Viability and Germination of Seeds and Initial Development of the Pioneer Dune Plant *Ipomoea pes-caprae*

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ABSTRACT


*Ipomoea pes-caprae* Sweet (Convolvulaceae) is a pioneer species that colonize primary coastal dunes throughout tropical and subtropical zones (Hueck, 1955). This species may be used in coastal dunes rebuilding programmes but its propagation is poorly understood. In order to test sexual propagation of *I. pes-caprae*, viability and germination of seeds and initial development of this plant were studied. Seed viability was assessed after imbibing periods in distilled water (0, 1, 3 and 5 h) and incubation times in 0.1% 2,3,5-triphenyltetrazolium chloride solution (0.5 and 1 h). It was necessary 3 h of imbibing and 1 h of incubation to verify viability of the seeds. Throughout this period water absorption was probably enough to activate the embryo respiratory metabolism, since the reagent was further absorbed and reduced. The average viability was 97% and dead seeds (3%) were predated by Megacerus cf. pes-caprae (Coleoptera: Bruchidae). In germination experiments the effect of mechanical scarification and different imbibing periods in distilled water (0, 1, 3 and 5 h) were tested. Mechanical scarification associated with 3 h of imbibing lead to an increase of the germination to 83% (except for predated seeds) and to a faster development of the seedlings, noticed by early emission of secondary roots, plumular hook elongation and expansion of cotyledons. These results indicated that *Ipomoea pes-caprae* seeds presented physical dormancy since water absorption promoted germination.

ADDITIONAL INDEX WORDS: Mechanical scarification, imbibition, physical dormancy.

INTRODUCTION

*Ipomoea pes-caprae* Sweet (Convolvulaceae) is a pioneer species that colonize primary coastal dunes throughout tropical and subtropical zones (Hueck, 1955). This species may be used in coastal dunes rebuilding programmes but its propagation is poorly understood.

Some pioneer species of coastal dunes from South Brazil have been studied in terms of seed germination and vegetative propagation. The effect of light and temperature on seed germination was studied in *Senecto crassiflorus* (Cordazzo and Souza, 1993), *Panicum racemosum* (Cordazzo and Davy, 1997) and *Blutaparon portulacoides* (Cordazzo, 1998). Seed dormancy by mechanical scarification, giberellic acid treatment and leaching was studied in *P. racemosum* (Cordazzo and Davy, 1997). Vegetative regeneration from rhizome fragments was verified in *B. portulacoides* (Bernardi et al., 1998) and *P. racemosum* (Cordazzo and Davy, 1999).

In this work viability and germination of seeds and initial development of *I. pes-caprae* were studied to help understanding the sexual propagation of this species.

METHODS

Collect and Storage of Seeds

Mature fruits of *I. pes-caprae* were collected from several plants along the coastal dunes of Navegantes Beach (Navegantes, SC, South Brazil) during February 2003. Seeds were manually separated from fruits, washed in tap water, dried and stored in paper bags at room temperature.

Viability Tests

Viability tests were performed with seeds of *I. pes-caprae* mechanically scarified at the side opposite to the embryo and imbibed in distilled water for 1, 3 and 5 h. They were cut, dividing the embryo in two halves. One embryo half was incubated in 0.1% 2,3,5-triphenyltetrazolium chloride (TTC) solution for 0.5 and 1 h. Non-imbibed seeds were used as control treatment. Five replicates containing 10 seeds were used for each treatment. After the incubation period, the percentage of embryos that acquired red color was evaluated, evidencing seed viability.

Mechanical Scarification Tests

*I. pes-caprae* seeds were mechanically scarified and transferred to washed beach sand in transparent acrylic boxes. Seeds were incubated for 10 days at 252°C under 16 h photoperiod (80 E/m²/s). Non-scarified seeds were used as control treatment. Five replicates with 10 seeds were used per treatment. After the incubation, germination percentage was assessed. Germination was defined as the emergence of the primary root from the seed. Results were compared using the Tukey test (p=0.05).

![Figure 1. Effect of imbibition periods in distilled water on viability of *I. pes-caprae* seeds after 1 h of incubation in 0.1% TTC solution.](image-url)
Imbibition Tests

*I. pes-caprae* seeds mechanically scarified were imbibed in distilled water for 1, 3, and 5 h and transferred to washed beach sand in transparent acrylic boxes. Seeds were incubated during 10 days under conditions described previously. Non-imbibed seeds were used as control treatment. Five replicates with 10 seeds were done for each treatment. During incubation period, germination percentage and initial development were assessed through the percentage of plants showing secondary roots emission, plumular hook elongation and cotyledon expansion. Results were compared using the Tukey test (p=0.05).

Viability Tests

The viability of *I. pes-caprae* seeds could not be verified in the treatment with 0.5 h of incubation in TTC solution. The percentage of seeds whose embryos aquired red color after 1 h of incubation in TTC solution was 98%, 96%, 69% and 49% in average for 5, 3, 1 and 0 h of imbibition in distilled water, respectively (figure 1).

Treatments of 3 and 5 h of imbibition were not significantly different (p=0.998) and were more efficient than treatments of 0 and 1 h of imbibition to show seed viability. Thus, 3 h of imbibition and 1 h of incubation in TTC solution were necessary to show the viability of *I. pes-caprae* seeds.

Considering treatments of 3 and 5 h of imbibition, *I. pes-caprae* seeds showed 97% of viability in average. Dead seeds were predated by *cf. (Coleoptera: Bruchidae)*.

Mechanical Scarification Tests

In mechanical scarification tests scarified seeds presented higher germination percentage (100%) than non-scarified ones (15%) (figure 2) after 10 days of incubation. These treatments differed significantly (p=0.00017). This shows that *I. Pes-caprae* seeds presented physical dormancy, and abrasion of the seed coat allowed germination.

Imbibition Tests

In imbibition testes significant differences among the treatments were verified after 4 days of incubation. Seeds imbibed during 3 and 5 h presented higher germination (83% and 89%, respectively) than seeds imbibed during 1 h and non-imbibed seeds (61% and 33%, respectively) (figure 3). Treatments of 3 and 5 h of imbibition did not differ significantly (p=0.9037). The treatment of 5 h differed significantly from treatments of 1 h (p=0.0258) and 0 h (p=0.0002) of imbibition. The treatment of 3 h differed significantly from the treatment of 0 h (p=0.0003) but did not differ from the treatment of 1 h (p=0.9944) of imbibition. These results show that 3 or more hours of imbibition promoted *I. pes-caprae* seed germination.

Seedlings originated from seeds imbibed for 3 and 5 h showed faster development compared to seedlings obtained from seeds imbibed for 1 h or non-imbibed seeds. After 5 days of incubation, the emission of secondary roots occurred in 100%, 81%, 42% and 15% of seedlings originated from seeds imbibed for 5, 3, 1 and 0 h, respectively (fig. 4). Treatments of 3 and 5 h of imbibition did not differ significantly (p=0.4436). The treatment of 5 h of imbibition differed significantly from treatments of 1 h (p=0.0002) and 1 h (p=0.0014). The treatment of 3 h of imbibition differed from treatments of 0 h (p=0.0003) and 1 h (p=0.0176) of imbibition. The treatment of 5 h of imbibition did not differ significantly (p=0.1294).

Seedlings obtained from seeds imbibed for 5, 3, 1 and 0 h presented 100%, 98%, 60% and 40% of plumular hook elongation after 5 days of incubation (fig. 5). Treatments of 3 and 5 h (p=0.9986), and 0 and 1 h (p=0.4545) of imbibition did not differ significantly. The treatment of 5 h of imbibition differed from treatments of 0 h (p=0.0016) and 1 h (p=0.031). The treatment of 3 h of imbibition differed from treatments of 0 h (p=0.0021) and 1 h (p=0.0432) of imbibition.

After 7 days of incubation, 84%, 70%, 53% and 21% of seedlings originated from seeds imbibed for 5, 3, 1 and 0 h, respectively, presented completely cotyledon expansion (fig. 6). Treatments of 3 and 5 h of imbibition did not differ significantly (p=0.6412). The treatment of 5 h differed significantly from treatments of 0 h (p=0.0016) and 1 h (p=0.0398) of imbibition. The treatment of 3 h differed significantly from the treatment of 0 h (p=0.0147) but did not differ from treatment of 1 h (p=0.3384) of imbibition.

Then, *I. pes-caprae* seed imbibition promoted faster initial developmet of whole seedlings rather than only seed germination.

DISCUSSIONS

Viability

The viability of *I. pes-caprae* seeds could only be assessed
Viability and Germination of *Ipomoea pes-caprae*

**Effect of Imbibition**

Imbibition of mechanically scarified *I. pes-caprae* seeds stimulated faster germination. In field conditions, *I. pes-caprae* seeds scarified by dune sand abrasion and/or temperature fluctuation could absorb water during rainy days or high tide.

Seedlings originated from seeds imbibed for 3 and 5 h showed faster development than seedlings obtained from seeds imbibed for 1 h or non-imbibed seeds. Early emission of secondary roots, plumular hook elongation and expansion of cotyledons indicated that development of whole plant was promoted by imbibition. Faster seed germination and seedling development during periods of water disponibility could help the rapid stabilishment of *I. pes-caprae* in favorable environmental conditions.

**CONCLUSION**

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**LITERATURE CITED**


