

NUTRACEUTICAL EVALUATION OF UNDER-UTILIZED WILD PLANT SEEDS IN NIGERIA

Ampitan, T. A., D. I. Adekambi¹ and A. A. Ampitan²

Federal College of Wildlife Management, Forestry Research Institute of Nigeria, P.M.B. 268, New Bussa, Niger State, Nigeria; ¹Ecole de ForesterieTropicale, Universite Nationale d'Agriculture, Porto-Novo, Benin Republic; ²Federal College of Forestry, Forestry Research Institute of Nigeria, P.M. B. 5087, Ibadan, Nigeria

Abstract

Nutrient evaluation and phytochemical screening of four selected wild plants seed from Kainji Lake National Park Range were carried out. The selected plants include *Detarium microcarpum*, *Daniela olivera*, *Vitallaria paradoxa* and *Entanda africana*. The various plant seeds were analysed for their proximate composition and the mean range values of moisture (5.09 ± 0.24 to 6.73 ± 1.11 g/100 g), ash (2.65 ± 0.27 to 9.93 ± 0.65 g/100 g), Crude fibres (1.24 ± 0.10 to 6.75 ± 0.37 g/100 g), crude protein (13.26 ± 0.66 g/100 g), crude fat (8.72 ± 0.42 to 16.00 ± 0.68 g/100 g) and the calculated NFE range (54.53 ± 0.27 g/100 g) were reported. Result revealed that all the plant seeds used were low in moisture contents an attributes for good storage and packaging for animal feed ratios. The qualitative analysis showed the presence of saponins, flavonoids, alkaloids, tannins, cardiac glycosides. Triterpenoids, quinine, sterols and traces of carbohydrate in *Vitellaria paradoxa* only. While phenol was not detected in all the plant seeds examined. The presence of saponins in all the plant seeds studied it is an indication that the seeds could be described as a potential source of natural antioxidants. This study therefore concluded that the phytochemical constituents revealed in some of the seed samples can be correlated with its medicinal properties used by traditional herbal healers around the study area.

Keywords: Nutraceutical; Medicinal; Phytochemical; Proximate; Wild-plants.

INTRODUCTION

Wild plants had been reported to have a dietary and medicinal value (Shad *et al.* 2013). The rural household around Kainji Lake National Park, Nigeria depends heavily on plant resources. It has earlier been reported that guinea savannah woodland ecosystems contain many plant resources of economic values such as herbal medicine (Amusa *et al.* 2012). The forest zone of Kainji Lake National Park is a rich source of a wide variety of wild plants but most of which has hardly been studied from the view point of its proximate composition and phytochemical constituents (Amusa *et al.* 2012). Again wild plants have been recognised to have a major role in the formation of the active constituents responsible for nutritional as well as therapeutic properties (Ray *et al.* 2004). There was a report that many traditional and conventional plants had the same range of these phytochemicals (Shad *et al.* 2013). An advantage of natural bioactive molecule is that they have a milder side effect on the body in comparison to chemically synthesized drugs (Badisa *et al.* 2013). With the acceptance of herbal medicine worldwide as alternative form of health care delivery, the screening of medicinal plants for bioactive compound cannot be over emphasised (Armand *et al.* 2012). It is from this perspective that this present works were carried out on the nutrient evaluation and phytochemical screening of four different wild plant seeds. This will herald the medicinal importance and as a source of feed supplement in livestock production. The four plants investigated are: *Detarium microcarpum*, *Entanda Africana*, *Deniela olivera* and *Vitellaria paradoxa*.

MATERIAL AND METHODS

Short description of plants used

(a) *Detarium microcarpum* (Bambara: *Ntamajalan*) is an African tree belonging to the family Fabaceae (Contu 2012). It is commonly known as sweet detar, sweet dattock or tallow tree. It is a small tree or shrub growing up to 15 m tall, but can reach 25 m in moist areas. It is an underutilized species of tree legume that grows naturally in the drier regions of West and Central Africa (Benin, Cameroon, Central African Republic, Chad, Gambia, Ghana, Guinea, Guinea Bissau, Côte d'Ivoire, Mali, Niger, Nigeria, Senegal, Sudan and Togo). Unlike the other species of its family, *D. microcarpum* grows in dry savanna, and sometimes in humid forest (Contu 2012). It flowers during the rainy season (July to September/November), but the main flowering period only lasts up to 8 days. It bears fruit from September-January/May and in November; the tree sheds its leaves and produces new leaves in March (Kouyate and van Damme 2006) (Fig. 1 a, b).



Fig.1. Showing the whole tree (a and c) and leaves (b and d) of *Detarium microcarpum* and *Entada africana* respectively.

(b) *Entada africana* (Guill. and Perr.) is a species of flowering plants in the family Fabaceae, in the mimosoid class of the subfamily Caesalpinioideae (Fern 2022a). It is a small deciduous tree that can grow up to 4-10 m in height and 90 cm in girth with a low branching with wide crown and the bark brown-grey to black. The tree is found in the Sudan zone and is widespread and abundant in Nigeria (Orwa *et al.* 2009) (Fig. 1 c, d).



Fig. 2. Showing the whole tree (a and c) and leaves (b and d) of *Daniellia oliveri* and *Vitellaria paradoxa* respectively.

(c) *Daniellia oliveri* ((Rolfe) Hutch. and Dalziel) is a species of tree in the family Fabaceae or leguminosae. *D. oliveri* is mainly found in West and Central Africa (Burkina Faso, Ivory Coast, Nigeria, Uganda, etc.). It is one of the tree species of the Sudan and Guinea Savanna (Ahmadu *et al.* 2004) and is commonly known as the African copaiba balsam tree, or the West African copal tree (Fern 2022b).

D. oliveri is a medium-sized, deciduous tree growing to a height of 25 m or more. It has a sometimes-twisted trunk up to 200 cm diameter, and a broad, flat-topped crown, and usually lacks branches on the lowest 9 m of trunk (Fern 2022b). Its leaves are pink to red at the time of flowering and its scaly bark is grey with a white stripped deep red slash. The trunk naturally secretes an exudate in the form of an oleoresin (Ahmadu *et al.* 2004) (Fig.2 a, b).

(d) *Vitellaria paradoxa* (Gaertn. f.), formerly known as *Butyrospermum parkii* (G. Don), but now commonly known as shea butter tree, or vitellaria, is a tree of the family Sapotaceae. It is the only species in the genus *Vitellaria* (Agroforestry Database 2022), and is indigenous to Africa. It is a deciduous tree usually 15 m tall, but has reached up to 25 m and a trunk diameter of 2 m. The shea tree grows naturally in the wild in the dry savannah belt of West and South from east Senegal to Cameroon, and as far as Sudan (Arbonnier 2004) (Fig. 2 c, d).

Collection of plant seeds

The samples of seeds were collected from Kainji Lake National Park (KLNP) Borgu sector. KLNP is the premier park in Nigeria covering a total area of 5340.82 km² and composed of two non-contiguous sectors, the Borgu and Zugurma sector (Amusa *et al.* 2012). The Borgu sector cover an area of 3,970.02 km² while Zugurma sectors, covers an area of 1,370 km². The entire park lies between latitude 9°40'N and 10° 23'E, and longitudes 3°30'N and 5° 50'E (Twc and Nardes 1983).

Extraction

The various plant seeds were oven dried at 70°C to minimise destruction of carbohydrates (AOAC 2002) and then pulverized to powder using a pestle and mortar in the laboratory. Approximately 500 g each of the powder plant seeds was extracted with methanol (1L) at room temperature (27°C) and the crude extracts were stored in refrigerator (4°C) for further analysis.

Phytochemical screening

Phytochemical analysis of the crude extracts was carried out according to standard methods (Rangari 2002, Harbone 1998, Sofowora 1993).

Salkowskireaction test for phytosterols

To 0.5 ml each of the extracts in a test tube was added 1.0 ml of concentrated H₂SO₄ from the sides of the test tube and then 1.0 ml chloroform was added. Appearance of reddish-brown colour in chloroform layer indicates the presence of phytosterols.

Liebermann - Burchard's test for triterpenoids

Extracts were treated with few drops of acetic anhydride, boil and cool. Concentrated H₂SO₄ acid was added from the sides of the test tubes which showed a brown ring at the junction at layer, and formation of deep red colour indicated the presence of triterpenoids.

Foam test for saponin

Small amount (0.1 g) of the various extracts were taken in test tubes with little quantity (1.0 ml) of water and shaken vigorously. Appearance of foam persisting for 10 min indicated presence of saponins.

Drangendroff's test for alkaloids

About 0.5g of each extract were dissolved into 1.0 ml chloroform and evaporated. The residues were acidified by adding few drops of Dragendroff's reagent (potassium bismuth iodide). Appearance of orange red precipitate indicated presence of alkaloids.

Molisch's test for carbohydrates

About 0.5 g of the various extracts was mixed with Molisch's reagent and then H₂SO₄ was added along the sides of the test tube to form layers. Appearance of reddish violet ring indicated the presence of carbohydrates.

Lead acetate test for flavonoids

To 0.1 g each of the extracts were dissolved into ethanol and few drops of 10% lead acetate solution were added. Appearance of yellow precipitate indicated presence of flavonoids.

Ferric chloride test for Phenol compounds and Tannin

About 2.0 ml of each extract was measured in a test tube and 0.01 mol/dm³ ferric chloride solution was added drop by drop. Appearance of bluish black precipitate indicated presence of phenolic compounds and tannins.

Keller-Killiani test for glycosides

About 1 ml of glacial acetic acid, few drops of 0.01 mol/dm³ ferric solution and H₂SO₄ (Conc) slowly through the sides of the test tubes were added to each extract. Appearance of reddish-brown ring at the junction of the liquids indicated the presence of deoxysugars.

Proximate Analysis

Analyse of various plant seed for moisture, crude proteins, fat, ash and nitrogen free extracts were carried out adopting the standard methods (AOAC 2003) and after which the NFE was calculated.

RESULTS AND DISCUSSION

This study was conducted to know and herald the nutritive value of four (4) plant seeds. The proximate analysis of *Detarium microcarpum*, *Daniela olivera*, *Vitellaria paradoxa* and *Entanda africana* were presented in Table 1. The results revealed that the percentage moisture contents in all the different plant seeds used were generally low. The moisture contents ranged between (5.09±0.24 g/100g) for *D. microcarpum* and (6.73±1.11 g/100g) for *V. paradoxa*. This observation is a good attribute to the plants under the study for storage and packaging. Previous research work had reported similar low moisture content (1.08±0-12.97±0.34 g/100g) for some plants in Nigeria (Agbo *et al.* 2013). The ash contents were found to be between 2.65±0.27 g/100g and 9.93±0.65g/100g for *E. africana* and

D. microcarpum, respectively. The same ranges were reported earlier, but lower than the values (7.7 to 10.5 g/100g) reported by Armand *et al.* (2012).

Table 1 Proximate composition of four (4) Wild plant Seeds in Kainji Lake National Park, Nigeria (g/100g).

Plant	Moisture	Ash	Crude Fibre	Crude Protein	Crude Fat	NFE
<i>Detarium microcarpum</i>	5.09±0.24	2.97±0.13	2.68±0.42	18.76±0.35	16.00±0.68	54.53±0.27
<i>Daniela Olivera</i>	5.77±0.79	5.80±0.12	6.75±0.37	15.68±0.33	8.72±0.42	57.29±0.21
<i>Vitellaria paradoxa</i>	6.73±1.11	9.93±0.65	5.97±0.27	13.26±0.66	9.60±0.51	56.36±2.92
<i>Entanda africanna</i>	6.08±1.00	2.65±0.27	1.24±0.10	16.91±0.13	13.09±0.74	59.35±0.05

This difference may be attributed to the origin and different parts of the plant used. Generally, the crude fat contents ranged from 8.72 ±0.42 g/100g (*D. olivera*) to 16.00±0.68 g/100g (*D. microcarpum*), but lower than earlier report (51.9g/100g) for Morrarna bean (Holse *et al.* 2010). The low fat contents may be attributed to the difference in the extraction methods. Considering other sources of oils (soy and groundnuts), *D. microcarpum*, *D. olivera*, *V. paradoxa* and *E. africana* can be considered as the good sources of fat. The crude fibres ranged from 1.24±0.10g/100g (*E. africana*) to 6.75±0.37g/100g in (*D. olivera*). The crude fibres contents were considered very low compared to the values reported earlier (Shumaila and Mahpara 2009). For the crude protein, values were in the order: *Detarium microcarpum* seed (18.76±0.35g/100g), *Entanda africana* (16.91±0.13g/100g), *Daniela olivera* (15.68±0.33g/100g) and *Vitallaria paradoxa* (13.26±0.66g/100g). These values revealed the relative dietary importance of all the plant seed samples as the sources of protein ration for animal feeds. The present result is considerably higher than the protein contents (1.70-19.00 g/100g) reported by Farhath *et al.* (2001) for *Opuntia* species. The Nitrogen free extract calculated for each plant seeds ranged from *Detarium microcarpum* (54.53±0.27g/100g) to *Entanda africanna* (59.35±0.05g/100g), these values were considered higher than the value (52.00g/100g) earlier reported by Chindo *et al.* (2003).

Table 2. Phytochemical Screening of Four Wild plant Seeds in Kainji Lake National Park.

	<i>Vitellaria paradoxa</i>	<i>Entanda africana</i>	<i>Daniela Olivera</i>	<i>Detarium microcarpum</i>
Phytochemical				
Alkaloids	+	-	-	-
Phenol	-	-	-	-
Flavonoids	++	-	-	+
Saponins	++	+	+	++
Tannin	+	-	-	+
Carbohydrates	Trace	-	-	-
Cardiac glycosides	+	-	Trace	-
Quinone	+	-	+	+
Sterols	+	-	-	-

The phytochemical analysis of the four plant seeds (Table 2) revealed that *Vitellaria paradoxa* contained all the phytochemicals examined except phenol; this revealed it's a medicinal status which include it's use in the treatment of whooping cough and neck pain (Ayoola *et al.* 2010). The presence of cardiac glycosides in *Vitellaria paradoxa* make it important as the glycosides have been reported to stimulate heart muscles and use in the treatment of congestive heart failure (Guevara *et al.* 2010).

Saponin was present in all the seed samples studied; there is evidence that they are potential source of medicinal plants. Saponins are effective in the treatment of syphilis, rheumatism and skin disease (Guevara *et al.* 2010). Alkaloids and sterols were present in the extracts of *Vitellaria paradoxa* only while quinone was found in all the examined plants except *Entanda africana*.

The presence of the phytochemicals in all the plant seed samples reported in this present study makes the seeds pharmacologically active and could be considered as good feed supplement by virtue of their proximate composition. Effort to quantify the chemical components for the seeds under studied is a task for future research work.

REFERENCES

- Agbo, O. J., S. A. Shomkegh and R. Mbakwe. 2013. Local Perception and Proximate Analysis of Some Edible Forest Plants around University of Agriculture Wildlife Park, Benue State, Nigeria. *J. Res. For. Wild. Environ.* **5**(1): 10-22.
- Agroforestry Database. 2022. *Vitellaria paradoxa*. World Agroforestry Centre. <https://en.wikipedia.org/wiki/Vitellaria>. Retrieved on 17th September.
- Ahmadu, A., Haruna, A. K., Garba, M., Ehinmidu, J. O. and Sarker, S. D. 2004. Phytochemical and antimicrobial activities of the *Daniellia oliveri* leaves. *Fitoterapia.* **75**(7-8): 729-732.
- Amusa T. O., S. O. Jimoh, P. Arindanzi and M. Haruna. 2012. Ethnobotany and Conservation of Plant Resources of Kainji Lake national Park, Nigeria. *A J. Plan. Peo. App. Res.* **8**: 182-194.
- AOAC. 2002. Official Methods of Analysis of AOAC International 17th Edition, Gaithersburg, md publisher.
- AOAC. 2003. Official Methods of Analysis of the Association of Official's Analytical Chemists, 17th edn. Association of Analytical Chemists. Arlington, Virginia.
- Arbonnier, M. 2004. *Trees, shrubs and lianas of West African dry zones*. CIRAD Margraf Publishers, GMBH MNHN, Corte d'voire. 574 pp.
- Armand A. B., Y. N. Nicolas. S. F. Harguin, S. Joel. M. Didier. M. Carl. and F. Mbofung. 2012. Proximate Composition, Mineral and Vitamin Content of Some Wild Plants used as Spices in Cameroon. *Food and Nutrition Sciences.* **3**: 423-432.
- Ayoola P. B., I. Adeyeye and O. O. Onawumi. 2010. Effect of Heating on the Chemical Composition and the Physicochemical Properties of *Arachis Hypogea* (groundnut) Seed Flour and Oil. *Pakistan Journal of Nutrition.* **9**: 751-754.
- Badisa R. B., O. Tzakou, M. Couladis and E. Pilarnou. 2013. *Cytotoxic activities of some Greek labiatae Herbs*. Wiley and Sons Ltd U. S. A. **17**(5): 472-476
- Chindo, B. A., S. Amos, A. A. Odutola, H. O. Vongatau, Abah J, C. Wambebe and K. S. Gananiel. 2003. Central Nervous System Activity of the Metabolic Extracts of *Ficus Plathyphylla* Stem Bark. *J. Ethnopharmacol.* **85**: 131-137.
- Contu, S. 2012. IUCN Red list of threatened species. <http://oldredlist;iucnredlist.org/details/summary/19893027/0>.

- Farhath, K., K. R. S. krishina, A. d. Semwal, K. R. Vishwanathan and F. Khanum 2001. Proximate Composition and Mineral Contents of Spices. *Ind. J. of Nutr. And Dietetics*. **38**: 93-97.
- Fern, K. 2022a. *Entada africana*. Tropical Plants Database. <https://tropicaltheferns.info/viewtropical.php?id=Entada+africana>. Retrieved 20th September, 2022.
- Fern, K. 2022b. *Daniellia oliveri*. Tropical Plants Database. <https://tropicaltheferns.info/viewtropical.php?id=Daniellia+oliveri>. Retrieved 18th September, 2022.
- Guevara, F. T., H. J. Islas, M. L. R. Escogido, A.G. Mortensen, B. B. Laursen, L-W. Lin, De L. Rodrigiez., I. S. Fomsgaard and P. P. B. de la Rosa. 2010. Proximate Composition, Phenolic Acids, and Flavonoids Characterization of Commercial and Wild Nopal (*Opuutia* spp). *Journal of food composition and analysis*. **23**: 525-532.
- Harborne, J. B. 1998. Phytochemical Methods. Chapman and Hall Ltd., London, pp. 100-200.
- Holse, M., S. Husted and A. Hansen. 2010. Chemical Composition of Marama Beans- a Wild African beans with unexploited Potential. *J. Food compost. Anal.* **23**: 648-657.
- Kouyate, A. M. and van Damme. 2006. Medicinal plants/Plantes Medicinales: *Detarium microcarpum* Guill & Perr. PROTA 11 No. 1, 2006. https://database.prota.org/PROTAhtml/Detarium%20microcarpum_EN.htm.
- Orwa, C., A. Mutua, R. Kindt, R. Jammadass and A. Simons. 2009. Agroforestry Database: A tree reference and selection guide version 4.0. <http://www.worldagroforestry.org/af/treedb/>.
- Rangari, V. D. 2002. *Pharmacognosy and Phytochemistry Nasik*. Carrier Pub. pp. 100-150.
- Ray, D. K., P. K. Njak, T. R. Rautray, V. Vijanyan and S. Jena. 2004. Elemental analysis of anti-diabetic Medicinal Plants Using Energy Dispersive X-Ray Fluorescence Techniques. *Indian J. Phys.* **78**: 103-105
- Shad, A., H. U. Shad and J. Bakht. 2013. Ethnobotanical assessment and Nutritive Potential of Wild food plants. *Journal of Animal and Plant Sciences*. **23**(1): 92-97.
- Shumaila, G. and S. Mahpara. 2009. Proximate Composition and Mineral Analysis of Cinnamon. *Pakistan Journal of Nutrition*. **8**(9):1456-1460.
- Sofowora, A. 1993. *Medicinal Plants and traditional medicine in Africa*. New York, Jojn Wilay and Sons, pp. 191-300.
- Tuna Wildlife Consultants and NARDES. 1983. *A master plan for the management of Kainji Lake National Park*. Consultancy report submitted to the Kainji Lake National Park Board, New Bussa, Nigeria.