World Journal of Agricultural Sciences 15 (3): 169-172, 2019
ISSN 1817-3047

DOI: 10.5829/idosi.wjas.2019.169.172

Phenotypic Variation in Fruit Size of Three Southern Provenances of *Allanblackia floribunda* Oliv. In Nigeria

H.O. Okonkwo, O.A. Koyejo and R.I. Oyediran

Swamp Forest Research Station, Onne, River State, Nigeria

Abstract: The study is aimed at identifying phenotypically promising provenances of *Allanblackia floribunda* in the country for subsequent capture through vegetative propagation for the development of improved cultivar. Twenty fruits collected from each of three southern provenances, Sapoba (Benin), Ndoki (Rivers) and Onne (Rivers), of *A. floribunda* in Nigeria were assessed for variability in three fruit traits: length, width and weight. The results showed that there were no significant differences ($p>0.05$) in the three fruit traits among the three provenances. There was however significant difference ($p<0.05$) in fruit length between Onne and Benin (Sapoba) provenances. Ndoki provenance showed the highest mean fruit width (39.58 cm), Onne provenance the highest mean fruit length (31.025 cm) and Ndoki provenance the highest mean fruit weight (1.9kg). Highest within provenance variability was recorded in Onne provenance fruit width (25.25) with a corresponding highest standard deviation from the mean (5.02 cm). Although the study did not assess tree to tree fruit trait variability and traits like number of seed per fruit, seed weight, good and bad seed ratio were not assessed, it is suggestive of the level of variability within the provenances. Follow up study may need to increase the number of provenances investigated as well.

Key words: Domestication · Improvement · Cultivation

INTRODUCTION

Allanblackia belongs to the family Clusiacaea [1]. It is found in the rainforest region of Africa. In Nigeria the species *Allanblanckia floribunda* Oliver is a medium sized forest tree, reaching a height of 30 cm with a straight bole. Although the tree grows mainly in the Niger-Delta States of Rivers, Cross-Rivers, Edo and Delta, it is also found in Ogun, Ebonyi, Ondo, Osun, Imo, Enugu, Anambra, Abia, Ekiti and Lagos States. However, potential areas include Adamawa, Taraba, Nassarawa and Benue States.

Various parts of the tree have been found to be used for different purposes. For example, the trunk is used as timber, while the bark, twig, leaves and roots are useful for curing ailments such as dysentery, tooth ache, malaria, cough and pains [2]. Recent findings have shown that the vegetable oil extracted from seeds of *A. floribunda* have properties which makes it ideal for manufacturing margarine: extraction from the seeds also contains stearic acid, suitable for production of soaps and cosmetics [1].

Since 2005, FRIN in collaboration with ICRAF and other partners have supported a project entitled "Domestication of *A. floribunda in Nigeria"*. The goal of the project is to develop strategies for sustainable production of *A. floribunda* in order to increase farmers' income, reduce rural poverty and reduce wild collection.

Allanblackia domestication is a multi-location project with strong development/extension/conservation component. While thousands of trees do exist in natural forest many are not accessible, many do not fruit and the species is dioecious making it difficult to separate the sexes in the wild. The species is declining due to forest destruction and subsequently has been labeled a threatened species in 2008 by the International Union for Conservation of Nature (IUCN) [1]. Farmers currently rely on unsustainable wild harvesting of few stands remaining in the forest. But propagation of the species had been reported to be constrained by low and delayed germination thus the attention is now on domestication [3]. More productive, sustainable and higher-value planted Allanblackia materials developed will provide environmental, social and economic benefits to selected

Corresponding Author: Okonkwo Henry O., Swamp Forest Research Station, Onne, River State, Nigeria.
Tel: +234 7032213189.

and participating communities. The purpose of domestication is to improve livelihoods by developing and promoting low-technologies for the propagation and integration of Allanblackia in farming systems in order to enhance alternative income generation for resource poor farmers in Nigeria and at the same time saving the species from the risk of extinction.

The poor germination of *A. floribunda* seeds has led to the development of vegetative propagation protocols for the species such as the work done by Munjuga *et al.* [3]. In vegetative propagation care is always taken to ensure that the clones deployed to farmers for cultivation are the best from the wild gene pools in the country. Therefore the present study is aimed at identifying phenotypically promising provenances in the country for subsequent capture through vegetative propagation. The study assessed fruits from three provenances in the country for phenotypic variability in three morphometric characters of fruit length, width and weight. This is preliminary study therefore efforts are on to compare all the provenances in the country and other morphometric characters.

MATERIALS AND METHODS

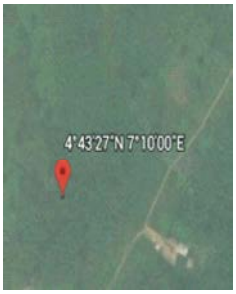
Benin (Sapoba), Ndoki (Oyigbo) and Onne (Table 1) are the three provenances that have provided the clones used for vegetative propagation of *A. floribunda* at the Swamp forest research station Onne of the forestry research institute of Nigeria. Twenty fruits were therefore collected from each of the three provenances for the preliminary study of the fruit traits. Fruits were measured fresh and three fruit traits were measured viz: fruit weight measured with a weighing balance, length and breadth measured with a meter tape. Analysis of variance and descriptive statistics were used to assess the significance of variation among the three provenances.

RESULTS AND DISCUSSION

Analysis of variance show that there were no significant differences ($p>0.05$) in fruit width and weight among the three southern Nigeria provenances of *A. floribunda*. This is in agreement with Leakey *et al.* [4] that found there were no significant differences ($p>0.05$) in fruit nut mass of *Sclerocarya birrea* subsp *caffra* beween geographic locations in Namibia. There was however a significant difference ($p<0.05$) in fruit length between Onne and Benin provenances. This is in agreement with Atangana *et al.* [5], Leakey *et al.* [6] and Jenya *et al.* [7] who found significant differences ($p<0.05$) in fruits/nuts between some provenances/populations of *Irvingia gabonensis, Canarium indicum* and *Adansonia digitata*, respectively. However since this is not a detailed study that involves intra-provevnance tree to tree fruit trait investigation like in Atangana *et al.* [5], Leakey [8], Para *et al.* [9] and Shanjani *et al.* [10] this result may not be taken as conclusion but only indicative.

Figure 1 shows the mean fruit length, width and weight among the three southern provenances of *A. floribunda*. Ndoki provenance showed the highest mean fruit width (39.58 cm), followed by Benin provenance (33.51 cm) and the lowest mean fruit width was found in the Onne provenance (28.79 cm): Onne provenance showed the highest mean fruit length (31.025cm), followed by Ndoki provenance (29.62 cm) and the least mean fruit length was Benin (28.81 cm): and once again Ndoki provenance showed the highest

Table 1: Climatic data and satellite image of Sapoba, Oyigbo and Onne provenances.

	Sapoba (Benin)	Oyigbo	Onne
Latitude	6° o5’55’’N	4°51’02’’N	4°43’27’’N
Longitude	5° 53’40’’E	7°06’48’’E	7°10’00’’E
Annual mean Rainfall	2132 mm	3500 mm	2400 mm
Annual mean Temp.	26.2 °C	27 °C	26 °C
Satellite image			

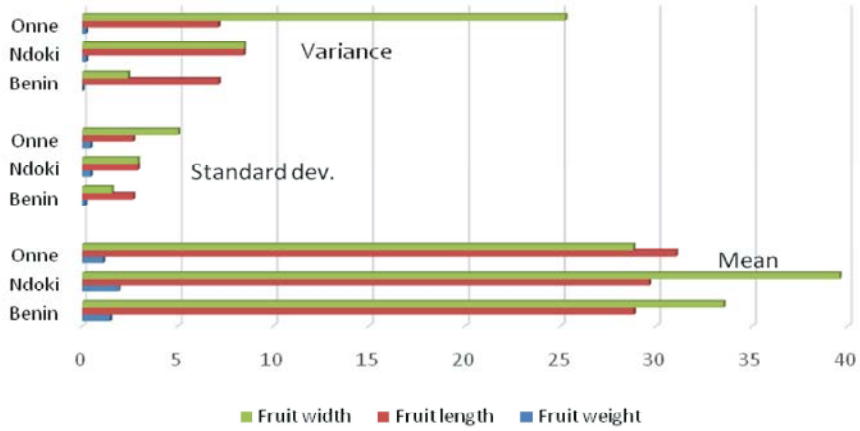


Fig. 1: Mean and standard deviations from the mean in some fruit traits of three southern provenances of *A. floribunda*.

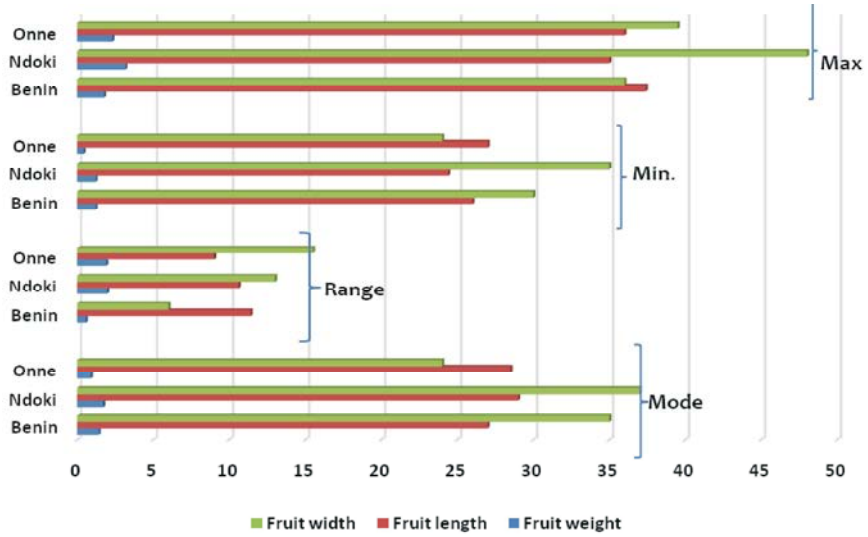


Fig. 2: Descriptive statistics of fruit trait the three southern Nigeria provenances of *A. floribunda.*

mean fruit weight (1.9 kg), followed by Benin (1.46cm) and the least mean fruit weight was recorded in the Onne provenance (1.103 cm). Standard deviations from the mean among the three provenances was highest in Onne provenance fruit width (5.02) with the resulting highest variability (25.24): this is followed by Ndoki provenance with a standard deviation from the mean of (2.91) and 8.47 variance, the least is Benin provenance with fruit width standard deviations of (1.55) and variance of (2.40) (Figure 1). Standard deviations from the mean of fruit length was very close in the three provenances and the same for the variance viz: Benin (2.50), Ndoki (2.91) and Onne (2.66) and variance was Benin (7.14), Ndoki (8.45) and Onne (7.12) respectively (figure 1). Standard deviations from the mean fruit weight was Benin (0.16), Ndoki (0.45) and Onne (0.44) and their respective variances were Benin (0.03), Ndoki (0.21) and Onne (0.19) (figure 1).This in agreement with Jenya *et al.* [7] and De Smedt *et al.* [11] who found within provenace variations in seed and fruit traits of *Adansonia digitata* in Malawi and Mali respectively.

Maximum (Max.) and minimum (Min.) fruit width was 48cm and 35cm in the Ndoki provenance with a mode of 37cm and a range of 13cm: fruit length was max. 35cm, min. 24.4cm, mode 29cm and range 10.6cm: while fruit weight was max. 3.15kg, min. 1.2kg, mode 1.7kg and range 1.95kg (Figure 2). Onne provenance had fruit width max. 39.5cm, min. 26cm, mode 24cm and range 15.5cm: fruit length max. 36cm, min. 27cm, mode 28.5cm and range 9cm: fruit weight max. 2.3kg, min. 0.4kg, mode 0.9kg and range 1.8kg (Figure 2). Benin provenance had fruit width max. 36cm, min. 30cm, mode 35cm and range 6cm: fruit length max.

37.4cm, min. 26cm, mode 27cm and range 11.4cn: fruit weight max. 1.75kg, min. 1.2cm, mode 1.4kg and range 0.55kg. The results are in agreement with Jenya *et al*. [7], Leakey [8], Para *et al.* [9] and Leakey and page [12] who found intra and inter-provenace variations in fruit traits of some indigenous fruit trees.

CONCLUSION

The study shows that the three southern provenances of *Allanblackia floribunda* Ndoki, Benin (Sapoba) and Onne were not significantly different in fruit weight and width. Onne and Benin (Sapoba) provenances however were significantly different in fruit length. The largest fruit (48cm width) was found in Ndoki provenance, the longest fruit (37.4cm long) was found in the Benin (Sapoba) provenance, while the heaviest fruit (3.15kg) was found in the Ndoki provenance. This provides some guidance in the collection of scion and clones for improved cultivar development in the species domestication effort in the country.

REFERENCES

1. Tsobeng, A., E. Asaah, R. Leakey, Z. Tchoundjeu, V. D. Patrick, D. Ofori and R. Jamnadass, 2018. Effects of pre-severance irradiance on the growth of *Allanblackia floribunda* (Oliv.) stockplants and on the subsequent rooting capacity of leafy stem cuttings. New forests, Springer nature B. V: author's personal copy.
2. Asaah, E.K., 2012. Beyond vegetative propagation of indigenous fruit trees: case study of *Dacryodes edulis* (G. Don) H. J. Lam and Allanblackia floribunda Oliv. PhD. Thesis, Faculty of Bioscience Engineering, Ghent University, Belgium, pp: 231.
3. Munjuga, M., D. Ofori, C. Sawe, E. Asaah, P. Anegbeh, T. Peprah, M. Mpanda, L. Mwaura, E. Mtui, C. Sirito, A. Atangana, S. Henneh, Z. Tchoundjeu, R. Jamnadass and A. J. Simons, 2008. Allanblackia propagation protocol. ICRAF, 1-44.
4. Leakey, R., K. Pate and C. Lombard, 2005. Domestication potential of Marula (Sclerocarya birrea subsp caffra) in South Africa and Namibia: Phenotypic variation in nut and kernel traits. Agroforestry Systems, 64: 37-49.
5. Atangana, A.R., Z. Tchoundjeu, J.M. Fondoun, E. Asaah, M. Ndoumbe and R.R.B. Leakey, 2001. Domestication of Irvingia gabonensis: Phenotypic variation in fruits and kernels in two populations from Cameroon. Agroforestry Systems, 53: 55-64.
6. Leakey, R.R.B., S. Fuller, T. Treloar, L. Stevenson, D. Hunter, T. Nevenimo, J. Binifa and J. Moxon, 2008. Characterization of tree-to-tree variation in morphological, nutritional and medicinal properties of Canarium indicum nuts. Agroforest Syst, 73: 77-87. DOI 10.1007/s10457-007-9103-4.
7. Jenya, H., C.R.Y. Munthali and J. Luhanga, 2012. Characterization of Baobab in selected wild populations in Malawi. RUFORUM Working Document Series, 14 (2): 341-348. Available from http://repository.ruforum.org
8. Leakey, R.R.B., 2005. Domestication potential of Marula (*Sclerocarya birrea* subsp. *caffra*) in South Africa and Namibia: Multiple trait selection. Agroforestry Systems, 64: 51-59.
9. Parra, F., A. Casas, J.M. Pen˜aloza-Ramı´rez, A.C. Corte´s-Palomec, V. Rocha-Ramı´rez and A. Gonza´lez-Rodrı´guez, 2010. Evolution under domestication: ongoing artificial selection and divergence of wild and managed *Stenocereus pruinosus* (Cactaceae) populations in the Tehuaca´n Valley, Mexico. Annals of Botany, 106: 483-496. doi:10.1093/aob/mcq143, available online at www.aob.oxfordjournals.org.
10. Shanjani, P.S., A.A. Jafari and M. Calagari, 2013. Genetic variation among wild and cultivated Agropyron desertorum populations based on total protein profiles and phenotypic traits. New Zealand Journal of Crop and Horticultural Science, 41(3): 117-134, http:// dx.doi.org/ 10.1080/ 01140671.2013.793203
11. De Smidt, S., K. Alaerts, A.M. Kuyate, P. Van Damme, G. Potters and R. Samson, 2010. Phenotypic variation of baobab (Adansonia digitata L.) fruit traits in Mali. Agroforest Syst, 1-12. DOI 10.1007/s10457-010-9357-0
12. Leakey, R.R.B. and T. Page, 2006. The 'ideotype concept' and its application to the selection of cultivars of trees providing agroforestry tree products. Forests, Trees and Livelihoods, (16): 5-16.