

# Palm Wine: A Neglected Traditional Alcoholic Beverage Consumed In Rural And Marginalized Areas Of Tropical Africa

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**Abstract:** *Hyphaene petersiana* and *H. coriacea* are palm species traditionally used to produce alcoholic beverage known as ilala palm wine. The potential of *H. coriacea* and *H. petersiana* as food plants, and sources of ecosystem goods and services in tropical Africa were reviewed. The literature relevant to the study was obtained from scientific databases such as PubMed, Embase, Google Scholar, ScienceDirect and SciFinder. In addition, complementary information was gathered from pre-electronic sources such as books, theses and scientific articles obtained from the University library. *Hyphaene coriacea* and *H. petersiana* are multipurpose species, serving as sources of food, herbal medicines, income, crafts, fodder and ecological benefits to local communities that depend on the species as sources of livelihood needs. This study represents a holistic view on multiple ecosystem goods and services that can be derived from plant species such as *H. coriacea* and *H. petersiana*. Since *H. coriacea* and *H. petersiana* are important to food security, ecological and provisioning roles throughout the distributional range of the species, there is need therefore, to diversify crops in the arable agricultural systems to include these two lesser known and underutilized species in order to strengthen the economic, food and ecological networks of local communities.

**Keywords:** Livelihood needs; Ecosystem goods and services; *Hyphaene petersiana*; *Hyphaene coriacea*; ilala palm wine; traditional knowledge; tropical Africa

## 1 INTRODUCTION

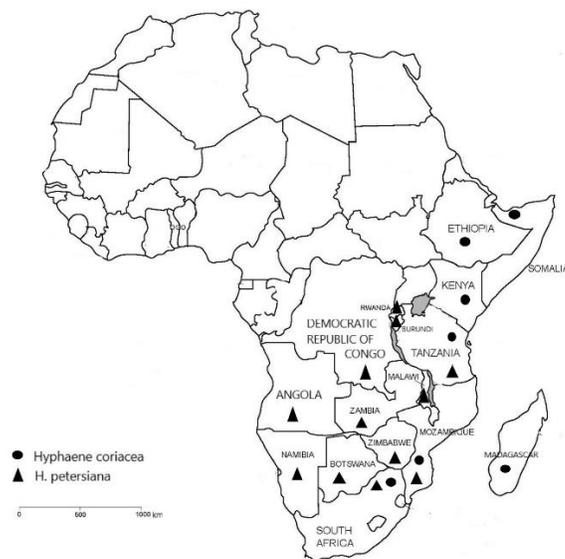
Tapping of sap from two *Hyphaene* Gaertn. species *H. petersiana* Klotzsch ex Mart. and *H. coriacea* Gaertn. (Fig. 1) to make palm wine is an important subsistence activity in east and southern Africa. These two species belong to the *Arecaceae* family are often referred to as “ilala palm” or “ilala palm” in southern Africa [1-4]. *Hyphaene coriacea* naturally occurs in Ethiopia, Kenya, Madagascar, Mozambique, Somalia, South Africa and Tanzania while *H. petersiana* has been recorded in Angola, Botswana, Burundi, the Democratic Republic of Congo (DRC), Malawi, Mozambique, Namibia, Rwanda, South Africa, Tanzania, Zambia and Zimbabwe (Fig. 2). The genus name *Hyphaene* is derived from the Greek word “hyphaino” meaning to “entwine”, in reference to fibrous fruits associated with several *Hyphaene* species [1]. The species name *coriacea* is derived from the Latin word “coriaceus” which means thick and leathery in reference to most parts of the species particularly the leaves [5]. The species name *petersiana* is in honour of Prof Wilhelm Karl Hartwich (or Hartwig) Peters (1815-1883), a German naturalist and explorer who collected several plant specimens in Mozambique in the early 19th century [4]. *Hyphaene coriacea* is a dichotomously branched palm growing to a height of seven metres [3], often suckering to form clumps with stems covered by remnant leaf sheaths (Fig. 3). *Hyphaene coriacea* has been recorded in low-altitude bushveld and coastal bush, often forming extensive stands in coastal grassland at altitude ranging from 50 m to 300 m above sea level [6]. *Hyphaene petersiana* is a tall, erect, single-stemmed tree (Fig. 1), reaching a height of 18 metres [3]. The trunk of *H. petersiana* is patterned with the scars of the fallen leaves.

*Hyphaene petersiana* has been recorded in sodic-saline alluvial and alkaline soils in bushveld, along swamps, pans and rivers, savanna and secondary vegetation often forming extensive stands at an altitude ranging from 275 m to 1000 m above sea level [6]. The leaves of both species are fan-shaped, greyish-green in colour with long petioles characterized by recurved black thorns. The male and female flowers of both species are borne on different trees. In Mozambique, South Africa and Tanzania where both *H. coriacea* and *H. petersiana* have been recorded (Fig. 2), these two species are identical in the appearance of the stems and leaves particularly when young. The main differences between the two species are in fruit characteristics with *H. coriacea* having pear-shaped fruits while *H. petersiana* has rounded fruits [2]. But in tropical Africa and other marginal environments of developing agricultural economies, many less well-known plant species are consumed, domesticated and managed in home gardens providing numerous ecosystem goods and services. The direct ecosystem goods provided by plant species include serving as food sources, medicines and energy while indirect ecosystem services include promotion of biodiversity, water storage and soil fertility [7]. Plant resources play a central role in the everyday lives of rural people in developing countries and marginalized areas, with their daily round of activities revolving around agriculture, the gathering of edible fruits, leafy vegetables, herbal medicines, fuelwood, the cooking and eating of largely plant-based food, and the construction of buildings and fences [8,9]. Such plant species include *H. coriacea* and *H. petersiana* characterized by socio-economic potential for food security of local communities, poverty alleviation and meeting important livelihood needs in rural, peri-urban and marginalized areas in tropical Africa. Van Wyk [10] argued that the stem sap and fruits of *H. coriacea* have commercial potential in South Africa for wine and processed foods production, respectively. It is therefore, within this context that the potential of *H. coriacea* and *H. petersiana* as food plants, and sources of ecosystem goods and services within their distributional range in tropical Africa were reviewed.

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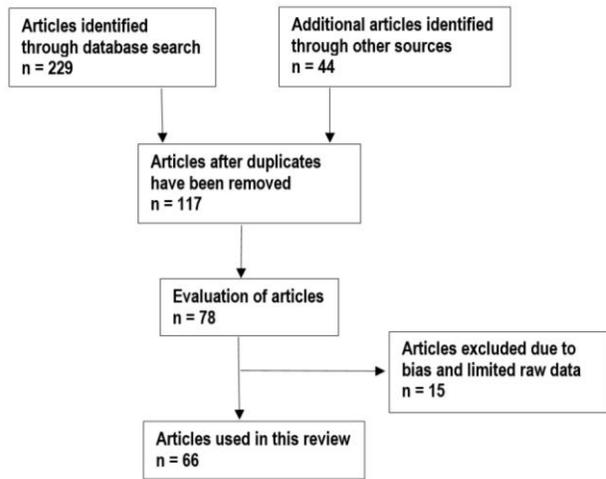
**Fig. 1:** General habit of *H. coriacea* (A, photo: Sune Holt) and *H. petersiana* (B, photo: P. Dawson-Brown)



**Fig. 2:** Distribution of *H. coriacea* and *H. petersiana* in tropical Africa

**2. MATERIALS AND METHODS**

In total 66 scientific papers, books, theses and online databases on *H. coriacea* and *H. petersiana* provided information on potential of the species as food plants, and sources of ecosystem goods and services within their distributional range in tropical Africa (Fig. 3). The bibliographic search employed several databases such as PubMed, Embase, Google Scholar, ScienceDirect and SciFinder. In addition, complementary information was gathered from pre-electronic sources such as books, book chapters, theses, scientific reports and journal articles obtained from the University library. No time limit was indicated, and examples of search terms included *H. coriacea*, *H. petersiana*, synonyms of the species such as *H. benguellensis* Welw., *H. benguellensis* Welw. var. *ventricosa* (J. Kirk) Furtado, *H. natalensis* Kunze and *H. ventricosa* J. Kirk. Other keywords used included common names “ilala palm”, “lala palm”, and terms such as “ecosystem goods”, “ecosystem services”, “local uses”, “medicinal uses”, “nutritional properties”, “pharmacological properties”, “traditional uses” of the two species.



**Fig. 3.** Flow diagram with the number of selected articles

**3. Wine production from *H. coriacea* and *H. petersiana***

The use of *H. coriacea* sap for wine production has been recorded in 57.1% of the countries where the species is indigenous and these countries include Kenya, Mozambique, South Africa and Tanzania (Table 1). Similarly, the use of *H. petersiana* for wine production has been recorded in 58.3% of the countries where the species is indigenous and these countries include Botswana, Malawi, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (Table 1). When tapping the trees for wine, the growing tip is cut away (Figure 4). Tappers insert V-shaped leaves into trimmed growing tip for sap collection (Fig. 4). Sap tapping for wine production is destructive to the plant as the process involves removing the rosette of upper leaves and making thin slices from the growing shoot cap of young stems every day for several weeks to keep the sap flowing into the collection container (Figure 4). Cunningham [11] estimated the mean daily sap yield of *H. coriacea* to range from 0.01 to 0.5 litres while an average sized *H. coriacea* and *H. petersiana* tree is said to produce an annual yield of about 68.0 litres [1]. The collected sap is fermented by naturally occurring yeast [12] which produces an alcoholic beverage commonly referred to as ilala palm wine. In Namibia and South Africa, the fruits of *H. coriacea* and *H. petersiana* are also used to produce an alcoholic beverage [10,13-16].

**TABLE 1**  
*HYPHAENE CORIACEA AND H. PETERSIANA AS SOURCES OF WINE AND OTHER TRADITIONAL USES*

Country	Wine production	Other uses	Reference
<i>H. coriacea</i>			
Kenya	Yes	Leaves used for thatching and weaving. Fruits edible. Seeds used as vegetable ivory	17-20
Madagascar	-	Leaves used for weaving	21
Mozambique	Yes	Wine sold in local and regional markets. Leaves used for fencing, thatching and weaving. Fruits edible	22-24
South Africa	Yes	Wine and crafts sold in local and regional markets. Leaves used for	1,3,4,11,15,2

		weaving, thatching and hand brooms. Young fruits produce juice, young shoots, pith, fruits and kernel edible. Leaves used as fodder.	5-30
Tanzania	Yes	Fruit kernel and pulp edible. Leaves for weaving and thatching. Crafts sold in local and regional markets.	20,31-33
H. petersiana			
Botswana	Yes	Leaves used for weaving, thatching, dyeing and firewood. Kernels used for vegetable ivory and ornaments. Fruits, kernel, pith and young shoots edible. Leaves used as fodder.	2,34-39
Malawi	Yes	Leaves used for weaving	40
Namibia	Yes	Wine and crafts sold in local and regional markets. Fruits edible and used to produce an alcoholic beverage. Leaves used for weaving, fencing and thatching. Leaves used as fodder.	1,2,13,14,16,41,42
South Africa	Yes	Wine and crafts sold in local and regional markets. Leaves used for weaving and thatching. Young fruits produce juice, young shoots, pith, fruits and kernel edible.	3,4,15
Tanzania	Yes	Leaves used for weaving and thatching. Crafts sold in local and regional markets. Young fruits produce juice, fruit kernel and pulp edible.	32,33
Zambia	Yes	Leaves used for weaving, fencing and thatching. Young fruits produce juice, fruit kernel and pulp edible. Kernels used for vegetable ivory and ornaments.	43
Zimbabwe	Yes	Leaves used for weaving, thatching and for dyeing. Wine and crafts sold in local and regional markets.	15,44-48

during the same period. Similarly, research carried in Mozambique by Martins and Shackleton [24] showed that the mean annual net income from palm wine sales is R24981 ± R12094 (US\$1878 ± 909), representing 85% of the annual household's income. Tapping of palm wine and collection of fresh or naturally dried fruits are practised year round playing an important role in local livelihoods and poverty alleviation in southern Africa [16,24,28]. Other parts of the two species such as fruits are used to produce juice, and young shoots, pith and kernel are edible [10,14-16,43]. Research by Foote et al. [45] revealed that during drought periods when crops fail, *H. petersiana* provides an alternative food and cash income to several households in southern Zimbabwe. The fruits of *H. coriacea* and *H. petersiana* have high concentrations of essential minerals (Table 2) and consumption of such fruits is recommended especially in poor settings [16,19]. The alcohol content of wine produced from *H. coriacea* is low, ranging from 2.0% to 3.7% while wine produced from *H. petersiana* fruits has variable alcohol content ranging from 0.8% to 55.3% [48,53]. In terms of mineral content, the fruits of *H. coriacea* and *H. petersiana*, and to some extent, palm wine produced from both species are excellent sources of essential minerals such as calcium, copper, iron, magnesium, phosphorus, potassium, sodium and zinc (Table 2). Reference is also made to the recommended dietary allowance (RDA) representing the average daily intake of essential nutrients that are needed to meet the nutrient requirements of a health person (Tables 2). A wide variety of nutrients associated with fruits and wine produced from *H. coriacea* and *H. petersiana* (Table 2) imply that these species could be sources of health promoting nutrients and therefore, serve as good supplements for nutrients such as carbohydrates, crude fibre, fats, proteins and vitamin C to complement the stipulated requirements for the RDA values. Some fatty acids such as lauric acid, linoleic acid, myristic acid, oleic acid, palmitic acid and stearic acid (Table 3) have been identified from the seed oil of *H. coriacea* and *H. petersiana* [54,55]. Similarly, Mitei et al. [56] characterized the phytosterols, vitamin E compounds, tocopherols and tocotrienols of the seeds oil of *H. petersiana* (Table 3). Lokuruka [54] identified essential amino acids such as histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine from the seed oil of *H. coriacea*. Therefore, palm wine produced from *H. coriacea* and *H. petersiana*, and the fruits of both species constitute an important food source characterized by valuable nutritional properties.



**Fig. 4:** Sap tapping of *H. coriacea* showing leaf gutter funnelling sap into collection container (photo: Sune Holt)

Tapping of sap from *H. coriacea* and *H. petersiana* to produce palm wine is traditionally an important subsistence activity in southern Africa with the alcoholic beverage considered to have important nutritional value [12,49-52]. Research by Cunningham [28] showed that nearly 980 000 litres of palm wine produced from *H. coriacea* were sold during the 12 month period between 1981 and 1982 in South Africa, with sales of the beverage generating R157 732 (US\$145 113)

**TABLE 2**  
NUTRITIONAL COMPOSITION OF FRUITS AND WINE PRODUCED FROM *H. CORIACEA* AND *H. PETERSIANA*

Nutritional component	<i>H. coriacea</i>	<i>H. petersiana</i>	Recommended dietary allowance (RDA)	Reference
Alcohol (% v/v)	2.00 3.70	0.80 55.30	-	12,48,51-53
Ash (g/100g)	0.40	9.00	-	16,51,52
Calcium (mg/100g)	0.13 17.43	- 103.00	1000-1300	16,51,52
Carbohydrates (g/100g)	0.70 1.20	- 69.50	130	16,51,52
Carotene (mg/100g)	-	0.06	-	51

Copper (mg/100g)	0.04 0.07	-	0.47	-	51,52	Caprylic (%)	0.60	-	54
Energy value (Kj/100g)	122.00 136.00	-	1265.00	10042	51-53	Cholesterol (%)	-	0.91	56
Fat (g/100g)	-	-	0.40	20.00 35.00	16,51	Citrostadienol (%)	-	1.05	56
Fibre (g/100g)	-	-	9.60	25.00 30.00	51	Cycloartenol (%)	-	36.90	56
Iron (mg/100g)	0.07 29.80	-	2.04	8.00 - 15.00	12,16,19 ,51,52	Diacetyl (mg/L)	-	845.00 3698.00	53
Magnesium (mg/100g)	3.37 5.40	-	197.00	310 - 320	16,51,52	Ethyl acetate (mg/L)	-	199.00 709.00	53
Manganese (mg/100g)	0.05	-	0.04	2.30	16,51,52	Histidine (mg/g)	41.00	-	19
Moisture (g/100g)	98.20 98.80	-	6.60	-	16,51,52	Isoleucine (mg/g)	51.00	-	19
Nicotinic acid (mg/100g)	0.11 - 0.5	-	4.62	16.00 35.00	12,51,52	Lactic acid (%)	-	3.80 6.90	48
Oxalate (mg/g)	-	-	0.02	-	16	Lauric acid (%)	30.90 32.60	-	25.92 54,55
Phosphorus (mg/100g)	1.37 7.80	-	156.00	1250	16,51,52	Leucine (mg/g)	77.00	-	19
Phytate (mg/g)	-	-	0.12	-	16	Linoleic acid (%)	2.00 3.20	-	4.29 54,55
Potassium (mg/100g)	152.00 155.00	-	2560.00	4700.00	16,51,52	Lysine (mg/g)	51.00	-	19
Protein (g/100g)	0.10 4.76	-	4.90	34.00	16,19,49 ,51,52,57	Methionine Cystine (mg/g)	+ 197.00	-	19
Riboflavin (mg/100g)	0.005 0.44	-	0.10	0.30 - 1.60	49,51,52 ,57	24-Methylene-cycloartanol (%)	-	9.03	56
Saponin (mg/g)	-	-	2.46	-	16	Myristic acid (%)	14.80 21.20	-	13.13 54,55
Selenium (mg/kg)	-	-	0.01	-	16	Oleic acid (%)	21.90 30.60	-	42.37 54,55
Sodium (mg/100g)	9.88 13.30	-	11.65	2300	16,51,52	Palmitic acid (%)	8.50 11.60	-	10.39 54,55
Sulfur (mg/kg)	-	-	2.93	14.00	16	2,3-Pentanedione (mg/L)	-	149.0 1038.0	53
Tannin (mg/g)	-	-	0.10	-	16	Phenylalanine Tyrosine (mg/g)	+ 96.00	-	19
Thiamin (mg/100g)	0.005 0.02	-	-	1.00 - 2.00	12,51,52	n-Propanol (mg/L)	-	142.00 237.00	53
Vitamin C (mg/100g)	5.00 6.80	-	19.70	46.00	51,52	Sitosterol (%)	-	37.08	56
Zinc (mg/100g)	0.01 4.29	-	0.56	8.00 - 11.00	16,51,52 ,54	Sitostanol/ $\Delta$ 5-avenasterol (%)	-	6.31	56
						Stearic acid (%)	0.20	3.90	54,55
						Stigmastanol (%)	-	0.51	56
						Stigmasterol (%)	-	3.87	56
						Threonine (mg/g)	31.00	-	19
						Tryptophan (mg/g)	14.00	-	19
						$\alpha$ -Tocopherol ( $\mu$ g/g)	-	3.27	56
						$\alpha$ -tocotrienol ( $\mu$ g/g)	-	86.65	56
						$\beta$ -tocotrienol ( $\mu$ g/g)	-	172.47	56
						Valine (mg/g)	45.00	-	19

**TABLE 3**

**PHYTOCHEMICAL COMPOSITION OF *H. CORIACEA* AND *H. PETERSIANA* FRUITS AND SEED OIL**

Phytochemical compound	H. coriacea	H. petersiana	Reference
Acetaldehyde (mg/L)	-	73.00 161.00	53
Acetic acid (%)	-	2.80 7.10	48
Iso-Amyl acetate (mg/L)	-	0.70 2.70	53
Amyl alcohols (mg/L)	-	124.00 1744.00	53
Iso-Butanol (mg/L)	-	158.00 838.00	53
Campesterol (%)	-	3.59	56
Capric (%)	0.90 21.30	-	54

Hyphaene coriacea and *H. petersiana* can be categorized as multipurpose plant species as the species are associated with provision of numerous ecosystem goods and services, see Table 1. The leaves of both species are widely used for fencing, making brooms, dye, thatching and weaving throughout the distributional range of the species (Table 1). The young leaves of the two species are used for weaving baskets, the fresh rachis for mats and the dry petioles for doors and chairs. The seeds are used as a source of vegetable ivory and other ornaments. The leaves of both species are also used as fodder for both game and livestock. The two species are also important components of bushveld, savanna and secondary vegetation. The crafts are sold in local and regional markets providing an important source of income to several households [11,28,45].

#### 4. Medicinal uses of *H. coriacea* and *H. petersiana*

Local people in east and southern Africa use the fibre, fruits, leaves, kernels and stems of *H. coriacea* and *H. petersiana* as traditional medicines (Table 4). In Kenya, the leaves and kernels of *H. coriacea* are used during circumcision ceremonies and herbal medicine for stomach ache [20,33,58]. In Madagascar, the leaves of *H. coriacea* are used for pregnancy, birth, puerperium disorders and toothache [21,59]. In South Africa, the fibre, fruits and stems of *H. coriacea* are used for menstrual problems, neck ache, infertility, after birth pains, postpartum bleeding, ease labour, soften hair, clean teeth and hypertension [26,29,60-62]. In Tanzania, the fruit pulp of *H. coriacea* and *H. petersiana* are used as traditional medicines for cancer, intestinal worms and stomach ache [20,31-33]. In Botswana, the roots of *H. petersiana* are used for cough, kidney problems and toothache [36-38] while the leaves of the species are used during healing ceremonies in Zimbabwe [63]. In Namibia, the leaves of *H. petersiana* are used during rituals while kernels and roots used against cough, wounds and as ethnoveterinary medicine [14,64]. In Zambia, the fruits, sap and seeds of *H. petersiana* are used against malaria, cough, tuberculosis, skin rashes and sexually transmitted infections [65].

**TABLE 4**  
**MEDICINAL USES OF *H. CORIACEA* AND *H. PETERSIANA***

Species	Medicinal uses	Country	Reference
<i>H. coriacea</i>			
Cancer	Kernel	Tanzania	31
Circumcision ceremony	Leaves	Kenya	58
Clean teeth	Fruits	South Africa	60
Hypertension	Roots mixed with leaves of <i>Aloe marlothii</i> A. Berger and <i>Trichilia emetica</i> Vahl	South Africa	62
Infertility	Stems	South Africa	61
Menstrual problems	Pith of trunk	South Africa	26,29,61
Neck ache	Fibre	South Africa	29
Pregnancy, birth and puerperium disorders	Leaves and stems	Madagascar and South Africa	21,61
Soften hair	Fruits	South Africa	60
Stomach ache	Fruit pulp	Kenya and Tanzania	20,32,33
Toothache	Leaves	Madagascar	59
<i>H. petersiana</i>			
Cough	Fruits, kernel and roots	Botswana, Namibia and Zambia	14,36,65
Ethnoveterinary medicine	Kernel	Namibia	14
Intestinal worms	Fruit pulp	Tanzania	32

Kidney problems	Roots	Botswana	36
Malaria	Fruits	Zambia	65
Rituals	Leaves	Namibia and Zimbabwe	63,64
Sexually transmitted infections	Sap	Zambia	65
Skin rash	Sap	Zambia	65
Stomach ache	Fruit pulp	Tanzania	32
Toothache	Roots	Botswana	38
Tuberculosis	Seeds	Zambia	65
Wounds	Leaves	Namibia	14

#### 5. Future research and perspectives

The multipurpose species like *H. coriacea* and *H. petersiana* are currently underutilized, neglected by researchers, agricultural extension officers and policy makers. Their promotion could assist in a protracted fight against malnutrition, domestication and environmental sustainability in tropical Africa. Apart from economic aspects, palm wine is regarded as the most widely consumed alcoholic beverage in the distributional range of *H. coriacea* and *H. petersiana* and has important nutritional properties [12,49,50,52]. It is therefore, important that sustainable management of *H. coriacea* and *H. petersiana* is considered because of the economic and nutritional value of fruits and palm wine derived from the species. Increased commercialisation combined with harmful harvesting techniques, has led to concerns about overexploitation of both *H. coriacea* and *H. petersiana*. These two species hold considerable potential as they can both be harvested sustainably and deliver significant development benefits to poor and marginalized rural communities. Increased commercialisation of palm wine and craft materials in some communities over the years has also led to an escalation of local over-harvesting of the plant species, and concerns about the sustainability of wild extraction. In recent decades, localised declines of both *H. coriacea* and *H. petersiana* populations have been recorded by several studies but based on the World Conservation Union (IUCN) Red List Categories and Criteria version 3.1 of threatened species (<http://www.iucnredlist.org>) for overall population size, extent of occurrence or area of occupancy and their statutes are not considered threatened [66]. The economic importance of *H. coriacea* and *H. petersiana* cannot be underestimated, especially in the area of poverty alleviation among rural people. A cursory survey of people involved in the trade of products generated from the two species established that a substantial amount of revenue could be realised. Research by Cunningham [28] revealed that the price of palm wine increases as the commodity changes hands from first degree to third degree traders. *Hyphaene coriacea* and *H. petersiana* are important to food security, macro- and micronutrient sources, ecological and provisioning roles throughout their distributional range, therefore, there is need to diversify crops in the arable agricultural systems to include the two lesser known and underutilized species in order to strengthen the economic, food and ecological networks of local communities. Future research should also evaluate the nutritional, phytochemical, pharmacological and toxicological properties of different plant parts of the two species that are used as sources of food and medicines. Since *H. coriacea* and *H.*

petersiana are multipurpose species, there is need for sustainable utilization of the species and also guarding against over-harvesting of the species.

## CONFLICTS OF INTEREST

No conflict of interest is associated with this work.

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