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Effect of using ultrasound to break dormancy and germination of xylopia emarginata mart seeds

Efeito do uso de ultrassom na quebra de dormência e germinação de sementes *x*ylopia emarginata mart

Efecto del uso de ultrasonido para romper la latencia y la germinación de semillas de xylopia emarginata mart

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Abstract

Xylopia emarginata Mart. is a typical species of gallery forests, characterized by its tolerance to strong water saturation, becoming a potential species for the recovery of riparian ecosystems, thus, evaluating the germination process of this species is of great importance, as it covers technical knowledge about the production of seedlings used in the revegetation of degraded areas. Some seeds have dormancy requiring techniques to accelerate germination. The present study aimed to evaluate the influence of ultrasound bathing on germination and conductivity of the spécies Xylopia emarginata Mart. The seeds were subjected to different immersion times (0, 3, 6, 9, 12, 15 and 18 minutes) in an ultrasonic bath (45 kHz) in distilled water and placed in BOD at 25 ºC to evaluate the electrical conductivity of the solution (50 ml). Then, they were placed to germinate in trays with vermiculite under environmental laboratory conditions for 60 days, to evaluate the percentage of final germination. 30 seeds were used for each of the 6 repetitions. The analysis of variance showed no significant effect

(p> 0.05) of the ultrasonic bath on the conductivity and germination of Xylopia emarginata Mart. Seeds, obtaining an average conductivity of 173.32 µS cm-1 at 25 ºC and germination average of 24.27%.

Keywords: Pindaíba-do-brejo; Germinative potential; Revegetation.

Resumo

A Xylopia emarginata Mart. é uma espécie típica de matas de galerias, caracterizada pela sua tolerância às fortes saturações hídricas, tomando-se uma espécie em potencial para a recuperação dos ecossistemas ciliares, assim, valiar o processo germinativo dessa espécie de tem grande importancia, pois abrange o conhecimento tecnico científico acerca da produção de mudas utilizadas na revegetação de áreas degradadas. Algumas sementes apresentam dormência necessitando de técnicas para acelerar a germinação. O presente estudo teve como objetivo avaliar a influência do banho em ultrassom na germinação e condutividade da espécie *Xylopia emarginata* Mart. As sementes foram submetidas a diferentes tempos de imersão (0, 3, 6, 9, 12, 15 e 18 minutos) em banho ultrassônico (45 kHz) em água destilada e colocadas em BOD a 25 ºC para avaliação da condutividade elétrica da solução (50 mL). Em seguida, foram colocadas para germinar em bandejas com vermiculita sob condições ambientais de laboratório por 60 dias, para avaliação da porcentagem de germinação final. Foram utilizadas 30 sementes para cada uma das 6 repetições. A análise de variância mostrou não haver efeito significativo (p>0,05) do banho ultrassônico na condutividade e na germinação das sementes de *Xylopia emarginata* Mart., obtendo-se condutividade média de 173,32 µS cm^{-1} a 25 ºC e germinação média de 24,27%.

Palavras-chave: Pindaíba-do-brejo; Potencial germinativa; Revegetação.

Resumen

Xylopia emarginata Mart. es una especie típica de los bosques de galería, caracterizada por su tolerancia a la fuerte saturación de agua, convirtiéndose en una especie potencial para la recuperación de ecosistemas ribereños, por lo que evaluar el proceso de germinación de esta especie es de gran importancia, ya que abarca conocimientos técnicos. sobre la producción de plántulas utilizadas en la revegetación de áreas degradadas. Algunas semillas tienen latencia que requieren técnicas para acelerar la germinación. El presente estudio tuvo como objetivo evaluar la influencia de los baños de ultrasonido en la germinación y conductividad de la especie Xylopia emarginata Mart. Las semillas se sometieron a diferentes tiempos de

inmersión (0, 3, 6, 9, 12, 15 y 18 minutos) en un baño ultrasónico (45 kHz) en agua destilada y se colocaron en DBO a 25 ºC para evaluar la conductividad eléctrica de la solución (50 ml). Luego, se colocaron a germinar en bandejas con vermiculita en condiciones ambientales de laboratorio durante 60 días, para evaluar el porcentaje de germinación final. Se utilizaron 30 semillas para cada una de las 6 repeticiones. El análisis de varianza no mostró efecto significativo (p> 0.05) del baño ultrasónico sobre la conductividad y germinación de semillas de Xylopia emarginata Mart., Con una conductividad promedio de 173.32 µS cm-1 a 25 ºC y germinación. promedio de 24,27%.

Palabras clave: Pindaíba-do-brejo; Potencial germinativo; Revegetación.

1. Introduction

Xylopia emarginata Mart. is a species belonging to the family Annonaceae, popularly known as water pindaí, pindafüa-do-brejo or pepper-do-brejo. According to Paula (1997), morphologically, it has a straight shaft, thin, aromatic bark and with the development of lichens on the surface; oblong or oblong-elliptical leaf, short petiole; axillary flower, in pairs or isolated; glabrous, apocarpous, bacifonnes fruits, consisting of 3 to S carpfdios each, which open through a longitudinal slit in the carpel suture; black seed with aryl. Lorenzi (1992) adds that the height is between 10 and 20 meters and the trunk is 20 to 30 cm in diameter. Its crown is small and pyramidal, with narrow, shiny and glabrous leaves, with 4 to 6 cm in length.

Considering the ecological aspects, X. emarginata Mart. It is a perennial plant, heliophyte, pioneer, characteristic of teneno swamps where it forms homogeneous massifs. It occurs mainly in secondary formations of almost all forest formations, however, always in wetlands by riverside. Its presence inside the dense primary forest is less common. It generally occurs in large groups, reaching almost plll'8S populations. Ratter (1971) describes X. emarginata as a tall, often emergent species, with a thin, straight trunk and a crown. narrow, and with the characteristic appearance of many gallery forests. Still, in swampy areas tabular roots (sapopemas) and superficial roots are abundant and characterize several species. Young X emarginata individuals have anchor roots; such roots leave the trunk up to 3 m above ground level; As the trunk grows, the roots join with it until they form tabular roots in large individuals. Despite its scarce production of viable seeds, it is cited as a potential species for the recovery of degraded riparian areas (Lorenzi, 1992). The natural occurrence of

X emarginata is recorded from Bahia to São Paulo (Castellani et al., 2001), in Brasília (Ratter, 1971), in the Mineiro Triangle (Schiavini, 1992) and in Mato Grosso (Oliveira-Filho, 1989).

In recent years, there has been an increase in the interest of researchers in the propagation of native forest species, mainly due to environmental problems and the need to recover degraded areas. However, with regard to the management and analysis of the seeds of most of these species, there is still little knowledge available, mainly related to the appropriate conditions for obtaining maximum germination (Alves et al., 2008). Knowledge of the appropriate conditions for seed germination of a given species is of great importance, since the responses are differentiated and depend on several factors, such as those related to seed dormancy mechanisms and environmental conditions, such as water, light, oxygen and temperature (Carvalho; Nakagawa, 2000).

The importance of studying seeds is related to the maintenance and improvement of cultivated plants, the maintenance of genetic variability, production of resources for revegetation and restoration of vegetation, to maintenance mechanisms, so it is important to seek new techniques for the renewal of forest populations. There are different methods of overcoming seed dormancy, among which the following can be highlighted: mechanical scarification; the incisions in the integument; exposures to high temperatures, and chemical scarification by strong acids. These methods provide for the rupture or weakening of the integument, a condition that allows the entry of water and oxygen, triggering the beginning of the germination process (Carvalho; Nakagawa, 2000; Marcos Filho, 2005).

Ultrasound is a form of mechanical, vibrational energy, which can have a deleterious or development-inducing action on living tissues depending on the intensity, the exposure time, the frequency of application and the distance from the transducer to the target (Hebling; Silva, 1995).

The objective of this work was to evaluate the effect of ultrasound on germination and conductivity of Xylopia emarginata Mart seeds.

2. Methodology

The experiment was conducted at the Laboratory of Seed Analysis and Plant Physiology and in a protected environment, belonging to the State University of Mato Grosso do Sul (UEMS), at the University Unit of Cassilândia (UUC), located in the municipality of Cassilândia - MS (19º07 ' 21 ”S; 51º43'15” W; 516 m altitude) in the period from January to July 2018. Using seeds of Xylopia emarginata Mart. The tests were performed in 30 plots of

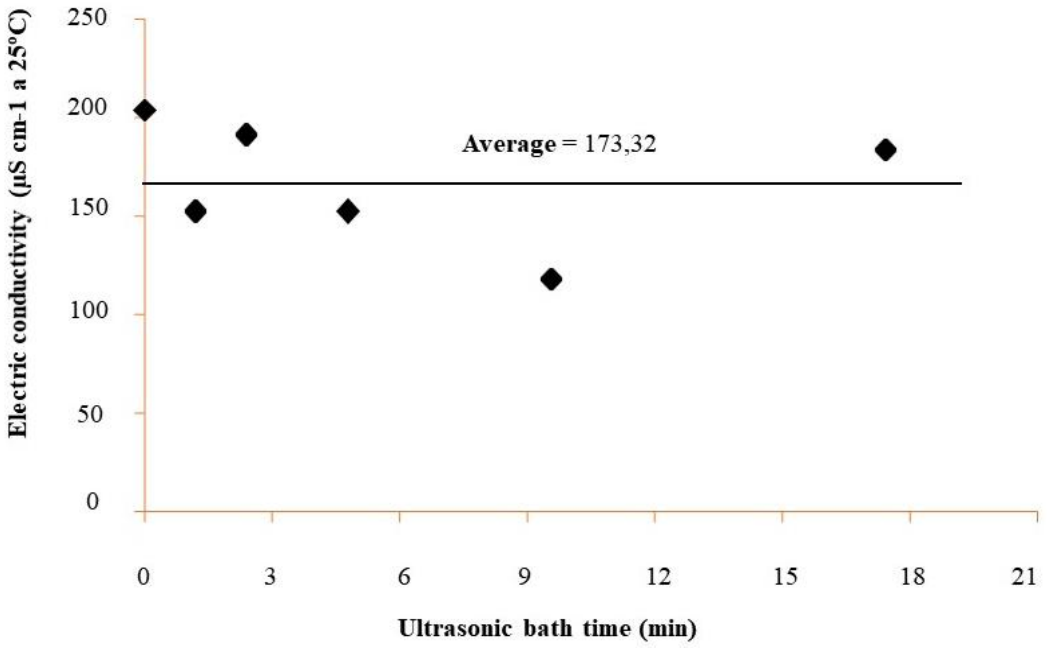
six repetitions at different times (0, 3, 6, 9, 12, 15 and 18 minutes) of immersion in the ultrasound (the ultrasound used is of constant frequency at 45 KHz), and each plot had 30 seeds totaling 900 seeds for the experiment, all were kept soaked in sodium hypochlorite (NaClO) for 10 minutes, then added 500 ml of distilled water to the ultrasound together with two Beckers with 55 ml of distilled water, each seed parcel were placed in the 5 ml beakers respecting the different times, then after the ultrasonic bath, the beakers' contents were transferred to plastic cups and then placed in the BOD incubator chamber at 25 ºC, for 24 h. Afterwards, the electrical conductivity of the solution with the seeds was evaluated. Then the seeds were placed to germinate in trays with vermiculite, in a laboratory environment (temperature, humidity and light). Seedling emergence was evaluated 60 days after sowing, obtaining the germination percentage (PG).

The data were submitted to Grubbs outlier tests, Anderson-Darling normality test and Barlett's homoscedasticity test. Then, the analysis of variance (ANOVA) was carried out to verify the effect of the treatments, considering the significance level of 5%.

3. Results and Discussion

The analysis of variance showed that there was no significant difference ($p < 0.005$) between the means of electrical conductivity and germination in relation to the treatments used (Figure 1).

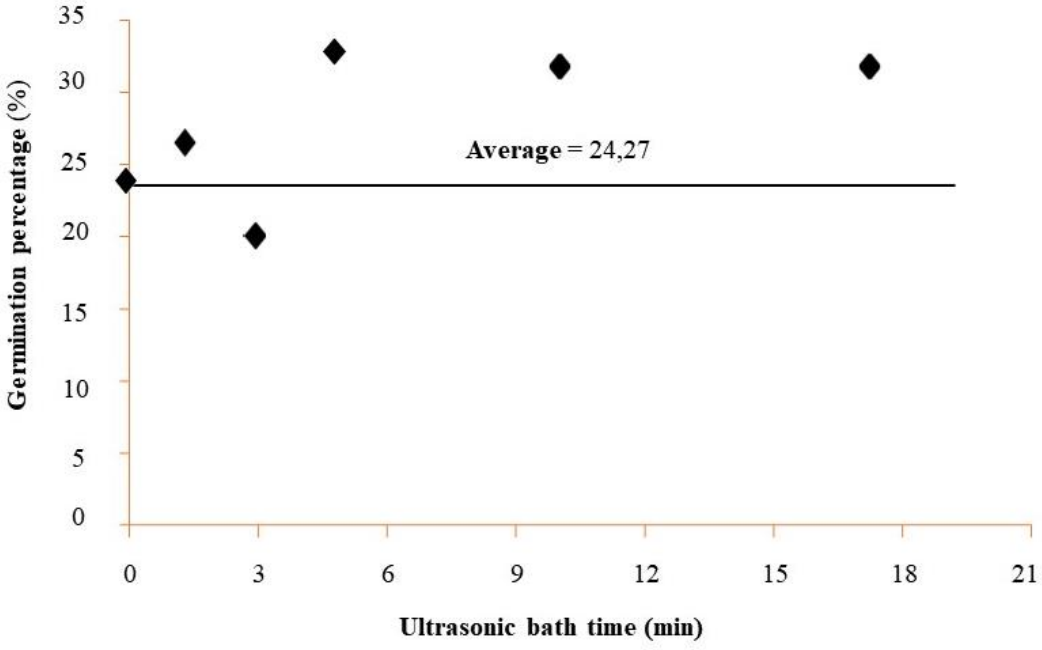
Figure 1. Electrical conductivity in relation to time in the ultrasonic bath.



Source: Authors.

Figure 2 shows that analysis of variance did not determine a significant difference between the germination averages in relation to the methods used at work.

Figure 2. Germination percentage in relation to the time in the ultrasonic bath.



Source: Authors.

The explanation for the equality of the averages of the treatments would be that the seeds would need a higher frequency of kHz or a longer time in the ultrasound with the same frequency and the temperature of the distilled water should be higher. According to studies by Franzin (2006), for the germination of rice seed using ultrasound submitted to the exposure of ultrasonic waves for periods of 5,10,15 and 20 minutes and temperatures of 20, 30 and 40 ° C.

The results indicated that there was variation in the responses of the cultivars to the treatments, with the best results being found at the highest temperatures. It is known that, in living animal tissues, ultrasound can cause destruction or growth induction, depending mainly on the intensity used (Duarte, 1983 & Alves, 1988).

According to Venâncio et al. (2016) in their studies observed that there was a higher percentage of germination in seeds of Senna multijuga seeds (Rich.) H. S. Irwin & Barneby. that remained for 4 minutes under the action of ultrasound with a germination percentage of 39% during the evaluation period. Carvalho (2005) states that Xylopia seeds have dormancy, caused by the deposition of coumarin, a germination-inhibiting substance, in the seed coat, which is why it is advisable to collect young fruits, reddish in color, as it has less coumarin content in the seeds , for later ripening during storage (Barbosa et al, 1992; Roossi, 2008).

Xylopia seeds have exogenous dormancy caused by the presence of germination inhibitors (Lima et al, 2006 apud Pereira, 2001), in addition to integumentary dormancy (Fowler; Bianchetti, 2000 apud Pereira, 2001). However, in a germination test performed with the same batch of seeds in this study, it was found that the seeds had no need for breaking dormancy, which is a possible cause of the inefficiency of the ultrasound. In studies carried out on bean seeds using low-intensity ultrasonic radiation (Berents apud Nagy, 1980 apud Frazin, 2008) found an increase in the speed of seed germination and (Attaullaev apud Nagy, 1980 apud Frazin, 2008) in corn seeds, this demonstrates that ultrasound can also be effective in seeds that do not have dormancy.

4. Final Considerations

It was concluded that the low frequency ultrasound bath, up to 18 min, does not promote the germination of Xylopia emarginata Mart seeds.

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