Interaction Between Location, Gender, Season and Indole-Butyric Acid and The Effects on Rooting of Bay Laurel (*Laurus nobilis* L.) Semi-Hard Wood Cuttings

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Abstract

The research was conducted in Latakia province, Syria, to investigate the effect of Location (Al-Samrah vs. Al-Nabaeen), tree gender, season, and indole-butyric acid {4000ppm, control (non-treated)} on the rooting ability of semi-hard wood stem cuttings of Bay Laurel (Laurus nobilis L.). Results showed that Location affects rooting percentage significantly (32.5% for Al-Samrah vs. 16.8% for Al-Nabaeen location). The number of roots per cutting for Al-Samrah (3.2 root/cutting) was superior to Al-Nabeen (2.4 root/cutting). Female trees' rooting ability (29.3%) was significantly higher than male trees (19.9%), while the no-significant effect on the number of roots per cutting was found. The highest rooting ability (%) was of cuttings taken in winter and spring (28.89%) semi-hard wooden in fall had significantly the lowest rooting ability (16.1%). The factorial analysis showed significant interaction among the studied parameters. The highest rooting ability was cutting taken from Al-Samrah location from female trees in winter and spring seasons when treated with IBA (4000ppm) (82.22%). Results suggest that for obtaining the highest rooting of laurel, semi-hardwood stem cuttings, cutting should be taken from Al-Samrah location in winter or spring from female trees and treated with IBA (4000ppm).

Keywords: IBA, Gender, rooting, cutting.

I. INTRODUCTION

Laurus nobilis L. is an important species related to the family Lauraceae, which contains 32 genera and 2000-2500 species[1]. Bay Laurel had high economic, cosmetic, and medical value ([2],[3],[4]).

Vegetative propagation by cuttings is considered a fast and easy tool to propagate trees; this method also guarantees to produce plantlets with identical genotypes. The rooting ability of cuttings is influenced by various factors such as cutting type, season, rooting media, cutting length… etc. ([5],[6]). Rooting studies on Laurel are scarce, and they all agree that Laurel cuttings are hard to root.

Rev.[7] mentioned the possibility of enhancing Laurel cuttings' rooting by using active bio-compounds like "Radistim 2," which increased rooting ability up to 60%.

Rev.[8] studied the effect of rejuvenation of mature trees of *L. Nobilis, Myrtus Communis, Arbutus uned, Pistacia lentiscus, Phillyrea latifolia*, and *Olea europaea var. sylvestris* on rooting ability of semi-hardwood stem cuttings of those species; rejuvenation increased the rooting ability of all species when treated with NAA (0.8%). In Turkey, semi-hardwood cuttings of Laurel were taken from five locations from male and female trees in December; cuttings were treated by IBA (2000-4000 ppm) and NAA (2000-4000); rooting ability (%) differed between 0-73% for female cuttings and 0-50% for male cuttings. Non treated cuttings (control) had lower rooting ability (9-10%) [9]. Results of rooting of Laurel in two periods (February-March) and (April-June) showed that semi-hardwood cuttings without leaves and with Auxin application increased the rooting ability significantly [2].

Rev.[10] studied the rooting ability of laurel populations subjected to rejuvenation in 11 periods starting from June until January on four different rooting media using five doses of IBA, results showed that September 30 was the optimal period and the doses 3000, 5000, 10000, and 20000ppm of IBA were similar in rooting ability which ranged between 0 and 52.8%.

Different types of hormonal solutions are used in rooting the cuttings, mainly indole butyric acid (IBA), indole acetic acid (IAA), naphthalene acetic acid (NAA), or mixtures of two types of these acid [11].

However, indole butyric acid is considered the best in terms of the success rate of rooting because of its high stability against the degradation enzymes produced by the cuttings used for propagation ([12],[13]).

Laurel is spread naturally in Syria but threatened by deforestation and fires, so this study aimed to find the optimal protocol for propagating this species using semi-hardwood stem cuttings**.**

II. MATERIALS AND METHODS

A. *Study sites and plant material:*

Semi-hardwood stem cuttings were taken from laurel trees (*Laurus nobilis* L.) located in two locations in Latakia province, Syria: The first Location was Al-Samrah (35.34'35°55 E, 43.03'35°54 S), 500 m above sea level and the second location was Al-Nabaaen (06.99'35°58 E, 16.93'35°54 S), 827 m above sea level.

Six disease-free uniform trees were selected from each Location (3 male and three female trees). Semi-hardwood stem cuttings with the following characteristics were taken: (length: 12-15 cm), (width: about 0.5 cm), with two leaves. Cuttings were taken in September 2018 (fall), February 2019 (winter), April 2019 (spring), and August 2019 (summer). Cuttings were rooted in a glass house in rooting media consisting of black pumice with fog irrigation and moisture about 80-90%; average air temperature ranged between 25-30°C. The depth of rooting was 3 cm. Indole-butyric acid (IBA) 4000 ppm was used. 30 cuttings were taken from each tree (replicate), 15 were treated with IBA 4000 ppm. Hormone solution was obtained by dissolving 4 g of IBA in 50 ml of ethanol and completes the volume to 1000 ml by adding distilled water. Control treatment (15 cutting) was treated in the same way but without adding IBA.

Rooting rate (%), number of roots per cutting (root/cutting) were studied.

B. *Study design and Statistical analysis:*

For rooting rates (%) the study was designed as factorial (4-Way completely randomized). Studied factors were: Location (two locations), tree gender (male-female), season (fall, winter, spring, and summer), and hormone application (IBA 4000ppm-control). Since no rooting was detected in non-treated cuttings (no IBA application), data were analyzed as 3-way completely randomized for the number of roots per cutting. Data were subjected to ANOVA, and means were separated using Duncan test. Costas software was used for data analysis.

III. RESULTS AND DISCUSSION

A. *Effect of Location:*

Location had a significant effect on the rooting ability of Laurel (Figure 1). Rooting (%) of cuttings taken from Al-Samrah (32.5%) was superior to Al-Nabaeen (16.8%). This result corresponds with the results of [9] that different locations differed in rooting ability depending on the genotype located in each Location.

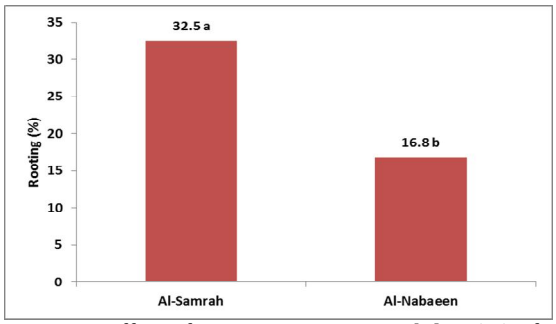

Fig 1: Effect of Location on rooting ability (%) of Laurel semi-hardwood stems cuttings.

Number of roots per cutting was influenced by Location. Al-Samrah location had the highest number of roots per cutting (3.2 root/cutting) significantly, while Al-Nabaeen had the lowest (2.4 root/cutting).

B. *Effect of the season:*

The season effect on rooting ability was minimal. No significant differences were found among winter, spring, or summer, the only fall had the lowest rooting ability (%) (Figure 2) significantly.

Rev.[14] the obtained different rooting ability of Kiwi *Actinidia chinensis* depending on the period of collecting the cuttings since each period had its own environmental conditions such as temperature, humidity, irradiance....etc., which affect the physiology of plants.

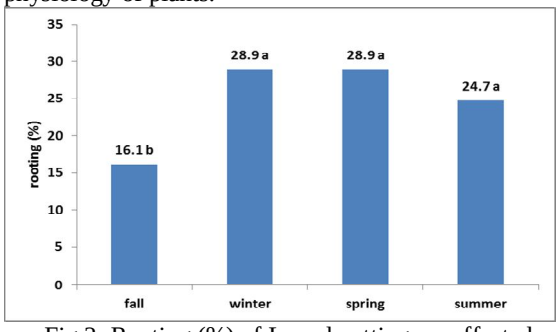

Fig 2: Rooting (%) of Laurel cuttings as affected by season of collecting.

Figure 3 showed no significant difference between winter and spring seasons on the number of roots per cutting (4.72 root/cutting), but both were superior to summer season which gave the lowest number of roots per cutting (3.57 root/cutting).

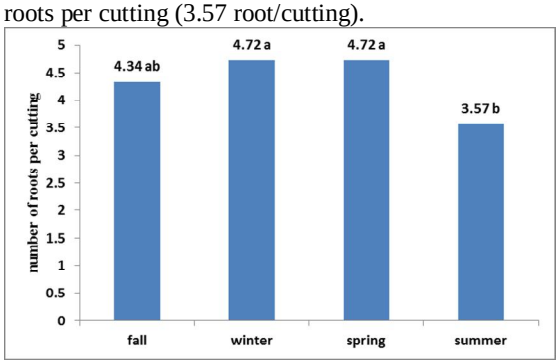

Fig 3: Effect of season on the number of roots/cutting of Laurel.

C. Effect of tree gender:

Figure 4 shows that the rooting ability of female trees (29.3%) was significantly higher than male trees (19.99%). This is in accordance with [9]; their study found that the rooting ability of female trees (17%) was higher than male trees (9.6%).

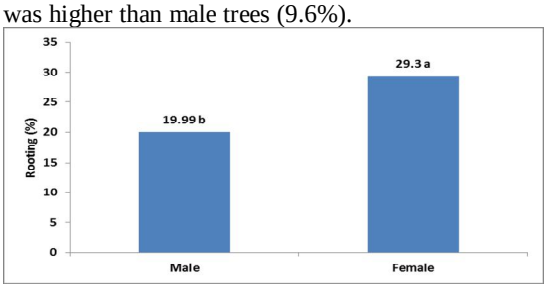

Fig 4: Effect of Tree gender on rooting ability of *Laurus nobilis* semi-hardwood cuttings.

Tree gender didn't affect the number of roots per cutting, which were 2.88 and 2.77 root/cutting for male and female trees, respectively.

D. Effect of indole-butyric Acid :

A non treated cutting (control) didn't give any roots regardless of Location, gender, or season. Only cuttings that treated with IBA rooted and rooting ability (%) were 49.3%. IBA is an essential hormone in rooting because this hormone increased RNA synthesis and activated the enzymes that produced essential compounds for cell division like RNA polymerase[15].

E. Effect of interaction among Location, season, tree gender, and IBA:

Figure (5) showed significant interaction among the studied parameters. The highest rooting ability (%) was of cuttings taken from Al-Samrah location from female trees in winter and spring (82.22%), while the lowest rooting ability was of cuttings taken from Al-Nabaeen location from male trees in fall (13.32%).

There was significant interaction among the studied parameters on the number of roots per cutting. Cuttings that were taken from Al-Nabaeen location in fall from male trees gave the highest number of roots per cutting (4.67 root/cutting) significantly while cutting taken from Al-Nabaeen location in summer from female trees gave the lowest number of roots per cutting (1.4 root/cutting).

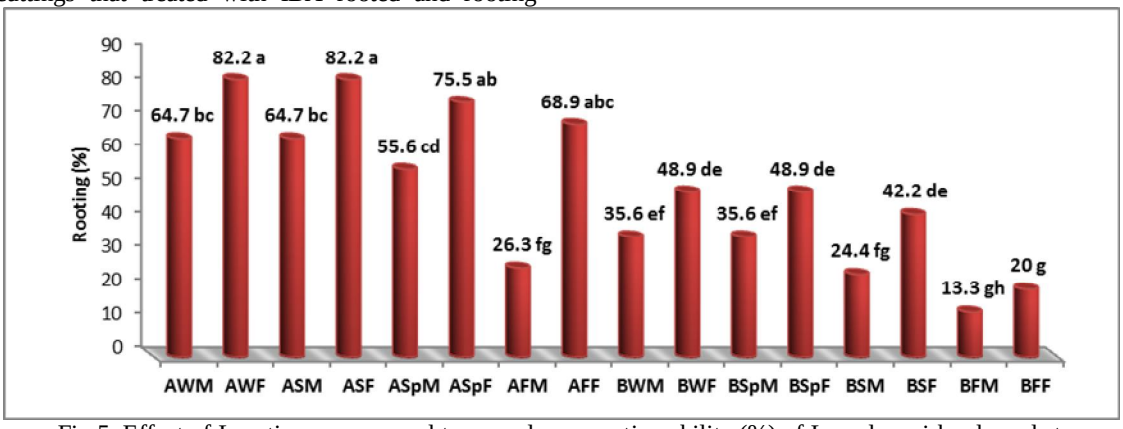

Fig 5: Effect of Location, season, and tree gender on rooting ability (%) of Laurel semi-hardwood stem cuttings treated with IBA 4000 ppm. A: Al-Samrah location, B: Al-Nabaeen location, W: winter, Sp: spring, S: summer, F: fall, M: male trees, F: female trees. IBA non-treated cuttings (control) were ignored from the figure because no rooting was obtained (0%).

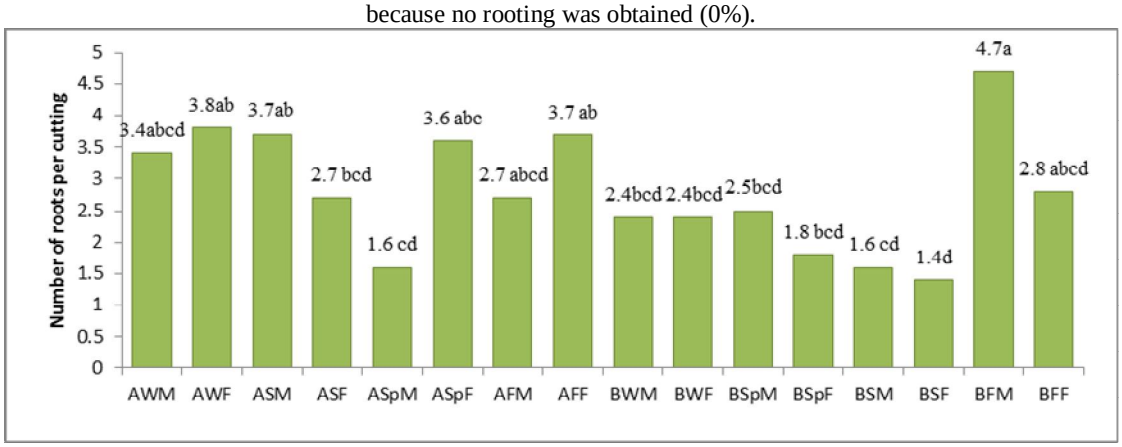

Fig 6: Effect of Location, season, and tree gender on the number of roots per cutting of Laurel semi-hardwood stem cuttings treated with IBA 4000 ppm. A: Al-Samrah location, B: Al-Nabaeen location, W: winter, Sp: spring, S: summer, F: fall, M: male trees, F: female trees.

Rev.[16] reported that hormones naturally produced by plants could differ between seasons and could interact with IBA, and this interaction could influence the rooting ability.

Rev.[17] found a significant interaction between cutting type and the time of collecting (March, April, August, September) on rooting ability and the number of roots per cutting of olive (*Olea europaea* L.).

Rev.[18] found a significant interaction between IBA and the period of taking Jojoba *Simmondsia Chinensis* cuttings on rooting ability, and they reported different responses to IBA depending on the time of collecting.

IV. CONCLUSIONS

Location, tree gender, season, and IBA treatments affected rooting ability (%) individually and combined. The rooting ability of Laurel semi-hard. wood stem cuttings could be enhanced by taking the cutting in winter or spring from female trees and treats them with IBA 4000ppm.

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