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Pre-germination treatment methods on the germination of *Caesalpinia coriaria* (Jacq.) Willd. and *Cassia hintonii* Sandwith seeds

Tratamientos pre-germinativos en semillas de *Caesalpinia coriaria* (Jacq.) Willd. y *Cassia hintonii* Sandwith

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Abstract

Recovering degraded ecosystems with native species includes seed management and knowledge of their physiology as a latency mechanism. The objective was to evaluate pre-germination treatments in two native tropical species of the Fabaceae family. The seeds were collected in Colima, Mexico, the germination test was carried out at CUCBA, using 30 seeds per treatment: T1 heat treatment: the seed was immersed in water at a temperature of 80 ° C for three minutes; T2 thermal shock, the seed was immersed in water at a temperature of 80 ° C for three minutes, immediately afterwards in water at a temperature between 0 and 2 ° C for three minutes and T3 (without treatment). The results showed that both species present latency, due to the hard testa characteristic of legumes, the thermal treatments, achieved a higher percentage of germination than the control, in both species. In the emergency speed index (IVE), the heat treatments also generated greater emergency speed. It is concluded that both species need pre-germination treatment to increase their germination percentage, with T1 (temperature at 80 °C) being the one that obtained the best results.

Senna, Cascalote, Dormancy removal

Resumen

Recuperar ecosistemas degradados, con especies nativas incluye el manejo de semillas y conocimiento de su fisiología como mecanismo de latencia. El objetivo fue evaluar tratamientos pre germinativos en dos especies tropicales nativas de la familia Fabaceae. Las semillas se colectaron en Colima, México, la prueba de germinación se realizó en el CUCBA, utilizando 30 semillas por tratamiento: T1 tratamiento térmico: se sumergió la semilla en agua a temperatura de 80 °C durante tres minutos; T2 choque térmico, se sumergió la semilla en agua a temperatura de 80 °C, tres minutos, inmediatamente después en agua a temperatura entre 0 y 2° C tres minutos y T3 (sin tratamiento). Los resultados mostraron que ambas especies presentan latencia, debido a la testa dura característica de las leguminosas, los tratamientos térmicos, lograron un mayor porcentaje de germinación que el testigo, en ambas especies. En el índice de velocidad de emergencia (IVE) los tratamientos térmicos generaron además mayor rapidez de emergencia. Se concluye que ambas especies necesitan tratamientos pres-germinativos para incrementar su porcentaje de germinación siendo el T1 (temperatura a 80 °C) el que obtuvo mejores resultados.

Senna, Cascalote, Rompimiento de latencia

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Introduction

Seed dormancy is an internal condition, which inhibits the germination process, thus it will not take place even under conditions suitable for this process (Benech-Arnold *et al*., 2000). It is of hereditary origin and is considered to be a trait strongly influenced by environmental conditions during seed development and formation (Bewley and Black, 1997; Baskin and Baskin, 2001). This characteristic is the result of physiological adaptations to ensure the survival of the species, as it protects the seeds during times of the year when conditions for germination would not be favourable. Dormancy can be classified according to the mechanism that causes it, and can be of a physical type, characterised by structures that prevent the intrusion of water and even gases, or of a physiological type, when there are mechanisms that act on the metabolism of the embryo, preventing it from developing (Baskin and Baskin, 1998). Propagation and restoration projects often require the introduction of plants obtained from seeds, which may often require prior treatment to eliminate dormancy to germinate successfully (Baskin and Baskin, 1998). Climatic conditions have even been shown to influence both the form (type) and intensity of seed dormancy (Benech-Arnold, 2000).

Caesalpinia coriaria (Jacq.) Willd, of the Family Fabaceae, Subfamily Caesalpinioideae with common name cascalote, dividivi, nacascalotl, nacascul in the state of Guerrero and nacaz-colotl, Xa-gal in the Zapotec language of the Isthmus of Tehuantepec, Oaxaca (Martínez, 1987). It is a tree no taller than 8 m., with scaly bark and very hard reddish wood; alternate, bipinnate compound leaves. Small creamy yellow or pale green flowers, arranged in short, simple or compound racemes. Fruits Indehiscent pods, 3 to 7 cm long, dark brown, curved or curled.

Or curled. Ellipsoid or reniform seeds, 6 to 7 mm long, of a shiny light brown colour. In Mexico it is distributed in the Pacific states from Sinaloa to Chiapas, and is also reported in the state of Mexico, mainly in savannah vegetation and thorny low deciduous forest (Mc Vaugh, 1987; Rzedowski, 1978).

Propagation is by seed (Pintor, 2000). Uses: shade, melliferous, fodder, for wildlife and domestic animals, however, its consumption is mainly whole fruit, as this in the form of flour showed low acceptance by livestock, in a selectivity test with sheep the consumption was 1.3±1.1 g/animal/day (Palma and Román, 2003).

Cassia hintonii Sandwith, of the subfamily Caesalpinioideae, is a tree 8 to 12 m high, with a normal diameter of 20 to 40 cm. Compound paripinnate leaves, 15 to 18 cm long, 15 to 17 pairs of leaflets, dark green and slightly velvety. The flowers are presented in yellow bunches, very showy. It occurs in low deciduous forest and medium sub evergreen forest. It is an important source of nectar and pollen for bees (Quiroz-García et al., 2011). The gum from the seed of dividivi (and other species of the genus Caesalpinia) is used to produce tannins for tanning leather. It is also used to produce dyes and in the manufacture of soaps and toothpaste. The shrub is used as a living fence. The leaves are used to feed livestock. Medicinal properties are attributed to it: the bark and leaves are astringent; the flowers are aromatic and are used against heart ailments and dyspepsia; the roots are used as an antiseptic in ulcerations and against gangrene; in Colombia they prepare a cholesterol-purifying drink. The present study was developed with the aim of removing seed dormancy in *Caesalpinia coriaria* (Jacq.) Willd. and *Cassia hintonii* Sandwith, multipurpose forest species.

Materials and Methods

The seed was collected in the municipality of Ixtlahuacán in the state of Colima, a sample of 30 seeds of each species was used for each pre-treatment, which were: T1) heat treatment, which consisted of seed immersion in water for 3 min at a temperature of 80° C, T2) heat shock, where the seed was subjected to immersion in water at 80°C for 3 min and immediately afterwards placed in water at a temperature of 0 to 2°C, for 3 min, sowing was carried out in germination trays, using peat, under greenhouse conditions. A control (T3) corresponding to untreated seed was included.

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Seedling emergence was counted every 5 days until the end of sowing. In addition to germination, the emergence velocity index (EVI) was also counted. To establish differences in seedling development and emergence under greenhouse conditions, 400 seeds were placed in germination trays using forest soil. The emergence rate coefficient was calculated with the equation proposed by Alm et al:

$$EVI = 1 + \frac{Nj}{Njdj} \quad (1)$$

Where:

EVI = Emergence Velocity Index

Nj = Number of seeds emerged at observation j

dj = Total number of seeds

The values of the speed of emergence coefficient range from 0 to 1.

Results

Figure 1 shows the results of the effect of the pre-treatments, which outperformed the control. Of these, immersion at 80°C was the most effective, since in *Caesalpinia coriaria* seed, 50% more germination was obtained, and in *Cassia hintonii*, this treatment was also the best.

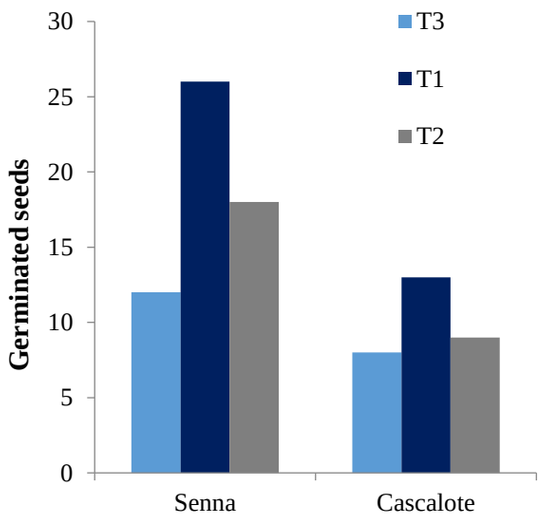

Figure 1. Number of germinated seeds per pre-germination treatment, immersion at 80°C (T1), thermal shock (T2) and control (T3)

Regarding the EVI, table 1 shows that both pre-treatments increased not only the number of seedlings but also the speed of seedling emergence.

The results show, in addition to the convenience of its application, the presence of physical dormancy mechanisms, which can be removed. These results coincide with Reino *et al*, (2011) who reported that stratification in water at 80°C for 2 minutes was more effective in *Crotalaria* sp. seed, demonstrating its effectiveness in eliminating the dormancy imposed by seed coatings (Muñoz *et al*., 2009); and with Atencio, *et al*, 2003, who obtained germination percentages of 90% using hot water at 80°C for 10 min in seed of acacia San Francisco (*Peltophorum pterocarpum*). These results will increase seed germination and thus seedling production for the species under study.

Specie	Days elapsed					TOTAL	EVI
	5	10	15	20	25		
Senna T1	1	13	12			26	**0.078**
Senna T2		11	7			18	**0.052**
Senna T3	1	8	1	1	1	12	**0.042**
Cascalote T1		6	5		2	13	**0.034**
Cascalote T2		6	3			9	**0.03**
Cascalote T3		3	3		2	8	**0.019**

Table 1 Seedling emergence rate under greenhouse conditions

Conclusions

Both species show physical dormancy mechanisms, mainly due to the hard testa characteristic of legumes.

The pre-germinative pre-treatment of immersion in hot water at a temperature of 80°C is the most recommended for seed of both species.

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