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Germination and Dormity in Jatobá Seeds

Marcus Vinicius Sandoval Paixão[1]; Kézia Moraes Vieira[2]; Eduardo Antonio Ferreira[3], Andrieli Ferrari Mônico [4]; Almy Junior Cordeiro de Carvalho[5]

[1]IFES, Campus Santa Teresa, São João de Petrópolis, Santa Teresa, ES. 29660-000. email: mvspaixao@ gmail.com.br;
[2] IFES, Campus Santa Teresa, email: kezia.m.v@gmail.com;
[3]IFES, Campus Santa Teresa, email: eduferreira@limainfo.com.br;[4]IFES, Campus Santa Teresa, email: andrieliferrari10@gmail.com;
[5]UENF, email: almy@uenf.br;

Abstract— *Considering the difficulties to obtain seeds of good physiological quality and ideal techniques for the production of seedlings by seed, the objective of this study was to evaluate the germination of jatobá seeds, submitted to different methods of breaking dormancy. The research was carried out in the seed laboratory of the Federal Institute of Espírito Santo - Campus Santa Teresa. The experimental design was completely randomized, with four replicates of 50 seeds. The treatments were composed of seed immersion for 30 minutes in the following solutions: distilled water (23ºC) (control), hot water (100ºC), gibberellin solution 2000 mg.mL-1, ice water (0ºC), potassium chloride 50 gL-1 and coconut water. The following variables were evaluated: percentage of germination (G); germination speed index (IVG); time of germination (TMG). The treatment with coconut water presented the best indexes for jatobá seeds and the treatment with water 100 ° C impaired germination and was not recommended for jatobá seeds.*
Keywords— ***gibberellin, coconut water, treatments.***

Resumo— *Considerando às dificuldades para obtenção de sementes de boa qualidade fisiológica e de técnicas ideais para a produção de mudas por semente, objetivou-se neste trabalho avaliar a germinação de sementes de jatobá, submetidas a diferentes métodos de quebra de dormência. A pesquisa foi realizada no laboratório de sementes do Instituto Federal do Espírito Santo - Campus Santa Teresa. O delineamento experimental utilizado foi o inteiramente casualizado, com quatro repetições de 50 sementes. Os tratamentos adotados foram compostos da imersão de sementes por 30 minutos nas seguintes soluções: água destilada (23ºC) (testemunha), água quente (100ºC), solução de giberelina 2000 mg.mL^{-1}, água com gelo (0ºC), solução de cloreto de potássio 50 g.L^{-1} e água de coco. Foram avaliadas as variáveis: porcentagem de germinação (G); índice de velocidade de germinação (IVG); tempo médio de germinação (TMG). O tratamento com água de coco apresentou os melhores índices para sementes de jatobá e o tratamento com água 100°C prejudicou a germinação, não sendo recomendado para sementes de jatobá.*
Palavras chave— ***giberelina, água de coco, tratamentos.***

I. INTRODUCTION

The Jatobá (Hymenaea courbaril var. Stilbocarpa) is a tree native to Brazil, also known as jataí. It is a large tree, which can reach 30 to 40 meters in height, and has a straight trunk up to 2 meters in diameter (or more than 5 meters of squeegee) and a thick bark of up to 3 centimeters (Shanley & Medina, 2005). Its origin is in the Amazon and kills the Brazilian Atlantic, being able to be found in large scale from Piauí to the North of Paraná. Its wood is used in construction and the furniture industry; being the fruits used in the food industry as well as the leaves and seeds used in the manufacture of cosmetics and medicines (Sousa et al., 2012).

The jatobá tree also has wide distribution in South America and Central America, from Mexico to Paraguay; is not seen on a large scale being observed in a dispersed way in the upland forests and some high floodplains, more frequently in clayey and poor soils (Shanley & Medina, 2005)

The fruit is a brown pod, usually with two seeds. Inside, a yellowish pulp coats and protects the seeds. The fruit is very hardy and it is not easy to remove the seed from within, with a tegument popularly known as peel, which makes the protection of the embryo. These are employed in the food industry and the leaves and seeds in the pharmaceutical and cosmetic industry (Zuba Júnior et al., 2010).

As observed in this work, its germination is epigeous, phanero controlled, presenting an emergence of curved form, with germination beginning on the twentieth day after sowing. It has a great irregularity in the germination,

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causing a great disomogeneity of the seedlings in the final formation of the seedlings, but with a low percentage of abnormal seedlings.

Seed dormancy refers to a state in which viable seeds do not germinate even when favorable conditions for germination are provided (Marcos Filho, 2015), an undesirable characteristic because it impedes germination, and dormancy techniques have to be used to obtain uniformity in seedling emergence (Andrade et al., 2010).

Among the main mechanisms of dormancy, water impermeability, inactive embryo and hormonal balance control the germination. Considering the existence of dormancy in Jatobá seeds, mechanisms of dormancy breaking to increase germination power should be tested for improvement of planting lots.

The seeds of the forest mainly suffer the phenomenon of dormancy due to the presence of inhibitory substances that act strongly, as well as impermeability of the integument and the condition of the embryo, being immature, rudimentary or dormant (Nesi et al., 2016). In the seeds of Jatobá (Hymenaea courbaril), usually dormancy is a function of a physical blockage found in the integument with presence of resistance to water entry and gas exchange, making embryo soaking and oxygenation difficult (Almeida et al. 2011).

Some seeds provided with hard and impermeable tegument can be prepared for sowing by heat treatment or by the use of products that can induce germination. The immersion of the seeds with pulp in boiling water can produce positive results. Several treatments can also produce favorable effects to the germination process of the seeds, since some substances have different levels of glucose, fructose and mineral salts, as well as plant hormones, inhibitors and promoters necessary for the germination process and seedling development.

Marcos Filho (2015) cites the importance of dormancy in seeds, from the point of view that it acts as a mechanism that prevents the germination of seeds when they present inadequate conditions for their development.

Freitas et al. (2013) cites the efficiency of the mechanical scarification of the jatobá seed as a method of breaking dormancy and increasing the percentage of germination and mean time of germination. In this way, it becomes important to study alternative methods to improve the germination of this seed.

The objective of this work was to evaluate the germination of Jatobá seeds, submitted to different methods of breaking dormancy.

II. MATERIAL AND METHODS

The research was carried out in the seed laboratory of the Federal Institute of Espírito Santo (IFES-Campus Santa Teresa), in the months of November and December of 2016.

In the experiment, seedlings, manually extracted from plants located in the institute region, were immersed for 30 minutes in the following treatments: distilled water (23ºC), hot water (100ºC), gibberellin solution 2000 mg.L-1, water with ice (0 ° C), 50 g L -1 potassiumchloride solution and coconut water.

The seed handling table was sterilized with 70% alcohol in which four replicates of 50 seeds were used for each treatment, seeded on two sheets of germitest paper under the seeds and one leaf on the seeds for each treatment, moistened with distilled water equivalent to 2.5 times the dry paper weight, and placed in BOD germinator with temperature stabilized at 25ºC and light 16/8 hours.

The following variables were evaluated: percentage of germination (G); germination speed index (IVG); time of germination (TMG).

The germination test was conducted according to the Rules for Seed Analysis (Brazil, 2009), and considering the lack of data on the days for the seed count, counting was used from the start of germination up to 30 days after the first seed germinates.

The experimental data were submitted to analysis of variance, taking into account the assumptions of the model by the Shapiro-Wilk test to verify normality and the means of the treatments were compared by the Tukey test at a 5% probability level.

III. RESULTS

The treatment with coconut water obtained the best results for germination of Jatobá (63%), followed by gibberellin (58%), KCl (50%) and ice (48%), with significant difference between treatments. It is observed that the control had low germination (30%), proving the existence of dormancy in these seeds. The treatment with hot water obtained only 9% of germination (Table 1). This result for boiling water may have occurred probably due to the deterioration of the seeds at that temperature.

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Table 1 - Germination in jatobá seeds submitted to different treatments

Treatments	G (%)	IVG	TMG
Pure Water	30 d	0,3590 b	22,3225 a
Water (100°C)	9 e	0,1072 c	22,4375 a
Ice (0°C)	48 c	0,5160 ab	24,0775 a
GA3 (2000 mg.L^{-1})	58 b	0,6180 a	24,1667 a
Coconut Water	63 a	0,7003 a	22,3125 a
KCl (50 g.L^{-1})	50 c	0,4963 ab	25,7907 a
CV (%)	21,31	23,08	14,53

Averages followed by the same letter in the column, for each variable, do not differ among themselves by the Tukey test at 5% probability.

Although no significant difference was observed in the treatments between treatments, coconut water presented the best results, and the same can be observed for IVG with statistical difference for pure water and water at 100 ° C, but with no difference for the others treatments but presenting the highest values.

IV. DISCUSSION

Several works have been performed to break dormancy in different seed varieties, however no work has been observed using coconut water, making this product appear as a research option for breaking dormancy.

Freitas et al. (2013), obtained low rates of emergence for Hymenaea courbaril var. stilbocarpa without treatment (11%), and with mechanical scarification obtained 53% of emergency and treatment with sulfuric acid at different times obtained 50% as the best emergency. These data confirm the existence of dormancy in Jatobá seeds.

Busatto et al. (2013) obtained in Jatobá seeds, only 6.67% of germination in the control, but it obtained good results with chemical scarification in 80% sulfuric acid, germination and mechanical chiseling of the integument with 60% germination. These two treatments allowed, in the period of time used in the study, germination statistically superior to the control, in which the seeds did not undergo any treatment to overcome dormancy. The immersion of the jatobá seeds in water at 90 ºC for ten minutes did not obtain germination corroborating with the results of this research that obtained only 9% of germination in this treatment.

Nesi et al. (2016) obtained after 150 days in the treatment with immersion in water at 90 ° C, 56% of twinning, but 2.67% started germination and died, and with scarification and subsequent immersion in 24 hours water, obtained 85 , 33% of total twinning and 5.34% started germination and died. Pagliarini (2012) using the same treatment with scarification and subsequent immersion in water 24 hours, obtained 68.8% of germination.

Busatto et al. (2013) consider that the contradictions found may be species specific, as well as other factors such as the time of collection, the stage of maturation of the seeds, the origin, the temperature and the period of immersion. One of the functions of boiling water in breaking dormancy is to increase the permeability of the integument, breaking the impermeable barrier, is considered a low cost method and with good practicality when applied in high scale, citing the need for other experiments with different water temperatures and time of exposure of the seeds to better respond on this treatment in Jatobá seeds.

The coconut has 93% water, 5% sugars, as well as proteins, vitamins and minerals, constituting a low calorie drink (average 20 calories / 100 mL), pH varying with fruit age. At 5 months pH is around 4.8, reaching over 5 until the end of fruit growth, whereas its water represents 25% of fruit weight (Aragão et al., 2001). During the fruit maturation process, some modifications are observed, with potassium being the nutrient that appears in greater quantity during maturation, sodium, calcium, magnesium, chloride, iron and copper are stable and the sulfur has a slow increase (Aragão et al., 2001). Coconut water is considered a great hydroelectrolytic repository, with similar action to commercial drinks with isotonic action and considerable mineral salts, besides being a natural product,, (Brito, 2004).

The isotonic action of coconut water and the presence of cytokinin can be considered a positive characteristic in its absorption and by the seed, increasing its germination capacity. It was used in popular culture as a substitute for water, and also to replace electrolytes in cases of dehydration (Aragão et al., 2001), the salts in coconut water may have acted preponderantly for this treatment to have achieved the best results. According to Sousa et al. (2005), the minerals Ca, Mg, Mn, Fe, Zn and Cu can be found in addition to Na and K in the mineral composition of bottled coconut water. The potassium salts reached 162 mg.100mL-1 (Teixeira, 2018), which probably acted as a germination inducer, reaching the rate of 63% as seen in Table 1.

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Besides the mentioned components, it also has citric acid and malic acid (Aroucha et al., 2010), which determine the pH of the water, being between 5.1 and 5.2 (Aroucha et al., 2014). Acidity is important as it is used as a sensory indicator for its role in taste and aroma (Charlo et al., 2009).

Similar to that found by Carvalho et al. (2018), the characteristics of coconut water may have been positive for the increase of germination, according to the results found in this research, placing this product as a further option of induction of germination and breakage of seed dormancy.

V. CONCLUSION

The treatment with coconut water presented the best results for germination of jatobá seeds.

The treatment with coconut water and gibberellin 2000 mg.L-1, produced positive effects for the evaluated characteristics, being recommended for breaking dormancy in jatobá seeds.

Treatment with 100 ° C water impaired germination and was not recommended for jatobá seeds.

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