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‘Ning Xiang 1’: A New *Lagerstroemia* Cultivar with Fragrant Red-purple Flowers

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Lagerstroemia (crape myrtles) are famous ornamental plants with large pyramidal racemes, a long duration of flowering, and diverse flower colors (He et al. 2013; Roy et al. 2015; Ye et al. 2019). The genus comprises more than 50 species and at least 500 named cultivars, mostly distributed in southeastern Asia and Australia (Brickell 1996; Cai et al. 2011; Qin et al. 2021). However, among the existing resources, only a limited number of these taxa are recognized to produce fragrant flowers, such as *Lagerstroemia stenopetala*, *Lagerstroemia caudata*, *L.* ‘Xiang Xue Yun’, and *L.* ‘Bai Mi Xiang’ (Zhang et al. 2007). Most of the *Lagerstroemia* are valued only for their distinct flower colors, which limits their economic value. Since the 1960s, large-scale crape myrtle breeding has been conducted in China and abroad, creating a lot of excellent breeders, such as Carl E. Whitcom, and Michael A. Dirr. However, the objectives focus mainly on disease resistance, tree habits, flower/leaf color, and flower shape (Hu et al. 2019; Li et al. 2015; Toki and Katsuyama 2008; Wang et al. 2013). Few efforts have been made to improve floral scent.

Floral scent constitutes an ancient and important channel of communication among flowering plants, their pollinators, and enemies (Raguso 2008; Xiang and Chen 2009). It is of great importance to breed valuable *Lagerstroemia* cultivars simultaneously with aromatic odors. ‘Ning Xiang 1’ was selected and released by the Institute of Botany, Jiangsu Province and Chinese Academy of Sciences (Nanjing Botanical Garden Mem. Sun Yat-Sen). This cultivar has gained much attention for its fragrant red-purple [Royal Horticultural Society (RHS) N74C] (Royal Horticultural Society, 2015) flowers, which have enriched *Lagerstroemia* aromatic germplasm resources and improved their ornamental value significantly. To date, no serious pests and/or diseases have been observed. The cultivar is suitable for street trees, courtyard beautification, public gardens, and other theme attractions.

Origin

In Summer 2014, *Lagerstroemia fauriei* (♀) was crossbred with *L.* ‘Tuscarora’ (♂) at the Nanjing Botanical Garden, Jiangsu Province, China (lat. 32°03'N, long. 118°49'E). Then, more than 500 cross-pollinated seeds were collected in November for dry storage. In Spring 2015, seeds were sown in a seedbed (width, 1.5 m; length, 50 m; depth, 8.0–10.0 cm). After germination, seedlings were transplanted into the field with a 20.0- × 20.0-cm spacing. In Spring 2018, a single plant with fragrant red-purple (RHS N74C) flowers was observed and selected for further evaluation, and was named ‘Ning Xiang 1’. After 2 years of softwood/hardwood cutting (2018–19) and 5 years of successive observations (2018–22), more than 30 young cuttings produced the exact morphological characteristics of the mother (donor) plant, confirming their phenotypic stability. The seedlings grew vigorously and exhibited good adaptation to high (37–40 °C) and low (4–6 °C) temperatures in Jiangsu. A few incidents of *Cercospora* leaf spot, sooty mold, and aphids were observed. This cultivar was authorized by the Forest Variety Certification Committee of China in 2022.

Description

Among existing *Lagerstroemia* germplasm, ‘Ning Xiang 1’ most resembles ‘Fen Ningxiang’, which was also released by Nanjing Botanical Garden in 2022. ‘Fen Ningxiang’ is characterized by purple (RHS N75B) flowers blooming from green and red buds, whereas green buds and red-purple (RHS N74C) flowers are presented in ‘Ning Xiang 1’. The two cultivars have distinctive fragrance components based on an analysis using headspace solid-phase microextraction and gas chromatography–mass spectrometry (Xu et al. 2014): (E)-2-hexenal and farnesol for ‘Fen Ningxiang’, and methyl geranate, (±)-2,3-dihydrofarnesol, and (E,E)-farnesol for ‘Ning Xiang 1’ (Table 1, Supplemental Fig. 1). The specific characteristics of ‘Ning Xiang 1’ are described next (Table 2).

Trees. ‘Ning Xiang 1’ is arbor-like and can reach up to 3.0 m in height with a 1.2-m spread at 4 years of age. The canopy is semi-upright and is composed of a straight trunk and many fast-growing branches that are all red (Supplemental Fig. 2A).

Twigs and foliage. The twigs are reddish brown (RHS 174A), four edged, and covered with short wings, and exhibit low-density pubescence. The leaves are papery and elliptic (6.0–7.5 cm long × 3.5–4.5 cm wide), and connected with short petioles (0.5–0.6 cm). The color of new leaves is red (RHS N34B), which then turn green (RHS NN137A) in Summer (Supplemental Fig. 2B). On the leaf subsurface, medium-density pubescence is found.

Flowers. The flowering time (10% open flowers) of ‘Ning Xiang 1’ is intermediate (about mid-July in Jiangsu, China) and can last for about 3 months (July to September). The cultivar has green (RHS 139D), conical buds (length, 0.8–1.0 cm; width, 0.7–0.9 cm) that grow with weak, raised suture and apical protuberance. The inflorescence is conical, consisting of red-purple (RHS N74C) flowers (4.0–5.0 cm) that are fragrant with numerous yellow stamens (n = 35–40). Similar to many *Lagerstroemia* cultivars, ‘Ning Xiang 1’ also has wrinkled petals (Supplemental Fig. 2C). The slender claws (0.7–0.9 cm) grow connected to the petals and are red-purple (RHS 71A).

Fruit. Young ‘Ning Xiang 1’ fruit are dark green (RHS 141B), circular, and of medium size (vertical diameter, 1.1–1.3 cm; horizontal diameter, 1.0–1.2 cm). The fruit are usually six-split and turn brown (RHS 200A) when mature or dry (Supplemental Fig. 2D). The seeds are found in mature, cracked fruit.

Table 1. Comparison of ‘Fen Ningxiang’ and ‘Ning Xiang 1’ phenotypic attributes.

Attribute	Fen Ningxiang	Ning Xiang 1
Bud color	Green and red	Green
Flower color	Purple (RHS N75B)	Red-purple (RHS N74C)
Main fragrance components	(E)-2-hexenal, farnesol	Methyl geranate, (±)-2,3-dihydrofarnesol, (E,E), farnesol

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Table 2. 'Ning Xiang 1' phenotypic characteristics.

Phenotypic trait	Description	Phenotypic trait	Description	Phenotypic trait	Description
Plant growth habit	Semiupright	Leaf pubescence density in the subsurface	Medium	Flower with fragrance	Yes
Plant life type	Arbor	Petiole length (cm)	0.54 ± 0.08	Flower with petaloid stamen	No
Trunk color	Red	Sepal length (cm)	0.52 ± 0.12	Petal surface wrinkled	Yes
Four-edged twigs	Yes	Sepal edge	None	Claw length (cm)	0.82 ± 0.03
Twig pubescence density	Low	Densely hairy sepals	No	Claw color	Red-purple (RHS 71A)
Twig color	Reddish brown (RHS 174A)	Bud length (cm)	0.93 ± 0.03	Fruit vertical diameter (cm)	1.28 ± 0.35
Wing length	Short	Bud width (cm)	0.86 ± 0.04	Fruit horizontal diameter (cm)	1.16 ± 0.24
Leaf texture	Papery	Bud shape	Conical	Fruit shape	Circular
Leaf length (cm)	6.93 ± 1.25	Bud color	Green	Color of young fruit	Green (RHS 141C)
Leaf width (cm)	4.07 ± 0.63	Bud with raised suture	Weak	Color of mature fruit	Brown (RHS 200A)
Leaf shape	Elliptic	Bud with appendage	No	Fruit with depressed base	No
Color of new leaves	Red (RHS N34B)	Bud with apical protuberance	Yes	Fruit with depressed apex	No
Color of mature leaves	Green (RHS NN137A)	Flower diameter (cm)	4.53 ± 1.28	Early flowering stage	Late July
Leaf surface covered with golden spots	No	Flower with multiple colors	No	Flowering phase	July–September
Undulated leaf margins	No	Flower color	Red-purple (RHS N74C)	Defoliating period	November

Cultivation

'Ning Xiang 1' is propagated mainly by softwood cutting (July to August) or hardwood cutting (late March to early April before sprouting). For softwood cutting, semilignified branches should be selected and then cut into short cuttings (≈10 cm in length) with two to three half-leaves kept at the top. For hardwood cutting, thick annual branches should be selected and then cut into cuttings of 10 to 15 cm in length, with a cutting depth of about 8 to 13 cm in prepared substrate ($V_{perlite}$:V_{peat} = 1:1). After that, the cuttings should be irrigated thoroughly. To retain moisture and heat, the seedbed should be covered with a layer of plastic film, and a shading net used for shading. In general, the cuttings can root in about 15 to 20 d; the shoots can reach 70 cm or more in length in that year after removing the film, keeping the shading net, and watering the shoots properly during the growth period.

Cercospora leaf spot, sooty mold, and aphid damage to young tips and leaves are not common. To prevent *Cercospora* leaf spot formation, the leaf surface can be sprayed with 50% carbendazim wettable powder at 500× dilution. To prevent sooty mold, the leaf surface can be sprayed with 40% omethoate at 1000× dilution. For aphid prevention, leaf-surface spraying with 50% pirimicarb at 3000× dilution is recommended.

Availability

'Ning Xiang 1' relevant plant material and research information can be obtained from Dr. Hong, Institute of Botany, Jiangsu Province and Chinese Academy of Sciences (Nanjing Botanical Garden Mem. Sun Yat-Sen, e-mail: chenhong@cnbg.net).

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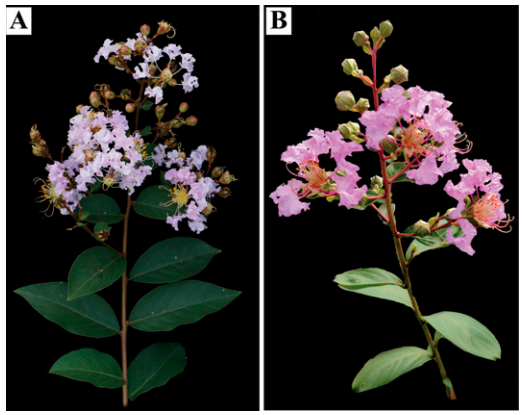
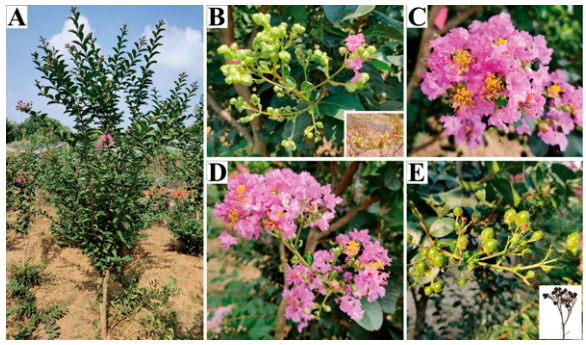


Supplemental Fig. 1. ‘Fen Ningxiang’ (**A**) and ‘Ning Xiang 1’ (**B**) floral attributes comparison.



Supplemental Fig. 2. (**A**–**E**) ‘Ning Xiang 1’ phenotypic characteristics. (**A**) Semiupright growth habit. (**B**) Red new leaves and green buds. (**C**) Red-purple (RHS N74C) flowers. (**D**) Flowering branches. (**E**) Young, brown mature fruit.