



*Research Paper*

**TEMPERATURE AND SEED GERMINATION OF *Alibertia edulis***

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**Abstract**

*Alibertia edulis* (Rich.) A. Rich (Rubiaceae) is a neotropical distribution tree that occurs in Brazil in the Amazon and Cerrado biomes, rich in medicinal compounds but with few agronomic studies on the species. The aim of this study was to verify the germination of *Alibertia edulis* seeds from plants of Baixada Cuiabana, Cuiabá, Mato Grosso - Brazil in different temperatures. It was used completely randomized experimental design with seven treatments (constant temperatures 15, 20, 25, 30 and 35 °C and alternating temperatures 25-20 °C and 25-15 °C) in four replicates, the experimental unit consisting of a 25 seeds. The germinated seeds counts occurred during 30 days and were considered germinated seeds, those that showed primary root protrusion at least 2 mm in length. It was evaluated the germination percentage, mean germination time, seedling length, root length and shoot length, aerial part mass and root fresh mass and aerial part mass and root dried mass. The accumulated germination curves were made and in constant temperatures a regression analysis with a significance level of 1% was performed. The accumulated germination curves differed between the temperatures used, indicating that in constant temperature of 30 °C the germination of the seeds of *Alibertia edulis* began at 12 days and in 25 °C at 14 days while in the alternating temperature of 25-20 °C, at 20 days. The highest final percentage of germination was observed at constant temperatures of 20, 25 and 30 °C, with values higher than 90%. No germination was observed at 15 °C and in 20 °C and 35 °C didn't was formed aerial part during the evaluation period. It was verified that in the temperature of 25 °C there was higher values of the seedling length, root length and freshmass and dry mass of root. Seeds of *Alibertia edulis* showed similar behavior to most of the shrub species of the Brazilian cerrado, with germination above 90% in temperatures between 20 and 30 °C and the best temperature for the germination test in the laboratory is 25 °C.

Key words: Marmelada bola, mean germination time, optimal temperature, Brazilian cerrado.

## INTRODUCTION

*Alibertia edulis* (Rich.) A. Rich (Rubiaceae) is a neotropical distribution tree that occurs in Brazil in the Amazon and Cerrado biomes. The plant is rich in bioactive compounds with antiseptic, anti-nociceptive, antiviral, anti-inflammatory, astringent and diuretic properties [1, 2], but there are few agronomic studies on the specie [3].

Studies of *Alibertia edulis* propagation are important to establish cultivation. The optimal conditions for seed germination tests mainly emphasizing the effects of temperature plays a fundamental role in scientific research and provides valuable information on the propagation of the species [4]. The temperature at which germination occurs affects the speed, percentage and uniformity of germination. The optimum temperature is the one that allows the most efficient combination between the percentage and speed of germination [5, 6].

Temperature is a factor that can alter the biochemical reactions that determine the entire germination process. The species exhibit different behavior in relation to temperature for germination, for example, *Dimorphandra mollis* Benth. [7] and *Myrcodruon urundeuva* Fr. All [8] that have good germinative performance under constant temperatures, *Croton floribundus* Spreng [9] and *Caesalpinia pyramidalis* TUL. [10] that respond well to temperature alternation. This behavior is associated with the ecological conditions of the species in the natural habitat [11].

In general, the germination test with seeds of Brazilian tree plants can be conducted with a constant temperature of 25 °C for the Cerrado species [12]. Seeds from mature fruits of *Alibertia edulis* collected in Dourados in the state of Mato Grosso do Sul (MS) - Brazil presented higher percentage and rate of germination and seedling length at 25°C [13]. However, studies with other native species have proven that seed origin also influences germination [7, 14, 15]. Thus, this work had the objective of studying the germination of *Alibertia edulis* seeds from plants of Baixada Cuiabana, Cuiabá, Mato Grosso - Brazil at different temperatures.

## MATERIALS AND METHODS

The fruits of still green *Alibertia edulis* were collected manually in healthy individuals during the months of August and September of 2015, in Santo Antônio de Leverger, Mato Grosso, Brazil, at coordinates 15°43'S and 56°04'W.)

The fruits were then transported in paper packaging to the Seed Analysis Laboratory (LAS) of the Faculty of Agronomy and Animal Science (FAAZ) of the Federal University of Mato Grosso (UFMT) and when they were complete the maturation was opened for the removal of seeds . The seeds were washed in tap water for the total removal of the pulp. Then the natural drying of the seeds and subsequent storage in paper packaging were carried out in a refrigerated chamber with a mean temperature of 18 °C and a relative humidity of 60%.

Before the experiment was installed, the water content in the seeds was determined with three samples of 3g each and dried at 105°C ± 3°C for 24h [16]. The experiment was installed in April 2016 in a completely randomized experimental design with seven treatments (constant temperatures 15, 20, 25, 30 and 35 °C and alternating temperatures 25-20 °C and 25-15 °C) with 12-hour photoperiod in BOD cameras. The seeds were sown on a paper-towel substrate in the form of a roller, with four replicates, the experimental unit consisting of a 25-seed roller. The rolls of paper were moistened

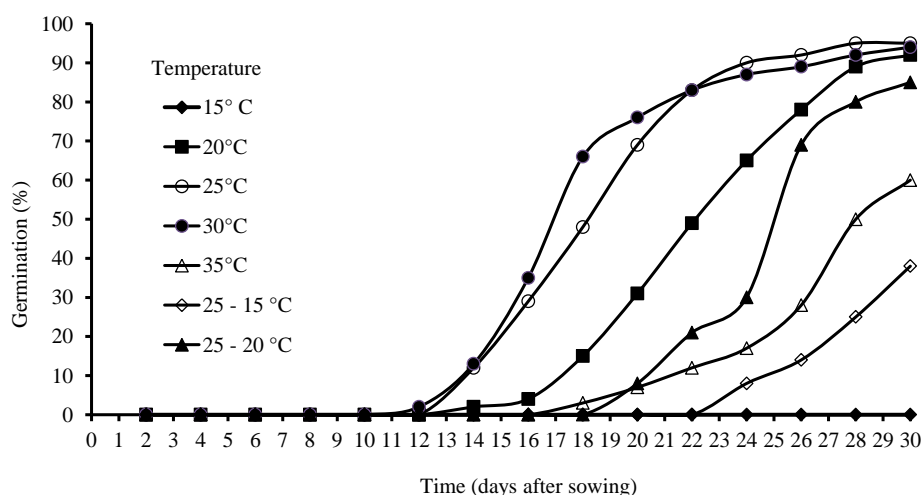
with water in the amount of 2.5 times the mass of the dried paper. To lessen the loss of water, the rolls of paper were kept inside clear plastic packaging.

The germinated seeds counts occurred during 30 days and were considered germinated seeds, those that showed primary root protrusion at least 2 mm in length. The germination percentage (%), the mean germination time (days), the seedling length (cm), shoot and root length (cm), aerial part and root fresh mass (g) and aerial part and root dried mass (g) were evaluated. The accumulated germination curves were made and at constant temperatures a regression analysis with a significance level of 1% was performed.

## RESULTS AND DISCUSSION

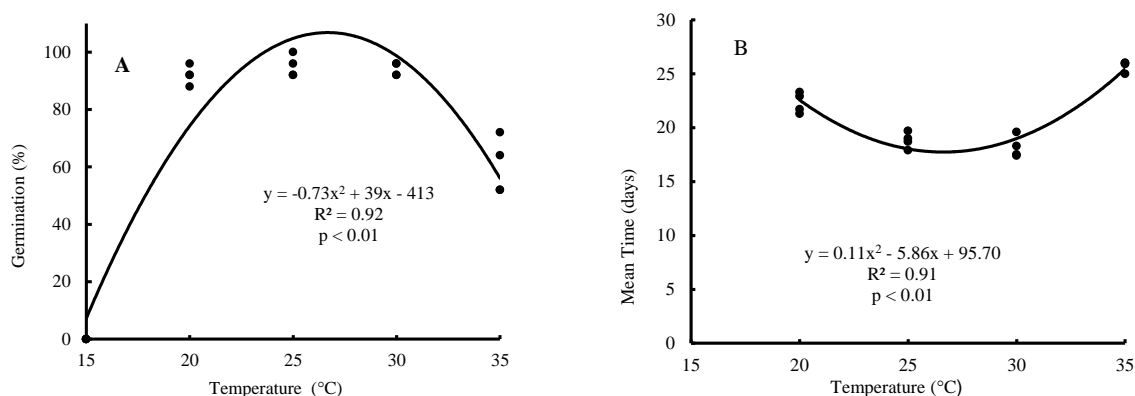
The water content in the seeds of *Alibertia edulis* at the beginning of the experiment was 11.07%, differently from the value of 19.35% found in the seeds of Dourados in Mato Grosso do Sul [13].

The accumulated germination curves differed between the temperatures used indicating that in the constant temperature 30 °C the germination of the seeds of *Alibertia edulis* began at 12 days and in 25 °C at 14 days, while in alternating temperature 25-20 °C, at 20 days (Figure 1). Note that constant temperatures 20 °C and 35 °C and alternating temperatures delayed the germination process.



**Figure 1. Cumulative percentage of *Alibertia edulis* germination in constant and alternating temperatures. Cuiabá, Mato Grosso. Brazil**

The temperatures studied significantly influenced the percentage and the mean germination time (Figure 2). The highest final percentage of germination (Figure 2A) was observed in constant temperature 20, 25 and 30 °C, with values higher than 90%, while in temperature 35 °C, on average, 60% of germination occurred. In temperature 25 °C the seeds of *Alibertia edulis* from Campo Grande, Mato Grosso do Sul - Brazil presented 92% germination both when freshly harvested and at eighteen months of storage [17]. This same temperature provided a higher percentage of germination (93.1%) in seeds of Dourados, Mato Grosso do Sul - Brazil [13].



**Figure 2. Percentage of germination (A) and mean germination time (B) of *Alibertia edulis* seeds under different temperatures. Cuiabá, Mato Grosso. Brazil**

No germination was observed in 15 °C, while in 20 and 35 °C, although the seeds germinated, they did not form aerial part during the evaluation period. In another study conducted with the same species by another authors [13] no germination was observed at the temperature of 15 °C and at 20 °C, and the seeds germinated, but the seedlings did not present aerial part as also occurred in the present work, however these authors did not evaluate the temperature of 35 °C. Temperatures constant and lower than 20 °C reduce or inhibit the germination process of other native Cerrado species, such as *Cochlospermum regium* [18]; *Erythrina verna* [19] and *Aristolochia esperanzae* [20].

The mean germination time (Figure 2B) was lower at temperatures of 25 and 30 °C, with an average value of 18 days. Seeds that take a long time to germinate can be attacked by fungi during the imbibition process and, thus, have the germination process compromised. Therefore, seeds that present higher velocity during the germination process may suffer less influence of pathogens [21]. In the case of *Alibertia edulis* seeds, the fact that they were not submitted to any pre-germination treatment, and present high germination rates and average germination time around 18 days, can confer a high degree of establishment in the field.

A review study on the germination of Cerrado seeds, showed that species of the families Melastomataceae and Vellozaceae presented greater germinability at 20 and 30 °C. Temperature 15 and 35 °C negatively influenced germination, and this corroborates the fact that temperatures between 20 °C and 30 °C are the most favorable for germination [22]. The range of 20-30 °C as the best condition for most subtropical and tropical species [6], which is in agreement with the results found in this work for *Alibertia edulis*. Regarding seedling formation, the only temperatures that gave rise to development were 25 °C and 30 °C (Table 1). It was verified that in the temperature of 25 °C the seedlings presented higher values of the total length, root length and fresh and dry mass of root compared to the seedlings that developed in the temperature of 30 °. These results indicate that the best temperature for germination (25 °C) was also the best for initial growth of seedlings, especially root growth.

**Table 1.** Mean values of the seedling length (CP), shoot length (CPA), root length (CR), fresh shoot mass (MFPA), dry shoot mass (MSPA), fresh root mass and root dry mass (MSR) of *Alibertia edulis* submitted to the germination test at constant temperatures of 25 °C and 30 °C. Cuiabá, Mato Grosso. Brazil. (\*\* p<0,01; \* p<0,05).

T °C	CP (cm)*	CPA (cm)**	CR (cm)**	MFPA (g)	MSPA (g)	MFR (g)*	MSR (g)
25 °C	9.33a	1.65b	7.68a	0.03049a	0.00346	0.02034a	0.00219
30 °C	8.58b	2.50a	6.07b	0.03513a	0.00333	0.01620b	0.00122

The results obtained in this work indicate that temperatures 25 °C and 30 °C, taking into account the percentage and mean germination time, are the most indicated for the germination test, but for the initial development of the seedling, the temperature is 25 °C. Thus, considering all the characteristics evaluated in the present study, it is possible to state that, for seeds of *Alibertia edulis*, the best temperature the germination test in the laboratory is 25 °C.

## CONCLUSIONS

Seeds of *Alibertia edulis* showed similar behavior to most of the shrub species of the Brazilian cerrado, with germination above 90% in temperatures between 20 and 30 °C and the best temperature for the germination test in the laboratory is 25 °C.

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