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OVERCOMING DORMANCY IN SEEDS OF BIRIBÁ AND SEEDLING GROWTH

Pablo Wenderson Ribeiro Coutinho[1*], Fabíola Villa[2], Ely Pires[1], Hingrit Mazurek Siqueira[1]

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ABSTRACT - The study aimed to evaluate the influence of overcoming dormancy of seeds of biribá through chemical and mechanical method in the emergence and initial growth of seedlings. The fruits were acquired from a mother plant in Cascavel (PR). The experimental design was a completely randomized in factorial 2 x 3, with four repetition, containing 25 seeds each repetition. The first factor was constituted of scarification with sandpaper n.80 of the two sides opposite the micropyle (with and without), the second factor was the soaking for 24 h (water, GA_3 in the concentration of 1000 mg L^{-1} and without soaking). The count was performed for up to 60 days, being calculated the emergence speed index, average time of emergence and speed of emergence. When the stabilization was achieved, the ratings of seedlings as the main root length and shoot, diameter of stem, number of leaflets, dry biomass of root, shoot and total seedlings. The imbibition in GA_3 promoted to overcome dormancy leishmaniasis, being that the chiseling in conjunction obtained better average speed of emergence and seedling length, thus confirming that the two techniques in conjunction assists in the growth of biribá seedlings.
Key words: *Rollinia mucosa* (Jacq.) Baill, emergence, sexual propagation, plant growth regulator.

SUPERAÇÃO DE DORMÊNCIA EM SEMENTES DE BIRIBÁ E CRESCIMENTO DE PLÂNTULAS

RESUMO - O trabalho teve por objetivo avaliar influência da superação da dormência de sementes de biribá por meio método químico e mecânico na emergência e crescimento inicial de plântulas. Os frutos foram adquiridos de uma planta matriz em Cascavel (PR). O delineamento experimental foi inteiramente casualizado em esquema fatorial 2 x 3, com quatro repetição, contendo 25 sementes cada repetição. O primeiro fator foi constituido da escarificação com a lixa n.80 dos dois lados oposto a micrópila (com e sem) e o segundo fator foi a embebição por 24 h (água, GA_3 na concentração de 1000 mg L^{-1} e sem embebição). A contagem foi realizada por até 60 dias, sendo calculado o índice de velocidade de emergência, tempo medio de emergência e velocidade media de emergência. Quando a estabilização foi atingida, realizaram-se as avaliações das plântulas quanto ao comprimento da raiz principal e da parte aérea, diâmetro do caulículo, número de folíolos, biomassa seca do sistema radicular, da parte aérea e total das plântulas. A embebição em GA_3 promoveu a superação da dormência tegumentar, sendo que unido com a escarificação obteve melhores velocidade média de emergência e comprimento de plântula, confirmando assim que as duas técnicas em conjunto auxiliam no crescimento das plântulas de biribá.
Palavras-chave: *Rollinia mucosa* (Jacq.) Baill, emergência, propagação sexuada, fitorregulador.

INTRODUCTION

The Annonaceae family composed by a large number of genera and species with wide distribution in tropical or subtropical regions (SÃO JOSÉ et al., 2014), and the genus *Annona* more important and of interest in commercial fruit growing (SANTOS et al., 2005). In Brazil, the amazon region stands in the consumption of fruits of biribazeiro (*Rollinia mucosa* (Jacq.) Baill), taking the country (Atlantic rain forests and Amazon) as a center of origin (FERREIRA et al., 2009).

The biribazeiro is distinguished from the other species of its genus *Rollinia* by presenting large edible fruits and the peel of the fruit has protrusions in the form of sharp scales and is yellow, containing clear fleshed mucilaginosa and sugary, which justifies its widespread cultivation in the neotropics (SOARES et al., 2014). The fruits have great popular acceptance, being consumed *in natura*. It is also known, biribá, biribá do Pará, fruit of the countess, biribá de Pernambuco, sweetsop, anona and jaca of poor (FERREIRA et al., 2009).

For the formation of seedlings of quality and subsequent commercial orchard of Annonaceae in general, it is necessary the use of vegetative propagation by grafting method (ALMEIDA et al., 2010). Due to the spread of the Annonaceae, when it occurs by seed, if you have a large variation between the shape and size of fruits, because of the cross-pollination of this species. In this way the seeds of biribá are usually employed in the production of rootstocks, being that these seeds have inhibitory substances of germination, besides teguments drives and

[1]Pós-graduação em Agronomia, Programa de Pós-Graduação em Agronomia (PPGA), Universidade Estadual do Oeste do Paraná (Unioeste), Rua Pernambuco, 1777, Caixa Postal 91, CEP 85960-000, Marechal Cândido Rondon, Paraná, Brasil. E-mail: pablowenderson@hotmail.com. *Autor para correspondência.
[2]Eng[a]. Agrônoma, Dr[a]., Professora Adjunto, Programa de Pós-Graduação em Agronomia (PPGA), Universidade Estadual do Oeste do Paraná (Unioeste), Rua Pernambuco, 1777, Caixa Postal 91, CEP 85960-000, Marechal Cândido Rondon, Paraná, Brasil. E-mail: fvilla2003@hotmail.com

impermeable to water, causing the numbness and hindering the germination (CAMPOS et al., 2015).

Several methods to chemical, physical and mechanical can be applied in overcoming dormancy of seeds of the Annonaceae family, among these the scarification and use of gibberellic acid (GA_3), alternatives that offer high rate of seed germination and subsequent seedling development (VASCONCELOS et al., 2015). Seed scarification with sandpaper and the use of GA_3 can provide a percentage and rate of germination in seeds of atemoya (*Annona cherimola* x *A. squamosa L.* L.) and pinha (*A. squamosa* L.) (SOUZA et al., 2008; OLIVEIRA et al., 2010).

A deficiency in studies on the production of seedlings in tropical fruit, which is causing an imbalance in the germination and emergence of seedlings, due to the presence of the teguments drives. Despite the use of techniques for overcoming seed dormancy, studies still need to be deepened, seeking greater efficiency and uniformity in the germination of seeds of biribá, having in view that the Rules for Seed Analysis (BRASIL, 2009), there are no recommendations and methodologies for overcoming dormancy in this species. Considering the above, the objective of this work was to evaluate the influence of overcoming dormancy of seeds of biribá through chemical and mechanical method in the emergence and initial growth of seedlings.

MATERIAL AND METHODS

The fruits of biribazeiro were purchased from a plant matrix, seeking to reduce the genetic variability. The location of the collection was in the Cascavel City (Paraná, Brazil), under the geographic coordinates of latitude 24°57'21"S and longitude 53°27'19"W. According to the Köppen classification, the place of collection fits as *Cfa*, characterized as subtropical climate, with average temperatures of the coldest quarter below 18°C, and in the quarter hotter, above 22°C, with hot summers, infrequent frosts and tendency of concentration of rainfall in the summer months.

The seeds were extracted from approximately 30 fruits, selected in function of maturation (mature), size (uniform), firmness, dirt (clean), pest attack (exempt) and other physical defects apparent. For the extraction of pulp held the Wash with tap water. Drying was done in shaded location, on newsprint, for a period of 24 h later were taken to the laboratory, for the application of treatments.

The delineation design was completely randomized in factorial 2 x 3, with four replicates, containing 25 seeds each. The first factor was constituted of scarification with sandpaper (with and without), the second factor was the soaking for 24 h (water, GA_3 in the concentration of 1000 mg L^{-1} and without soaking).

The sandpaper scarification was performed with n°80 of the two sides, opposite the micropyle, being recommended by Ferreira et al. (2010). The GA_3 used in the experiment was diluted in alcohol and the volume completed with water being used magnetic stirrer for mixing, being the recommended concentration by Campos et al. (2015). After the break for soaking of treatments, seeds were placed in plastic trays, using a commercial substrate Hortmax® and arranged in B.O.D. at a temperature of 25°C and photoperiod of 12/12h, being performed daily visual monitoring. The moisture of the substrate was monitored periodically by adding water whenever necessary.

The counts of emergence test (E %) were performed every day for up to 60 days, at which there was no more emergence, being considered the emerged seedlings whose of stem was above the level of the substrate (CAMPOS et al., 2015). On the basis of the count of emergence, we calculated the index of germination speed (MAGUIRE, 1962).

On the basis of data were also calculated the average emergence speed (AES) and the mean emergence time (MET). The AES and MET calculations were performed according to the methodology of Labouriau (1983).

When the emergence stabilization was achieved, the ratings of seedlings as the length of the main root and aerial part (cm), diameter of stem (cm), number of leaflets, dry biomass of the root system (g) and aerial part (g) and total dry biomass of seedlings (g). The length of the aerial part and root were measured with the aid of graduated ruler, whereas as the total length of the cervix to the apex of the aerial part and the cervix to the apex of the main root, respectively. The diameter of stem was performed with the aid of a digital caliper, whereas the neck of the aerial part. For the evaluations of dry biomass, the seedlings were separated in the aerial part and root system. Then, were arranged in Kraft paper bags and taken to the forced circulation oven at 65°C for 72h. Subsequently, the samples were weighed on an analytical balance with a precision of 0.001g, and the results were expressed in grams.

The data were checked for normal distribution of residuals by Shapiro-Wilke test, subjected to analysis of variance using the statistical software Sisvar (FERREIRA, 2014). When the existence of statistically significant differences, the means were compared by the Tukey test at 5% probability of error.

RESULTS AND DISCUSSION

There was no interaction between imbibition and scarification of seeds of biribazeiro for almost all evaluated characteristics of germination as emergence (E) and MET, so the factors were studied separately. For E, best results were observed in seeds imbibed in GA_3, being that for scarification was not observed statistical difference (Table 1).

The Chiseling held in seeds, on both sides, opposite the micropyle, can contribute to the increase of the permeability of the tegument, but this work has not been verified difference to E. Work performed by Ferreira et al. (2009), verified that the Chiseling favors the imbibition of the seeds and, consequently, the overcoming dormancy, thus facilitating the germinative process and culminating in the largest E.

TABLE 1 - Emergence (E), average time of emergency (MET), diameter of stem (DS), dry biomass of the aerial part (DBAP), root dry biomass (RDB) and total dry biomass of seedlings (TDBS) for different methods to overcome dormancy of seeds of biribá.

Soaking	E (%)	MET (days)	DS	BDPA	RDB	TDBS
Water	0.4487 b*	46.49 a	2.35 a	0.0811 b	0.0487	0.1300
GA_3	0.6169 a	37.94 b	2.08 c	0.1163 a	0.0509	0.1673
Without soaking	0.4318 b	44.97 b	2.22 b	0.0733 b	0.0564	0.1295
DMS	0.1581	3.2	0.1219	0.0281	0.2467	0.0466
Scarification						
With	0.5339 a	41.34 b	2.28 a	0.0963 a	0.0498	0.1462
Without	0.4643 a	44.93 a	2.16 b	0.0841 a	0.0542	0.1383
DMS	0.1059	2.14	0.0816	0.0188	0.0165	0.0312
CV (%)	24.38	5.71	4.23	23.97	36.51	25.22

*Medium followed by the same letter, in column, did not differ among themselves by the Tukey test at 5% probability of error.

The evaluation of the E in seeds of trees is very important, because the higher the value, the lower the seed exposure to adverse conditions of the environment, such as attack from fungi and insects, as well as shorter length of seedlings in the nursery, resulting in greater efficiency in the productive process of seedlings (CAMPOS et al., 2015). Similar results in overcoming seed dormancy of Annonaceae, using scarification and gibberellic acid were observed by Vasconcelos et al. (2015) and Sousa et al. (2008), increasing the speed of germination index by more than 50%.

In relation to the mean emergence time (MET) seeds, we found better results for the seeds imbibed water only and without scarification (Table 1). The seeds that were submitted to the other treatments, took a little less to stabilize, with a MET lesser. Being better for the production of seedlings, because a MET uneven becomes undesirable, constitutes a problem in the final quality of the product (CAMPOS et al., 2015).

The average speed of emergence (AES) are also presented in a similar manner to the E, with better results for overcoming dormancy when the seeds were soaked in GA_3, being that for AES you were scarified (Table 2), differentiating itself from the other treatments. It can be inferred that the AES and E seeds are influenced by the imbibition in GA_3, thus overcoming dormancy of the species and accelerating the emergence of same.

The seeds that will receive the chiseling on both sides, opposite the micropyle, and yet were soaked in the solution of gibberellic acid, may have contributed to the increase of the permeability of the tegument, and thus accelerating its germination process. Since there is a greater absorption and passage of the solution, and consequently the hydration of the seed, reactivating the metabolism and the growth of the embryonic axis, initiating the germination process, and in this way if having a greater AES.

For the morphometric characteristics of seedlings was observed interaction between imbibition and scarification of seeds of biribazeiro, for root and seedling length and number of leaves (Table 2), for the remaining characteristics factors were studied in isolation.

In relation to the length of seedlings, the seeds were soaked in GA_3 and scarified, showed significant differences with greater lengths (15.03 cm). Campos et al. (2015) obtained better lengths of seedlings of Annonaceae with applying these same methods for overcoming dormancy of seeds (scarification and imbibition in GA_3, 1000 mg L^{-1}). The rest of the treatments behaved similarly statistically.

Still in Table 2, it can be verified that the root length from seed just soaked in GA_3 without scarification, showed no statistical difference in relation to the other treatments (8.68 cm). In this way, the imbibition of the seeds on vegetable regulator overcame dormancy, corroborating Campos et al. (2015), which demonstrated that the positive response to the root growth was related with the concentration of GA_3 used, probably due to the increase in AES. The rapid germination and establishment of plants favor the development of vegetative structures.

A larger quantity of leaves on seedlings of biribá were observed in seeds imbibed in GA_3 with and without scarification, and scarified seeds without soaking. This increase of leaves on certain treatments is linked to average speed of emergence, where the same settled but fast, accelerating the leaf development.

In Table 1 there are the results of the diameter of stem, dry biomass of the aerial part, root dry biomass and dry biomass of seedlings with statistically significant differences for all the variables presented.

For stem diameter, it was observed that the best results in seedlings from seeds that have been soaked in water and when were scarified, showed higher take-overs, the same as for the germination and emergence of same, the seeds do not need nutrients, but only of the hydration of the seed. The likely rapid imbibition of water can be derived from the scarification of the two opposite sides of the micropyle of seed, where the chiseling facilitated the absorption, and thus the growth of the embryo, speeding up the process of germination, which will induce the formation of stem and radicle. The same was observed in seeds of *Annona muricata* L., in scarified seeds on the opposite side of the micropyle and with different doses of bovine manure (SILVA et al., 2017).

Ratings of diameter of stem seedlings are important, because this variable is important in the formation of the rootstock (BRAGA et al., 2014), this should present around 5 mm (BERNARDES et al., 2007).

In Table 1 it appears that the values were around 2.35 and 2.28 mm, when soaked in water and scarified, respectively, a consequence of the tegumentary dormancy in seeds. Were observed in other treatments, a smaller diameter of stem, thereby proving that this vegetable regulator has no relation in the expressive increase of this parameter in the growth of seedlings of biribá.

In Table 1 it was observed still significant results for dry biomass of the aerial part, where the seeds soaked in GA_3 showed better results for dry biomass of the shoot. Corroborating Campos et al. (2015), who worked with overcoming dormancy in seeds of (*Rollinia mucosa* (Jacq.) Baill), where scarification or not, didn't hurt the development of seedlings.

TABLE 2 - Average speed of emergence (AES), number of leaves (NL), seedling length (SL) and root length (RL) and for different methods to overcome dormancy of seeds of biribá.

Soaking	AES (days)		NL	
	Scarification		Scarification	
	With	Without	With	Without
Water	0.0220 Ba*	0.0213 Ba	2.25 Ba	2.03 Ba
GA_3	0.0288 Aa	0.0245 Ab	2.80 Aa	3.10 Aa
Without	0.0233 Ba	0.0215 Ba	2.80 Aa	2.13 Bb
CV (%)	DMS column	DMS line	CV (%)	DMS column 0.12
4.96	0.0021	0.0018	9.77	DMS line 0.37
Soaking	SL (cm)		RL (cm)	
	Scarification		Scarification	
	With	Without	With	Without
Water	10.33 Ba	9.35 Ba	7.21 Aa	6.81 Ba
GA_3	15.03 Aa	11.01 Ab	7.51 Ab	8.68 Aa
Without	10.68 Ba	9.93 ABa	7.65 Aa	7.46 Ba
CV (%)	CV (%)	DMS column 1.43	CV (%)	DMS column 0.77
4.96	7.03	DMS line 1.17	5.52	DMS line 0.21

*Medium followed by the same uppercase and lowercase column on the line, do not differ among themselves by the Tukey test at 5% probability of error.

The seeds scarified or not, and whether or not they were soaked in water and GA_3, showed no difference between the treatments submitted to root dry biomass and total dry biomass of seedlings. Results obtained by Campos et al. (2015) are in contrary agreement with this work, where they obtained the lowest root dry biomass and total dry biomass of seedlings that were scarified seeds.

Due to the scarcity of studies reporting methods for overcoming dormancy in seeds of *Annona*, future studies with biribá should be performed, mainly in relation to the concentrations of GA_3 and/or other regulators in the imbibition of seeds.

CONCLUSION

The imbibition of the seeds with GA_3 favored the emergence speed index and dry biomass of the aerial part, being that this method when it was performed the chiseling in conjunction obtained better average speed of emergence and seedling length, thus confirming that the two techniques in conjunction assists in the growth of seedlings of biribá.

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