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THE EFFECTS OF SARCOTESTA AND STORAGE TEMPERATURE ON THE LONGEVITY OF SEEDS OF FIVE PAPAYA (*Carica papaya*) LANDRACES

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ABSTRACT
The study was done to investigate the effects of sarcotesta and storage temperature on seed longevity in papaya (*Carica papaya*). Seeds extracted from ripe fruits of five different landraces (FUTM-Da, FUTM-Gmk, FUTM-Gmg, FUTM-Coe and FUTM-Gkw) were shade-dried to a moisture of about 10% with or without the removal of the sarcotesta. Samples of the dry seeds of the different landraces were packaged in paper envelopes and stored at 12^{O} C or 30^{O} C. Seedling emergence in top soil was tested immediately after seed drying and at 4, 8, 12, 16 and 20 weeks of storage. Values obtained which did not differ significantly between seeds with or without sarcotesta, were low (13 to 60%) prior to storage in all landraces. An increase was however recorded within the first four to eight weeks after storage irrespective of treatment. At the peak, seedling emergence of up to about 70% to 90% in seeds stored without sarcotesta were recorded, whereas the maximum emergence of seedlings from seeds with sarcotesta was mostly between 52% and 75%. The superiority of 12^{O} C over 30^{O} C in terms of viability maintenance was more consistent in seeds stored without sarcotesta,,seeds stored without sarcotesta stored better than those with sarcotesta. In all treatments, seedling emergence decreased after a maximum value was recorded. However, viability was best maintained in FUTM-Co without sarcotesta.

KEY WORDS: Landrace, sarcotesta, germination, longevity, papaya.

INTRODUCTION

Papaya is usually consumed fresh as a breakfast or desert fruit. It can also be processed and used in a variety of products such as jams, fruit juices and ice cream. It is also consumed as a desert and it is an ingredient in a variety of cuisines throughout the world. Unripe fruits and leaves are consumed as a vegetable and the seeds are also used as an ingredient in salad dressings. Consumption of the fruit is reported to aid digestion (Chia, 1990). The potentials of papaya as a cash producing crop is enormous for farmers especially those residing near the urban areas.

However, poor seed handling and storage are known to affect germination, seedling emergence, poor or low seedling vigour and even total or complete failure of seedlings with attendant low yield and quality. Nongpanga *et al*. (2003) implicated poor post-harvest handling techniques in the low, erratic and uncomplete germination of *C. papaya* seeds. The seed is enclosed within a gelatinous sarcotesta, the presence of which has been reported to prevent or reduce germination and decrease the number of normal seedlings (Tokuhisa, 2007; Angeline and Ouma, 2008). Yahiro (1979) and Perez and Cneva (1980) suggested the presence of some growth inhibitors in the sarcotesta as the causal agents. Malo and Campbell (2001) reported that sarcotesta not only prevent germination but also subsequent seedling emergence. Dormancy is also observed in seeds from which sarcotesta has been removed (Tokuhisa, 2007). Freshly extracted seeds are therefore normally cleaned to remove the sarcotesta and washed in running tap water to enhance germinability (Chia, 1990). Presoaking of seeds in water for 24 hours has also been reported to promote germination of papaya (Riley, 1981).

Different varieties/landraces of papaya abound worldwide and literature has shown that variations exist in their seed germination and storage behaviours. Very few studies have however been conducted to compare the longevity of seeds stored with and without sarcotesta. This study was therefore conducted to ascertain the roles genotype, seed processing techniques and storage temperature may play in seed viability and maintenance in five of the papaya landraces in Nigeria.

MATERIALS AND METHODS

This experiment was conducted at the Crop Production laboratory of the Federal University of Technology, Minna (9^{O} 41' N, 6^{O} 31' E) Niger State, Nigeria. Ripe fruits of five different landraces of papaya (FUTM-Co, FUTM-Da, FUTM-Gmk, FUTM-Gmg, and FUTMGkw) were harvested and their seeds extracted. Some seeds of each landrace were washed free of sarcotesta under running tap water and then shade dried for seven days at room temperature (about 30^{O} C and relative humidity of about 40%). Some other seeds were left with sarcotesta intact and also shade dried for seven days. The moisture content of the seed was determined using the oven method (at

130^{O} C for 1 hour). Seeds of the different treatment combinations were packaged in polythene envelopes and stored under ambient condition (about 30^{O} C) and 12^{O} C. Four replicates of 25 seeds each were sown into 5 kg of top soil in polythene pots. The pots were watered a day prior to sowing and following sowing as found necessary. Data were collected on percent seedling emergence four weeks after seeds were sown. Data collected on all parameters were subjected to analysis of variance based on completely random design. All data involving percentages were transformed to arcsin values before analysis.

RESULT

The levels of and the differences between the seedling emergence from seeds with and without sarcotesta before storage varied amongst landraces (Figures 1 to 5). Values ranged from about 13-15%, 28-38%, 38-50%, 38-60% and 50-60% in FUTM-Da, FUTM-Co, FUTM-Gmk, FUTM-Gmg and FUTM-Gkw respectively. In each of the landraces however, the differences between seeds with and without sarcotesta were not significant. Following storage, a general increase in percentage seedling emergence was recorded and with a few exceptions, a peak was attained at about 8 WAS. At this point all the seed samples which were stored without sarcotesta at 12^{O} C gave seedling emergence values of 80% and above. Furthermore, except in few cases, seedling emergence did not exceed 70% when seeds were stored with sarcotesta. From 4 WAS in FUTM-Co (Fig.2) and from 8 WAS in FUTM-Gmk (Fig.3), seeds without sarcotesta stored significantly better at 12^{O} C than at 30^{O} C. This trend was also shown in some instances in the other landraces. There was generally no significant effect of storage temperature on seedling emergence when seeds of FUTM-Gmk and FUTM-Gkw were stored with sarcotesta contrary to what was recorded for the other landraces. Following the increase in seedling emergence reported above, a decline set in and the point at which a sharp drop was recorded varied with landraces and seed treatment. For example, whereas seedling emergence from seeds of FUTM-Co stored at both 12^{O} and 30^{O} C without sarcotesta did not drop drastically until after 16 WAS, a sharp decline was recorded in FUTM-Da, FUTM-Gmg and FUTM-Gmk immediately after the point of maximum performance (i.e. after about 4 to 8 WAS). The decline in FUTM-Gmk stored at 12^{O} C was less sharp and as at 20 WAS, emergence was still maintained at over 80%

DISCUSSION

Freshly extracted papaya seeds are known to be dormant, a situation that has been reported to be due to the presence of some growth inhibitors in the sarcotesta (Gherardi and Valio, 1976; Begum *et al*., 1987). However, seeds in which sarcotesta has been removed have also been reported to exhibit dormancy (Tokuhisa, 2007). Salomoa and Mundim (2000) and Anburani and Shakila (2010) reported that the treatment of papaya seed with gibberellic acid (GA_3) enhanced germination. This implies that germination inhibitors are not only present in the sarcotesta but also resident in the seed, a view that also agrees with that of Angeline and Ouma (2008). The variations with respect to seedling emergence among landraces in this study suggest that the levels or concentration of the growth inhibitors that have been implicated in poor papaya seed germination may vary with genotypes. That such inhibition may not even be exhibited in some other genotypes have been alluded to by the result of Santos *et al*. (1999) which showed that maximum germination could be obtained in freshly harvested papaya seeds. in tandem with the report of Vigglano *et al*. (2000a, b), Aroucha, *et al*. (2004) and Dias *et al*. (2010), results from the current study also showed an improvement in seedling emergence as seed aged which was attributed to breakdown of the post-harvest dormancy. The subsequent decrease in seedling emergence as recorded in this study is a common trend in seed storage and is due to some physiological and biochemical disorders associated with seed ageing (Basra *et al*., 2003; Kapoor *et al*., 2010). Seed ageing is normally faster at higher temperature as recorded in this study due to increase in respiratory activities of some enzymes (Vieira, 1996; Spinola *et al*., 2000). The results of this study did not only reveal that the presence of sarcotesta reduced seed germination prior to storage, it also resulted in poor longevity. This agrees with Dias *et al*. (2010) who reported that seeds without sarcotesta maintained better physiological quality than those with sarcotesta. Yahiro (1979) and Angeline and Ouma (2008) had postulated that the sarcotesta on papaya seed could reduce germination by preventing the infiltration of oxygen into the seed. Sangakkara (1995) was of the opinion that sarcotesta might be acting as a barrier to germination and healthy seedling development. In the present study in which seed with sarcotesta never germinated as highly as those with removed sarcotesta all through the storage period until their emergence declined. This suggests that seeds dried with sarcotesta might have been poorer in vigour prior to storage which might have arisen due to reduction in oxygen supply to the embryo during drying. Kranner *et al*. (2010) indicated that some byproducts of anaerobic metabolism can impair respiratory transport leading to some chain reactions that can result in loss of cell function and death and ultimately seed death. According to Shande *et al*. (1999) and Adebisi *et al*. (2004), low vigour seed lots generally deteriorate faster than high vigour seed lots. The slower decline in emergence level in FUTM-Gmk following maximum attainment at 8 WAS could be attributed to the higher vigour of seeds of this landrace. Difference in seed vigour have been recorded among some papaya cultivars (Barche *et al*., 2010; Dhinesh Babu *et al*., 2010).

CONCLUSION AND RECOMMENDATION

It is concluded from this study that seeds of all the landraces tested survived better when stored without sarcotesta and at lower temperature. It is recommended that papaya seeds should be washed to remove the sarcostesta, dried and stored at low temperature of 12^{O} C for enhanced longevity. The mechanism through which sarcotesta reduces papaya seed quality needs to be properly investigated.

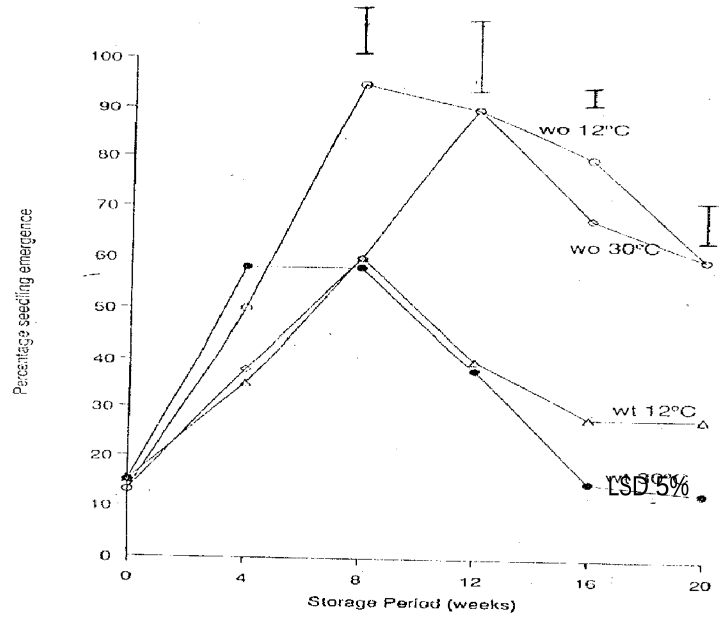

Fig.1.Seedling emergence (%) trends from FUTM-Da seeds stored with (wt) and without (wo) sarcotesta at 12 and 30°C

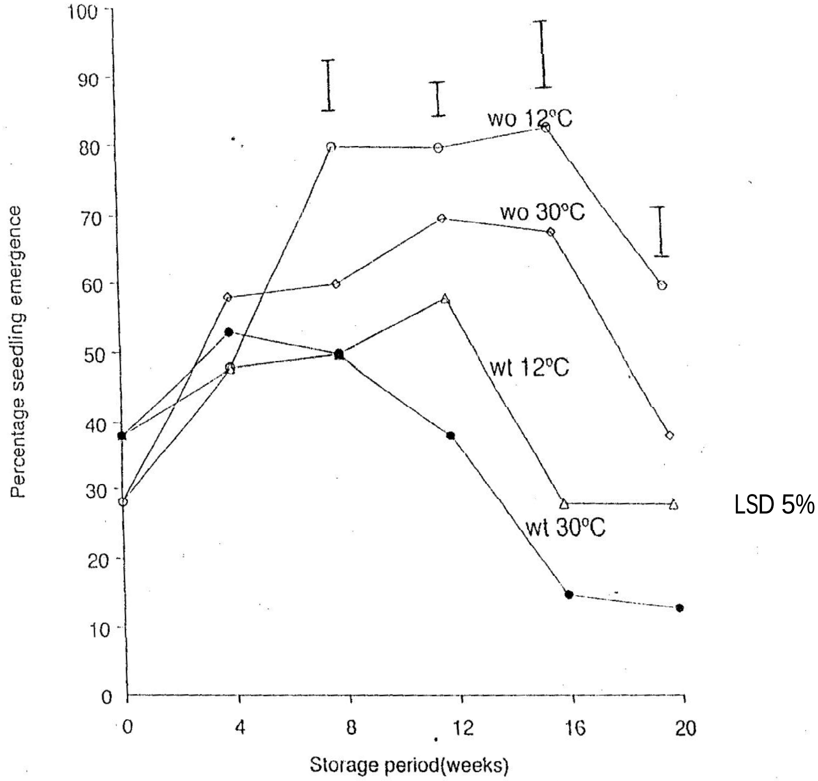

Fig.2. Seedling emergence (%) trends from FUTM-Co seeds stored with (wt) and without (wo) sarcotesta at 12 and 30°C

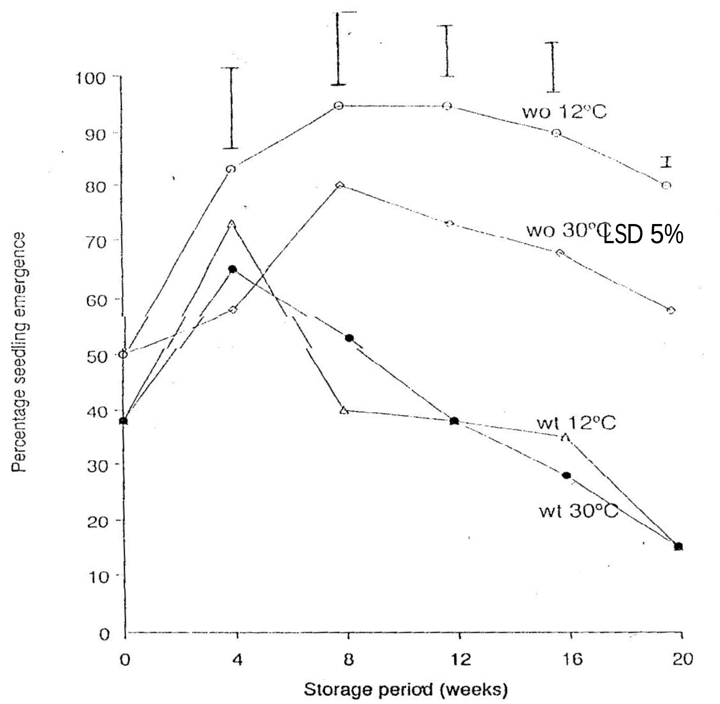

Fig.3. Seedling emergence (%) trends from FUTM-Gmk seeds stored with (wt) and without (wo) sarcotesta at 12 and 30°C

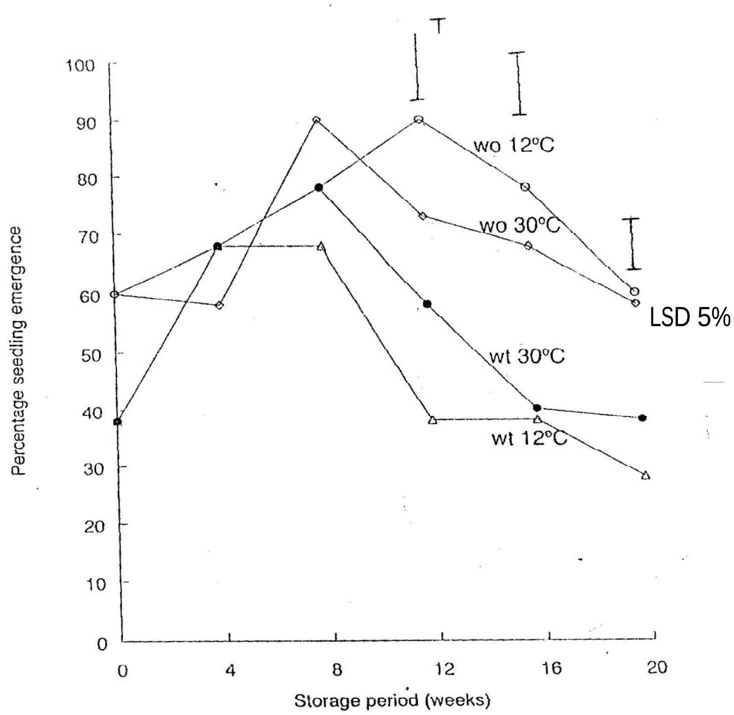

Fig. 4. Seedling emergence (%) trends from FUTM-Gmg seeds stored with (wt) and without (wo) sarcotesta at 12 and 30°C

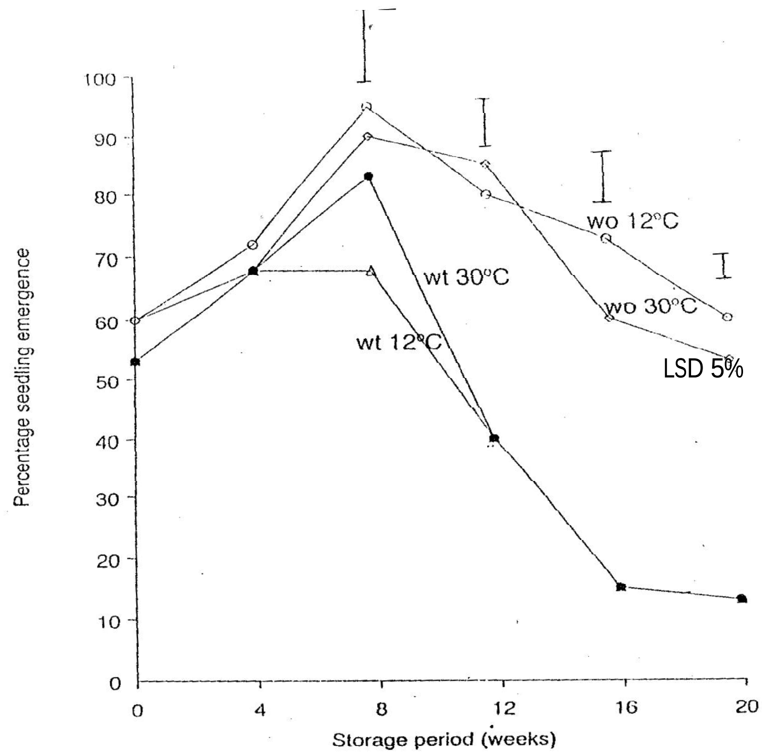

Fig. 5. Seedling emergence (%) trends from FUTM-Gkw seed stored with (wt) and without (wo) sarcotesta at 12 and 30°C

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