Differences of fruit morphology and nutrient composition of baobab fruits from Eastern and Coastal Kenya

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Background and objectives

Baobab *(Adansonia digitata* L.*)* is an indigenous fruit tree in sub-Saharan Africa (SSA). It is a multipurpose, drought tolerant species and its fruits contain valuable nutrients, which can contribute to combat malnutrition in African drylands. Our recent review study on the nutrient composition of ten indigenous fruits in SSA (including baobab) showed a huge variability of the published data.[1] Regarding baobab, the review showed in addition a lack of information in Kenya.

The objective of the present study is to evaluate the variability of morphological characteristics and nutritional composition of baobab fruits from Eastern and Costal Kenya aiming at selecting superior mother trees for future domestication programs.

Materials and methods

Along a transect from Eastern to Coastal Kenya, 64 individual baobab trees were sampled at different geographical locations from September to December 2012. For statistical analysis, geographical regions were divided in coastal (Malindi, Kilifi and Diani) and inland (Voi, Mtito Andei and Kibwezi) clusters (Figure 1). For each of the trees (Figure 2) GPS locations were documented and 5-10 fruits randomly sampled.

Morphological characteristics of the fruits were assessed, including qualitative (e.g. fruit shape, pulp colour, pulp aroma) and quantitative (e.g. fruit length, weight of fruit, pulp and seed, number of seeds) traits (Figure 3; Figure 4). The methodology used for the morphological characterization of baboab was adapted from ´Descriptors for mango (*Mangifera indica* L.)´, developed by Bioversity International.[2]

For nutritional analysis fruit pulp of all fruits per tree were merged to form composite samples. The components being analyzed include water, vitamin C, total acidity, sugar and selected minerals.

Statistical analysis was undertaken by using SPSS (Mann-Whitney test and correlation analysis).

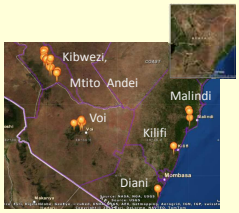

Figure 1. Sampling locations of baobab fruits in Eastern and Coast Provinces of Kenya

Figure 2. One of the sampled Baobab trees in Kibwezi , Kenya

Results I
Morphological characteristics of Baobab fruits

Figure 3. Example of whole and open baobab fruit with whitish fruit pulp covering the seeds

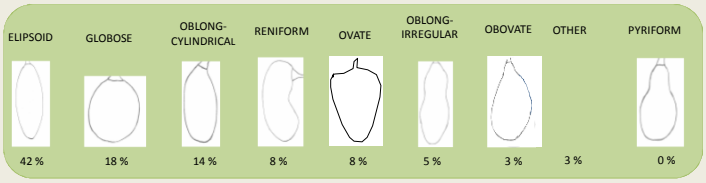

Figure 4. Different fruit shapes used for morphological characterization and frequency of fruit shapes (%) among all collected fruits

The most frequent fruit shape among all collected fruits was ellipsoid (42%), followed by globose (18%) and oblong cylindrical (14%) (Figure 4). No fruit was found to have a pyriform fruit shape.

Table 1. Quantitative characteristics of the sampled baobab fruit and fruit parts separately for coastal and inland accessions

		Fruit length (cm)	Fruit diameter-longitudinal section (cm)	Fruit weight (g)	Pulp weight (g)	Number of seeds/fruit	Proportion of pulp weight to total fruit weight (%)	Proportion of total seed weight to total fruit weight (%)
Coast	**Median**	**23.2**[a]	**8.9**[a]	**257**[a]	**44**[a]	**170**[a]	**17**[a]	**25**[a]
	range	14.6–29.8	7.3-11.6	138- 627	4-125	98-279	12-22	18-40
	n	15	15	15	15	15	15	15
Inland	**Median**	**12.7**[b]	**7.6**[b]	**115**[b]	**23**[b]	**76**[b]	**18**[a]	**34**[a]
	range	8.5–17.6	5.0-9.7	61-227	8-47	30-218	11-34	18-49
	n	49	49	49	49	49	49	49

Where significant difference was seen within a column ($p \leq 0.05$; Mann-Whitney test), values are lettered in [a] and [b].

Morphological fruit characteristics differed significantly between accessions from coastal and inland zones (Table 1). Fruits in costal areas were bigger and heavier compared to fruits from the inland. The smallest individual fruit (length: 6.6 cm) was found in Kibwezi and the longest individual fruit (length: 36.6 cm) in Malindi. One fruit from Voi area had lowest (20 g) and another from Kilifi area the highest fruit weight (713 g). Fruit weight and pulp weight of the 64 accessions correlated significantly (r = 0.954***; Figure 5a), whereas no significant correlation was found between fruit weight and proportion of pulp weight to total fruit weight (Figure 5b).

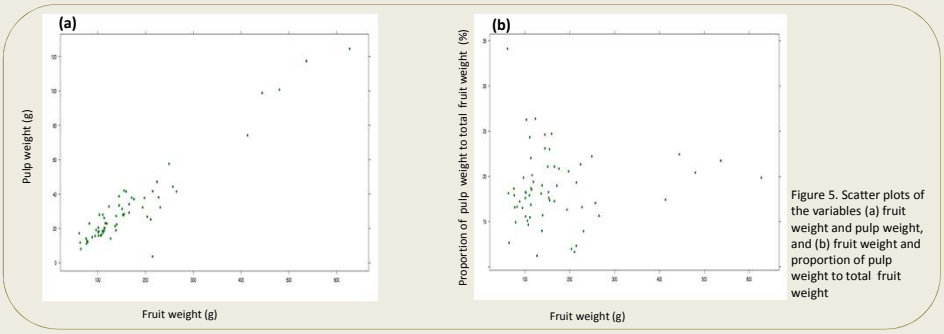

Figure 5. Scatter plots of the variables (a) fruit weight and pulp weight, and (b) fruit weight and proportion of pulp weight to total fruit weight

Results II
Nutrient composition of Baobab fruit pulp

Nutrient analyses are currently being undertaken to assess whether the detected tree-to-tree variability of morphological traits is also reflected in the nutrient composition of the fruit pulp. Water values per accession ranged from 8.9 to 11.5 g/100 g fresh weight of edible portion (EP).

Vitamin C analysis (via titrimetric method) have been carried out on 1/3 of the samples so far. The fruit pulp vitamin C content of the accession ranged from 54 mg to 157 mg/100 g EP. Compared to average values found in the literature (273 mg/100 g EP)[1] the values in the current study are rather low. This may be attributed to the long storage duration (11 months) of the fruit samples before analysis. However, for detailed discussion and interpretation of the values the entire data set needs to be analyzed.

Conclusion

Preliminary results of this study show that morphological differences of baobab fruits exist among geographical areas in Kenya. It is expected that the analysis of the nutrient components will result in similarly high tree-to-tree differences. The outcomes of this study will be useful for developing future domestication programs and for promoting the consumption of these valuable indigenous fruits.

References
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Presented at the 3rd NUS conference, Accra, Ghana, 25-27 Sep 2013