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RHODODENDRONS IN UTTARAKHAND: DIVERSITY AND CONSERVATION

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Abstract

Rhododendron is a very widely distributed genus, occurring throughout most of the Northern Hemisphere except for dry areas, and extending into the Southern Hemisphere in southeastern Asia and northern Asia with 1200 species. In India, *Rhododendrons* are represented by 80 species with 10 subspecies and 14 varieties most of which are widely distributed in the Himalayas at an altitude ranging from 1500 – 5500 m. During the course of a revisionary study of *Rhododendrons* in Uttarakhand, an attempt has been made to collect information on the uses of different species from the field through personal communications with the inhabitants of the remote villages and through repeated inquiries from local folk. Besides of its immense horticultural importance, about 6 species have been recorded here which are used by the local people in different ways. Some species are also found poisonous. The paper deals with the enumeration of these species, their vernacular names, distribution and abundance, uses and methods of utilization. Natural calamities anthropogenic activities such as deforestation, unsustainable extraction for firewood pose a serious threat to *Rhododendrons*.

Keywords: Rhododendron, Flowering, Capsule, Temperate, Himalaya

Introduction

The term *'Rhododendron'* comes from the Greek word 'rhodo' meaning 'rose' and 'dendron' meaning 'tree', in combination 'rose tree' (Hora, 1981). The genus *Rhododendron* is an ecologically and economically important group of plants that occur in temperate forests. *Rhododendron* is a relatively primitive group of flowering plants that have flourished in the temperate zones of the northern hemisphere for almost 100 million years (de Milleville, 2002). Towards the equator, this genus is mainly distributed at higher altitudes, and today some species have significant ecological and economic importance (Mao *et al*., 2001). Species height range from 2.5 cm (1 inch) alpine plants to 30 m (98 feet) tall trees and are either evergreen, semi-deciduous or deciduous (Hora, 1981).

The aesthetic values of *Rhododendrons* are significant and it is recognized regional flower in the American States of Washington (*Rhododendron macrophyllum*) and West Virginia (*Rhododendron maximum*) and in Japan's Shiga Prefecture (*Rhododendron metternichii* var. *hondoense*), and *Rhododendron arboreum* is Nepal's national flower and is depicted on its coat of arms (de Milleville, 2002). In India, *Rhododendron* is the state flower of Himachal Pradesh (*Rhododendron campanulatum*) and Nagaland (*Rhododendron arboreum*) and is the state tree of both Sikkim (*Rhododendron niveum*) and Uttarakhand (*Rhododendron arboreum*, Kant, 2004; Joshi and Sharma, 2005).

Due to human interference natural calamities, the natural populations of *Rhododendrons* in Uttarakhand and in the entire Himalaya are gradually diminishing. The major threats to *Rhododendrons* are deforestation, unsustainable extraction for firewood, natural calamities like (Landslides and flash floods) and incense by local people. So, the present task of diversity and conservation status of *Rhododendrons* of Uttarakhand has made to know the distribution and status in Uttarakhand.

Methodology

Uttarakhand the 27^{th} state of the Republic of India lies between 28^{o} 44' & 31^{o} 28' N Latitude and 77^{o}35' & 81^{o} 01' East longitude, the altitudinal variation of the state is from 300 to 7000 meters above sea level. Total geographical area of 53,484 km^2 is 1.6% of the total area of the country's geographical area, out of which 46,035 km^2 is hilly. Uttarakhand has forest cover of 45.32% of the total geographical area of the state (FSI, 2015). Out of the total

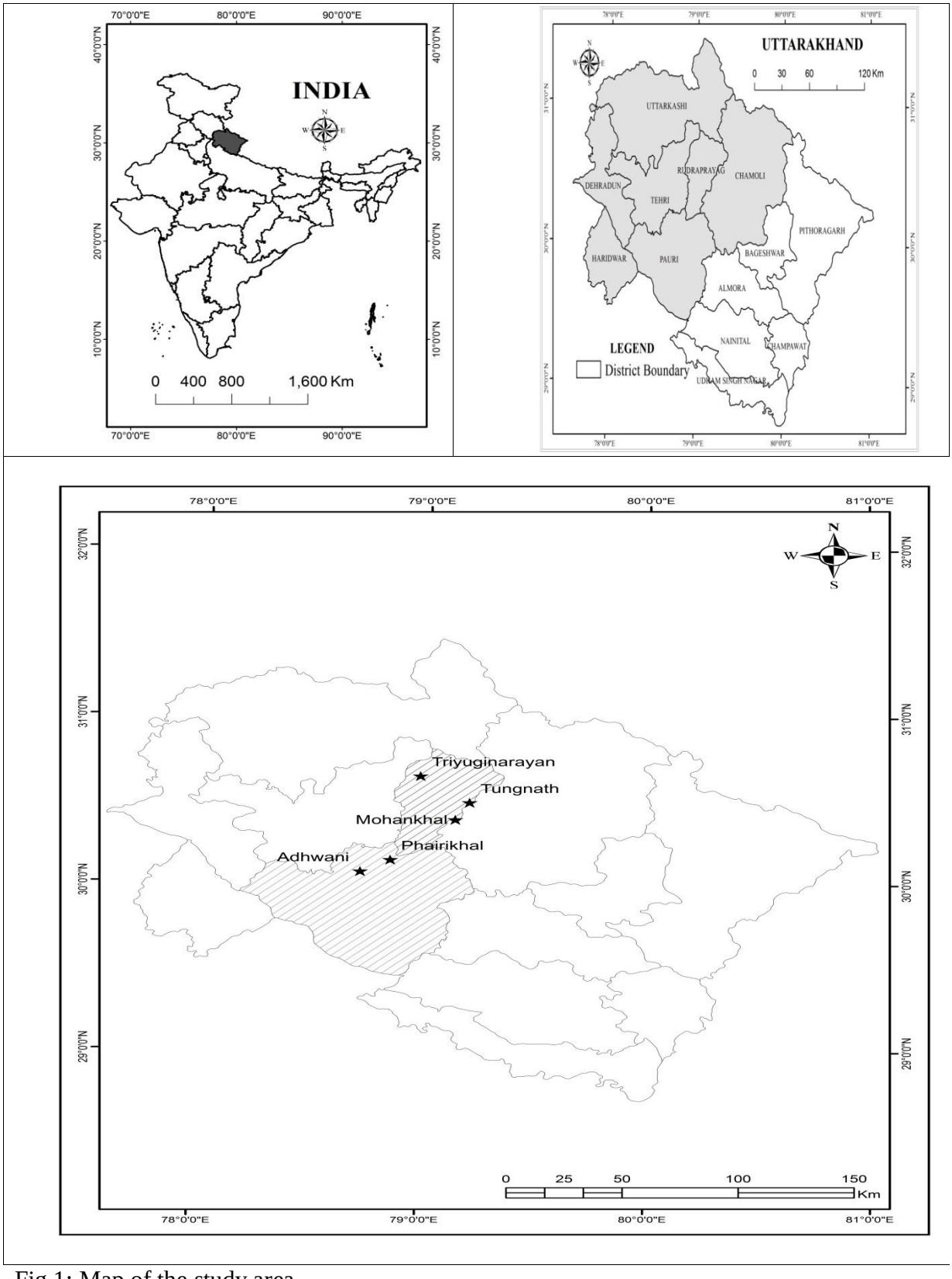

Fig 1: Map of the study area

geographical area of the state, about 19% are under permanent snow cover, glaciers and steep slopes where tree growth is not possible due to climatic and physical limitations (FSI, 2009). The natural vegetation of the forests is divided into five zones (i) Sub-montane zone (up to 1500 m) (ii) temperate-zone (from about 1500 to 3400 m) and (iii) Alpine zone (3400 to 4600 m). During the course of a revisionary study of *Rhododendrons* in Uttarakhand, observations on the uses of *Rhododendron* species were recorded from the field trips through personal communications with the local inhabitants where *Rhododendron* species are distributed. Data collection was done from five sites (Adhwani, Phairikhal, Mohankhal, Triyuginarayan, and Tungnath, Fig: 1), Information on vernacular names, uses, and method of utilization were gathered through repeated inquiries from local folk. A comprehensive literature survey was done for threat categorization; for that, we consulted different published scientific papers, monographs, red-list documents, IUCN list, etc. All the taxa with altitudinal distribution in Uttarakhand and other states of Himalayan region have been listed in the result section.

Results and Discussion

Rhododendron has the greatest number of species of all genera in the family Ericaceae, with more than 1200, known to occur throughout the world stretching from the highlands of Nepal, India and China (east of Yunnan and Sichaan) and Malaysia (Leach, 1961**;** Chamberlain *et al*.,1996, Rotherham, 1983). The genus *Rhododendron* is represented by 87 species, 12 subspecies and 8 varieties of *Rhododendrons* in Indian Himalayan Region (IHR) in India (Chandra Sekar and Srivastava 2010). Among 87 species, Western Himalaya has 6 species, namely *Rhododendron anthopogon, R. arboreum, R. barbatum, R. campanulatum, R. lepidotum* and *R. nivale*; while Eastern Himalaya is represented by all other species. The maximum concentration of species is observed in Arunachal Pradesh (86%). Out of 87 species known from IHR, 75 species occur in the state of Arunachal Pradesh alone. Uttarakhand is situated in the lap of Western Himalaya famous for its rich heritage, culture, biodiversity, flora, and fauna. *Rhododendron*s are mainly found at higher altitude, from dominating species all along the cool temperate, subalpine and alpine zones.

Rhododendrons, in general, prefer to grow in regions of high rainfall, high humidity, and a temperate climate, also having a preference for acidic soils.

History of *Rhododendrons* in world and in India

The first record of a *Rhododendron* in cultivation in Britain is of *R. hirsutum*in 1650. The rampant *R. ponticum*, primarily from the Pontus Mountains and the Black Sea region, is also a native of Portugal and southern Spain. From Siberia came *R. dauricum* in 1780 and *R. chrysanthum* in 1796. *R. luteum* was introduced from the Caucasus in 1792 and *R. caucasicum* in 1803. *R. camtschaticum* came from Kamtschatka in 1799 and grows on both sides of the Bering Straits (Magor, 2008). *Rhododendron arboreum* was first species discovered and identified by specialist near Srinagar in 1796 (de Milleville, 2002), but there is no authentic record of its introduction before 1817. *R. campanulatum* from Nepal followed in 1825, *R. barbatum* in 1829 and *R. formosum* from Assam in 1843 (Magor, 2008). Pioneer botanist Joseph D. Hooker (1817- 1911) undertook a trip to Nepal but he could not see any *Rhododendron* blooming and continued his exploration in Northern India. He made an extensive tour of the Sandakphur region and the Singalila range to the northwest of Darjeeling. His famous work, "The *Rhododendrons* of the Sikkim-Himalaya," (1849) is considered as the standard test for the study of Himalayan *Rhododendron*.

Distribution of *Rhododendrons*

In consideration of many aspects of *Rhododendron*, the geographical distribution of the genus the large aggregation of species in the great clefts and gorges of W. China, N.E. Burma, and S.W. Tibet. The genus extends broadly in three directions. Firstly, the least vigorous extension extends westward through the Himalaya and the Caucasus to the Alps of Europe, giving us such well-known species as *R. ponticum*, *R. caucasicum*, *R. ferrugineum*, and *R. hirsutum*. Secondly, we have an extension eastwards through east and N.E. Asia across to N. America, and thirdly, and at the present time most pertinently, the extension South - a vigorous generic probe terminating with *R. lochiae* in Queensland and with *R. subpacificum* and other species in the Solomons (Black, 2008). The genus *Rhododendron* includes 850 species mainly in the northern hemisphere (Mabberley, 1997). *Rhododendrons* are found in a number of humid and cool regions across the northern hemisphere. These

plants generally do not grow in low altitudes, preferring mountainous areas that have a temperate climate, although there are some that do flourish in alpine conditions. The rhododendrons are best suited to elevation between 2000- 4000m that extends from eastern Nepal to Yunnan (de Milleville, 2002). The distribution of *Rhododendron* as natural habitat is found in India, China, Japan, Burma, Malaysia, Borneo, Sumatra, Java and New Guinea, Britain, Bhutan, Europe. All the six species of rhododendron distributed in Uttarakhand and other states of Himalayas have not been yet evaluated for their status so, a thorough study is needed to know the status of these keystone species in Uttarakhand and other states of Himalaya.

Table 1: Distribution of *Rhododendron* in Uttarakhand, India and in IHR

Name of the taxa	Distribution		Status
	India	Other region	
R. arboreum Smith	AP, HP, JK, UK, MN, MG, MZ, NG, SK, WB	Bhutan, Myanmar, Nepal, Sri Lanka, Pakistan, Tibet	NE
R. anthopogon D. Don subsp. *hypenanthum* (Balf. f.) J. Cullen	AP, HP, JK, SK, UK	Bhutan, Nepal	NE
R. barbatum G. Don	AP, SK, UK, WB	Bhutan, China, Nepal	NE
R. campanulatum D. Don	AP, HP, JK, SK, UK, WB	Bhutan, Nepal	NE
R. nivale Hook. f.	SK, UK Bhutan,	China, Nepal	NE
R. lepidotum Wall. ex D. Don	AP, JK, HP, SK, UK	Bhutan, China, Myanmar, Nepal, Pakistan	NE

AP – Arunachal Pradesh; HP – Himachal Pradesh; JK-Jammu & Kashmir; MG – Meghalaya; MN – Manipur; MZ- Mizoram; NE – Not Evaluated; NG – Nagaland; SK – Sikkim; UK – Uttarakhand; WB – West Bengal

***Rhododendron* in Uttarakhand and their uses**

Rhododendron arboreum

Amongst the Indian species, *Rhododendron arboreum* Smith (Ericaceae) is the most widely distributed and occur from the western to the eastern Himalayan region of India and other neighboring countries. *Rhododendron arboreum* is the state tree of Uttarakhand. It is called Burans, "Bras' and 'Buras' in the local dialect. *Rhododendron arboreum* holds the Guinness Record for World Largest *Rhododendron* and is widely popular for its medicinal benefits & economic value (Srivastava, 2012). In Uttarakhand, it is widely popular for processed juice of its flowers which have gained market popularity as Rhodojuice/Sharbat. It is a small evergreen tree often with a somewhat crooked trunk. Bark soft, easily cut through with a pocket knife, 0.5-1 inch thick, old bark grey, exfoliating in irregular longitudinal plates, exposing the smooth pinkish new bark beneath. The wood is of inferior quality, both as timber and as fuel.

Distribution and habitat: - This is a common tree in western Himalaya, occurring chiefly at 2500 - 2800 meter in association with *Quercus leucotricophora* and *Lyonia ovalifolia*, and at the lower elevations with *Pinus roxburghii*, but ascending to 3400 mt. or even higher. It is somewhat rare in hazara, being commonest in the Siran *Pinus longifolia* forests at 1400 meters and upwards in moist ravines. It extends to the eastern Himalaya, where, it is less common; it is also found in the Khasi hills and the hills of Burma, southern India, and Ceylon.

Flowering and Fruiting: -The large showy crimson, sometimes pink, flowers in dense corymbs appear usually from March to May, but in certain years only partial flowering takes place then, and a second flowering takes place in June and July; this happened in the Shimla hills in 1916, following an exceptional dry winter and spring, and the flowers of the second bloom were paler in colour than usual. Similar late flowering is also said to take place if the first bloom is checked by hail or other elated injuries. Occasionally trees may be seen in flower in January- February. The fertilization of the flowers is carried out partly by insects. Mr. G.B.F Muir notes on interesting case observed in Tehri Garhwal of Indian martens (*Martes flavigula*) visiting one cluster of flowers after another and thrusting their noses into

the flowers to lick up the nectar; fertilization is thus carried out by their agency, and possibly birds may also be agents in cross-fertilization.

The capsules are 2 to 3 cm long by 1 to 1.5 cm in diameter, oblong, curved, greenish brown when ripening, and then turning brown. They contain a large number of minute dark brown compressed oblong seeds about 0.05 in. long, with a fimbriate tuft at either end. The capsules open and shed their seeds chiefly from January and March (western Himalaya). The open capsules, as a rule, remain many months on the tree.

Plate 1: *Rhododendron arboreum* in Phairikhal

R. barbatum

An evergreen tree, up to 15m.in ht.; found in the Himalayas from Kumaun to Bhutan, extending into the Aka hills and Balipara tract of Assam, at altitudes of 2,100-4,000 m. Bark purple red, smooth, peeling off in large flakes; leaves elliptic – lanceolate or oblong, 10-20cm. x 4-7cm.; young leaves woolly underneath.

Distribution and habitat: - It is native over much of the Himalayan Range, from Uttarakhand in the west, through Nepal, Sikkim & Bhutan to western Arunachal Pradesh, India in the east with populations in adjacent areas of S Tibet. This species is quite common

in the wild, sometimes occurring as solid stands in forest openings but more commonly seen as scattered individuals in coniferous and mixed forests. It is found from 8,000 to 12,000 feet (2,400 to 3,700m) in elevation and typically grows as a large upright shrub or small tree.

Flowering and Fruiting: Flowers fleshy, deep crimson or deep red, in many-flowered heads; Inflorescence densely umbellate, 10–20-flowered; rachis ca. 5 mm, glabrous. Pedicel 0.5–1.3 cm, glabrous; calyx green flushed red, cupular; lobes 5, 7–15 mm, broadly ovate or obovate-oblong, glabrous or with base hairy; margin erose; corolla tubular-campanulate, fleshy, deep red to blood-red, 3.1–3.6 × 3–3.6 cm, with 5 deep blackish red nectar pouches at base, glabrous; lobes 5, ± rounded, ca. 1.8 × 1.6–1.8 cm, apex deeply emarginate; stamens 10, unequal, 1.3–2.1 cm, filaments white, glabrous, anthers sub - elliptic, purplish black, 1.6–2 mm; ovary cone-shaped, ca. 5 mm, densely short-glandular-hairy; style ca. 1.6 cm, glabrous; stigma small, reddish, ca. 1.8 mm wide. Capsule cylindrical, ribs obvious, slightly curved, 20–24 mm, with vestigial glandular hairs; calyx persistent; style persistent. Flowering: March-April, from Aug–Sep.

R. Campanulatum

It is commonly called as Chimura, simris in Garhwal region and in Hindi it is pronounced as Cherailu. An evergreen shrub or a small tree having height of 3 to 5 meter and girth up to 90 cm. Bark thin, cinnamon-colored or grey, smooth, peeling off in thin, papery flakes; leaves elliptic or ovate, leathery, 7-15 cm x 3-6 cm. undersurface with rusty-brown tomentum.

Distribution and Habitat:-*Rhododendron campanulatum*speciesaeruginosum is a wild species rhododendron found in the Himalayan alpine regions of Northern India (Uttarakhand) and Northeastern India (Sikkim), Bhutan, and Nepal. It grows on the stony alpine slopes and ledges at altitudes of 3200 to 3400 meters. This species generally form a bridge between timberline and alpine zone (meadows) known as ecotone.

Flowering and Fruiting:-*Rhododendron* flowers grow in large trusses, or clusters, which can be up to 10 inches across. Each flower is shaped like a small bell about 3 to 5 cm long. They bloom from spring to early summer, and may be pink, white, red, purple, yellow, orange, or various shades of each. Inflorescence racemose-umbellate, 8–12-flowered; rachis 20–30 mm. Pedicel 1.5–3.5 cm, glabrous; calyx 1–2 mm, glabrous; corolla broadly

campanulate, white to pale rose or lilac to purple, upper interior ± purple-spotted, 3.5–4 cm, lobes 5; stamens 10, unequal, filaments pubescent at base; ovary ca. 7 mm, glabrous; style ca. 2.8 cm, glabrous, stigma slightly lobulated. Capsule slightly curved 20–30 × 4–5 mm. Flowering: May–Jun, from Jul–Sep.

Plate 2: *R. Campanulatum* in Tungnath

R. anthopogon

R. anthopogon is locally called as Konthya or Dhoop and its height is up to 40 cm. found in bushes habitat. It has a little yellow flower and indicates as a threatened medicinal herb. The leaves of which are used for essence in religious ceremonies by Buddhists all over its distribution range in Himalaya. The leaf of *R. anthopogon* is also used in tea. The leaves are reported to possess stimulant properties. The plant yields incense. The associate of *R. anthopogon* is dwarf shrubs *Berberis kumaonsis, Juniperus communis, R. lapidotum* and *Lonicera obovata*.

Distribution and habitat: - This is a common shrub in western Himalaya Alpine and meadows eco-region occurring chiefly at 3800 meters in association with other species of *Rhododendron lapidotum*. It is native to the Himalaya from Bhutan to Central Nepal. In India, it mainly found on moist open slopes, hillsides, and ledges of cliffs of Uttarakhand and Sikkim.

Flowering and Fruiting: It is known for its brilliant blossoming that covers hillsides. Inflorescence 4–6 (–9) flowered. Pedicel 0.2–0.4 cm, scaly; calyx lobes 3–5(–6) mm, elliptic or oblong, persisting to enclose mature capsule, scaly, margin densely ciliate; corolla narrowly tubular-funnel form, pink, or yellowish white, tube 6–12 mm, outer surface not scaly; inner surface densely pilose; lobes spreading, 1.2–2 cm; stamens 6–8 mm, included in corolla tube, filaments glabrous; ovary ca. 1 mm, scaly; style short, thick, straight, as long as ovary, glabrous. Capsule ovoid, 3–5 mm, scaly, Flowering: May-Jun, fr. Jul–Aug.

R. anthopogon in Tungnath

R. lapidotum:-

*R. lapidotum*is growing up to 3800-4500 m and prefer ridges for growing. It occurs a height up to 35 cm. just less than *R. anthopogon*. *R. lapidotum*was commonly observed with pink flowers along open mass covered rocky stone. However, this species has a wide distribution from Pakistan and across Western and Central Himalaya to Southwest China between 2,500-4,500 m where it prefers rocky and stony grassy slopes. The *R. lapidotum* is most dominant in Kedarnath Wild Life Sanctuary in Tungnath.

Table 2: Uses of *Rhododendron* Species

General uses		
Uses	Species	Parts used
Fuel wood	*Rhododendron arboreum* Sm. *R. barbatum* Wall. ex G. Don *R. campanulatum* D. Don	Main stem and branches
Preparation of Jams, jellies and Juice	*Rhododendron arboreum* Sm.	Fresh corolla
Making of cups, spoons, boxes, saddles, kukri handles	*Rhododendron arboreum* Sm.	Wood
Snuff		Powdered bark
In worship		Flowers
Decoration of hair bun		Inflorescence truss
In Indoor decoration	*Rhododendron arboreum* Sm. *R. campanulatum* D. Don	Inflorescence truss
Incense; used along with Junipers	*R. anthopogon* D. Don	Leaves and twigs
Medicinal uses		
In treatment of diarrhoea and dysentery	*Rhododendron arboreum* Sm.	Fresh flowers
Taken with ghee after frying to check blood dysentery		Dried flowers
Taken when fish bones stuck in the gullet		Fresh and dried corolla
Used as poultice in high fever and headache		Leaves
Used in treating chronic rheumatism, syphilis and sciatica	*R. campanulatum* D. Don	Leaf decoction
Used as snuff after mixing with tobacco leaves to cure Hemicarnia and colds		Powdered dried leaves
In treatment of chronic fevers		Dried twigs and wood in powdered form
In treatment of Catarrh; also in treating cold, cough, chronic bronchitis and	*R. anthopogon* D. Don	Decoction of leaves

asthma; administered to produce sneezing		
In treating indigestion and lung infection		Decoction of leaves and flowers
Mixed with oil and used in massage in post-delivery complications		Dried flowers in powdered forms
Drinks made is supposed to be purgative	*R. lepidotum* Wall. ex G. Don	Bark
Poisonous		
Harmful when consumed in excess	*R. arboreum* Sm.	Nectar of Flowers
Poisonous to livestock	*R. campanulatum* D. Don	Leaves
Fish Poison	*R. barbatum* Wall. ex G. Don	Leaves

***Rhododendron* a keystone species of the biodiversity**

Rhododendron plays an important role beyond admiring as keystone species of Himalaya region. It is one of the most important genera of the Himalayan region which has a major use in landscaping, accent, and woodland planting. It has the potential to attract tourism in the Himalayan region through its scarlet blooming in the flowering season which results in generating employment for local people and consequently boost up the needs of local people. Beside flourishing tourism, *Rhododendron* species has medicinal uses which increase its importance more. *R. arboreum* flower petals are used in making health juice **(**Badola, 1992) and to stop excessive bleeding in female when mixed with water (Pradhan and Badola, 2008). While *R. anthopogon* leaves are mixed with *Juniper* species to provide incense that is widely used in Buddhist monasteries. The fruits are the favorites of birds, which also disperse the seeds. Furthermore, the plant provides the very good fuel which results in the degradation of this species in many areas. Ecosystem services are also an important area where *Rhododendrons* play a vital role. *Rhododendrons* grow in areas of high rainfall and high humidity on acidic soils; conditions under which few plants would survive. Therefore their role in slope stabilization and watershed protection should not be

underestimated, particularly in the Himalayas where so many of Asia's major rivers start; nor should we overlook the role of *Rhododendrons* in providing the structure of plant communities which support a wealth of biodiversity. Thus, the *Rhododendron* plays a pronounced role as a keystone species, provides an ecological stability to the vegetation communities and associated niche of the region. Therefore, restoration of *Rhododendron* and their conservation in nature promotes an existence of other biodiversity components. Similarly on considering subalpine to alpine transition zone that includes timberline is the most fragile ecosystem in the Himalaya. *Rhododendron* is the only group of plants that has an existence in the aforesaid ecotone and beyond doubt maintains the biological sustenance in this fragile zone. Hence, after knowing the importance of these species which prove its dominant existence in higher altitude vegetation needs conservation as changes in climate particularly in temperature of earth definitely will affect the life cycle of this important species or may resultin extinction.

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References

Badola, H. K., Paliwal, S. P. and Paliwal, G. S., 1992. Dormancy and spring activation of cambium in some Himalayan tree species, pp. 209-219. In: Rojo. J.P., Aday, J.U., Barlie, E.R., Araral, R.K. and America, W.M. (eds), *Proc. 2nd Pacific Regl. Wood Anat. Conf*., For Prodts. Res. & Dev. Inst., College, Laguna, Philippines.

Black, M., 2008. Historical Survey of Rhododendron Collecting with Emphasis on its Close Associations with Horticulture. Journal American Rhododendron Society, 23:4

Chamberlain, D. F., Hyam, R., Argent, G., Fairweather, G., and Walter, K. S., 1996.The genus Rhododendron: Its classification & synonym*y*. Royal Botanic Garden, Edinburgh, p.181.

Chandra, S.K., and Srivastava, S. K., 2010. Rhododendrons in Indian Himalayan Region: Diversity and Conservation. American Journal of Plant Sciences, 1:131-137.

F.S.I., 2015. State of Forest Report. Forest Survey of India, Ministry of environment forests and climate change Government of India, P:40

Hora, B., 1981.The Oxford Encyclopedia of Trees of the World, Oxford University Press, Conscent Books, New York, P. 288.

Joshi, A.P., and Sharma, N., 2005. Flower power. Rhododendron is a health freak's delight. Science and Environment Fortnightly. Down To Earth, 14(3): 52.

Kant, A., 2004. Wildlife (the northeast travel special). Sanctuary Asia. 24(2): 67-84.

Leach, D.G., 1961. Rhododendrons of the world. Charles Scribners's Sons, Newyork. P.544.

Mabberley, D. J., 1997. The Plant-Book. A portable dictionary of the vascular plants.Cambridge University Press. United Kingdom 2nd edition.

Magor, E.W.M., 1986. Sikkim Himalayan Rhododendrons in British Gardens. Himal. Plant J.,4: 58-68.

Mao, A.A., Singh, K.P. and Hajra, P.K. 2001.Rhododendrons. In: Singh, N.P. and Singh, D.K. (eds.), *Floristic Diversity and Conservation Strategies in India*: *Volume IV*: Angiosperms (Selected Groups), Economic and Ethnobotany, Kolkata, Botanical Survey of India, pp. 2167-2202.

Milleville, R. D., 2002. The *Rhododendron* of Nepal. Himal Books, Lalitpur, Nepal P. 136.

Pradhan and Badola., 2008. Ethnomedicinal plant use by Lepcha tribe of Dzongu valley, bordering Khangchendzonga Biosphere reserve, in North Sikkim, India. Journal of Ethnobiology and Ethnomedicine, 4: 22

Rotherham, I.D., 1983. The ecology of *Rhododendron ponticum* L. with special reference to its competitive and invasive capabilities. Ph. D Thesis, University of Sheffield UK.

Srivastava P., 2012. *Rhododendron arboreum*: An Overview. Journal of Applied Pharmaceutical Sciences. 02 (01): 158-162.