BEHAVIOUR OF *Maytenus ilicifolia* SEEDS IN DIFFERENT PERIODS AND STORAGE CONDITIONS

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Abstract

Seeds of *Maytenus ilicifolia* collected on December 1993, were subsequently packed in permeable paper bags and kept for 30, 60, 90 and 120 days at environmental conditions (bench top), dry chamber (15°C, 45% relative humidity) and cold chamber (5°C, 85% relative humidity). Seeds humidity, germinability, and electric conductivity were assessed monthly. Results showed an increase in electric conductivity and a decrease in germinability for three different storage conditions. The initial humidity of 41% had a significant decrease after 30 days of storage, reaching 7% in both dry chamber and at normal environmental conditions (bench top), and reaching 21.8% in cold chamber. The best results for germinability were observed at cold chamber, followed by dry chamber, and at environmental conditions (bench top), with 85%, 66% and 28%, respectively after 120 days.

1. Introduction

*Maytenus ilicifolia* Mart. ex Reiss., know in Brazil as “espinheira santa” has a wide range of medicinal use, with therapeutic properties recognized by the Ministry of Health (Carlanti, 1988).

It belongs to the *Celastraceae* family. According to Willis (1981), it is a pantropical and widely spread genus (255 species). In Brazil there are nearly 77 species, with expressive occurrence in Rio Grande do Sul.

It is a branched bush with bivalved capsular fruit and reddish pericarp when mature. The seeds are completely covered with aril; the forehead is firm, smooth, of dark and shiny color. The endosperm is abundant; and the axial embryo shows membranaceous and smooth cotyledons.

Nowadays, it is vastly commercialized and little is known about its cultivation, suggesting that indiscriminate harvests are done. It is among the medicinal species of great expression and large commercial exploitation, submitted to a significant genetic erosion process.

The difficulty to obtain raw material of this species in sufficient quantity and good quality is the main obstacle to fulfill the market’s demands. Thus, more studies are needed to understand the plant’s behaviour and to develop agricultural yielding techniques.

The aim of this work was to evaluate the physiological quality of the seeds of *M. ilicifolia* when submitted to different periods and storage conditions.
2. Material and Methods

On December 1993, mature fruits were collected from a natural population of *M. ilicifolia* in the City of Santa Cruz do Sul, RS, Brazil.

The mature fruits were collected from the plant's lower region to the middle of the clump, and they were placed in plastic containers and taken to the evaluation site. The fruits considered mature were the ones that presented open shells and exposed aril, since it is the stage of fruit development -Magalhães *et al.* (1992) - when seeds had higher germination rates. After collection, the fruits were stored at a low temperature (around 5°C) during 12 hours until the manual removal of the aril. Then, a sample of seeds was taken in order to categorize them regarding initial humidity, germination. Weight of 1000 seeds were calculated according with the Rules for Analisys of Seeds (Brasil, 1993). The seeds were divided in groups of samples which were kept during 30, 60, 90 and 120 days at environmental conditions (bench top), dry chamber (15°C, 45% relative humidity), and cold chamber (5°C, 85% relative humidity).

The germination tests were carried out in chambers at alternated temperatures of 20-30°C adapted with fluorescent lights and photoperiods of 8 hours/light and 16 hours/darkness. Gerbox recipients containing sterilized sand were used. The test was conducted for 40 days with counts every five days from emergence.

The vigor evaluation was performed by electric conductivity test, according with methodology described by Matthews and Powell (1981).

The experimental delineation was completely randomized with four repetitions of 50 seeds per treatment, and data were submitted to Anova and the means were compared using Tukey test (Sanest).

3. Results

3.1. Analysis of seeds

*M. ilicifolia* seeds, rigth after collection, showed a weight of 99,9 g for 1000 seeds, and humidity degree of 41%. It was also obtained 91% of germination in sand substratum and a lixiviation of solutes of 56 µS/cm/g.

Through chemical analysis, a presence of 54% of lipids, 11,7% of protein, 7% of starch, and 2,8% of ashes was recorded, characterizing the seed as oleaginous. Only oleaginous seeds present 20% or more of lipids in its composition (Lang, 1965).

The emergence of *M. ilicifolia* seeds starts on the 15th day and is completed on the 35th day after the seeding in sand substratum (results not shown).

3.2. Parameters of vigor

When *M. ilicifolia* seeds are submitted to different periods and storage conditions there are modifications in the moisture of the seeds (see figure 1). When stored in a cold chamber, the humidity level in the seeds decreased gradually, and it kept significantly higher than in another storage conditions.

Figure 2 shows the percentage of *M. ilicifolia* plantlets emergence. Up to 60 days the seeds kept equivalent, and higher values than the ones up to 90 and 120 days, when a dramatic reduction in the emergence did take place. The lowest values in emergence were observed at environmental conditions (bench top).

The physiological condition of the seeds was also evaluated through measurements of electric conductivity. These values are shown at figure 3. The conductivity readings were done after 4 hours of soaking in water, displaying significant differences within
treatments. Since the coefficient of correlation between the readings after 4 hours and 24 hours of soaking was expressive (75%), the best results can be obtained if the test could be done after 4 hours.

4. Discussion

The quality of the seeds depends on all genetic, physical, physiological, and sanitary attributes that affect their capability to originate high productivity plants. The period in which the seeds remain viable is determinate genetically, and it is influenced by environment factors that occur during storage.

*M. ilicifolia* seeds, when physiologically mature, present a high degree of moisture (humidity – figure 1). According to Harrington (1972), this moisture is a handicap regarding the preservation of the seeds in storage, since it accelerates their deterioration either by the action of microorganisms or by the high respiration rate.

The seeds stored at environmental conditions (bench top) were exposed to the climatic conditions of the months of January, February, March, and April, with high temperature and high relative humidity of the air. The seeds faced temperatures of 30°C on February, and relative humidity reaching at times 100%. These conditions affected the physiological attributes of the seeds during those 120 days, drastically reducing their viability from the 60th day on (figure 2). Popinigis (1977) mentions that if climatic conditions were not favorable for seeds storage, they must be preserved in a controlled environment (humidity and temperature).

Although the dry chamber allowed germination higher than 50% at the end of the 90th and 120th days, it was registered that the environment that best kept the viability of the *M. ilicifolia* seeds was the cold chamber. Plantets resulting from seeds stored for 120 days showed well development main structures, seeds well proportioned and healthy, while the ones kept at environmental conditions (bench top) were mostly abnormal. Similar results were found (Nakagawa et al., 1991) with yellow passion fruit (*Passiflora edulis*) regarding the cold chamber storage conditions.

Roberts (1973) introduced the terms orthodox and recalcitrant to define differences in seed storage physiology. Orthodox seeds tolerate the reduction of moisture while recalcitrants loose their viability after reduction of moisture. Ellis et al. (1990) showed in studies with coffee seeds that they fail to fulfil the definitions of other typical orthodox or recalcitrant storage behaviour, creating a possible third category of storage behaviour intermediate to those of orthodox and recalcitrant seeds.

A study is needed to determine the best humidity degree for each species. Eira et al. (1993) classified *M. ilicifolia* seeds as orthodox, since they tolerate relatively high desiccation when stored at environmental conditions (bench top) and in the dry chamber. In this present work, the seeds standard behaviour, regarding germination and vigor, kept high values when stored in cold chamber with a humidity degree around 12%. Thus, further studies are required in order to decide which is the best category storage condition for this species.

With an increase of storage time there is an increase of the amount of lixiviated solutes by the seeds when imbibed (figure 3). Marcos Filho et al. (1990) recommend for big seeds, such as soybean and pea, a soaking period of 24 hours since during this time it is possible to evaluated lixiviation of solutes and to identify small differences in vigor between different lots of seeds. With small seeds, such as celery, lettuce, and carrot, the soaking period can be reduced to 5 to 15 minutes, during this period, 90% of potassium lixiviation occurs (Simon and Matahavan, 1986). *M. ilicifolia* seeds require only 4 hours of soaking in order to characterize the different levels of deterioration through lixiviation of solutes.
These results suggest that the cold chamber better kept the integrity of the membranes until the end of the period, while the dry one and the bench top (environmental conditions) were not favorable to seed preservation. The electric conductivity test can be useful to evaluated the speed of the metabolic processes that act upon the membrane integrity, since this condition is associated to its level of degradation. This way it is possible to foresee the vigor or evaluated the influence of storage conditions on the quality of *Maytenus ilicifolia* seeds.

Concluding, the results from this study showed that *Maytenus ilicifolia* seeds require controlled conditions for periods over 60 days to be able to keep their physiological quality. The south region of Brazil, does not present favorable climatic conditions for the storage of these seeds.

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6. References


Figure 1 - Seed humidity degree of *Milicifolia* submitted to different periods and storage conditions expressed in percentage.

In the periods of storage (axis x) different lower case letters differ at the level of 5%.
In the storage conditions (axis y) different capital letters differ at the level of 5%.

Figure 2 - Percentage of seedling emergence of *Milicifolia* with seeds submitted to different periods and storage conditions.

In the periods of storage (axis x) different lower case letters differ at the level of 5%.
In the storage conditions (axis y) different capital letters differ at the level of 5%.
Figure 3 - Electric conductivity (uS/cm/g of seeds) of the solution in which seeds of *M. ilicifolia* submitted to different periods and storage conditions were embedded after 4 hs.

In the periods of storage (axis x) different lower case letters differ at the level of 5%.

In the storage conditions (axis y) different capital letters differ at the level of 5%.