

## Diversity of *Rhododendron* Linnaeus (Ericaceae) in Singalila National Park located in Darjeeling part of the Himalayas

Upakar Rai<sup>1</sup>, Dorjay Lama, Nayan Thapa and Surya Rai

Department of Botany, St. Joseph's College, North Point, Darjeeling – 734104, West Bengal

<sup>1</sup>Corresponding author: E-mail: upakar@yahoo.com

[Received 07.04.2013; accepted 17.12.2013]

### Abstract

Singalila National Park, located in the state of West Bengal in India was declared a National Park in 1992 with a total area of 78.6 sq km. The Park comprises of mountainous tract with elevation ranging from 2400 m to 3660 m. One of the principle components of Singalila is the rhododendrons (Ericaceae) that are found to bloom in various colours and shades during spring. The Park exhibits incredible richness in rhododendron species. As much as 18 % of rhododendrons (19 of 95 Indian taxa) are concentrated in this small geographic region. The present study deals with the taxonomic enumeration of 19 taxa along with key to identification of rhododendrons recorded from Darjeeling. These taxa are distributed under two sub-genera, three sections, thirteen sub-sections and 17 species. Following IUCN (2001) guidelines and criteria 10 species were evaluated as threatened for West Bengal. Of these, 2 are critically endangered, 2 endangered and 4 are vulnerable.

**Key words:** *Rhododendron*, Darjeeling, Singalila National Park, Himalaya, RET species

### INTRODUCTION

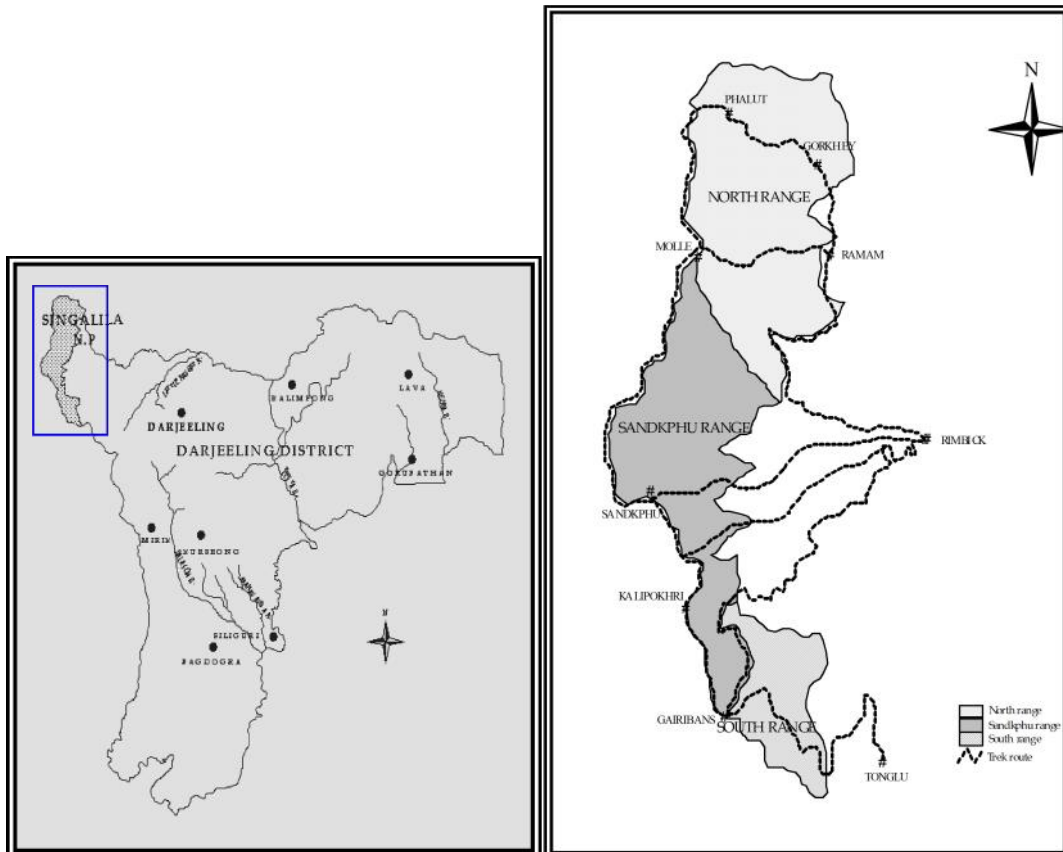
*Rhododendron* Linnaeus is one of the largest genera of Ericaceae. With about 1000 species worldwide (Chamberlain *et al* 1996; Fang *et al* 2005), it is mostly distributed in the temperate to alpine eco-regions of Northern hemisphere. Almost 80 % of its species are found in South-East Asia, extending from north-west Himalayas from Pakistan, India, Nepal, Bhutan, Myanmar, East Tibet, central and south-east of China (Irving & Hebda 1993). In India, 92 species are found to grow throughout the Himalayas from Jammu and Kashmir to Arunachal Pradesh (Singh *et al* 2003; Paul *et al* 2005; Sastry 2010; Sastry & Hajra 2010). The Eastern Himalaya is one of the main centres of origin of rhododendrons. Arunachal Pradesh has the highest number of 75 species of *Rhododendron* and is followed by Sikkim with 36 species (Hooker 1849; Pradhan & Lachungpa 1990; Grierson & Long 1991; Singh *et al* 2003; Singh 2009; Pradhan 2010; Sastry & Hajra 2010). The Darjeeling and Sikkim parts of the Himalayas situated on the Eastern side are equally rich in *Rhododendron* diversity. The Western Himalaya has less species representation (Sastry 2010).

Rhododendrons are one of the most conspicuous flowering plants of the temperate and sub-alpine region of Singalila National Park (SNP). They are of immense significance to high altitude ecosystem in terms of aesthetic and horticultural values and maintenance of ecological balance. Many Himalayan species are used as stock for hybridization throughout

the world (Spethmann *et al* 2010; Jussila *et al* 2010) that adorns the gardens and landscapes. It also provides as alternative livelihood for people living in the vicinity of the Park through homestays and as guides to visiting tourists.

### Study area

Singalila National Park is situated in the North-western side of Darjeeling district (Fig. 1) in the Singalila range of the Eastern Himalaya and is geographically located between 27° 13' 15" N to 28° 01' 46" N latitudes and 88° 01' 51" E to 88° 07' 05" E longitudes. The Park is



**Figure 1:** Map showing the location of Singalila National Park in Darjeeling district

contiguous with the mountainous region of Sikkim in the North and West and Nepal in the East. It was declared a National Park in 1992 covering an area of 78.60 sq km. Administratively SNP is divided into two ranges with 6 beats. The Park comprises of hilly spurs and ridges, and the peaks ranging from 2400 – 3600 m above sea level. Temperature remains below 15° C throughout the year but the upper elevation of SNP remains covered with snow for at least 2 months in the early part of the year during winter. The average annual rainfall within the park is above 3000 mm.

The Park exhibits wide geographic and climatic variations with diverse eco-zones and is endowed with extremely rich flora and fauna unique to this region. It is characterized by two vegetation zones – Temperate and Sub-alpine. The vegetation is dominated by temperate plants like species of *Quercus*, *Castanopsis*, *Rhododendron*, *Abies*, Laurels, Hemlock, etc. Rhododendrons are one of the principle components of SNP. The Park is an ideal eco-

region for luxuriant growth of *Rhododendron* and their subsequent evolution. *Rhododendrons* with various shades of flowers cover the entire Park during March – June.

The present study was undertaken to enumerate different species of *Rhododendron* found within the Park and to investigate their distribution and population status.

## MATERIALS AND METHODS

Inventory of rhododendrons in Singalila National Park (Figure 1) was carried out during March, June and September 2010 when the plants were in flowering and fruiting conditions. Voucher specimens were collected and tagged along with their GPS locations. The herbarium sheets prepared are kept in the St. Joseph's College Herbarium and Natural History Museum, Darjeeling. One set of the herbarium will be deposited to the Llyod Botanical Garden, Darjeeling. Identification and authentication of species were done by consulting available literatures (Hooker 1849; Pradhan & Lachungpa 1990; Grierson & Long 1991; Fang *et al* 2005) and matching with the specimens housed at Llyod botanical garden herbarium. The threat status of the recorded taxa is evaluated following IUCN Red List Categories and Criteria version 3.1 (IUCN 2001).

## ENUMERATION

All the recorded taxa are enumerated here along with their correct name, synonym and/or basionym, local name, description, distribution, availability status and altitudinal distribution of 19 taxa under 17 species and 3 varieties of *Rhododendron* found in the Singalila National Park.

**Rhododendron** Linnaeus, Sp. Pl. 1: 392. 1753.

### Keys to species

- 1a. Mostly trees, 2 – 25 m tall, without discoid scales; leaves mostly 24 – 30 cm long; inflorescence 2 – 4-flowered ..... 2
- 1b. Dwarf to tall shrubs, with pelted discoid scales; leaves mostly 8 – 12 cm long; inflorescence 5 – 30-flowered ..... 11
- 2a. Abaxial surface of leaf with two layers of hair, outer layer cupular; nectar pouch absent; corolla verticose-campanulate ..... 3
- 2b. Abaxial surface of leaf 1-2-layered indumentum, hairs never cupular; nectar pouch present; corolla campanulate or tubular-campanulate ..... 5
- 3a. Midrib on adaxial surface depressed forming channel; corolla lobes 5; stamens 10; filaments glandular at base ..... *R. decipiens*
- 3b. Midrib not forming channel; corolla lobes 8-10; stamens 12-18; filaments without glands ..... 4
- 4a. Adaxial surface of leaf rugose, red-brown tomentose beneath; corolla white or creamy ..... *R. falconeri*
- 4b. Adaxial surface of leaf glabrous, shiny, soft white or pale brown tomentose beneath; corolla pinkish-red ..... *R. hodgsonii*
- 5a. Leaves elliptic-ovate, obtuse, mucronate; inflorescence 5-8-flowered; filaments pubescent at base ..... 6
- 5b. Leaves oblong or lanceolate; apex acute or acuminate; inflorescence 10 – 25-flowered; filaments without hairs ..... 7

- 6a Pedicels 1 – 2 mm long; corolla white to pale rose or purplish; capsules yellow strongly curved upwards ..... *R. campanulatum*
- 6b Pedicels 1.5 – 2.5 cm long; corolla lilac or pinkish mauve; capsules green slightly curved upwards ..... *R. wallichii*
- 7a Corolla 2.5 – 4.5 cm long; capsule equal to or 1.5 times longer; stamens 10 ..... 8
- 7b Corolla 5 – 8 cm long; capsule 2.5 – 4 times its length; stamens 12 – 16 ..... 10
- 8a Abaxial surface of leaf tomentose; petioles 1 – 2.5 cm long; winter buds eglandular, non-sticky ..... 9
- 8b Abaxial surface of leaf glabrous; petioles 0.5 – 1.3 cm long; winter buds glandular sticky ..... *R. barbatum*
- 9a Leaf base cuneate; inflorescence 18 – 20-flowered; corolla red, pink with or white with blotches on corolla tube ..... *R. arboreum*
- 9b Leaf base rounded or slightly cordate; inflorescence 8 – 14- flowered; corolla blood red ..... *R. fulgens*
- 10a Abaxial surface of leaf silvery matted hairs; petioles 3.5 – 5 cm long; flowers 20 – 25; calyx caducous; corolla 8- lobed; stigma large discoid; winter buds 1.5 – 2.2 cm long ..... *R. grande*
- 10b Abaxial surface of leaf glabrous; petioles 2 – 3.5 cm long; flowers 3 – 5; calyx persistent, saucer-shaped; corolla 5- lobed; stigma swollen; winter buds 0.8 – 1.2 cm long ..... *R. griffithianum*
- 11a Leaves more than 3 cm in length; lateral veins prominent ..... 12
- 11b Leaves less than 3 cm in length; lateral veins not prominent ..... 16
- 12a Petioles 0.5 – 2.5 cm long; calyx 0.5 – 1.1cm long ..... 13
- 12b Petioles 4 – 9 mm long; calyx 1 – 4 mm long ..... 14
- 13a Leaves ovate-elliptic, pedicel and leaf underside with dense woolly tomentum obscuring scales; capsules 0.8-1 cm long, densely scaly ..... *R. edgeworthii*
- 13b Leaves oblong-ob lanceolate; no woolly tomentum in pedicel and leaf underside; capsule 1 – 2.2 cm scaly densely woolly ..... *R. cinnabarinum*
- 14a Corolla 5 – 11 cm long, tubular-campanulate ..... 15
- 14b Corolla 0.8 – 5 cm long, funnel-shaped ..... *R. triflorum*
- 15a Pedicels scaly, otherwise glabrous; calyx lobes with white ciliate margins ..... *R. lindleyi*
- 15b Pedicel pubescent and scaly; calyx lobes not ciliate on margins ... *R. dalhousiae*
- 16a Terrestrial shrub; leaves elliptic-ovate or oblanceolate; calyx 3-4 mm long; capsules 5 – 7 mm long woody ..... *R. lepidotum*
- 16b Epiphytic or lithophytic shrub; leaves obovate-spathulate; calyx ca 2 mm long; capsules 2 – 2.5 cm long, not woody ..... *R. vaccinioides*

***Rhododendron arboreum*** Smith, Exot. Bot. 1: 9, pl. 69. 1805; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 465. 1882; H. Hara, Fl. East. Himal. 237. 1966; 2: 95. 1971; Pradhan & Lachungpa, Sikkim Himal. Rhod. 75. 1990; Gierson & Long, Fl. Bhutan 2(1): 372. 1991.

Local name: *Lali Gurans*

Trees, 5 – 20 m tall; bark grey-brownish, exfoliating into thin and small irregular flakes. Leaves oblong-lanceolate, 6 – 15 x 2 – 4.5 cm, abaxial surface with indumentum of 1- or 2-layered, densely compacted, white to fawn tomentose, sometimes with loosely floccose



**PLATE - I.** Different species of *Rhododendron* found in the Singalila National Park: **Fig. 1.** *R. dalhousiae*; **Fig. 2.** *R. arboreum* ssp. *arboreum*; **Fig. 3.** *R. griffithianum*; **Fig. 4.** *R. campanulatum*; **Fig. 5.** *R. cinnabarinum*; **Fig. 6.** *R. edgeworthii*; **Fig. 7.** *R. falconeri*; **Fig. 8.** *R. grande*; **Fig. 9.** *R. barbatum*; **Fig. 10.** *R. hodgsonii*; **Fig. 11.** *R. lepidotum*; **Fig. 12.** *R. lindleyi*



brown upper layer, glabrescent; lateral veins 15 – 26-paired. Inflorescence racemose, 18 – 20-flowered. Calyx lobes 5, 1 – 2 cm long, sparsely hairy. Corolla campanulate, 1.2 – 1.7 cm long, 5-lobed, pink to deeply crimson, rarely white, 3.5 – 4 cm long, with 5 black-blotched basal nectar pouches. Stamens 10. Ovary conical, 0.4 – 0.6 cm long, white-tomentose, sometimes glandular; style ca. 3.3 cm long, glabrous. Capsules cylindrical, ca. 1.8 – 3.1 × 0.6 – 0.9 cm long.

### Key to subspecies

- 1a. Abaxial leaf surface with 2-layered indumentum, the upper layer loosely brown-floccose ..... ssp. *cinnamomeum*
- 1b. Abaxial leaf surface with 1-layered compacted, fawn to white indumentum ..... 2
- 2a. Abaxial leaf surface with white to silvery-white indumentum; corolla red to carmine, rarely pink ..... ssp. *arboreum*
- 2b. Abaxial leaf surface usually with loose floccose whitish to fawn indumentum; corolla deep crimson to carmine red ..... ssp. *delavayi*

***Rhododendron arboreum*** Smith subsp. *arboreum* Pradhan & Lachungpa, Sikkim Himal. Rhod. 77. 1990; Gierson & Long, Fl. Bhutan 2(1): 373. 1991. *R. puniceum* Roxburgh, Fl. Ind., ed. 1832 2: 409-411, 409. 1832. *R. windsorii* Nuttall, Hooker's J. Bot. Kew Gard. Misc. 5: 357. 1853.

Lamina usually oblong-lanceolate, 6 – 15 × 2 – 4 cm, acuminate or acute, abaxial surface indumentum 1-layered, white to silvery-white. Corolla red to deeply crimson. Capsules cylindrical, brown 2 – 3.1 × 0.6 – 0.9 cm.

*Flowers:* March – May; *Fruits:* August.

*General distribution:* Throughout Nepal, Sikkim, Bhutan, north and north-east India, China in mixed forests between 1500 – 3600 m.

*Distribution in the Park:* The subspecies is only seen in Gorkhey in the north range at an elevation of 2300 – 2600 m. It is characteristically absent in the South range within the park

*Status in the park:* Common in the park, not evaluated.

*Specimens examined:* Rai & Lama SNP-R/027, dated 27.03.2010.

***Rhododendron arboreum*** Smith subsp. *cinnamomeum* (Wallich *ex* G. Don) Tagg, Sp. Rhodod. 15: 15. 1930; Pradhan & Lachungpa, Sikkim Himal. Rhod. 77. 1990; Gierson & Long, Fl. Bhutan 2(1): 373. 1991. *R. cinnamomeum* Wallich *ex* G. Don, Gen. Hist. 3: 844. 1834. *R. arboreum* subsp. *campbelliae* (J.D. Hooker) Tagg, Sp. Rhodod. 15. 1930. *R. arboreum* subsp. *cinnamomeum* (Wallich *ex* G. Don) Tagg, Sp. Rhodod. 15. 1930. *R. campbelliae* J. D. Hooker, Rhododendron Sikkim Him. Pl. 6. 1849.

Lower surface of leaf compact, fawn to white. Corolla pink to carmine, occasionally white. Capsules cylindrical, brown 2 – 3.1 × 0.6 – 0.9 cm.

*Flowers:* March-June; *Fruits:* September – November.

*General distribution:* Eastern Nepal, West Bengal, Sikkim north-east India, China.

*Distribution in the Park:* It shows wide ecological amplitude occurring throughout the Park starting from Tumling to Phalut displaying wide floral colour variations. White form is very rare with only 3 individual within the Park.

430 *Rhododendron* diversity in Singalila National Park

*Status in the park:* Very common.

*Specimens examined:* Rai & Lama SNP-R/001, 002, 004, 008, 011 – 016, 023 – 026, dated 24.03.2010.

***Rhododendron arboreum*** subsp. ***delavayi*** (Franch.) D.F. Chamberlain, in J.L. Luteyn, *Contrib. Classif. Rhod.* 45. 1980; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 77. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 373. 1991. *R. delavayi* Franchet, *Bull. Soc. Bot. France* 33: 231. 1886.

Usually with higher amount of nectar than other two sub-species. Capsules oblong, brown tomentose, 1.8 – 2.0 × 0.6 – 0.8 cm.

*Flowers:* April; *Fruits:* June.

*General distribution:* Mixed forests, evergreen broad-leaved forests, forest margins, thickets, hills, rocky slopes; 2500 – 3200 m. Bhutan, north-east India, Myanmar, Thailand, Vietnam China.

*Distribution in the Park:* Recorded only from Gorkhey

*GPS Location:* 27° 11' 12.5" N and 88° 04' 05.5" E.

*Status in the park:* Vulnerable (VU) [C2a (ii)].

*Specimens examined:* Rai & Lama SNP-R/029, dated 29.03.2010.

***Rhododendron barbatum*** Wallich *ex* G. Don, *Gen. Hist.* 3: 844. 1834; C.B. Clarke in J.D. Hooker, *Fl. Brit. India.* 3: 468. 1882; H. Hara, *Fl. East. Himal.* 237. 1966; 2: 95. 1971; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 83. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 376. 1991. *R. lancifolium* J.D. Hooker, *Rhod. Sikkim Himal. Pl.* 4. 1849.

Local name: *Lal Chimal*

Large shrubs or small trees, 1.5 – 8 m tall; old branches greyish-brown, smooth with papery peeling. Lamina oblong to obovate-oblong, 9.8 – 18 × 3.5 – 5.8 cm; midrib and base setose; petioles 1.2 – 2.2 cm long, glandular-setose or glabrous. Inflorescence umbellate, 10 – 20-flowered. Calyx 5-lobed, 0.7 – 1.5 cm long, glabrous or with hairy base, cupular, persistent. Corolla 5-lobed, tubular-campanulate, 3.1 – 3.6 × 3 – 3.6 cm, deep red to blood-red with 5 deep blackish-red nectar pouches at base. Stamens 10, unequal, 1.3 – 2.1 cm. Ovary cone-shaped, densely short-glandular-hairy; style ca. 1.6 cm long, glabrous; stigma small, reddish. Capsules cylindrical, 2 – 2.4 × 0.7 – 0.9 cm, slightly curved with glandular hairs. Winter buds conical ca. 1.5 × 1 cm, often glandular, sticky; lower scale leaves green with apiculate apex, dark brown.

*Flowers:* May – June; *Fruits:* August – September.

*General Distribution:* Nepal, Darjeeling, Sikkim, Bhutan and south Xizang between 2400 – 3500 m in *Abies* forest.

*Distribution in the Park:* isolated small population in Tumling (along the trek route), Kaiyakatta top and Kalpokhri. Very common from Rimbick fatak till Bikhey, and from Sandkphu till Phalut. The species is common above 3000 m.

*Status in the park:* The species is assessed as Vulnerable (VU) [B1b(ii,iii,v)] globally by Gibbs *et al.* (2011), however, in the park it is common and is evaluated as least concerned (LC).

*Specimens examined:* Rai & Lama SNP-R/005, 017, 020, dated 24.03.2010

*Notes:* Three variations are met; i. normal dendroid hairs in petiole and ventral midrib, ii. Plants without hairs and iii. Plants with dendroid hairs in young stem, petiole and ventral midrib. In some places all three types were present in the same ecological condition.

***Rhododendron fulgens*** J.D. Hooker, *Rhod. Sikkim-Himal.* Pl. 25. 1849; C.B. Clarke in J.D. Hooker, *Fl. Brit. India*, 3: 466. 1882; H. Hara, *Fl. East. Himal.* 239. 1966; 2: 96. 1971; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 108. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 377. 1991.

Local name: *Chimal*

Shrubs, 1.5 – 4 m tall; young shoots and petioles glabrous. Lamina oblong-ovate to obovate, 6 – 11 × 4.5 – 7 cm, abaxial surface densely fulvous woolly, hairs fasciculate, adaxial surface glossy, glabrous. Inflorescence compact racemose-umbellate, 8 – 14-flowered. Calyx red, ca. 1.2 mm long, glabrous. Corolla tubular-campanulate, 2 – 3.5 cm long, 5-lobed, scarlet to blood-red, un-spotted, with 5 dark red nectar pouches at base inside. Stamens unequal, 1.2 – 2 cm long. Ovary conical, 5 mm long, glabrous; style slightly curved upwards, tinted pink, 1.5 – 1.7 cm long, glabrous. Capsules ca. 1.3 × 5 mm, narrowly elongate-cylindric, slightly curved, 5-valved. Winter buds conical, green ca. 1 × 0.6 cm; outer scales often with yellow margins.

*Flowers:* April-May; *Fruits:* August.

*General Distribution:* Nepal, Sikkim, Bhutan, north-east India and south Xizang, China along *Rhododendron* thickets.

*Distribution in the park:* Charhatey, between Sandkphu-Sabargram, between 3500 – 3600 m.

*GPS Location:* 27° 07'51.3" N and 87° 59' 33.9" E. Only few individuals were seen.

*Status in the park:* Critically Endangered (CR) [C2a(i)].

*Specimens examined:* Rai & Lama SNP-R/052, dated 08.05.2010.

***Rhododendron campanulatum*** D. Don, *Mem. Wern. Nat. Hist. Soc.* 3: 410. 1821; C.B. Clarke in J.D. Hooker, *Fl. Brit. India* 3: 466. 1882; H. Hara, in *Fl. East. Himal.* 238. 1966; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 85. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 375. 1991.

Local name: *Nilo Chimal*

Shrubs, 1 – 4.5 m tall; older branches dirty greyish. Lamina broadly elliptic to oblong-elliptic, 5 – 15 × 3 – 6 cm, abaxial surface yellowish, fulvous, rust-brown or rust-yellow, indumentum thin or thickly felted. Inflorescence racemose-umbellate, 8 – 12-flowered. Calyx 1 – 2 mm long, glabrous. Corolla broadly campanulate, 3.5 – 4 cm long, 5-lobed, white to pale rose or lilac to purple, upper interior ± purple-spotted. Stamens 10, unequal. Ovary ca. 7 mm long, glabrous; style ca. 2.8 cm long, glabrous. Capsules yellow, cylindric, strongly curved upwards, 2 – 3 × 0.6 – 0.8 cm. Winter buds ovoid, ca. 1.5 × 1 cm; scales 14 – 18 reddish- brown glandular, tomentose.

*Flowers:* May–June; *Fruits:* July–September.

*General Distribution:* Himalayan region extending from Kashmir, Nepal, Darjeeling, Sikkim, Bhutan, eastern Arunachal Pradesh and south Xizang between 3100 – 4300 m.



432 *Rhododendron* diversity in Singalila National Park

*Distribution in the Park:* Isolated patches in Rimbick fatak, more common along Sandkphu-Phalut ridge from Sandkphu to Sabargram between 3300 – 3500 m.

*Status in the park:* Vulnerable (VU) [A1acd+ 2]. It is common in the higher elevation of the Park but is experiencing threat from unsustainable felling by hoteliers and the security personals stationed there for space heating. Over the past decade many patches of *R. campanulatum* forest at Sandkphu have disappeared.

*Specimens examined:* Rai & Lama SNP-R/009, dated 16.06.2010.

***Rhododendron wallichii*** J.D. Hooker, Rhod. Sikkim-Himal. Pl. 5. 1849; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 466. 1882; Pradhan & Lachungpa, Sikkim Himal. Rhod. 90. 1990; Gierson & Long, Fl. Bhutan 2(1): 376. 1991. *R. campanulatum* D. Don var. *wallichii* Hooker, Bot. Mag. 82: , pl. 4928. 1856. *R. heftii* Davidian, Rhod. Sp., 2 (Ser. Arboreum-Lacteum) 307: 149. 1989.

Local name: *Wallich ko Chimal*

Shrubs, 2 – 5 m tall; older branches smooth reddish-brown, with thin papery peeling. Leaves elliptic to oblong-obovate, 7 – 12 × 2.5 – 5 cm, abaxial surface brown to ferruginous, indumentum granular, discontinuous, hairs fasciculate. Inflorescence racemose-umbellate, 5 – 8-flowered. Calyx lobes 1 – 2 mm long, rounded or triangular. Corolla broadly campanulate, 3.5 – 5 cm long, 5-lobed, lilac-purple, ± deeply rose-spotted. Stamens 10, unequal; filaments pubescent at base. Ovary 5 – 7 mm long, 5 – 6-locular, glabrous, rarely with a few pubescent hairs; style glabrous; stigma lobed, Capsules dark green cylindric, 1.9 – 2.3 × 0.6 – 0.8 cm, slightly curved upwards, ridged. Winter buds ovoid, ca. 9 × 5 mm.

*Flowers:* May – June; *Fruits:* July – September.

*General distribution:* Eastern Nepal, Sikkim, Darjeeling, Bhutan, north-east India and China in mixed forests, mountain slopes; 3000 – 4300 m.

*Distribution in the Park:* Few individuals are found in Rimbick fatak and isolated individuals along Sandkphu-Phalut ridge.

*GPS Location:* 27° 05' 25.0" N and 88° 01' 30.3" E.

*Status in the park:* Critically Endangered (CR) [D].

*Specimen examineds:* Rai & Lama SNP-R/019, dated 25.03.2010.

***Rhododendron falconeri*** J.D. Hooker, Rhod. Sikkim Himal. Pl.10. 1849; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 465. 1882; Pradhan & Lachungpa, Sikkim Himal. Rhod. 95. 1990; Gierson & Long, Fl. Bhutan 2(1): 370. 1990.

Local name: *Pahelo Korlingo*

Medium to large trees, 5 – 15 m tall; bark peeling; branchlets brown tomentose. Lamina broadly elliptic-obovate, 15 – 35 × 7 – 17 cm, abaxial surface thinly red-brown tomentose with long fimbriate cup-shaped hairs; lateral veins 12 – 17 pairs. Inflorescence racemose, sub-globose, 12 – 16 cm across, 15 – 20-flowered. Calyx a minute cup, 1–2 mm long. Corolla fleshy, verticose-campanulate, 4 – 5 cm long, 8 – 10-lobed, white or creamy with purple blotch at base. Stamens 12 – 16, unequal. Ovary densely glandular and thinly to thickly tomentose. Capsules straight, oblong, slightly ridged 3.1 – 4.3 × 1.2 – 1.6 cm, with brown fasciculated hairs. Winter buds conical ca. 2.1 × 1.5 cm; lower scale leaves extending tip enclosing subsequent leaves, scales greenish-brown.

*Flowers:* April – June; *Fruits:* September – December.

*General Distribution:* Nepal, Sikkim, Darjeeling, Bhutan, and Arunachal Pradesh.

*Distribution in the Park:* It is found between 2900 – 3500 m in the temperate and Sub-alpine region. It forms small gregarious forest patches near Tumling (along trek route) and continuously occurs from Kaiyakatta to Sabargram and Molle.

*Status in the park:* The species is common and abundantly found in the district and park from 2900 – 3600 m above sea level. It does not qualify for any of the threat category, we have evaluated it as least concerned (**LC**).

*Specimen examined:* Rai & Lama SNP-R/003, dated 15.06.2010.

***Rhododendron decipiens*** Lacaita in J. Linn. Soc. Bot. 43: 473. 1916; Pradhan & Lachungpa, Sikkim Himal. Rhod. 99. 1990.

Local name: *Jhukaune Korlinga*

Shrubs or small trees, 2.5 – 3 m high, with non-peeling bark. Leaves pendulous, elliptic to oblong-elliptic, 17 – 22 cm broad, abaxial surface silvery-fawn tomentum; lateral nerves prominent, 10 – 23 pairs. Inflorescence 25 – 30-flowered, verticose-campanulate, rose-pink, fading to light almost white lobes. Calyx absent. Corolla ca. 4 × 4.5 cm, broadly 5-lobed; lobes very broad, undulate and having dark crimson blotch at the throat. Stamens 10, unequal in length, glandular at base. Pistils ca. 2.5 cm long, red, terminating in a light green stigma; ovary ca. 1 cm long, 8-celled, tomentose, glandular. Capsules oblong, 3.1 – 4.3 × 1.2 – 1.6 cm, straight. Winter buds conical, ca. 2.1 × 1.5 cm; lower scale leaves completely enclosing subsequent scales, greenish-brown.

*Flowers:* May – June; *Fruits:* July – September.

*General distribution:* Darjeeling, Sikkim

*Distribution in the park:* It is found in Bikhay, Sandkphu-Sabargram route between 3100 – 3400 m. The species shows very sparse distribution in the Park.

*GPS Location:* 27° 05' 36.59" N and 88° 00' 49.04" E.

*Status in the park:* Endangered (**EN**) [B2ab(i, iii & iv)].

*Specimens examined:* Rai & Lama SNP-R/020, dated 15.06.2010.

***Rhododendron hodgsonii*** J.D. Hooker, Rhod. Sikkim Himal. Pl. 15. 1849; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 464. 1882; H. Hara, Fl. East. Himal. 239. 1966; Pradhan & Lachungpa Sikkim Himal. Rhod. 103. 1990; Gierson & Long, Fl. Bhutan 2(1): 371. 1991.

Local name: *Gulabi Korlinga*

Shrubs or small trees, 3 – 7 m tall; branchlets stout, smooth peeling. Leaves oblong-elliptic to oblanceolate, 16 – 30 × 5 – 12 cm, abaxial surface with pale brown, 2-layered indumentum; lateral veins 14 – 16, raised abaxially. Inflorescence 15 – 20-flowered. Calyx 7-lobed, minute; corolla verticose-campanulate, 3.5 – 4 cm, 7 – 8-lobed, pinkish-red or purple, with darker basal blotch. Stamens 15 – 18; filaments glabrous, 2.5 – 3.5 cm long. Ovary conoid, ca. 1 cm, tomentose. Capsules slender, cylindric, 2.1 – 2.8 × 0.7 – 0.9 cm, slightly curved, brown often ridged. Winter buds pyramidal, ca. 2.1 × 1.5 cm, green; lower scale leaves completely enclosing subsequent leaves.

*Flowers:* May – June; *Fruits:* August – September.

434 *Rhododendron* diversity in Singalila National Park

*General distribution:* Nepal, Sikkim, Darjeeling, Bhutan and south China.

*Distribution in the Park:* A small population occurs in Bikhey, Molle and along the Sandkphu-Phalut ridge between 3500 – 4000 m in *Abies* forests.

*Status in the park:* It is common in the upper reaches of the park. But the distribution is narrow. We have assessed the species as Near Threatened (NT).

*Specimen examined:* Rai & Lama SNP-R/022, dated 16.06.2010

***Rhododendron griffithianum*** Wight, Icon. Pl. Ind. Orient. 4: 6, t. 1203. 1848; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 468. 1882; H. Hara, Fl. East. Himal. 239. 1966; Pradhan & Lachungpa, Sikkim Himal. Rhod. 106. 1990; Gierson & Long, Fl. Bhutan 2(1): 386. 1991. *R. aucklandii* J.D. Hooker, Rhod. Sikkim Himal. pl. 11. 1851. *R. griffithianum* var. *aucklandii* (J.D. Hooker) Hooker, Bot. Mag. 84: pl. 5065. 1858. *R. oblongum* Griffith, Icon. Pl. Asiat. pl. 523. 1854.

Local name: *Seto Chimal*

Shrubs or small trees, 2 – 10 m tall; bark smooth greyish-brown, papery. Lamina oblong to oblong-elliptic, 10 – 19 × 4.5 – 12 cm, lateral veins 19 – 24-paired. Inflorescence racemose, 4 or 5-flowered. Flowers fragrant. Calyx saucer-shaped, spreading, 0.7 – 2 cm long, glabrous. Corolla campanulate, white with slight pink tinge, 5.5 – 8 cm long; lobes 5. Stamens 12 – 18. Ovary ovoid, ca. 7 cm long, glandular. Capsules stout, oblong-ovoid, 2.5 – 3.6 × 1.8 – 2.8 cm, with slight furrows. Winter buds green, ovoid, 0.8 – 1.2 × 0.5 – 0.7 cm; bud scales 22 – 26 in number.

*Flowers:* April – May; *Fruits:* July – September.

*General distribution:* Throughout East Nepal, Sikkim, Darjeeling, Bhutan, north India and south China.

*Distribution in the Park:* Gorkhey between 2400 – 2800 m.

*GPS Location:* 27° 11' 40.8" N and 88° 03' 49.6" E.

*Status in the park:* This species is distributed in the mid elevation region throughout the district, but the population is very sparse. The species was observed only in one place inside the park with few individual. We have therefore, accorded the status of Near Threatened (NT) to this species.

*Specimens examined:* Rai & Lama SNP-R/028, dated 08.05.2010.

***Rhododendron grande*** Wight, Calcutta J. Nat. Hist. 8: 176. 1847; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3:464. 1882; H. Hara, Fl. East. Himal. 239. 1966; Pradhan & Lachungpa, Sikkim Himal. Rhod. 110. 1990; Gierson & Long, Fl. Bhutan 2(1): 370. 1991. *R. argenteum* J.D. Hooker, Rhod. Sikkim Himal. Pl. 9. 1849. *R. longifolium* Nuttall, Hooker's J. Bot. Kew Gard. Misc. 5: 366. 1853. *Waldemaria argentea* (J.D. Hooker) Klotzsch, Bot. Ergeb. Waldem. Reise 99. 1862.

Local name: *Patle Korlinga*

Large trees, 8 – 15 m tall; bark greyish-brown leathery. Lamina oblong-lanceolate to oblanceolate, 14 – 30 × 8 – 13 cm; petioles sparsely whitish hairy. Inflorescence in dense racemes, 20 – 25-flowered. Pedicels 2 – 3 cm long, glandular. Calyx teeth 8, 1 – 2 mm long, glandular. Corolla campanulate, 5 – 7 cm long, 8-lobed, pale rose in bud, later white or creamy-white, with purple nectar pouches. Stamens 16, 3.5 – 6 cm long; filaments pubescent at base. Ovary ca. 9 mm long, 16-locular, densely glandular-hairy and tomentose. Capsules oblong-cylindric, 2.5 – 5.6 × 1.2 – 1.8 cm, slightly curved upwards, faintly ridged and furrowed. Winter buds often two or more, ovoid, 1.5 – 2.2 × 1 – 1.5 cm; bud scales 32 – 38 in number.

*Flowers:* March; *Fruits:* August – September.

*General Distribution:* East Nepal, Sikkim, Darjeeling, Bhutan and south-east China.

*Distribution within the Park:* Tumling to Kaiyakatta in the south range and above Gorkhey between 2300 – 2900 m in north range forming associates with *Quercus* sp.

*Status in the park:* The species is common in the district and within the park and as such we have not evaluated.

*Specimen examined:* Rai & Lama SNP-R/009, dated 24.03.2010.

***Rhododendron cinnabarinum*** J.D. Hooker, *Rhod. Sikkim-Himal. Pl.* 8. 1849; C.B. Clarke in J.D. Hooker, *Fl. Brit. India* 3: 474. 1882; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 57. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 382. 1991.

Local name: *Sanu Chimal*

Shrubs, often straggling 1–4 m tall; bark greyish-brown with papery peeling. Leaves narrowly to broadly elliptic or oblong-elliptic, 3 – 6 × 1.5 – 2.5 cm, usually scaly; petioles. Inflorescence terminal, umbellate, 2 – 4-flowered. Calyx discoid or undulate, 1–2 mm long, usually scaly. Corolla tubular to narrowly campanulate, 2.5 – 3.8 cm long, variable in colour, yellow to cinnabar red (sometimes 2-colored); sometimes with scales on abaxial surface. Stamens 10, slightly shorter than corolla; filaments pubescent towards base. Ovary scaly. Capsules oblong-conical, straight, densely scaly, 0.8 - 1 × 0.3 – 0.4 cm. Winter buds ovoid-elliptic, greyish-green, 1.2 – 2.2 × 0.5 – 0.7 cm; bud scales 12 – 14, margins of outer bud scales reddish.

*Flowers:* May; *Fruits:* September.

*General Distribution:* Nepal, Darjeeling, Sikkim, Bhutan, north-east India, Myanmar, south Xizang and north-west Yunnan between 1900 – 4000 m in open woodlands, forest margins, *Rhododendron* thickets, among shrubs.

*Distribution in the Park:* It is found in Tumling, Kalpokhri, Rimbick Fatak, Sandkphu to Sambargram. It occurs along with *R. barbatum*, *R. campanulatum* and *R. thomsonii* with altitudinal distribution ranging from 2900 – 3500 m.

*Status in the park:* The species is found throughout the park but its distribution is sparse therefore, we accorded the status of near threatened (NT).

*Specimens examined:* Rai & Lama SNP-R/007, 018; dated 15.06.2010.

***Rhododendron edgeworthii*** J.D. Hooker, *Rhod. Sikkim-Himal. Pl.* 21. 1849; C.B. Clarke in J.D. Hooker, *Fl. Brit. India* 3: 469. 1882; H. Hara, *Fl. East. Himal.* 96. 1971; Pradhan & Lachungpa, *Sikkim Himal. Rhod.* 30. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 378. 1991.

Local name: *Edgeworth ko Chimal*

Shrubs, often epiphytic, 0.5 – 1.5 m tall. Lamina ovate-elliptic, 4 – 16 × 2 – 6 cm, abaxial surface densely brown or fawn, woolly tomentum, scales dense, very small, pale brown, adaxial surface strongly bullate, glabrous, petioles 0.5 – 2.5 cm long, woolly tomentose. Inflorescence 1 – 3-flowered, fragrant. Calyx red or tinged red, deeply 5-lobed; lobes 1.1 – 1.7 cm long, oblong, ovate or rounded, scales present on margin. Corolla broadly campanulate, 3.4 – 7.5 cm long, white, sometimes flushed pink and with a yellow blotch at base; outer surface scaly. Stamens 10, unequal; filaments densely pilose below. Ovary densely woolly, sparsely scaly; style straight as long as corolla, base scaly and woolly. Capsules cylindrical-ovoid or globose, 1 – 2.2 cm long, scaly, densely woolly.

436 *Rhododendron* diversity in Singalila National Park

*Flowers:* April – June; *Fruits:* November.

*General Distribution:* Bhutan, north India, Myanmar, Sikkim, China between 2000 – 4000 m in dense forests, cliffs, rocks often growing epiphytically.

*Distribution in the Park:* Growing epiphytically in *Lithocarpus pachyphylla* near Gorkhey

*GPS Location:* 27° 11' 55.50" N and 88° 03' 22.78" E.

*Status in the park:* Endangered (EN) [A1cd]. The species is distributed in the mid elevation region in the district and are found to occur in Singalila National Park, Neora Valley Park and Senchal Wildlife Sanctuary. But the population is very small. Moreover, collection of the species for ornamental value it is being exploited.

Specimens examined: *Rai & Lama SNP-R/055*; dated 08.05.2010.

***Rhododendron lepidotum*** Wallich *ex* G. Don, Gen. Hist. 3: 845. 1834; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 471. 1882; H. Hara, Fl. East. Himal. 240. 1966; Pradhan & Lachungpa, Sikkim Himal. Rhod. 65. 1990; Gierson & Long, Fl. Bhutan 2(1): 384. 1991.

Local name: *Bhale Sunpathey*

Small shrubs, evergreen, 0.5 – 2 m tall. Lamina oblong-lanceolate to lanceolate, 1.2–2.4 × 0.4–1.4 cm, scales present on both the surface. Inflorescence 1 – 3-flowered. Calyx reddish; lobes 2–4 mm long, variable in shape, scaly, ciliate. Corolla broadly campanulate, 0.9–1.7 cm long, white, pink, red to purple or yellow, often with darker spots scaly. Stamens 8 – 10, longer than corolla; filaments densely pubescent towards base or for up to two-third of their length. Ovary densely scaly; style sharply deflexed, short, glabrous. Capsules conical, 6 – 8 × 2 – 3 mm, upright with ridges densely scaly and furrows.

*Flowers:* May – July; *Fruits:* July – September.

*General Distribution:* Nepal, Darjeeling, Sikkim, Bhutan, north-east India, west Sichuan, south Xizang and north-west Yunnan between 3000 – 3600 m in forests, scrub, grassy slopes, moorlands, rocks.

*Distribution in the Park:* The species is common above 3000 m generally occurring in open and exposed places. It is found in Kalpokhri, Bikhey, Sandkphu, Sabargram.

*Status in the park:* Common in the upper elevation forming mat thus the species is not evaluated.

Specimens examined: *Rai & Lama SNP-R/009*, dated 16.06.2010.

***Rhododendron dalhousiae*** J.D. Hooker, Rhod. Sikkim-Himal. Pl. 1, 2. 1849; C.B. Clarke in J.D. Hooker, Fl. Brit India 3: 469. 1882; Hara, Fl. East. Himal. 238. 1966; Pradhan & Lachungpa, Sikkim Himal. Rhod. 40. 1990; Gierson & Long, Fl. Bhutan 2(1): 379. 1991.

Local name: *Laharey Chimal*

Shrubs, often epiphytic, ca. 2 m tall; young branches scaly, otherwise glabrous or sparsely ciliate. Leaves oblong or oblanceolate, 9–11 × 3–4 cm, scales glandular, reddish-brown. Inflorescence 2 – 3-flowered, fragrant. Calyx lobes ca. 1.1 cm long, oblong-elliptic, persistent in fruit, scaly at base. Corolla pale yellow, or greenish-yellow, 8 – 10.5 cm long. Stamens 10; filaments hairy; anthers ca. 1.2 cm long, brown. Ovary 5-locular, densely scaly; style sparsely scaly below. Capsules oblong, tapering towards tip 4.2 – 4.5 × 1.2 – 1.5 cm with 5 distinct furrows representing locule, reddish when mature. Winter buds green, ovoid, 0.8 – 1.2 × 0.5 – 0.7 cm; bud scales ranges from 22 – 26 in number.

*Flowers:* May – June; *Fruits:* August – November.

*General Distribution:* East Nepal, Darjeeling, Sikkim, Bhutan, and China between 1500 – 2600 m in secondary mixed forest margins, hillsides, crevices on slopes.

*Distribution in the Park:* They are found epiphytically growing on trees and rocks. The species is recorded in Gairibans, Old jeepable road and Gorkhey.

*GPS Location:* 27° 11' 11.8" N and 88° 04' 05.7" E.

*Status in the park:* Common in lower elevation, but very rare in the park. Because of its common occurrence in the lower elevation it is not evaluated

*Specimens examined:* Rai & Lama SNP-R/030, dated 24.03.2010.

***Rhododendron lindleyi*** Moore, Gard. Chron. 1864: 364. 1864; Pradhan & Lachungpa, Sikkim Himal. Rhod. 42. 1990; Gierson & Long, Fl. Bhutan 2(1): 380. 1991. *Rhododendron bhotanicum* C.B. Clarke in J.D. Hooker, Fl. Brit. India 3(9): 475. 1882.

Local name: *Sano Laharey Chimal*

Shrubs, often epiphytic, 1.5 – 3 m tall, sparsely branched; young shoots scaly. Lamina narrowly elliptic, 6 – 15 × 1.5 – 5.5 cm with scattered red scales of variable size on adaxial surface of leaf. Inflorescence terminal, umbellate, 2 – 3-flowered, pedicels brownish- red scaly. Calyx lobes 1 – 1.5 cm long, oblong with ciliate margins, scaly at base. Corolla broadly tubular-campanulate, white, 7 – 9 cm long, outer surface scaly at base. Stamens 10; filaments pubescent in the lower part. Ovary 5-locular, densely reddish brown scaly; style base scaly; Capsules ca. 5 cm long, not keeled.

*Flowers:* April – May; *Fruits:* August – September.

*General Distribution:* East Nepal, Darjeeling, Sikkim, Bhutan, Myanmar and south Xizang; sometimes growing epiphytically between 1600 – 2900 m.

*Distribution in the Park:* Gairibans on the way to Phokte village.

*GPS Location:* 27° 02' 58.7" N and 88° 01' 56.4" E.

*Status in the park:* Vulnerable (VU) [D2]. The species has a very sparse distribution in the lower elevation of the district also. In the park it occurs only in one place.

*Specimens examined:* Rai & Lama SNP-R/051, dated 24.03.2010.

***Rhododendron triflorum*** J.D. Hooker, Rhod. Sikkim-Himal. Pl. 19. 1849; C.B. Clarke in J.D. Hooker, Fl. Brit. India 3: 474. 1882; H. Hara, Fl. East. Himal. 240. 1966; Pradhan & Lachungpa, Sikkim Himal. Rhod. 45. 1990; Gierson & Long, Fl. Bhutan 2(1): 380. 1991.

Local name: *Pahela Chimal*

Shrubs or rarely small trees 1–4 m tall. Lamina ovate-lanceolate, or oblong-lanceolate, 2.5 – 6.5 × 1.5 – 2.5 cm, with scales on the abaxial surface, petioles scaly. Inflorescence in terminal racemes, 2 – 5-flowered. Calyx triangular, obscurely 5-lobed, rounded, ca. 1 mm long, densely scaly. Corolla broadly campanulate, zygomorphic, pale yellow, sometimes with lobes tinged pink, inside with brown spots, 2 – 3.3 cm long, outer surface scaly. Stamens 10 unequal, 1.2 – 2.8 cm long, longer than corolla; filaments villous. Ovary 5-locular, densely scaly; style long, glabrous. Capsules narrowly cylindrical, 6 – 9 × 3 – 4 mm, 5-lobed. Winter buds elliptic- lanceolate, 6 – 9 × 2 – 4 mm; tip of outer bud scales reddish.



438 *Rhododendron* diversity in Singalila National Park

*Flowers:* May – June; *Fruits:* July – August

*General Distribution:* Nepal, Darjeeling, Sikkim, Bhutan, Assam, Arunachal Pradesh, Burma, south Xizang and Yunnan in China. It is found to grow between 2500 – 3700 m.

*Distribution in the Park:* The species shows a very scattered distribution occurring in open forest areas between 2400 – 3000 m. They are particularly seen in the route between Kaiyakatta to Kalpokhri.

*Status in the park:* Vulnerable (VU) [D2].

*Specimens examined:* Rai & Lama SNP-R/006, dated 16.05.2010.

***Rhododendron vaccinioides*** J.D. Hooker, *Rhod. Sikkim Himal.* Pl. 3. 1849; C.B. Clarke in J.D. Hooker, *Fl. Brit. India* 3: 464. 1882; H. Hara, *Fl. East. Himal.* 240. 1966; Pradhan & Lachungpa, *Sikkim Himal. Rrhod.* 26. 1990; Gierson & Long, *Fl. Bhutan* 2(1): 386. 1991. *R. sinovaccinioides* I. B. Balfour & Forrest, *Notes Roy. Bot. Gard. Edinburgh* 13(65): 295 – 297. 1922.

Local name: *Khainue pate gurans*

Dwarf shrubs, sometimes epiphytic or lithophytic often pendulous, 0.3 – 1 m tall; branches sparse, young shoots densely papillate-glandular. Lamina clustered towards the branch ends, spatulate-oblongate, 1.3 – 2 × 0.5 – 0.8 cm with scales; lateral veins inconspicuous on both surfaces, petioles scaly. Inflorescence terminal, umbellate, 1 or 2 flowered. Calyx deeply lobed, 5, ca. 3 mm long. Corolla rotate-campanulate, 5-lobed, creamy white or white tinged with pale red, 4 – 6 mm long. Stamens 10, unequal, as long as corolla, exerted; filaments densely villous in lower two-third. Ovary 5-locular, densely scaly; style stout, erect or arched, shorter than corolla and stamen. Capsules linear-cylindric, curved, 1.4 – 2.5 cm long, with pale membranous margins, splitting and reflexing to base.

*Flowers:* May – June; *Fruits:* July.

*General Distribution:* Nepal, Darjeeling, Sikkim, Bhutan, north-east India, south-east Xizang, and Yunnan.

*Distribution in the Park:* The species is distributed from 1800 – 2700 m. It is found to grow in moist shady places along the fringe of forest floor. The species was only recorded near Gorkhey.

*GPS Location:* 27° 11' 11.8" N and 88° 04' 05.7" E.

*Status in the park:* NT. The species is found in the lower elevation albeit sparse distribution in Senchal Wildlife Sanctuary and reserve forests. It was observed in only one place in the Park. We assessed the species as near threatened.

*Specimens examined:* Rai & Lama SNP-R/030; dated 16.06.2010.

## DISCUSSION

From the present survey for *Rhododendrons* in Singalila National Park in the year 2010, 19 taxa of species and infra-specific rank was recorded out of 95 taxa occurring in India. This accounts for 18 % *Rhododendron* species in India. These 19 taxa are distributed under 3 sections and 2 subgenera. While 10 species are belonging to the section *Ponticum* of subgenus *Hymenanthes*, other 6 species belongs to the section *Rhododendron* and one species to the section *Vireya* under the subgenus *Rhododendron*. Present finding is more than those reported by Gierson & Long (1991; 17 taxa), while Pradhan & Lachungpa (1990) recorded

15 taxa; Sastry (2010) recorded 13 taxa. C.B. Clarke (1882) and J.D. Hooker (1849) recorded 6 and 5 species respectively from Darjeeling Hills.

The 19 taxa found in Darjeeling Himalaya of West Bengal were evaluated for its threatened status following IUCN Red List Categories and Criteria version 3.1 (IUCN 2001). Of these *R. fulgens* and *R. wallichii* are evaluated as Critically Endangered (CR), *R. edgeworthii* and *R. dicepiens* as Endangered (EN) and *R. lindleyi*, *R. triflorum*, *R. campanulatum* and *R. arboreum* subsp *delavayi* as Vulnerable (VU). While *R. hodgsonii*, *R. vaccinioides*, *R. cinnabarinum* and *R. griffithianum* were evaluated as Near Threatened (NT). Rest as least concerned (LC) as they are common and abundant throughout the Hills.

During the survey we also came across a very rare white form of *R. arboreum* subsp *cinnamomeum* hitherto unknown previously with three individuals recorded at two locations. *R. arboreum* subsp *delavayi* has been recorded from Darjeeling Hills for the first time which is localized only in one place with a small population. Morphometric variations within some species like *R. arboreum*, *R. lepidotum*, *R. campanulatum*, *R. cinnabarinum* and *R. grande* suggests that the forces of evolution in Darjeeling area is active in the genus as well as in the flora/vegetation in the region (Das 1995, 2004). Conservation of 8 threatened taxa requires immediate attention. Propagation through seeds and vegetative method and their reintroduction in their natural range of distribution will help in augmenting population structure. Attention must also be given to the taxa those are evaluated as Near Threatened (NT) too!

#### LITERATURE CITED

- Chamberlain, D.F.; Hyam, R.; Argent, G.; Fairweather, G. & Walter, K.S. 1996. *The genus Rhododendron, its classification and synonymy*. Royal Botanic Garden, Edinburgh. Pp. 184.
- Clarke, C.B. 1882. *Rhododendron*, in J.D. Hooker (ed.) *Flora of British India*. Vol. 3: 419 – 481. L. Reeve & Co., Ashford, Kent, London.
- Das, A.P. 1995. Diversity of the angiospermic flora of Darjeeling Hills. In *Taxonomy and Biodiversity*, ed. A.K. Pandey. 118 – 127. CBS, New Delhi.
- Das, A.P. 2004. Floristic studies in Darjiling hills. *Bull. Bot. Surv. India*. 43(1-4): 1 – 18.
- Fang, M.; Fang, R.; Fang, R.; He, M.; Hu, L.; Yang, H. & Chamberlain, D.F. 2005. Ericaceae. In: Wu, Z.Y.; P.H. Raven & D.Y. Hong (eds.), *Flora of China*. Vol. 14 (*Apiaceae* through *Ericaceae*). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis. Pp. 260 – 517.
- Grierson, A.J.C & Long, D.G. 1991. *Flora of Bhutan*. Vol. 2 Part 1. Royal Botanic Gardens, Edinburgh. Pp. 432.
- Hooker, J.D. 1849. *The Rhododendrons of Sikkim-Himalayas*. L. Reeve & Co., Asford, Kent, London.
- Irving, E. & Hebda, R. 1993. Concerning the Origin and Distribution of Rhododendrons. *J. Amer. Rhod. Soc.* 47(3): 139.
- IUCN 2001. *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. doi 1038/38873
- Jussila, O.; Theqvist, K. & Vainola A. 2010. Finnish experience on Himalayan rhododendrons: climate response. In: A. Mainra, H.K. Badola & B. Mohanty (eds.), *Pro. Int. Con. on Rhododendrons: Conservation and Sustainable Use*. Forest Environment & Wildlife Management Department, Govt. of Sikkim, Gangtok, Sikkim, India. Pp. 42 – 47.

440 *Rhododendron* diversity in Singalila National Park

- Paul, A.; Khan, M.L.; Arunachalam, A. & Arunachalam, K. 2005. Biodiversity and Conservation of rhododendrons in Arunachal Pradesh in the Indo-Burma Biodiversity Hotspot. *Curr. Sci.*, 89(4): 623 – 634.
- Pradhan, U.C. & Lachungpa, S.T. 1990. *Sikkim-Himalayan Rhododendron*. Primulaceae Books, Kalimpong, Darjeeling. Pp. 130.
- Pradhan, K. 2010. *Handbook - Rhododendron of Sikkim*. Logical, Kolkata. Pp. 143.
- Sastry, A.R.K. 2010. Diversity, distribution and conservation of Indian Rhododendrons. In: A. Mainra, H.K. Badola & B. Mohanty (eds.). *Proc. Int. Con. on Rhododendrons: Conservation and Sustainable Use*. Forest Environment & Wildlife Management Department, Govt. of Sikkim, Gangtok, Sikkim, India. Pp. 36 – 41.
- Sastry, A.R.K. & Hajra, P.K. 2010. *Rhododendrons in India: Floral and Foliar Splendour of the Himalayan Flora*. BS Publications/BSP Books. Pp.182.
- Singh, K.K. 2009. Notes on Sikkim Himalayan rhododendrons: a taxa of great conservation importance. *Turk. J. Bot.*, 33: 305 – 310.
- Singh, K.K.; Kumar, S.; Rai, L.K. & Krishna A.P. 2003. Rhododendron conservation in Sikkim Himalaya. *Curr. Sci.* 85(5): 602 – 606.
- Spethmann, W.; Michaelis, G. & Schepker H. 2010. Rhododendrons in Germany and the Rhododendron gene bank. In: A. Mainra, H.K. Badola & B. Mohanty (eds.). Some aspects, *Proc. Int. Con. on Rhododendrons: Conservation and Sustainable Use*. Forest Environment & Wildlife Management Department, Govt. of Sikkim, Gangtok, Sikkim, India. Pp. 31 – 35.

