Research, Society and Development, v. 9, n. 7, e510974226, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i7.4226

Silva, AAP, Lima, APL, Lima, SF, Muchalak, F, Silva, DB & Hayashi, BT. (2020). Superação de dormência em *Dimorphandra mollis e Hymenaea stigonocarpa*. ***Research, Society and Development***, 9(7): 1-11**,** e510974226.

Superação de dormência em *Dimorphandra mollis* e *Hymenaea stigonocarpa*

Overcoming dormancy in *Dimorphandra mollis* and *Hymenaea stigonocarpa*

Superar la latencia en *Dimorphandra mollis* y *Hymenaea stigonocarpa*

Recebido: 04/05/2020 | Revisado: 06/05/2020 | Aceito: 15/05/2020 | Publicado: 24/05/2020

Arlindo Ananias Pereira da Silva
ORCID: https://orcid.org/ 0000-0002-3093-6796
Universidade Estadual Paulista "Júlio de Mesquita Filho", Brasil
E-mail: arlindo.ananias@unesp.br
Ana Paula Leite de Lima
ORCID: https://orcid.org/0000-0002-6442-2734
Universidade Federal de Mato Grosso do Sul, Brasil
E-mail: paula.leite@ufms.br
Sebastião Ferreira de Lima
ORCID: https://orcid.org/0000-0001-5693-912X
Universidade Federal de Mato Grosso do Sul, Brasil
E-mail: sebastiao.lima@ufms.br
Franciele Muchalak
ORCID: http://orcid.org/0000-0001-8281-6350
Universidade Federal de Mato Grosso do Sul, Brasil
E-mail: francieleddd@hotmail.com
Dayane Bortoloto da Silva
ORCID: http://orcid.org/0000-0002-3264-0390
Universidade Estadual Paulista “Júlio de Mesquita Filho”, Brasil
E-mail: dayebortoloto@gmail.com
Beatriz Thiery Hayashi
ORCID: http://orcid.org/0000-0003-0967-1508
Universidade Federal de Mato Grosso do Sul, Brasil
E-mail: beatriz.thiery@gmail.com

Resumo

Alguns anos atrás começaram as preocupações com a necessidade de recuperar áreas degradadas e reestruturar a paisagem. Uma das dificuldades para produzir mudas nativas, entre vários fatores, é a dormência das sementes de algumas espécies, porque mesmo em ambientes favoráveis as sementes não germinam. O objetivo deste estudo foi avaliar a influência de diferentes métodos de superação da dormência no surgimento de duas espécies da família Fabaceae, nativas do Cerrado do nordeste do Mato Grosso do Sul, Brasil. Sete tratamentos foram utilizados para ambas as espécies, onde houve uma combinação de escarificação e imersão em água. Os métodos de quebra de dormência aplicados para interferir na porcentagem de germinação e no índice de velocidade de emergência para ambas as espécies. Para *Dimorphandra mollis*, o melhor tratamento é uma escarificação oposta ao hilo seguida de imersão em água por 9 horas. Para *Hymenaea stigonocarpa*, o uso de pelo menos duas escarificações seguidas de imersão em água favorece o percentual de sementes germinadas, enquanto duas escarificações laterais ao hilo, combinadas à imersão em água, favorecem a velocidade de emergência dessas sementes.

Palavras-chave: Cerrado; Germinação; Semente.

Abstract

A few years ago, concerns about the need to recover degraded areas and to restructure the landscape began. One of the difficulties to produce native seedlings, among several factors, is the dormancy of the seeds of some species because even in favorable environments the seeds do not germinate. The objective of this study was to evaluate the influence of different methods of overcoming dormancy in the emergence of two species of the Fabaceae family, native to the Cerrado of the northeast of Mato Grosso do Sul, Brazil. Seven treatments were used for both species, where there was a combination of scarification with immersion in water. The dormancy break methods applied to interfere with the germination percentage and the emergence velocity index for both species. To *Dimorphandra mollis*, the best treatment is a scarification opposite to the hilum followed by immersion in water for 9 hours. To *Hymenaea stigonocarpa*, the use of at least two scarifications followed by immersion in water favors the percentage of germinated seeds while, two lateral scarifications to the hilum, combined with immersion in water, favors the velocity of the emergence of these seeds.

Keywords: Cerrado; Germination; Seed.

Resumen

Hace unos años, comenzaron las preocupaciones sobre la necesidad de recuperar áreas degradadas y reestructurar el paisaje. Una de las dificultades para producir plántulas nativas, entre varios factores, es la latencia de las semillas de algunas especies porque incluso en ambientes favorables las semillas no germinan. El objetivo de este estudio fue evaluar la influencia de diferentes métodos para superar la latencia en la aparición de dos especies de la familia Fabaceae, nativas del Cerrado del noreste de Mato Grosso do Sul, Brasil. Se utilizaron siete tratamientos para ambas especies, donde hubo una combinación de escarificación con inmersión en agua. Los métodos de interrupción de la latencia aplicados interfieren con el porcentaje de germinación y el índice de velocidad de emergencia para ambas especies. Para *Dimorphandra mollis*, el mejor tratamiento es una escarificación opuesta al hilio seguida de inmersión en agua durante 9 horas. Para *Hymenaea stigonocarpa*, el uso de al menos dos escarificaciones seguidas de inmersión en agua favorece el porcentaje de semillas germinadas, mientras que dos escarificaciones laterales al hilio, combinadas con la inmersión en agua, favorecen la velocidad de aparición de estas semillas.

Palabras clave: Cerrado; Germinación; Semilla.

1. Introduction

The concern with the need to recover degraded areas and with the landscape restructuring in Brazil has intensified in recent decades, as well as the recovery actions. However, one of the obstacles found for the effectiveness of these actions is the little knowledge about the forestry of native species, mainly in terms of to the processes involved in the production of these seedlings (Negri et al., 2008).

The main problems of seedlings large scale production are the dormancy of seeds of some species. Making your production become slower and unevenly (Bracalion et al., 2010; Carvalho & Nakagawa, 2000). Although the numbness is an advantage that the seeds have against extinction, for man is not advantage, since it is necessary to use them on a large scale for the agronomic environment as forest.

There are several types of dormancy such as physiological, morphological, physical, chemical and mechanical. However, within the Fabaceae family, many species present tegument dormancy, which is characterized by water impermeability and gaseous exchanges. The methods used for their overcoming vary with the species, these may be physical or chemical and, as a result, they allow to improve the viability of seedling production, decreasing the time seed germination (Oliveira et al., 2003).

Among the Brazilian biomes, the Cerrado had greater degradation, mainly due agricultural activities. To use and preserve this biome, you need to know your phytophysiognomies, as well as the species that compose them (Sano et al., 2008).

In this biome the species of the Fabaceae family are representative in diversity and in addition to having economic and ecological importance, being constituted in its majority by tropical trees (Sprent, 2001). They help in ecological restoration due to the associations with soil microbiota, macro and Mesofauna. Concomitantly, in the face of biodiversity in Brazil, there is few information about the native species and their propagation forms (Maranho and Paiva, 2012).

In this context, this research aimed to evaluate the influence of different overcoming dormancy methods in the emergence of two species of the Fabaceae family, native to the Cerrado of northeastern of Mato Grosso do Sul, Brazil

2. Methodology

A research is done to bring new knowledge for society as stated by Pereira at al. (2018). Here we did a quantitative investigation. Fruits used in this study were collected in the Chapadão do Sul city, Brazil, in a Cerrado area modified by anthropic action and located in the urban perimeter. Prior to the application of the treatments, the seeds of *Hymenaea stigonocarpa* and *Dimorphandra mollis* used in this study were cleaned in the case of *H. stigonocarpa*, fruit pulp has been removed, and then immersed in sodium hypochlorite at 2%, for 5 minutes. Two assays were performed, one for each species. The experiment was installed in a greenhouse at the Federal University of Mato Grosso do Sul, campus of Chapadão do Sul, Brazil. During the conduction of the tests was recorded the values of temperature and Relative humidity within the greenhouse (Table 1).

Table 1 - Temperature and relative humidity values of the greenhouse. Chapadão do Sul, Brazil.

Data	T max.	T ave.	T min.	RH max.	RH ave.	RH min.
		°C			%	
05/11/16	28,93	23,92	18,91	88,75	67,50	46,25
10/11/16	29,78	24,89	20,0	90,78	69,11	47,44
15/11/16	30,29	24,81	19,33	92,57	69,64	46,71
19/11/16	29,39	23,74	18,10	84,0	62,38	40,75

T max: maximum temperature; T min: minimum temperature; T ave.: average temperature; RH max: maximum relative humidity; RH min: minimum relative humidity; UR ave: average relative humidity.
Source: prepared by the authors, 2020.

The experimental design was randomized blocks consisting of seven treatments and four replications, being 24 seeds per repetition. The treatments used for The overcoming of dormancy, were T1- control (without scarification and immersion in water); T2- immersion in water for 9 hours; T3- lateral scarification to the hilum combined with immersion in water for 9 hours; T4- two lateral scarifications to the hilum combined with immersion in water for 9 hours; T5- opposite scarification to the hilum combined with immersion in water for 9 hours; T6- opposite scarification to the hilum and a lateral combined with immersion in water for 9 hours; T7- opposite and two lateral scarification combined with immersion in water for 9 hours. The seeds were scarified in October 2016, using sandpaper Number 80.

After application of the treatments, sowing in polyethylene bags was performed (12.0 cm x 12.0 cm x 0.20 cm), using one seed per bag. The substrate used was composed of a mixture of subsoil and cotton manure, in the proportion of 1:1 (Table 2 and 3). The experiment was irrigated by a microsprinkler system, with an interval of 8 hours, For a period of two minutes each, with flow rate of 27.2 L $h^{-1}$and pressure of 20 $kgf.m^{-2}$.

Table 2- Chemical analysis of the soil used in the execution of the experiment, Chapadão do Sul, Brazil. 2016.

Depth cm	pH $CaCl_2$	O.M. g dm^{-3}	P mg dm^{-3}	K mg dm^{-3}	
0-20	4,5	37,7	11,1	109,48	
20- 40	4,8	24,6	3,6	74,29	
Depth cm	Ca	Mg	H + Al	SB	CTC
	----------	----------	$cmol_c$ dm^{-3}	----------	----------
0-20	2,7	1,0	5,0	3,98	9
20- 40	1,7	0,6	5,5	2,49	8

Depth: soil depth; O.M.: organic matter; SB: sum of soil bases; CTC: ability to exchange cations. Source: prepared by the authors, 2020.

Table 3- Soil granulometric analysis used in the experiment execution, Chapadão do Sul, 2016.

Soil fractions ($g\ kg^{-1}$)	Depth (m)		
	0,0-0,10	0,10-0,20	0,20-0,30
Clay	400,40	400,40	400,40
Silt	99,60	99,60	95,20
Sand	500,00	500,00	504,40

Source: prepared by the authors, 2020.

The data obtained in this study were statistically analyzed by ANOVA. The experimental design of randomized blocks (RBD) and the means were compared between the treatments by Tukey test, with significance level $P < 0.05$. Statistical analyzes were performed using the Sisvar 5.7 software (Ferreira, 2019). The index of emergence velocity (IVE) by the equation proposed by Maguire (1962; Equation 1).

$$\mathrm{IVE} = \frac{G1}{T1} + \frac{G2}{T2} + \cdots + \frac{Gn}{Tn} \qquad \text{(Equation 1)}$$

Where: IVE: Emergency speed index, admensional; G_1, G_2, G_N: Germination, %; T_1, T_2, T_N: Time, days.

3. Results and Discussion

The methods of overcoming dormancy tested interfered with the percentage of seeds germinated from *D. mollis* (Table 4). The highest germination percentage was observed when a opposite scarification to the hilum was combined with immersion in water for 9 hours (91.65%).

Intermediate germination values were found when one applied (45.85%) Or two (37.50%) side scarifications to the hilum combined with immersion in water. However, these decrease in germination percentage of 50% and 59.1%, respectively, in relation to the first treatment.

In studies conducted by Freitas et al. (2009), where *D. mollis* and *Dimorphandra wilsonii* germination was evaluated. obtained similar results where mechanical scarification was sufficient to favor germination, in which seeds of *D. mollis* showed up to 89% germination, and *D. wilsonii* seeds up to 78% germination.

According to Freitas et al. (2009), In studies relating temperatures and germination of *D. mollis* and *D. wilsonni* demonstrate that the scarified seeds of *D. mollis* showed higher germination between 20:30ºC and temperature alternation, the highest germination rate was 89%. Similar temperatures to those recorded in the present study (Table 1), where the variation was between 18:30ºC, possibly this is a factor that provides a higher germination of the seeds.

Table 4 - Germination percentage of *Dimorphandra mollis* and *Hymenaea stigonocarpa*, subjected to different methods of dormancy breakage, nineteen days after sowing. Chapadão do Sul, Brazil, 2016.

Trataments	Germination (%)	
	H. stigonocarpa	*D. mollis*
T1- Control	16.50 c	0.00 e
T2- immersion in water for nine hours	24.42 c	4.18 de
T3- one lateral scarification to the hilum combined with immersion in water for nine hours	50.00 a	45.85 b
T4- two lateral scarifications to the hilum combined with immersion in water for nine hours	54.17 a	37.50 c
T5- opposite scarification to the hilum combined with immersion in water for nine hours	30.62 bc	91.65 a
T6- opposite scarification to the hilum and one lateral combined with immersion in water for nine hours	43.57 ab	8.35 d
T7- opposite scarification to the hilum and two sides combined with immersion in water for nine hours	43.57 ab	8.35 d

Averages followed by the same letter do not differ statistically from each other, by Tukey's test with significance level ($P < 0.05$). Source: prepared by the authors, 2020.

Rizzini (1969), when studying the germination of *D. mollis* observed final percentage of germination of only 4% in seeds not scarified and 60% for scarified at the end of 16 days of sowing, results similar to those found in this study. Dormancy was satisfactorily surpassed when the seeds were subjected to different methods of scarification, which acted as an accelerator of the germinative process of the species (Nunes et al., 2006). Probably, mechanical scarification allowed water absorption by imbibition, initiating germination (Borges & Rena, 1993).

For the species *H. stigonocarpa*, the highest percentages of germination (on average, 52.08%) were found when one or two lateral scarifications to the hilum were made combined with water immersion (Table 4). However, these treatments were not differentiated of those in which a scarification was made opposite to the hilum plus one or two combined with water immersion (43.57%).

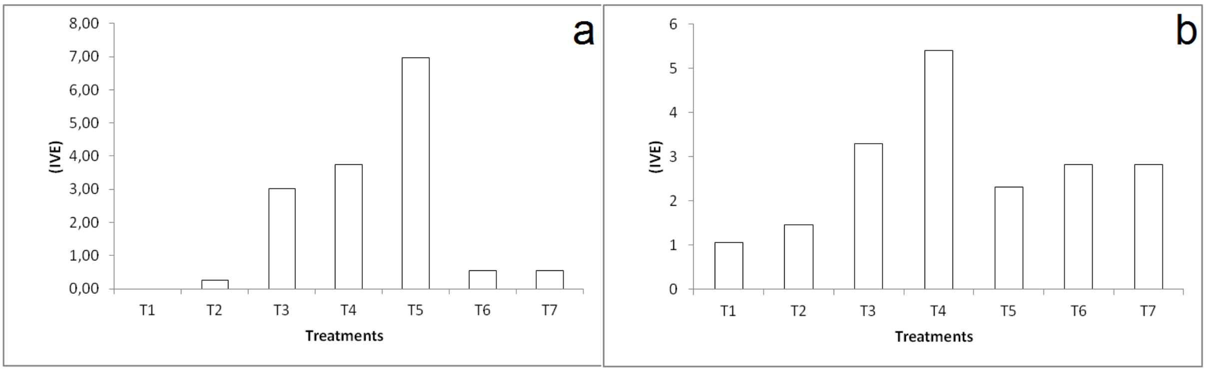
However, when comparing these methods of overcoming dormancy that presented the best results (on average, 47.8%) with the water immersion method and the control, there was a reduction in the percentage of germinated seeds of 48.9% and 65.5%, respectively. That demonstrates the importance of scarification, especially in two seed positions, in the dormancy break of this species. Similarly, Souza et al. (2014), testing the methods of dormancy breakage for this same species, verified that two scarifications also provided better results.

Similar results were found by Carvalho et al. (2005), in studies on germination of *H. stigonocarpa* showed that the combination of scarification with imbibition provided a higher percentage of germination (86%, on average 8.2 days), followed by mechanical scarification (82% germination in 12 days). In another study, Cruz et al. (2001), using the method of scarification with electric emery for *H. Intermedia*, obtained 95% germination, both for scarified and not scarified seeds. However, the Scarified seeds reached this percentage of germination in 26 days after sowing while, those not scarified germinated in 418 days. These results demonstrate the importance of combining scarification with water immersion to accelerate germination.

Germination reports the total number of germinated seeds, however, does not reflect how long it was necessary for the seeds to reach this percentage of germination. The germination times and distribution may be different. There may be seeds that germinate faster, generally more vigorous, and others whose germination is slower. For these situations, there are measures that quantify the germination from a kinetic point of view, that is, they inform how much time was necessary for a certain seed batch germinate, among them the Index of Emergency Speed, developed by Maguire (1962).

Analyzing the emergence velocity index for the studied species, it was found that for *D. mollis* (Figure 1a), similarly to that observed for the germination percentage, the use of a scarification opposite to the hilum followed by immersion in Water was the treatment that provided the highest IVE (6.97). Different result from found by Pacheco et al. (2011) in which D. mollis presented an emergency velocity index of 2.92.

Figure 1- Emergency velocity index (IVE), for *Dimorphandra mollis* (a) and *Hymenaea stigonocarpa* (b), subjected to different methods of overcoming dormancy, nineteen days after sowing. Chapadão do Sul, Brazil, 2016.



Source: prepared by the authors, 2020.

Still for *D. mollis*, T4 and T3 treatments presented the second and third higher IVE values, respectively. If compared to the result of the percentage of germination, there was a change in their order. That is, although the use of a lateral scarification to the hilum (T3) provided a higher percentage of germination (45.85%), than the execution of two lateral scarifications to the same (T4), the use of this the latter may be more interesting for the production of large-scale seedlings, since provides greater uniformity in seedling size.

For the species *H. stigonocarpa* (Figure 1b), the combination of two lateral scarifications to the hilo with immersion in water resulted in the highest value of IVE (5.4). Different from that found by Andrade et al. (2010) for *H. courbaril*, whose highest value was 0.69 for scarification side to the hilum combined with immersion in water and the treatment with two lateral scarifications to the hilo obtained the result for IVE of 0.55. Possibly due to imbibition time in this work was inferior to that used by Andrade et al. (2010) which may have impaired the development of the germinative process of the seeds, as well as the time when the experiment was conducted, evidencing the importance of the imbibition phase, in the process germination, as well as the conduction time of the experiment.

4. Conclusions

The methods of overcoming dormancy applied interfere in the percentage of germination and the emergency velocity index for both species. To *D. mollis*, the best treatment is a opposite scarification to the hilum followed by immersion in water for nine hours. For *H. stigonocarpa*, the use of at least two scarifications followed by immersion in water favors the percentage of germinated seeds while two lateral scarifications to the hilum, combined with immersion in water, favors the emergence speed of these seeds.

Referências

Andrade, LAD, Bruno, RDLA, Oliveira, LSBD & Silva, HTFD. (2010). Aspectos biométricos de frutos e sementes, grau de umidade e superação de dormência de jatobá. *Acta Scientiarum. Agronomy*, 32(2), 293-299.

Borges, EDL & Rena, AB. (1993). Germinação de sementes. Sementes florestais tropicais, 83-136.

Brancalion, P. H., Novembre, A. D., Rodrigues, R. R., & Marcos Filho, J. (2010). Dormancy as exaptation to protect mimetic seeds against deterioration before dispersal. *Annals of botany*, 105(6), 991-998.

Carvalho, N. D., & Nakagawa, J. (2000). Sementes: Ciência. Tecnologia e produção, 4.

Carvalho, P. S., Miranda, S. C., & Santos, M. L. (2005). Germinação e dados biométricos de *Hymenaea stigonocarpa* Mart. ex Hayne (Leguminosae-Caesalpinoideae) Jatobá-do-cerrado. *Revista Anhangüera*, 6(1), 101-116.

Cruz, E. D., Martins, F. D. O., & Carvalho, J. E. U. D. (2001). Biometria de frutos e sementes e germinação de jatobá-curuba (Hymenaea intermedia Ducke, Leguminosae-Caesalpinioideae). *Brazilian Journal of Botany*, 24(2), 161-165.

Ferreira, D. F. (2019). Sisvar: a computer analysis system to fixed effects split plot type designs. *Revista Brasileira de Biometria*, 37(4), 529-535.

Freitas, V. D. O., Alves, T. H. S., Lopes, R. M. F., & Lemos Filho, J. P. (2009). Biometria de frutos e sementes e germinação de sementes de *Dimorphandra mollis* Benth. e *Dimorphandra wilsonii* Rizz. (Fabaceae–Caesalpinioideae). *Revista Scientia Florestalis*, 37(81), 27-35.

Maranho, A. S., & de Paiva, A. V. (2012). Superação de dormência tegumentar em sementes *Senna silvestres* (Vell.) HS Irwin & Barneby. *Biotemas*, 25(2), 25-31.

Maguire, J. D. (1962). Speed of germination—Aid in selection and evaluation for seedling emergence and vigor 1. *Crop science*, 2(2), 176-177.

Negri, L. C. G., Rosa, A. F., & Zonetti, P. C. (2009). Quebra de Dormência de Sementes de Espécies Arbóreas. *Revista em Agronegócio e Meio Ambiente*, 2(3), 487-500.

Nunes, Y. R. F., Fagundes, M., Santos, M. R., Braga, R. F., & Gonzaga, A. P. D. (2015). Germinação de sementes de *Guazuma ulmifolia* Lam. (Malvaceae) e *Heteropterys byrsonimifolia* A. Juss (Malpighiaceae) sob diferentes tratamentos de escarificação tegumentar. *Unimontes Científica*, 8(1), 43-52.

Oliveira, LMD, Davide, AC & Carvalho, MLMD. (2003). Avaliação de métodos para quebra da dormência e para a desinfestação de sementes de canafístula (*Peltophorum dubium* (Sprengel) Taubert. *Revista Árvore*, 27(5), 597-603.

Pacheco, MV, Mattei, VL, Matos, VP, Sena, LHDM & Sales, AGDFA. (2011). Dormência de sementes e produção de mudas de *Dimorphandra mollis* Benth. *Ciência Florestal*, 21(4), 689-697.

Pereira, AS, Shitsuka, DM, Parreira, FJ & Shitsuka, R. (2018). *Metodologia da pesquisa científica*. [*e-book*]. Santa Maria. Ed. UAB/NTE/UFSM. Disponível em: https://repositorio.ufsm.br/bitstream/handle/1/15824/Lic_Computacao_Metodologia-Pesquisa-Cientifica.pdf?sequence=1.

Rizzini, CT. (1969). Espécies novas de árvores do Planalto Central Brasileiro. *Academia Brasileira de Ciências*, 41, 239-244.

Sano, SM., de Almeida, S. P., & Ribeiro, J. F. (2008). Cerrado: ecologia e flora (Vol. 1). Brasília: Embrapa Informação Tecnológica.

Souza, TR., Inaê, MDA & de Souza, AM. (2014). Superação de dormência de sementes de *Hymenaea stigonocarpa* Mart. em laboratório. VIII Simpósio Brasileiro de Pós-Graduação em Ciências Florestais.

Sprent, JI &, J. (2001). Nodulation in legumes (p. 146). Kew: Royal Botanic Gardens.

Percentage of contribution of each author in the manuscript

Arlindo Ananias Pereira da Silva – 18%

Ana Paula Leite de Lima – 18%

Sebastião Ferreira de Lima – 18%

Franciele Muchalak – 16%

Dayane Bortoloto da Silva – 15%

Beatriz Thiery Hayashi – 15%