



## Effect of Global warming on *Rhododendron arboreum* Budding, Flowering and Dehisences

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### Abstract

Studies from Temperate climate zone of the Ranshi site in Garhwal Himalaya generate evidences of the global warming on Phenology and persistence of *Rhododendron arboreum*. Commonly *R. arboreum* is known as Burans. Besides the characteristic status and threats, the flower of Burans is also used as medicinal plant and juices. Juice of the flower of Burans helps keep the heart healthy.

**Keywords:** *Rhododendron arboreum*, Temperate region, Ransi site, Effect of Global warming, etc.

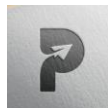
### Introduction:

In Sikkim, *Rhododendrons* are known as a Natural legacy. Genus *Rhododendrons* are being grown in alpine and sub-alpine regions. Among the 36 species of this genus, *Rhododendron arboreum* is the establish species. *R. arboreum* is having a large number of ingredients with significant value. *R. arboreum* (Ericaceae) inhabited in the hills of Assam and Manipur and in the Himalayas from Kashmir to Bhutan at the altitude of 1200-400m. In Himalayas *R. arboreum* is an impressive species of *Rhododendrons* genus. Teraxerol (C<sub>30</sub>H<sub>50</sub>O) and ursolic acid acetate (C<sub>32</sub>H<sub>50</sub>O<sub>4</sub>) has been found in the bark of this species.<sup>1</sup>

*Rhododendron arborium* consist alkaloids, glycosides, tannins, flavonoides, terpenes, phenolic compounds and steroids therefore used in folk medicine. Dried flowers are used in the treatment of blood dysentery, diarrhea, while leaves are useful in alleviating headache.<sup>2</sup>

### Study Area:

The sites of the present study were located in Pauri (Garhwal), Uttarakhand. The district located at 30°8'59" N and 78°49'8" E. Pauri is situated at elevation of 1650m above sea level on the western Himalaya. The general climate of the area is moist temperate having the luxuriance of Oak, Pine, Deodar and *Rhododendron* forest. The district is believed to possess about ~58% forest cover, highest one in North West Himalaya and North India.



### Climate:

The various climatic elements viz., temperate, rainfall, humidity, etc. reflect a certain type of climatic condition of that area. Temperature depends on the balance between incoming and outgoing heat of a place at a given time. The climatic data from October 2013 to March 2014 are given in the table: 1 and figure: 1 to figure: 5.

- The meteorological data of the study period indicated that average minimum temperature ranged from 1.6°C in 26 December 2013, while maximum in 30 March 2014 (29.6°C).
- The maximum mean temperature during my study period recorded in October 2013 (20.39°C).
- The total rainfall during the study period was recorded 4mm in October, 2.33mm in November, 8mm in January, 3.66mm in February and 10.6mm in March.
- The maximum rainfall was recorded in the month of March.
- The high humidity was recorded in the month of January (97.69%) and low humidity was recorded in the month of December (53.12%).
- Snow fall was recorded 4cm in 15 January, 3cm in 15 February and 4cm in 16 February.

### Location and Geographical area based on latitude and longitude in Pauri Garhwal:

Pauri is situated between 29°45' to 30°15' latitude and 78°24' to 79°23' longitude.

**Table: 1. Meteorological data of Pauri, Garhwal during the study period of October 2013 to March 2014**

Name of the Month	Mean Temperature (Max) in °C	Rainfall (mm)	Snowfall (cm)	Humidity (%)	No. of Rainy day
Oct	20.39	4	-	76.69	4
Nov	16.16	2.33	-	61.13	3
Dec	11.85	-	-	53.12	-
Jan	10.83	8	4	97.69	1
Feb	11.53	3.66	7	61.64	3
March	15.50	10.6	-	63.35	5

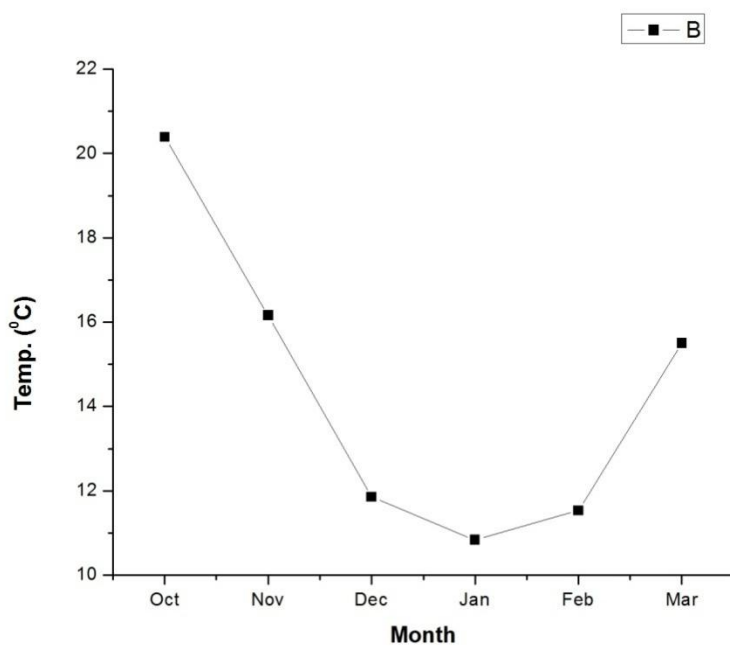


Figure: 1. Maximum Temperature of Pauri during Study period

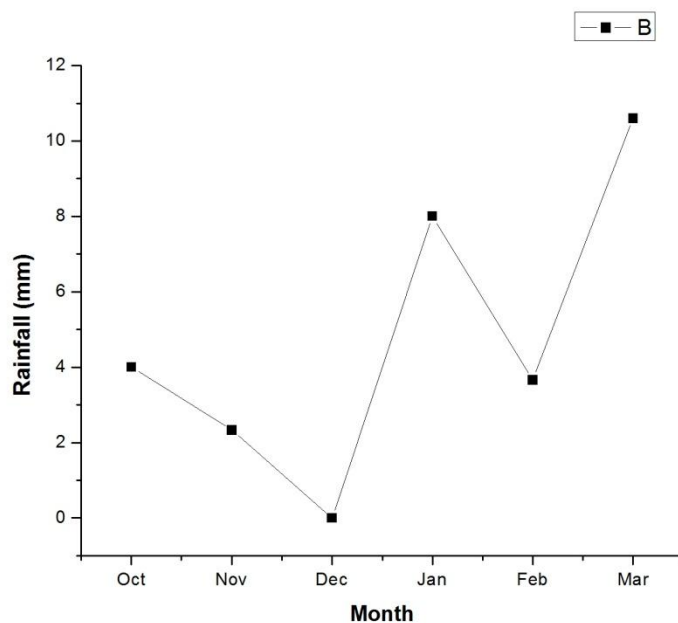
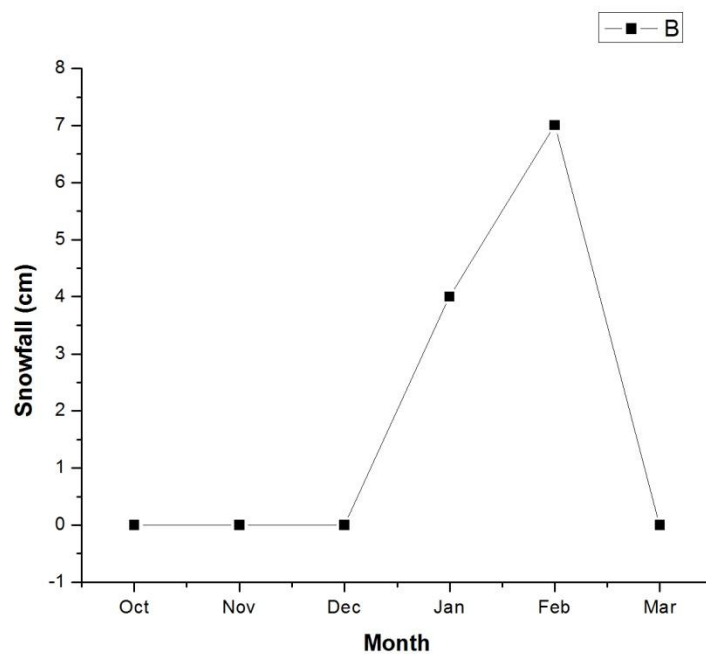
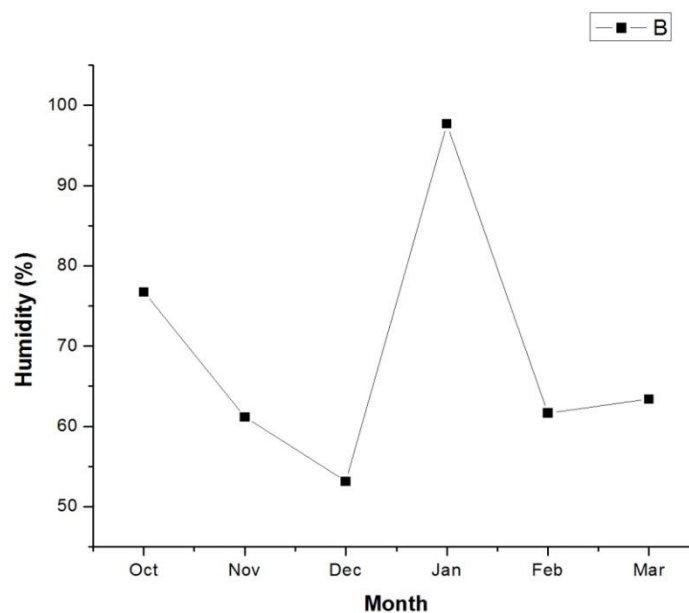


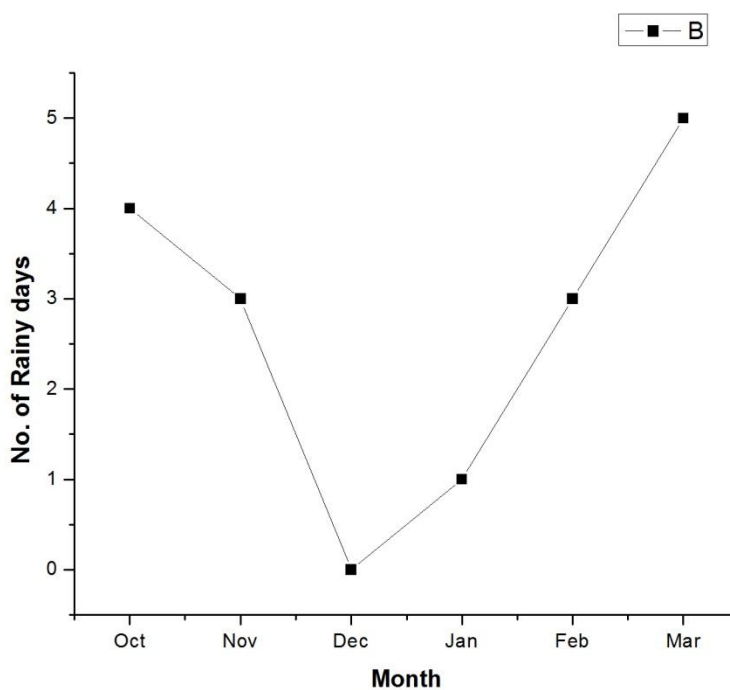
Figure: 2. Rainfall in Pauri during Study period



**Figure: 3. Snowfall in Pauri during Study period**



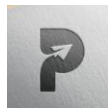
**Figure: 4. Humidity in Pauri during Study period**



**Figure: 5. No. of rainy days during Study period**

**Material and Methodology:**

1. The methods applied for the collection of samples of present work as collected randomly from lower altitude to higher altitude.
2. The data was collected in the first and last week of every month and observed the study objectives:
  - (a) Initiation of bud
  - (b) Initiation of leaves
  - (c) Initiation of flowering
  - (d) Dehiscence of flowering
3. The observation of the objectives recorded in field condition and analyzed them seasonally.



**Results:**

Rhododendron arboreum was found in Ranshi site. During my study period, I was found leafing initiation in the month of Nov, 2013 and increases in size day by day. It becomes broad in shape and size in the last week of December, 2013.

I was observed during my visit to Rashi site that the flower bud initiated in the end of month December. Flowering started in the last week of January.

The month of February is suitable period for flowering in Rhododendron arboreum as showed red patches in Rashi forest. The following Biotic and Abiotic factors were responsible for the early flowering in Rhododendron arboreum:

- (a) Temperature
- (b) Sunlight
- (c) Moisture
- (d) Rainfall
- (e) Altitude
- (f) Slope
- (g) Topography

Our study revealed that the flower dehiscence started in the last week of February. Observation of data given in the table: 2 and figure: 6, figure: 7.

**Table: 2. Observation Data**

S.No.	Date of Month	Temp. °C	Budding	Leafing	Flowering	Flower Dehiscence
1.	19 Oct, 2013	25	Start reddish in color	Start	No	No
2.	17 Nov, 2013	22	Continuously large number budding start	Start and bunch shape, light green	No	No
3.	25 Dec, 2013	15	1 or 2 flower bud initiate start	Increase in size, dark green	No	No
4.	29 Jan, 2014	6	Continuously flower bud initiation	Mature and broad shape	Flower initiation	No
5.	24 Feb, 2014	7	Flower bud initiation stop	Mature	Red patchy phenophase show	Started flowering dehiscence
6.	7 Mar, 2014	20	Stop	Leaf fall start	Flowering stop	Continuously flowering dehiscence



### **Discussion:**

The present study demonstrated the Global Warming effect of temperature on Rhododendron arboreum flowering condition. The two year data of present study revealed the drastic change in leafing, budding and flowering of Rhododendron arboreum.

This change may be due to the temperature, one of environment factor, which affect the physiological process of Rhododendron arboreum.

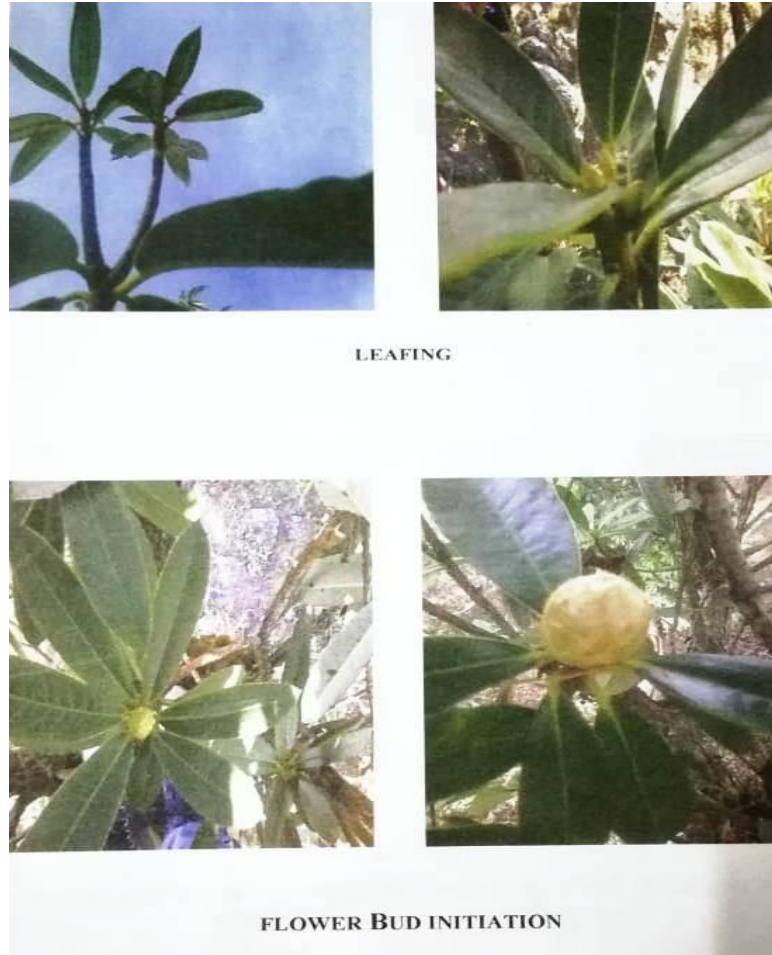
If the rate of temperature will increase year by year than it may be chances of flowering in early period.

Kailash S. Gairola et al., 2014 reported the 50 % flowering on R. arboreum in Shyahidevi, Kumaon site on 9 March, 2011.<sup>3</sup> In present study flowering on Ranshi, Garhwal site initiate in the month of January.

### **Recommendation:**

To overcome the effect of Global warming, we should have to take major step listed below:

- To aware people about the importance of the nature and natural resources.
- Study camp.
- A forestation.
- Overcome forest fire.
- Every project taken under EIA (Environment Impact Assessment).
- Control of gases released from different sources.
- Recommendations to deal with global warming.
- People awareness programs for global warming.
- Municipal Corporation should be taken for awareness programs in villages and towns.
- Control of CFC.
- Illegal emission of polluted gases from factories.



**Figure: 6. Leafing and budding in *R. arboreum* during study period**





FLOWER INITIATION



COMPLETE FLOWER



FLOWER DEHISCENCE

**Figure: 7. Flowering and Dehiscence on *R. arboreum* during study period**



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