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Short Communication

Effect of IBA concentrations on air-layering of *Berberis aristata*

Anita Tomar*

Indian Council of Forestry Research and Education - Eco-rehabilitation Centre, Prayagraj

3/1, Lajpat Rai Road, New Katra, Prayagraj-211002, India.

*Corresponding author:anitatomar@gmail.com

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Abstract

Germplasm of *Berberis aristata* was collected from Himachal Pradesh and Uttarakhand consisting of 8 accessions.There was no significant difference in rooting and plant per cent among 5000, 6000 and 7000 ppm IBA concentrations when tested on *B. aristata* during air layering in various accessions. Rooting percentage varied in a narrow range of 20.0 to 23.8 per cent except in control, while plant percentage ranged from minimum 13.8 to a maximum of 18.8 per cent. Maximum rooting percentage was found 23.8% regardless of source of germplasm.

Key words: Air layering, *Berberis aristata*, germplasm, indole butyric acid, rooting percentage

Air layering method, believed to have been developed centuries ago by the Chinese, as a means of propagating some of the more difficult-to-root plants. It required excessive care and patience, air layering was used only by the highly trained plantsman as a method of reproducing ornamental and cultivated plants (Mergen 1953). Vegetative propagation through air layering has an advantage over other methods, since reserve food of the parent branch induces the formation of well-developed root system. Also, the air-layered branches in general, have balanced root system than cuttings, and develop rapidly on planting out. In India, this method of vegetative propagation has not been tried on forest trees on a significant scale. There are several vegetative methods for multiplication of the quality stock in forest tree species but air layering is often used as a method of propagation where the formation of roots from cuttings is slow (Hartmann *et al.* 1997).

Berberis aristata DC (vern. *Kshmoi, Kingora*) is an evergreen shrub growing to 3.5 m .It flowers in May. It is a member of the Berberidaceae group that grows in America, Europe, and Asia. *B. aristata* has about 3-4 m in height. It seems yellow from the inside and yellow to brown from outside (Roshanravan *et al.* 2020). The species is hermaphrodite (has both male and female organs) and is pollinated by insects. The plant is self-fertile, has grey bark and branches are pale yellow. Leaves are 3-4 inches long. It is found in higher hills at 2000 – 2700 m altitude (Kanjilal and Gupta 1969). However, Rao *et al*. (1998) have revised the family and have reported that the plant species belongs to Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Madhya Pradesh, Tamil Nadu, Nepal and Bhutan at much lower altitudes as indicated by Kanjilal and Gupta (1969). Berries are eaten and are considered diuretic, demulcent. Wood is used as fuel (Agarwal 2005). It is also suitable for wasteland afforestation.

The plant is used traditionally in inflammation, wound healing, skin disease, menorrhagia, diarrhoea, jaundice and affection of eyes. Pharmacological studies on the plant revels the proven activity of its as hypoglycaemic, antibacterial, antifungal, antipyretic, anti-inflammatory, hepatoprotective antioxidant, anticancer. The plant fruit is edible and it is rich in vit-C. A very valuable ayurvedic preparation 'rasaunt' is prepared by this plant which is used in curing human ailment like ophthalmic, ulcer as a laxative and tonic

and blood purifier (Bhushan *et al*. 2022) Phytochemical studies shows that plant *B. aristata* contains mainly yellow-coloured alkaloids Berberine, oxyberberine, berbamine, aromoline, a protoberberine alkaloid karachine, palmatine oxyacanthine and taxilamine and tannins, sugar, starch. The plant has effective pharmacological action and shows promising future for further research (Sharma *et al.* 2011). *B. aristata* has good dyeing properties and its colour can be enhanced by natural mordants those are safer and eco-friendly, and can be a source of new dye stuff for textile industries (Semwal *et al*. 2012).

Stem of *Berberis aristata* is used in Indian traditional medicine for treating antibacterial, antiperiodic, antidiarrhoeal, ophthalmic, skin diseases and diabetes mellitus. It is an important commodity in folklore medicine of India for as laxative, ophthalmia and other eye diseases (Upwar *et al*. 2010).

Branches with 1.00 to 2.00 cm diameter were selected for tying the air layers during premonsoon season. The bark of the twig (approximately 1-inch-wide ring) was removed with the help of knife and 4000, 5000, 6000 and 7000 ppm IBA in the form of powder was applied to the wounded surface. Untreated layers served as control. Sphagnum moss was moistened with water and thereafter squeezed to remove excess water to place around the treated area and wrapped with a polyethylene sheet and finally tied at both ends with plastic thread to avoid the escape of moisture. In this experiment, there were a total of 4 treatments and in each treatment 10 shoots were air layered randomly. The first observation on air layered branches to confirm root initiation was recorded after 40 days of setting the experiment and subsequently other observations were made after every tenth day for a period of two months to monitor the development of roots. When roots were visible through the transparent polythene sheet the air layers were detached from mother plant just below the girdle. These rooted air layers were transplanted in polythene bags filled up with growing media containing sand, soil and FYM (1:1:2 ratio). These polybags were kept in shade for about one weeks and watered regularly until the root system was well established in the soil. The germplasm of *Berberis aristata* was collected from different sites, as given below:

S.No.	Location	Latitude/longitude	Altitude (m)
Uttarakhand			
1.	Chakrata, Dehradun	30.7016°N, 77.8696° E	2118
2.	Chamba, Tehri Garhwal	30.3455°N, 78.3947° E	1524
3.	Buakhal, Pauri Garhwal	29.813°N, 78.98871° E	1814
4.	Kosi, Almora	29.6498°N,79.0935° E	1638
5.	Lansdowne, Pauri Garhwal	29.8377°N, 78.6871° E	1700
6.	Narendra Nagar, Tehri Garhwal	30.1600°N, 78.2903° E	1326
Himachal Pradesh			
7.	Nahan, Sirmaur	30.5599°N, 77.2955° E	932
8.	Kandaghat, Solan	30.9702°N, 77.1054° E	1425

During June, plants have high content of food reserves, which can contribute to the increased rooting even when low IBA concentrations are applied. The best time for air layer initiation is June, which is associated with the presence of sufficient food reserves in most plants and minimal plant develop-mental activities such as budding and flowering, which are antagonistic to rooting. Rooting and subsequent development of the air layers was enhanced by IBA (Mwang'ingo and Lulandala 2011). In this study there was no significant difference in rooting and plant percent among 5000, 6000 and 7000 ppm IBA concentrations on *Berberis aristata* during air layering in various accessions (Table 1). Excluding control treatment, rooting percentage fluctuated in the narrow range of 20.0 to 23.8 per cent, while plant percentage ranged from minimum 13.8 per cent to maximum 18.8 per cent. Control resulted in negligible rooting and plant per cent in all germplasm accessions. Therefore, 5000 ppm can be safely and economically used to propagate this species through air layering regardless of source of germplasm. The result is analogous with Parmar and Khamu (1989), who reported that air layering was successful in *Berberis aristata* when carried out in July in branches treated with 5000 ppm IBA (35.5% rooting) or Seradix B (16.3%).

Scientists of the various parts of the globe engaged in tree improvement programmes, achieved poor to good success of air layering in different tree species. Good success on rooting and root characteristics of air

Table 1. Effect of IBA concentrations on air layering success of *Berberis aristata* belonging to different sites

Rooting (%) characteristics	4000 ppm	5000 ppm	6000 ppm	7000 ppm	Control
Chakrata, Dehradun, Uttarakhand					
Rooting (%)	22.5	21.3	22.5	22.5	0.0
Plant percent (%)	15.0	15.0	16.3	16.3	0.0
Nahan, Sirmaur (H.P.)					
Rooting (%)	22.5	21.3	22.5	21.3	1.3
Plant percent (%)	16.3	16.3	16.3	15.0	0.0
Kandaghat, Solan (H.P.)					
Rooting (%)	21.3	21.3	20.0	20.0	0.0
Plant percent (%)	15.0	16.3	17.5	15.0	0.0
Chamba, Tehri Garhwal, Uttarakhand					
Rooting (%)	21.3	20.0	20.0	21.3	2.5
Plant percent (%)	17.5	13.8	15.0	17.5	0.0
Buakhal, Pauri Garhwal, Uttarakhand					
Rooting (%)	21.3	22.5	21.3	22.5	1.3
Plant percent (%)	17.5	16.3	15.0	15.0	0.0
Kosi, Almora, Uttarakhand					
Rooting (%)	22.5	23.8	23.8	22.5	0.0
Plant percent (%)	16.3	17.5	17.5	18.8	0.0
Lansdowne, Pauri Garhwal, Uttarakhand					
Rooting (%)	23.8	22.5	23.8	23.8	0.0
Plant percent (%)	18.8	17.5	18.8	17.5	0.0
Narendra Nagar, Tehri Garhwal, Uttarakhand					
Rooting (%)	22.5	23.8	22.5	22.5	1.3
Plant percent (%)	17.5	17.5	17.5	17.5	0.0

CD (P=0.05) for Rooting (%): 4.8

CD (P=0.05) for plant percent: 5.1

layering in *Chebulic mycobalum* has been recorded by Misra and Jaiswal (1994) after treatments with Indole Butyric Acid (IBA). IBA has been found to stimulate root initiation in air layers of many plant species like *Carissa carandas* and *Dalbergia sissoo* (Puri and Nagpal 1988). The hormone treatments proved successful in inducing the root initiation in comparison to control.

Conclusion: Based on the findings of the present investigation, it can be concluded that rooting and plant percent of different germplasm accessions within a species generally did not vary significantly which suggests that these propagation protocols can be reliably applied for multiplying germplasm of these species from wide sources. Thus, air layering with 5000 ppm in pre-monsoon season proved to be as one of the best, easiest and cheapest method of propagation of *Berberis aristata* as cuttings failed to root.

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