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RESEARCH ARTICLE

DORMANCY BREAKING METHODS FOR BARU SEEDS

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ABSTRACT

The baru has a sexual propagation with a low germination index. Thus, the aim of the present study was to evaluate dormancy breaking methods on baru seeds in order to get information to improve the baru seeds germination, even after the pericarp extraction. The experiment was carried out at the Biology Laboratory of the Mato Grosso State University using a completely randomized experimental design with eight seed dormancy breaking treatments: control; immersion on water at room temperature for 12, 24 and 48 hours; temperatures of 40ºC during 3 and 6 hours; mechanical scarification with a nº 80 sand paper; 2-minute boil. The seeds were extracted with a hammer. For each treatment the seeds were placed on a moistened paper towel, rolled up and placed in a perforated plastic trayon a countertop in a protected environment under normal conditions of temperature, photoperiod and air relative humidity. At 4 and 10 days after seeding, the germination percentage and the germination speed index were evaluated. The maximum germination percentage was achieved just with the extraction of the pericarp that involves the seed. For the earlier and uniform germination the immersion on water at room temperature for 48 hours or the scarification in a nº 80 mechanical sander is recommended. The baru dormancy is only due to the tegument hardness and after the seed extraction, no dormancy was observed.

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INTRODUCTION

The stimulus to the expansion of the agricultural frontier during 70s in Brazil lead to the Cerrado area occupation. These areas are favorable to agriculture, however, little is known about the potential use of the natural resources of this biome, especially for plants with natural occurrence (Zuffo *et al*., 2014a). The Cerrado biome consists of several native species that have fruits with potential for agroextractivism. Among them stands out the baru. The baru [*Dipteryx alata* Vog., Fabaceae] is used as a food, forestry and wood production (Zuffo *et al*., 2014b).

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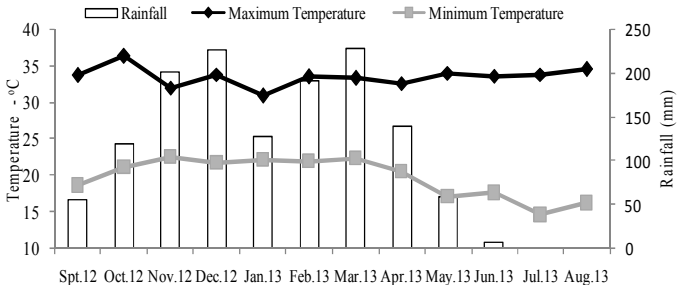
The fruits are used for food processes due to the high amounts of proteins, zinc and iron (Fernandes *et al*., 2010; Sousa *et al*., 2011). The tree is considered as key specie because the ripening occurs during the dry season, producing food for wildlife (Sano *et al*., 2004). Each baru plant produces from 2000 to 6000 fruits, on average (SoaresJúnior *et al*., 2007). The specie has a sexual propagation with a low germination rate (Lorenzi, 2002), due to dormancy. Perez (2004) reports that the dormancy of this specie is characterized by the tegument hardness with a high impermeability level, which results in a delay in germination. Accordingly, Pagliarini *et al*. (2012) evaluated the influence of scarification treatments (1: scarified seed; 2: non-scarified seed; 3: scarified fruit) in baru seeds germination. The authors concluded that for the treatments that the seed was removed from the fruit, with and without seed

scarification, better results were achieved when compared to fruit scarification and the seeds with and without scarification presented 92% and 26% of germination, respectively. Thus, it is evident that even after the pericarp extraction, in seeds that received mechanical scarification the germination result was higher, which can lead to a possible dormancy characterization. According to this, the aim of the present study was to evaluate the baru seed dormancy breaking methods in order to obtain information to improve the baru seeds germination, even after the pericarp extraction.

MATERIALS AND METHODS

The experiment was carried out in the Biology Laboratory of the Mato Grosso State University, Nova Xavantina, MT, Brazil, situated at 275 m of altitude and 14º41'25'' of south latitude and 52º20'55'' of west longitude. The experiment was realized on August, 2013 with seeds of the same year. The fruits were harvest in a natural occurrence area with trees in the natural preservation area of the União Farm (14º50'41"S; 52º22'49"W) with 100 hectares on the Serra Azul Valey, 28 km from Nova Xavantina municipality and with 290 meters of altitude, in the east part of the Mato Grosso state, Brazil. The climate is classified as Aw, according to Köppen classification, with two well defined seasons, being one dry, which usually goes from May to September, and one rainy season, from October to April, with an average annual temperature of 24°C and average rainfall of 1500 mm (Silva *et al*., 2008b). The climatic data were obtained from the meteorological station of the National Institute of Meteorology - INMET (Figure 1).



Source: INMET Experimental station, Nova Xavantina, MT, Brazil

Figure 1. Average maximum and minimum temperature (°C) and monthly rainfall (mm) during fruit formation during the 2012 and 2013 years

The ripe fruit were collected on the soil of the canopy projection of 10 baru trees during the first week of August, 2013, dry season in the region. Ten trees were with 200 meters of distance were randomly chosen. Fruit were placed in boxes for the transport to the Biology Laboratory of the Mato Grosso State University, Nova Xavantina, MT, Brazil. The seed was removed after the endocarp disruption with a hammer. The experiment was carried out in a completely randomized design, with 8 treatments (to break the dormancy) and five repetitions, with 10 seeds each. The treatments were: T1-control; T2, T3 and T4 -water immersion at room temperature during 12, 24 and 48 hours, respectively; T5 and T6 - 40°C for 3 and 6 hours; T7- scarification in a nº 80 mechanical sander; T8- 2 minutes boiling. For each treatment the seeds were placed on a moistened paper towel, rolled up and placed in a perforated plastic tray on a countertop in a protected environment under normal conditions of temperature, photoperiod and air relative humidity. During the experiment, daily irrigation was realized in order to replace the evapotranspired water. The following evaluations were performed from 4 to 10 days after sowing (DAS): germination percentage-GP= (n/a) x 100, being 'n' the total number of germinated plants and 'a' the number of sown seeds. To calculate the germination speed index (GSI), the Maguire (1962) formula was adopted. After the collection and tabulation of the test data, a variance analysis were performed and the averages of the significant variables were grouped by the Scott-Knott test at 5% of significance using the Sisvar® (Ferreira, 2011) software.

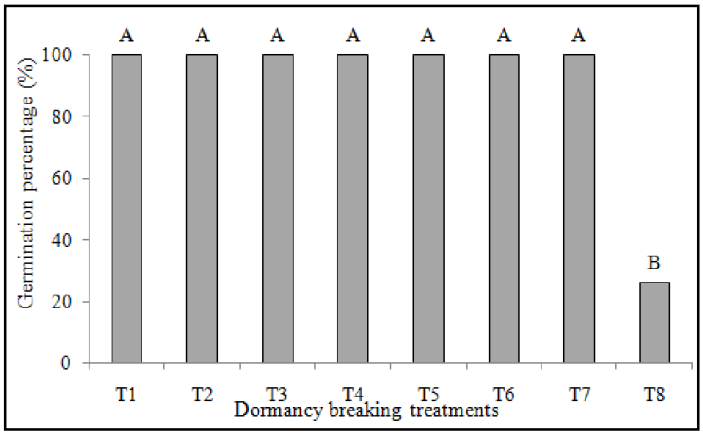


Figure 2. Germination percentage of baru seeds according to dormancy breaking treatments. T1-control; T2, T3 and T4 - water immersion at room temperature during 12, 24 and 48 hours, respectively; T5 and T6 - 40°C for 3 and 6 hours; T7- scarification in a nº 80 mechanical sander; T8- 2 minutes boiling

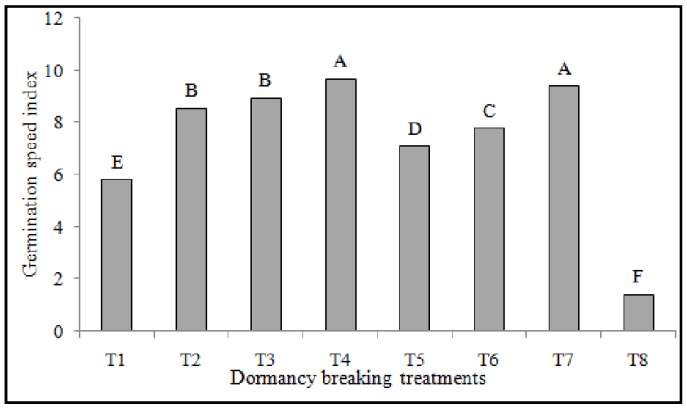


Figure 3. Germination speed index of baru seeds according to dormancy breaking treatments. T1-control; T2, T3 and T4 - water immersion at room temperature during 12, 24 and 48 hours, respectively; T5 and T6 - 40°C for 3 and 6 hours; T7- scarification in a nº 80 mechanical sander; T8- 2 minutes boiling

RESULTS AND DISCUSSION

According to the variance analysis of the germination percentage and germination speed index, significant differences ($p<0.01$) were observed for the dormancy breaking treatments (Table 1). These results are in accordance to Albuquerque *et al*. (2007) when the authors observed that the dormancy breaking

methods influenced the germination and the speed germination index of the *Bowdichia virgilioides* specie.

Table 1. Variance analysis of the germination (G) and germination speed index (GSI) obtained during the baru seeds dormancy breaking experiment. Nova Xavantina – MT, Brazil, 2013

Source of variation	DF	Mean Square	
		G	IVG
Treatament	7	3422.50**	36.81**
Repetition	4	3.75	0.04
Residue	28	3.75	0.16
CV (%)	-	2.55	5.49

** significantat 1% according to F test. DF – degree of freedom; CV – coefficient of variation.

The germination percentage is presented on Figure 2. It is possible to observe that the 2-minutes boiling treatment was not efficient, when compared to others, that presented 100% of germination. These results differ from those observed by Pagliarini *et al*. (2012), in which the authors observed a higher germination percentage when compared to control. The differences between experiments could be related to the physiological quality of the seeds and the experiment conditions (greenhouse, laboratory, etc). Similar results were observed by Cavalcante *et al*. (2011) in an experiment of dormancy breaking methods on 'Gurguéia' nuts [*Dypteryx lacunifera* Ducke] when the boiling reduced the germination percentage, mainly when applied for 10, 15 and 20 minutes. According to Mayer & Poljakoff-Mayber (1989) the immersion on boiling water can lead to tegument protein denaturation, increasing the water inside the seed and the seed hydration. However, after the boiling treatment the seeds presentedan inhibition on the germination process, with a reduction of 74% in the germination percentage.

The time used in the experiment was above the time that the baru seed can support, occurring the embryonic death. The baru seed do not present germination dormancy, being the dormancy related to the pericarp, which is waterproof and impairs germination. According Taiz & Zeiger (2009), the seed tegument can exert an inhibiting effect on germination, through mechanisms that prevent oxygen and water changes, producing mechanical restriction and chemical inhibitors. The germination speed index is presented on Figure 3 and it is possible to observe that the seeds submitted to immersion in water at room temperature for 48h and the scarified ones presented higher average when compared to other treatments. These findings are partially the same observed by Alves *et al*. (2004), which observed higher germination speed index values for pata-de-vaca seed [*Bauhinia divaricata*] that were submitted to mechanical scarification, when compared to control. Pagliarini *et al*. (2012) also observed high germination speed index in baru seeds submitted to mechanical scarification.

Probably the seeds immersion on water at room temperature for 48h and the treatment of mechanical scarification accelerated the germination process due to the early contact with water. Besides that, the scarification can lead to an increase in water and oxygen absorption and a faster activation of the metabolic process during germination. In a study carried out by Freitas *et al*. (2013) the authors observed that the mechanical scarification can favored the germination speed index of jatobá seeds [*Hymenaea courbaril*], when compared to control. The treatments of mechanic scarification and water immersion for 48 hours were efficient to break the dormancy and increase the speed emergency index of 'paineira branca' [*Ceiba glaziovii* (kuntze) k. Schum] seeds, as concluded by Nascimento (2012). The seeds submitted to boiling treatment presented a reduction of 72.16% of the germination speed index when compared to control. For Perez (2004), the use of warm water depends on the time and temperature for its efficacy, which are in accordance to each species, and in some cases this method is not effective to break the dormancy of some seeds, as observed in the present study. Therefore, the mechanic scarification and the immersion on water at room temperature during 48 hours promoted germination uniformity and homogeneity.

Conclusion

The baru dormancy is only due to the tegument hardness. The maximum germination percentage is achieved with the extraction of the pericarp that protects the seed. For a uniform and early germination, the immersion on water at room temperature for 48 hours or the scarification in a nº 80 mechanical sander is recommended.

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