Rhododendron arboreum: Propagation through Seeds, Cultivation, Diseases and Control Methods

Mitra Lal Pathak[1]*, Dipak Lamichhane[1], Lila Ballav Neupane[2] & Kamal Bahadur Nepali[1]
[1]National Botanical Garden, Department of Plant Resources, Godawari, Lalitpur, Nepal
[2]Ministry of Home Affairs, District Administration Office, Kaski, Nepal
*Email: scientistdrmitra@gmail.com

Abstract

This paper aims to discuss about the seed germination process, problems during cultivation, diseases and control methods of *Rhododendron arboreum*. Germination test was carried out at National Botanical Garden, Godavari from the seeds collected from there. The problems during seedling transplantation and disease appeared were observed in Hupsekot Rural Municipality, Nawalparasi District at elevation of about 1500 m asl. The seed germination period was found more than one year with about eighty percent germination percentage with 90–95% survival rate. It was also found that the *R. arboreum* was acid loving plant. Powdery mildew was the common disease appeared in the field. Some recommendations are proposed for prevention and cure of Rhododendron related diseases.

Keywords: Diseases, Ericaceae, Germination percentage, Precaution

Introduction

The name 'Rhododendron' is derived from the Greek word 'Rhodo' means rose and 'Dendron' means tree. *Rhododendron* is a large genus of woody plants belongs to family Ericaceae and consists of around 1000 species within one genus and 8 sub-genera (Chamberlain et al., 1996). There are 571 and 80 species of *Rhododendron* recorded in China and India respectively (Wu et al., 2005; Bhattacharya & Sanjappa, 2008). 31 species of *Rhododendron* are reported from Nepal, which are distributed from the subtropical region (*R. arboreum*) to the nival region (*R. nivale*) (Poudel et al., 2018). Most of the species have an elevation range of 1000 m asl, but four species (*R. lepidotum, R. anthopogon, R. arboreum,* and *R. setosum*) have a 2000-3000 m asl range of distribution, covering more than one vegetation zone (Noshiro et al., 1995; Watson & Rajbhandari, 2005). Among them, *R. arboreum* is found as low belt *Rhododendron* (1200 m asl in Western Nepal), while *R. nivale* is reported from the nival region near the vegetation limit (5600 m asl). Recently, the emphasis has been given for the conservation of *Rhododendron* species (especially for rare and endangered species) around the globe (Ma et al., 2014). The Government of Nepal has prepared the Rhododendron Conservation and Action Plan (DoFSC, 2019).

This paper has aimed to know the seed germination technique, required precautions during seedling plantation, disease infestation and control methods of *R. arboreum* in Nepal.

Materials and Methods

The experiment was carried out in National Botanical Garden, Godawari, Lalitpur, Nepal. The altitudinal range of this botanical garden is 1515-2000 m asl. The temperature range is 20°C to 30°C during summer and -5°C to 20°C during winter and annual rainfall is approximately 2075mm (Nayava, 1981). Field visit was carried out in the Hupsekot Rural Municipality of Nawalparasi (Bardaghat-Susta East) where the large barren hill area was planted with *Rhododendron arboreum*. Seed germination test was carried out at National Botanical Garden (NBG). Fruit (Capsule) of *R. arboreum* becomes mature from October to December. Mature capsule were collected arbitrarily selected *R. arboreum* trees in December 2017. Then, the capsules were carried to the green house of NBG. All capsules were air dried and stored in the porous cotton bags for 3 months. Seeds were separated from the capsules and 500 robust seeds were selected for germination test. Altogether, the germination was repeated five times. For seed germination, the beds of soil collected

from forest area of NBG, sand and cow dung were mixed well and sown in the beds made in wooden box (2ft×1.5ft).The wooden boxes were then kept in shaded area of agro-net house. The watering was done regularly to keep the soil moist. The pH was also noted. Germination percentage, survival rate, seeds germinating time, height of seedlings, number of leaves emerging in a time interval and their length and breadth were also recorded. From the field visit, the survival rate of saplings, problems seen in the field and symptoms of disease were recorded. Discussion with key stake holders was carried out during field observation.

Results and Discussion

The minute seeds of *Rhododendron arboreum* were germinated in the mixture of soil, sand and cow dung (1:1:1) after the 50 weeks of seed sowing, the average height of seedlings was 0.5 cm, average number of leaves was 3, the average length of the leaf was 0.5 cm, and breadth was 0.9 cm after almost one year. The average height of seedlings was measured 1 cm with average number of leaves 5, length and breadth 1.2 cm and 0.8 cm respectively after one year of picking from soil beds to poly bags. Similarly, in next year the average height of seedlings were measured 6.7 cm with average number of leaves 8, length and breadth were 6.5 cm and 2.5 cm respectively (Table 1). The germination percentage was ~ 80%. Survival rate was 90-95%. This finding is similar with previous research (Shen et al., 2015)). The pH measured was 6.2 for the mixture of soil, sand and cow dung.

To know the precautions before cultivation, problems during cultivation of seedlings and problems and disease appeared in seedlings, the cultivation site was visited and some significant points were noticed during the field visit. To study about the problems during cultivation of seedlings and appeared diseases, the plantation site done by others was selected in the Hupsekot area of Nawalapur (previously Nawalaparasi) District.

From our field visit, we recommend following points to be considered before plantation of *Rhododendron.*

- Consultation with expert about right confirmation of the plant species and taxonomical confirmation of the targeted plant species.
- Broad knowledge of the distribution and growth habitat of the target species.
- Environmental factors like temperature and rainfall of plantation area.
- Testing of soil components like Nitrogen, Potassium, Phosphorous, soil pH, Moisture content etc.
- Most important point is Acclimatization/ adaptation of seedlings or saplings.
- From the expert view, It is believed that if we collect saplings with soil root, the chances of survival rate increased by fifty percent.

In case of *Rhododendron*; Acid-loving plants may be applied in late winter or early spring but much manure is not needed as other plants. More fertilizers are harmful sometimes, even whole plant can die. If plants are mulched with materials like fresh sawdust or wood chips, there will be a nitrogen demand caused by the decomposition of these materials, and unless nitrogen fertilizer is added, the plants are likely to show yellowish foliage and poor growth. In this case, an organic nitrogen fertilizer can be added. It is shown that not to use phosphorus (needed for flower buds) fertilizers unless a soil test indicates a deficiency.

Probable diseases in *R. arboreum* around the globe are as follows:

- Powdery mildew: sometimes exhibits the typical white powdery or fuzzy growth, but often takes on a completely different appearance light

Table 1: Average height of seedlings, leaves number, leaves length and leaves breadth in different time interval

S.N.	Average height of seedling (cm)			Average no. of leaves emerging (cm)			Average length of leaves (cm)			Average breadth of leaves (cm)			Remarks
	2018 Aug	2019 Aug	2020 Aug	2018 Aug	2019 Aug	2020 Aug	2018 Aug	2019 Aug	2020 Aug	2018 Aug	2019 Aug	2020 Aug	
1	0.5	1	6.7	3	5	8	0.5	1.2	6.5	0.3	0.8	2.5	

green or yellowish patches on the top of leaves sometimes accompanied by purple-brown areas on the backside of leaves are signs of powdery mildew. These symptoms were seen in our study area.

- Gall: Gullis fruit-like growth in a leaf or flower petal caused by spores of the fungus *Exobasidium*. Fungicide control of the disease generally has not been successful. Removal and disposal of galls before they become white-colored is the most effective means of controlling the disease.
- Petal blight: causes spots in a flower petal to look like they are wet. It is seen after flowering.

Common insect pests in *Rhododendron* are as follows:

- Lace bug: They eat back side of the leaf and leaf started fall down.
- Weevils: Active at night and often eat margin of the leaf.
- Rhododendron Borer: Often seen in big trees. Need to care when plants are big enough.

Problems seen in the seedlings of *Rhododendron* in Rudrapurgadhi Nawalpur can be summarized as follows:

- Water deficiency and struggling with stress.
- Problem of grazing.

Figure 1: Common insects pests seen in Rhododendron. (1) Lace bug, (2) Weevils, and (3) Rhododendron Borer

Figure 2: Stressed plants

- Lack of acclimatization, especially for big seedlings.
- Diseases were seen especially in leaf (powdery mildew) due to stress.
- 3 to 5% plants were died, 15-20% seedlings were struggling for stress or drought, and remaining plants were in good condition.

We have some recommendations to solve the problems seen in the study area:

- Manage water supply as soon as possible.
- Water storage polythene tank can be built to store water for winter.
- To look out the seedlings in the field, manpower should be managed according to the number and area of plantation.
- While replacing the dead seedlings, as far as possible, the seedlings from local area or adjoining forest should prioritize.
- If possible, the seedlings should collect with root soil for plantation.
- Plantation of large seedlings should be avoided.
- Acclimatization of seedlings in the targeted area is also very important. So, the seedlings should acclimatize before plantation.
- Fungicide or insecticide should use for suffered seedlings.
- Awareness program and local participation is seriously needed to conserve the planted or cultivated seedlings in the proposed foot trail or tourist area.

Conclusion

It can be concluded that, *R. arboreum*, national flower of Nepal, can be grown or propagated successfully from seeds; however the germination is slow and takes relatively longer times. The rate of germination is very high (~80%). The survival rate is 90–95%. Powdery mildew, Gall, Petal blight are the common diseases seen in the *Rhododendron* and Lace bugs, Weevils, *Rhododendron* Borer are the common insects which bring trouble after plantation or growing for *Rhododendron*. Selection of small seedlings, collecting of seedlings with root soil, acclimatization of seedlings before plantation and prevent from different diseases are the major precautions and challenges for plantation of *Rhododendron arboreum* in the hilly region of Nepal.

Author Contributions

The first author develop concept, visited field, and finalize Manuscript by the help of second author. Second, third and fourth author did field experiment and taken data.

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