

# The binary stars of the water lily world: *Nymphaea* 'Sirius A' and *N.* 'Sirius B'

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## Abstract

This study introduces *Nymphaea* 'Sirius A' and 'Sirius B', two new interspecific hybrid cultivars that mirror a binary star system. Developed through hybridization between *Nymphaea caerulea* and the miniature species *Nymphaea thermarum*, these 'sister' cultivars share distinct stellate flowers and white petals suffused with pale blue-purple tips. Despite their shared origins and similar morphology, they exhibit distinct dimensional variations. 'Sirius A' is larger, featuring 6–7 cm blooms rising 11–13 cm above the water, while 'Sirius B' is significantly more compact (flower diameter 3–4 cm), with darker olive-green foliage. Both cultivars successfully integrate the dwarf traits of *N. thermarum* with superior ornamental characteristics, offering novel, compact options for tropical water lily markets.

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## Introduction

Water lilies belong to the family Nymphaeaceae and the genus *Nymphaea*. The genus *Nymphaea* comprises five subgenera: *Brachyceras*, *Lotos*, *Nymphaea*, *Anecphya*, and *Hydrocallis*<sup>[1–4]</sup>. Based on their growth temperature requirements, water lilies are classified into two categories: tropical and hardy<sup>[5]</sup>. As perennial aquatic flowers with high ornamental value, water lilies are widely appreciated in landscape architecture<sup>[6]</sup>. In particular, tropical water lilies are extensively applied in environmental beautification due to their advantages, such as vibrant flower coloration and prolonged flowering periods<sup>[7]</sup>.

Within the subgenus *Brachyceras*, species exhibit significant morphological variation<sup>[8]</sup>. Among them, *Nymphaea caerulea* is characterized by its star-shaped flowers, which range from pale to deep blue, and its spotted sepals. As a perennial aquatic herb, it inhabits the margins of lakes and rivers<sup>[9]</sup>. In contrast, *Nymphaea thermarum* is a diminutive species endemic to Rwanda. It grows in small, muddy ditches and pools, demonstrating a unique adaptation to damp mud habitats that is extremely rare within the family Nymphaeaceae<sup>[10]</sup>.

In this study, new cultivars were developed through hybridization within the subgenus. Specifically, interspecific hybridization was conducted between *N. caerulea* and *N. thermarum*. The objective was to utilize distant hybridization to integrate the miniature traits of *N. thermarum* with the superior floral morphology of *N. caerulea*, thereby selecting and breeding new tropical water lily cultivars that are compact and highly ornamental. By combining the advantageous traits of distinct species, these hybrids not only exhibit enhanced ornamental value, but also enrich market diversity and improve market competitiveness.

## Origins

In this study, interspecific hybridization was performed between *N. caerulea* and *N. thermarum*. *N. caerulea* was used as the female parent. It is characterized by stellate, vividly colored flowers with

high ornamental value. The leaf margins are irregularly serrate, and the leaf surfaces lack distinct spots. The male parent, *N. thermarum*, is characterized by its dwarf stature and small white flowers, making it suitable for miniature potted cultivation. In the hybridization experiment, the female flowers were emasculated on the first day of anthesis, followed by artificial pollination using pollen from the male parent. After pollination, the flowers were bagged to prevent contamination by exogenous pollen. The resulting F1 generation was self-pollinated to produce an F2 population. Within the F2 population, individuals exhibiting superior ornamental traits were carefully evaluated. Two elite individuals showing stable phenotypes and the ability for vegetative propagation were selected. These selected F2 individuals were subsequently propagated asexually by tuber division for several consecutive generations. No obvious segregation in floral or vegetative traits were observed during clonal propagation, indicating good phenotypic stability and uniformity. The two stable lines were finally designated as *Nymphaea* 'Sirius A' and *Nymphaea* 'Sirius B' (Figs 1 and 2).

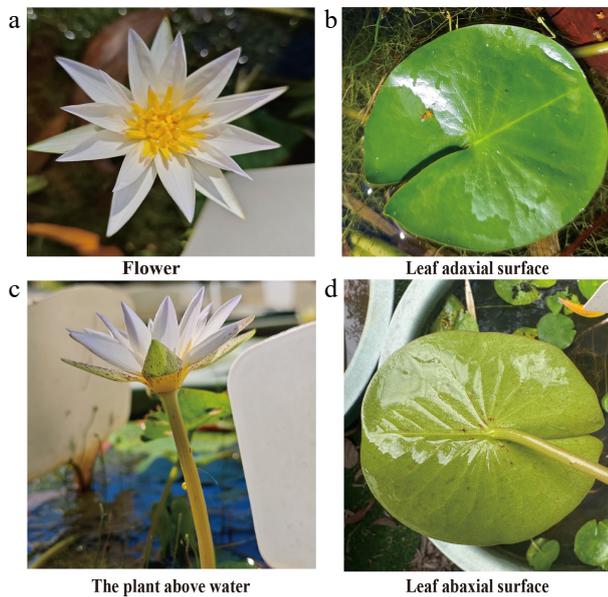
## Descriptions

The morphological characteristics of 'Sirius A' and 'Sirius B' were investigated in accordance with the registration guidelines for Nymphaeaceae cultivars designated by the International Society for Horticultural Science (Table 1). Color descriptions of plant organs were based on the Royal Horticultural Society Color Chart (2015).

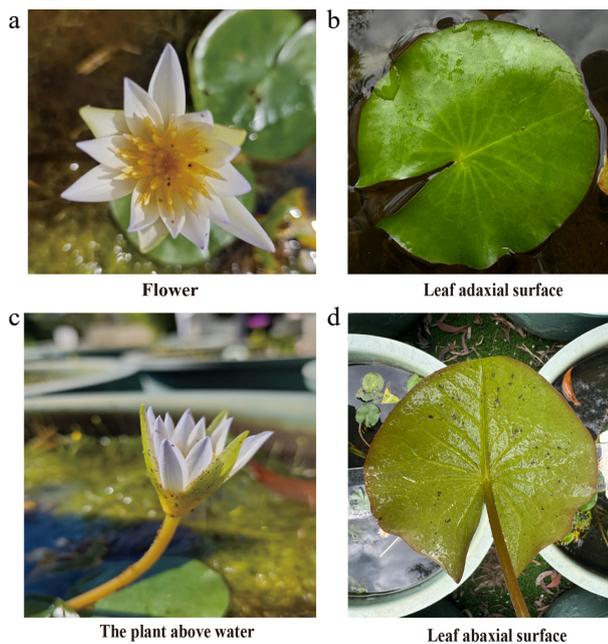
**Plant Habit.** *Nymphaea* 'Sirius A' is a small, tuberous, perennial aquatic hybrid herb. The plant height above the water surface ranges from 11 to 13 cm.

**Plant Habit.** *Nymphaea* 'Sirius B' is a small, tuberous, perennial aquatic hybrid herb. The plant height above the water surface ranges from 6 to 8 cm.

**Flower.** The flowers of *Nymphaea* 'Sirius A' are stellate, 6–7 cm in diameter, and faintly fragrant. The petals are predominantly white, with the tips suffused with very pale blue-white (RHS 202D). The perianth is differentiated into sepals and petals. There are five sepals, narrowly lanceolate with acuminate apices. The adaxial



**Fig. 1** New water lily cultivar *Nymphaea* 'Sirius A'.



**Fig. 2** New water lily cultivar *Nymphaea* 'Sirius B'.

surface of the sepal is grey-green (RHS 195B), while the abaxial surface has a yellow-green (RHS 152B) ground color, densely covered with distinct, irregular purple-red (RHS 183A) spots and streaks. The flower contains 12–14 petals. Filaments and anthers are both golden yellow (RHS 14A). Some anthers feature short, milky white or greyish-pink acute appendages at the apex.

**Flower.** The flowers of *Nymphaea* 'Sirius B' are stellate, 3–4 cm in diameter, and faintly fragrant. The petals are predominantly white, with the tips suffused with pale blue-purple (RHS 91C). The four sepals are narrowly lanceolate. The adaxial surface of the sepal is grey-green (RHS 193C), while the abaxial surface is light olive green (RHS 152C) with distinct purple-red spots (RHS 183A). The flower contains 10–12 petals. Filaments and anthers are both golden yellow (RHS 14B), and the anthers possess short, pale white or creamy yellow acute appendages at the apex.

**Table 1.** Morphological features of the new cultivars *Nymphaea* 'Sirius A' and 'Sirius B'.

Traits	Sirius A	Sirius B
General overall shape of the flowers	Stellate	Stellate
Flower petal color(s)	White (RHS 155C)	White (RHS 155C)
Filament color	Yellow (RHS 14A)	Yellow (RHS 14B)
Anther color	Yellow (RHS 14A)	Yellow (RHS 14B)
Sepal abaxial color	Yellow-green (RHS 152B)	Light olive green (RHS 152C)
Sepal adaxial color	Grey-green (RHS 195B)	Pale grey-green (RHS 193C)
Sepal number	5	4
Diameter of flower (cm)	6 to 7	3 to 4
Petal number	12 to 14	10 to 12
Emergence height above water (cm)	11 to 13	6 to 8
General overall shape of the leaves	Broadly ovate	Orbicular
General margins of the leaves	Entire	Entire
Leaves average length × width (cm)	7 × 8	10 × 11
Leaves abaxial color	Yellow-green (RHS 154B)	Dark olive (RHS 152A)
Leaves adaxial color	Grass green (RHS 200C)	Grass green (RHS 144A)
Petiole color	Yellow-green (RHS 151A)	Yellow-green (RHS 154A)

**Leaves.** In *Nymphaea* 'Sirius A', the leaves are circular or nearly circular, measuring 7–9 cm in length and 7–8 cm in width. The adaxial surface is grass green (RHS 200C), while the abaxial surface is yellow-green (RHS 154B); the surface is smooth and glossy, with no conspicuous spotting. The leaf margin is entire, with smooth, non-serrated outlines. The basal lobes terminate in a rounded-obtuse shape and diverge in a V-shaped manner at the point of petiole attachment, remaining separate without overlap. The peduncle is dark olive green (RHS 147A).

**Leaves.** In *Nymphaea* 'Sirius B', the leaves are circular or nearly circular, measuring 7–11 cm in length and 8–13 cm in width. The adaxial surface is vivid green (RHS 144A), and the abaxial surface is dark olive green (RHS 152A); the surface is smooth, with no obvious spotting. The leaf margin is smooth and entire, without serrations. The basal lobes terminate in either acute or rounded-obtuse shapes and open in a V-shaped manner at the petiole attachment, with partial overlap observed in some leaves. The peduncle is brownish green (RHS 153B).

The new cultivars 'Sirius A' and 'Sirius B' are both interspecific hybrids developed through hybridization and selection. They share several prominent common characteristics while also exhibiting subtle differences (Table 2). Both cultivars are perennial, tuberous aquatic herbs with a relatively compact growth habit. Morphologically, the flowers of both cultivars are star-shaped and emit a faint fragrance. The anthers and filaments are predominantly golden yellow in color. Overall, the petals are white, with the petal apices suffused to varying degrees with pale bluish-purple coloration. In both cultivars, the sepals are narrowly lanceolate, and the abaxial surfaces of the sepals bear irregularly distributed purplish-red spots. The leaves are smooth and glossy, without conspicuous spots or stripes; the margins are entire, and the basal lobes open in a V-shaped manner at the point of petiole attachment.

## Cultivations

'Sirius A' and 'Sirius B' are both tropical water lily cultivars, with an optimal cultivation temperature range of 18–35 °C, and they are capable of continuous flowering in Hainan, China. The plants can be

**Table 2.** Comparison of two new water lily cultivars.

Feature category	Comparison item	<i>Nymphaea</i> 'Sirius A'	<i>Nymphaea</i> 'Sirius B'	Remarks/differences
Plant morphology	Height above water	11–13 cm	6–8 cm	'Sirius A' is taller
	Leaf size (L × W)	Mean 7 × 8 cm	Mean 10 × 11 cm	'Sirius B' leaves are relatively larger
	Leaf shape	Broadly ovate / Orbicular or suborbicular	Orbicular / Orbicular or suborbicular	Shapes are similar
Flower morphology	Adaxial surface	Grass green (RHS 200C)	Vivid green / Grass green (RHS 144A)	'Sirius B' is more vivid green
	Abaxial surface	Yellow-green (RHS 154B)	Dark olive (RHS 152A)	'Sirius B' is darker on the underside
	Flower diameter	6–7 cm	3–4 cm	'Sirius A' flowers are significantly larger
	Petal count	12–14	10–12	'Sirius A' has slightly more petals
	Flower color details	White, tip suffused with very pale blue-white (RHS 202D)	White, tip suffused with pale blue-purple (RHS 91C)	Purple tone is more distinct in 'Sirius B'
	Sepal count	5	4	Difference in sepal number
	Abaxial sepal color	Yellow-green (RHS 152B)	Light olive green (RHS 152C)	Slight difference in green hue
Other organs	Filament/Anther color	Golden yellow (RHS 14A)	Golden yellow (RHS 14B)	Slight code difference; both are golden yellow
	Peduncle color	Dark olive (RHS 147A)	Brownish-green (RHS 153B)	
	Petiole color	Yellow-green (RHS 151A)	Yellow-green (RHS 154A)	

RHS = Royal Horticultural Society color chart number.

grown in ponds or containers. Full sunlight is required during cultivation; insufficient light results in reduced flowering or complete failure to flower. In addition, water depth should be maintained between 30 and 50 cm, depending on plant size, and may be gradually increased as the plants grow. A fertile, cohesive (clayey) soil is recommended as the growth substrate.

## Author contributions

The authors confirm contribution to the paper as follows: study conception and design: Chen F; participation and coordination of the research: Zhang J, Li J; draft manuscript preparation: Zhang J, Li J, Chen F. All authors read and approved the final manuscript.

## Data availability

The *Nymphaea* cultivars 'Sirius A' and 'Sirius B' are maintained at the Sanya Nanfan Research Institute, Hainan University (Hainan, China). Requests for plant material should be addressed to the corresponding author.

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## Conflict of interest

The authors declare that they have no conflict of interest.

## Dates

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