

The Mineral Constituents of *A. heterophyllus* and *T. africana*

¹Objekwu E.J., ²Izundu A.I. and ²Ugwoke C.E

¹Department: Biology College: Nwafor Orizu College of Education Nsugbe.

²Department: Botany University: UNIZIK

ABSTRACT

The Mineral Constituents of *A. heterophyllus* and *T. africana* was analyzed. The test samples, (the seeds, leaves, stem and root of *Treculia africana* and *Artocarpus heterophyllus*) were obtained from Umuoji, in Idemmili North Local Government Area of Anambra State, Nigeria. Chemicals and facilities used in the practical were obtained from the Yitzhak Rabin Laboratory Biotechnology Research Centre, Nnamdi Azikiwe University, Awka and Plant Science and Biotechnology Laboratory, University of Nigeria Nsukka, Nigeria. The result of the mineral compositions of stem, root, seed and leaf of both plants revealed that its seed gave higher composition of magnesium (29.04 ± 0.01 mg/g), its leaf gave higher composition of calcium (185.97 ± 0.02 mg/g), phosphorous (0.57 ± 0.057 mg/g), potassium (39.66 ± 0.02 mg/g) and sodium (53.67 ± 0.01 mg/g). the result also revealed that for *T. africana*. Its stem gave higher composition of calcium (112.22 ± 0.02 mg/g) and magnesium (29.18 ± 0.02 mg/g), its root gave higher composition of phosphorous (132.58 ± 173.20 mg/g), and its leaf gave higher composition of potassium (37.98 ± 0.02 mg/g) and sodium (50.78 ± 0.01 mg/g). In conclusion, *A. heterophyllus* and *T. africana* are rich in minerals, extracts of the plant parts or its whole consumption could boost the health of humans after consumption.

Keywords: Mineral, Constituents, *A. heterophyllus* and *T. africana*

INTRODUCTION

African breadfruit is of the family Moraceae and the most viable alternative to it may be plant of the same family [1,2,3,4]. There are researches being carried out on how to mitigate the rate at which plants are going into extinction [5,6,7]. Part of the efforts are directed towards identification of possible alternatives to these endangered plant species while other works are planned to modify the growth and/or development pattern of the plants why retaining the fruit quality (quality of edible parts) [8,9,10]. *T. africana* is a tropical plant of desired economic value but which is rapidly disappearing. Morphologically Jackfruit artocarpus species seem to be the closest alternative to the well known African breadfruit [11,12,13]. Within the genus is jackfruit (*A. heterophyllus*) which is one of the outstanding species. The fruit resembles that of African breadfruit. It is therefore possible that this species may be the best alternative to African breadfruit [14,15,16]. Jackfruit (*Artocarpus heterophyllus* Lam) is one of the most significant dicotyledonous trees in tropical homegardens and perhaps the most widespread and useful tree in the genus

Artocarpus [17,18,19,20]. The generic name comes from the Greek words 'artos' (bread) and 'karpos' (fruit); the fruits are eaten and are commonly called 'African breadfruit' or 'Bread of the Tropics'. The specific name, 'heterophyllus', in Latin means, with leaves of different sizes and shapes and the word 'heteros' in Greek corresponds to the word 'different' [21]. The word 'jackfruit' comes from Portuguese jaca, which in turn, is derived from the term 'chakka' in Malayalam language. The ancient Indian Language Sanskrit refers this fruit as Atibruhatphala [22] and it is known in south east of Nigeria among the igbos as *ukwa bekee/ukwa oyibo* (white-man bread fruit) [23]. Jackfruit is both the name of the fruit and of the tree it grows on [24]. It is a perennial fruit tree crop, growing vigorously on both the branches and trunks of trees that can reach up to 8-25 meters in height and 2 meters in girth [25]. Fully-ripened Jackfruit will fall from the tree, so it is often harvested early to avoid having the large fruits fall on top of anyone. These attribute are close to the features of *Treculia*. The aroma of a mature Jackfruit has been described as off-putting, similar to overripe fruit.

Younger ripe fruit has a sweeter aroma. Jackfruit has a sweet taste and a flavor that is likened to bananas, pineapple and even bubblegum. As the fruit matures, the bulbs become a darker orange-yellow and the taste gets sweeter [6]. The succulent, aromatic, and flavorful fruit is eaten fresh or preserved in myriad ways. The nutritious seeds are boiled or roasted and eaten like chestnuts, added to flour for baking, or cooked in dishes [11]. It is also known for its remarkable, durable timber, which ages to an orange or redbrown color. The leaves and fruit waste provide valuable fodder for cattle, pigs, and goats. Many parts of the plant including the bark, roots, leaves, and fruit are attributed with medicinal properties. Wood chips yield a dye used to give the famous orangered color to the robes of Buddhist priest [18]. The tree can provide many environmental services. In homegardens, the dense jackfruit canopy can provide a visual screen and is very ornamental. The fruit is known as the 'poor man's fruit' in eastern and southern parts of India because it is a major part of their diet as a vegetable and nutritious dish during the season [19]. African breadfruit is a traditionally important edible fruit tree whose importance is due to the

potential use of its seeds, leaves, timber, roots and bark. It is increasingly becoming commercially important in Southern Nigeria hence, [20] described it as an important natural resource which contributes significantly to the income and dietary intake of the poor. [21], reported that there is an increased interest in African breadfruit seed, which is an important food item among the Igbo tribal group of South-Eastern Nigeria. In the past the consumption was limited to poor village dwellers for whom it supplemented their diets during times of food scarcity and substituted the more expensive rice during festivals and other ceremonies on the basis of tradition and cost [22], thus addressed as a poor man's source of diet. But today, African breadfruit has become a delicacy and a specialized meal not only for the rich and the urban dwellers in Nigeria but has also become a source of foreign exchange as the dehulled seeds are sun-dried and exported to cater for the African consumer interests overseas. It is in high demand in rural and urban populations, widely used in catering at official events and ceremonies [14]. Prices for African breadfruit have increased in recent years [17,19].

Aim of the Study

The aim of this research was to ascertain the Mineral Constituents of *A. heterophyllus* and *T. africana*

MATERIALS AND METHODS

Source of Materials

The test samples, (the seeds, leaves, stem and root of *Treculia africana* and *Artocarpus heterophyllus*) were obtained from Umuoji, in Idemmili North Local Government Area of Anambra State, Nigeria. Chemicals and facilities used in

the practical were obtained from the Yitzhak Rabin Laboratory Biotechnology Research Centre, Nnamdi Azikiwe University, Awka and Plant Science and Biotechnology Laboratory, University of Nigeria Nsukka, Nigeria.

Identification of Materials

All plant materials used in this study were identified by Prof. C.U. Okeke, - a professor of Taxonomy in Botany

Department, Nnamdi Azikiwe University, Awka.

Determination of Minerals

Mineral content of this sample was done following the dry ash extraction methods [6]. A measured weight of these samples were burnt to ashes (as in ash determination) thereby remaining all the organic materials leaving the inorganic

ash. The resulting ashes were each dissolved in 5mls of dilute (0.1M) hydrochloric solution and then diluted to 100mls in a volume flask. This extract was used in specific analysis for the different mineral elements.

Statistical Analysis

Data collected was analysed using Analysis of Variance (ANOVA) and test of significance were processed using

Duncan's Multiple Range Test and Student's 't' test at 5% level of probability.

RESULTS

Mineral Constituents of the Parts of *A. heterophyllum* and *T. africana*

Result of the mineral compositions of stem, root, seed and leaf of both plants shown in Table 1. For *A. heterophyllum*, the table 1 revealed that its seed gave higher composition of magnesium (29.04±0.01 mg/g), its leaf gave higher composition of calcium (185.97±0.02mg/g), phosphorous (0.57±0.057 mg/g), potassium (39.66±0.02 mg/g) and sodium (53.67±0.01 mg/g). the result also revealed that for *T. africana*, its stem

gave higher composition of calcium (112.22±0.02mg/g) and magnesium (29.18±0.02 mg/g), its root gave higher composition of phosphorous (132.58±173.20mg/g), and its leaf gave higher composition of potassium (37.98±0.02mg/g) and sodium (50.78±0.01mg/g). There was significant difference in the phosphorus composition between the parts of *T. africana* assayed (P>0.05).

Table 1: Comparative Mineral Constituents of *A. heterophyllum* and *T. africana*

Constituent	Specie	P-value	Plant Part				P-value for parts
			Stem	Root	Seed	Leaf	
Calcium (mg/g)	<i>A.heterophyllum</i>		86.57±0.01 ^a	24.03±0.02 ^b	88.18±0.02 ^c	18.97±0.02 ^d	0.00
	<i>T. africana</i>		112.22±0.02 ^a	25.65±0.02 ^b	46.49±0.01 ^c	17.64±0.01 ^d	0.00
		p-value	0.00	0.00	0.00	0.00	
Phosphorus (mg/g)	<i>A.heterophyllum</i>		42.88±0.01 ^a	44.64±0.02 ^b	57.64±0.01 ^c	62.53±0.01 ^d	0.00
	<i>T. africana</i>		53.94±0.02 ^a	132.58±173.20 ^a	5.33±0.02 ^a	44.74±0.01 ^a	0.39
		P-value	0.00	0.47	0.00	0.00	
Potassium (mg/g)	<i>A.heterophyllum</i>		36.04±0.02 ^a	36.76±0.02 ^b	37.44±0.01 ^c	39.66±0.02 ^d	0.00
	<i>T. africana</i>		35.53±0.01	34.58±0.01	36.64±0.02	37.98±0.02	0.00
		P-value	0.00	0.00	0.00	0.00	
Magnesium (mg/g)	<i>A.heterophyllum</i>		27.52±0.46 ^a	27.77±0.02 ^b	29.04±0.01 ^b	26.43±0.02 ^c	0.00
	<i>T. africana</i>		29.18±0.02 ^a	28.33±0.02 ^b	27.36±0.01 ^b	28.47±0.42 ^c	0.00
		P-value	0.03	0.00	0.01	0.00	
Sodium (mg/g)	<i>A.heterophyllum</i>		43.79±0.01 ^a	46.65±0.02 ^b	48.57±0.01 ^c	53.67±0.01 ^d	0.00
	<i>T. africana</i>		48.36±0.01 ^a	40.44±0.01 ^b	43.43±0.02 ^c	50.78±0.01 ^d	0.00
		P-value	0.00	0.00	0.00	0.00	

For each parameter, columns sharing similar superscripts are not significantly different at P>0.05. Results are in Mean ± Standard Deviation.

DISCUSSION

Among the minerals, calcium and phosphorus was found to be extremely high (Table 1) in all the four parts of *A.*

heterophyllum and *Treculia africana*, this did not agree with the report of Ajayi, 2008 who stated potassium to be the

prevalent mineral elements. The high contents of calcium and phosphorus suggest both plants to vital role in formation of bones and teeth. Generally, there is no deficiency of phosphorus

because it is so readily available in the food supply [7, 15]. Therefore, extracts of the plant parts or its whole consumption will boost the health of humans.

CONCLUSION

In conclusion, *A. heterophyllus* and *T. africana* are rich in minerals, extracts of the plant parts or its whole

consumption could boost the health of humans after consumption.

REFERENCES

1. Aderibigbo, A. O., Adeyemi, I. O. and Agboola O. I. (2010). Central Nervous System Depressant Properties of *Treculia africana* Decne. *Journal Ethnobotanical*, 14:108-2010.
2. Agbogidi, O.M. and Onomerebor, V.A. (2008). Morphological Changes in the Seedlings of *Treculia africana* Grown in Crude Oil Impacted Soils. In: Climate Change and Sustainable Renewable Natural Resources Management (Ed.) Popoola L. *Proceeding of 32nd Annual Conference of the Forestry Association of Nigeria, held in Umuahia, Abia-State, Nigeria. 20th -24th Oct; 2008*. Pp. 170-182.
3. Ali, N.C., Agbo, A.E., Attah, C.P. Ekwueme, J.I. and Ugwoke, F.N. (2003). *A Note on African breadfruit (Treculia africana Decne)*. (Unpublished) Report Submitted in Partial Fulfillment of CSC 341, Dept. of Crop Science, University of Nigeria, Nsukka. 11Pp
4. Allen, V. B. and Pilbeam, D.J. (2007). *Handbook of Plant Nutrition* CRC Press. ISBN 978-0-8247-5904-9. Retrieved 28 March 2019.
5. Al- Mayah, A.A and Hammadi, K.J. (1998). Vegetative Anatomy of *Polygonum* (Polygonaceae), *Basrah Journal of Science*, 16: 55-62.
6. AOAC (1990). *Official methods of Analysis*. Association of analytical chemists (15th Ed.) Washington, D.C, U.S.A. 409 Pp.
7. Arawande, J. O., Ajayi, I. O and Adewumi, B. L. (2009). Nutritive Significance of Husked and Dehusked Seeds of African breadfruit and Characterization of Its Extracted Oil. *Journal of Research in National Development*, 7 (1):
8. Ariahu, C. C., Ukpabi, U. and Mbajunwa, K. O. (1999). Production of African breadfruit (*Treculia africana*) and Soya Bean (*Glycine max*) Seed Base Food of Germination and Fermentation of Nutritional & Organoleptic Quality. *Plant Food Human Nutrient*, 54: 193-206.
9. Arigbede, O.M., Anele, U.Y., Jolaosho, A.O., Onifade, O.S and Wahab, T.A. (2008). Chemical Composition and in vitro Gas Production of African breadfruit (*Treculia africana* Decne). *Archivos de Zootecnia*, 57 (218): 113-121.
10. Berg, C.C. (1977). *Bull. Jard. Bot. Belg.* 47: 339. In: Berg, C.C., Corner, E.J.H. and Jarrett. F.M. (2006). *Moraceae- Genera Other Than Ficus*. Leiden: National Herbarium Nederland, 263Pp.
11. Berg, C.C. (2001). *Moraceae, Artocarpeae, and Dorstenia (Moraceae) with introductions to the family and Ficus and with additions and corrections to Flora Neotropica Monograph 7*. New York: New York Botanical Garden. 364Pp.
12. Berg, C.C., Corner, E.J.H. and Jarrett. F.M. (2006). *Moraceae- genera other than Ficus*. Leiden: National Herbarium Nederland, 263Pp.
13. Harborne, J.B. (1973). *Phytochemical Methods*. A Guide to Modern Techniques in Plant Analysis. Chapman and Hall, New York. 600p. In: Osabor, V.N. Ogar, D.A. Okafor P.C. and Egbung, G.E. (2009). Profile of the African Bread Fruit (*Treculia africana*). *Pakistan Journal of Nutrition* 8(7): 1005-1008.

14. IAWA (2004). IAWA List of Microscopic Features for Hardwood Identification. In: Wheeler, E.A.; Baas, P.; Gasson, P., (Eds). *International Association of Wood Anatomy Bull.* 10. ISSN: New Series 10(3): 219-332.
15. Iwu, M.M., Ducan, A.R., Okunji, C.O. (1999). New Antimicrobials of Plant Origin. In: *Perspectives on new Crops and New Uses*. Janick, J. (Ed), ASHS press, Alexandria, VA, Pp. 457-462.
16. Kala, A., Soosairaj, S., Raja, P. and Dhatchanamoorthy, N. (2013). Micromorphological Assessment and Stem Anatomy of Spermacoce Species of Tamilnadu, India. *Life Science Leaflets*, 8: 19-28.
17. Ko, F.N., Cheng, Z.J., Lin, C.N. and Teng, C.M. (1998). Scavenger and Antioxidant Properties of Prenylflavones Isolated from *Artocarpus heterophyllus*. *Free Radical Biology and Medicine*, 25(2): 160-168.
18. Makinde, M.A., Elemo, B.O., Arukwe, U., and Pellett, P. (1995). Ukwa Seed (*Treculia africana* Decne) Protein 1. Chemical Evaluation of the Protein Quality. *Journal of Agricultural and Food Chemistry*, 33(1): 70-72.
19. Malan, F. (1991). Variation, association and Inheritance of Juvenile Wood Properties of *Eucalyptus grandis* Hill ex Maiden with Special Reference to the Effect of Rate of Growth. *South African Forestry Journal*. 157:16-23.
20. Manjeshwar, S.B., Arnadi, R. S., Raghavendra, H., Jerome, D. and Bhat, P.H. (2011). Phytochemistry, Nutritional and Pharmacological Properties of *Artocarpus Heterophyllus* Lam (Jackfruit): A Review of Food Research *International*. 44(7):1800-1811.
21. Ogunkunle, A. T.J. (2010). A Quantitative Modelling of Pulp and Paper Making Suitability of Nigerian Hardwood Species. *Advances in Natural and Applied Sciences*, 4(1): 14-21.
22. Orwa, C, A., Mutua, Kindt, R., Jamnadass, R. and Anthony, S. (2009). Agroforestry Database: a Tree Reference and Selection Guide Version 4.0 (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.a.sp>).
23. Pandey, S.N. and Misra, S.P (2008). *Taxonomy of Angiosperms*. Ane Books PVT. LTD, New Delhi, India, 620Pp.
24. Sato, M. and Fujiwara, S. (1996). Flavones with Antibacterial Activity Against Carcinogenic Bacteria. *Journal of Ethnopharmacology* 54(2-3):171-176
25. Saxena, A., Bawa, A.S. and Raju, P.S. (2009). Phytochemical Changes in Fresh-cut Jackfruit (*Artocarpus heterophyllus* L.) Bulbs during Modified Atmosphere Storage. *Food Chemistry* 115(4):1443-1449.
26. SCUC (2006). Jackfruit *Artocarpus heterophyllus*. Field Manual for Extension Workers and Farmers. SCUC, Southampton, UK.