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Rhododendron rawatii (Ericaceae), a new species from the Western Himalaya, India

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Abstract

A new species of *Rhododendron, R. rawatii* is illustrated and described from the Western Himalaya. The species is sporadically found in the subalpine–timberline zone of Uttarakhand state. Fascicled white cottony hairs on the abaxial surface in between lateral veins of leaves, bright pink and shine-less corolla and comparatively large calyx with hairy margins distinguish the new species from its nearest ally *R. fulgens*. The populations of the species were found in two geographically distinct localities in the Rudraprayag and Pithoragarh districts of Uttarakhand state. The distinguishing morphological characters, affinities with other species and various ecological aspects of the new species are discussed here.

Key words: Floral diversity, subalpine-timberline zone, taxonomy, Uttarakhand

Introduction

Rhododendron Linnaeus (1753: 392) is a large genus comprising ca. 1000 species worldwide, classified into 8 subgenera (Chamberlain 1996, Fang et al. 2005). Rhdododendron is distributed widely in the northern hemisphere, with China having the highest diversity (ca. 571 species fide Fang et al. 2005) and endemism. In India, 92 species, 8 subspecies and 9 varieties are reported, which are distributed from Arunachal Pradesh to Jammu and Kashmir and one subspecies from the Western Ghats. The Eastern Himalayan region is a hot spot for *Rhododendron* diversity (75 species, 4 subspecies, 5 varieties), whereas only 6 species are reported from the Western Himalaya (Sastry & Hajra 2010). Among all the species in India, Rhododendron arboreum Smith (1805: 9) has the widest elevational range, while other species are confined to high altitude regions which mainly form krummholz vegetation and alpine scrubs (Naithani 1984). During 2007-2010, a vegetation survey was carried out in the Western Himalaya along the subalpine-timberline zone, and a new species of Rhododendron was observed, which was conspicuously distinct in morphology from other species of rhododendrons across the world. The morphological characters such as habit, size, leaf, bark, floral parts, capsule and seed were measured with the help of a stereo microscope and scales. Each vegetative and floral part was measured of different individuals. Morphological characters and phenological traits of the new species were monitored for three years (2008–2010) and distinguishing characters were identified. A flowering branch of the species was deposited in the herbarium of the Wildlife Institute of India (WII). Comparison with the relevant literature on *Rhododendron* species and local floras, such as Hooker (1851, 1882), Osmaston (1978), Naithani (1984), Pollunin & Stainton (1984), Grierson & Long (1991), Gaur (1999), Milleville (2002), Fang et al. (2005) and Sastry (2010) revealed that the new species is a hitherto undescribed species and new to the genus Rhododendron.

TABLE 1. Comparison of Rhododendron rawatii sp. nov.	v. with its nearest relative, R. fulgens following Hooker (185	1),
Chamberlain (1996), Fang et al. (2005) and Sastry (2010)).	

Character	Rhododendron rawatii sp. nov.	Rhododendron fulgens
Habit	Shrub or small tree, evergreen	Shrub or small tree
Habitat	Subalpine to treeline (3100–3350 m)	Subalpine to alpine (3200–4300 m)
Bark	Whitish-red, smooth, peeling	Smooth, peeling
Leaf		
Shape	Elliptic or oblong-elliptic, leathery	Broadly ovate or elliptic, leathery
Longevity (months)	<u>≤</u> 14	?
Petiole surface	Glabrous	Glabrous
length (cm)	1.5–2.5	Up to 1
# lateral veins	30–44 pairs	?
Lamina length (cm)	12.2–19.6	5–13
width (cm)	4.6–7.9	2.5–7
base	Rounded to cordate	Rounded to cordate
apex	Mucronate	Rounded
surface adaxial	Glabrous, green, shiny	Glabrous, dark green, shiny at maturity
abaxial	Green with whitish to brown cottony hair, fascicled in between the side veins	dense woolly clothing underneath, thick fawn to fulvous unistrate indumentum, which wholly obliterates the venation
Inflorescence, Flowers		
Rachis (mm)	13–20	10–20
Flowers per inflorescence	13–16, loosely arranged	8–14, compactly arranged
Bract tip and surface	Cuspidate, hairy	Hairy
Bracteoles	2, hairy	_
Pedicel surface	Glabrous	Glabrous
length (mm)	6–13	10
Calyx		
Shape and margins	Semi-globose, margins hairy	Glabrous
Length (mm)	2.1–5.6	1–2
Width (mm)	2.7–4.6	?
Corolla		
Shape	Open campanulate	Tubular campanulate
Colour	Bright pink, spotted, not shining	Scarlet to deep blood red, shining
Tube length (mm)	37–49	20–33
diameter at throat (mm)	47–59	-
Stamen		
Number	10	10
Length (mm) shorter	9–19	10.22
longer	21–32	10–22
Filament	Pubescent at base, white	Glabrous, pink
Gynoecium		
Ovary surface	Glabrous	Glabrous
length (mm)	5–7	?
Style	Glabrous, persistent	Glabrous, not persistent
length (mm)	24–28	15–17
Capsule	Curved	Curved
surface	Glabrous	Glabrous
length (mm)	17–28	10–30
diameter (mm)	5–7	4–8
Seed length (mm)	1.75–2.5	?
width (mm)	0.3–0.5	?
tail	Minute, 0.2±0.05mm	?

Taxonomy

Rhododendron rawatii I. D. Rai & B. S. Adhikari, sp. nov. (Figs. 1 & 2)

Rhododendron rawatii resembles *R. fulgens* Hooker (1851: t. 25) in habit and having peeling bark, glabrous young shoots and shining mature leaves but differs in the abaxial surface of leaves with fascicled cottony hairs in between the lateral veins, a bright pink, not shiny corolla and a large globose calyx with hairy margins.

Type:—INDIA. Uttarakhand: Kedarnath Wildlife Sanctuary, Tungnath, along timberline ecotone, 30°30'8.00"N, 79°13'27.61"E, 3320 m, 20 April 2010, *I.D. Rai 11451* (holotype WII!).

Shrub to small tree up to 4.5 m tall; bark thin, papery, peeling, reddish–white. Leaves mostly clustering at the ends of branches; petiole glabrous, 15–25 mm long; lamina infolded towards abaxial side from margins at maturity, becoming more convex towards adaxial surface, $122-196 \times 46-79$ mm, leathery, elliptic to ellipticoblong, base rounded to cordate, apex mucronate, margin entire; adaxial surface green and shiny, abaxial surface with sparsely distributed fascicled white to brown cottony hairs in between lateral veins, becoming more or less glabrous at maturity (1 year); veins conspicuous, lateral veins in 30-44 pairs. Inflorescence terminal, rachis 13–20 mm long, flowers 13–16, loosely arranged; pedicel glabrous, 6–13 mm long; bracts elliptical, convex adaxial surface, apex cuspidate; bracteoles 2, hairy; sepals 5, $2.1-5.6 \times 2.7-4.6$ mm, membranous, globose, pink, margins ciliate with weak hairs; petals 5, tube open-campanulate, $37-49 \times 47-59$ mm (tube length × width at throat), bright pink, not shiny, glabrous, notched, margins entire, with dark pink to brown spots in the corolla tube, well-marked nectar pouches at base of each petal; stamens 10, unequal, 9–19 to 21–32 mm long (smallest and longest), filaments pubescent at base, white; ovary cylindric, glabrous, green, 5–7 mm long at the time of flowering; style glabrous, 24–28 mm long, slightly shorter than the corolla tube, persistent; stigma capitate, green, 5-lobed. Capsule $17-28 \times 5-7$ mm, slightly curved at maturity, glabrous, dehiscing from the tip of capsule, placenta remaining attached to central axis after dehiscence; seeds numerous and minute, $1.5-2.5 \times 0.3-0.5$ mm, tailed, tail up to 0.25 mm, compressed and brown in colour.

Etymology:—The epithet *rawatii* acknowledges Prof. Gopal Singh Rawat, one of the leading phytotaxonomists and ecologists of India.

Phenology:—The flowering period lasts from March to mid-May and capsule dehiscence starts from October onwards.

Comparison:—The new species resembles *R. fulgens* and shares several common characters, such as habit (a small tree to shrub), peeling bark, glabrous young shoots and shining leaves at maturity. The new species differs in many characters as follows: light green abaxial surface of leaf with fascicled cottony hairs in between lateral veins in *R. rawatii*, whereas in *R. fulgens* the indumentum wholly obliterates the venation. Flowers are dark pink having a globose calyx with hairy margins in *R. rawatii*, whereas in *R. fulgens* petals are bright blood-red, highly polished and shining, the calyx is minute.

Study area, forest type and climate:—The study area is located in the state of Uttarakhand of the Indian Republic (Fig. 3). The species is mainly recorded in the subalpine–timberline ecotone region. The subalpine forests are dominated by *Quercus semecarpifolia* Sm., *Betula utilis* D. Don, *Abies spectabilis* (D. Don) Mirb. and *Rhododendron arboreum* with *krummholz* dominated by *Rhododendron campanulatum* Don (1821: 410). Six species of *Rhododendron*, viz. *R. arboreum*, *R. barbatum* Wallich ex Don (1834: 844), *R. campanulatum*, *R. anthopogon* Don (1821: 409), *R. lepidotum* Wallich ex Don (1834: 845) and *R. nivale* Hooker (1851: 26b) have been reported from the Western Himalaya. The climatic data were recorded for 3 years during 2008–2010 at Tungnath area (3300 m a.s.l.) in Kedarnath WS (type locality), and the climate of the region has three prominent seasons: long winter (October to April), short dry summer (May to June) and rainy season (July to September). The mean annual temperature ranged between -8.9°C (January) and +25.6°C (May) with an annual average of $6.6\pm0.7^{\circ}$ C. The annual precipitation was 2410 ± 432 mm, of which 89% was received during June–September. The area remains snow-bound for 85 ± 28 days per year (Adhikari *et al.* 2011).



FIGURE 1. *Rhododendron rawatii* I. D. Rai & B. S. Adhikari *sp. nov.* A. & B. Habit and habitat (flowering and vegetative stage). C.Leaf abaxial and adaxial surface. D. & E. Bark. F. Inflorescence. G. Flower. H. Stamen, calyx and bract. I. Basal part of the flower with calyx. J. Ovary, calyx and bracteoles. K. Flower bud. L. Leaf bud. M. & N. Mature and dehisced capsule. O. Seeds. (Photographs by IDR from type locality).



FIGURE 2. *Rhododendron rawatii* I. D. Rai & B. S. Adhikari *sp. nov.* **A.** Flowering branch. **B.** Leaf: adaxial (left) and abaxial (right) surface. **C.** Flower with bracteoles. **D.** Androecium and gynoecium. **E.** Bract. **F.** Intact and dehisced capsules. **G.** Seeds (Illustration by IDR from type locality).

Distribution and Habitat:—The new species is described from the type locality inside the Kedarnath Wildlife Sanctuary along the timberline zone. Another population is recorded enroute to Chhipla-Kedar from Chhirkila (29°57'26"N, 80°30'55"E, 3120 m) in Pithoragarh district, Uttarakhand (ca. 150 individuals). Individuals were found to grow at the edge of open canopy forest in northwest aspects between 3100 and 3375 m. The daily mean air temperature remains below 0°C for more than 3 months, and the soil remains under snow for about 3–4 months in a year and acidic in nature (pH 4.3–5.0).

Phytogeography, endemism and conservation status:—The species has so far been recorded from only two localities in the Western Himalaya. A regenerating population of about 11 individuals was located in Tungnath area of Kedarnath Wildlife Sanctuary and *ca.* 150 individuals were found in Pithoragarh district. The distribution of species is very narrow, and plants were found near and above 3100 m elevation along the subalpine–timberline zone. According to IUCN criteria, the species falls under the Endangered (EN) category (IUCN 2011, section 2.3) having very small (<250 individuals) and restricted populations. On the basis of total number of individuals (*ca.* 161 individuals) found in 2 populations, the status of species may be considered for immediate conservation measures and the habitat as critical, as the area is under high anthropogenic pressure. The geographical range is extremely narrow and the population is fragmented, therefore, the species requires immediate *in-situ* conservation and habitat management interventions.



FIGURE 3. Map of India (left lower side) and Uttarakhand state (representing locations of the habitat of *R. rawatii* recorded (left star type locality at Tungnath in Kedarnath Wildlife Sanctuary, Rudraprayag (R) district and right star enroute Chhipla–Kedar in Pithoragarh (P) district).

Relationships

The species is placed in *Rhododendron* subsect. *Fulgensia* Chamberlain (in Cullen & Chamberlain 1979: 336) under the subgenus *Hymenanthes* (Blume 1826: 862) Koch (1872: 170).

Rhododendron subsect. Fulgensia

Shrubs or small trees; young shoots tomentose, glandular or glabrous; leaf blade oblong–elliptic to obovate; abaxial surface densely fulvous woolly, hairs fasciculate or long-stipitate stellate; inflorescence terminal, lax or dense, 4–14-flowered; rachis 0.2–2.5 cm long; calyx minute to well developed and cup shaped, 1–10 mm long, 5-lobed; corolla funnel to tubular–campanulate, 5-lobed, blood-red, or scarlet to deep carmine, with nectar pouches; stamens 10; ovary and style glabrous, capsule straight or slightly curved.

Key for the species of Rhododendron subsect. Fulgensia

1a.	Young shoots glabrous; inflorescence 8-16-flowered, corolla tubular-campanulate, pink to blood-red to scarlet,
	calyx 1–5.6 mm long
2a.	Corolla tubular-campanulate, blood-red to scarlet, 2-3.5 cm long; calyx 1-2 mm long, not ciliate; leaves with thick
	fawn to tawny indumentums which wholly obliterates the venation
2b.	Corolla openly campanulate, bright pink, 3.7-4.9 cm long; calyx 2.1-5.6 mm long, globose, margins ciliate; leaf
	abaxial surface with fascicled cottony hairs in between the veins
1b.	Young shoots hairy; inflorescence 4-6-flowered; corolla funnelform-campanulate, deep carmine; calyx 3-10 mm
	long
3a.	Young shoots glandular; abaxial leaf surface with long-stipitate stellate hairs; calyx 3.5 mm; corolla 3.5–4 cm long.
3b.	Young shoots eglandular; abaxial leaf surface with fasciculate hairs; calyx 8–10 mm long; corolla 3–3.5 cm long

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