Morphological Variations in Traits of African Pear Fruit
(Dacryodes edulis (G.Don) H.J. Lam) Provenance

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Abstract: An experiment was conducted at the sustainable forest management nursery of the Forestry Research Institute of Nigeria, Ibadan, Oyo state, Nigeria to determine the morphological variations in traits of African pear fruit (Dacryodes edulis (G.Don) H.J. Lam) provenance with a view of selecting the best provenance for seed collection. Dacryodes edulis is a potential fruit tree that serves the dual function of human nutrition and industrial raw material. The improvement of D. edulis offers opportunities to improve the livelihoods of both agroforestry farmers and subsistence farmers. Fruits were collected from D. edulis trees from Edo, Delta, Ondo and Oyo state, Nigeria. The extracted seeds were planted in a 17 by 20 cm diameter depth propagating pots that were arranged in a completely randomized design (CRD) with five replications. Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS 2000). Means were compared using Duncan Multiple Range Test at 5% level of probability (P ≤ 0.05). Results obtained showed that there were significant differences among the provenance in all the morphological traits evaluated in this study. Significant differences observed among the provenance for all the traits evaluated in this study indicated variation in the performance of the provenance. This suggests that Dacryodes edulis is a wide range adaptable crop and any of the traits can be selected in any of the provenance which implies that there is potential for selection among the provenance.

Key word: Dacryodes Edulis, Morphological Traits, Provenance, Selection

INTRODUCTION
African pear (Dacryodes edulis (G.Don) H.J. Lam) is a popular fruit tree indigenous to West Africa. The fruit are edible, and the bark; leaves, stem, and roots are employed for a variety of purposes (Neuwinger 2000; Waruhiu, Kengue, Atangana, and Tchoundjeu and Leakey, 2004). The fruit pulp may be cooked (softened) or eaten raw. Cooked flesh of the fruit has a texture similar to butter. Oil from the fruit is rich in amino acids and triglycerides and can augment common household oils (Ajiwe, Okeke, Nnabuike, Ogunleye and Flebo. 1997; Ikhouria and Malikii, 2007; Kapseu and Tchiegang, 1996). Increasingly, the species is becoming commercially important. The fruit are sold in local markets and, to some level, have attracted international trade (Ajabesin 2011; Awono, Ndoye, Schreckenberg, Tabuna, Isseri, and Temple, 2002). In addition to the use of African pear fruits as a staple food, there is growing interest in preparing fruits into preserves like jams, jellies, and in the extraction of the oil for cooking or use in the margarine, soap and perfume industries (Sonwa, Okafor, Mpungi, Buyungu, Weise, Tcha, Adesina, Nkongmeneck, Ndoye and Endamana, 2002). Dacryodes edulis trees are also important for the provision of shade and is commonly found in homegardens and in smallholder cocoa farms in Cameroon (Leakey and Tchoundjeu, 2001).

Nutritionally, the fruits of Dacryodes edulis contain adequate amount of fatty acids such as palmitic acids, linoleic acid and oleic acids (Iyare, 2009). Besides lipids, the pulp also contains substantial amounts of many other nutrients which include proteins, carbohydrates, minerals, vitamins and fibres (Obame, Edou, Bassolle, Koudou, Agnaniet, Eba, and Traore, 2008). Oil from the fruit is rich in amino acids and triglycerides and can augment common household oils (Ajiwe et al., 1997; Ikhouria and Maliki, 2007; Kapseu and Tchiegang, 1996). Iyanre (2009) reported that the physiochemical analysis suggested that the seeds have valuable functional attributes of industrial interests. The socio-economic importance of D. edulis has been documented (Schreckenberg, Degrande, Mbosso, Boli Baboulé, Boyd, Enyong, Kanmegne, and Ngong, 2002). Trees are predominantly planted as shade trees in association with cocoa or coffee, where they are also a source of income, as their fruits are widely traded locally and regionally (Ndoye, Pérez and Eyebe, 1998.) and even internationally (Awono et al., 2002). There are opportunities to develop D. edulis fruits as an oil crop (Kalenda, Missang, Kink, Krebs and Renard, 2002). It is being recognised that D. edulis plays an important role in alleviating the threats on food security caused by disturbances to the balance of nature arising from human activities. As demand for fruits and other non-timber forest products are increasing, their supply from the forests is threatened by increasing deforestation. This situation of increasing demand and decreasing supply of fruits from the wild necessitate an urgent domestication of the trees and this involves selection of elite trees for multiplication (Schreckenberg, Awono, Degrande, Mbosso, Ndoye and Tchoundjeu, 2006).
The need for expansion and tree improvement for improved tree quality and fruit yield requires better understanding of the morphological components (Vaughan and Zuno-Alto 1988). A successful breeding programme will depend on the genetic diversity of a crop for achieving the goals of improving the crop and producing high yielding and better resistant varieties (Padulosi, 1993). Therefore, there is the need to diversify the genetic base of improved *Dacryodes edulis*, and the first step towards this is to evaluate the germplasm or genotypes at morphological level. This is because the evaluation of phenotypic diversity usually reveals important traits of interest to plant breeders (Singh, 1989).

Survey on farmers’ species prioritized for agroforestry identified *D. edulis* as a priority species for domestication in the humid lowlands of West Africa (Tchoundjeu, Kengue and Leakey 2002), therefore, this study examines the morphological variations in traits of African pear fruit, *Dacryodes edulis* provenance with the aim of providing knowledge on which source to base plus-tree selection for species development.

**MATERIALS AND METHODS**

**Seed collection and processing**

Fruits were collected from *Dacryoides edulis* trees from Edo, Delta, Ondo and Oyo state, Nigeria at the peak of the fruiting season. These mature and undamaged fruits were randomly picked among the recent-fallen fruits from four quarters of each tree crown at the tree. The fruits from each tree were bagged and labeled for assessment. The seeds were gently removed manually to avoid splitting of the seeds.

**Description of experimental sites and climate**

The experiment was conducted at the sustainable forest management nursery of the Forestry Research Institute of Nigeria, Ibadan, Oyo state, Nigeria.

The study area, Nigeria, lies between 4-14°N and 3-15°E in the Southern edge of West Africa. The country is characterized by two main seasons: dry and rainy season. The wet season commences from April and lengthened till November, distributed in a distinct bimodal pattern with high proportion in July and September with a short dry spell in August and a long dry spell in December to April. Ibadan is located on the latitude of 7° 16’N and longitude of 3° 47’E at 255m above sea level.

**Experimental set-up and plant management**

The extracted seeds were planted in a 17 by 20 cm diameter depth propagating pots that were arranged in a completely randomized design (CRD) with five replications. The soils were well drained, with an average pH value close to 7.0. The cultural operations carried out were manual elimination of weeds and frequent watering to maintain soil moisture. The experiments were terminated at 9 months old when enough morphological data has been collected.

**Data collection**

The following variables were collected:

1. Number of leaves per plant: This was done by counting the number of leaves
2. Plant height (cm): The heights of the seedlings were taken from the soil surface to the tip of the main stem with the aid of a ruler.
3. Collar diameter (mm): collar diameters of the seedlings were measured using digital venier caliper.
4. Leaf length (cm): This was measured from the stalk to the apex of the leaf using ruler.
5. Leaf breadth (cm): This was measured at the centre of the leaf using ruler.
6. Leaf length/breadth ratio: This will be determined as the ratio of the leaf length to breadth ratio.
7. Fresh weight (g): Weighing the fresh plant using sensitive weighing balance.
8. Dry weight (g): by the used of oven. The seedlings were placed in oven at constant temperature of 70°C until a constant weight is attained.

**Data analysis**

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS 2000). Means were compared using Duncan Multiple Range Test at 5% level of probability (P ≤ 0.05).

**RESULTS AND DISCUSSION**

Table 1 shows the mean square of analysis of variance for the effect of provenance on the morphological characters evaluated in *Dacryodes edulis*. The mean squares revealed significant morphological effect for all the traits. Significant differences observed among the provenance for all the traits evaluated in this study indicated variation in the performance of the provenance. This suggests that *Dacryodes edulis* is a wide range adaptable crop and any of the traits can be selected in any of the provenance which implies that there is potential for selection among the provenance. The major role of morphological traits in phenotypic variation is consistent with the works on *Irvingia gabonensis* (Atangana et al., 2002) and *D. edulis* (Waruhiu et al., 2004).
Table 1: The mean square of analysis of variance for the effect of provenance for the morphological characters evaluated in Dacryodes edulis.

<table>
<thead>
<tr>
<th>SV</th>
<th>DF</th>
<th>NOL</th>
<th>PLT HT</th>
<th>COL DIA</th>
<th>LEAF LEN</th>
<th>LEAF BR</th>
<th>LLB RATIO</th>
<th>INT DIS</th>
<th>FRESH WT</th>
<th>DRY WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROV</td>
<td>3</td>
<td>88.73**</td>
<td>112.15*</td>
<td>8.90**</td>
<td>29.82*</td>
<td>13.79*8</td>
<td>1.31**</td>
<td>8.29*</td>
<td>22.17**</td>
<td>5.28**</td>
</tr>
<tr>
<td>ERROR</td>
<td>16</td>
<td>21.13</td>
<td>37.87</td>
<td>1.78</td>
<td>8.04</td>
<td>3.95</td>
<td>0.16</td>
<td>2.49</td>
<td>2.74</td>
<td>1.09</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
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</table>

** significant at p<0.01, * significant at p<0.05


Table 2 shows the mean performance of the morphological characters as influence by provenance in Dacryodes edulis. All the provenance differed significantly with respect to all the traits. Number of leaves was 15.83 and 22.62 for Delta and Edo state respectively. Plant height was not significantly different in Edo and Delta provenance but these were significantly different from the other provenance. It was observed that Ondo had the shortest plant of 22.56cm.

All the provenances differ significantly in terms of leaf length. Delta provenance had a leaf length of 14.20cm whereas that of Ondo was 10.96cm. The highest dry weight of 7.08g was recorded for Edo provenance whereas Delta provenance had a leaf length of 10.96cm. All the provenances differed significantly in terms of plant height. Plant height was not significantly different in Edo and Delta provenance but these were significantly different from the other provenance. It was observed that Ondo had the shortest plant of 22.56cm. The existence of wide morphological variations among the provenance has been caused by the growing conditions (Ndoumbe, M., Leakey, R.R.B. 2002).

The highest dry weight of 7.08g was recorded for Edo provenance whereas Delta provenance had a leaf length of 14.20cm whereas that of Ondo was 10.96cm. The existence of wide morphological variations among the provenance which was observed by significant difference in the four provenance provided the opportunity to select this tree crop in different locations. Some traits performed well in certain provenance, this is an indication that farmers seeking crop improvement and conservation strategy can select among the provenance.

Table 2: Mean performance of the morphological characters as influence by provenance in Dacryodes edulis

<table>
<thead>
<tr>
<th>Provenance</th>
<th>NOL</th>
<th>PLT HT</th>
<th>COL DIA</th>
<th>LEAF LEN</th>
<th>LEAF BR</th>
<th>LLB RATION</th>
<th>INT DIS</th>
<th>FRESH WT</th>
<th>DRY WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oyo</td>
<td>16.60c</td>
<td>23.76b</td>
<td>6.79c</td>
<td>13.54b</td>
<td>5.25c</td>
<td>2.58a</td>
<td>6.91b</td>
<td>15.46bc</td>
<td>6.51b</td>
</tr>
<tr>
<td>Ondo</td>
<td>20.21b</td>
<td>22.56c</td>
<td>6.68c</td>
<td>10.96d</td>
<td>6.10a</td>
<td>2.09b</td>
<td>4.86d</td>
<td>12.95d</td>
<td>6.35b</td>
</tr>
<tr>
<td>Delta</td>
<td>15.83c</td>
<td>27.66a</td>
<td>7.08ab</td>
<td>14.20a</td>
<td>7.56a</td>
<td>2.03b</td>
<td>6.26c</td>
<td>15.49bc</td>
<td>5.96c</td>
</tr>
<tr>
<td>Edo</td>
<td>22.62a</td>
<td>27.26a</td>
<td>7.36ab</td>
<td>12.70c</td>
<td>5.93b</td>
<td>2.20b</td>
<td>7.38a</td>
<td>17.16a</td>
<td>7.08a</td>
</tr>
</tbody>
</table>


CONCLUSION

The result from this study had clearly indicated that there were sufficient variations among the provenance of Dacryodes edulis used in this study as indicated by wide range of variability among the characters evaluated. Thus, there is potential for selection among the provenance. The study also showed the traits performed differently under the four provenances used in this study. The significant difference in the four-provenance observed provided the opportunity to select and conserve the genetic materials from these locations. The existence of wide morphological variation among the provenance is useful information towards the selection of this choice species for improvement and conservation purposes as greater variation will enhance its survival fitness of the species.

REFERENCES


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