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SUBSTRATES ON GERMINATIVE SEED PROCESSES IN *Tabebuia roseo-alba* (Ridl.) Sandwith) AND *Tabebuia serratifolia* (Vahl) G. Nicholson

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ABSTRACT - Among the constituents of Brazilian flora, the *ipes*, belonging to the Bignoneaceae family, occur widely, and therefore do not occupy a single habitat. This group species has various values, including economic, ornamental and medicinal. The objective of this work was to evaluate the effect of various substrates on the seed germination process of *Tabebuia roseo-alba* (Ridl.) Sandwith) (ipê rosa) and *T. serratifolia* (Vahl) G. Nicholson (ipê amarelo). The experiment was carried out with BOD type germinators, adjusted to a constant temperature of 30ºC, with a photoperiod of twelve hours daily. The seeds were distributed in transparent acrylic boxes (Gerbox) and conditioned under the substrates: carbonized rice husk (CRH), commercial substrate (CS) Bioflora, washed sand (WS) and vermiculite (V). The treatments were distributed in a 2 x 5 factorial scheme (two species and five substrates), with four replications. At 30 days, the final percentage of emergence (% E) or the total percentage of seeds emerged up to 30 days after sowing was calculated. In general, *T. serratifolia* seeds showed relatively higher values of emergence percentage and emergence speed. The treatment containing 100% commercial substrate showed the best results for both species in terms of percentage and emergence speed, however it can be inferred that the washed sand substrate showed similar values for the yellow ipê under the tested conditions.
Keywords: forest seedlings, emergence, seeds.

SUBSTRATOS NO PROCESSO DE GERMINAÇÃO DE *Tabebuia roseo-alba* (Ridl.) Sandwith) AND *Tabebuia serratifolia* (Vahl) G. Nicholson

RESUMO - Entre os constituintes da flora brasileira, os ipês, pertencentes à família Bignoneaceae, ocorrem amplamente e, portanto, não ocupam um único habitat. Essa espécie de grupo possui vários valores, inclusive econômicos, ornamentais e medicinais. O objetivo deste trabalho foi avaliar o efeito de vários substratos no processo de germinação de sementes de *Tabebuia roseo-alba* (Ridl.) Sandwith) (ipê rosa) e *T. serratifolia* (Vahl) G. Nicholson (ipê amarelo). O experimento foi realizado com germinadores do tipo BOD, ajustados a uma temperatura constante de 30ºC, com fotoperíodo de doze horas diárias. As sementes foram distribuídas em caixas de acrílico transparente (Gerbox) e condicionadas sob os substratos: casca de arroz carbonizada (CRH), substrato comercial (CS) Bioflora, areia lavada (WS) e vermiculita (V). Os tratamentos foram distribuídos em esquema fatorial 2 x 5 (duas espécies e cinco substratos), com quatro repetições. Aos 30 dias, calculou-se a porcentagem final de emergência (% E) ou a porcentagem total de sementes emergidas até 30 dias após a semeadura. De maneira geral, as sementes de *T. serratifolia* apresentaram valores relativamente mais altos de porcentagem de emergência e velocidade de emergência. O tratamento contendo 100% de substrato comercial apresentou os melhores resultados para ambas as espécies em termos de porcentagem e velocidade de emergência, entretanto pode-se inferir que o substrato areia lavada apresentou valores semelhantes para o ipê-amarelo nas condições testadas.
Palavras-chaves: mudas florestais, emergência, sementes.

INTRODUCTION

Several native Brazilian species have the potential for cultivation, serving innumerable purposes and presenting value as ornaments, timber, food and ecological specimens (MACEDO et al., 2011). Studying the technology of native species, including *ipês,* and the quality of their seeds, is of essential importance to obtain seedlings that are capable of serving the numerous demanding segments of the forest sector. Therefore, discussions and studies have been performed to understand the seed biology and germinative processes involved.

According to the Brazilian Ministry of Agriculture (2009), seed quality is measured by the germination test. This test indicates the maximum potential of germination of a particular lot for purposes of standardizing the optimal conditions of germination for each species. Testing is carried out in various places, thereby evaluating several factors that combine to produce regular germination, at greater speed, with greater number of seeds germinated in the lot.

Germination is defined as the emergence of seedlings. In this process, the metabolic activity of the

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embryonic axis is resumed, characterized by the emergence of the radicle (MONTIEL et al., 2017). The germinative process in turn is defined as the emergence and development of essential structures of the embryo, manifesting its ability to give rise to a normal seedling under favorable environmental conditions (SOUZA et al., 2014).

Knowledge of the relationships between environmental factors and their action during the emergence of seeds is important because several external factors, including temperature, composition and humidity of the substrates, exposure and intensity of spectral radiation distribution, chemical influences, among others factors, are related to the germination and development of the seedlings (NICOLLA et al., 2012).

The ideal substratum, according to Silva et al. (2010), must have characteristics such as good porosity, resistance to both microorganisms and pathogens, in addition to providing adequate development of the root system. This is the primary source of water and nutrients for plants. Furthermore, the materials to be used to compose the substrate must be readily available, found in sufficient quantity and as close as possible to the place of production; finally, the material must be available at an affordable price (ALVES and FREIRE, 2017).

There is a lot of research on species native forests in which the authors analyzed an influence of temperature and substrate on a twinning of seeds, as in *Dimorphandra mollis* benth. (PACHECO et al., 2010), *Amburana cearensis* (Allemão) A.C. Smith. (GUEDES et al., 2010), *Peltophorum dubium* (Sprengel) Taubert (ALVES et al., 2011), *Piptadenia moniliformis* Benth. (AZERÊDO; PAULA; VALERI, 2011), *Caesalpinia pyramidalis* TUL. (LIMA et al., 2011), *Dalbergia nigra* (Vell.) Everyone. (GUEDES et al., 2011) and *Diptychandra aurantiaca* (OLIVEIRA et al., 2013).

Therefore, the objective of this work was to evaluate the effect of various substrates on the germination process of seeds of forest species *Tabebuia roseo-alba* (Ridl.) Sandwith) (ipê rosa) and *Tabebuia serratifolia* (Vahl) G. Nicholson (ipê amarelo).

MATERIALS AND METHODS

The present study was conducted in the Laboratory of Seed Analysis of the Federal University of Tocantins (UFT), between February and March of 2018 in the municipality of Gurupi, Tocantins, Brazil. We used seeds of the forest *Tabebuia roseo-alba* (Ridl.) Sandwith) (ipê rosa) and *Tabebuia serratifolia* (Vahl) G. Nicholson (ipê amarelo). Before sowing, seeds were cleaned by immersion in 5% sodium hypochlorite for 10 min (SOUZA et al., 2012), and then washed in running water for 5 min.

The experiment was carried out on biochemical oxygen demand (BOD)-type germinators adjusted to a constant temperature of 30ºC, with photoperiod of twelve hours daily, using fluorescent lamps. The seeds were distributed in transparent acrylic boxes (Gerbox) previously sterilized with sodium hypochlorite and conditioned under the substrates: carbonized rice husk (CRH), rice husk *in natura* (RH), autoclaved for 2 h at 120ºC, commercial substrate (CS) Bioflora, washed sand (WS), and vermiculite (V), conducted for 30 days after sowing, with distilled water added to the substrates as necessary.

The treatments were: treatment 1 (T1) = carbonized rice husk (CRH), T2 = rice husk *in natura* (RH), T3 = commercial substrate - Bioflora (CS) T4 = washed sand (WS) and T5 = vermiculite (V). At 30 days, we calculated the final percentage of emergence (%E) or total percentage of seed emerged up to 30 days after sowing, given by the number of emerged seedlings/total number of seeds × 100, according to the criteria adopted in the rules for seed analysis (Brazil; 2009). Sequential calculations were performed of seedling emergence index (SEI), according to the expression developed by Nakagawa (1994) that determines the number of seeds emerged per day in each treatment until the end of the experiment according to the Equation 1:

$$SEI = \frac{E1}{N1} + \frac{E2}{N2} + \cdots \frac{Em}{Nm} \qquad \text{(Equation 1)}$$

Where:

SEI = seedling emergence index,

E1 to Em = numbers of seedlings emerging each day and

N1 to Nm = intervals (days).

For each replicate, 25 seeds were used, totaling 100 seeds per treatment. The experimental design was completely randomized, with the treatments distributed in a 2 x 5 factorial arrangement (two species and five substrates), with four repetitions, performed at a constant temperature of 30ºC. The results were subjected to analysis of variance, with a comparison of the means by the Tukey, test at 5% of probability, using the Sisvar Program (FERREIRA, 2011).

RESULTS AND DISCUSSION

The emergence of seeds of *Tabebuia serratifolia* (Vahl) G. Nicholson (ipê amarelo), proceeded for 22 days after the initiation of the experiment. The seeds *Tabebuia roseo-alba* (Ridl.) Sandwith (ipê rosa) emerged for 19 days after the experiment was initiated. Both in terms of the percentage of emergence (%E) and the rate of emergence (RE) of both species, we found significant differences in all parameters.

In general, seeds of *Tabebuia serratifolia* (Vahl) G. Nicholson gave higher values of emergence percentage, where 95% of the seeds emerged with T3, the highest number of seeds emerged among the treatments, and 25% of seeds emerged with T2, the lowest number of emerged seeds observed among the treatments. Furthermore, *ipê amarelo* gave higher rates of emergence, obtaining 7.9 emerged seeds per day with T4 to 1.1 seeds emerged per day with T5. *Tabebuia roseo-alba* (Ridl.) Sandwith gave lower values for both emergence percentage (with a variation of 65% to 13% of seed emerged in the treatments) and for the rate of emergence (ranging from 5.9 to 0.8 seeds emerged per day). We found great variation in the indices (%E, RE) among treatments, particularly between the means of the highest treatments and the means of the lowest treatments.

The lowest percentages and speed of emergence were obtained with the seeds of the treatments (T1) = carbonized rice husks and (T2) = unprocessed rice husks. Therefore, it is clear that these substrates did not demonstrate ideal conditions of humidity and oxygenation, since the seeds did not express their maximum potential for emergence (Tables 1 and 2).

For both species, the percentages of emergence (%E) were higher in T3, the treatment containing 100% commercial substrate (95% *T. serratifolia* and 65% *T. roseo-alba*). Studies by Andrade et al. (2000), with seeds of *Genipa americana* L. indicated that in substrates made up of larger particles there is more empty space, less apparent density or less degree of compaction, greater aeration and, therefore, greater facilities for seedling emergence. The commercial substrate gave a statistically similar result to that of T4, the treatment including 100% washed sand, a result observed only for *ipê amarelo*, because for the *ipê branco*, the T4, T5 and T1 did not differ significantly, and they had lower percentages of germination (34%, 43% and 44%, respectively) (Tables 1 and 2).

TABLE 1 - Percentage of emergence (%E) of seeds of *Tabebuia serratifolia* (Vahl) G. Nicholson (ipê amarelo) and *Tabebuia roseo-alba* (Ridl.) Sandwith (ipê rosa), in various substrates at 30°C.

Treatments	*Tabebuia* species	
	Tabebuia serratifolia	*Tabebuia roseo-alba*
T3	95 a*	65 a
T4	88 a	34 b
T5	59 b	43 b
T1	58 b	44 b
T2	25 c	13 c
CV%	8.29	19.29
Average	65	39

*Means in columns followed by the same letter do not differ among themselves by the Tukey test, at 5% of error probability.

TABLE 2 - Index of speed of emergence (SE) of seeds of *Tabebuia serratifolia* (Vahl) G. Nicholson (ipê-amarelo) and *Tabebuia roseo alba* (Ridl.) Sandwith (ipê rosa), in various substrates at 30°C.

Treatments	*Tabebuia* species	
	Tabebuia serratifolia	*Tabebuia roseo-alba*
T4	7.95 a*	3.24 ab
T3	4.76 b	5.95 a
T1	3.16 c	2.43 ab
T2	1.19 d	0.88 b
T5	1.17 d	0.87 b
CV%	13.44	71.07
Average	3.65	2.67

*Means in columns followed by the same letter do not differ among themselves by the Tukey test, at 5% of error probability.

Silva et al (2017) also evaluated the germination of *Parkia platycephala* Benth in commercial substrate and found that 80% of the seeds germinated. Similar results were reported by Pacheco et al. (2010), who evaluated the percentage of germination using commercial substrate, among other treatments. Macedo et al. (2011), using *Tabebuia roseo-alba* (Ridl.) Sandwith) on various substrates, observed the highest values of %E in the commercial substrate.

The other treatments for both the *ipê amerelo* and the *ipê rosa* resulted in a low emergence percentage, and the smallest of them were found in T2, the treatment containing 100% of rice husk *in natura* (25% *T. serratifolia* and 13% *T. roseo-alba*), a fact that can probably be explained by the prolonged interval to the beginning of germination, favoring the development of microorganisms, primarily in the substrate composed of 100% organic material, in humid and high temperature conditions, an environment conducive to the development of microorganisms. While the conditions of the commercial substrate do not favor their development, they were still able to maintain a satisfactory water content for the imbibition process, favoring emergence.

Another factor that would explain the lower percentage of emergence and the lower speed of emergence may be related to water stress caused by a putative excess humidity in the substrates. This is because there is no methodology describing the amount of daily water to be placed in each Gerbox in order to moisten the substrates. Once they are wet beyond what is necessary, the moisture will remain trapped in the Gerbox that must remain closed until a there is a constant emergence of the seeds. The abundance of water may cause a decrease in germination because of a lack of oxygen.

The first stage of development of a plant is the germination of the seeds. The germination is directly influenced by the environmental conditions. Several factors can influence during this process, including humidity, substrate type, temperature, vigor and maturity of the seed. Interference with any of these factors may result in the low speed index and total emergence percentage of the seedlings that probably occurred during the development phase of the experiment. In this sense, data regarding the type of substrate are fundamental for the germination process and seedling establishment, as Carvalho and Nakagawa (2009) reported that factors such as structure, aeration, water retention capacity, among others may vary in the seed germination process, thus new studies with regard to the standardization of germination in different substrates they are essential for the initial growth of *Tabebuia roseo-alba* and *Tabebuia serratifolia* seedlings, since both species have ecological and economic potential.

CONCLUSION

The treatment containing 100% commercial substrate showed the best results for both species in terms of percentage and speed of emergence.

However, it can be inferred that the washed sand substrate showed similar values for the yellow ipê under the tested conditions.

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