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STUDIES ON THE CELTIS AUSTRALIS L. SEEDS PREPARATION METHODS IN ORDER TO SPEED UP GERMINATION

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Abstract
Celtis australis L., is a tree up to 20 m tall. The range is Mediterranean to the Caucasus, in Romania it is found sporadically in Banat, Oltenia and Dobrogea, the species being used in green spaces where it is planted in alignment, isolated or in massifs, but also on the Black Sea Coast has adapted very well. The genus includes about 70 species, trees and shrubs widespread in the northern hemisphere, from tropical to temperate regions. The elm-like branch is distichous. The stalk has a broken marrow, made up of very thick blades, asymmetrical leaves with 3 ribs at the base, polygamous, andromonoic flowers, the male ones in bundles at the base of the stalk, the hermaphroditic ones arranged at the base of the petiole of the leaves, usually solitary. Fruits are spherical or ovoid drupes, with a strong stone and a thin, fleshy mesocarp. The purpose of this experiment is to speed up the germination of seeds that have been prepared in the four variants: stratification, wetting with hot water, scarification, wetting with cold water. Biometric measurements were performed on the following morphological features: seedling stem height, stem diameter, number of roots, root length, number of leaves, leaf area. Analyzing the four methods of seed treatment related to chemical treatment (control) it is observed that the best results are at V1 (stratification) for all analyzed characters.

Keywords: Celtis australis L., germination stimulating, green spaces.

1. INTRODUCTION

Celtis australis L., is a tree up to 20 m high, from the *Ulmaceae* family, *Celtis* genus (Figure 1). The area is Mediterranean to the Caucasus, In Romania in sporadically found in Banat, Oltenia and Dobrogea, and the species is used in green spaces where it is planted in alignment, isolated or in massifs, but it has also adapted very well on the Black Sea Coast. The genus includes approximately 70 species, trees and shrubs distributed in the northern hemisphere, from tropical to temperate regions. The elm-like branching is distichous. Lugers have an interrupted pith, consisting of very dense lamellae. Asymmetrical leaves, with 3 ribs at the base. Polygamous, andromonoic flowers, the male ones in fascicles at the base of the stems, the hermaphrodite ones arranged at the base of the petiole of the leaves, usually solitary. Fruits - spherical or ovoid drupes, with a hard seed and thin and fleshy mesocarp (Nețoiu et al., 2008).
According to the new taxonomic classification, it belongs to the *Cannabaceae* family (The Plant list – Angiosperms, 2012).

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Figure 1. Celtis australis L

For the study "Effect of seed source and temperature on seed germination of Celtis australis L.: a promising agroforestry tree crop from the Central Himalayas, India" provenance research was done, seeds were collected from 13 locations with altitudes and temperatures different effects on the germination of *Celtis australis* seeds (Bhupendra et al, 2004).
In the study on variation in seed and seedling characteristics of *Celtis australis*, from Central Himalaya, India, fruits were collected from 13 different sources, seed weight showed maximum variation among seed populations compared to other morphological characters. *Celtis australis* is an ornamental tree, particularly suitable for urban areas because of its resistance to drought and pests and its elegant shade-providing crown (Bhupendra et al., 2006).
Another study, also from the Central Himalayas, India, aimed to compare the nutritional composition of adult and juvenile leaves of *Celtis australis*, collected from different altitudes (Bhupendra et al., 2010).
Research was done to examine the characteristics of the seeds and the effects of different pretreatments on their germination in the Mediterranean species (Güney, 2018).
In the Indian Himalayas, *Celtis australis* is an important agroforestry tree species that is heavily exploited for domestic use (firewood, fodder and small timber), so growth and biomass production related to the species is important. Therefore, selection of genetically diverse seed sources and evaluation of their potential could be one of the future strategies for adapting agroforestry practices related to climate change (Kumar et al., 2021).
The seeds of some ornamental woody species do not germinate without prior preparation or germinate in a reduced proportion. The main role of seed preparation is to ensure germination in a high percentage, as evenly and as quickly as possible.
The purpose of this experiment is to accelerate the germination of seeds from the species *Celtis australis* L.
In the species: *Gleditsia triacanthos* L. (Posta et al., 2015) and *Albizzia julibrissin* Durazz. (Posta, 2010) for stimulating germination, the seeds were prepared in the same way as those of *Celtis australis* L.

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The germination index was higher during storage at room temperature than at cold, low temperature, indicating that germination was comparatively higher and faster in seeds stored at room temperature than in those stored at low temperature (Bhupendra S. et al., 2021).

2. MATERIALS AND METHODS

The fruits of *Celtis australis* L. were harvested on October 5, 2019 from specimens located in the Botanical Park of Timisoara.

The drupes were prepared immediately after harvesting for sowing by maceration (Figure 2). The obtained seeds were winnowed and kept in paper bags, at a temperature of 5-7°C, except for those that were stratified for 90 days in wet sand, at a temperature of 4-5°C (V1).

Figure 2. Celtis australis L. drupes: A. after harvest; B. after maceration

On January 10, 2020 the seeds were prepared as follows: hydrothermal treatment, by keeping the seeds in water at a temperature of 50°C, 24 hours, scarification, moistening with cold water 3-5°C, 24 hours.

On January 11, 2020, the seeds prepared in the four variants were sown: stratification (V1), hydrothermal treatment, by keeping the seeds in water at a temperature of 50°C for 24 hours (V2), scarification (V3), moistening with cold water 3-5°C, 24 hours (V4).

Sowing was done in the greenhouse of the Arboriculture discipline at the Didactic and Research Base of our faculty in a mixture of 50% manure and 50% sand for all four variants, maintaining a temperature of 18° C and atmospheric U% at 75% and 55% in soil.

The first seedlings sprouted on March 03, 2021. Every 5 days, their emergence was observed and noted.

On April 10, 2021, 40 days after the emergence of the seedlings, before transplanting, biometric measurements were made on the morphological characters of the seedlings: stem height, stem diameter, length and number of roots, leaf surface.

The obtained results were statistically interpreted using the STATISTICA 10 software.

3. RESULTS AND DISCUSSIONS

Due to the low germination rate, it is necessary to apply treatments to stimulate it, as follows: the stratified seeds (5.94 mm) and the hydrothermally treated seeds (5.32 mm) recorded very significant values on the height of the stems of the seedlings with differences of 1.27% respectively 0.65%

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compared to the variant prepared by scarification considered as control. In the variant in which the seeds were moistened, a deficit with a difference of -0.63 can be observed, being very significant compared to the same variant considered as a control (Table 1).

Table 1. Influence of seed treatment on seedling stem height

Recipe	*Stem height*		*Difference ±D*	*Signification of difference*
	Obtained values (mm)	%		
V1	5.94 a	127.2	1.27	***
V2	5.32 a	113.9	0.65	***
V4	4.04 c	86.6	-0.63	000
V3	4.67 b	100.0	0.00	Control

SD (Duncan test) 0.030-0.32

LSD (p 5%)	16.38
LSD (p 1%)	37.82
LSD (p 0.1%)	120.94

Analyzing the four seed treatment methods related to the scarification treatment (Control) on the seedling stem diameter presented in Table 2, the best results are at V1 (stratification) followed by V2 (hydrothermal treatment). Following the significance of the differences between the four variants resulting from the method of treatment applied to the seeds, it can be observed that the stratification ensures a difference of 0.12%, being distinctly significant compared to the control of the experience treated by scarification.

Table 2. Influence of seed treatment on seedling stem diameter character

Recipe	*Stem diameter*		*Difference ±D*	*Signification of difference*
	Obtained values (mm)	%		
V1	0.32 a	159.8	0.12	**
V2	0.26 b	131.0	0.06	*
V4	0.16 c	79.9	-0.04	-
V3	0.20 c	100.0	0.00	Control

SD (Duncan test) 0.06-0.07

LSD (p 5%)	0.06
LSD (p 1%)	0.08
LSD (p 0.1%)	0.12

The number of the seedling's roots are influenced by the applied treatment (Table 3). We registered a distinctly significant difference in the case of the stratification treatment compared to the control. Using the Duncan test as a method of comparison, for the significance threshold, is assured significance between the variants where the letter differs.

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Table 3. Influence of seed treatment on seedling root number character

Recipe	*Root number*		*Difference* ±D	*Signification of difference*
	Obtained values	%		
V1	2.80 a	133.3	0.70	**
V2	2.43 b	115.5	0.33	-
V4	2.00 bc	95.2	-0.10	-
V3	2.10 c	100.0	0.00	Control

SD (Duncan test) 0.37-0.40

LSD (p 5%)	0.37
LSD (p 1%)	0.53
LSD (p 0.1%)	0.79

Regarding the influence of the treatment on the length of the root of the seedlings, we recorded values between 0.51-1.50 mm. We found that, regardless of the treatment applied according to the Duncan test for the significance threshold 95%- DS 5%, there is ensured significance between the variants (Table 4).

Table 4. Influence of seed treatment on seedling root length character

Recipe	*Seedling root length*		*Difference* ±D	*Signification of difference*
	Obtained values (mm)	%		
V1	1.50 a	211.7	079	***
V2	0.98 b	138.5	0.27	**
V4	0.51 d	71.4	-0.20	0
V3	0.71 c	100.0	0.00	Mt

SD (Duncan test) 0.16-0.17

LSD (p 5%)	0.06
LSD (p 1%)	0.08
LSD (p 0.1%)	0.12

The unilateral influence of the treatments on the number of leaves presented in Table 5, highlights the fact that the values were between 1.98-2.45. In the case of the variant by stratification being significant, statistical differences (0.47%) are ensured compared to the variant prepared by scarification considered as a control.

For the analyzed character, the leaf surface influenced by the application of seed treatments, values between 0.57-0.95 mm^2 were obtained (Table 6). It can be observed that in the case of the variants with hydrothermal treatment and by wetting compared to the variant prepared by scarification considered as a control, the results obtained are not statistically guaranteed. In the variant by stratification compared to the same control, there is a difference of 0.27%, being distinctly significant.

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Table 5. Influence of seed treatment on seedling leaf number character

Recipe	*Leaf number*		*Difference ±D*	*Signification of difference*
	Obtained values	%		
V1	2.45 a	124.1	0.47	*
V2	2.23 ab	112.7	0.25	-
V4	2.08 ab	105.1	0.10	-
V3	1.98 b	100.0	0.00	Mt

SD (Duncan test) 0.39-0.42

LSD (p 5%)	0.06
LSD (p 1%)	0.08
LSD (p 0.1%)	0.12

Table 6. Influence of seed treatment on leaf surface character

Recipe	*Leaf surface*		*Difference ±D*	*Signification of difference*
	Obtained values (mm^2)	%		
V1	0.95 a	139.8	0.27	**
V2	0.82 ab	120.3	0.14	-
V4	0.57 bc	84.3	-0.11	-
V3	0.68 c	100.0	0.00	Mt

SD (Duncan test) 0.15-0.16

LSD (p 5%)	0.15
LSD (p 1%)	0.21
LSD (p 0.1%)	0.31

4. CONCLUSIONS

The stratified seeds (5.94 mm) and the hydrothermally treated seeds (5.32 mm) recorded very significant values on the stem height of the seedlings compared to the version prepared by scarification considered as a control.

Analyzing the four seed treatment methods related to the treatment by scarification (Control) on the stem diameter of the seedlings, the best results are in V1 experimental variant (stratification) followed by V2 (hydrothermal treatment).

In the case of the number of roots of the seedlings influenced by the applied treatment, a distinctly significant difference was registered in the case of the stratification treatment compared to the control.

For the root length character of the seedlings, where values between 0.51-1.50 mm are recorded, it is found that, regardless of the treatment applied according to the Duncan test for the significance threshold 95% -SD 5%, there is assured significance between the variants.

The character number of leaves in the analyzed saplings, the variant by stratification being significant, statistical differences (0.47%) are ensured compared to the variant prepared by scarification considered as a control.

In the case of the leaf surface, in the variant by stratification compared to the same control, there is a difference of 0.27%, being distinctly significant.

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5. REFERENCES

Bhupendra S., Bhatt, B.P., Prasad,P., (2021). Effects of storage period on seed germination of Celtis australis L. in Central Himalaya, India. *Indian Journal of Agroforestry*.

Bhupendra, S., B.P., Bhatt, P., Prasad (2006). Variation in Seed and Seedling Traits of Celtis australis, a Multipurpose Tree, in Central Himalaya, India. *Agroforestry Systems 67*, 115–122.

Bhupendra, S., Bhagwati P.B., Pratti, P., (2010). Altitudinal variation in nutritive value of adult-juvenile foliage of Celtis australis L.: A promising fodder tree species of Central Himalaya, India. *Journal of American Science 6(2)*, 108-112.

Bhupendra, S., Bhavik, B., Prasad, P. (2004). Effect of seed source and temperature on seed germination of Celtis, Australis L.: A promising agroforestry tree-crop of Central Himalaya, India. *Forests Trees and Livelihoods Trees and Livelihoods 14 (1)*, 53-60. https://doi.org/10.1080/14728028.2004.9752479

Güney, D., Turna, İ., & Atar, F. (2018). The effects of different pretreatments on germination of Mediterranean hackberry (Celtis australis L.) seeds.). *Biological Diversity and Conservation, 11(1)*, 61-67.

Kumar, R., Mehta, H., Kumar, A., Bhardwaj, A. K., Kaushal, R., Dobhal, S., ... & Verma, K. (2021). Seed source variation affects the growth, biomass, carbon stock, and climate resilience potential: A case study of Celtis australis in Indian Himalayas. *Global Ecology and Conservation*, *26*, e01469.

Netoiu, C., Visoiu, D., & Badele, O. (2008). *Dendrologie [Dendrology]*. Editura Eurobit. Timișoara.

Poșta, D.S., Camen, D., (2015). Research regarding the influence of the preparing methods on seed germination on Gleditsia triacanthos L. *Romanian Biotechnological Letters, 20 (6)*.

Poşta, D.S., Hernea, C., Moatăr, M.M., Sărac, I., Dragomir P., (2010). Technical research on the use of methods for improving quality seeds at the species Albizzia julibrissin Durazz. *Journal of Horticulture, Forestry and Biotechnology, 2010, 14 (2)*, 171-173.

The Plant list, (2012) Angiosperms. http://www.theplantlist.org/tpl1.1/record/kew-2708167

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