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Methods to overcome of the dormancy in murici (*Byrsonima verbascifolia* Rich) seeds

Métodos para superação da dormência de sementes de murici (*Byrsonima verbascifolia* Rich)

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Abstract

The great agricultural development in the Brazilian savannah brought with it the reduction of its natural vegetation, which has been quickly lost, especially due to extractive exploitation by man. Murici (*Byrsonima verbascifolia* Rich) is a fruit bearing plant of great medicinal importance in the savannah; however, its propagation is hindered by the fact that the seeds have low germination and seedling emergence in the field is slow. This study evaluated the effect of different dormancy breakage methods in murici seeds. Therefore, were evaluated effect of different temperatures; soaking in gibberellic acid and water; chemical and mechanical scarification and two types of substrate (distilled water and KNO₃). Treatments were arranged in a randomized block design. Records made daily on the number of germinated seeds were used to determine the germination percentage and germination speed index. Among the methods evaluated, gibberellic acid at 2,309.46 µM gave the greatest seed germination percentage, especially when the germination paper was moistened with KNO₃.

Key words: Germination, medicinal plants, savannah fruit bearing trees

Resumo

O grande desenvolvimento agrícola na região do Cerrado foi acompanhado pela redução da vegetação atual e essa rica formação vegetal vem sofrendo uma rápida depredação, principalmente devido à exploração extrativista por parte do homem. O murici (*Byrsonima verbascifolia* Rich) destaca-se por ser uma planta de grande importância medicinal e frutífera do cerrado, entretanto, sua propagação é dificultada pelo fato de suas sementes terem baixa taxa de germinação e a emergência das plântulas em campo serem lentas. Objetivou-se com este trabalho avaliar o efeito de diferentes métodos de superação da dormência em sementes de murici. Para tanto, foram avaliados o efeito de diferentes temperaturas; imersão em ácido giberélico; imersão em água e escarificação química e mecânica do endocarpo e dois tipos de substrato umedecidos (água destilada e KNO₃), dispostos em delineamento de blocos ao acaso. Foram realizadas contagens diárias para determinar a porcentagem de germinação e índice de velocidade de germinação. Entre os diversos métodos avaliados, o ácido giberélico a 2.309,46µM proporcionou maior porcentagem de germinação das sementes, sobretudo quando o papel de germinação foi umedecido com KNO₃.

Palavras-chave: Germinação, plantas medicinais, frutífera do cerrado

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The present agricultural occupation and production system contributes for the speedy reduction of savannah areas, jeopardizing biodiversity and extinguishing the culture of native people. The savannah vegetation has peculiar characteristics, making it unique among the other vegetation types. The importance of basic studies to better understand their adaptation mechanisms has been suggested. There are native fruiting species within the great diversity in this ecosystem that present cropping potential in traditional systems and, in the context, *Byrsonima verbascifolia* Rich. Ex A. Juss, commonly known as murici, is one the species that have been predatorily exploited.

Murici is a fruit bearing tree, with yellow, fleshy fruits with strong sweet and sour flavor, slightly oily, that can be consumed *in natura*, besides the use as preserves, juice, ice-cream and liqueur. However, this species does not have the fruit as the only use. Although there are no reports of commercial production of this tree, the wood is adequate for housing. The wood presents a yellowish or redish color, satin like and shiny, and is widely used in fine masonry. The bark is used in folk medicine for fever control. Moreover, it is astringent (contains 15 to 20% tannin), and can be used in tannery. A black dye is extracted from it and used in fabrics industry, giving a gray color to cotton. The leaves are commonly used by cattle since the species has great foraging potential (ALMEIDA et al., 1998).

The knowledge level about planting techniques of savannah native species still is incipient, since they are wild, presenting great genetic variability (SILVA et al., 2001). Studies about seed germination of murici are scant; however, with the increasing interest by researchers, new, crucial information are being discovered. According to Lorenzi (2002), murici flowers and fruits in specific times of the year, and the greatest difficulty of seed propagation is the low germination rate and slow plantlet emergence in the field.

Considering the reduced seed viability and

increasing demand for murici fruits, this study determined the effect of different methods to overcome of the dormancy.

Vegetable Material

Ripe fruits were collected in February 2008, in the county of Rio Verde, GO, district Ouroana, with the coordinates (16° 07' 915" S / 051° 17' 857" W); at 579 m above sea level, with a moisture contents of 11.11%.

Dormancy Tests

The collected fruits were stored in plastic trays at approximately 25°C for 14 days. Subsequently, the fruits were mechanically depulped.

The seeds were dried at room temperature, packaged in plastic bags and stored in the refrigerator, at 5°C for 180 days. After this storage period, the seeds were subjected to the treatments.

a) Temperature

Pre-cooling (0°C) for seven days;

Pre heating (40°C) in forced air oven for seven days;

Pre heating (70°C) for 5, 10 and 20 hours in forced air oven;

Heat shock (0°C for 1 hour and immersion in H₂O at 85°C for 10 minutes);

Heat shock (40°C for 4 hours and immersion in H₂O at 0°C for 10 minutes).

b) Growth regulator

Immersion in giberellic acid at 1,154.73 µM, (48 hours), average temperature 27.45°C;

Immersion in giberellic acid at 2,309.46 µM, (48 hours), average temperature 27.45°C.

c) Water

Immersion in distilled water for 24 hours, at room temperature (28.2°C) and 48 hours at room temperature (27.5°C);

Immersion in boiling water for 5, 15 or 30 minutes, respectively; final water temperature (5 minutes: 79°C; 15 minutes: 66°C; 30 minutes: 55°C).

d) Scarification

Chemical, by seed immersion in sulfuric acid (H_2SO_4) P.A. (98%), for 5, 15 or 30 minutes, followed by rinsing in tap water and drying over paper towel at room temperature for one hour;

Mechanical, the endocarp was sanded with the aid of sandpaper number 80, in the upper side opposed to the embryo axis.

The control consisted of whole seeds, in which no treatment was applied.

The seeds were placed in Gerboxes (11.0 x 11.0 x 3.5 cm) over two moistened blotter papers with 2.5 times the weight of the dry substrate with distilled water or KNO_3 (0.2%) solution and maintained in germinator "Mangelsdorf" at 30°C under constant lighting.

Weekly counts were made for 150 days, evaluating germination percentage and IGV (index of germination velocity). IGV was calculated by Maguire's formula (MAGUIRE, 1962).

The experimental design was randomized blocks as a 2x19 factorial, with 2 moistening liquids (distilled water or KNO_3), and 19 methods of dormancy breakage plus the untreated control, with four repetitions (each one with 15 seeds), in a total of 152 experimental units. The data were submitted to analysis of variance and the averages compared by the Tukey test at 5% probability.

Low germination percentage was observed in all murici seed treatments which, consequently,

reflected into the low index germination velocity (IGV). The average percent germination of the untreated seeds (control) was 2% (Table 2), corroborating the reports in the literature describing the low germination rate for the species (NOGUEIRA et al., 2004; LORENZI, 2002).

The low germination index and the heterogeneity of emerged plants can be the result of the balance between growth promoters and inhibitors since the seeds in all treatments imbibed, but only those from the GA_3 treatment germinated. Seeds of this treatment, in conditions evaluated, and for both substrates, germinated. The concentrations of GA_3 did not differ between treatments, in contrast with the substrates, and the KNO_3 solution was the best substrate with GA_3 at 2,309.46 μM . Average germination values of 17,00% were obtained, which were better than 12,00%, obtained from seeds imbibed in 1,154.73 μM GA_3 (Table 1).

The efficacy of the use of growth regulator as a trigger of the germination process has been shown for several native tree species, such as pequi (*Caryocar brasiliense* Camb.), fruta do conde (*Annona squamosa* L.), jenipapo (*Genipa americana*), among others. In this context, the gibberellins are fundamental, since they are related to the synthesis of hydrolytic enzymes that break down the reserves, which are used in the embryo development, as well, as in the elongation of the radicle, thus promoting the germination (SOUZA et al., 2007; PRADO NETO et al., 2007; FERREIRA; ERIG; MORO, 2002). Therefore, seed presenting low gibberellins concentration, could have greater germination and more homogeneous if treated with GA_3 , at adequate concentration. In the case of murici seeds, the presence of gibberilic acid certainly concurred for promoting germination and greater velocity index, in relation to the other treatments. Similar results were found by Rossetto et al. (2000), studying the effect of GA_3 in sweet passion fruit (*Passiflora alata* Driand), and also by Scalón, Scalón Filho and Rigoni (2004) in uvaia (*Eugenia uvalha* Cambess) and by Stein et al. (2007) in ingá (*Inga vera* Willd.).

Table 1. Index germination velocity (IGV) and germination percentage of Murici (*Byrsonima verbascifolia* Rich) seeds subjected to several dormancy breaking treatments. Treatments related to: A) temperature, B) growth regulators, C) water, D) scarification. The germination paper was moistened with KNO₃ (0.2%) solution, or water, for all treatments.

		Methods to overcome	GERMINATION		IGV	
TREATMENTS		of the dormancy	SUBSTRATE			
			H ₂ O	KNO ₃	H ₂ O	KNO ₃
A	TEMPERATURE	0 °C (7 dias)	1.000 Ca	2.000 Ba	0.012 Aba ^z	0.013 Ba
		40 °C (7 dias)	1.000Ca	1.000 Ba	0.002 ABa	0.002 Ba
		5 h/ 70°C	0.000 Ca	0.000 Ba	0.000 Ba	0.000 Ba
		10 h/ 70°C	0.000 Ca	0.000 Ba	0.000Ba	0.000 Ba
		20 h/ 70°C	0.000 Ca	0.000 Ba	0.000 Ba	0.000 Ba
		0 °C/ 10min.	0.000 Ca	0.000 Ba	0.000 Ba	0.000 Ba
		40 °C/ 10min.	1.000 Ca	0.000 Ba	0.004 ABa	0.000 Ba
B	REGULATOR	GA ₃ / 400mg.L ⁻¹	9.00 Aa	12.00 Aa	0.036 Aa	0.034 ABa
		GA ₃ / 800mg.L ⁻¹	8.00 ABb	17.00 Aa	0.034 ABb	0.055 Aa
C	WATER	5 min.(98-79 ⁰ C)	0.000 Ca	0.000 Ba	0.000 Ba	0.000 Ba
		15 min.(98-66 ⁰ C)	0.000 Ca	0.000 Ba	0.000Ba	0.000 Ba
		30 min.(98-55 ⁰ C)	0.000 Ca	0.000 Ba	0.000 Ba	0.000 Ba
		24 h (28,2 ⁰ C)	0.00 Ca	0.00 Ba	0.000 Ba	0.000 Ba
		48 h (27,5 ⁰ C)	0.00 Ca	0.00 Ba	0.000 Ba	0.000Ba
D	ESCARIFICATION	H ₂ SO ₄ / 5 min.	0.000 Ca	2.000 Ba	0.000 Ba	0.000 Ba
		H ₂ SO ₄ / 15 min.	1.000 Ca	2.000 Ba	0.000 Ba	0.012 Ba
		H ₂ SO ₄ / 30 min	0.000 Ca	3.000 Ba	0.000 Ba	0.011 Ba
		Sand paper n. 80	1.00 Ca	1.00 Ba	0.021 ABa	0.003 Ba
		Control	2.00 BCa	0.00 Ba	0.013 ABa	0.000 Ba

^z Averages followed by the same capital letter in the column and small cap in the lines do not differ by the Tukey test at 5% probability.

No differences were found among the treatments evaluating different temperatures in both substrates (Table 1). Also, no germination was observed in the water treatments. Similar results were observed by Alves et al. (2004), who used water at 80°C for 6 or 9 minutes and 100°C for 1 or 2 minutes, with seeds of pata de vaca (*Bauhinia divaricata*), and found no inhibitor effect of these temperatures and immersion times.

Germination was observed in all scarification treatments when the substrate contained KNO₃ solution. In contrast, when the blotter paper was moistened with water, only seeds treated with H₂SO₄ for 15 minutes or sanded (sand paper number 80) germinated (Table 1). Tegument impermeability is the major cause of low water contents inside the seeds, preventing intense metabolism, which is fundamental for germination of initial

seedling growth (ZAIDAN; BARBEDO, 2004). The methods to be use for breaking this kind of dormancy should cause openings in the tegument, allowing seed soaking, which is done by physical or chemical scarification. Several authors report the efficacy of potassium nitrate and sulfuric acid for breaking the dormancy of tree seeds, such as paricarana (*Bowdichia virgilioides*) (SMIDERLE; SOUZA, 2002) anileira (*Indigofera suffruticosa*) (GARCIA et al., 2000), sabiá (*Cassia excelsa*) (JELLER; PEREZ, 1999), capiçova (*Erechtites valerianaefolia*) (ZAYAT; RANAL, 1997) and calabura (*Muntingia calabura*) (LOPES; PEREIRA; MARTINS-FILHO, 2002).

Therefore, according to the conditions evaluated, it can be concluded that the best treatment for murici seeds germination is immersion in GA₃ for 48h and, subsequently, germinate them in substrate moistened with KNO₃.

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