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GERMINATION PERFORMANCE OF *Dacryodes edulis* (Don. G. Lam H. J.) SEEDS FROM DRY AND MOIST HEAT SOFTENED FRUITS

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ABSTRACT

The study was designed to assess the germination performance of seeds from moist heat and dry heat softened fruits of D. edulis. Ripe fruits were harvested from mother trees and mixed together to mute any effects due to genotype and subjected to two heat treatments: forty-eight fruits were soaked in warm water at 57°C in the moist heat treatment, while a total of twenty fruits were placed on cooling hotplate at (54°C) in the dry heat treatment. Seeds were propagated in clear polythene bags 0.1 mm thick and 100 x 150 mm dimension at 26°C room temperature in a completely randomized design experimental layout. Data collected include: number of days before germination, germination count, total number of germinated seed, and duration of germination. While germination characteristics evaluated were: dormancy period, mean germination speed, mean daily germination, mean germination time, and germination capacity. Data analysis was carried out using Mann-Whitney U-test after a normality test confirmed data was non-normal. The results showed that dormancy period in seeds from dry heat softened fruits was 9 days and moist heat softened fruits 10 days: seeds from moist heat softened fruits however recorded higher mean germination speed (4 seed), germination capacity (100 %), mean daily germination (3 seeds), and lower mean germination time (8 days): while seeds from dry heat softened fruits recorded lower mean germination speed (0.33), germination capacity (55%), mean daily germination (1 seed), and higher mean germination time. There was a significant difference in germination performance of the two heat treatment methods. Dry heat penetrating D. edulis seed reduced the germination performance.

Keywords: germination characteristics, propagation

INTRODUCTION

Indigenous tropical fruit trees have continued to be relevant in the livelihoods of people in Nigeria despite the increased rate of importation of fruits. This is underpinned by the rising costs and therefore inadequate supply of imported fruits. Indigenous fruits are critical to diversification of local diet and improved nutrition of the people. Indigenous fruit trade is a local source of livelihood diversification, wealth and job creation. Therefore, fruit trees have continued to be livelihood assets in the rural areas that supply most traded indigenous fruit trees (Okonkwo, *et al.* 2020).

D. edulis is one of the important indigenous fruit tree species in Nigeria, west and central Africa (Tchoundjeu *et al.*, 2002). Although the species is little cultivated the supply of the fruit continues to thrive from the wild and home gardens. Locally, prices are about US$1per kilogram (kg) in Brussels to FF40 (US$5)/kg and FF50 (US$6)/Kg in Paris and Lyons. The mesocarp, which is eaten raw, boiled in water or roasted, is an important source of lipids and proteins. The oil content of the fresh pulp varies between 33 and 65% depending on the variety and the state of maturity (Ayuk, *et al.*, 1999: Tchoundjeu, *et al.*, 2002). The lipid fraction consist mainly of palmito-oleic acids with 47.33% of palmitic acid (C16:0), 27.35% of oleic acid (C18:2) and 20.46% of linoleic acid. The high content of fatty acids combined with its amino-acid content makes *D. edulis* an alternative source of vegetable oils for the food, pharmaceutical and cosmetic industries (Ayuk *et al.*, 1999). *D. edulis* also known as the African plum is an evergreen tree indigenous to the central Africa and Gulf of Guinea region. The natural range extends from Angola in the South, Nigeria in the North, Sierra Leone in the West and Uganda in the East. It is also cultivated in Malaysia (Lam, 1985). The tree has a relatively short trunk and a deep dense crown. The bark is pale gray and rough with droplets of resin (Kapseu and Tchiegang, 1996). The preferential habitat of *D. edulis* is a shady, humid tropical forest. However, it adapts well to variations in soil type, humidity, temperature, and day length. The major use of *D. edulis* is its fruit (Kengue, 1994). The fruit can take various forms and sometimes reach 15cm in length. *D. edulis* is also a source of shade, forage, timber and fuel wood, hence, a multipurpose tree (Etukudo, 2000). *D. edulis* is an economic fruit tree in south eastern Nigeria (Nwufor and Anyim, 1998). The pulp of the African pear plays a very important role in the nutrition of people living in the forest zone of South-eastern Nigeria. It is usually consumed as an accompaniment to fresh maize during the months of April to September. The African pear pulp is first softened in hot water, steam or hot ash before consumption (Onuegbu and Ihediohanma, 2008). Ojeifor, *et al.*, (2007) reported that some *D. edulis* seeds discarded after consumption of the pulp, sometimes, are found germinating. There was therefore the need to evaluate the effect of the two common methods of softening the fruit pulp before consumption locally on the germination performance of the seeds of *D. edulis.*

MATERIALS AND METHODS

Study Area

D. edulis fruits used in the study were collected from the Swamp Forest Research Station, Onne, Rivers State. The area is located between Lat.4^o 42, 08" and 4^o 42' 15" N and Long.7^o 10' 36" and 7^o 10' 42" E. Annual rainfall is 2500 mm with a mean value of 75% relative humidity in February and 80% in July. The mean minimum temperature is 25^{o}C (Okonkwo *et al.*, 2020).

Sample collection

A total of sixty-eight (68) fruits were harvest fresh from the mother trees and mixed together to mute effects due to genotype of seeds. Fruits were given two heat treatments viz: moist and dry heat. For the moist heat treatment forty-eight fruits of *D. edulis* were soaked in warm water at 57^{o}C, covered and left to soften. Fruits were checked at an average interval of about two (2) to three (3) minutes for softening. Softened fruits showed lacerations on the pulp. While in the dry heat treatment fruits of *D. edulis* were placed on a cooling electric hot plate 54^o C, covered and left to soften. The fruits were checked at intervals of one (1) minute for softening. There was total of twenty (20) fruits in the treatment. Seeds recovered were used in germination experiment. Seeds were propagated in clear polythene bags 0.1 mm thick and 100 x 150 mm dimension at 26^{o}C room temperature.

Experimental Design

Experimental layout used in the study was Completely Randomized Design with four replicates. Data collected were: (i) Number of days before germination inception, (ii) daily germination count, (iii) total number of germinated seed, and (iv) duration of germination. While germination characteristics evaluated were:

(1) Mean germination speed (MGS): This was calculated using the formula of

Gairola *et al.* (2011); Kebede and Yidinekachew, (2014):
Mean germination speed = $n_1/d_1+n_2/d_2+n_3/d_3+\ldots./N$ --------------1
Where, n = number of germinated seed, N = number of observations, d = number of days.

(2) Mean germination time (MGT): This was calculated as:
MGT= $d_1+d_2+d_3+\ldots /N$-----------2
Where, d = germination days, n = number of observations.

(3) Mean daily germination (MDG): This is calculated using the method of Czabator (1962); Kebede and Yidinekachew (2014):
MDG = Total number of germinated seed/Total number of days ------------3

(4) Number of days before first germination (dormancy period) (DP): This was the number of days from the sowing date to the first germination.

(5) Germination capacity (GC%): Calculated as:
Germination percentage (%) = Number of germinated seed/total number of seed x100 --4

Data analysis was carried out using Mann-Whitney U-test for two independent samples after a normality test confirmed data was non-normal and therefore not fit for t-test analysis.

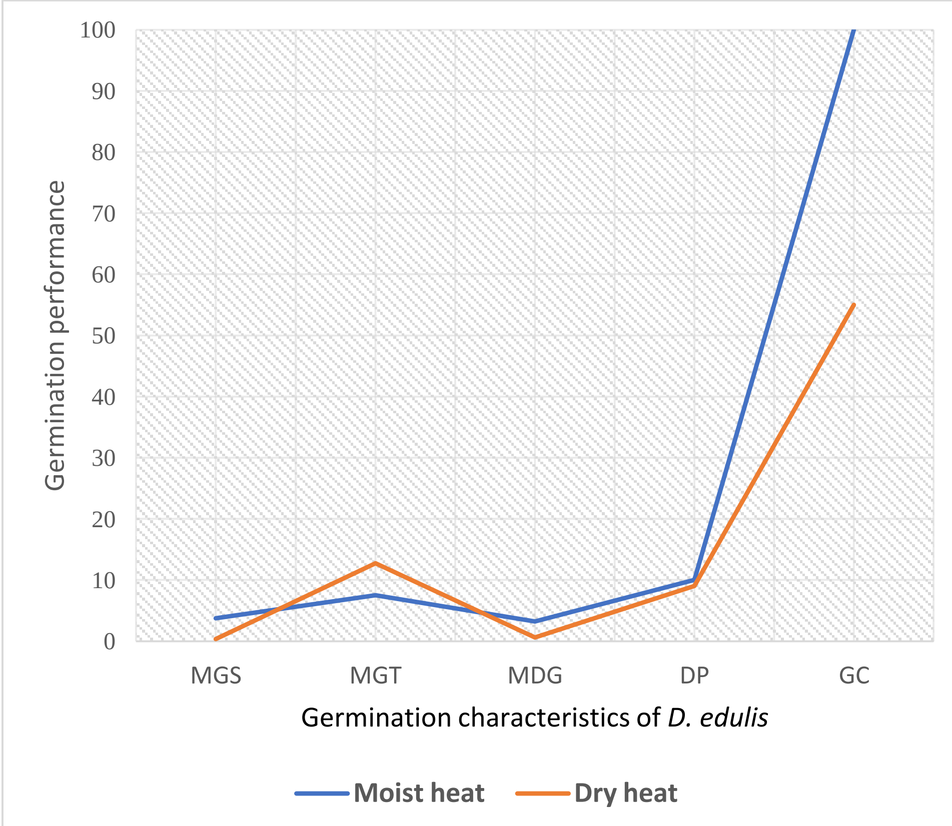
RESULTS

Dormancy period in seeds from dry heat softened fruits was 9 days while those from moist heat softened fruits was 10 days: seeds from moist heat softened fruits however recorded higher mean germination speed (4 seed), germination capacity (100 %), mean daily germination (3 seeds), and lower mean germination time (8 days): while seeds from dry heat softened fruits recorded lower mean germination speed (0.33), germination capacity (55%), mean daily germination (1 seed), and higher mean germination time (Fig. 1). Mann-Whitney test shows there was a significant difference in germination performance between *D. edulis* seeds from moist and dry heat softened fruits (Table 1).

Table 1: Mann-Whitney analysis of germination performance of *D. edulis* seed from moist and dry heat softened fruits.

Statistics	Moist heat	Dry heat
Count	5	5
Median	7.5	9
Rank sum	29	26
U	11	
U-critical	46**	

Note: ** = significant i.e. U-critical (46) > U (11).



(i) mean germination speed (MGS), (ii) mean germination time (MGT), (iii) mean daily germination (MDG), (iv) dormancy period (DP), and (v) germination capacity (GC%).

Figure 1: Evaluation of germination performance of *D. edulis* seed from moist heat and dry heat softened fruits using five characteristics of germination

DISCUSSION

Softening of *D. edulis* fruits by dry heat affected the ability of the seed to germinate negatively while softening with moist heat was safer. Although heat treatment often can be a pre-germination treatment for some type of seeds especially seeds with hard seed coat or physical dormancy (Pammenter and Berjak, 1999). *D. edulis* however does not possess hard seed coat and germinates readily (Agbogidi *et al.* 2007). *D. edulis* seeds therefore stand the risk of embryo damage or mortality when treated with heat as has been reported in some similar seeds. For example, Eyo-Matig, *et al.* (2007) reported that 24 hours heat treatment of *Garcinia kola* seeds in a cooling 70^0C water resulted in embryo mortality.

D. edulis seeds were not totally damaged by dry heat due to the presence of the mesocarp during fruit softening. However, dry heat unlike moist heat is able to penetrate the seed and damage the embryo and hence the reduced germination performance of the seeds from dries heat-treated fruits. Similar result has been reported in *Garcinia kola* by Okonkwo *et al.* (2020) who reported that *Garcinia kola* seeds treated with 30^oC hot water for 72 hours reduced the germination performance of the seed. Apart from reducing the germination performance of *D. edulis* seeds softening the fruits with dry heat also reduces the chances of establishment of seedlings from such seeds. For example, Nwoboshi, 1982 and Ekeke, 1995 reported that seedling vigour or the ability of young plants to grow rapidly and withstand environmental stresses tends to be greatest in seeds with high rates of germination. Embryos with a low rate of germination tend to produce weak and sometimes abnormal seedlings that are less able to withstand unfavourable environmental conditions. Therefore softening *D. edulis* fruits with dry heat is a threat to the survival of the next generation of *D. edulis* population and results in seed wastage and loss of germplasm.

CONCLUSION

Germination performance of moist heat softened *D. edulis* fruits was significantly better than those softened by dry heat. Dry heat was able to penetrate the seed coat and affect the embryo negatively enough to limit the germination performance of the seed. Moist heat therefore should be preferred over dry heat in softening *D. edulis* fruits in order not to reduce the germination performance and successful establishment of seedlings from discarded seeds in the wild.

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