Germination Studies on *Stenocereus griseus* and *Escontria chiotilla*

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Abstract

Germination studies were performed on two varieties of pitaya (*Stenocereus griseus* (Haworth) Buxbaum) and jiotilla (*Escontria chiotilla* (Weber) with the further aim of reforestation. A viability test, with tetrazolium chloride at 1 %, was done on the seeds at 0 and three months after extraction from the fruits. Seeds, just removed from fruits (0 month old seeds), were germinated under both in light and dark, at temperatures of 18ºC and 30ºC and on the surface or covered with soil. Three month old seeds were germinated after been treated with water, sulphuric acid or gibberellic acid (GA_3). In general, the best germination conditions at 0 months were: in the light, 30ºC and on the surface. Viability level is maintained after three months but germination percentage decreased. The highest germination percentage at three months was shown by jiotilla under GA_3.

INTRODUCTION

Although a wide range of vegetation types can be found in Mexico, arid zones account for around 50 % of the total area and are therefore of great importance (López-Gómez et al., 2000). In such areas, the vegetation is constantly disrupted by humans and livestock as in Mixteca state of Oaxaca. In that region, cacti represent a farming option for economic development. Fruits of pitaya (*S. griseus*), naturalized in Oaxaca, and jiotilla (*E. chiotilla*), which is native there (Mercado and Granados, 1999), are eaten fresh or as jelly and refreshing drink (Arnaud et al., 1997). These plants have been grown only by vegetative propagation with the result that genetic variability is lost. With the aim of preserving genetic variability, these species will be cultivated from seeds and used to reafforest disrupted areas. The objective of the present work is to perform germination studies on these species.

MATERIALS AND METHODS

Plant Material

Fruits were taken from jiotilla and two types of pitaya, “ceniza” and “olla”, collected from orchards in Chazumba, State of Oaxaca, Mexico. Seeds were removed from the flesh, washed, dried and kept in a glass jar at 4ºC.

Viability Test

Seeds hydrated for 24 hours were cut longitudinally in halves. One half of each seed was boiled and both halves were put in a tetrazolium chloride solution at 1 % for 24 hours, in darkness. The test was performed with both 0 months and three months old seeds.

Germination Test

1. Germination at 0 Months. Freshly removed seeds (0 months old seeds) were disinfected in 70 % ethanol for 5 minutes, rinsed with sterilized water, disinfected with 0.6 % sodium hypochloride for 15 minutes, and rinsed with sterilized water for five

minutes. Lots of 50 seeds were grown in combinations of one of each pair of the following conditions: light/dark, temperatures of 18ºC/30ºC) and on the surface or covered with a layer of 2 mm of sand.

2. Germination at 3 Months. Seeds removed from the fruit three months previously (3 months old seeds) were disinfected as stated for 0 months old seeds. A lot of 50 seeds was grown directly in water. A second lot was treated with a solution of gibberellic acid (GA_3, 1mg/l), for 24 hours, previously grown in water, to promote germination. The third lot of 50 seeds was treated with a solution of sulphuric acid (H_2SO_4, 30%), for 10 minutes, as chemical scarification, rinsed with water and grown. The growing conditions for all three lots were the same: on the surface, in the light and at 30ºC.

RESULTS

Viability

Although viability percentages showed small changes from 0 to 3 months (Table1), there were no statistically significant differences (z test, $\alpha = 0.05$).

Germination at 0 Months

As shown in Table 2, there was almost no growth in the dark, thus showing a significant difference from growth in light (χ^2 test, $\alpha = 0.05$). Hence the following discussion deals only with results in light. Several χ^2 tests ($\alpha = 0.05$) for marginal effects and interactions were performed, showing marginal effect of depth, lack of marginal effect of temperature, interaction between depth and species, interaction between temperature and species, as well as interaction depth and temperature. Therefore, the further analysis was done by combinations of all the experimental conditions. For pitaya olla there is no difference between growing on the surface or in the soil; on the surface there is no difference due to temperature, but there is in seeds grown in the soil, showing a higher germination percentage at 18ºC. Pitaya ceniza germinates better on the surface, without difference due to temperature. Jiotilla germinates more on the surface, at 30ºC, showing the highest germination percentage of all species under any of the experimental conditions tested.

Germination at 3 Months

Since growing on the surface was better for pitaya ceniza, with pitaya olla showing no difference due to depth, and jiotilla growing better on the surface at 30ºC, all of them with better results in the light, germination of 3 month old seeds was carried out in the light, on the surface, at 30ºC. As shown in Table 3, there was no growth either with sulphuric acid treatment; regardless of the plant group or in pitaya olla, regardless of treatment group. According to a Kruskal-Wallis test ($\alpha = 0.05$ treatment with GA_3 was most effective, but no difference between water and sulphuric acid treatments (comparisons at $\alpha = 0.05$).

DISCUSSION

There are very few studies about germination in pitaya and none was found for jiotilla. Lopez and Sanchez (1989) and Martinez (1983) mentioned that seeds of pitaya need light to germinate, which agrees with our results, and obtained germination percentages up to 90 %. Martinez (1983) got the best results with 2 hours of imbibing, an exposure to red light for 30 minutes and a temperature of 21ºC; whereas Lopez and Sanchez (1989) obtained the best results in the light, as well in the dark but adding GA_3. In both papers, the authors used seeds stored for one year, since they argued that freshly harvested seeds do not germinate. In this work 0 month old seeds showed a good viability and germination percentages. After 3 months viability is maintained although germination is low, which lead us to think that seeds of pitaya go into dormancy between 0 and 3 month after harvest, and probably regain the germination ability being exposed to water and light about a year after. Seeds of jiotilla displayed the same photoblastic behavior as

those of pitaya, as well as going into dormancy when 3 months old. Nevertheless, jiotilla partially recover its germination ability when treated with GA_3. Even though sulphuric acid is a chemical scarifier, it fails to break dormancy. Further studies are needed to improve results, increase germination percentages, break dormancy and determine the field settling conditions of seedlings.

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Tables

Table 1. Viability percentage.

Group	0 months	3 months
Pitaya olla	55	57
Pitaya ceniza	80	80
Jiotilla	85	83

Table 2. Germination percentages at 0 months.

	Surface				in soil			
	18ºC		30ºC		18ºC		30ºC	
Group	Light	Dark	Light	Dark	Light	Dark	Light	Dark
P. olla	18	4	6	0	20	0	0	0
P. ceniza	14	0	12	0	0	0	6	0
Jiotilla	54	0	76	0	4	0	2	0

Table 3. Germination percentages at 3 months (surface/light/30ºC).

Group	Water	GA_3	H_2SO_4
P. olla	0	0	0
P. ceniza	2.67	2.67	0
Jiotilla	2	30.67	0