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Scientific Note

Vigor test in *Dimorphandra wilsonii* seeds depending on soaking and electrical conductivity

Teste de vigor em sementes de *Dimorphandra wilsonii* em função da embebição e da condutividade elétrica

Miele Tallon MATHEUS[1, 2]; Allan Rocha de FREITAS[3]; José Carlos LOPES[4]; Rodrigo Sobreira ALEXANDRE[5]

[1] Trabalho de disciplina de Pós-Graduação em Análise de Sementes do primeiro autor (*in memoriam*); Pesquisa financiada pelo Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)
[2] Eng. Florestal, Msc., Depto. Ciências Florestais e da Madeira, UFES, Jerônimo Monteiro, ES, Brasil. 295500-000; miele.matheus@ufes.br
[3] Eng. Agrônomo, Doutorando em Produção Vegetal, Depto. Produção Vegetal, UFES, Alto Universitário, Alegre, ES, Brasil. 29500-000; allanrochaf@gmail.com
[4] Autor para correspondência; Eng. Agrônomo, DS; Depto. Produção Vegetal; UFES, Alto Universitário, Alegre, ES, Brasil 29500-000; jcufes@bol.com.br
[5] Eng. Agrônomo, DS; Depto. Ciências Florestais e da Madeira; UFES, Jerônimo Monteiro, ES, Brasil. 295500-000; rodrigosobreiraalexandre@gmail.com

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Abstract

The objective of this work was to study the physiological quality of seed lots of *Dimorphandra wilsonii* as a function of soaking and electrical conductivity. The water content of seeds, germination rate, and the germination index for the characterization of the initial seed quality and the electrical conductivity test were evaluated, for which two volumes of deionized water solution (75 were tested and 100 mL) and three different residence times in the seed solution (24, 48 and 72 hours). The soaking periods showed no statistical differences, and use the solution with 75 mL for a period of 24 hours, associated with the germination test was able to separate plots with different levels of force, showing the superiority of lot 1 in relation to lots 2 and 3.

Additional keywords: faveiro-de-wilson; germination; membrane integrity; vigor.

Resumo

Objetivou-se com este trabalho estudar a qualidade fisiológica de lotes sementes de *Dimorphandra wilsonii*, submetidas à embebição e à condutividade elétrica. Foram avaliados o teor de água das sementes, capacidade germinativa, e o índice de velocidade de germinação, para a caracterização da qualidade fisiológica inicial das sementes e o teste de condutividade elétrica, para o qual foram testados dois volumes de solução de água deionizada (75 e 100 mL) e três diferentes períodos de permanência das sementes em solução (24, 48 e 72 horas). Os períodos de embebição não evidenciaram diferenças estatísticas, e a utilização da solução com 75 mL por um período de 24 horas, associado ao teste de germinação foi eficiente para separar os lotes com diferentes níveis de vigor, evidenciando a superioridade do lote 1 em relação aos lotes 2 e 3.

Palavras-chave adicionais: faveiro-de-wilson; germinação; integridade de membranas; vigor.

Introduction

Faveiro-de-wilson (*Dimorphandra wilsonii* Rizz.) is a leguminous tree, found in the region of Paraopeba, in Minas Gerais State (Silva, 1986), which has medicinal properties due to the presence of flavonoid glycosides, especially rutin, in its fruits (Fernandes et al., 2007). Nonetheless, it is on the list of endangered species due to its restricted distribution, the isolation of its populations and the destruction of its habitat (Mendonça & Lins, 2000). However, little is known about its physiology of the species seeds and the aspects related to the seminiferous reproduction.

The seeds studied are characterized as bitegmic, having a hard and water impermeable integument (Lopes & Matheus, 2008).

The germination test is uneventful in assessing the ability of seeds to produce normal seedlings under laboratory conditions. Notwithstanding, it is not always possible to detect performance differences between batches of seeds during storage or in the field (Carvalho & Nakagawa, 2012). The evaluation of seed vigor is a complement to the information provided by the germination test, in which several procedures have been used, being highlighted the electrical conductivity test (Matthews & Powell, 1981; Valadares & Paula, 2008; Coelho et al., 2014). However, the test has been widely used in seeds of large crops, with little research with seeds of vegetable crops, exotic forests and native and forage essences (Sá, 1999).

According to Delouche & Baskin (1973), the degradation of cell membranes constitutes itself in one of the early events in the decaying process, which settles in the seed even before the reduction in germinative capacity is verified. To Vieira et al. (2002), the electrical conductivity test stands out in the evaluation of seed vigor.

The test is based on the structure of the membranes and the sensitivity of the seeds, when soaked in water, having as consequence greater release of exudates to the outside of the less vigorous cells, resulting in greater electrical conductivity compared to the more vigorous seeds (Popinigis, 1985; Marcos Filho, 2005). Notwithstanding, the results may be influenced by other factors such as time of soaking, age of seeds and solution volume (Araujo et al., 2011).

Thus, the aim of this work was to study the physiological quality of lots of *Dimorphandra wilsonii* seeds depending on soaking and electrical conductivity.

Material and methods

The seeds of *Dimorphandra wilsonii* Rizz. used in this study were extracted from harvested fruits of three matrix trees in Paraopeba-MG, between August and September 2008, and taken to the Botanical Garden Seed Laboratory of the Zoo-Botanical Foundation of Belo Horizonte for conducting experiments.

Three lots of seeds were used, each representing a distinct matrix tree, which are identified by the encoding used by the Botanical Garden of the Zoo-Botanical Foundation of Belo Horizonte, as follows: lot 1 (A01 matrix); lot 2 (A04 matrix); lot 3 (G01 matrix). The evaluations of seed physiological quality were made by the following tests: water content – it was determined by the method of oven at 105 ± 3 °C for 24 hours (BRASIL, 2009), individually for each lot, immediately upon receipt of the seeds in laboratory; germination – it was conducted using four replicates of 25 seeds, sown in gerbox plastic boxes, on two germitest® paper sheets, moistened with a volume of water equivalent to 3.0 times the mass of dry paper, held in BOD germination chamber, with 12 hours photoperiod and constant temperature of 30 °C, for 15 days, in which were considered germinated the seeds that had primary root protrusion ≥2 mm in length; germination speed index – it was given simultaneously with the germination test, being held daily count of seeds that issued the primary root, over 15 days, and the calculations made according to Maguire (1962); electrical conductivity test – it was conducted with four replications of 25 seeds, which were homogenized, initially weighed and kept in plastic cups with a capacity of 200 mL, wrapped with aluminum paper. The cups were held in a BOD germination chamber regulated at a temperature of 25 °C for each immersion period. Two volumes of deionized water solution were tested (75 and 100 mL) and three different residence times of seeds in solution (24, 48 and 72 hours of soaking). Immediately after each soaking period, each replicate was gently stirred on a magnetic stirrer and electric conductivity measured in bench digital conductivity meter, and the results expressed as µs per gram of seed, using the equation: conductivity (µs) per vial - water conductivity)/weight (g) of the sample of *seeds*, with the result expressed in µs cm^{-1} g^{-1} (Oliveira et al., 2004). The conductivity of pure water was tested at 20 °C, and did not exceed 1.5 µs cm^{-1}.

The experimental design was completely randomized, in a factorial 3 x 2 x 3 (lots of seeds x volume solution x soaking periods) for the electrical conductivity test. It was performed the analysis of variance and treatment means were compared by Tukey test at 5% probability.

Results and discussions

According to the results obtained, although the three lots of seeds have shown uniformity in water content in the germination speed index (GSI), the germination of lot 1 was significantly higher than the germination presented by the other lots (Table 1). The homogeneity of the water content between lots, with maximum variation of less than one percentage point, suggests that this feature did not influence the test results (Marcos Filho, 1999).

Table 1 - Water content, germination and germination speed index (GSI) of *Dimorphandra wilsonii Rizz.* seeds.

Lots	Water content (%)	(1)Germination (%)	(1)GSI
1	7.9	48 A	2.71 A
2	8.1	39 B	2.24 A
3	7.9	40 B	2.14 A

(1) Means in the column followed by the same letter do not differ by Tukey test at the level of 5% probability.

The seeds soaking periods assessed in the present study did not show statistical differences, possibly due to the size of the seeds, which are small, and the homogeneous lots. However, Marques et al. (2002) state that, in general, for distinguishing between lots with different qualities in larger seeds, longer periods of soaking are required.

Using the volume of 75 mL in the soaking solution, there was separation of lots in all periods, pointing lot 1 as superior, and lots 2 and 3 as with the least vigor. Nonetheless, using the volume of 100 mL, there was separation of lots from the 48 hour period, which remained constant after 72 hours of soaking, indicating lots 1 and 2 as with the most vigor and lot 3 as with the least vigor (Table 2).

Table 2 - Results of the vigor test with electrical conductivity (µs cm^{-1} g^{-1}) on different lots of *Dimorphandra wilsonii* seeds according to volume and periods of soaking.

Volume (mL)	Lots		
	1	2	3
		(1)24 hours	
75	12.18 Ba	17.47 Aa	17.16 Aa
100	9.51 Aa	10.28 Ab	9.69 Ab
		(1)48 hours	
75	13.80 Ba	21.85 Aa	21.91 Aa
100	12.67 Ba	13.18 Bb	17.95 Ab
		(1)72 hours	
75	14.16 Ba	21.46 Aa	20.59 Aa
100	14.29 Ba	13.56 Bb	19.18 Aa

(1) Means followed by the same letter, uppercase in lines and lowercase in columns, do not differ by Tukey test at 5% probability.

There was stability in the readings of electrical conductivity regarding lot 1, since, regardless of the soaking period, the conductivity values were statistically the same in the two volumes used. Nonetheless, lots 2 and 3 showed instability in the readings due to the volume used because the readings taken with these lots in different periods of soaking differed statistically for the volumes of 75 and 100 mL, showing trend of lower electrical conductivity values with increase in the solution volume (Table 2). Similarity of results was verified by Magro et al. (2011) working with *Brassica oleracea* var. *italica* seeds, when higher electrical conductivity values were obtained in 25 mL of solution compared with the volume of 50 mL. Similar behavior was observed in *Dictyoloma vandellianum* A. Juss. seeds (Flavio & Paula, 2010).

For seeds of the species under study, as observed in *Solanum sessiliflorum* Dunal seeds by Pereira & Martins Filho (2012), diluting the soaking solution may have reduced the efficiency in evaluating the seed vigor by electrical conductivity, causing readings for larger volumes not to make possible the stratification of the lots in accordance with the lots physiological characterization shown in Table 1.

It is verified, from the results of germination and vigor assessments made, that lot 3 was characterized as with the least vigor. Although, using the volume of 100 mL for the analysis of electrical conductivity, lot 2 did not differ from lot 1, showing lower conductivity readings in relation to the values obtained with the test in solution with volume of 75 mL, which was more sensitive to detect demonstrations of lower vigor of lot 2, when it showed higher electrical conductivity values, even after 24 hours. This difference observed in lot 3 can be attributed to the likely reduction in the amount of nutrients and photoassimilates translocated for seeds according to the position of the matrix tree compared to the others and to probable genetic and environmental differences.

Therefore, the use of the solution with 75 mL for 24 hours was efficient to rank the vigor of lots, demonstrating the superiority of lot 1 in relation to lots 2 and 3, both of smaller vigor. This statement confirms what has been verified by physiological characterization of the seeds of the three lots, in which, although not differing in terms of GSI, the lot 1 presented, similarly, the highest percentage of germination (Table 1). Marques et al. (2002) obtained differentiation between lots of *Dalbergia nigra* (Vell.) Fr. All. ex Benth. seeds, working with 75 mL solution, for a period of 30 to 36 hours, and in an analogous manner to what was observed in the present study, the classification of the lots by means of the electrical conductivity test was highly related to the result of the germination test.

Notwithstanding, in the work of Gonzales et al. (2009), the electrical conductivity test was not efficient in separating the physiological quality of lots of *Albizia hassleri* (Chodat) Burkart. seeds from different matrix, in which there was a low correlation between the results of the tests of electrical conductivity and germination.

Although germination is the last physiological characteristic affected by the deterioration process, not being efficient to detect differences between lots of seeds (Marcos Filho, 2005), in this study, the germination test, along with the the electrical conductivity test, managed to order lots of *Dimorphandra wilsonii* seeds with regard to the vigor.

Conclusions

The electrical conductivity test is appropriate to order lots of *Dimorphandra wilsonii* Rizz. seeds regarding the vigor level.

The immersion for 24 hours in a solution with 75 mL of deionized water is effective in the ranking of the vigor of lots of *Dimorphandra wilsonii* Rizz seeds.

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