Desiccation, storage and germination of *Hancornia speciosa* seeds

Antonieta Nassif Salomao

Embrapa Recursos Genéticos e Biotecnologia – PqEB W5 Norte, C.P. 02372 CEP 70849-970 Brasília – DF Brazil

Abstract

When seeds of *Hancornia speciosa* were incubated at 5 up to 40°C, they did not germinate at 5°C, while maximum germination was obtained at 10°C, indicating chilling sensitivity below this temperature in these seeds. The highest (100%) germination was obtained at 25ºC. Seeds could be partially desiccated to 33% MC without significant reduction in germination and be further dried to 9% MC with great decrease in germination capacity. However, seedling vigour was affected by desiccation, when seeds were dried to or below 26% MC. In the storage experiments, seed viability was not maintained for longer than 2 months at 5 and 10ºC. *H. speciosa* seed responses to dehydration and storage at low temperatures confirmed its classification as a recalcitrant species.

Introduction

Hancornia speciosa Gomez (Apocynaceae), named locally as mangaba, mangabeira, occurs in low and high frequency in semi-arid and savannah regions of Brazil. The species produces an edible fruit, which can be consumed *in natura* or used to prepare ice cream, pudding, juice, jam, wine, vinegar and liquor. The seed is a flat and irregular discoid with a central hilum. The seed coat is thin and yellowish-brown and the endosperm is white (FAO 1986; Lorenzi 1992). The seed classified as recalcitrant has a short lifespan (Oliveira and Valio 1992).

Recently, the species has been included in breeding programmes, due to its nutritional and commercial values. The establishment of conditions for germplasm conservation becomes a priority to meet breeders´ demands.

Materials and methods

Seed collection and extraction

Fruits were collected in Oct and Nov 1996, and in Nov 1997 and 1998, each harvest composing a seed lot. As shown in Table 1, collections were made from three different locations to obtain enough seeds in 1996 and from only one location in the other years. The collection was made from the ground in grazing-lands in each of the locations.

The seeds were extracted from fruits by hand. After removing the fleshy pulp by rubbing the fruits in a sieve, the seeds were washed in tap water. Moisture content determination and desiccation trials were initiated the same day of seed processing.

Initial tests

Fruit and seed weights were determined on 100 individuals. Seeds of lots 1 and 4 were used to determine seed weights, and fruit weights were measured using lot 4. Initial moisture contents were measured on individual seeds (1×100 seeds) of lots 1 and 4, and on samples of whole seeds (5×3 to 5 seeds) of lots 1, 2, 3 and 5. Seed components were also used to measure moisture contents of a sample of 10 excised embryonic axes and endosperms from lots 1 and 4.

Table 1. Seed lots used in the trials

Collection	Seed lot	Provenance
1996	1	54.5 km from Brasília (route to Unaí)
	2	Mozondó farm, near Maranhão river, between District Federal and the State of Goiás
	3	Vãozinho de dentro farm, 55 km from São João da Aliança municipality, State of Goiás
1997	4	Mozondó farm, near Maranhão river, between District Federal and the State of Goiás
1998	5	Near to Mutuca farm, 60 km from São João da Aliança municipality, State of Goiás

Effect of temperature on seed germination

Germination tests were performed by placing two replicates of 25 seeds on a layer of cotton wool moistened with distilled water, over a

range of constant temperatures between 5 and 40°C (lots 1 and 2), and a photoperiod of 12 h light per day.

Desiccation trials

Seeds were desiccated, mixed with silica gel (4 g silica/1 g seed) at room temperature (25±2°C), for 0 and 100 h (lot 1), for 0 and 48 h (lot 2), and for 0 up to 92 h (lot 4). After each desiccation period, moisture content was determined on five replicates of five seeds (lots 1 and 2) and on 10 individual seeds (lot 4). Germination tests were carried out using two replicates of 25 seeds of lots 1 and 2, and 4 replicates of 25 seeds of lot 4, at a constant temperature of 25°C, and a photoperiod of 12 h light per day.

In a separate trial, seeds from lot 5 were desiccated, mixing them with an equal amount of silica gel. Controls were placed in similar containers with vermiculite in place of the silica gel. Dehydration periods of 0 up to 63 h were determined in line with the results of preliminary desiccation trials. After each desiccation period, moisture content was determined with five replicates of five whole seeds, and germination tests were carried out using four replicates of 25 seeds, at a constant temperature of 25°C and with a photoperiod of 12 h light per day.

Storage trials

After desiccation and fungicide application, samples of seeds of lot 5 were mixed with vermiculite and sealed in impermeable bags. Seeds desiccated to 52.5, 50.7 and 47.7% MC were stored at 5°C, and seeds with 49.0 and 38.5% MC were stored at 10°C, storage at both temperatures lasted for 2, 6 and 12 months.

Results

Initial tests

Fruit weights varied greatly within the same population, whereas there was a smaller variation in seed weights (Table 2). Initial moisture contents were high, around 50% for all seed lots (Table 3).

Effect of temperature on germination

Of all tested temperatures, *H. speciosa* seeds did not germinate at 5°C, while maximum germination was obtained at 10°C. High germination percentages of 88 to 100% were obtained for seeds incubated at 10 to 30°C, above which temperature viability declined to 58 and 4% (Fig. 1). However, it has been observed that seeds initiated germination at 10, 15, 35 and 40°C, with only radicle protrusion but not normal development of seedlings. This occurred only with seeds germinating at 20, 25 and 30°C.

Table 2. Mean weights of 100 individual seeds and fruits from lots 1 and 4

Material	Weight (g±sd)
100 seeds (lot 1)	0.228±0.052
100 seeds (lot 4)	0.184±0.063
100 fruits (lot 4)	42.188±18.192

Table 3. Mean initial moisture contents of seeds and seed components

Material	Moisture content±sd (%)
100 individual seeds (lot 1)	51.13±3.61
100 individual seeds (lot 4)	55.69±8.23
5×5 whole seeds (lot 1)	52.90±1.54
5×3 whole seeds (lot 2)	51.53±0.99
5×3 whole seeds (lot 3)	53.74±1.80
5×5 whole seeds (lot 5)	50.63±1.10
10 individual embryonic axes (lot 1)	78.08±3.51
10 individual endosperms (lot 1)	48.68±4.60
10 individual embryonic axes (lot 4)	77.53±4.22
10 individual endosperms (lot 4)	45.57±6.33

Desiccation trial

Table 4 and Figure 2 present the effect of desiccation of *H. speciosa* seeds from different lots. Germination percentage decreased after drying seeds to ca. 25% MC, and no seed germinated at 7% MC and below. The critical moisture content for the onset of viability loss seemed to be around 30%. Although some seeds germinated at lower moisture contents, reduced vigour was observed in seedlings from seeds dried to 25% MC and below (see Table 4). High moisture content was maintained in the control seeds in vermiculite, which also germinated over 80% on average.

Storage trial

Storage at 5°C led to approximately 50% germination or less, whereas more than 70% were obtained at 10°C after 2 months storage. Only 5% of seeds with 46% MC germinated after 6 months at 10°C. No other seed germinated after storage for 12 months, irrespective of conditions (see Table 5).

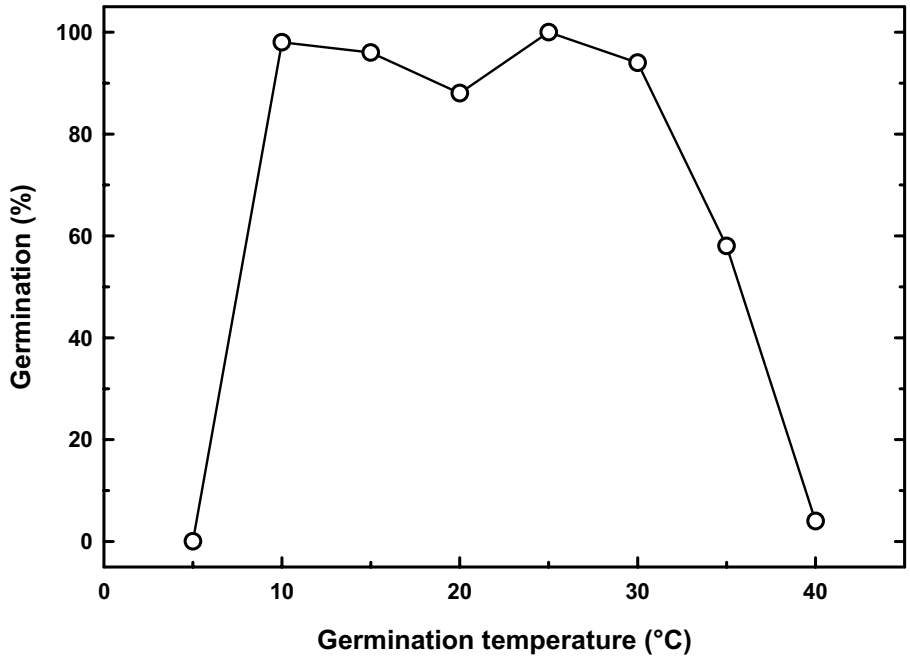

Figure 1. Effect of germination temperature on *H. speciosa* fresh seeds from lot 1.

Table 4. Effect of desiccation using an equal amount of silica gel (g g^{-1} seed), on the viability of seeds from lot 5

Desiccation Period (h)	Vermiculite (control)		Silica gel (drying)		
	MC±sd (%)	Germination (%)	MC±sd (%)	Germination (%)	Observations on seedling vigour
0	50.6±1.10	80	—	—	—
4	48.8±0.88	88	46.7±1.75	86	—
12	45.3±1.98	90	32.9±1.95	93	—
20	47.1±0.85	86	25.6±2.44	75	Reduced
24	47.1±1.99	89	19.2±1.40	62	Reduced
28	45.5±2.20	85	18.9±2.36	70	Reduced
44	45.8±2.91	83	9.1±1.27	23	Reduced
51	46.9±1.23	78	7.2±0.84	0	—
68	44.7±3.88	81	5.9±0.37	0	—

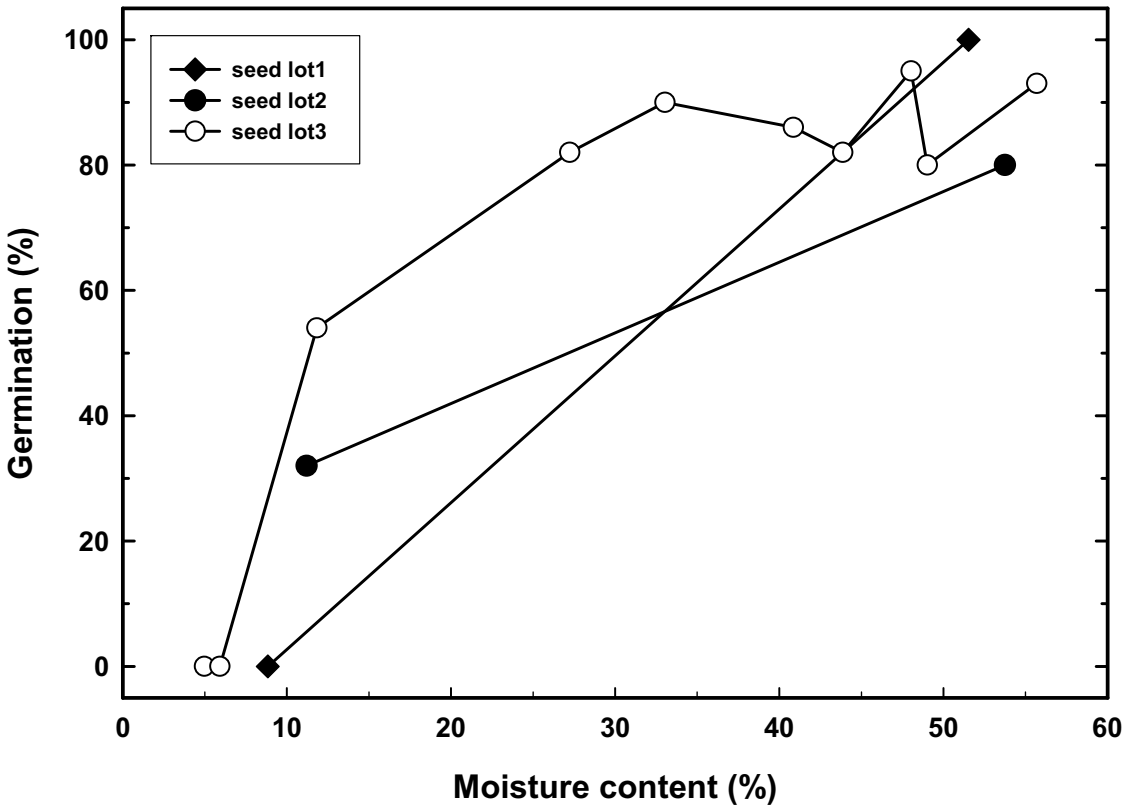

Figure 2. Relationship between moisture content and germination of *H. speciosa* seeds.

Table 5. Seed germination (G) response to storage conditions at 5 and 10°C for 12 months

Storage temp.	MC±sd (%)	Initial G (%)	Storage period				
			2 months	6 months		12 months	
			G (%)	MC (%)	G (%)	MC (%)	G (%)
5°C	52.54±3.86	80	40	9.52± 0.27	0	38.70± 1.14	0
	51.12±3.86	84	58	9.52± 0.27	0	36.88± 0.99	0
	47.69±2.63	86	36	39.55± 0.93	0	13.90± 1.47	0
10°C	48.99±2.97	84	90	46.27± 3.12	5	45.46± 2.87	0
	38.46±2.91	82	73	40.29± 3.88	0	40.76± 3.61	0

Discussion

Seeds of *H. speciosa* did not germinate at 5°C, while maximum germination was obtained at 10°C, indicating chilling sensitivity in these seed species. Seeds could be partially desiccated to ca. 30% MC without significant reduction in germination and be further dried to 9% MC with great decrease in germination capacity. However, seedling vigour was affected by desiccation, when seeds were dried to or below 26% MC. In the storage experiments, seed viability was not maintained for longer than 2 months at 5 and 10°C.

During germination, fungal infection compromised the capacity of seeds. The principal identified fungi were *Fusarium oxysporum*, *Penicillium* sp, *Periconia* sp, *Rhizopus* sp and *Torula* sp. However, a preliminary test showed that seed tissues were not affected by bacteria contamination during regeneration of embryonic axes after desiccation or desiccation followed by exposure at –196°C. It is therefore suggested to develop a cryopreservation protocol for the *ex situ* conservation of this species.

Conclusion

Hancornia speciosa seeds cannot withstand desiccation below 30% MC, which should be avoided. Storage conditions, including temperatures above 10°C need to be further investigated. On the basis of the present results, it must be recommended to avoid germination or storage below 10°C.

References

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