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DISTRIBUTION PATTERN, POPULATION DENSITY AND CONSERVATION BY VEGETATIVE PROPAGATION OF *ULMUS VILLOSA* IN TEMPERATE CONDUCTIONS OF KASHMIR

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ABSTRACT

Propagation of *ulmus villosa* was tested by treatments with different concentrations of indole-3-acetic acid (IAA) @ 1000, 2000 (ppm), indolebutyric acid (IBA) @ 1000, 2000 (ppm) and naphthlcetic acid (NAA) @ 1000, 2000 (ppm). The cuttings treated with IBA @ 2000 ppm and IBA @ 1000 ppm had a sprouting rate of 80% and 95%, followed by NAA @2000ppm with 65%, IAA @2000ppm with 60% , NAA @1000ppm with 58%, IAA @1000ppm with 55% which was higher than that of control. Highest percentage of roots was recorded in The cuttings treated with IBA @ 2000 ppm and IBA @ 1000 ppm had a Rooting rate of 95% and 90%, followed by NAA @2000ppm with 75%, IAA @2000ppm with 72% , NAA @1000ppm with 68%, IAA @1000ppm with 65% which was higher than that of control; Survival rate of all cuttings treated with different treatments was high but the highest survival percentage was recorded @IBA 2000ppm and1000 ppm which showed 100% survival rate, followed by IAA @2000ppm 90%, NAA @2000ppm with 89%, NAA @1000ppm with 85%, IAA @1000ppm with 81%.in control l 70% survival was observed. Among all of these plant growth regulators IBA@ 2000ppm and @1000 shows the best result.

INTRODUCTION

Ulmus villosa Brandis ex Gambles is one of the most distinctive Asiatic elms, belonging to the family Ulmaceae and a species capable of remarkable longevity. It is endemic to the Valley of Kashmir growing at an elevation from 1200 to 2530m but has become increasingly rare owing to its popularity as cattle fodder. The mature trees are now largely restricted to temples and shrines where they are treated as sacred. Some of these trees are believed to be aged over 800 years. Growing up to 25m in height, the tree is rather highly and pendulously branched, the bark is smooth with distinctive horizontal bands of lenticels, although it eventually becomes very coarsely furrowed. *Ulmus villosa* Brandis is a medium-to-large deciduous tree species of the north- western sub-Himalayas (Singh, 1982). The species is highly valued for its multiple uses (timber, fuel, and fodder) and fast growth rate. It is considered one of most important agro forestry tree species for the valleys and the mid-hill agro-ecosystems of the region. It also has great potential outside its natural range for use in farms, community and degraded lands. However, irregular and infrequent seeding habit, low seed viability, and short longevity hamper large-scale nursery production. This study therefore investigates vegetative propagation as a means of providing a regular supply of the quality planting stock for large-scale plantations. Propagation through stem cuttings in woody plants is used to capture speciûc genetic combinations (phenotypes) and to provide superior cultivars for planting. Root regeneration in cuttings is affected by plant growth regulators, stockplant age, time of cutting collection and shoot position. In addition, certain co-factors such as p-hydroxy benzoic acid (p-HBA), paracoumaric acid, and ferulic acid have been reported to enhance rooting in easy-, difûcult- and obstinate-to-root species (Bora, 1990). Haissig (1974) identiûed co-factors such as phenolic-auxin conjugates and proposed several theories to explain the effect of phenolics compounds, including modiûcation of IAA-oxidase activity, stimulation of auxin synthesis, liberation of auxin, and formation of covalently bonded auxin phenolic conjugates. vegetative propagation, to treat cuttings with growth hormone has become an effective measure in mass propagation of desired genotypes. However, ulmus villosa is not commonly propagated through vegetative means because it is hard to root. To treat the cuttings with auxin or other plant growth regulators (PGRs) can promote root sprouting and is helpful to cell multiplication and elongation of root. Mishra *et al.* (2003) studied the vegetative propagation of *Quercus leucotrichophora* through stem cuttings by using different PGRs in dry formulation. Stimulatory effect of growth regulators on root formation have been reported by various researchers in many forest species like Eucalyptus (Wilson, 1993) and *Taxus baccata* (Khali & Sharma

2003). Cuttings of Ulmus wallichiana (Elm) gave 27% of rooting rate when treated with indole-3-acetic acid (IAA) or indolebutyric acid (IBA) (Bhat *et al*., 2007). Thakur and Gupta (1998) treated the cutting of A. nitida with different concentrations of IBA and obtained the highest root percentage at IBA 800 ppm. In the present study, the stem cuttings of *ulmus villosa* were treated by plant growth regulators, IAA, IBA and naphthlcetic acid (NAA).Since ulmus vilosa is an endemic tree of Kashmir Himalaya and already in the threatened species and hence needs conservation strategy keeping the fact in mind, the aim of this paper was to study the distribution pattern, population density and conservation by vegetative propagation of *ulmus villosa* through stem cuttings treated with plant growth regulators in temperate Kashmir valley conductions.

MATERIALS AND METHODS

In Kashmir Himalaya, areas (Srinagar, Baramulla, Budgam, Ganderbal, Anantnag and Shopian) were selected and the plots were demarcated. Simple random- sampling techniques were used. Thirty quadrants were laid at each site. The dimensions of trees falling in each plot were recorded. The sizes of the quadrats were 30 × 30 m^2 for trees (Singhal, *et al*.1986). Population density was recorded by laying 30 × 30 m^2 quadrants and number of plants per quadrant was noted to calculate population density. Petiole length was measured by taking thirty leaves from each plant with the help of measuring scale in centimeters. Field investigations and experiments were conducted during the period February 2013 to November 2013.

The cuttings of Ulmus villosa were treated with different concentrations of IAA @ 1000, 2000 (ppm), IBA @ 1000, 2000 (ppm) and NAA @ 1000, 2000 (ppm) to determine the effect of different plant growth regulators on root initiation Simple talc powder was used as control Blazich (1998). Stem cuttings with uniform size (22 cm in length and 1.5"2 cm in thickness) were collected in April 2013 from different trees. A ringed cut was made at 1.5"2 cm above the basal end of the stem cuttings in order to induce callusing and subsequent root formation. In total 210 cuttings were used in the experiment and 30 cuttings were used for each treatment. The treatments were prepared in dry formulation by mixing the PGRs in talc powder. The cuttings were soaked in distilled water for 3"5 min, dipped in talc powder containing PGRs, and then were planted in polybags (12.5 cm x 17.5 cm) containing sand as rooting medium. A hole in the sand in polybags was made by a stick to prevent detachment of PGRs mixed talc powder from the cuttings. The polybags were taken care with respect to watering and weeds. The experiment lasted for one full growing season from April 2013 to Sep. 2013. Sprouting percentage, rooting percentage, survival percentage, was recorded Bhardwaj and Mishra (2005).

RESULTS AND DISCUSSION

In the present research work, survey was conducted across the Kashmir valley. The above map (Fig. 1) shows the distribution of Ulmus villosa in Kashmir Himalaya. The following sites, viz., Srinagar, Baramulla, Budgam, Ganderbal, Anantnag and Shopian were selected for this research work to study population density and phenotypic variability

Field surveys were conducted and the distribution of Ulmus villosa at different altitudes of Kashmir Himalayas was studied. The number of trees present in quadrant was used to calculate the approximate population density. Data (Table 1) compiled reveals that Budgam (13.5 ± 8.09) has highest population density followed by Shopian (6.8 ± 6.56), Pulwama (5.7 ± 4.93) Srinagar (5.1 ± 2.96), Ganderbal (2.8 ± 1.78) Baramulla (2.8 ± 1.56), Shopian (1.36 ± 0.61), and least was found in Anantnag (2.2 ± 1.12) and). Largest circumference (1.64 ± 2.48 m) was recorded in Budgam, Ganderbal (1.48 ± 2.46), followed by Pulwama (0.91 ± 0.29m), Srinagar(0.78 ± 0.34m), Baramulla (0.78 ± 0.30),and least was found in Shopian(0.71 ± 0.28). Maximum leaf area (57.13 ± 39.97cm^2) was recorded in Srinagar followed by Budgam (48.96 ± 5.81 cm^2), Anantnag (41.28 ± 16.12cm^2), Ganderbal (40.56 ± 23.71 cm^2), Shopian (31.03 ± 5.89cm^2), Pulwama (29.6 ± 11.48Cm^2) and minimum

Table 1: Variation in different morphological parameters of *Ulmus villosa*

PlaceMean	Srinagar1580 m	Baramulla1593 m	Badgam1609 m	Pulwama1630 m	Anantnag 1700 m	Ganderbal 1900m	Shopian 2057 m
Population density of Plants (30x30 sq m)	5.1 ± 2.96	2.8 ± 1.56	13.5 ± 8.09	5.7 ± 4.93	2.2 ± 1.12	2.8 ± 1.78	6.8 ± 6.56
Mean circumference(m)	0.78 ± 0.34	0.78 ± 0.30	1.64 ± 2.48	0.91 ± 0.29	0.74 ± 0.31	1.48 ± 2.46	0.71 ± 0.28
Leaf Area(cm^2)	57.13 ± 39.97	28.55 ± 12.00	48.96 ± 5.81	29.6 ± 11.48	41.28 ± 16.12	40.56 ± 23.71	31.03 ± 5.89
Petiole size(cm)	0.74 ± 0.11	0.76 ± 0.26	0.67 ± 0.10	0.93 ± 0.35	0.71 ± 0.20	0.69 ± 0.18	0.83 ± 0.25
Fresh Weight of Leaves(g)	0.71 ± 0.40	0.38 ± 0.17	0.62 ± 0.26	0.63 ± 0.40	0.53 ± 0.19	0.51 ± 0.35	0.54 ± 0.25
Dry Weight of Leaves(g)	0.29 ± 0.15	0.19 ± 0.08	0.46 ± 0.15	0.25 ± 0.15	0.22 ± 10	0.19 ± 0.14	0.22 ± 12
Weight of Ten Seeds (g)	0.8 ± 0.05	0.9 ± 0.06	0.9 ± 0.06	0.8 ± 0.06	0.7 ± 0.04	0.10 ± 0.07	0.6 ± 0.03

Table 2: Effects of plant growth regulators on sprouting, rooting and survival of cuttings of *Ulmus villosa*

Treatment(growth hormones)	Sprouting(%)	Rooting(%)	Survival(rooted cuttings)[%]
Control (Talc powder)	40	50	70
IAA (1000 ppm)	55	65	81
IAA (2000ppm)	60	72	90
IBA (1000 ppm)	80	90	100
IBA (2000ppm)	95	95	100
NAA (1000 ppm)	58	68	85
NAA (2000 ppm)	65	75	89

Figure 1: Map Showing the Distribution of *Ulmus villosa* in Kashmir Valley

leaf area ($28.55 \pm 12.00 cm^2$) in Baramulla. Maximum petiole length (0.93 ± 0.35 cm) was recorded in Pulwama followed by Shopian , (0.83 ± 0.25 cm), Baramulla (0.76 ± 0.26 cm), Srinagar (0.74 ± 0.11 cm)Anantnag (0.71 ± 0.20 cm), and minimum petiole length (0.75 ± 0.29 cm) was recorded in Ganderbal(0.69 ± 0.18 cm) and Budgam(0.67 ± 0.10 cm) In addition, fresh weight and dry weight of leaves were also recorded and data revealed that the maximum fresh weight (0.71 ± 0.40g) was recorded in Srinagar followed by Pulwama, (0.63 ± 0.40 g), Budgam (0.62 ± 0.26 g), Shopian (0.54 ± 0.25 g), Anantnag (0.53 ± 0.19 g)Ganderbal(0.51 ± 0.35 g). and minimum fresh weight (0.38 ± 0.17 g) were recorded in Baramulla and Maximum dry weight of leaves (0.29 ± 0.15g) was recorded in Srinagar followed by Budgam, Pulwama, (0.25 ± 0.15g), Shopian (0.22 ± 12 g), Anantnag (0.22 ± 10 g), and minimum dry weight (0.19 ± 0.14, 0.17 ± 0.08g) was recorded in Ganderbal and Baramulla Weight of the seeds was also recorded .Maximum weight was recorded in Ganderbal(0.10 ± 0.07g) fallowed by budgam (0.9 ± 0.06g), Baramulla (0.9 ± 0.06g), Pulwama (0.8 ± 0.06g), Srinagar (0.8 ± 0.05g) and minimum weight of the seeds was recorded in Anantnag (0.7 ± 0.04g), Shopian (00.6 ± 0.03).

(IAA, indole-3-acetic acid; IBA, indolebutyric acid; NAA, naphthlcetic acid)

Different sprouting rates were obtained for the cuttings treated with different plant growth regulators (Table 1)The cuttings treated with IBA @ 2000 ppm and IBA @ 1000 ppm had a sprouting rate of 80% and 95%, followed by NAA @2000ppm with 65%, IAA @2000ppm with 60% , NAA @1000ppm with 58%, IAA @1000ppm with 55% which was higher than that of control; Rooting of the cuttings occurred with all the treatments but the highest percentage was recorded in The cuttings treated with IBA @ 2000 ppm and IBA @ 1000 ppm had a Rooting rate of 95% and 90%, followed by NAA @2000ppm with 75%, IAA @2000ppm with 72% , NAA @1000ppm with 68%, IAA @1000ppm with 65% which was higher than that of control; Survival rate of all cuttings treated with different treatments was high but the highest survival percentage was recorded @IBA 2000ppm and1000 ppm which showed 100% survival rate, followed by IAA @2000ppm 90%, NAA @2000ppm with 89%, NAA @1000ppm with 85%, IAA @1000ppm with 81%.in control l 70% survival was observed.

Our study proved that IBA @ 2000 ppm is an optimal plant growth regulator for cutting rooting of *ulmus villosa*. This result is in accordance with other studies Rani et al (2015). Shamet et al. (1989) obtain 80% rooting rate of Celtis australis cuttings treated with 3000 ppm IBA. A previous study by Sharma & Pandey (1999) showed that application with 5000 ppm of IBA had a very high rooting rate of 89.30% in Dalbergia sisso (Sisso) and 76.43% in Dalbergia latifolia (Indian rose wood).

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