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ORIGINAL RESEARCH ARTICLE

Ethnobotanical Survey of *Hyphaene thebaica (L.)* Products and their uses among Inhabitants of Katsina Metropolis

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ABSTRACT
Hyphaene thebaica, commonly known as doum palm, is one of the most important plants in Africa. Parts of the plant, such as fibers, leaflets, and roots, are used to weave baskets and ropes, and the nuts are used in traditional medicines. An ethnobotanical survey was carried out to document the availability of the products made from *H. thebaica* in the Katsina metropolis. Data were gathered through oral interviews with the product sellers using a questionnaire designed for this purpose. Results showed a total of 46 products, and the products made from the leaves were found to be more frequent, with 51% availability, followed by stem and trunk products with 26%, and products from the fruits with 18%, while products made from the roots have the lowest percentage of 5.

INTRODUCTION

Ethnobotany is the study of the relationship between plants and humans. This is practically a new field of research in which plants are studied in-depth and systematically, bringing great value to archaeologists, anthropologists, geographers, ethnobotanists, and phytochemists. Ethnobotany focuses on how plants have been or are used, managed and perceived in human society and includes plants used for food, medicine, cosmetics, textiles, construction, clothing, life rituals, etc. It also studies the relationship between a particular culture and a regional use of native plants. (Samaila and Monier, 2014). Ethnobotanical studies play a crucial role in biodiversity conservation, cultural preservation, community development, sustainable resource management, pharmaceutical development, and education, making them invaluable for scientific and societal advancement.

Hyphaene thebaica, on the other hand, is a desert palm native to the Nile Valley (Egypt, sub-Saharan Africa) and West India and is listed as one of the most useful plants in the world (Siddeeg *et al.*, 2019). The trunk of this palm tree is divided into two branches like Y, and each branch further subdivides into another Y form, having a unique appearance; it has a dichotomous and arbore scent in nature (Siddeeg *et al.*, 2019). It is called doum or gingerbread in Egypt; it belongs to the palmae family, which comprises over 210 genera and over 2500+ species that grow up to 6-9 m high. The tree usually has forked stems with fan-shaped leaves 65-75 cm long (Lokuruka, 2008; Nwosu, *et al.*, 2008).

The tree trunk is widely used for constructing and manufacturing various domestic utensils, and the leaves are used to make mats, bind parcels, and write paper. The yellow-orange apple-sized fruit has a red outer skin, a thick, spongy, large kernel, and a sweet, fibrous fruit pulp that tastes like gingerbread. The fruit has an edible covering and can be pounded to form a powder (Aboshoro *et al.*, 2015). The dried powder is often added to food as a flavouring agent (Orwa *et al.*, 2009). The roots of the doum palm are used to treat bilharziasis, while the fruit is often chewed to control hypertension (Nalado *et al.*, 2021). The doum fruit is a good source of potent antioxidants; the fruit pulp is used for cooking as fuel; the unripe kernel is edible; the ripe kernel is hard and is used only as vegetable ivory; and it is used to treat sore eyes in livestock using charcoal from the seed kernel as well as making buttons, small carvings, and artificial pearls (Hsu *et al.*, 2006). The rind from the kernel is used to make molasses, and the ground kernels are used to dress wounds (Siddeeg *et al.*, 2019). Doum palm was reported to lower

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blood pressure when its biological activity was evaluated in rat feeding experiments (Betty *et al.*, 2006).

Hyphaene thebaica has cultural and traditional significance in many communities, requiring an understanding of its application in traditional medicine, crafts, and cultural rituals to preserve indigenous knowledge. Ethnobotanical study on *Hyphaene thebaica* in Katsina metropolis is important in ecological assessment, conservation efforts, cultural preservation and biodiversity awareness, thereby contributing to our understanding of the complex relationships between plants, ecosystems and human society.

In view of the numerous ethnobotanical benefits of *Hyphaene thebaica*, it is pertinent to publish a study on the diversity of its products and document their importance and uses. Based on this background, this research aims to study and document literature on the availability and diversity of ethnobotanical products made from *Hyphaene thebaica* and their uses in the Katsina metropolis.

METHODOLOGY

Ethical Statement

The following research methodology and its ethics have been fully reviewed and approved by the departmental academic board, Department of Biology, Umaru Musa Yaradua University Katsina, Nigeria. All participants were informed about the study aims and procedures and provided written consent before participating. Measures were taken to ensure participants' confidentiality and data protection throughout the entire study process.

Study Area

Katsina State has a total area of 23,938 km^2, about 2.7 percent of the land area of Nigeria, and is geographically located between longitude 6^0 45^I E and 8^0 15^I E and latitude 11^0 20^I N and 13^0 20^I N. It borders Kaduna and Kano States to the South and Southeast, the Republic of Niger to the North, and Jigawa and Zamfara States to the East and West respectively. According to the 2006 population census, Katsina State has a population of over 5.8 million people and an average growth rate of 2.8% (NPC, 2006). The key topographical features of the state are dominated by gently rolling pane planes rising from an elevation of about 300m to an average of 450m and peaks at 850m (Federal Republic of Nigeria, FRN, 2010).

The state has two distinct climate seasons; rain and dry seasons. The rainy season is between May and September, while the dry season covers about seven months, usually between October and April. The average rainfall is 750mm in the Northern part, while the Southern part receives up to 110mm and the extreme Northeastern part as little as 600–650mm. The state has an average temperature between 21^0C and 30^0C (Federal Republic of Nigeria, FRN, 2010).

Method of Data Collection

The field methodological framework chosen for this study has been used in ethnobiology (Martin, 1995a; Cotton, 1996; Alexiades and Sheldon, 1996) and is based on the methods of Bhandari 2022; Samaila and Monier, 2014; Yirga, 2010, using semi-structured interviewee, observation, and guided field walks with informants were used to obtain ethnobotanical data. Fieldwork was conducted by collecting ethnobotanical information through structured and semi-structured interviews with knowledgeable people in the area. For each product recorded, one questionnaire was filled *out*. Although a structured questionnaire was required to be filled, direct questions were avoided and the necessary basic information was taken during the interview. Also, no specific selection criteria were used in selecting informants. However, most of the interviewees were between the ages of 40 and 60.

The data was collected through the administration of a questionnaire and oral interviews with vendors selling the products from Chake Kofar Guga, Kofar Marusa, and Tsohuwar Kasuwa markets of Katsina metropolis. Respondents were men and women of ages, mainly between 40 and 60. The data obtained was collated and organized to provide product names, plant parts used in production, production methods, and ethnobotanical uses.

During the oral interview, questions asked of the respondents included their names, Hyphaene thebaica products they sell, knowledge of production methods, parts used, and their uses. During the survey, the respondents cooperated in answering questions and questions about the ethnobotanical importance of the plant were also included.

RESULTS

The ethnobotanical products made from Hyphaene thebaica L., the part of the tree used in the production, the methods of production, and the ethnobotanical use(s) of each product are shown in Table 1. A total of 46 products were recorded. Products made from the leaves were more frequent, with 51% availability, followed by stem/trunk products with 26%, and then products from the fruits with 18%. *In comparison,* products from the roots have the lowest percentage of 5. The total number of products varied from one market to another: 27 in *the* Chake market, 28 in *the* Kofar Marusa market, and 30 in *the* Tsohuwar Kasuwa market. While 5 products were absent in all three *studied markets, the questionnaires recorded their information.*

Table 1: Part used, methods of production, and ethnobotanical uses of each product.

Product Name	Part Used	Production Method	Ethnobotanical Uses	M1	M2	M3
Animals fodder	Young leaves	Left scattered in the pasture land	Essential nutrition source for animals raised for meat, milk, etc.	+	+	+
Basket	Leaflet	Weaving	Storage, harvesting, food preparation, fishing, hunting, etc.	+	+	+
Beehives	Tree trunk	Weaving	Apiculture	-	-	+
Bowl	Leaf blade	Weaving	Food preservation and storage	-	+	-
Box	Leaf fiber	Weaving	Transportation, preservation, and archiving of important documents, etc.	-	-	+
Broom	Leaves	Weaving	Floor cleaning, gardening and yard work, arts and crafts, etc.	+	+	+
Cage Traps	Leaves	Weaving	Trapping and capturing birds	+	-	-
Canoe	Tree Trunk	Wood strip	Transportation, fishing, recreation, exploration of rivers, lakes, etc.	-	-	-
Charcoal	Wood	Pyrolysis	Charcoal can be processed into briquettes used as a fuel source in cooking, heating and industrial applications.	-	-	+
Cover (Locally called faifai)	Fiber from leaflet	Weaving	Used by the locals to cover various items such as food, a bowl of cow milk, water, etc.	+	+	+
Decoctions	Leaves, bark, and roots	Extraction	Used in treating ailments such as diarrhoea, dysentery, stomachaches, etc.	+	+	-
Fabric–covered buttons	Doum nut	Crafting	Clothing, accessories like hats, bags, shoes, etc.	-	-	-
Firewood	Fronds, leaves, wood, etc.	Hewing	Source of heat and fuel for various purposes.	+	+	+
Fishing net	Root fibers	Weaving/Netting	Fishing activities	-	+	-
Flax plate/ spinning bobbins	Leaf fibers	Weaving	Used to hold the cotton or flax fibers during the production process of threads	+	+	-
Game bag	Fibers from leaf blade	Weaving	Game bags help hunters keep their catches secure and prevent them from getting damaged.	-	-	+
Hammocks	Leaves fiber	Weaving	Hammocks are popular for relaxation and outdoor activities.	-	-	+
Hand-woven fans	Leaflet	Weaving	Cooling, fashion accessories, especially in traditional and cultural events, souvenirs and gifts, etc.	+	+	+
Harpoons	Tree trunk	Hewing	Harpoons are used to hunt large marine animals, such as whales or seals.	-	-	-
Kitchen rack	Leaf fiber	Weaving	Storage and organization, decorative elements, kitchen space saving, etc.	+	-	-
Ladder	Palm tree trunk	Hewing	Used for various purposes such as harvesting fruits, climbing tall trees, thatching roofs, etc.	+	+	+
Livestock strap	Leaves	Weaving	Use to restrain and control the movement of animals	+	+	+
Livestock waterer	Tree trunk	Hewing	These are containers designed to provide a continuous and accessible supply of water to animals, such as cattle, horses, sheep, and other livestock.	+	+	-

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Mat/Carpet	Fibers from leaf blade	Weaving	Area rugs or floor coverings in homes, mats for picnics or beach outings, used for traditional ceremonies, rituals, cultural events, etc.	+	+	+
Molasses	Rinds of the fruits/seeds	Rinds of the seed are pounded to make powder used for molasses	Use as a sweetener and flavouring in baking and cooking.	+	-	+
Palm cabbage	Apical bud, young shoots.	Harvesting	Palm cabbage can be used in culinary preparations. Its delicate flavour makes it a popular ingredient in various cuisines.	-	+	+
Palm juice/wine	Fruit sap	Fermentation of the fruit sap leads to the transformation of sugars into alcohol.	Consumption, culinary, traditional rituals, industrial uses, income generation, etc.	-	-	-
Palm-kernel powder	Palm fruits	Threshing	Used for culinary purposes, skin care, traditional medicine practices, etc.	+	+	+
Palm-leaf shovel	Leaf fronds	Weaving	It is a traditional tool used for gardening, agriculture, or other manual labour activities.	-	+	-
Palm rope	Leaf fibers	Weaving	Used in construction purposes, agricultural practices such as tying up plants, fishing activities, etc.	+	+	+
Palm-leaf paper	Leaves	Writing directly on the leaves (in 17th – 18th Cent.).	Palm-leaf papers were used for educational purposes, literary works, religious scriptures, cultural heritages, etc.	-	-	-
Panama hats	Leaves	Weaving	Outdoor events, beach vacations, gardening, and other activities where sun protection is desired.	+	+	+
Pen box/case	Leaves	Weaving	Its primary use is to store and protect pens.	-	-	-
Pillars	Palm Trunk	Cut from the three trunks using an axe	Used as a support in roofing/building	+	+	+
Poles	Palm tree trunk	Hewing	Construction or support purposes, landscaping projects, creating pergolas, etc.	+	+	+
Quiver	Leaf fiber	Weaving	Arrows storage	+	-	-
Sac wrapper	Leaves fibers	Weaving	Covering of sacs (tomatoes sac, potato sac, sweet paper, etc.) protecting from dust, sun, moisture, etc.	+	+	+
Silo	Fibers from the leaves and fronds	Weaving	Silos are designed to protect stored farm produce from damage.	+	+	+
Sling	Leaves	Leaves are cut and designed to make a sling	Children often use it as a toy for throwing objects, such as small stones, or as a hunting tool to capture birds.	-	-	+
Sponges or brushes	Fibers from petiole	Crafting	The brushes can be used for cleaning, such as removing dirt from the garden tools.	+	+	+
Sweetmeats or Confections	Midrib of the leaf	Cooked or steamed to make sweetmeats	Sweetmeats can often be consumed as desserts or treats or enjoyed with other desserts like ice cream or fruits.	+	+	+

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Tannin or dyestuff	Dried back and sap	Dried bark and sap are extracted to produce dyestuff	-Textile dyeing -Used as a pH indicator -Biological strains	+	+	+
Thatched roofs	Fibers from the leaves and fronds	Weaving	Used in traditional and rural buildings, provides insulation, natural ventilation, etc.	-	+	+
Timber	Palm Trunk	Hewing	Construction, furniture, paper and pulp, decorative items, fencing and landscape, boat building, etc.	-	-	+
Water trough	Tree Trunk	Hewing	Irrigation purposes, serve as sewage, used to provide water for livestock or horses, etc.	-	+	+
Wood beam	Palm Trunk	Hewing	Used in residential construction to support roofs and provides structural stability	+	-	-

Market 1 (M1) = Chake Kofar Guga Market 2 (M2) = Kofar Marusa Market 3 (M3) = Tsohuwar Kasuwa + = Present; - = Absent

DISCUSSION

The ethnobotanical survey conducted on *Hyphaene thebaica* in the Katsina metropolis provides valuable information on the importance of this plant in the local context. The variety of products derived from different plant parts highlights its diverse utility in the community. The predominance of leaf-based products, especially with an availability rate of 51%, indicates a significant dependence on this plant for weaving baskets and ropes, highlighting its role in traditional crafts. These results are consistent with previous studies on the cultural and economic importance of the plant in different communities, highlighting the socio-economic value of *Hyphaene thebaica* in the study area (Ratsirarson, 1996).

The varying availability of the product in different markets suggests the potential for regional specialization or preference for certain applications of *Hyphaene thebaica*. The observed differences in the availability of the product between markets, with the Chake market having 27 products, the Kofar marusa market having 28 products and the Tsohuwar kasuwa market having 30 products, may be due to factors such as market dynamics, consumer preferences or local traditions (Kigomo, 1998; Samaila and Monier, 2014; Ratsirarson, 1996). Understanding these variations may be important for sustainable resource management and community development, warranting further investigation.

Identifying products absent in the three markets but recorded in the questionnaire raises intriguing questions about preserving traditional knowledge and practices. This suggests a potential gap between the knowledge possessed by local communities and the market demand for certain products, suggesting future research directions to explore the reasons behind such discrepancies (Johannes and Walter, 2019).

CONCLUSION

The current study achieved its main objective of comprehensively studying and documenting the availability and diversity of ethnobotanical products made from *Hyphaene thebaica* in the Katsina metropolis. Through oral interviews and tailored questionnaires, the survey provided valuable information about the cultural significance and practical uses of *Hyphaene thebaica* in the community.

By investigating the products derived from various components of *Hyphaene thebaica,* the study identified a total of 46 distinct items. Notably, leaf-based products represented a significant 51% of the total, emphasizing the significance of leaves in local crafts. Discrepancies in product availability across different markets suggest potential regional preferences or market dynamics, prompting avenues for further research.

In conclusion, this ethnobotanical investigation deepens our understanding of the diverse applications of *Hyphaene thebaica* but also lays the foundation for future research efforts. These findings encourage further exploration of market dynamics, traditional knowledge conservation, and sustainable resource management practices related to *Hyphaene thebaica* in the Katsina metropolis.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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