

Nymphaea alba var. *rubra* Lönnr. (Nymphaeaceae): a new record for the aquatic flora of Kashmir Himalaya, India

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Abstract

Nymphaea alba var. *rubra* Lönnr. is reported for the first time from Dal Lake, Kashmir Himalaya, India. The taxonomic identification was confirmed based on rhizome, leaf and flower characters. A brief description and photographic illustrations of *N. alba* var. *rubra* are provided to validate the new distribution record for aquatic flora of this Himalayan region. A comparison of *N. alba* var. *rubra* with its allied taxon, *N. alba* var. *alba*, is provided to facilitate field identification.

Keywords

Biodiversity, delimiting characters, identification, taxonomy.

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Introduction

The genus *Nymphaea* L. comprises 50–60 species and is one of the most diverse genera in the order Nymphaeales (Wiersema 1988; Mabberly 2017). The genus is divided into five subgenera: *Anecphyra* Casp., *Brachyceras* Casp., *Hydrocallis* Planch., *Lotos* DC., and *Nymphaea* L., with each showing a distinct distribution (Conrad 1905). These are mostly perennial, rhizomatous, aquatic herbs distributed across the tropical and temperate regions (Cook 1990). The flower comprises of four sepals, 7–40 petals, 20–700 stamens, and 5–47 carpels, the latter forming a ring embedded in cup-shaped receptacular and appendicular tissue to which the appendicular organs are attached laterally. The upper surface of each carpel contributes a ray of stigmatic

tissue to the stigmatic disk, which tops the ovary, and this ray usually terminates abaxially in a free appendage termed as the carpellary appendage or carpellary style (Wiersema 1988).

From the Indian subcontinent, Hooker (1897) reported four species of *Nymphaea*: *N. alba* L., *N. lotus* L., *N. stellata* Willd., and *N. pygmaea* Aiton. Nearly a century later, Cook (1996) reported seven species from India: *N. nouchali* Burm. f., *N. alba* L., *N. candida* C. Persl, *N. odorata* Aiton., *N. tetragona* Georgi, *N. tuberosa* Paine, and *N. pubescens* Willd. Ansari and Jeeja (2009), in a monographic work on genus *Nymphaea*, reported 15 taxa from India. Recently, three additional taxa have been described from India: *N. manipurensis* Asharani

& Biseshwori, *N. manipurensis* var. *versicolor* Asharani & Biseshwori (Sagolsem and Thongam 2014), and *N. abhayana* Anurag & M. Chowdhury (Chowdhury and Chowdhury 2016). From the Kashmir Himalaya, till now seven plant taxa of *Nymphaea* have been reported: *N. alba* L. var. *alba*, *N. candida* C.Persl, *N. lotus* L., *N. mexicana* Zucc., *N. stellata* Willd., *N. tetragona* Georgi, and *N. tuberosa* Paine (Kaul and Zutshi 1967; Stewart 1972; Kak 1990; Khuroo et al. 2007).

The present study reports the occurrence *Nymphaea alba* var. *rubra* Lönnr as a new distribution record to the aquatic flora of Kashmir Himalaya, India. A detailed taxonomic description, photographic illustrations of diagnostic characters, and a comparison with its allied taxon, *Nymphaea alba* var. *alba* L. are provided to validate the new plant record and facilitate field identification.

Methods

During a recent floristic survey in Kashmir Himalaya, India, the authors collected specimens of a hitherto unknown *Nymphaea* taxon growing in the Dal Lake. Standard methods have been used for collection, drying, and further processing of the specimens (Bridson and Forman 1998). The specimens collected are deposited in the University of Kashmir Herbarium (KASH) with a proper voucher specimen number.

The fresh plant specimens were identified using relevant taxonomic literature (Ansari and Jeeja 2009; Dhkar et al. 2011). The geographic location of study site was obtained with a GPS receiver (Garmin GPSMAP 76CSX). The photographs of the diagnostic characters were taken with the help of a portable hand-held microscope (DINO Lite AM4515ZT4).

Results

Nymphaea alba var. *rubra* Lönnr.

Nymphaea alba var. *rubra* Lönnr. 1856: 124; Conard (1905: 179, Pl. 15), Mitra (1993: 435).

Figures 1A–H, 2

New records. INDIA • 1; Jammu and Kashmir, Srinagar District, Kobuter Khana, Dal Lake; 34°07'42"N, 074°52'34"E; 1583 m a.s.l.; 11. Oct. 2018, at 14:11 h; A. Hassan and A. Masoodi leg; floating; KASH 301.

Global distribution. The *Nymphaea alba* var. *rubra*, reported to be a hybrid between *Nymphaea alba* and *N. odorata* was first recorded from the north-eastern Indian state of Meghalaya (Dhkar et al. 2011), and now extends its distribution westwards in Kashmir Himalaya. *Nymphaea alba*, the paternal species is distributed from Europe to Western Himalaya; while as its maternal species, *Nymphaea odorata* is distributed in USA, Australia, Brazil and India.

Identification. Perennial herb, root 20–30 cm long; horizontal rhizome 20–50 cm long, 2–5 cm in diameter (Fig. 1A, B). Leaves ovate to orbicular, entire, 10–20 cm in

diameter, thick with impressed veins and without mottling, glabrous both adaxially and abaxially, cordate or sagittate at base; petiole 25–30 cm in length, reddish (Fig. 1C, D). Flower 5–20 cm in diameter (Fig. 1E). Sepals 4, lanceolate, 8 cm long, caducous or decaying after anthesis, sometimes indistinguishable from petals. Petals many, 6 cm long, pinkish, elliptic, gradually transforming into stamens (Fig. 1F). Stamens petaloid, anthers linear, introse, filament of inner stamens more or less as wide as anther (Fig. 1G). Carpels many, in one whorl, completely united (Fig. 1H).

Nymphaea alba var. *rubra* differs from *N. alba* var. *alba* (Fig. 1I–L; Table 1) in having leaves glabrous on both abaxial and adaxial side, while as in latter, the leaves are only abaxially glabrous. The petal colour in *N. alba* var. *rubra* varies and possesses different shades of red, while as in *N. alba* var. *alba* it is white to creamy yellowish. There is no report of seed set in *N. alba* var. *rubra* whereas its allied taxa *N. alba* var. *alba* sets seeds.

Discussion

The genus *Nymphaea* consists of showiest aquatic plants and has attracted the attention of botanists and plant enthusiasts (Kabatova et al. 2014). Kashmir Himalaya is well-known for its freshwater ecosystems which harbor rich aquatic flora (Kaul and Zutshi 1967; Kak 1990). The present study has reported one more addition, *Nymphaea alba* var. *rubra* to the aquatic flora of this Himalayan region. In fact, Dhkar et al. (2011) had previously reported this plant taxa from north-eastern Indian state of Meghalaya, which is located at a distance of 1700 km away from Kashmir Himalaya.

Dhkar et al. (2011), based on molecular studies, suggested that *N. alba* var. *rubra* is a hybrid between *N. alba* and *N. odorata*. In recent times, hybridization is considered to be an important factor for evolution of invasiveness in plants (Ellstrand and Schierenbeck 2000). The introduction, establishment and spread of invasive species is a global concern and is occurring at an accelerated rate (Khuroo et al. 2007; Chandra and Gerhardt 2008). Generally, aquatic ecosystems have greater impacts of invasion than terrestrial ecosystems. Invasive species are predicted to be the most important drivers of biodiversity loss in lake ecosystems (Sala et al. 2000; Khuroo et al. 2012). Besides having ornamental value, some species of the *Nymphaea* are notorious invasive weeds. Most of the invasive species are nearly impossible to eradicate once established in new habitats (Pimentel et al. 2005). At present, *N. mexicana* is the most problematic weed which has completely invaded major areas of the Dal Lake, in Kashmir Himalaya. The extensive spread of *N. mexicana* has drastically reduced the growing area of *Nelumbo nucifera*, an economically important plant species that provides livelihood to the local people. Therefore, the distribution records of new plant taxa help in predicting the future spread of the potential invasive



Figure 1. A–H. *Nymphaea alba* var. *rubra*. A. Habit. B. Rhizome. C. Adaxial surface of leaf. D. Abaxial surface of leaf. E. Flower. F. Petal. G. Stamen. H. Carpel. I–L. *Nymphaea alba* var. *alba*. I. Habit. J. Flower. K. Petal. L. Stamen.

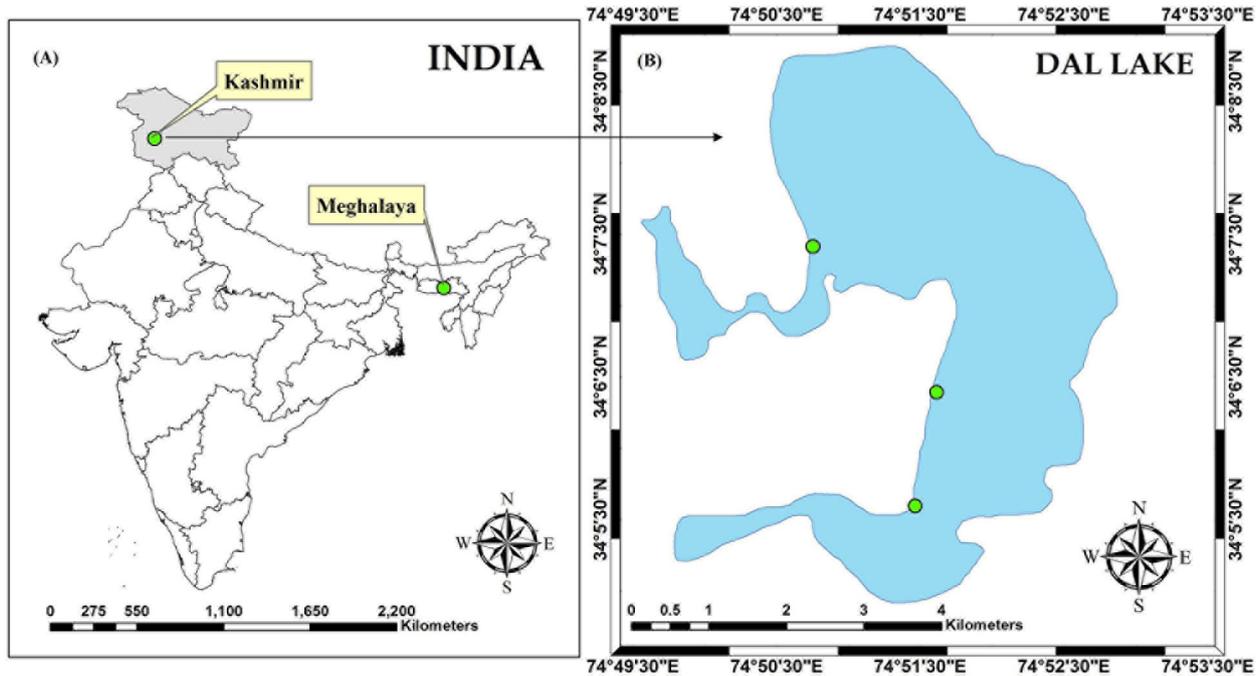


Figure 2. Location of previous and new records of *Nymphaea alba* var. *rubra*. in India. **A.** Meghalaya **B.** Dal Lake, Kashmir Himalaya.

Table 1. Comparison of diagnostic characteristics of *Nymphaea alba* var. *rubra* with its allied taxa, *N. alba* var. *alba*.

| Diagnostic characters | <i>Nymphaea alba</i> var. <i>rubra</i> | <i>Nymphaea alba</i> var. <i>alba</i> |
|-----------------------|---|---|
| Leaf | | |
| Angle | Entire and narrow cut just above the centre making an angle of 20° | Entire and deep cut just above the centre making an angle of 30° |
| Pubescence | Glabrous abaxially and adaxially | Glabrous abaxially |
| Colour | Turns from green to deep reddish | Remains green abaxially and adaxially |
| Flower | | |
| Diameter | 10–15 cm | 10–20 cm |
| Petal colour | Shades of red, outer petals light carmine red, inner one deep carmine red | White to creamy yellow; both inner and outer petals white in colour |
| Anther size | Filaments of outer stamens longer than anthers | Filaments of outer stamens smaller or equal to length of anthers |
| Anther colour | Saffron red | Yellowish |
| Seeds | Does not produce seeds | Produce seeds |

species and helps in taking timely action for management of aquatic ecosystems.

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Author's contribution

The plant specimens were collected by AH and AM. Specimens were examined by AH, SR, AAK and IAN. Identified by SR and AAK. Manuscript was written by

AH, SR and AAK. AH and SR photographed the specimens and prepared figures.

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