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RESEARCH ON SEED GERMINATION STIMULATION AT PAULOWNIA TOMENTOSA THUNB. STEUD.

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Abstract
Paulownia tomentosa (Thunb.) Sieb. & Zucc. Ex Steud. (syn. P. Imperialis Sieb. & Zucc.), is a native species to China, popularly being called "Princess Tree". In Romania, the species is sensitive to the early frosts, which cause frostbite of non-lignified stems. Unprotected trees can be destroyed to ground level, but recover vigorously from shoots. Paulownia tomentosa is an invasive species introduced to the US from China as an ornamental and landscape tree in the mid-1800s. The family name derives from its genus Paulownia Siebold & Zucc., 1835 whose name was given in honour of the Danish princess Anna Paulowna or Pavlovna (1795-1865), the consort of King William II of the Netherlands and the daughter of Tsar Paul I of Russia (Gledhill, D., 2008). The aim of the research was to speed up the germination of Paulownia tomentosa seeds with Nitrozyme (based upon a highly concentrated and purified extract of marine kelp) in different concentrations: 0.1%, 0.3%, 0.5%, 0.7%, 0.9%. The germination capacity of the seeds decreases from the moment of dispersal even in optimal conditions of storage in the laboratory. In the case of treated seeds with 0.1% Nitrozyme the values of height and diameter of the seedling increased slightly.

Keywords: germination stimulation, Nitrozyme, Paulownia tomentosa.

1. INTRODUCTION

Paulownia tomentosa (Thunb.) Steud. (syn. *P. Imperialis* S&Z), species native to China. The name of the species in English is *Princess Tree*. Tree of 15 m tall, with opposite, large, ovate leaves (Figure 1). Large flowers of 5-6 cm long, purple, which appear before the leaves, belong to the *Scrophulariaceae* family (Ciocârlan, 2000). According to the new taxonomic classification, it belongs to the *Paulowniaceae* family (Botanical Journal of the Linnean Society 2003, The Plant list - Angiosperms). The family name derives from its genus *Paulownia* Siebold & Zucc., which was named after Princess Anna Paulowna or Pavlovna of Denmark (1795-1865), consort of King William II of the Netherlands and daughter of Czar Paul I of Russia (Gledhill, 2008).

In our country, it is sensitive to frost and early frosts, which cause the thawing of non-lignified branches. Unprotected seedlings can be destroyed down to the ground level, but they recover vigorously from the shoots. If the climate is warm, the growing season is long and it is planted under the shelter of buildings or other trees, it can develop well. It bears fruit after 5 years, sprouts and branches well. In green spaces, it is planted in isolation, for its large, beautifully colored

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flowers and very large leaves (Nețoiu et al., 2008). It is propagated by seeds sown immediately after harvesting in the greenhouse and by root cuttings (Iliescu, 1998).
Princess tree (*Paulownia tomentosa* (Thunb.) Sieb. & Zucc. ex Steud.), an invasive species introduced to the USA from China as an ornamental and landscape tree in the mid-1800s (Hu, 1961).

Figure 1. Paulownia tomentosa (Thunb.) Steud - the appearance of the tree

In the spring of 2007, a plantation of *Paulownia tomentosa* (Thunb.) Steud was established on the grounds of our university, with container seedlings belonging to two clones (Hernea et al. 2008).
The germination of the seeds of the princess tree (*Paulownia tomentosa*) can also be stimulated by the action of light and temperature (Grubišicá and Konjević, 2006). *Paulownia elongata* is an economically important tree species in China. Germination was tested in response to light, temperature, cold stratification, after-ripening and GA3 (Liu et al., 2017).
Angela et al., (2021), conducted a study on the response of the invasive princess tree (*Paulownia tomentosa*) to wildfire and other disturbances in an Appalachian hardwood forest. The conclusion of this study was that all disturbances considered, including wildfires, created favorable conditions for princess tree growth and expansion in forest areas. Princess tree has the ability to invade post-fire sites, particularly where fire severity was high (Black et al., 2018).
Paulownia tomentosa can survive fires because of its growing stems. It is tolerant to pollution and is not picky about the type of soil. For this reason, it functions ecologically as a pioneer plant. Its nitrogen-rich leaves provide good fodder and its roots prevent soil erosion. (Reza, 2017).

2. MATERIALS AND METHODS

The research was carried out in the laboratory of the Arboriculture discipline at the Teaching and Research Base of the University of Agricultural Sciences and Veterinary Medicine of Banat "King Mihai I of Romania" in Timisoara.
The fruits of *Paulownia tomentosa* Thunb. Steud. (Figure 2) they were collected on October 20 from the University Park and kept at a temperature of 4°C, in the refrigerator. In order to obtain seedlings in a short period of time, it is very important to prepare the seeds before sowing.

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Figure 2. Paulownia tomentosa (Thunb.) Steud - fruits and seeds

The monofactorial experiment was established on March 5, 2021 in controlled environmental conditions at 22° C temperature, the seeds were treated with Nitrozyme, a biostimulator for seed germination, is a highly concentrated seaweed extract and contains a wide range of natural growth enhancers. It was used different concentrations: 0.1%, 0.3%, 0.5 %, 0.7%, 0.9% (Figure 3).

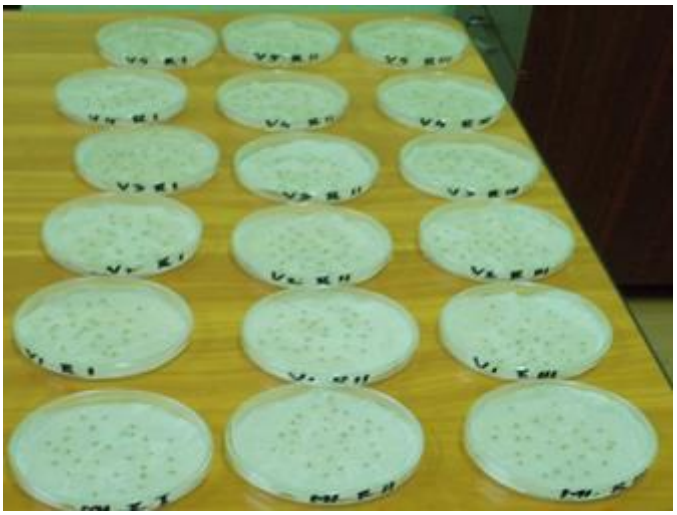

Figure 3. Paulownia tomentosa (Thunb.) Steud – seed germination stimulation

The longevity of princess tree seeds appears to be relatively short. Seed germination declines from the time of dispersal even under optimal laboratory storage conditions (DeLoach, 1997; Graves, 1989; Carpenter et al., 1979; Graves et al., 1989). The seeds of the species *Catalpa bignonioides* Walt. were stimulated to accelerate germination with Nitragin in different concentrations (Poșta, 2021). Gocan, et al. (2021) studied the effect of chemical treatments on the quality of cut flowers. Preparing the seeds before sowing by using different methods is an alternative to improve their cultural value (Poșta, 2013).
The obtained results were statistically processed using the STATISTICA 10 software.

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3. RESULTS AND DISCUSSIONS

For a good interpretation of the results, it was necessary to correlate the experimental data expressing the height and diameter of *Paulownia tomentosa* Thunb seedlings. Steud. after applying the treatments at different concentrations.

Analyzing the influence of the treatment on the seeds in terms of the correlation between the height and diameter of the seedling in Figure 4, a connection between the two parameters is highlighted.

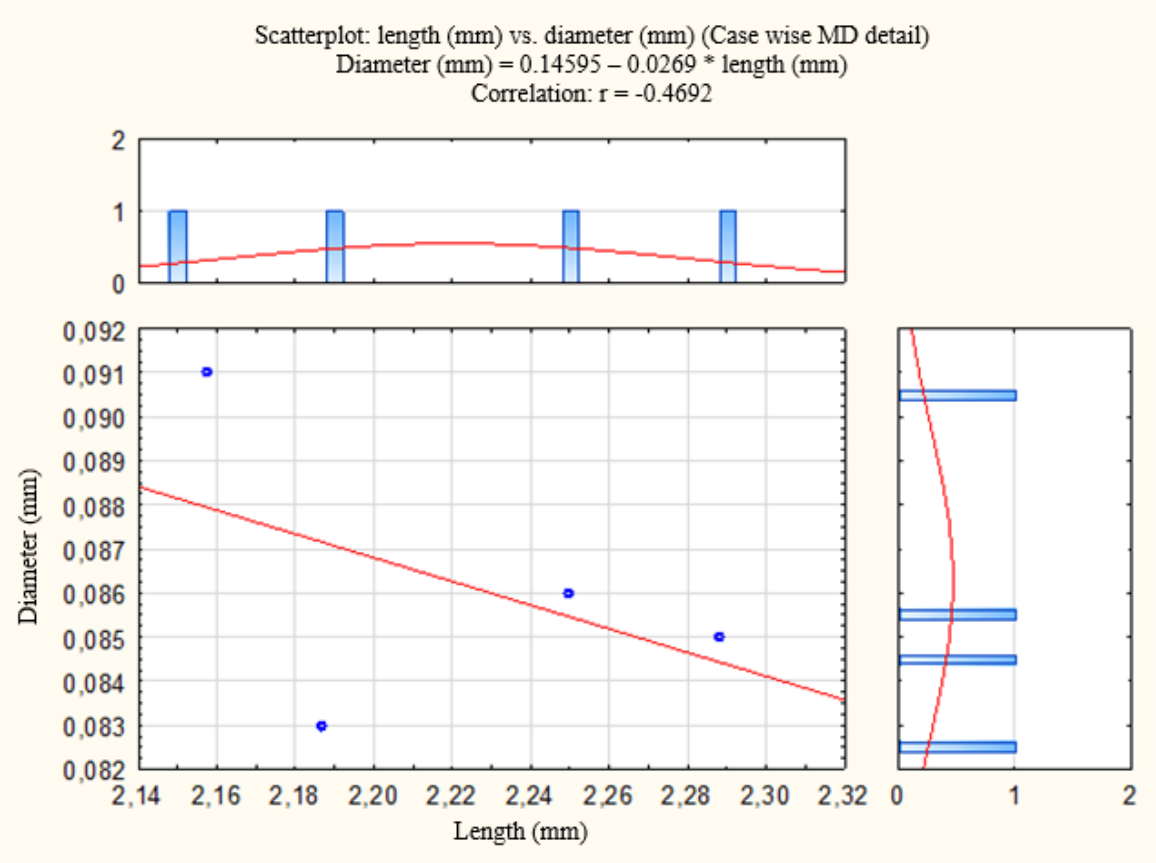

Figure 4. Correlations between plant height and diameter in the case of untreated seeds

There is a linear equation, and in the first untreated case the value of the correlation coefficient (r = -0.4692^{0}) is observed to be significantly negative.

The values increased slightly for the analyzed parameters in the case of seeds treated with the concentration of 0.1%, the correlation coefficient also increases (r = 0.61135**) being distinctly significantly positive (Figure 5).

In the case of using the concentration of 0.3% (Figure 6) the connection between the height of the seedling and its diameter is represented by the linear equation being statistically uncertain according to the correlation coefficient (r = -0.1543).

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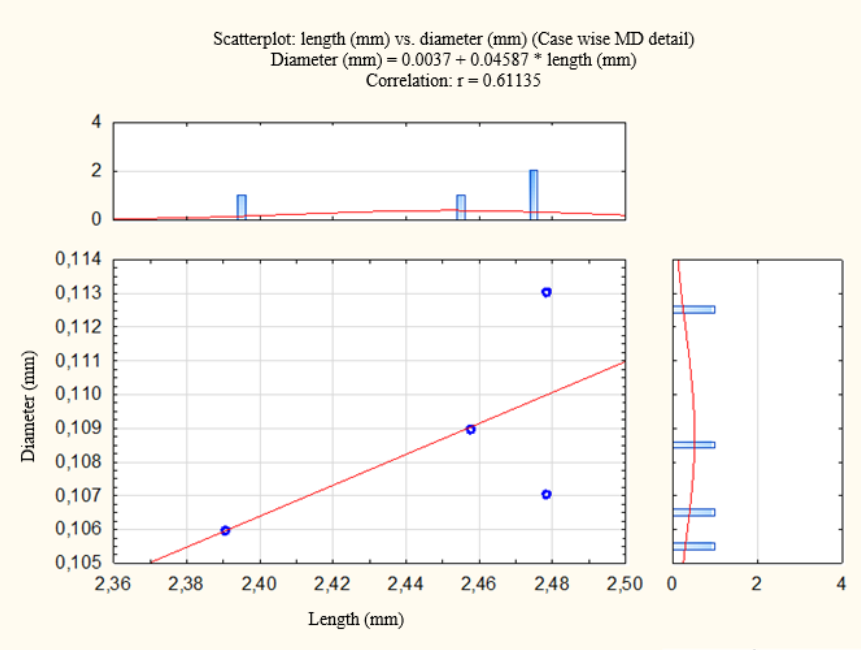

Figure 5. Correlations between seedling height and diameter in the case of seeds treated with a concentration of 0.1% Nitrozyme

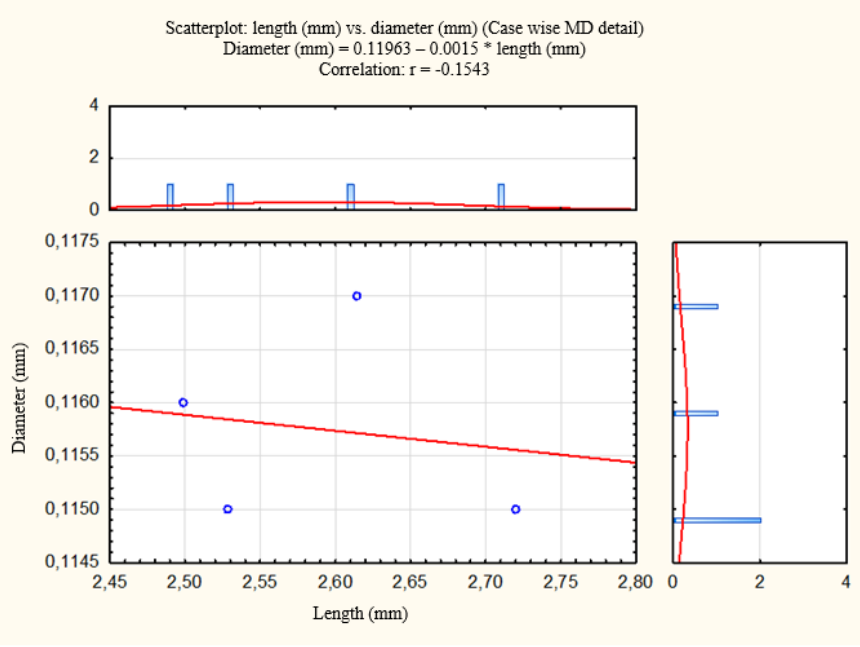

Figure 6. Correlations between seedling height and diameter in the case of seeds treated with a concentration of 0.3% Nitrozyme

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The higher values of the correlation coefficient (r = 0.79767***) show a much closer direct relationship between the height of the seedling and its diameter being very significant at the concentration of 0.5% Nitrozyme (Figure 7). However, they recorded lower values than in the case of the 0.7% concentration.

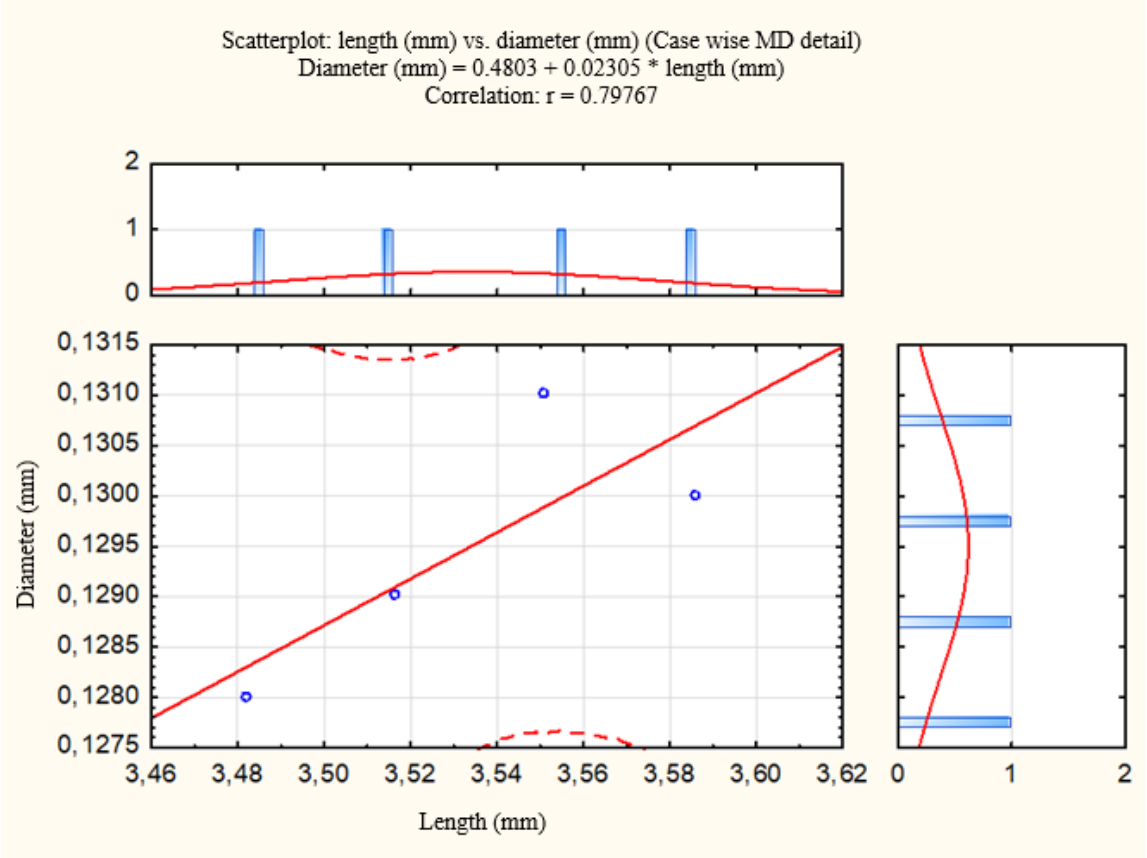

Figure 7. Correlations between seedling height and diameter in the case of seeds treated with a concentration of 0.5% Nitrozyme

Also, when using the concentration of 0.7% Nitrozyme, correlating the values of the seedling height and diameter, very significant linear correlations were obtained (r = 0.89663***) (Figure 8). This concentration led to the best results in terms of the monitored parameters.
In the case of the 0.9% Nitrozyme concentration, applied to the seeds, the correlation coefficient had significant values. Between the length of the seedling and its diameter, a correlation coefficient value of 0.3343* can be observed (Figure 9).

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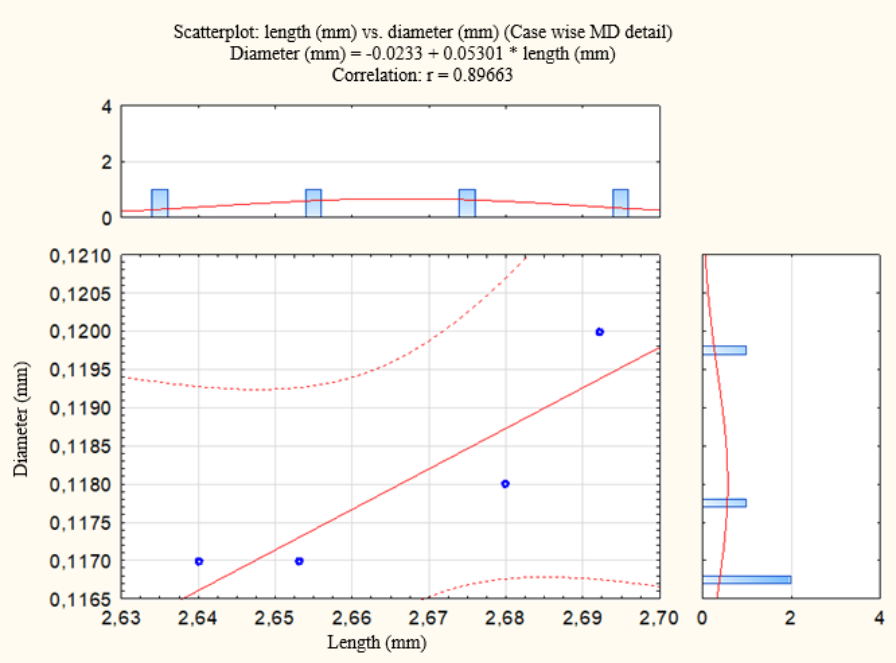

Figure 8. Correlations between seedling height and diameter in the case of seeds treated with a concentration of 0.7% Nitrozyme

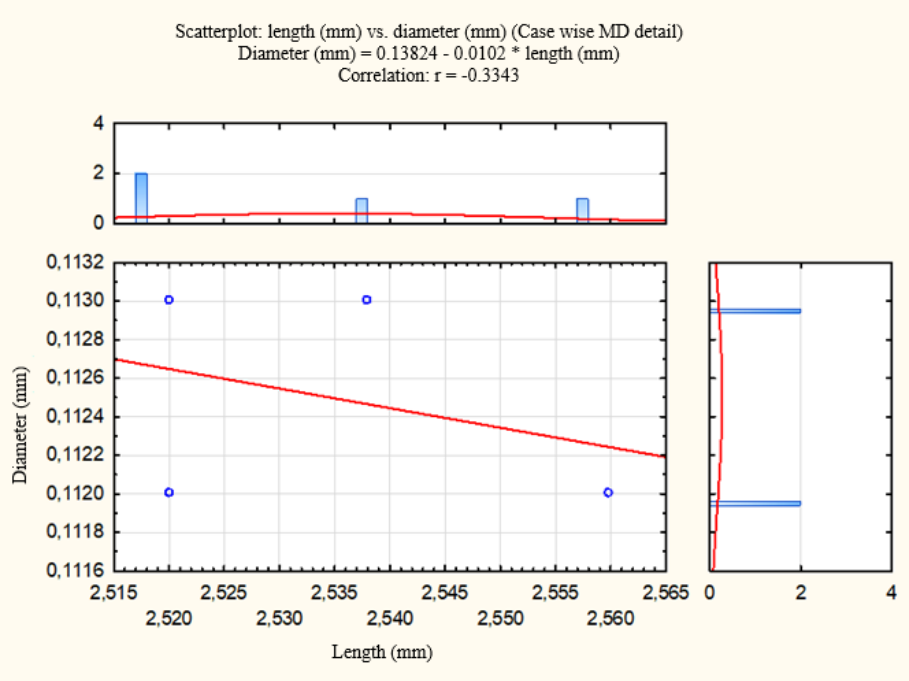

Figure 9. Correlations between seedling height and diameter in the case of seeds treated with a concentration of 0.9% Nitrozyme

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4. CONCLUSIONS

Regarding the efficiency of the Nitrozyme biostimulator applied to the seeds in different concentrations, the following can be observed:

• in the case of seeds treated with a concentration of 0.1%, the values of seedling height and diameter increased slightly;

• the height and diameter of the seedling in the case of the concentration of 0.3% is represented by the linear equation, being statistically uncertain according to the correlation coefficient;

• the height and diameter of the seedling is very significant at the concentration of 0.5%;

• also, when using the concentration of 0.7% Nitrozyme, correlating the values of the seedling height and diameter, very significant linear correlations were obtained

• in the case of the 0.9% Nitrozyme concentration, applied to the seeds, the correlation coefficient had significant values.

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