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Full Length Research Paper

Vegetative propagation of *Berberis aristata* DC. An endangered Himalayan shrub

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***Berberis aristata* DC. is critically endangered species of Indian Himalaya due to it's extensively collection of roots for its Berberine alkaloid. The objective of this research was to explore the possibility of propagating the species vegetatively to maintain its genetic identity and population. Therefore, an experiment was conducted by taking different cutting portions viz., apical, sub-apical and basal which were treated with various IBA concentrations viz., control, 2500, 5000 and 7500 ppm. Results shown that apical cuttings when treated with 5000 ppm IBA concentration performed significantly better in sprouting (85%) and rooting percentage (50%) in comparison to other treatments. While as control treatment had shown no rooting in all types of cutting portions.**

Key words: *Berberis aristata*, vegetative propagation, IBA.

INTRODUCTION

The Himalaya, as a whole is botanically rich in plant wealth with a high degree of endemism (Maithani et al., 1986). Continuous exploitation of several medicinal plant species from the wild and substantial loss of their habitats during the past 15 years have resulted in the population decline of many high value medicinal plant species over the years (FAO, 2003) . The genus, *Berberis* belonging to family Berberidaceae consists of spiny shrubs widely distributed in temperate and sub-tropical regions of Northern hemisphere and temperate South-America (Chauhan, 1999). Duke et al. (2002) stated that *Berberis* has about 650 species world wide of which 54 have been reported from Indian Himalaya (Sharma et al., 1993). *Berberis aristata* popularly known as Daruhaldi has diverse uses such as fuel wood, fodder for goats, fruits, live-fence and high medicinal value. Roots of this species yield valuable alkaloid, berberine of isoquinoline nature. The species is distributed between altitudinal ranges of 1,850 - 3,300 m amsl spreading over the Himalaya. It is a large deciduous shrub, usually 1.8 - 3.6 m high with 10 - 20 cm stem diameter. Twigs are whitish or pale yellowish brown erect cylindrical, smooth and strongly striate. Blaze 5 - 7.5 mm, bright yellow with coarse reticulate fibres. Leaves 3.8 - 10 x 1.5 - 3.3 cm, obovate or elliptic, entire or spinous-toothed, base gradually narrowed, with prominent reticulate nerves, glossy dark green above and glossy pale green beneath. Flowers are numerous and stalked. Inflorescence a simple drooping raceme, bracts small, linear, acuminate. Fruit a small berry about 7 - 10 mm, ovoid or oblong ovoid, blue black with a whitish bloom tipped along with the persistent style and stigma. The roots are thick, woody, yellowish brown, cylindrical, knotty and covered with a thin brittle bark. Bark is internally yellowish brown, rough, closely and rather deeply furrowed. Cut surface bright yellow, rough, fibrous with small fine ridges, root diffused porous, fracture hard; odorless and bitter in taste (Parmar and Kaushal, 1982; Prajapati et al., 2003). *B. aristata* so far have been traditionally obtained from the forests to meet larger demand and no systematic efforts have been made in the past for developing the agro-techniques for their cultivation. The possibility of the multiplication of this species by way of cuttings was explored in the present study to give more insight into its propagation techniques.

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MATERIALS AND METHODS

Description of experimental area

The experiment was conducted in the Forest product nursery of Dr. YS Parmar university of Horticulture and Forestry Nauni-Solan from

Table 1. Effect of different cutting portions and IBA treatments on sprouting (%), rooting (%) and root growth parameters in *B. aristata.*

Treatments	Sprouting (%)	Rooting (%)	Root length (cm)	Fresh root weight (g)	Dry root weight (g)
Cutting portions (T)					
T_1 :(Apical)	58.75(50.66)	24.17(25.61)	4.70	0.98	0.56
T_2 :(Sub-Apical)	33.33(34.71)	12.50(17.83)	1.74	0.43	0.24
T_3 :(Basal)	22.57(27.57)	8.75(14.91)	0.93	0.32	0.17
SEM ±	1.14	0.94	0.01	0.005	0.0038
$CD_{0.05}$	2.37	1.96	0.020	0.010	0.0080
IBA concentrations (C)					
C_0 :(Control)	18.89(24.47)	0.00(0.00)	0.00	0.00	0.00
C_1 :(2500ppm)	42.22(40.24)	13.89(21.63)	2.53	0.64	0.35
C_2 :(5000ppm)	55.00(48.72)	28.89(31.73)	5.10	1.19	0.67
C_3:(7500ppm)	36.67(36.93)	17.78(24.45)	2.19	0.49	0.29
SEM ±	1.31	1.09	0.0141	0.005	0.0044
$CD_{0.05}$	2.73	2.26	0.024	0.012	0.0093

Figures in parentheses are arc sine transformed values

2005 - 2007. The area is situated at 30^{O} 50' N latitude and 76^{O} 11' E longitude at an elevation of 1200 m above mean sea level on North Eastern aspect. The climate of the area is sub-temperate but slightly skewed towards temperate climate, so it is a transition zone between temperate and sub- tropical. The temperature ranges from 1°C in winter to 36°C in hot summers. The area receives 1100 to 1400 mm annual precipitation. The major portion of the rain is received during July and August (Monsoon period) months. Winter showers are though common, frost occurs recurrently from December to February and snowfall is also experienced rarely.

Experimental material and design

The *B. aristata* branch cuttings were collected from randomly selected shrubs of comparable vigorous growth in its natural habitat. The three cutting portion viz., apical (T_1), sub-apical (T_2) and basal portion (T_3) were treated with three IBA concentrations 2500 ppm (C_1), 5000 ppm (C_2) and 7500 ppm (C_3). A control (C_0) was used in this experiment. The slanting cuttings of 20 - 25 cm in length with at least 2 - 3 nodes were prepared. The prepared cuttings were immediately taken to laboratory for IBA treatments. The control and treated cuttings were tagged and planted in poly bags of dimension 10 x 25 cm filled with soil, sand and farm yard manure, in the ratio of 2:1:1 respectively. The two-third portion of cuttings was planted in poly bags and one- third portion remaining above the poly bags for recording data. The cuttings were regularly irrigated till monsoon. The numbers of cuttings that sprouted and showed successful root initiation after planting were counted to determine their sprouting percentage and rooting percentage respectively. The root length (cm) was calculated as the length of five largest roots of each cutting and their average was computed. The fresh root weight of each cutting was recorded by using electronic top pan balance. After taking fresh root weight, roots were kept in paper bags for drying in oven at 80°C $\pm$ 1 till constant weight was recorded as dry root weight.

The experiment thus consists of 12 treatments each replicated thrice in Randomized Block Design (Factorial) with ten cuttings per treatment. The two year results were subjected to analysis of variance (ANOVA) technique. To determine significant difference among mean values of the various treatments, we used the Duncan Test (P 0.05) with the SPSS statistical software package. Data as percentages were transformed to arcsine $(x/100)^{0.5}$.

RESULTS AND DISCUSSION

Vegetative propagation is practiced in forestry and horticulture to obtain plants of desired genetic constitution within short period. Against this backdrop, the different cutting portions and role of auxin (IBA) were studied to understand their effect in promoting sprouting and rooting per cent in *B. aristata* under field condition. The results (Table 1) showed that apical cuttings (T_1) produced significantly higher sprouting (58%) and rooting (24.17%) with other parameters like root length (cm), fresh root weight (g) and dry root weight (g). On the other hand, basal portion cuttings (T_3) produced the minimum values for all the parameters. Among the different concentrations of IBA, the response of 5000 ppm IBA (C_2) resulted higher sprouting of 55% and rooting of 28.89%. The treatment also result maximum values to all other parameters. Auxins enhanced callusing and rooting in cuttings of many tree species has been reported by numerous research workers (Loach, 1988; Uniyal et al., 2001). It is well known that auxins increase the mobilization of reserve food materials by increasing the activity of hydrolytic enzymes, which as a consequence stimulate rooting of stem cuttings (Nanda et al., 1968) . The treatment interaction of the experiment revealed that apical cutting when treated with 5000 ppm IBA (C_2T_1) resulted in significantly higher values for sprouting of 85% (Figure 1), rooting of 50% (Figure 2), root length of 9.55 cm (Figure 3), fresh root weight of 2.16 g (Figure 4) and dry root weight of 1.3 g (Figure 5) in this regard “This confirm

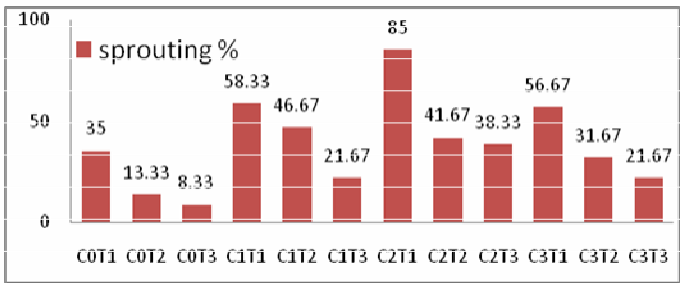

Figure 1. Interaction effect of different cutting portions and IBA concentrations on sprouting percent.

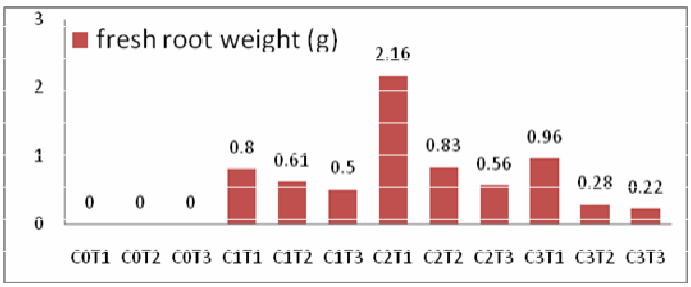

Figure 4. Interaction effect of different cutting portions and IBA concentrations on fresh root weight.

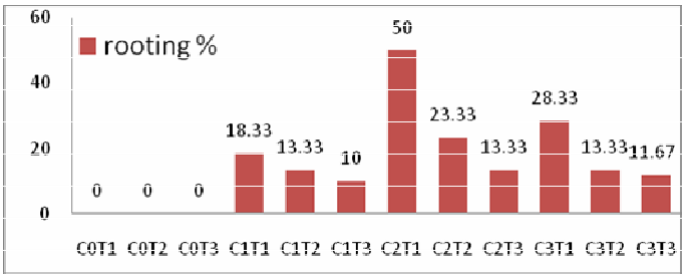

Figure 2. Interaction effect of different cutting portions and IBA concentrations on rooting percent.

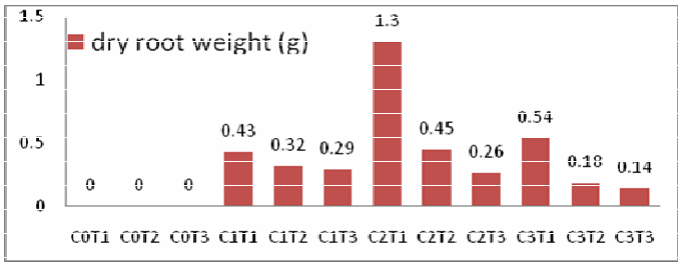

Figure 5. Interaction effect of different cutting portions and IBA concentrations on dry root weight.

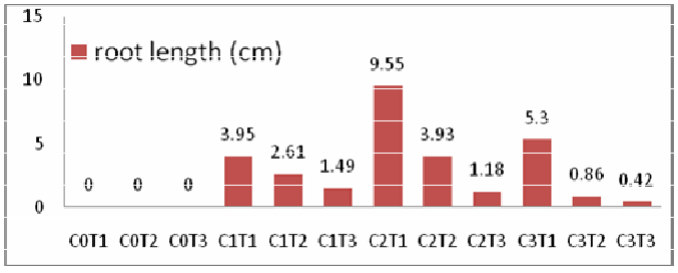

Figure 3. Interaction effect of different cutting portions and IBA concentrations on root length.

the finding that, cuttings obtained from the terminal segments of shoot provide maximum rooting (Haines et al., 1992)". The control treatments viz., (C_0T_1, C_0T_2 and C_0T_3) showed no rooting in the species. The results revealed that application of 5000 ppm IBA enhanced the sprouting and rooting potential compared to the untreated cuttings of *B. aristata.* This finding is supported by kumar (1994) who reported that rooting potential increased in *Berberis lycium*, *Carissa caranda*, *Elaegnus parvifolia* and *Prin-sepia utilis* when cuttings were treated with IBA com-pared to untreated cuttings.

Similar results were obtained by Sharma (1989) and Puri and Shamet (1988) working on *Woodforida floribunda*, *Coriaria nepalensis* and *Debregeasia hypoleuca* on one hand, and *Populus deltoids* and *Lecucaena leucocephala* on the other hand respectively. However, the finding of this study is inconsistent with Parmar and Khamu (1989) in which *B. aristata* cuttings showed no rooting upon treatment with 500, 1500 and 2000 ppm IBA. The agrotechnology of total known medicinal plants is about 1% and information regarding the propagation is less than 10% available throughout the world (Lozoya, 1994; Khan and Khanum, 2000). Taking the importance of propagation, the study standardized the vegetative propagation to meet the escalating demand of pharmaceuticals industries, farmers and forest personals involved in cultivation and conservation its wild genetic diversity in Indian Himalayas.

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