

Descriptive Study of Burans (*Rhododendron arboreum* Smith) in the Uttarakhand, India, North West Himalaya

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Received April 06, 2018; Accepted August 21, 2018; Published January 13, 2019

Keywords: Burans, Red burans, Rhododendron

INTRODUCTION

Rhododendron genus belongs from the Ericaceae family [1]. Rhododendron was derived from the Greek word Rhodo means “rose” and Dendron means “tree” [2]. The Rhododendron originally discovered from north central India and distributed in the Himalayas from Kashmir to Bhutan and in the hills of Assam and Manipur at altitudes of 1200-1400 m [3]. The Rhododendrons do exhibit significant diversity in habit, inflorescence and flower color, etc. in Himalays. The genus of Rhododendron is produced attractive and beautiful flowers almost 1000 species in the world and covered highland area like Nepal, India, China and Malaysia [4]. The China having the highest diversity of Rhododendron (571 species) and are endemism [5]. In India, 72 species of Rhododendron were reported by Paul et al. [6]. Again in India, 92 species, 8 subspecies and 9 varieties are reported in 2010, which are distributed from Arunachal Pradesh to Jammu and Kashmir and one subspecies from the Western Ghats as well as the Eastern Himalayan region. Diversity of Rhododendron is (75 species, 4 subspecies, 5 varieties), whereas only 6 species are reported from the Western Himalaya [7]. Representation of Rhododendron species in Indian states are Arunachal Pradesh (61), Darjeeling in West Bengal (12), Himachal Pradesh (01), Jammu and Kashmir (03), Manipur (05), Mizoram (03), Nagaland (02), Sikkim (36), Tamil Nadu (1) and Uttarakhand (3) [4]. Recent study showed that six species of Rhododendron was reported in Uttarakhand such as *R. arboreum*, *R. anthopogon* [8], *R. campanulatum* [9], *R. barbatum* [10], *R. lepidotum* [11] and *R. nivale* [12] or *R. rawatii* is new species reported by Rai and Adhikari [13].

Rhododendron arboreum is one the most important species distributed in Uttarakhand hills. Flower of *Rhododendron arboreum* (Burans) was declared state tree by Government of Uttarakhand and national flower of Nepal. It is evergreen shrubs or small tree maximum height 15 m [4], distributed

from Kashmir, Arunachal Pradesh (Western-Eastern Indian Himalayas), Nepal, Sikkim, Darjeeling and Bhutan at 1500-3400 m. asl. is vulnerable status. The trunk is often much branched, crooked or gnarled [14]. Bark is reddish brown, soft and rough [3]. Leaves are oblong-lanceolate, 10-20 cm long and 3.6 cm wide crowded towards the ends of branches and petiole covered with white scales when young it's [14]. Flowers are color range from a deep scarlet, to red with white markings, pink to white, bearing up to twenty blossoms in a single truss spectacular sight when in full bloom [15]. The bright red color flower bearing is found at lower elevation and seed is small like minute as well as dark brown reported by Orwaa et al. [14]. *Rhododendron arboreum* contain energy value (19.7 ± 0.06 kJ/g), Moisture contain ($25.3 \pm 0.90\%$), density (0.69 ± 0.02 g/cm²), ash contain ($0.24 \pm 0.01\%$) and biomass/ash ratio (417) it was reported by Chettri and Sharma [16]. The study shown flower weight maximum (4.59 ton/ha) at Khirsu Pauri followed by Kharpatya (4.22 ton/ha) and minimum (2.07 ton/ha) at Ranichauri. The study was diameter basis reported average flower production maximum in the 36-45 cm cbh class was maximum production (1509.76 ± 147.94) followed by 26-35 cm cbh class (1496.76 ± 67.52) and 46-55 cm cbh class (1307.94 ± 201.67) and minimum (815.60 ± 39.97) in 05-15cm cbh class.

It is a common tree in Western Himalaya, occurring mainly at 5,000-8,000 ft. association with *Quercus* and *Pinus*

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Citation: Lal P & Chauhan DS. (2019) Descriptive Study of Burans (*Rhododendron arboreum* Smith) in the Uttarakhand, India, North West Himalaya. J Agric Forest Meteorol Res, 2(1): 59-62.

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species and it extends to the Eastern Himalaya, where, it is less common but it is also found in Khasi hills and the hills of Burma southern India [17]. The *Rhododendron arboreum* and allied trees occur as associates of different forest types in various parts of the Western Himalaya. The main forest types of these species form a significant part are Montane Temperate Forest (12/C1 Lower West Himalaya Temperate Forest, 12/C1a Banj Oak Forest, 12/C1b Moru Oak Forest, 14/C1 West Himalaya Subalpine Birch/Fir Forest, 14/C1b West Himalaya Birch/Fir Forest, 15/C1 Birch Rhododendron Scrub Forest and 15/C2 Deciduous Alpine Forest) Forest type [18]. Tree density in different habitat like stream bank habitat (157 ind./ha), dry habitat 86 ind./ha, ridge habitat 223 ind./ha and moist habitat 230 ind./ha. was reported by Rawat and Chandra [19]. Mean values of density ($175 \pm 75 \text{ ha}^{-1}$) was recorded by Hussain et al. [10] another (67 ind./ha) at the 2100 meter (165 ind./ha) at the 1700 m and (40 ind./ha) at 1550 m recorded by Sharma et al. [20]. Another site wise density 1st site recorded (213 ind./ha), 2nd site (80 ind./ha), 3rd site (53 ind./ha), 4th site (390 ind./ha), 5th site (380 ind./ha), 6th site (120 ind./ha), 7th site (220 ind./ha) and 8th site (20 ind./ha) trees were reported by Kumar et al. [21]. Our study had been conducted at different district in Garhwal region, where as recorded *Rhododendron arboreum* tree density maximum (930 ind./ha^{-1}) at Kharpatya Rudrpryag followed by Pharakhal Puri (890 ind./ha^{-1}) and minimum (670 ind./ha^{-1}) density shown at Ranichauri Tehri.

Flowering is started from mid-December to last week of May such as initial flowering started to second or third week of February, peak flowering started from second week of March to April and end flowering commenced from second week of May to earlier June [22]. It is never leafless the foliage is renewed gradually [23]. Flushing and leaf or floral bud formation commencement in April and leaf fall in October to November [24]. From mid-September onward capsules should be observed and collected as they start to turn from green to brown [25]. Capsules can be picked green and then opened in gentle heat as long as their seeds are fully developed. The capsules are 0.8-1.1 inch long and 0.3-0.4 inch in diameter, it is oblong, curved, greenish brown when it is ripening then turning brown and it contains large number of minute dark brown compressed oblong seeds approximate 0.05 inch long [17]. Seed is orthodox storage behavior; moisture content of 4-9% will remain viable about 2 years at room temperature. Seed viability remained unchanged after 5 years of storage at 18 EC and 4 EC, which strongly suggests that viability for even longer periods is possible [26].

The young leaves are said to be poisonous (causes intoxication in large quantities) also medicinal and applied it's on the forehead to alleviate headache [27]. The fresh and dried corolla that is acid-sweet in nature is given when fish bones get struck in the gullet [28].

Of late 1980 in hilly areas, local people used *Rhododendron arboreum* flower as commercially. Flowers are sweet and sour taste is used in the preparation of squash, jams, jellies and local brew. It is a very common and pleasant drink, drunk once daily as refreshing appetizer and also to prevent high altitude sickness. Fresh petals are used to prepare chutney. The juice of the leaves is spread over cots and beds to get rid of bed lice. Wood is used to charcoal and fuel and making 'khukri' handles, packsaddles, gift-boxes, gunstocks and posts [6]. An study showed that cost benefits analysis of *Rhododendron arboreum* juice, input 185 ± 4.4 and output 490 ± 5.8 (305 ± 4.4) and squash, input 490 ± 8.8 and output 900 ± 10.1 (370 ± 14.2) [29]. Our study carried out at different villages in Garhwal region at district level there was Margaun village Khirsu Pauri used maximum flower as a juice preparation ($20.37 \pm 4.51 \text{ kg}$), monetary equivalent ($9200.0 \pm 2040.62 \text{ Rs.}$) and get net return ($3772.0 \pm 836.65 \text{ Rs.}$) and followed by Ghimtolli Rudrpryag weight of flowers for juice preparation ($19.08 \pm 2.67 \text{ kg}$), monetary equivalent ($7800.0 \pm 1025.54 \text{ Rs.}$) and get net return ($3198.0 \pm 420.47 \text{ Rs.}$).

Rhododendron arboreum provide vegetables and fruits round the year. It is not only helpful in supporting the livelihood but address the economic needs by selling them in the local market. Growing *Rhododendron arboreum* with large number of varieties in mixed cropping pattern is not only a compulsion but of per amount importance in view of food security. This pattern fulfills the requirement of farm households and helps them to sustain their livelihood in the region reported by Mehta et al. [30]. *Rhododendron arboreum* contents highest calorific value (19.7 kJ/g) and local peoples to assume an ideal firewood species is the one that gives comparatively better heat during combustion and long lasting fire, it must be heavy, and not produce too much ash. Due to its low ash content, high wood density and low moisture, *R. arboreum* was found to be the most desirable firewood with the highest fuel wood value index (FVI value). These preference shows are very much related to high energy value, high density, low ash content and low moisture content [31]. Sustainable utilization of species and associated societal needs, ethical and cultural values, and economic status of communities to meet their present and future demands from high value firewood species and demand for the domestic energy resources continue to grow [16]. According to fuel wood point of view 75% respondents for *R. arboreum* is used for domestic energy like cooking food and heating, wood used for making excellent charcoal and wood utensil and leaves are used as fodder, while immature leaves are used preparation of fish poisonous [32].

CONCLUSION

The present study find out the detail information of *R. arboreum* or Rhododendron in Uttarakhand region, and look out the peoples dependency on the *R. arboreum*, how are using *R. arboreum* for various purpose also see the different

parts use of its for different purpose. In this context here is recorded density of it's as well as observed sailing quantity of extraction material from the flowers. It is species most valuable to livelihood and medicinal point of view. In Uttrakhand region *Rhododendron arboreum* regeneration rate are decreasing so need to good and adequate strategies for conserving it.

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