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Germination and vigor of *Macrotyloma axillare* cv Java seeds under different methods for overcoming dormancy

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The aim of this study was to evaluate the germination and vigor of seeds *Macrotyloma axillare* cv Java (archer) under different methods to overcome dormancy. The seeds were submitted to the following treatments to overcome dormancy: (a) control, (b) manual scarification with sandpaper, (c) immersion in sulfuric acid 98% for five minutes, (d) immersion in sodium hypochlorite solution 2% for 15 min. The experimental design was completely randomized with four treatments and four replications with 50 seeds per replication. The sandpaper method was the one that provided the highest percentage of germination (54.5) and speed of germination index (4.56) and did not differ (p = 0.17) from immersion in hypochlorite for 15 min (4.18). The scarification with sandpaper presented higher seedlings length (8.37 cm), while immersion in sulfuric acid and in sodium hypochlorite (5.66 and 5.15 cm) was not statistically different. Therefore, the manual scarification with sandpaper, which promoted the highest percentage of germination, speed of germination index and seedlings length, can be recommended as the best method to overcome dormancy of archer seeds.

Key words: Archer, Fabaceae, seed quality physiology.

INTRODUCTION

The *Macrotyloma axillare* (E. Meyer) Verdc. (Archer) is a perennial legume, that has voluble growth and average to low demand of soil fertility, high grazing tolerance, and good ability to consorting with *Brachiaria* and *Panicun* grasses (Paiva et al., 2008). However, the establishment phase is one difficulty in its implantation in the pasture, which may be linked to many factors, such as the low germination percentage of its seeds. Despite all the

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benefits such as improvements in soil chemistry and nutritional quality of forage intercropped, the difficulty of implementation of legumes in pastures established by grasses is a determinant of low utilization of grass-legume consortium (Almeida et al., 2015).

Some legume seeds, even though in favorable environmental conditions, usually do not germinate due to impermeable seed coat to water, which characterizes the seeds as hard or with integumentary dormancy. Thus, the study of methods to overcome dormancy in macrotiloma seeds is essential, because it diminishes the costs for pasture implementation. Moreover, it is important to identify the vigor of the lots with greater or lesser probability of presenting better performance in the field or during storage, so that, vigor tests become important tools, as auxiliary instrument to germination test in research on physiological seed quality (Guedes et al., 2009)

Dormancy is a characteristic that increases the survival of the species over time in the environment, but it is a problem when spread for cultivation and production of plants is desired among others, because these seeds do not germinate (Leal et al., 2008). In Fabaceae, it is mainly related to the presence of impermeable seed coat to water, which characterizes the seeds as hard or with tegumentary dormancy (Costa et al., 2010). Thus, the dormancy in species of Fabaceae must be overcome for an effective method to increase the rates of germination and allow a greater quantity of plants in the field (Silva et al., 2014).

The germination and vigor tests are essential components of the quality control process of seed companies (Torres et al., 2014). Among the vigor tests, the seedling length test has potential to provide additional information to those obtained in the germination test and enable to estimate the potential for seedling emergence in the field (Guedes et al., 2009)

Due to the above, the objective on this study was to evaluate the germination and vigor of *Macrotyloma axillare* cv Java (archer) seeds under different methods of overcoming dormancy.

MATERIALS AND METHODS

The study was conducted at the Instituto de Agronomia of the Universidade Federal Rural do Rio de Janeiro (UFRRJ) Seropédica – RJ (Brasil), during November of 2015. The archer seeds were submitted to different treatments for overcoming dormancy: (a) control, (b) manual scarification with sandpaper, (c) immersion in sulfuric acid (H_2SO_4) 98% for five minutes, and (d) immersion in sodium hypochlorite (NaClO) solution at 2%, for 15 min.

The samples used in the seed germination test were randomly picked from the “pure seeds” portion after the purity test. After homogenization, 200 seeds were counted per treatment in 4 replications of 50 seeds each, in a germination chamber BOD type (biochemical oxygen demand) with 12 h of light, where the seeds were placed in “gerbox” boxes on germitest paper sterilized and imbibed with distilled water in a ratio of 2.5 times the weight of the paper, in order to proceed with the germination test and the speed of germination index.

The seedling length was obtained by measuring parts of normal seedlings with a ruler, and the average results expressed in centimeters. The germination speed index was obtained by summing the number of germinated seeds each day, divided by the number of days since the test assembly, according to the Maguire’s formula (1962).

The first germination evaluation occurred on the 4th day after the test assembly and the second on the 10th day, when the percentage of seed germination was quantified, which corresponds to the ratio of the number of seeds that produced seedlings classified as normal in accordance with the described recommendations in MAPA (2009).

For the evaluation of the seedlings length, the tests were performed in a germinator on germ test paper rolls packed in vertically positioned plastic bags for seven days in the absence of light and at 25 °C. The experimental design was completely randomized with four replications.

The data were submitted to normality test and analysis of variance, and in the case of statistically significant differences, the means were compared by Tukey’s test at 5% of probability using the ExpDes package from the statistical R program (Ferreira et al., 2013).

RESULTS AND DISCUSSION

The results obtained in the seed germination test are shown in Table 1. The treatment which used sandpaper provided the highest germination percentage, but there were not statistically significant differences ($p > 0.05$) comparing with the treatment with H_2SO_4.

The scarification with sandpaper increases the percentage of germination, because it allows the formation of cracks in the seed tegument, which favors the start of imbibition and germination process (Guedes et al., 2013), while the use of H_2SO_4 promotes abrasion of the seed tegument, due its corrosive action. The use of scarification with sandpaper, presents advantages over sulfuric acid in the relationship acquisition cost and the risk of manipulation that acid presents (Scheffer-Basso and Vendrusculo, 1997), besides the amount that can be used and the difficulty of acquiring it in the market (Bruno et al., 2001).

Paiva et al. (2008) obtained an increase of the archer seed (cv. Java) germination percentage, with scarification, by removing the seed tegument. Literature describes out the recommendation of the use of scarification with sandpaper to make the dormancy break of seeds of forage legumes: *Calopogonium mucunoides* (Morais et al., 2014), *Clitorea ternatea* (Deminicis et al., 2006), *Neonotonia wightii* (Deminicis et al., 2012) *Stylosanthes macrocephala* and *Stylosanthes capitata* (Carmona et al., 1986). The use of H_2SO_4 was indicated for *Mimosa caesalpiniaefolia* (Bruno et al., 2001) *and Piptadenia viridiflora* (Santos et al., 2014).

Chikumba et al. (2006), they studied methods to overcome the dormancy of two seed lots of *Macrotyloma daltonii* (Webb) Verdc, which were submitted to the treatments: Removal of the integument, application of dry heat, hot water, acid scarification, sandpaper scarification,

Table 1. The results of germination tests of archer seeds submitted to different methods for overcoming dormancy.

Variable	Treatments			
	Control	Sandpaper	H_2SO_4	Sodium hypochlorite
Germination (%)	37.50^{C}	54.5^{A}	53.50^{A}	44.00^{B}
CV (%)	7.27			

Means followed by the same letter do not differ significantly at 5% of probability (Tukey's test).

Table 2. Speed of germination index (SGI) and seedlings length (cm) after the application of different treatments to break seed dormancy of archer seeds.

Variable	Treatments				CV (%)
	Control	Sandpaper	H_2SO_4	Sodium hypochlorite	
SGI	3.10^{B}	4.56^{A}	3.04^{B}	4.18^{A}	6.14
Seedlings length	4.08^{C}	8.37^{A}	5.66^{B}	5.15^{BC}	12.23

Means followed by the same letter in the same line do not differ significantly at 5% of probability (Tukey's test).

pre-chiling and combination with H_2SO_4 and dry heat, and concluded that immersion in H_2SO_4 for 20 min was more effective at increasing germination from 10 to 80%.

Table 2 represents the speed of germination index (SGI) and seedlings length of archer seeds after submission to different treatment methods for overcoming dormancy. The treatment using sandpaper and immersion in sodium hypochlorite for 15 min showed higher SGI and the values were not statistically different ($p > 0.05$). The control and immersion in H_2SO_4 presented lower SGI and values were not statistically different ($p>0.05$) from each other.

The results of this study are in agreement with those reported by Deminicis et al. (2006) which showed higher SGI values for eight tropical forage legume seeds submitted to scarification with sandpaper and the use of H_2SO_4. Lima et al. (2013) evaluated different methods of scarification (immersion in water, hot water immersion, scarification with sandpaper and H_2SO_4, and combinations of these methods) in *Delonix regia* seeds, and found a higher speed of emergence index in the treatment with scarification by sandpaper, when compared to other treatments.

The treatment that used sandpaper had as a result higher average lengths of seedlings. Immersion in H_2SO_4 did not differ significantly from immersion in sodium hypochlorite solution ($p > 0.05$), and the control had lower seedlings length. The seedlings length has the potential to provide additional information to those obtained in the germination test which makes it possible to estimate the potential for seedling emergence in the field (Guedes et al., 2015). Therefore, the use of scarification with sandpaper presented itself as the most efficient; this indicates that in addition to a better germination, an improving of the plants vigour will prepare them for the occurrence of stresses and weathering effects in the field.

Conclusion

The scarification with sandpaper provided higher germination percentage, speed of germination index and seedlings length, suggesting its recommendation as a method for overcoming dormancy in archer seeds.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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