INTRODUCTION

*Talipariti elatum* (Sw.) Fryxell (Malvaceae) is a highly esteemed tropical pioneer tree (Herrera-Peraza et al. 1997) and has been widely used in Cuban forest planting programs (Betancourt 1987). The fruits are dehiscent capsules (Bisse 1988) and their seeds have a poor and erratic germination unless pregerminative treatments such as thermic or acid scarification are applied (Álvarez 1985). This difficulty could be due to seed coat impermeability to water (Maresma & Cardenas 1981, Álvarez 1985, Betancourt 1987) but Muñoz (1998) obtained germination from fresh and intact seeds when these were sown at constant 25°C and at fluctuating 25/35°C (15 and 59% respectively).

Experimental results provide no evidence on whether fresh seeds of *T. elatum* have solely exogenous dormancy imposed by seed coats or whether any other types of dormancy are involved, as has been reported from other tropical pioneer species (Vázquez-Yánez 1974, Acuña & Garwood 1987, Vázquez-Yánez & Orozco-Segovia 1994, Muñoz et al. 2001). The main objective of this work was to determine the type of seed dormancy in fresh seeds of *T. elatum* from two ecosystems.

MATERIALS AND METHODS

Fresh seeds were collected in March, 2001 in two ecosystems or provenances: a moist evergreen forest at the Biosphere Reserve...
Dormancy and germination in *Talipariti elatum* seeds

‘Sierra del Rosario’, Pinar del Río (82° 57’W, 22° 49’N), and in a secondary forest at the Instituto de Ecología y Sistemática (IES), Havana (82° 2’W, 23° 01’N), both in western Cuba. Annual rainfall in the moist evergreen forest is 2014 mm, mean summer temperature is 25.9°C and 22.2°C in winter (Vilamajó et al. 1988). Annual rainfall in the secondary vegetation is 1300 mm, and mean summer temperature is 27°C and 23°C in winter. In each ecosystem, 10 trees were selected and 100 fruits collected from every tree; mean seed number/fruit did not differ significantly in all ecosystems and was approximately 50 (SE ± 2.3). The collected fruits/site were taken to the laboratory where seeds were collected and assembled together obtaining therefore two seed populations from each provenance. Imbibitions and germination tests were carried out immediately after seed collection. For this purpose, seed samples from each population were taken at random. Seeds have a 98% initial viability estimated by the tetrazolium (TZ) test (International Seed Testing Association 1999).

Seed Structural variables: length (mm), fresh weight (g), dry weight (g) and initial moisture content (%) per seed were determined in 100 seeds from each provenance. Dry weight and initial water content were determined by drying for 17 hours in an oven at 103 ± 2°C (International Seed Testing Association 1999). The seed mass relative reserve [(embryo+endosperm) weight/seed total dry weight] was also calculated, in accordance with the Seed Nutritional relative reserve [(embryo+endosperm) weight/seed total dry weight] 2ºC (International Seed Testing Association 1999). The seed mass content were determined by drying for 17 hours in an oven at 103 ± 2°C (International Seed Testing Association 1999).

Moisture content of each intact seed was measured in seeds lying on the forest floor (Fenner 1985). Seeds were washed profusely in running water for 10 minutes. Germination tests were carried out at an alternate temperature of 25/35°C comprising 8 hours at 35°C±1°C and 12 hours at 25°C±1°C with 2 transition periods of 2 hours between both photoperiods. For this experiment five replicates (50 seed each) were established for each provenance and treatment. The seeds were placed on filter paper moistened with distilled water in Petri dishes (9 cm diameter) under fluorescent white light and a 8 hours photoperiod. Germination was assessed daily for 15 days and the criterion for germination was visible protusion of the radicle. Final germination percentage, start and germination rate (expressed as time to attain 10% germination of the sample, T10) were determined.

Means and standard error were measured for each variable. Percentage data were transformed into arcsine% and start and rate of germination into x. Seed structural variables were analysed with a Student ‘t’ test and germinative variables with ANOVA factorial. Untransformed data are shown in table.

**RESULTS AND DISCUSSION**

Seed structural variables did not differ significantly (P0.05) between the two ecosystems (Table 1). In both, seed mass relative coats had higher values than seed mass relative reserve. This distribution could be related to dormancy and permits greater protection against abiotic agents and the attack of microorganisms in seeds lying on the forest floor (Fenner 1985).

**Table 1.**

Means of structural variables in seeds of *T. elatum* collected in moist evergreen forest (Provenance I) and secondary forest (Provenance II). SE (Standard Error).

<table>
<thead>
<tr>
<th>Characters</th>
<th>Provenance I</th>
<th>Provenance II</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (mm)</td>
<td>0,54</td>
<td>0,54</td>
<td>0,00</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>12,9</td>
<td>12,0</td>
<td>0,11</td>
</tr>
<tr>
<td>Dry seed mass (g)</td>
<td>0,02</td>
<td>0,02</td>
<td>0,00</td>
</tr>
<tr>
<td>Seed mass relative reserve (g)</td>
<td>43,8</td>
<td>42,6</td>
<td>0,50</td>
</tr>
<tr>
<td>Seed mass relative coats (g)</td>
<td>56,2</td>
<td>57,2</td>
<td>0,50</td>
</tr>
</tbody>
</table>

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Figure 1.— Water absorption dynamics in intact fresh seeds (A) and scarified seeds (B) of *T. elatum* from 2 provenances (I moist evergreen forest and II: secondary forest). In A the arrow indicates the approximate time of first visible sign of germination. In both figures the error bars indicate ± standard error.
Intact seeds of *T. elatum* from both ecosystems were hydrated after being in contact with water (Fig. 1A). The seeds of both ecosystems showed a lineal imbibitions pattern characterized by a steady and slow increase in moisture content until radicle emergence started after 118 hours of imbibitions. Otherwise, scarified seeds from both ecosystems showed a triphasic pattern of water absorption (Fig. 1B) which most cultivated plants follow (Bewley 1997, Sánchez *et al.* 2001) and radicle emergence took place after 52 hours of imbibitions in scarified seeds.

It was also noticed that scarified seeds show a higher imbibition rate than intact seeds since at a 20-hour hydration, humidity values higher than 50% were obtained in both provenances (Fig. 1B), whereas the hydration percentage in intact seeds in an equal time does not surpass 18% (Fig. 1A). However, water content in intact and scarified seeds from both provenances at 118 and 52 hours (2 hours before visible germination starts) did not differ significantly, its mean value being 69 and 70% respectively (Fig. 1A y B).

When moisture content in each seed after 118 hours of imbibition was determined, 12% from both provenances were not hydrated (Fig. 2), that is, they showed exogenous dormancy (seed coat having water impermeability).

However, 30% from the seeds collected total of provenances I and 20% of provenance II were little hydrated, they showed 30% and 20% of hydration respectively. The others (more than 50% of seed total) from each provenance presented high hydrated percentage and in some instances radicle emergence were observed. In addition, the percentage of hydrated seeds (little and very hydrated) was similar to the frequency of seeds that showed visible hydration when exposed to cross cuts after 6 hours hydration. Likely, fresh seeds of *T. elatum* have another dormancy type combined with certain water impermeability.

Fresh and intact seeds from both provenances showed low percentage of final germination when sown at 25/35°C. Start and rate of germination also were delayed significantly when compared to seeds treated with total scarification (Table 2). The best germinative response in intact seeds (T1) was found in provenance II though there was no significative difference compared to provenance I. Different responses
for both provenances are probably due to parent effect or seed provenance (environmental conditions experienced in seed maturation), which might induce different degrees of dormancy among seeds (Bewley & Black 1994). However, both provenances had the same amount of resources in their seed coats as explained above (Table 1). Therefore, differences could be related to varying degrees of permeability in seed coats as demonstrated in seeds from the secondary forest (provenance II, Fig. 2) where highly hydrated seeds prevail.

Results in seeds under total mechanical scarification treatment (devoid of seed coats) and in individual hydration (Fig. 2) corroborate that the greatest impediment for the germination of fresh seeds of *T. elatum* is the mechanical barrier that seed coats impose on embryo emergence. It was also proved that seeds of *T. elatum* have no endogenous embryo dormancy (Nikolaeva et al. 1977, Bewley & Black 1994) and also that the endosperm is not a mechanical barrier delaying radicle emergence.

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The foregoing results also prove that most seeds in our germination tests need an optimal temperature of 25/35°C (Muñoz 1998) for radicle emergence and this temperature does not cause seed coat break up as demonstrated by the low germination percentage in intact seeds. Likely, the temperature needed for seed coat break up is higher than the one causing radicle emergence. This seems to be an advantageous mechanism found among non-photoblastic pioneer species like *T. elatum* (Muñoz 1998) for detecting clearings in the forest (Vázquez-Yánez & Orozco-Segovia 1994). In fresh seeds of *Trichospermum mexicanum* (DC.) Baille., a forest pioneer tree, according to Sanchez and Muñoz (2004), embryo growth takes place at 25°C but the metabolic events of the germination that occur in the endosperm (e.g., weakening) do not possibly occur.

Summing up, results from fresh and intact seeds of *T. elatum* demonstrate that seeds absorb water from their surroundings but have different potentials in performing this process. Poor and erratic germination in this species is not only due to seed coat water impermeability (Álvarez 1985, Betancourt 1987) but also there is a main impediment for germination: a mechanical dormancy in combination with a certain degree of seed coat impermeability found in most seeds in our sample.

According to Fenner (1985), exogenous dormancy has a great ‘ecological relevance’ since it offers seeds the possibility for survival when they are confronted with environmental changes. Seeds of *T. elatum* fall on the forest floor mainly during the Cuban dry season (November to April). Therefore, combined dormancy in these seeds could give a better protection against high temperatures and the attack of predators until the first rains arrive with the cold waves from the North or the rainy season comes as it is the case with other Cuban forest trees which exhibit different types of exogenous dormancy and fall on the forest floor during the dry season, e.g., *Mastichodendron foetidissimum* Jacq., *Andira inermis* W. Wright and *Calophyllum pineroturn* Bisse (Sánchez et al. 1997; Mancina & Sánchez 2001, Sánchez et al. 2002).


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REFERENCES