

## Overcoming of dormancy of seeds of plant species used in revegetation of degraded areas

### Superação de Dormência das sementes de espécies vegetais utilizadas em revegetação de áreas degradadas

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#### Abstract

Among the native tree species used for reforestation are the “aroeira vermelha” (*Schinus terebinthifolia*) and the “canafístula” (*Peltophorum dubium*), however, the dormancy of these seeds often makes it impossible to produce large scale seedlings, due to low germination and seedling growth inequality. Therefore, this work aimed to test methods for the dormancy breaking of the seeds of these species, for the production of seedlings that will be used in the recomposition of the springs and riparian forests. The treatments used for "canafístula" seeds were immersion of the seeds in hot water 95°C during 30 minutes, immersion of the seeds in hot water 95°C during 3 minutes, maintained for 36 hours outside the heating and storage for 5 days and the control treatment. For the "aroeira vermelha" was tested the germination of the fruits and seeds after the removal of epicarp and mesocarp. The experimental design was completely randomized, with three replicates for each treatment and 20 seeds per plate. The analyzed variables were percentage of germination, length of radicle and hypocotyl. The results were submitted to analysis of variance and the means were compared by the Tukey test ( $p \leq 0.05$ ). The most efficient treatment was immersion in hot water at 95 °C for 30 minutes. It was evidenced the necessity of realizing the dormancy break for these species

**Keywords:** *Schinus terebinthifolia*, *Peltophorum dubium*, break of dormancy

#### Resumo

Dentre as espécies arbóreas nativas, utilizadas em reflorestamento, encontram-se a aroeira (*Schinus terebinthifolia*) e a canafístula (*Peltophorum dubium*), entretanto a dormência dessas sementes muitas vezes impossibilita a produção de mudas em larga escala, devido ao baixo índice de germinação e desigualdade no crescimento das plântulas. Sendo assim, esse trabalho objetivou testar métodos para a quebra de dormência das sementes dessas espécies, para a produção de mudas que serão utilizadas na recomposição das nascentes e matas ciliares. Os tratamentos utilizados para as sementes de “canafístula” foram imersão das sementes em água quente 95°C durante 30 minutos, imersão das sementes em água quente 95°C durante 3 minutos, mantidas por 36 horas fora do aquecimento e armazenamento por 5 dias e o tratamento controle. Para a “aroeira vermelha” testou-se a germinação dos frutos e sementes após remoção do epicarpo e mesocarpo. Utilizou-se o delineamento experimental inteiramente casualizado, sendo três repetições para cada tratamento e 20 sementes por placa. As variáveis analisadas foram porcentagem de germinação, comprimento de radícula e hipocótilo. Os resultados foram submetidos a análise de variância e as médias foram comparadas pelo teste de Tukey ( $p \leq 0,05$ ). O tratamento mais eficiente foi o de imersão em água quente 95°C durante 30 minutos. Evidenciou-se a necessidade da realização da quebra de dormência para essas espécies.

**Palavras-chave:** *Schinus terebinthifolia*, *Peltophorum dubium*, quebra de dormênci

## Introduction

The existence of flora in riparian areas is fundamental for the protection of water resources, climate balance and as a biodiversity reserve. In this way, the demand for seedlings of native forest species is growing for use in spring recovery programs and degraded areas.

Among the factors that influence the production of seedlings, seed dormancy stands out, since the great majority of forest essences are propagated by seeds.

The success in the formation of seedlings depends on the knowledge about the germination process of each species (FERREIRA, & BORGHETTI, 2004).

Seed dormancy is characterized by absence or delay of germination, even when the seed is in favorable environmental conditions for its growth and development (VASCONCELOS et al., 2010). One of the main types of dormancy is due to the impermeable seed coat, which prevents the seed from receiving water, which is responsible for the physical and metabolic processes of germination (VASCONCELOS et al., 2010).

These seeds that present natural dormancy due to the resistance of their

integument, can withstand long periods of storage, resisting time (BRANCALION et al., 2011). However, this feature causes the seedlings to develop unevenly or even not to develop, and thus, dormancy is an undesirable characteristic for nursery owners (AZEREDO et al., 2010).

Among the treatments that stand out most for the dormancy of the seeds of arboreal species, there is the chemical scarification, which allows the seeds to perform exchanges with the medium. Mechanical scarification, consisting of the abrasion of the seeds on a rough surface and the immersion of the seeds in hot water that is used in seeds that have the impermeable tegument (OLIVEIRA et al., 2003; BRASIL, 2009). These methods provide faster and uniform growth.

Among the several native tree species that can be used in revegetation of degraded areas, stands the aroeira (*Schinus terebinthifolius* Raddi), popularly known as pink pepper. It is a pioneer species, heliophite and perennial, of medium size, reaching up to 15 meters in adulthood of height and 60 cm of diameter.

The cultivation of aroeira pepper is very low in Brazil, being much of the

production obtained through extractivism. The species is often used in reforestation and urban afforestation. In Europe, it is used in cooking. The species occurs from the Rio Grande do Norte to the Rio Grande do Sul, in several plant formations, being more common in river borders and in the fields (LORENZI 2002).

The *Peltophorum dubium* (Sprengel) Taubert, is popularly known as the canafístula, presenting a wide natural distribution, being found in the Semidecidual Seasonal Forest, extending through the following states: Bahia, Rio de Janeiro, Minas Gerais, Mato Grosso do Sul and Paraná (LORENZI, 2002; CARVALHO 2003).

Because it is a native species, it is widely used in the recovery of degraded areas and in the forestation of highways, parks and squares. It is ideal for landscaping since it presents rapid growth. It is commonly used in civil construction, because its wood is moderately heavy, hard and of long durability, presenting high commercial value (LORENZI, 2002; VIVIAN et al., 2010).

The crown of the canafístula is broad, umbelliform, and flat, its leaves are composed bipinnate. The

inflorescences are showy, with yellow or orange coloration and hermaphrodite sexual system. The fruits are of the vegetable type legume (SILVA, 2007).

The species presents effective sexual propagation due to abundant seed production, but it presents natural dormancy due to impermeability of the seed coat.

The introduction of species in plantations in degraded areas requires the selection of matrices that ensure suitable individuals, who present characteristics typical of the target species, with, for example, good sanitary conditions and great germinative effectiveness (VECHIATO, 2010).

Due to the need to produce seedlings for reforestation projects, this work aims to test the efficiency of different dormancy breaking treatments of the species *Peltophorum dubium* (Sprengel) Taubert and *Schinus terebinthifolius* Raddi, in order to produce seedlings on a large scale for recovery of springs and riparian forests, using native species.

## Material and methods

The present work was developed in the Biotechnology laboratory, in the

University Center of Itajubá-FEPI, located in Itajubá-MG.

The fruits of canafistula were collected manually, from matrices located in the Campus of the University Center of Itajubá-FEPI, located in the south region of the state of Minas Gerais at 22°25'32 "south latitude and 45° 27 '10" west longitude, when they presented brown coloration.

After collection, the fruits was dried in the sun, and the seeds was removed manually.

The seeds of “aroeira vermelha” was collected from matrices located in the Municipal Park of Itajubá located at 22°30'30" south latitude and 45° 27 '20" west longitude.

Was collected rose or red fruits The seeds was extracted from the fruits manually and thereafter were maintained the shadow, in ambient temperature of approximately  $25 \pm 20$  ° C for 24 hours.

The municipality presents mesothermic tropical climate - humid mild climate, with moderate temperatures throughout the year with an average of around 18°C and 19°C; it is Cwb climate, according to the classification of Koppen, with the average rainfall of approximately 1400 mm per year.

The experimental design was completely randomized, with three treatments and three replicates of 20 seeds per experimental unit, for the species *Peltophorum dubium* and two treatments for *Schinus terebinthifolius*.

The treatments used for the seeds of canafistula were immersion of the seeds in hot water 95°C during 30 minutes, immersion of the seeds in water at 950 C for 3 minutes being maintained during 36 hours outside the heating and later stored for five days, at temperature ambient and the control treatment, where no preliminary treatment was used.

To seeds of “aroeira vermelha” was tested the germination of the fruits after the removal of the epicarp and the mesocarp of the fruits. After the achievement of the treatments, the seeds were arranged in Petri dishes, having five sheets of filter paper with 10 ml of distilled water in each plate. Afterwards the seeds were conditioned in a germination chamber (BOD) at  $25^{\circ}\text{C} \pm 2$  with photoperiod of 12 hours, until achieve germinative stability.

During the conduction of the experiment the Petri dishes were kept moist, aiming to provide the ideal conditions for germination.

Was evaluated the variable percentage of germination, radicle length and hypocotyl. Data was submitted to analysis of variance using Sisvar software (FERREIRA, 2011), and the means were compared by the Tukey test ( $p \leq 0.05$ ).

## Results and discussion

It was verified that the treatment with the highest germination percentage and the highest initial growth of the seedlings was the immersion of the seeds in hot water 95°C for 30 minutes (Table 1). Dutra et al. (2013) verified that the most efficient method for seed dormancy breakdown of “canafistula” seeds was to immerse them in hot water, resulting in vigorous seedlings in a short period.

Several authors report that the immersion in hot water promotes the softening of the integument and the removal of the waxes, which may favor the germination, and the initial growth of the seedlings (BRASIL, 2013; SPERANDIO et al., 2013; MARCOS FILHO, 2015; FREIRE et al., 2016; MARIANO et al., 2016).

TABLE 1- Length of radicle (C.R.), length of hypocotyl (C.H.) and percentage of germination (%G) of the seeds of “canafistula”

Tratamentos	C.R. (cm)	C.H. (cm)	%G
T1	1,56a	1,75a	26,67b
T2	1,98a	1,96a	56,67a
T3	0,00b	0,00b	0,00c
C.V.	3,45	2,78	19,12

Means followed by the same letter do not differ statistically by the Tukey test ( $p \leq 0.05$ ).

T1- Witness. T2-immersion of the seeds in hot water at 95 ° C for 30 minutes. T3 - immersion of seeds in water at 95° C for 3 minutes and held for 36 hours out of heating and storage for 5 days.

However, Schmidt (2000) shows that the efficiency of the use of hot water depends on the ambient temperature, the water temperature and the immersion time during a scarification. Nunes et al. (2006) observed the scarification with hot water had a better germination percentage in the seeds of *Guazuma ulmifolia* Lam, however, for most species, this is not the more effective method.

It was verified that the germination percentage for the seeds of “canafistula” was of 56.67%, after the immersion of the seeds in 95% water, however it is considered low, suggesting that the humid thermal treatment may not be the most indicated method to overcome or break dormancy of seeds of this species. However, even with a low germination percentage, the method differed

significantly ( $p \leq 0.05$ ) from the control treatment.

Pereira et al. (2014) demonstrated that the humid thermal treatment is an inefficient treatment to overcome of dormancy of seeds of Fabaceae species, even with subsequent soaking, especially due to the high percentages of hard seeds remaining.

In this study it was verified that in the treatment where the seeds remained immersed in hot water at 95°C and later they were kept in that same water, without heating, during 36 hours, being stored for five days, it was not effective, since there was no germination. These results do not confirm the obtained by Oliveira et al. (2003) who verified that the treatment of immersion of the “canafistula” seeds in hot water (95°C) and subsequent stay in the same water for 24 hours, outside the heating, was efficient in promoting the germination, being practical and feasible, even without the use of previous disinfestation treatments. The results verified suggest that the time of immersion in water should not exceed the period of 24 hours.

Seeds of forest species belonging to the Fabaceae family, such as “canafistula”, are commonly susceptible

to several types of internal damage, and some treatments of dormancy overcoming can lead to injuries, thus compromising the germination and initial growth of the seedlings (PEREIRA & FERREIRA, 2010).

In relation to the “aroeira vermelha”, it was verified did not occur to the germination in any of the conditions tested.

Velasque et al. (2015) tested the germination of *S. terebinthifolius*, at different temperatures and substrates, and verified significant interactions between temperature and substrate, suggesting that there is a combination between these two factors, that optimizes the percentage of germination. The authors observed that the highest percentages of germination were obtained with 25°C (80%) blotting paper, followed by vermiculite the 25°C (71%) and paper towel the 20, 25 and 30 °C (56, 72 and 66%, respectively) and concluded that all temperatures tested promoted seed germination.

Carvalho (2003) states that the germination rate of the “aroeira vermelha” varies between 50 and 80%, these results show that there is an adaptation of the species to the natural thermal variations of the environment

(GUEDES et al., 2010). In this study the seeds of aroeira were kept at  $25 \pm 2$  ° C temperature, which normally provides effective germination of the seeds of this species.

BRASIL (2013) points out that the phenotypic plasticity of *S. terebinthifolius* has great variation in its ideal condition according to its region of occurrence, suggesting that seeds obtained from distinct localities may present different germinative potential.

Both pre-germination procedures for the *S. terebinthifolius* species showed a 100% fungal incidence, the fungi associated with the seeds of forest species can directly influence both the quality and the production of seedlings, making the process of seedling production costly and costly. (Santos et al., 2001), which may indicate that the seeds must be subjected to some method of sterilization before any dormancy-breaking procedure.

Studies on the association of pathogens with forest seeds are incipient, and most of the existing works are restricted to reporting the associated microorganisms, without checking their effect on plant germination and development. Therefore, we suggest new studies testing methods and treatments

pre-germination of these seeds aiming to reduce the fungal incidence, which can directly interfere in the germination.

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