The effect of seed size on the germination of *Dioscoreophyllum cumminsii* (Stapf)

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Abstract: The effect of seed size on the germination of *Dioscoreophyllum cumminsii*, a neglected indigenous fruit species in Nigeria was examined in this study. 120 seeds selected from seeds collected from 10 mother plants and were divided equally into three size classes namely: large, medium and small. The morphological parameters of the seeds were examined. The results obtained revealed that morphological variations abound in the seeds of this species and germination varied among the sizes of the seeds sown in the germination trays. Germination was observed to be directly proportional to the size of the seeds thus suggesting that the use of large seeds might be beneficial in the efforts to propagate the seeds of this species.

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Key words: Seed size, germination, indigenous fruit species, *Dioscoreophyllum cumminsii*

Introduction

Recent study by Kayode and Bamigboye (2016) listed *Dioscoreophyllum cumminsii* as one of the neglected indigenous fruit species (IFS) in Ekiti State, Nigeria, where a myriad of problems has been identified as disincentives to their cultivation despite their potentials in meeting the needs of the residents. The IFS has been identified as alternatives to food sources and reservoir of food diversity (Onyekwelu *et. al.,* 2012), basic insurance to food security and maintenance of nutritional balance. They are also source of medicine (FAO 1988) and potentials for the development of small scale industries as they could be processed into a number of products and thus contribute to employment and rural economy (Chigbu *et. al*., 2011).

The increasing number of endangered IFS and subsequent risk of extinction are now of serious concern to all stakeholders. Indeed, Obioh and Isichei (2006) opined that conservation is required as a salvage programme for most of the species. Kayode and Ogunleye (2008) observed that most Nigerian endangered species reproduced poorly and are presently poorly represented in the sapling stage. Thus, a viable conservation strategy must examine all agronomic features that would improve the reproductive nature of IFS. One of such is the size of the seeds.

Recent initiatives revealed that seed size is an important physical indicator of seed quality that affects vegetative growth (Ojo, 2000, Adebisi, 2004 and Ambika *et al*., 2014). Study by Nerson (2002) asserted that there is an association between seed physical parameters and seed quality. A wide array of different effects of seed size has been reported for seed germination, emergence and related agronomic aspects in many species (Ambika *et al*., 2014). Thus the study being reported here aimed at the examination of the effect of seed size on the germination of *D. cumminsii.* It an integral part of on-going efforts at the Department of Plant Science, Ekiti State University, Ado-Ekiti, Nigeria, aimed at the domestication and conservation of this wild IFS.

Materials And Methods

Seeds were collected from ten (10) mother plants. The collected seeds were thoroughly mixed together and 120 seeds selected. The selected seeds were divided equally into three size classes namely: Large, medium and small. The morphological parameters of the seeds – seed weight, seed length, breadth and diameter and seed volume - were examined.

The seed weight (g) was measured using sensitive scale while the length (cm) and diameter (cm) of the seeds were measured with a digital vernier caliper. Seed volume (cm^3) were estimated using displacement method by pouring water into volumetric flask to a known level after which the seeds were filled into the flask and the new level read. The difference between the two volumes was taken to be the volume of the seeds.

5 seeds each of the seeds in the three seed sizes were sown in germination trays. Germination in each tray was observed and recorded for 25 weeks. This germination experiment was replicated five times for each of the seed size examined.

Results

The results obtained revealed that morphological variations abound in the seeds of *D. cumminsii* (Table1), The seed weights of 40 seeds were 5, 8 and 9g for small, medium and large seeds respectively. The average lengths and breadths were 0.57 and 0.40cm, 0.68 and 0.48cm, 0.87 and 0.61cm respectively for small, medium and large seeds respectively. The average diameter of small seed was 1.86cm, medium seeds 2.04cm and large seeds 2.13cm. The volumes of 40seeds were 5, 6 and 7ml for small, medium and large seeds respectively.

Table 1: Morphological Variation in Seeds of *D. cumminsii*

Parameters	Seed Sizes		
	Small	Medium	Large
Weight of 40 seeds (g)	5	8	9
Average length (cm)	0.57	0.68	0.87
Average breadth (cm)	0.40	0.48	0.61
Average diameter(cm)	1.86	2.04	2.13
Volume of 40 seeds (ml)	5	6	7

Table 2 revealed that the occurrence of germination varied among the sizes of the seeds sown in the germination trays. Germination was observed to be directly proportional to the size of the seeds. Germination was first observed at 97, 133 and 137 days after sowing in the large, medium and small seed sizes respectively. Similarly, the % seed germination increased with increase in the size of the seeds.

Table 2: Effects of seed size on germination of *D. cumminsii*

Parameters	Seed sizes		
	Large	Medium	Small
(a) Number of days taken for first germination to be observed:	97	133	137
(b) Total number of germinated seeds @ 25 weeks	4	3	2
(c) % seed germination @ 25 weeks	16	12	8

Discussion

Results obtained in this study revealed that the large seed size had the best germination in terms of reduced time of germination and % seed germination. The proportion of germinated seeds observed in this study confirmed the assertion that germination of *D. cumminsii* is extremely poor in the study area. This has been a major disincentive to its adoption for cultivation in the study area.

Previous studies conducted in some species asserted that large seed size is generally assumed to provide individuals with a competitive advantage (Black 1958; Harper *et. al.*, 1970; Fenner 1980; Gross and Werner 1982; Gross 1984). For example, Suresha *et al*. (2007) reported that in soap nut, the larger size seeds possessed higher percentage (98%) of germination. Also, Nagaraju (2001) noticed higher germination percentage in large size seeds compared to small seeds in sunflower. In rice, Roy *et. al.*, (1996) observed that germination rate and seedling vigour index values increased with the increase in seed size.

Similarly with increased seed size, higher germination and emergence was determined in triticale (Kaydan and Yagmur, 2008). Mandal *et al.* (2008) noted that in *Hyptis suaveoleus*, variation in seed size and mass influenced emergence; large seeds showed a higher emergence potential than smaller seeds.

The use of large seed size has also been observed to possess other agronomic advantages. Manonmani *et al*. (1996) and Gunaga *et al*. (2007) have recorded higher seed germination and seedling vigour by using bigger sized seeds in *Pongamia pinnata* and *Vateria indica* respectively. In wheat, Ries and Everson (1973) as well as Cookson *et al.* (2001) asserted that larger seeds tend to produce more vigorous seedlings. Larger seeds were capable of emerging from greater planting depths and showed an enhanced ability to penetrate ground cover and survive burial by litter (Mandal *et al*., 2008). Some researchers showed that large soybean seeds are preferable in stress condition (Hanley *et al*., 2007). Menaka and Balamurugan (2008) proved that larger seeds of *Amaranthus* possess higher physiological quality.

In conclusion, the results obtained in this study tend to suggest that the use of large seeds might be beneficial in the efforts to propagate the seeds of this important IFS.

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