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COULD AFFECT THE ROOTING OF TWO TAXUS BACCATA VARIETIES STEM CUTTING LENGTH AND PROPAGATION PERIOD?

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Abstract
Ornamental trees are used worldwide in landscape design. Taxus baccata L. is an evergreen non-resinous tree, often with multiple trunks and spreading, pyramidal or rounded canopy. It can be propagated generatively and vegetatively. Nurseries mostly prefer to propagate them by vegetative way, because this type of method is quicker and the newly propagated plants inherit the genetics of the mother plants. In this study we have selected two varieties of Taxus baccata `Repandens` (TBR) and T. baccata `Fastigiata Aurea` (TBF), in which different length stem cuttings (5–10, 10–20, and 20–25 cm) were obtained and propagated in two different periods (May and July). From our results could be concluded that TBR rooting percentage increased at the collected cuttings in May and at 10–20 cm size. On the other hand, at TBF cuttings rooting percentage reported significant increases at 5–10 cm, also at the cuttings collected in May. In conclusion, our research suggests that Taxus baccata cuttings could obtain a higher rooting percentage when they are collected in May, moreover the length of the cuttings could be an influencing factor.

Keywords: ornamental trees, rooting, Taxus, vegetative propagation.

1. INTRODUCTION

Ornamental trees and shrubs interest has been enhancing in the recent years, and are important part of horticulture and landscaping, moreover can be used to amplify the visual effect of a home garden, park, even a walkway, they can be flowering or non-flowering plants (Naik, 2018). With an increasing request of ornamental trees and shrubs the growers are in a need of new propagation methods (Kentelky et al., 2021), also to reduce the propagation material quantity. All ornamental trees and shrubs could produce flowers, moreover seeds, nevertheless they demand favourable climatic conditions, and in some case can take many years to develop mature plants. Even so, not all can produce fertile seeds, and because of this fact they are propagated vegetatively (Stuepp et al., 2018), and also major fact is that the new plants inherit the mother plant genetics. Propagation by cuttings is a very popular and common technic, however external issues such as season, light intensity are factors that are affecting the adventitious root formation (Maden, 2003). Adventitious root formation is a plant physiological process allowing the vegetative propagation of many plant species (Husen et al., 2017). Furthermore, a relatively low adventitious root formation could be also the age of the stock plant or even the genetics of the species (Olaniyi et al., 2021).

The genus *Taxus* belongs to the family *Taxaceae* and its native to central and southern Europe, northwest Africa, and southwest Asia with 80 species (Benham et al., 2016; The Plant List, 2022). *Taxus baccata* L., commonly known as Common yew or European yew, is one of the seven species

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of the *Taxus* genus, they are slow growing evergreen trees (Majada et al., 2000; Husen et al., 2017; Kaviani and Negahdar, 2017). *Taxus baccata* is a preferred species in gardens and parks, however is important to mention that shoots, leaves, and seeds are highly poisonous (Benham et al., 2016); because of this fact, it has been reported that has been decreasing in many places (Bayraktar et al., 2018).
The aim of the research was to determine if stem cutting length and propagation period could be an influencing factor into obtaining a higher quality of rooted material.

2. MATERIALS AND METHODS

The study was conducted in the experimental greenhouse belonging to Sapientia Hungarian University of Transylvania, Târgu Mureș (46°31′17″ N 24°35′54″ E). The cuttings were obtained from a local nursery (Biota, Găiești village, Romania). The cuttings were immediately transported to the experimental sites to prevent desiccation. As plant material we have selected two varieties of *Taxus baccata*:

- *T. baccata* `Repandens` (TBR): is a small, wide-spreading, evergreen shrub, could reach a high of 60–120 cm and a spread of 180–450 cm (Figure 1a).
- *T. baccata* `Fastigiata Aurea` (TBF): is an upright, dense evergreen shrub, could reach a high of 120–900 cm and a spread of 60–240 cm (Figure 1b).

(a)

(b)

Figure 1. Taxus baccata 'Repandes' (a) and Taxus baccata 'Faastigiata Aurea' cutting preparation

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The first experiment started on 20 May, and the second on 6 July, with the same *Taxus* varieties. For each variety 30 sub-apical shoots (herbaceous spring and semi-hardwood summer cuttings) per replication with three replications were used a total of 540. Disease and pest-free propagation material was collected with a secateur from the nursery, with the length of 5–10, 10–20, and 20–25 cm. The leaves on the lower one-third to one-half of the stems were removed. The cuttings were immersed in 0.8% of 1–Naphthaleneacetic acid (NAA) rooting hormone. After the rooting hormone was applied, the cuttings were planted in 50 × 40 cm plastic trays filled with perlite rooting medium. Planting distance was 3 cm between the cuttings. We had filled the plastic tray with perlite to a depth of 20 cm (granulation: 1–3 mm, density: 0.05 kg/L, and pH: 7–7.5) and this was well irrigated before planting the cuttings; no artificial lights were used. Propagation trays were placed in the greenhouse with an automatic humidifier controller in order to provide the 80–90% humidity required for rooting. Humidity and temperature were measured using a Testo 175H1; the average temperature was between 22–28 °C.

Rooting percentage (the percentage of cuttings that developed at least one root), root volume (cm^3—a measuring cylinder was filled with water, the plant was submerged in it and under the pressure of the cutting water, filled out), number of roots, root length (cm). Root length was measured with a tape measure.

Data were analyzed using Past 4 statistical software (Oslo, Norway). Data were tested for normality of errors and homogeneity of variance. All data were normally distributed. The significance of the differences between the treatments was tested by applying ANOVA, at a confidence level of 95%. When the ANOVA null hypothesis was rejected, Tukey's post hoc test was carried out to establish the statistically significant differences at $p < 0.05$.

3. RESULTS AND DISCUSSIONS

Considering the rooting percentage, can be observed that the length of the stem cutting did not report significant differences regarding the two *Taxus* varieties (Figure 2). In the case of the TBR (Figure 2a) small increases were recorded when comparing the different stem cutting length, but there were no significant differences not at the May nor at the July propagation period. On the other hand, at TBF (Figure 2b) significant differences were observed at the May propagation period; at the 10–20 cm length stem cuttings decreases were reported compared to the 5–10 and 20–25 cm. When comparing the propagation periods could be observed that at both varieties significant differences were reported. High increases were determined at the cuttings propagated in May compared to the July cuttings (Figure 2). In previous study was reported that the cutting propagated in May-June reported higher rooting percentage than those collected in February-March (Maden, 2003), which results are similar to our findings. Furthermore, in a study was found that IBA 5000 ppm combined with perlite boosted the rooting percentage of the *Taxus baccata* cuttings, moreover is also mentioned that the rooting table temperature should be higher than 5 °C (Bayraktar et al., 2018).

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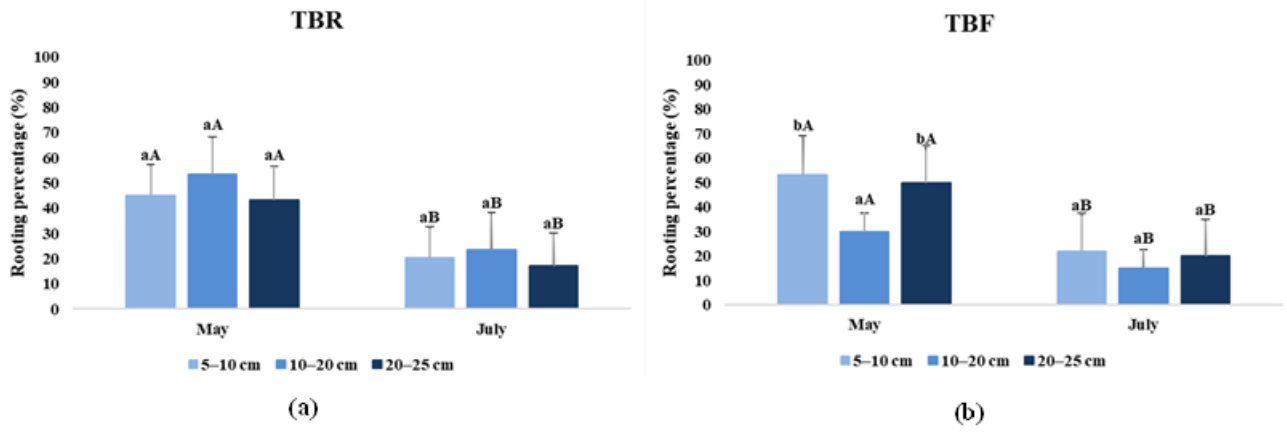

Figure 2. Effect of stem cutting length and propagation period on rooting percentage of the selected Taxus baccata varieties: (a) T. baccata 'Repandens' (TBR) and (b) T. baccata 'Fastigiata Aurea' (TBF). Bars represent the means ± SE (n = 30). Different lowercase letters above the bars indicate significant differences between the length of the stem cutting, and different uppercase letters indicate the significant differences between the May and July propagation period, according to Tukey's test (p < 0.05).

As expected, the number of root appearance was significantly affected by the propagation period (Figure 3). In the case of the TBR (Figure 3a) could be observed clearly that greater increases were reported at the May propagation periods then at the July. Similar results were obtained at the TBF (Figure 3b), here again the cuttings propagated in May reported higher increases in root number than the July propagated cuttings. Regarding the stem cutting length at TBR no significant changes were observed at none of the propagation periods, however at the TBF increases were determined at the May propagation period; the 20–25 cm cuttings recorded higher increases compared to the other two variants. Olaniyi et al., (2021), reported that root number was higher at stem cutting of 8 cm than at 6 cm at *Picralima nitida*.

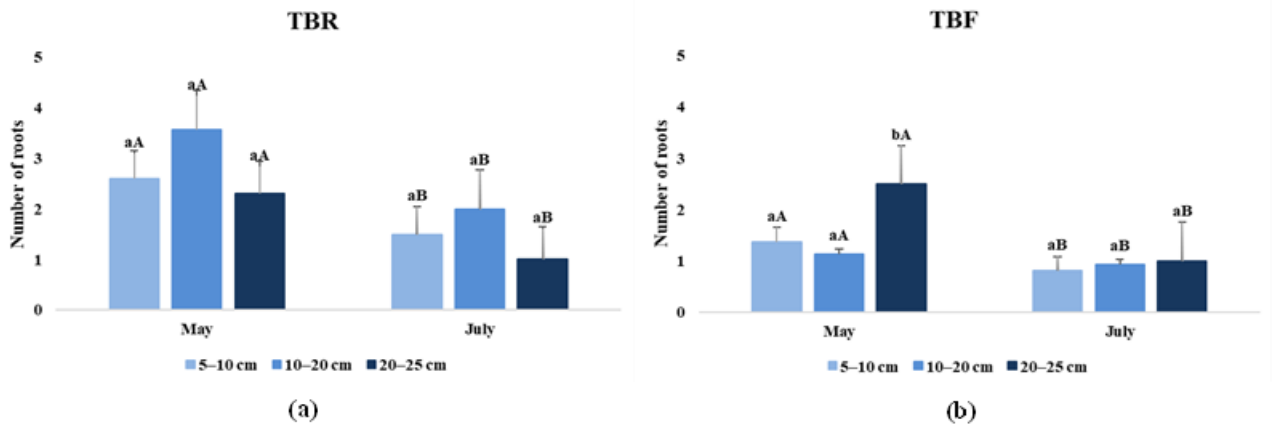

Figure 3. Effect of stem cutting length and propagation period on number of roots of the selected Taxus baccata varieties: (a) T. baccata 'Repandens' (TBR) and (b) T. baccata 'Fastigiata Aurea' (TBF). Bars represent the means ± SE (n = 30). Different lowercase letters above the bars indicate significant differences between the length of the stem cutting, and different uppercase letters indicate the significant differences between the May and July propagation period, according to Tukey's test (p < 0.05).

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From the results for the root length small increases were observed at the TBR (Figure 4a) in both propagation periods, however no significant changes were determined. On the other hand, at TBF (Figure 4b) decreases were observed at the 10–20 cm length cuttings in the May propagation period. When comparing propagation period, as it was expected, the cuttings collected in May reported higher root length then the July cuttings at both *Taxus* varieties. Propagation period and hormone treatments could significantly increase root length and number (Badawy et al., 2020), which was clearly visible from our results, the cutting propagated in May root number and length were significantly increase from the July propagation period. Stem cutting length and diameter are affecting the adventitious root formation: at *Moringa* stem cuttings between 50–57 cm recorded positive results (Santoso and Parwata, 2020).

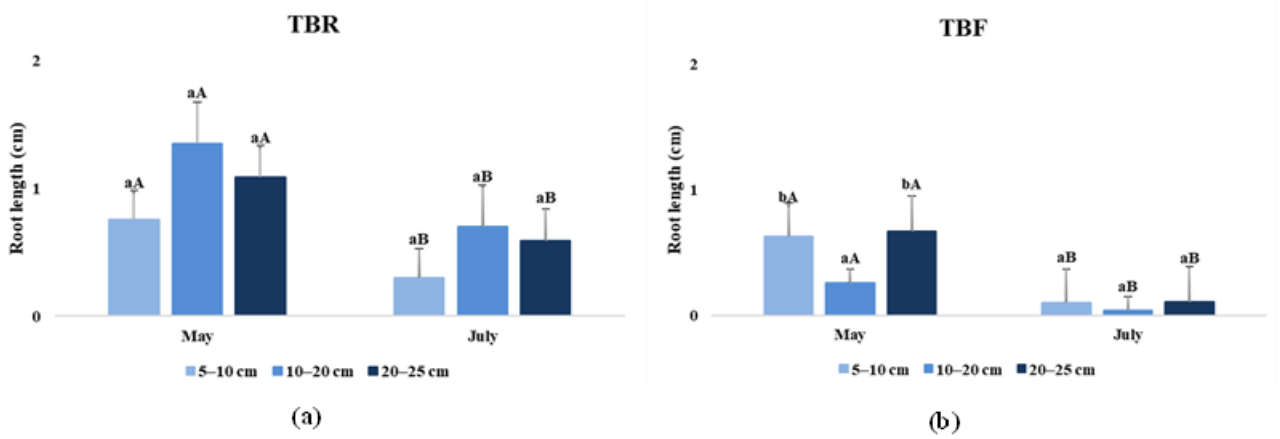

Figure 4. Effect of stem cutting length and propagation period on root length of the selected Taxus baccata varieties: (a) T. baccata 'Repandens' (TBR) and (b) T. baccata 'Fastigiata Aurea' (TBF). Bars represent the means ± SE (n = 30). Different lowercase letters above the bars indicate significant differences between the length of the stem cutting, and different uppercase letters indicate the significant differences between the May and July propagation period, according to Tukey's test (p < 0.05).

Under our experimental conditions, at volume of roots (Figure 5) no significant differences were observed, when comparing the cuttings length, at both varieties. However, the root volume was significantly affected when the propagation periods are compared. At both varieties, TBR (Figure 5a) and TBF (Figure 5b) the cuttings collected in May reported significant increases compared to the July cuttings.

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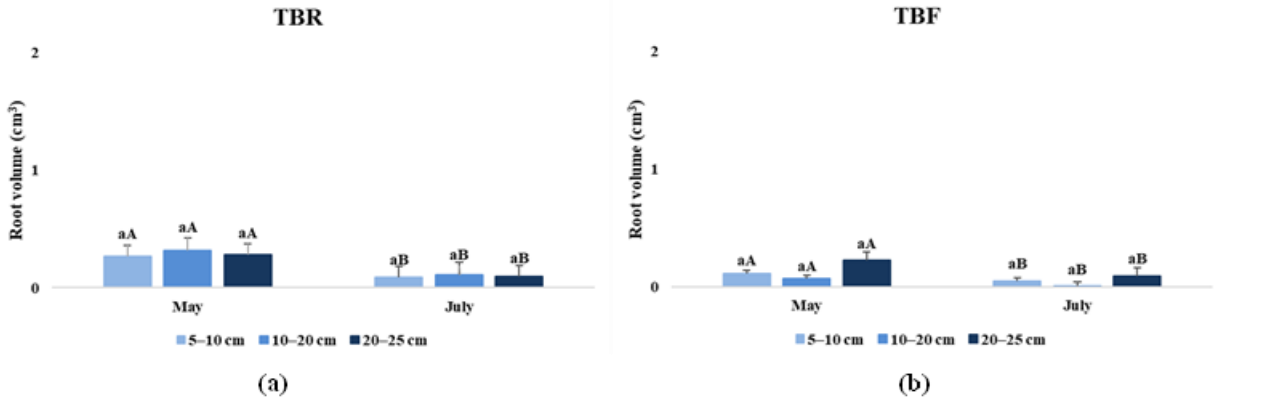

Figure 5. Effect of stem cutting length and propagation period on root volume of the selected Taxus baccata varieties: (a) T. baccata 'Repandens' (TBR) and (b) T. baccata 'Fastigiata Aurea' (TBF). Bars represent the means ± SE (n = 30). Different lowercase letters above the bars indicate significant differences between the length of the stem cutting, and different uppercase letters indicate the significant differences between the May and July propagation period, according to Tukey's test (p < 0.05).

4. CONCLUSIONS

Our research suggests that *Taxus baccata* cuttings could obtain a higher rooting percentage and a better adventitious root formation when they are collected and propagated in May. Moreover, stem cutting length could be also an influencing factor, in the case of *T. baccata* 'Repandens' (TBR) small increases were reported, however not significantly different. On the other hand, at *T. baccata 'Fastigiata Aurea'* (TBF) the 20–25 cm cuttings recorded significant changes compared to the others, also at the 5–10 cm cuttings significant differences were observed. On the basis of the results presented here, it could be stated that the rooting of the *Taxus baccata* could be also a variety-dependent process.

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