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‘Xiao Tuanyuan’: A New Variety of *Hemerocallis*

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The genus *Hemerocallis* (Asphodelaceae) covers 15 to 19 wild species and more than 100,000 cultivated varieties of daylilies (Gao and Wang 2023; Keene et al. 2020) distributed predominantly across East Asia, with China representing the primary center of diversity (Ren et al. 2017) . As the global hotspot for *Hemerocallis* germplasm resources, China has been cultivating these plants for more than 3000 years and is regarded as global center for *Hemerocallis* germplasm resources. Daylilies were introduced into Europe from China in the 16th century. Renowned as the Mother Flower of China, daylilies hold enormous ornamental, culinary, medicinal, and cultural significance. They are easily cultivated, with minimal maintenance requirements, and are usually characterized by abundant genetic resources, strong environmental resilience (Manzoor et al. 2019), and high aesthetic appeal. Alongside irises and hostas, daylilies are among the world’s top-three perennial flowers (Ren et al. 2017).

Modern daylily breeding originated in the United States during the 1940s and thus laid the foundation for modern cultivars. Rapid development in daylily breeding was attained between 1940 and 1950 by the breeders, who introduced novel floral coloration and morphology. Later, breeders adopted colchicine-induced tetraploid technology to develop novel daylily cultivars with significantly enlarged and vibrantly colored floral organs. This technological advancement led to interploid hybridization among daylily cultivars with varied ploidy levels, thus enriching the germplasm and marking the beginning of a golden age in daylily breeding. These cultivars have great potential to be used as a future model plant by floral geneticists because of their regulated mechanisms for flower opening and senescence (Rodriguez-Enriquez and Grant-Downton 2013). Since the advent of 20th century, the breeding of superior hybrid daylilies has expanded worldwide, with the international cultivar repository now exceeding 100,000 accessions (Duan et al. 2023). Research on daylilies in China commenced only within the past few decades, which initially focused on edible and medicinal applications. The breeding programs gained momentum in the post-2000 era, thus leveraging China’s rich germplasm resources coupled with foreign breeding technologies. The breeding program for the development of aesthetically superior, cold- and drought-tolerant, and water-efficient cultivars better adapted to Chinese cultivation conditions addresses both breeding objectives and the growing demand for economical landscape architecture.

Origin

Hybridization trials were conducted at the Xiaotangshan National Engineering Research Center for Floriculture Base in Beijing from Jun to Aug 2013. The parental lines comprised the elite daylily cultivars Bourbon Kings (female parent) and Naomi Ruth (male parent), both of which were introduced from the Beijing Botanical Garden. Conventional methods for artificial pollination were used. Ovary enlargement was noticed after 3 to 5 d of successful pollination, whereas fruit dehiscence occurred ∼50 d postpollination with apex yellowing and crack formation. Seeds were harvested Oct 2013 and were sown immediately in a substrate mix of perlite and peatmoss (1:3, v/v). Seedlings were transplanted to open-field conditions Apr 2014. First bloom was observed Jul 2015. The selection criteria focused on high flower count and dark-color eye zones. From the hybrid progeny, selection cultivar No. 2 was identified based on these traits. The new *Hemerocallis* cultivar Xiao Tuanyuan was established after successive vegetative propagation with stable phenotypic expression.

Phenotypic stability was confirmed through two consecutive vegetative cycles exhibiting no observable variations in morphological traits. Thirteen clumps (∼30 individual plants) were evaluated during the flowering period, which demonstrated uniform expression of major characteristics. ‘Xiao Tuanyuan’ has retained the traditional features of its parental lines, exhibiting larger flower size, enhanced floral coloration, and refined morphological traits. In addition, its enhanced adaptability and high ornamental value render it highly suitable for landscape projects and ornamental applications (Zhang 2018).

Morphological Characteristics

‘Xiao Tuanyuan’ was planted in the experimental fields at Xiaotangshan, Beijing Forestry University, Beijing, China (lat. 40.0°N, long. 116.3°E). Data were collected from 2015–17. We assessed morphological characteristics, including plant height, number of leaves, leaf length and width, scape length, flower diameter, inner perianth length and width, and outer perianth length and width. The data were analyzed using SPSS v. 22.0 software (IBM Corp, Armonk, NY, USA).

‘Xiao Tuanyuan’ exhibits an average plant height of 36.1 cm. The foliage is light green. The scapes are thick and branched, with an average length of ∼29 cm. The

Table 1. Key morphological traits of both parents of the new *Hemerocallis* cultivar Xiao Tuanyuan.

	Parents	
Trait	Bourbon Kings, female parent	Naomi Ruth, male parent
Ploidy	Diploid	Diploid
Seedling no.	W65-79	TA69-8
Scape height (cm)	66	76
Bloom size (cm)	13	9
Color	Deep blue–red with yellow–green throat and lavender cast midribs	Apricot pink self with green throat
Bloom season	Midseason	Midseason
Bloom habit	Diurnal	Diurnal
Parentage	Unavailable	Bambi Doll × sdlg

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Table 2. Key morphological traits of the new *Hemerocallis* cultivar Xiao Tuanyuan.

Trait	Mean value	Minimum	Maximum
Plant height (cm)	36.1	31.0	40.5
No. of leaves	10.5	10	12
Leaf length (cm)	44.0	40.9	55
Leaf width (cm)	1.3	1.2	1.7
Leaf length/width	33.85	—	—
Scape length (cm)	29.0	20.0	45.0
Flower diameter (cm)	8.2	8.0	8.5
Inner perianth length (cm)	6.4	6.0	6.6
Inner perianth width (cm)	2.9	2.5	3.1
Inner perianth length/width	2.21	—	—
Outer perianth length (cm)	5.6	5.2	6.0
Outer perianth width (cm)	1.7	1.6	1.8
Outer perianth length/width	3.29	—	—

flower has a circular/cup shape and single-petal blooms with a diameter of 8.2 cm and conspicuous bracts. The other floral characteristics include a pink perianth with a yellow watermark, with reflexed inner and outer perianths having wavy margins. The outer perianth measures 5.6 cm (length) × 1.7 cm (width) and is red, with yellow midribs, and an absence of spots. The inner perianth measures 6.4 cm (length) × 2.9 cm (width) and is red, with yellow midribs, and an absence of spots. Phenotypic evaluation was performed on 21 plants; key morphological traits are summarized in Tables 1 and 2.

'Xiao Tuanyuan' exhibits similar horticultural characteristics as 'Red Currant', with quite varied morphological differences in eye zone coloration, inner perianth pigmentation, margin morphology, plant architecture, and foliage color. Specifically, 'Xiao Tuanyuan' has light-green foliage, a yellow eye zone, and inner perianth segments that are primarily red with crimped margins. On the contrary, 'Red Currant' has dark-green foliage, a green eye zone, and inner perianth segments that are primarily purple with smooth margins (Fig. 1).

Key Cultural Practices for Cultivation

'Xiao Tuanyuan' has exhibited good adaptability to cultivation in urban landscaping, with successful overwintering observed in open ground conditions in Beijing. It can be planted easily in both spring and autumn. Propagation methods generally include division, supplemented by stem cuttings and tissue culture techniques. Rhizome division is chiefly conducted in autumn, followed by floral initiation occurring the subsequent summer. This new cultivar shows broad soil adaptability, thriving in both full-sun and partial-shade conditions. It requires deep, well-drained fertile soils rich in organic matter for optimal growth. Preplanting preparation includes deep plowing, removal of soil debris such as rocks and weeds, and incorporation

Fig. 1. Floral organs (**A**) and plant architecture (**C**) of the new daylily cultivar Xiao Tuanyuan. Floral organs (**B**) and plant architecture (**D**) of the similar cultivar Red Currant.

of well-decomposed organic fertilizer as a base dressing.

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