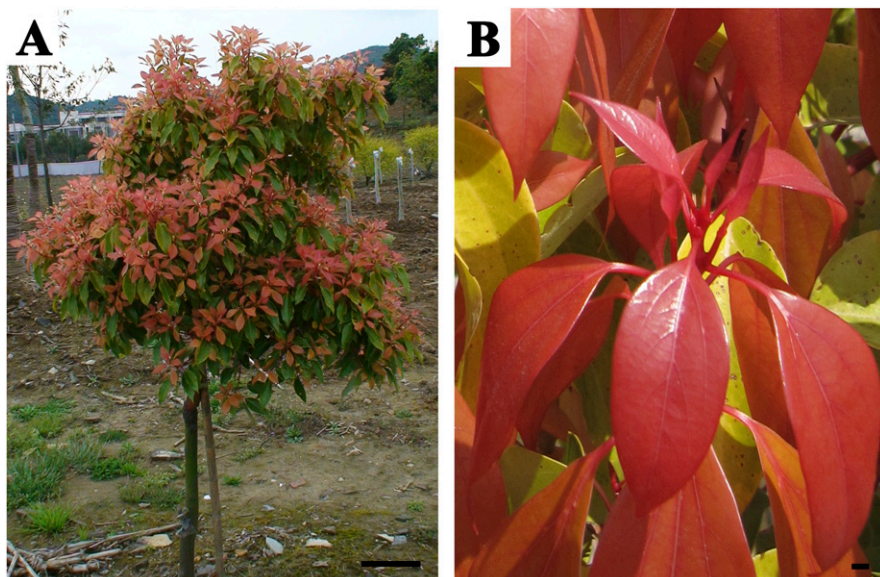


Fig. 2. *Cinnamomum camphora* 'Xianguang' in full sun in early April. (A) Appearance of the 2-year-old grafted tree. Scale bar = 20 cm. (B) The current year leaves. Scale bar = 6 mm.

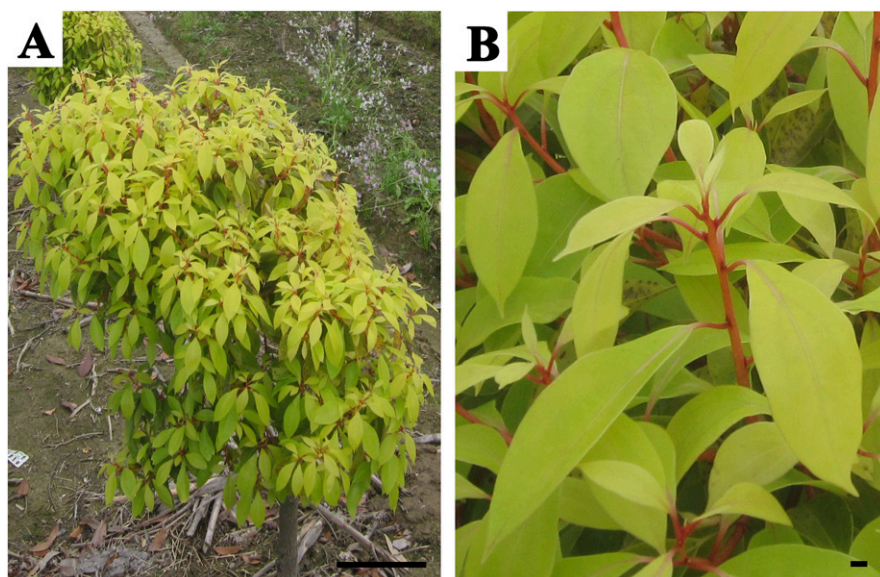


Fig. 3. *Cinnamomum camphora* 'Yuhuang' in full sun in early April. (A) Appearance of the 2-year-old grafted tree. Scale bar = 20 cm. (B) The current year leaves. Scale bar = 6 mm.

5500 seeds were collected and sowed using a routine procedure. On the basis of the color traits of leaves, branches, and trunk, two individuals were selected and propagated for further evaluation in May 2009. One of the two genotypes which was later registered as *C. camphora* 'Xianguang' had brilliant red (Pantone 1785C) leaves and red (Pantone 185C) branches and trunk, and the other one registered as *C. camphora* 'Yuhuang' had Naples yellow (Pantone 127C) leaves and red (Pantone 1787C) branches and trunk. After 4 to 5 years of asexual propagation, the leaves, branches, and trunks of both genotypes exhibit stable color traits. These two genotypes were registered as new cultivars in Ningbo in 2012 and 2014, respectively, by the National Ministry of Forestry in China.

Description

C. camphora 'Yongjin' (Fig. 1) sprouts from the end of February to the beginning of March under full sun conditions in Ningbo (121.53° E, 29.83° N). The buds are yellow (Pantone 100C) and start to grow from the middle to end of March. New leaves are golden yellow (Pantone 101C), but the leaf area around main vein and lateral veins is reddish (Pantone 032C). The leaves turn light yellow (Pantone 114C) when they become fully developed. The new leaves in early summer turn yellowish white (Pantone 600C), then turn pale yellow (Pantone 375C), and yellow (Pantone 1225C) in autumn. In addition, there are red rings at the base of new leaf stalks and branches. *C. camphora* 'Yongjin' flowers

from early April and continues until early May in Ningbo. Flowers and flower stalks are golden yellow (Pantone 102C). The fruiting period is from June to December. Fruit color changes dramatically during fruit development. A young fruit is generally light yellow (Pantone 388C), but it turns purple black (Pantone Black 6C) when it becomes mature. New branches are bright yellow (Pantone 100C), turn light red (Pantone 1785C) when they are semi-lignified, and then gradually turn bright red (Pantone 185C) as they grow. The branches become red (Pantone 192C) when the branch skin has not been suberized yet, and eventually turn yellow (Pantone 603C) after suberization. *C. camphora* 'Yongjin' grows fast at an annual rate of 1.2 to 1.5 m in the early stage of plant development. Ten-year old plants could reach 6.5 to 10.0 m in height, and 10 to 15 cm in diameter at breast height.

C. camphora 'Xianguang' (Fig. 2) sprouts at the end of February to the beginning of March under full sun conditions in Ningbo. The buds are red (Pantone 186C) and start to grow from early to late March. New leaves are red (Pantone 1785C). When leaves mature, they gradually change from red (Pantone 1785C) to pale green (Pantone 382C). The new leaves in summer turn yellowish white (Pantone 393C), then turn light green (Pantone 375C), and pale green (Pantone 372C) in autumn. A red ring does not appear at the base of the new leaf stalk and branch. *C. camphora* 'Xianguang' flowers from early April and continues until early May in Ningbo. Flowers and flower stalks are golden yellow (Pantone 102C). The fruiting period is from May to December. The young fruits and fruit stalks are yellow (Pantone 1365C), and mature fruits are purple black (Pantone Black 6C). New branches are red (Pantone 185C), turn chartreuse (Pantone 380C) when they are semi-lignified, and gradually turn bright red (Pantone 185C) as they grow. The branches are red (Pantone 192C) before the branch skin becomes suberized, and eventually turn yellow (Pantone 603C) after suberization. This cultivar grows faster than *C. camphora* 'Yongjin' at an annual rate of 1.5 to 1.8 m in the early stages of plant development.

C. camphora 'Yuhuang' (Fig. 3) sprouts from the end of February to the beginning of March under full sun conditions in Ningbo. The buds are bright yellow (Pantone 100C), and start to grow from late March to early April. The new leaves and leaf veins are Naples yellow (Pantone 127C). As the leaves mature, the leaf color changes gradually from Naples yellow (Pantone 127C) to pale green (Pantone 382C). New leaves in summer are yellowish white (Pantone 600C), then gradually turn pale green (Pantone 382C), and yellow (Pantone 1225C) in autumn. There is a red ring at the base of the new leaf stalk and branch. New branches are pink red (Pantone 198C), turn light red (Pantone 184C) when they are semi-lignified, and gradually turn red (Pantone 185C) as they grow. This cultivar grows almost as fast as *C. camphora* 'Yongjin' at an annual rate of 1.0 to 1.2 m in the early stages of plant development.

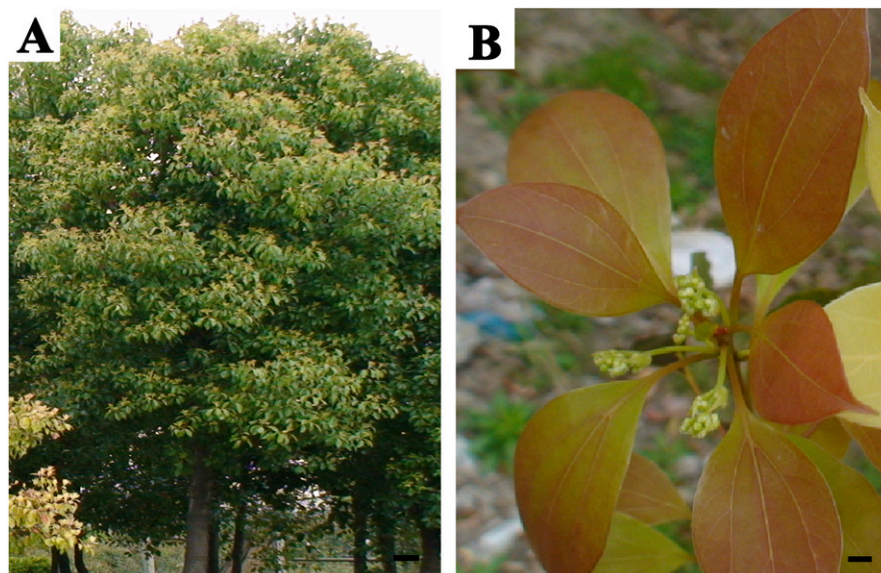


Fig. 4. *Cinnamomum camphora* (♂) in full sun in early April. (A) Appearance of the 11-year-old tree. Scale bar = 20 cm. (B) The current year leaves. Scale bar = 6 mm.

Culture

C. camphora ‘Yongjin’, *C. camphora* ‘Xiaguang’, and *C. camphora* ‘Yuhuang’ should be planted in full sunlight for their leaf color to be exhibited. Given that the apical buds of camphor tree grow slower than lateral buds, the lateral buds should be removed during the seedling stage. No severe diseases or pests have been observed at Ningbo Forestry Nursery, but freezing temperatures could cause damage to buds and leaves.

Propagation

C. camphora ‘Yongjin’, *C. camphora* ‘Xiaguang’, and *C. camphora* ‘Yuhuang’ are propagated through grafting or cutting.

Grafting is usually conducted from the end of February to the middle of March. Generally, seedlings that are 3 years old or more are selected as rootstocks, and the 2-year-old branches of the new cultivars are selected as scions for grafting at the position 50 cm above the ground (Wang et al., 2012). Cutting propagation could be performed either from April to May or from September to October. Current-year semi-lignified branches, 5 to 10 cm in length, are selected as cuttings. Yellow soil (a soil formed under broad-leaved forests in humid subtropical regions, chiefly on parent material from clayey shales) is commonly used as the cutting medium. About half to two-thirds of the cuttings should be inserted into the medium, and

thorough watering is required thereafter. Suitable humidity and partial shade should be provided during the propagation. Practically, this could be done by covering the cuttings with plastic sheet and shading net. The cuttings could be transplanted in April of the following year. The survival rate of cuttings is ≈85%.

Availability

C. camphora ‘Yongjin’, *C. camphora* ‘Xiaguang’, and *C. camphora* ‘Yuhuang’ were evaluated and registered as new cultivars in Ningbo by the National Ministry of Forestry in China. China plant patents have been approved for ‘Yongjin’, ‘Xiaguang’ and ‘Yuhuang’ in 2009, 2012, and 2014 (20090009, 20120074, and 20140054), respectively. Propagation and production rights have not been assigned to any commercial company yet.

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