

## Notes on the Sikkim Himalayan rhododendrons: a taxa of great conservation importance

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**Abstract:** Rhododendrons form dominating species all along the temperate, subalpine and alpine zones in the Sikkim Himalaya. *Rhododendron* L. is one of the largest genus of the Ericaceae family, occurring in the higher altitudes having ecological significance and economic importance in addition to its splendiferous flowers. It has aesthetic, sacred, aromatic, medicinal and fuelwood values. There are 36 species with 45 different forms (including subspecies and varieties) in the Sikkim Himalaya. Using IUCN guidelines for categorization eight species are being evaluated according to population characters. It has been observed recently that the rhododendrons of the region are under pressure, which are basically exploitations, and some of the species are in the verge of extinction. An effort is made in this note to understand the current status of the rhododendrons in the region.

**Key words:** *Rhododendron*, conservation, Sikkim Himalaya

### Introduction

*Rhododendron* L. was for the first time described by Carl Linnaeus in 1737 in *Genera Plantarum*. *Rhododendron* are the denizens of high altitude comprising about 1000 species mainly inhabiting a vast section of southeastern Asia stretching from the northwestern Himalaya through Nepal, Sikkim, eastern Tibet, Bhutan, Arunachal Pradesh, northern Myanmar and western and central China; more than 90% of the world's population of *Rhododendron* are from this region (Leach, 1961; Chamberlain et al., 1996).

Sikkim is a small state with an area of 7096 km<sup>2</sup> and a population of 405505, with an average density of 57 persons per km<sup>2</sup> (1991 census). The state

extends between 27°4'46" to 28°7'48" N and 88°58" to 88°55'25" E with an altitudinal variation from 300 m in the valleys to 8598 m at the peak of Mount Khangchendzonga. It is bound on the west by Nepal, on the north by Tibet, on the east by Bhutan and Tibet, with the Darjeeling district of West Bengal stretching along its southern boundary. The state falls within biodiversity hot spot for India. The state is regarded as a hot spot for biodiversity. It is rich in cultural diversity with distinctive ethnic groups such as the Lepchas, Bhutias, Nepalese and Limbus and they differ from each other in their food habits and life style, which also play a major role in survival and conservation of Sikkim Himalaya.

In India, the genus *Rhododendron* is represented by eighty species (Gamble, 1936; Cowan & Cowan,

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1938; Pradhan & Lachungpa, 1990; Bhattacharyya & Sanjappa, 2008) and is mainly distributed in the Himalayan region specially as a dominant forest taxa in eastern parts. The genus could be regarded as a keystone element for the high altitude areas having more or less direct implication on the soil and moisture regime of the location, as about 72% of the Indian *Rhododendron* species are found in Sikkim, and 85% occur in the state of Arunachal Pradesh (Paul et al., 2005).

The genus forms a very important dominant combination of forest types in the cool temperate and sub-alpine region, and also along the alpine meadows of the Sikkim Himalaya, covering a wide range of altitudinal progression with considerable ecological amplitude. Himalayan rhododendrons are now in definite danger of elimination unless immediate resurrection measures are made (Singh et al., 2003; Kumar et al., 2004).

At present the rhododendrons of the region have reached a stage where many species are found as rare and endangered (Table 1). At the time of baseline assessment many species were found under varying degrees of threat within their habitat. Gradual pressure over the plant resources, anthropogenic or otherwise, has now entered this region of the Himalaya too and some of the plant species are under severe pressure. Owing to it being conspicuous and at certain places being used

extensively as fuelwood the rhododendrons have now become an item for immediate conservation in the region. During tree-felling, governmental or private, the epiphytic rhododendrons suffer greatly. Pradhan and Lachungpa (1990) reported that due to heavy rainfall in 1980 at Yakchey, North District Sikkim massive landslides occurred resulting in the degradation of entire population of *R. niveum* Hook.f. As the *Rhododendron* habitat is now under recurrent pressure and thus violated physically time and again the genus is considered a taxa of considerable conservation importance. The regeneration status in the form of available seedlings/saplings is very poor due to the above situation for many of the rhododendrons. The above situation could be detrimental for a selected few *Rhododendron* species which are naturally found in small isolated populations (Figure 1). Though floristically rich, the genus *Rhododendron* in the region is one of the most neglected groups of plants in terms of scientific inquiry so far.

To counteract the possibility of full-scale destruction of *Rhododendron* habitats against the odds cited above the rare species, e.g., *R. fulgens* Hook.f., *R. leptocarpum* Nutt., *R. maddenii* Hook.f., *R. niveum* Hook.f., *R. pendulum* Hook.f., *R. pumilum* Hook.f., *R. sikkimense* Pradhan & S.T. Lachungpa, *R. wightii* Hook.f. should be conserved under in situ/ex situ condition as well as through in vitro propagule cryo-preservation.

Table 1. Rarity of eight *Rhododendron* species in the Sikkim Himalaya.

Species	Altitude (m)	Availability		Space		Status (IUCN categories)
		Few	Extremely few	Localised	Extremely localised	
<i>R. leptocarpum</i> Nuttall	3000-3500		●		●	Critically Endangered (CR)
<i>R. maddenii</i> Hook.f.	2500-4000		●	●		Critically Endangered (CR)
<i>R. niveum</i> Hook.f.	3000- 3700		●		●	Critically Endangered (CR)
<i>R. pendulum</i> Hook.f.	3300-4000		●	●		Vulnerable (VU)
<i>R. pumilum</i> Hook.f.	3500-4500		●	●		Critically Endangered (CR)
<i>R. wightii</i> Hook.f.	3500-4500	●		●		Vulnerable (VU)
<i>R. sikkimense</i> Pradhan & Lachungpa	3700		●		●	Endangered (EN)
<i>R. fulgens</i> Hook.f.	4000-5000			●		Vulnerable (VU)

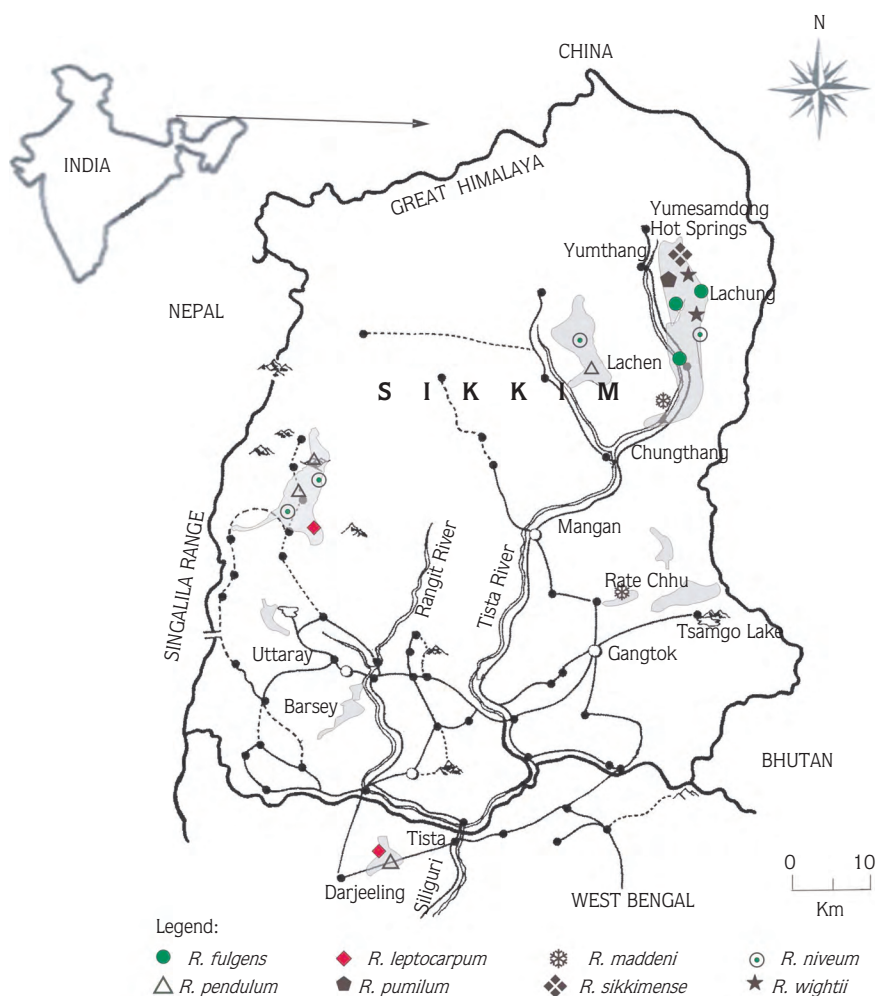


Figure 1. Map showing occurrence of *Rhododendron* species in Sikkim Himalaya, India.

## Materials and Methods

Extensive field visits were made to different sites at North Sikkim at 3000-4000 m amsl (Singba, Yumthang, Lachung, Lachen), East Sikkim (Kyongnosla, Tsangu, Kupup, Rate Chhu) West Sikkim (Barsey, Tshoka, Dzongri), Neora Valley National Park and Singalila National Park (Darjeeling hills, West Bengal) during 2003-2006. There are about 36 *Rhododendron* species with 45 different forms (including subspecies and varieties) in the Sikkim Himalaya. Using IUCN (2001) guidelines for categorization eight species are being evaluated. The *Rhododendron* species were identified and enumerated. Individual species were studied for their field character, habitat, morphological characters, flowering and fruiting, availability and

their population. Following assessments were made on eight *Rhododendron* species in Sikkim Himalaya.

## Results

### Rarity of species recorded

*Rhododendron fulgens* Hook.f. [Brilliant *Rhododendron*, Nepali: Chimal]; First report by Hooker (1849). This is plant like *R. baileyi* Balf.f. which inhabits the Lachung-Yumthang stretch at 3500 m under similar environmental conditions. It is a shrub carrying bright green young branch. The plant is free of glands, hairs or scales except the floral bract and young foliage. Flowers dark blood to scarlet, rather fleshy, tube bell shaped. Flowering-May to June; Fruiting-October. The population here is quite scarce.

*R. leptocarpum* Nuttall [Slender-fruited *Rhododendron*, Nepali: Jhinophale Gurans]; First report by Nuttall (1984), syn. *R. micromeres* Tagg (1930). A very rare species in the Sikkim Himalaya. The plant is a straggling much-branched shrubby epiphyte reaching to shrub proportions. Leaves are 3-7 x 1.5-3 cm. Inflorescence comes out in July, which consists of 3-6 flowers in terminal heads. This species is so far found only at Tshoka (3500 m) village in Dzongri of west Sikkim. Flowering-June-July; Fruiting-October. About 15 plants are recorded. It grows on live trees as well as on fallen logs but never seen on the ground.

*R. maddenii* Hook.f. [Major Madden's *Rhododendron*, Nepali: Major Madden ko Chimal]; First report: Hooker (1849). *R. maddenii* is one of the scarce species in the Sikkim Himalaya, being more or less absent in the Darjeeling Hills. It occurs between the elevations 2500-4000 m and favors a moist environment. It forms small patches of scrub vegetation. The wood is light-brown in color, moderately hard. In exploratory trips in the recent years no plant has been found at its type locality (Chungthang and Rate Chhu catchment, East Sikkim). *Rhododendron maddenii* is critically endangered species among the eight species and much fewer in number than the other species. Flowering-June to July; Fruiting-September. Throughout the region it grows only at two isolated locations and total count of specimens is twenty.

*R. niveum* Hook.f. [Snow-leaved *Rhododendron*, Nepali: Hiun-pate Gurans]; First report by Hooker (1849). Usually localized within 3000-3700 m elevations of the Sikkim Hills, *R. niveum* is scarce in the Darjeeling hills, almost a rare element. Within the *Rhododendron* community of the region, *R. niveum* is a comparatively large tree, attaining heights of over 3 m. It is quite a distinctive species as far as its general habit and flowers are concerned. Flowers of deep magenta or lilac with darker nectar pouches appear in April and May. The leaves are hairy underneath. Under our recent field exploration it has been found out that the *R. niveum*, endemic to Sikkim (also the state tree of Sikkim) is limited to a microniche at a place called Yakchey in northern Sikkim, and individual count shows 45 plants. Flowering-April; Fruiting-July.

*R. pendulum* Hook.f. [Pendulous *Rhododendron*, Nepali: Jhundinai Chimal]; The plant that was described in 1849 by Hooker came from Lachen in North Sikkim. This species grows between 3300-4000 m mostly in the Sikkim Hills. This is a small straggling epiphytic shrub up to 1 m in height, or growing on rocks, with trailing branchlets covered with dense brown or fawn wooly hairs and with glandular spots. In the month of May the white flowers come out in a group of 2-3 per umbel, often flushed with yellow, pink or cream at the throat. Corolla are broadly tubular and lobed. Flowering-May; Fruiting August to September. The plants are found at Yakchey, Lachen and Dzongri.

*R. pumilum* Hook.f. [Dwarf *Rhododendron*, Nepali: Purke Gurans]; First report-Hooker (1849). This is a slender creeping shrublet of the rocky talons and banks of the higher Sikkim between 3500-4500 m. Leaves are small, 8-20 mm, elliptic and with acute tips. Loose scales are found at the lower surface. The flowers are pilose all over the surface and come out in the months of June-July in solitary cymes or in clusters of 2-3. The corolla is pink (sometimes purple), widely tubular, up to 2 cm long and 5-lobed. This is by far a scarce species found only at the vicinity of Bhirum lake (4600 m) and a few at Chachuzuk (3800 m).

*R. sikkimense* Pradhan and Lachungpa [Sikkimense *Rhododendron* Nepali: Sikkimense Gurans]; First report-Pradhan and Lachungpa (1990). This is newly discovered species from the northern Sikkim at the height of about 3700 m. It grows under *Abies densa* Griff. forests as understory shrubs with *R. campanulatum* D.Don as associate species. The flowers are white and come around May-June in clusters. The leaves are short description to be added similar to *R. campanulatum*. It reaches up to 1.5 m in height. Flowering-May to June; Fruiting-October. This is one *Rhododendron* species in Sikkim Himalaya with very localized growing area. Endemic to Sikkim.

*R. wightii* Hook.f. [Dr. Wight's *Rhododendron*, Nepali Wight ko Gurans]; First report-Hooker (1851). *Rhododendron wightii* is more common in the hills of Sikkim than in Darjeeling. Flowers are bell-shaped, pale-yellow with purple throat come out in May and last till June. Flower clusters bear about



10-20 flowers in loose umbels. The bark is extremely thin, cinnamon red, peeling off in papery rolls. Wood is light yellow, moderately hard, and usually employed for fuel. Found at the northern part of Sikkim between 3500 and 4500 m elevations, over the spurs, and most of the time growing gregariously.

### Conservation issue for management

There has been few/limited number assessment in the natural restoration of *Rhododendron* populations. In the Sikkim Himalayan context Uday Chandra Pradhan from Kalimpong West Bengal started The Journal of Himalayan Plants but it was discontinued within a short time. During its limited publication life some of the field based research works of the region were covered. In the meantime the *Rhododendrons* numbers of the region have reached a stage from where species are classified as rare, vulnerable, endangered and critically endangered (CR). The International Rhododendron Societies abroad, e.g., the American Rhododendron Society, Rhododendron Species Foundation, Australian Rhododendron Society, International Rhododendron Union, also keep record on the development of the genus but the major activity here centers around horticulture and breeding.

The Government of Sikkim has also initiated the work for the *Rhododendron* conservation. It has extended the protected areas as biosphere reserve, national parks and sanctuaries, keeping in view of the conservation of *Rhododendrons*. There is one Biosphere Reserve, two National Parks and six Wildlife Sanctuaries, where the 36 species of *Rhododendron* of the region are found. The Shingba *Rhododendron* and the Bersey *Rhododendron* sanctuaries are exclusively declared as protected areas, keeping in view the conservation of *Rhododendron*. Most of the *Rhododendron* occur in the restricted areas of the state/central government and permits are only issued with a set of guidelines. This has given a positive sign towards conservation. Forest Department has also been planting some of the *Rhododendron* back into natural habitat to see whether sustainable initiative can meet the requirements for traditional use.

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been evaluating the status of these *Rhododendron* species in nature for the past 8 years, and ex situ regeneration works are in progress (Singh et al., 2003; Singh, 2008; Singh et al., 2008a). Some of the rare and critically endangered species like *R. maddenii*, and *R. niveum*, are now under in vitro research procedures. Under a collaborative programme the GB Pant Institute of Himalayan Environment and Development, Sikkim unit (Pangthang-Gangtok) and Department of Forest, Government of Sikkim, have initiated a unique kind of rare and threatened plant conserving two hectare area in the Himalayan Zoological Park, Bulbulay-Gangtok. Large number of tissue culture raised plants of *R. maddenii* and conventionally propagated plants of six different *Rhododendron* species (*R. griffithianum* Wight, *R. baileyi*, *R. maddenii*, *R. dalhousieae*, *R. grande* Wight, and *R. ciliatum* Hook.f.) have been planted in the Rare and Threatened Plant Conservation Park' the of the Zoological Park, Gangtok and also in the Institute's Arboretum where they are growing satisfactorily (Badola et al., 2006; Singh et al., 2008a).

In order to bring out sustainable *Rhododendron* conservation and management, it is essential to adopt several different approaches for managing forests and Sikkim Himalayan biodiversity. There is also a need of greater involvement of communities, and for models that decentralize the management and conservation roles and its responsibilities. Maintaining viable population of *Rhododendron* species is a crucial factor in conservation and this requires appropriate conservation methods such as ex-situ and in-situ conservation approaches. The Institutions working in the area need to network and coordinate their activities so that priority issues and areas are identified. The Ministry of Environment and Forests (MoEF), Government of India, must set up a database for the Indian *Rhododendrons* as a whole. Owing to habit fragmentation and consequent losses suffered by different population, there is a need for ensuring the safety of the *Rhododendron* lying outside the protected areas.

Population viability analysis in this study for different species have revealed that the loss of even a single individual from a small population could adversely affect the population structure, viability and may lead towards the extinction of species (e.g.

*R. leptocarpum*). Plant tissue culture and vegetative propagation are also the best alternatives towards species management (Anderson, 1975; Kumar et al., 2004; Singh et al., 2008b). Although most of the species has been considered as rare and endangered species, large-scale removal still continues at rates well over natural regeneration. It is desirable to apply simple methods, e.g. seed germination or propagation via air layering/cuttings; these would be easy to perform in the field and are also cost effective. Educating local people on the significance of the species and their variations in nature is deemed crucial for conservation initiatives. To counteract the possibility of full scale destruction of *Rhododendrons* habitats through natural calamities, threatened species of *Rhododendron* needs ex situ preservation in similar other localities and/or in arboreta. Seeds of such species should be preserved through Government Research Institutions. *Rhododendron* conservation would be very successful when linked in a sustainable manner to the economic upliftment of local people through

their proper utilization. Government research Institution should involve themselves in searching for such alternatives for threatened species. Forest planner should take into consideration planting of *Rhododendrons* that add aesthetic and tourism importance and also play a major role in the economic upliftment of the people. Use of biotechnological tools for *Rhododendron* conservation would be far more appealing to the inherently nature loving population of Sikkim Himalaya.

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