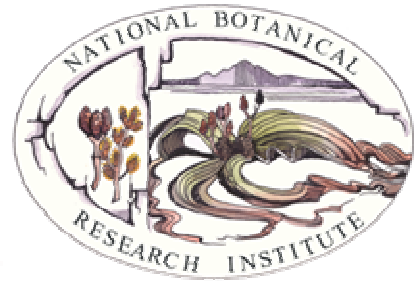


Kew

PLANTS PEOPLE
POSSIBILITIES



This report was generated from the SEPASAL database (www.kew.org/ceb/sepasal) in August 2007. This database is freely available to members of the public.

SEPASAL is a database and enquiry service about useful "wild" and semi-domesticated plants of tropical and subtropical drylands, developed and maintained at the Royal Botanic Gardens, Kew. "Useful" includes plants which humans eat, use as medicine, feed to animals, make things from, use as fuel, and many other uses.

Since 2004, there has been a Namibian SEPASAL team, based at the National Botanical Research Institute of the Ministry of Agriculture which has been updating the information on Namibian species from Namibian and southern African literature and unpublished sources. By August 2007, over 700 Namibian species had been updated.

Work on updating species information, and adding new species to the database, is ongoing. It may be worth visiting the web site and querying the database to obtain the latest information for this species.

Internet SEPASAL

New query

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 *Display help*In names list include: synonyms vernacular names and display: 10 names per page*Your query found 1 taxon***Hyphaene petersiana Klotzsch ex Mart. [1362]**

Family: PALMAE

Synonyms

Hyphaene benguellensis Welw.

Hyphaene benguellensis Welw. var. plagiocarpa (Dammer)Furtado

Hyphaene benguellensis Welw. var. ventricosa (Kirk)Furtado

Hyphaene ventricosa J.Kirk

Vernacular names

(East Africa) [nuts]	dum [2357]
(Zimbabwe)	murara [3023], ilala [3030]
Afrikaans (Namibia)	makalanie-palm [5083] [5087] [5098], opregte waaierpalm [2136], waaierpalm [5087]
Afrikaans (Southern Africa)	noordelike lalapalm [5082], opregte waaierpalm [1171] [2795] [3045]
Barakwengo-Bushmen (Namibia) [fruit]	lallo [5087]
Barakwengo-Bushmen (Namibia) [leaf]	lgaa [5087]
Bushmen (Namibia)	tjanni [5087]
Bushmen (Namibia) [stem]	hee [5087]
Central Ndebele (Zimbabwe)	ilala [2506]
Central Shona (Zimbabwe)	murara [2506], muzira [2506]
Chewa (Malawi)	ka koma [1838], ma laza [1838], li ngwenda [1838]
Damara (Namibia)	!unias [5095], !unib [5095], !unihais [5095], !unis [5095]
Damara>Nama (Namibia)	!unias [5098], !unihais [5098]
English	vegetable ivory palm [1340] [1838] [3017] [3018] [3029], makola palm [1257] [2803] [3019], real fan palm [1279], northern ilala palm [1279], doum [2968] [3019], dum palm [1340], fan palm [1340], ilala palm [1340], mulala palm [1340], vegetable ivory [1340]
English (Botswana)	northern ilala palm [5093], real fan palm [5092] [5093], vegetable ivory palm [2803]
English (Namibia)	dum palm [1304] [2136], fan palm [1304] [5087] [5098], ivory palm [1304] [2136], makalani palm [2136] [5083] [5091] [5121] [5376], real fan palm [2136], vegetable ivory palm [1304] [2801]
English (Southern Africa)	mokola palm [2795], northern lala palm [5082], real fan palm [1171] [2795] [3045], vegetable ivory palm [2795]

English (Zimbabwe)	ilala palm [2506], northern lala palm [5082], vegetable ivory [2506], vegetable-ivory palm [5082]
Gciriku (Namibia)	ngone [5087] [5098]
German (Namibia)	Makalani Palme [5083] [5087], Facherpalme [5098], fascher palm [1304]
Heikum Bushmen (Namibia)	!abab [5087], lunib [5087]
Herero (Namibia)	omurunga [5083] [5087] [5091] [5098]
Herero (Namibia) [fruit, plural]	omarunga [5087]
Herero (Namibia) [fruit, singular]	erunga [5087]
Herero (Namibia) [fruit]	omarungu [5091] [5095]
Herero (Namibia) [leaf, plural]	ovivare [5083] [5087]
Herero (Namibia) [leaf, singular]	otjivare [5083] [5087]
Herero (Namibia) [small plant, plural]	omavare [5083] [5087]
Herero (Namibia) [small plant, singular]	ervare [5083] [5087]
Herero (Namibia) [small plant]	otjivare [5087]
Herero (Southern Africa)	evare [1171], omurungu [1171] [2795]
Himba (Namibia)	omurunga [5087] [5095] [5098]
Himba (Namibia) [fruit]	omarunga [5087]
Himba (Namibia) [small plant]	omavare [5087] [5095], otjivare [5087]
Ila (Zambia)	lu bali [1838], mu nkomona [1838]
Jul'hoan (Namibia)	!hani [5083], #kaba [5083], lkaba [5083], llaba [5083], llabaha [5083], llei [5083]
Khoekhoegowab (Namibia)	!unihais [5083], !unis [5083], lbab [5083]
Kunda (Zaire)	ma gwembe [1838], ka koma [1838], ma laza [1838]
Kung Bushmen (Namibia)	!hani [5098], !heni [5098]
Kung Bushmen (Namibia) [fruit]	!heni [5087]
Kung Bushmen (Namibia) [small plant]	lle? [5087]
Kwambi (Namibia)	!heni [5087]
Kwangali (Namibia)	ngone [5087] [5098], sivare [5087]
Kwangali (Namibia) [fruit, plural]	nondunga [5087]
Kwangali (Namibia) [fruit, singular]	ndunga [5087]
Kwangali (Namibia) [leaf, plural]	nombare [5087]
Kwangali (Namibia) [leaf, singular]	ruvare [5087]
Kwangali (Namibia) [petiole]	murunga [5087]

Kwanyama (Namibia)	omulunga [1304] [5087] [5098]
Kwanyama (Namibia) [fruit]	ondunga [1304] [5087]
Kwanyama (Namibia) [leaf, plural]	eembale [1304] [5087], epokola [1304]
Kwanyama (Namibia) [leaf, singular]	oluvale [1304] [5087]
Kwanyama (Namibia) [plural]	omilunga [1304]
Kwanyama (Namibia) [small plant]	oshivale [1304] [5087]
Kxoe (Namibia)	hee [5083], tjanni [5083], lallo [5083], lgaag [5083], llau [5083]
Lala (Zambia)	ka. chi mbili [1838]
Lenje (Zambia)	ka pukupuku [1838]
Lozi (Namibia)	kakulwane [5087], kanganda [5083], mikulwani [5083], mukulwane [5087], mukulwani [5083], mulala [5083], munganda [5083] [5087], mungwenji [5083]
Mbalantu (Namibia)	omulunga [5087]
Mbukushu (Botswana)	njumu [edible shoots] [2803], gau [meristem] [2803]
Mbukushu (Namibia)	kakoma [5087] [5098]
Mbukushu (Namibia) [fruit]	ngone [5087]
Mbukushu (Namibia) [leaf]	mbare [5087]
Mbukushu (Namibia) [petiole]	mbare [5087]
Mbukushu (Namibia) [small plant]	dikindhu [5087]
Mbundu (Angola)	omulunga [5087]
Nama (Namibia)	!abab [5087], !unib [2136]
Namutoni Bushmen (Namibia)	!uniba [5087]
Ndebele	ilala [1340] [3029]
Ndonga (Namibia)	omulunga [5087] [5098]
Ndonga (Namibia) [fruit]	ondunga [5087]
Ndonga (Namibia) [leaf, plural]	oombalo [5087]
Ndonga (Namibia) [leaf, singular]	olwaale [5087]
Ndonga (Namibia) [small plant]	oshaale [5087]
Nkolonkadhi (Namibia)	omulunga [5087]
Nkumbi (Angola)	omulunga [5087], otjiwale [5087]
Norekau Bushmen (Namibia)	!aba [5087]
Nsenga (Malawi)	m cheu [1838], m. mu lala [1838], ka puku [1838]
Oshikwanyama (Namibia)	epokola [5083] [5121], omulunga [5083], ondunga [5083], oshivale [5083]
Oshikwanyama (Namibia) [leaf, plural]	eembale [5083]

Oshindonga (Namibia)	omulunga [5083] [5376], ondunga [5083], oshaale [5083]
Oshindonga (Namibia) [leaf, plural]	oombalo [5083]
Oshindonga (Namibia) [leaf]	oluvale [5083], olwaale [5083]
Oshiwambo (Namibia)	omulunga [2390] [5121]
Oshiwambo (Namibia) [alcoholic beverage]	olambika [2801], omulunga [2801]
Otjiherero (Namibia)	omulunga [5121]
Ovambo (southern Africa)	omulunga [1171] [2795]
Rukwangali (Namibia)	ngone [5083], sivare [5083]
Rukwangali (Namibia) [fruit, plural]	nondunga [5083]
Rukwangali (Namibia) [leaf, plural]	nombare [5083]
Rukwangali (Namibia) [leaf]	ruvare [5083]
Rukwangali (Namibia) [petiole]	murunga [5083]
Rumanyo (Namibia)	nbare [5083], ngone [5083]
Rumanyo (Namibia) [fruit]	ndunga [5083]
Rumanyo (Namibia) [leaf]	mbare [5083]
Rumanyo (Namibia) [petiole]	murunga [5083]
SeTswana (Botswana)	mokola [3029], mokolwane [5093]
Setawana (Botswana)	mokolane [5093]
Shambyu (Namibia)	ngone [5087] [5098]
Shambyu (Namibia) [fruit]	ndunga [5087]
Shambyu (Namibia) [leaf]	mbare [5087]
Shambyu (Namibia) [petiole]	murunga [5087]
Shambyu (Namibia) [small plant]	nbare [5087]
Shona	murara [3029], inala [1340], muchindwi [1340], mulala [1340], munganda [1340], mungwenji [1340]
Sikololo	mu kulwane [1838], ka. mu nganda [1838], ntonge [1838]
Sinkoya	m. mu lala [1838], mu nkoma [1838]
Thimbukushu (Namibia)	ghundunga [5083], kakoma [5083], mbare [5083] [5121]
Thimbukushu (Namibia) [fruit]	ngone [5083]
Tjimba (Namibia)	omurunga [5087]
Tjimba (Namibia) [fruit]	ozondunga [5087]
Tjimba (Namibia) [small plant]	otjivale [5087]
Toka (Zambia)	m. mu lala [1838], ka nkunka [1838]

Tonga, Plateau (Zambia)	m. mu lala [1838], mu ngumba [1838]
Tonga, Valley (Zambia)	ma pokwe [1838]
Tswana	mokolane [1340], mukolwane [1340]
Tswana (Botswana)	mokolane [5092]
Ushi (Zambia)	ka. chi mbili [1838]
Yanga	nkwalangwa [1838]

Partial distribution

Plant origin	Continent	Region	Botanical country
Native	Africa	East Tropical Africa	Tanzania [1362] [1838] [2968]
		South Tropical Africa	Angola [1362] [1838] [2803] [2968], Malawi [1838] [3021], Mozambique [1362] [1838], Zambia [1362] [3011] [3019] [5481], Zimbabwe [1838] [2803] [2988] [3011] [3017] [3018] [3023] [3026] [3030] [5419]
		Southern Africa	Botswana [1257] [1838] [2803] [5104], Namibia [1304] [1362] [1669] [1838] [2801] [3011] [5104], Transvaal [1362] [1669] [2968] [5104]
		West-Central Tropical Africa	Rwanda [2968], Zaire [1362] [2968]
Status Unknown	Africa	West-Central Tropical Africa	Burundi [2968]

ISO countries: South Africa [1362] [1669] [2968] [5104]

Descriptors

Category	Descriptors and states
DESCRIPTION	Evergreen [3029]; Single Stemmed [1279] [2506] [2795] [2801] [3029] [3045] [5082] [5121]; Can be Coppiced [1257]; Tussock Forming/Tufted/Caespitose [3045] [5082]; Erect [2968] [3045]; Multistemmed [1279] [2506] [2795] [2968] [3019] [5082] [5121]; Dioecious [1171] [1838] [2506] [3045] [5098]; Terrestrial [2390] [2749] [2790] [2968] [3018]; Shrub [2506]; Slow Growth Rate [1279] [1600] [2506] [5082] [5092] [5093]; Tree [2968] [5104]; Perennial [2968] [5104]; Taproot Present [1279] [5082] [5092]; Thicket Forming [2795]; Thorny/Spiny - leaves [1279] [3029] [3045]; Aromatic - infructescences [2968]; Plant Height 1.5-18 m [3045] [5104]; d.b.h. <= 35 cm [2968]
SOILS	High Water-Table [1257] [2803]; Saline [1304] [2968] [5092]; Alluvial Soils [1838] [2968] [3019]; Sandy [1279] [1838] [2968] [3019] [5082] [5092] [5121]; Dry [1838]; Loams [1838]; Clays [1838] [3019]
HABITAT	Lowland [3045]; Plateaux [5121]; Forest [1838]; Woodland [1838] [3019]; Valleys [1838] [3019]; Shrubland/Bushland/Scrub [3045]; Grassland/Forb-Land [2803] [3019]; Wooded

Grassland [1838] [2968] [3019]; Ridges [1838]; Outcrops/Kopjes/Inselbergs [5121]; Ant-Hills/Nests [1838]; Dunes [5121]; Watercourses [1257] [2506] [2968] [3019] [3045] [5082] [5091] [5121]; Permanent Watercourses [5091]; Non-Permanent Watercourses [5091]; Other Topographical Sites [1838]; Floodplains [3019] [5092] [5121]; Vlei/Dambo/Seasonally Flooded Grassland [1838] [3045] [5082] [5093]; Pans [1838] [3019] [3045] [5082] [5092] [5121]; Plains [1838] [5121]; Altitude 275-1300 m a.s.l. [2968] [5104]

PHYSIOLOGY

Fire Resistant/Regenerates After Fire [1838] [5092]

WOOD

Finish - Good [1838]; Polishing Finish - Good [1838]

PROPERTIES

PRODUCTION AND VALUE

Subsistence Value [2801] [2810]; Traded Locally [1576] [2390] [2801] [2803] [3011]; Commercial Value [2810]; Potential Material Uses [1838]; Traded Globally Between Continents [1257]

FURTHER DATA

Botanical Illustration [2506] [3045] [5093]; Additional References [2101] [3018] [5667];

SOURCES

Regional Distribution Map [3045] [5082]; Databases [5123] [5327]; Habit Illustration/Photograph [1171] [3045] [5082] [5092] [5093] [5376]; Use Related Illustration/Photograph [1304] [2390] [2795] [2801] [5376]; Grid Map [5093] [5123] [5327]

SEPASAL DATASHEET STATUS

All Data Transferred from SEPASAL Paper Files; Comprehensively Researched; Nomenclature Checked

CHEMICAL ANALYSES

Unspecified Carbohydrates - infructescences [187]; Nutritional Analyses - leaves [5250]; Nutritional Analyses - infructescences [187] [3021]; Proteins - leaves [5250]; Proteins - infructescences [187]; Vitamin B2/Vitamin G (riboflavin) - infructescences [187]; Sugar Alcohols - seeds [2357]; Vitamin B7/Vit. P-P (nicotinamide, nicotinic acid) - infructescences [187]; Vitamin B7/Vit. P-P (nicotinamide, nicotinic acid) - sap/leaf sap [2795]; Vitamin C (ascorbic acid) - infructescences [187] [3021]; Vitamin C (ascorbic acid) - sap/leaf sap [2795]

Uses

Major use

Major use	Use group	Specific uses
FOOD	Unspecified Parts	potable water [1188]
	Seedlings/Germinated Seeds	raw [1171] [5092]
	Stems	other stem parts, vegetables, raw [1838] [2801] [2803] [3019]; other stem parts, vegetables, savoury preparations [1838] [3019]; other stem parts, vegetables, condiments/relishes/chutneys [1188] [1838]; other stem parts, vegetables [1171] [1257] [1304] [2136] [2801] [2803] [5092] [5095]; other stem parts, savoury preparations [1257]; other stem parts [2801] [3019]; other stem parts, vegetables [2136] [2390] [5092]
	Leaves	young leaves, vegetables [1257] [2803]; young leaves [3045]
	Infructescences	entire immature fruits, dessert fruits, raw [1838] [3029]; other infructescence parts, dessert fruits [1838]; fruits [1171] [1188] [1257] [2136] [2390] [2795] [2801] [3029] [5095] [5098] [5376]; fruits, staple food [1257]; fruit pulp, raw [1171] [1279] [1304] [2506]; fruit pulp, other food types, alcoholic beverages [2801]; fruits, spirits [1304] [2801]; fruits, alcoholic beverages [2390]; fruits, wines [1304]
	Seeds	liquid albumen, non-alcoholic beverages [1171] [1257] [1279] [1838] [2506] [2795] [3045] [5082] [5092]; kernels [1838]; seed oil, oils/fats [5376]; famine food [3045]; other seed parts, spirits [1304]; kernels, raw [5093]; other seed parts, alcoholic beverages [1304]
	Exudates	sap, wines [1171] [1257] [1279] [1304] [1838] [2136] [2390] [2506] [2795] [2801] [3011] [3018] [3045] [5082] [5092]

		[5095] [5098] [5376] [5478]; sap, alcoholic beverages [1171] [1279] [1838] [2795] [2801] [3011] [3018] [5091] [5092] [5093] [5095] [5121]; sap, spirits [1279] [1304] [2506] [2795] [2801] [3018] [5082] [5092] [5093]; sap, beverages [1171] [5092]
ANIMAL FOOD	Fertile Plant Parts	fruits [1257] [1838]; fruits, game mammals [1257] [3029] [5082] [5092] [5121]; fruits, primates, forage [3029]; frogs; fruits, primates [1257] [5082] [5092]; entire immature fruits, primates [2506]
	Aerial Parts	young leaves, cattle, browse [1838] [2390] [2801] [2803]; young leaves, goats, browse [1838] [2390] [2801] [2803]; young leaves, camels, browse [1838] [2801] [2803]; young leaves, donkeys, browse [1838] [2390] [2801] [2803]; young leaves, other mammals, browse [2803]; leaves, game mammals [3045]; young leaves, game mammals, browse [1838] [2506] [3045] [5092]; mammals, browse [2801]; young leaves, mammals, browse [2801] [2803]
	Other Parts	donkeys [2801]
MATERIALS	Fibres	leaves, baskets [1257] [1304] [2136] [2506] [2795] [2801] [2803] [2988] [3011] [3019] [3023] [3024] [3029] [3045] [5092] [5093] [5095] [5118] [5376]; young leaves, bags [1838] [2801] [2803] [2988] [3011] [3023] [3024]; young leaves, baskets [1257] [1838] [2390] [2795] [2801] [2803] [2988] [3011] [3019] [3023] [3024] [3029] [5092]; young leaves, mats [1838] [2801] [2803] [2988] [3011] [3019] [3023] [3024]; young leaves, hats [1838] [2803] [3011]; young leaves, cord/string/twine [1838] [2801] [2803] [3011] [3019]; baskets [1304] [2801] [3011]; dolls [1304]; clothing [1304]; leaves, ropes [1257] [1304] [2136] [2803]; basketry (from fibre) [1576] [2801] [3011] [3029]; leaves, matting [1257] [1304] [2506] [2801] [2803] [3011] [3019]; leaves, cord/string/twine [1257] [1340] [2801] [2803] [5091] [5095]; leaves, sacking, sacks [3019]; other leaf parts, other fibrous materials, other products [3019]; leaves, tooth cleaners [5121]; leaves, thatch, roofs [2506]; leaves, hats [1304] [2506]; leaves, brushes/brooms [1304] [2506]; leaves, fish traps [5376]; leaves, bows (weapons) [5091] [5095]; leaves, plates/bowls [5091]; young leaves, plates/bowls [5091]; leaves, other products [5091]; young leaves, ropes [3011]; other leaf parts, walls [1838]; other leaf parts, fences [1838] [2390] [2801]; other leaf parts, bows (weapons) [1304] [5091] [5095]; other leaf parts, other products [1304] [3019] [5091]; leaves, roofs [1304] [2136]; other leaf parts, huts [1304]; leaves, sieves [1304]; young leaves, woven material, baskets [2803]; leaf blades, clothing [1304]; leaf blades, necklaces [1304]; leaf blades, bracelets [1304]; leaves, fences [5376]
	Wood	heartwood, marquetry wood [1838]; stems, poles (from wood), buildings [2801]; stems, fences [2390] [2801] [3029]; stems, troughs [2801]; other leaf parts, props, fences [2801]; stems, buildings [3029]; stems, combs; wood, plates/bowls [5376]; trunks, stools [5376]; stems, beams/scantlings [1838]; seeds, carved wood; wood, troughs [1304] [2390] [2801] [5376]; trunks, beams/scantlings, houses [962] [3019]
	Tannins/Dyestuffs	young leaves, dyes, baskets [5095]
	Other Materials/Chemicals	kernels, carved materials (non-wood), buttons [1304] [1838]

		[3017] [5092]; kernels, carved materials (non-wood), brooches [1838] [3017]; kernels, carved materials (non-wood), walking sticks [1838]; kernels, carved materials (non-wood), ornaments [1279] [1304] [1838] [2136] [2506] [2795] [2988] [3017] [3027] [5082] [5092] [5095] [5121]; kernels, other products [1279] [2988] [3011] [3017] [3027]; fruits, dolls [1304] [5091] [5095]; kernels, boxes [3027]; fruits, other products [1340]
FUELS	Miscellaneous Fuels	other leaf parts [2801]
ENVIRONMENTAL USES	Indicators	saline soils [5093]
	Boundaries/Barriers/Supports	other types of boundaries/barriers/supports, other environmental materials [2801]
	Agroforestry	other agroforestry uses [5376]

Picture

None recorded

Notes

NOMENCLATURE/TAXONOMY

Numerous names have been applied to this palm; *H. ventricosa* is perhaps the most commonly applied name in earlier literature [2968] .

Numerous synonyms are listed in Flora of Tropical East Africa (1986) [1362] .

Name derivation:

The generic name is derived from the Greek word 'hyphaino' which means 'to entwine', referring to the fibrous fruits [2136] [5092] .

Name derivation:

petersiana is probably in honour of the famous German botanist , W. Peters [5092] .

VERNACULAR NAMES

Sikololo, Sinkoya, Yanga:

Countries not known but Zambia presumed .

DISTRIBUTION

Africa:

Occurs in Tanzania from Lake Manyara and through Zaire to the west coast of Africa in Angola and Namibia [1362] .

Africa:

Found at high altitudes in Rwanda and Burundi. In east and southern Africa, occurs in a broad swathe from Tanzania southwards into north Transvaal and west into Angola and Zaire [2968] .

Botswana:

Occurs in sizeable numbers in the area stretching from Nata village, westward to the Okavango Delta [5093] .

Botswana:

Northern Botswana, from Nata to Shakawe, Delta and Makgadikgadi (according to Moss and Taylor, 1983, referring to the synonym *H. benguellensis* var. *ventricosa*) [1257] .

Namibia:

Fairly widespread across northern Namibia, north of 20 degrees. Most abundant in the Cuvelai where it is often the dominant tree species. Two records from the Swakop River in the central Namibia desert, away from farms and unlikely to have been planted, probably represent regeneration from seeds washed down the river from cultivated palms upstream [5121] .

Namibia:

Kaokoveld, Owamboland, Etosha, Grootfontein, Kavango [5098] .

Namibia:

Very common along the Kunene and large seasonal rivers [5091] .

Okavango Delta, Botswana:

Very common, often forming homogenous island communities which cover the entire island. The Mogogelo floodplain is dominated by these palms, but the Khwai floodplain boasts only a few specimens. Prevalent around pans and on the edges of sand islands [5092] .

Southern Africa:

Far north of Namibia, northern Botswana, northern Zimbabwe, Mozambique, Angola, Zambia and Malawi [2795] .

Zambia:

Northern, Central, Eastern, Lusaka, Southern and Western Provinces [5481] .

Zimbabwe:

Widespread [5419] .

Africa:

Occurs on the high water-table grasslands of Zimbabwe, Angola and Botswana [2803] .

ORIGIN/DOMESTICATION

Namibia:

Introduced into Namibia by the Germans [2136] .

RARITY/CONSERVATION

Zimbabwe:

Leaf production in harvested ramets can be restored within 1 year, but in rural areas ramets are continually exposed to harvesting. The effects of this continuous harvesting on the status of the resource can only be determined after a few years of measuring [3029] .

Botswana:

The entire palm population of the main basket-making area of Etsha, in Botswana, is threatened due to demand and careless over-utilisation [1257] .

Botswana:

The main raw material of the basket weaving industry, *H. petersiana* is threatened by over-utilisation of the young fronds and the livelihood of thousands of people is in jeopardy. Only the young, unopened leaf shoots are used for weaving. Previously they were only cut when 1-2 m in height but the short supply now means that 1 m is the norm. Cutting of young shoots seriously affects the growth of the young plants and can kill them. As harvesting from tall palms is difficult, they are often coppiced. However, since only mature trees produce fruit, this is affecting natural regeneration [1257] .

Adult palms are destroyed by people tapping them for palm wine [1838] .

Botswana:

In 1983, it was considered that an increase in the rate of exploitation could have disastrous consequences for the tree [1257] .

The impact of overexploitation needs to be reduced, for example by creating protected areas [1257] .

Namibia:

Although heavily exploited, this species has good regenerative abilities and there are plenty of young plants around. Nevertheless, it should be monitored as extensive harvesting of nuts in some areas may have an effect on recruitment in the future [5121] .

Namibia:

Harvesting the heart of the palm is now forbidden, as this type of harvesting kills the tree [2136] .

Northern Namibia:

This species is actively protected and planted [5376] .

Southern Africa:

IUCN Status - Data Deficient (DD) (as *H. petersiana* Klotzsch) [3044] .

Hyphaene palms have a particularly slow reproductive rate, making the sustainable use of existing populations imperative for both palm users and biodiversity managers [3011] .

Botswana:

The change in *H. petersiana* use as a fibre resource and dye from subsistence to commercial use has decimated palm populations [2803] .

Botswana:

As the demand for palm leaves grew, mokola gatherers had to walk further to collect adequate materials. In the early 1970s mokola was abundant, but a decade later mokola collectors had to walk 5 - 6 hours before reaching suitable collecting sites. The recent practise of axe or hoe cutting damages young palm leaves and apical meristems, depleting the resource. Because of the aspirations of rural people for higher living standards and for items not made in rural areas (cotton fabric, canned foods, radios) and because of the increasing numbers of people in rural communities it will be difficult to maintain the utilisation of a cash-providing natural resource (*H. petersiana* leaves) at a fixed level. Although over-utilisation limits the life of the resource and its dependent industries, the short-term sacrifices required to maintain the resource for the future will be opposed by villagers unless crafts based on alternative materials can be developed and marketed [2803] .

Namibia:

Both removal of apical meristem for palm hearts, and tapping the stem for palm wine, destroys the palm stem from which they are harvested. As human populations increase (both naturally and as a result of the influx of Angolan refugees and Namibians returning from exile), there will be a corresponding increase in pressure on *H. petersiana* in north-central Namibia. Even without human and livestock population increases, it is likely that the demand for particular *Hyphaene* resources will increase, exacerbated by changes in land tenure patterns within the region. There is evidence that as north-central Namibia is drawn further into the cash economy the relatively equitable traditional land distribution system is being disrupted, forcing increased pressure on multi-use species such as *H. petersiana* on communal land [2801] .

Botswana, Namibia:

The primary feature of the current *H. petersiana* population structure in Namibia, which is almost certainly related to historic and present uses, is its skewed height class distribution. High numbers of juvenile unstemmed palms and very low numbers of stemmed individuals in the replacement height classes indicate that growth of immature suckers and seedlings into mature, sexually reproductive palms is not occurring. This pattern is more pronounced in heavily utilised areas. The palm population structure in north-central Namibia appears to be changing from stands of tall, fruit-bearing stemmed palms of various heights to short palm scrub consisting of clumped juvenile plants. Such a transformation may have significant negative implications for the future viability of the palm population. A similar change in population structure has been observed in heavily utilised *Hyphaene petersiana* populations elsewhere - particularly in north-west Botswana, attributed to the felling of palms for their fruits, browsing by livestock and the overutilisation of unopened leaves for basketry [2801] .

Botswana:

In the early 1990s the annual offtake of leaves for basketry amounted to 10%, within sustainable levels estimated at 30% per annum, but now severe browsing by livestock is a threat to the species' survival [3029] .

BOTANICAL DESCRIPTION

See Flora of Tropical East Africa [1362] .

See Fanshawe (1967) [1838] .

DESCRIPTION

Leaves:

Fan-shaped and arranged in a spiral along the apex of the ramet. The leaf petioles have hooked thorns along their margins. The number of green leaves on the ramet varies with ramet size. In Zimbabwe, leaf production continues throughout the year, but with two peaks - September-December (just after flowering) and March-June. Leaf longevity ranges from three to ten months [3029] .

Height:

5-7 m, sometimes 15 m (according to Coates Palgrave, 1977, referring to the synonym *H. benguellensis* Welw.) [1279] .

Leaves:

Fan-shaped, grey-green, 1.5-2 m long, petiole armed with spines [1279] [3045] .

Fruits:

Round or slightly oval, 4-5 cm, produced in large numbers taking 2 years to mature and 2 years to fall [1279] .

Height:

Up to 20 m (according to Moss and Taylor, 1983, referring to the synonym *H. benguellensis* var. *ventricosa*) [1257] .

Flowers:

In drooping clusters [3045] .

Fruits:

Roughly spherical, brown, up to 8 cm (according to Moss and Taylor, 1983, referring to the synonym *H. benguellensis* var. *ventricosa*) [1257] .

Fruits:

Small, more or less globose, 4.0 - 6.0 cm in diameter, ripening from green through orange to glossy dark brown [3045] .

Height:

1.5 - 14 m [5104] .

Height:

5 - 7 m, up to 18 m [5082] .

Height:

Mostly a tree of 3 to 8 m, but shrubby forms less than 3 m [5121] .

Height:

The stem may reach more than 10 m [5098] .

Height:

Up to 15 - 20 m [2506] .

Height:

Up to 16 m [2795] .

Height:

Up to 18 m [3045] .

Lifeform:

Single stemmed, with a slight swelling about halfway up the stem, or suckering and forming clumps [3045] [5082] .

Lifeform:

Where conditions are not favourable the tree grows as a small dry shrub with leaves at ground level [2506] .

Most juvenile palms arise from suckers produced by the rhizome left behind when an adult palm is destroyed.

Suckering may be stimulated by fire. Root suckers occasionally develop from the fusion of two or more roots of the parent palm [1838] .

Habit:

This species is generally a short tree reaching 7 m [3011] .

Stems:

Stems sometimes occur as a V-shape as a result of basal branching at ground level. Trunks also found aggregated at close proximity, arising from a suckering basal thicket. Many individuals develop a tapered ventricose swelling, typically 10 m above ground and 50 cm diameter at the widest part [2968] .

Leaves:

A mature trunk typically carries a crown of 20-25 active leaves with spirals of triangular clefted leaf bases in the upper part. These part to leave a clean trunk below, bearing regular leaf scars 2.5 cm apart. The petioles are 1.5 m long and 10 cm wide at the base tapering to 6 cm. They are rounded below and slightly concave above, particularly towards the base and bear the typical, regular, double array of dark viscous spines along the upper edges, angled towards the lamina. The petiole is waxy, with scattered black scales and numerous light brown hairs. The hastula, 5 mm high, is symmetrical or sometimes sloping with black spines and hairs. The leaf is strongly costapalmate with the costa curved and 75 cm long. The lamina is generally near-circular, folded about the costa and divided into 35-40 tapering segments to about one third to half the radius. The segments are somewhat narrow, about 5 mm wide at the base, and are further divided at the extremity to give a forked tip. The filaments between the segments are conspicuous. The lamina has a greyish bloom, dotted with small roundish scales [2968] .

Inflorescences:

The male inflorescence is pendulous and somewhat elongate, arching out from the leaf axil and 1-2 m long. The peduncle is short, around 7 cm diameter at the base. The rachis bracts carry as many as 12 partial inflorescences in the upper part, and the lower bracts are large and conspicuous, waxy and densely covered in scales and hairs. The primary branch is short, bearing as many as 13 linear or sometimes undulating rachillae, stiffly held in a semi-circle. The rachillae are large, 40 cm long by 1.2 cm in diameter and the bracts on the surface spirals are 7 mm wide and raised by 2 mm. The female inflorescence is similar but smaller than the male, 1-1.25 m long with ten partial inflorescences at the most. The primary branch bears fewer rachillae, rarely more than two. The rachillae are shorter and stubbier than the male. The reddish brown hairs of the floral pits are particularly conspicuous [2968] .

Fruits:

Variable in shape but always rounded, ovoid, or near globose, typically 5-7 cm high and 5-7 cm diameter in mid-section. The epicarp is very smooth and polished with only slight dimpling; reddish-brown in colour. When ripe, the

epicarp parts easily from the aromatic, yellow-orange flesh of the fibrous mesocarp [2968] .

Habit:

Grows to 20 m tall with a smooth trunk crowned by a canopy of large, fan-shaped leaves with spiny petioles. Stands of single-stemmed palms are being replaced by palm scrub, the sucker shoots produced by felled palms .

Fruits:

Somewhat spherical, approaching pear-shaped. The endocarp is thick. Seeds: The seed is flat at the base, nearly round in horizontal section, about 2.9 cm long and 3.2 cm wide with the apex slightly peaked at the embryo [3027] .

IDENTIFICATION

Very similar to *H. coriacea*. Separated mainly on the shape of the fruit. *H. coriacea* has a pear-shaped fruit with a distinctly narrow base, whilst *H. petersiana* has a round or slightly ovoid fruit. Their distributions show little overlap in southern Africa [5082] .

FOOD - UNSPECIFIED PARTS

Potable water:

Used by Bushmen in Namibia and/or Botswana for food and/or water (Story, 1958 cited by Grivetti, 1981) [1188] .

FOOD - SEEDLINGS/GERMINATED SEEDS

Raw:

The fruits are sprouted by covering them in a pit and the shoots produced are eaten [1171] [5092] .

Sprouted fruits can be boiled and eaten [1838] .

FOOD - STEMS

Other stem parts, vegetables:

The Bushmen use the core of young trunks as a vegetable [1171] .

Other stem parts, vegetables:

The crown-heart of the stem is eaten as a vegetable [2801] [5092] .

Other stem parts, vegetables, relishes:

The palm heart/pith is used as a vegetable relish by the Gwembe Tonga of Zambia, available in January (Scudder, 1971 cited by Grivetti, 1981) [1188] .

Other stem parts, vegetables, raw, savoury preparations:

The palm hearts of juvenile and mature plants are eaten raw or cooked [1838] .

Other stem parts, savoury preparations:

The entire stem is edible when roasted [1257] .

Other stem parts, vegetables:

The palm heart is considered a delicacy; also, young coppice stems from above- and below-ground are eaten [1257] .

Other stem parts, vegetables:

Terminal bud considered a delicacy, but its removal is now forbidden [1304] .

Other stem parts:

In Zambia, when a palm develops a stem of c. 1.8 m it is cut down and the palm heart is removed for eating [3019] .

Other stem parts:

The terminal bud is eaten as palm heart [2801] .

FOOD - LEAVES

Young leaves, vegetables:

In Botswana, the young leaf bases are relished as foods by villagers, who excavate them with sharp hoes [2803] .

FOOD - INFRUCTESCENCES

Fruits:

A survey in 1992 in northern Namibia showed that most households regularly collected fruits for home consumption

in the dry season: the fruiting peak (September/October) coincides with the end of the dry season, before the millet harvest and when other wild leaves and fruits are unavailable [2801] .

Pericarp, spirits:

Spirit distilled from the fleshy pericarp fulfils an important income-generating role for rural people in north-central Namibia: 68% of households interviewed during a survey regularly sold the drink [2801] .

Fruit pulp, raw:

A thin layer of sweet, ginger flavoured, spongy, fibrous pulp surrounds the seed [1279] [2506] .

Fruit pulp, raw:

The !Khu Bushmen eat the raw flesh of the fruit in summer and winter [1171] .

Fruit pulp, raw:

In Zimbabwe the fruit pulp is chewed like gum [2506] .

Fruits, wines, sprits:

Fleshy fibrous outery layer of seed removed and fermented to make wine, or distilled to make brandy [1304] .

Fruits:

The young fruits are boiled and eaten [1171] .

Fruits:

Used by the Gwembe Tonga of Zambia, available in June (Scudder, 1971 cited by Grivetti, 1981) [1188] .

Entire immature fruits, raw:

Young fruits are edible before the endocarp hardens and matures; the pericarp has the flavour of carob [1838] .

Fruits, staple food:

Nutritious and high in calories [1257] .

Fruit pulp, raw:

Fibrous mesocarp eaten [1304] .

Fruits, spirits:

In Namibia, the fleshy pericarp of the fruit is distilled into a spirit known in Oshiwambo as olambika [2801] .

FOOD - SEEDS

Liquid albumen, non-alcoholic beverages:

When young, 'milk' is produced which is relished by the indigenous people of Botswana and Namibia [1279] .

Kernels, raw:

The nuts are eaten raw in Botswana [5093] .

Oils, seed oil:

In northern Namibia, oil is extracted from the seed after removing the hard coat of the fruit by hitting it with a hard stick, and eating the flesh [5376] .

Liquid albumen, non-alcoholic beverages:

The 'milk', similar to coconut milk, can be drunk [1171] [1838] [2506] [2795] [3045] [5082] .

Other seed parts, alcoholic beverages, spirits:

The fleshy, fibrous outer layer of the seed is fermented or distilled [1304] .

FOOD - EXUDATES

Sap, alcoholic beverages:

60-70 litres of sap can be harvested from an average tree, which may be distilled into a strong liquor. However, this kind of exploitation frequently leads to tree death [1279] .

Sap, alcoholic beverages, beverages:

Shangaan, Swazi, Thonga and Zulu make an intoxicating drink by fermenting the sap; unfermented it tastes like flat ginger beer [1171] .

Sap, spirits:

About 10 litres of palm wine is used to make 1 litre of spirit [5082] .

Sap, spirits:

Palm wine made from sap can be distilled into an alcoholic beverage [1279] [1304] [5082] [5092] [5093] .

Sap, wines:

The palms are tapped from the apex to produce wine [1279] [1304] [1838] [2801] [3011] [5082] [5092] [5093] [5098] [5478] .

ANIMAL FOOD - FERTILE PLANT PARTS

Entire immature fruits, primates:

When young, the fruit is eaten by monkeys in Zimbabwe [2506] .

Fruits, primates:

Eaten by baboons [1257] [5092] .

Fruits, game mammals:

Elephants eat the fleshy layer of the fruit [1257] [5092] [5121] .

Fruits:

Nutritious and high in calories, the fruits are a staple food for wildlife [1257] .

ANIMAL FOOD - AERIAL PARTS

Young leaves, game mammals, browse:

Elephants browse the young leaves [1838] [2506] [2803] [3045] [5092] .

Young leaves, game mammals, mammals, browse:

The sucker shoots have little chance of regaining reproductive maturity because the unopened leaves are browsed by domestic livestock, hippopotami, and elephants [2803] .

Leaves, browse:

In the absence of alternative fodder, and despite the fibrous texture and unpalatability of palm leaves, the leaves of juvenile palms provide an important source of browse for livestock [2801] .

ANIMAL FOOD - OTHER PARTS

Donkeys:

Occasionally, in northern Namibia, the wood from inside felled mature palm stems that have been split open to provide livestock drinking troughs is eaten by donkeys [2801] .

MATERIALS - FIBRES

Fences, other leaf parts:

Petioles of large leaves are used as fencing droppers [2390] [2801] .

Baskets, young leaves:

Palm leaves for basketry should be cut through the petiole using a sharp knife, to avoid damaging the meristem and other leaves: 30% of annual leaf production is recommended for sustainable leaf harvesting [2390] .

Baskets, leaves:

In northern Namibia, baskets made from makalani palm fronds are used to carry dung to spread on the fields before the growing season, and to carry clay to use in pottery [5376] .

Baskets, leaves:

The Topnaar of Namibia divide the leaves into thin strips to use for weaving all kinds of baskets [2136] .

Baskets, leaves:

The leaves are used to make baskets. The species is one of the major species supporting the basket industry in the Okavango Delta, Botswana [5093] .

Baskets, young leaves:

More than 15,000 baskets are sold annually in Botswana. The growing tourist industry has greatly increased the palm tree's economic potential [5092] .

Baskets, young leaves:

Pliable young leaves are harvested before the folded leaf segments unfold. Only about one third of the young leaf is removed, a length of 40 - 100 cm, so that the same leaf can develop further and be harvested again. The leaf ends are prepared for weaving by boiling them in water for half an hour and then drying them in the sun. They may also be boiled in a natural dye. Some weavers remove the tough outer edges of the leaf segments before boiling, to ensure the material remains the natural creamy colour. In any case, only the inner part of the leaf segments are actually used for weaving. The outer edges may be used to form the central coil for coil-built baskets. A strip of palm leaf soaked in rain water is wrapped around the coil by weaving it through small holes made by an awl at regular intervals, along the previously wrapped coil row. The work continues in a spiral until the basket is the required size, when the last piece of coil is reduced in thickness gradually to merge with the last coil row [2795] .

Bows (weapons), other leaf parts:

Strong bows are made from petioles by Kwanyama people in Namibia [1304] .

Bows (weapons), other products, other leaf parts:

The leafstalks, which may be over a metre long, are carved into bows and stirring sticks by the Himba of Kaolkoland [5091] .

Brooms, leaves:

A special broom made from split leaflets is used by the Kwanyama, Namibia, to sweep the stamping place [1304] .

Brooms, leaves:

Leaves are tied together to serve as brooms [2506] .

Fences, leaves:

In northern Namibia, palm fronds are used for fencing where mopane trees are scarce and palms are common [5376] .

Fences, walls, other leaf parts:

Petioles of adult leaves are used for temporary fencing and hut walls [1838] .

Fish traps, leaves:

In northern Namibia, fish traps are made using omulunga fronds bound together with bark from *Grewia* species [5376] .

Huts, other leaf parts:

Petioles sometimes used by Kwanyama people, Namibia, as part of frames for huts [1304] .

Necklaces, bracelets, clothing, leaf blades:

The Kwanyama people, Namibia, used to use leaf blades to braid necklaces, bracelets and skirts during girls' puberty rites [1304] .

Other products, other leaf parts:

Large petioles used by Kwanyama people, Namibia, to make balance poles used to carry calabashes etc [1304] .

Other products, other leaf parts:

The Kwanyama people, Namibia, use the petioles to make stirring spoons for making porridge from millet, and some other cooked food. These are the only 'spoons' in their culture [1304] .

Plates/bowls, young leaves:

The Himba people of Kaokoland, Namibia use the fan shaped leaves to weave a variety of plates and bowls. These receptacles, of which every Himba family owns a number, are preferably made from the separated layers of young, unopened leaves. Receptacles used for holding liquids are smeared with fat to make them waterproof [5091] .

Roofs, leaves:

Leaves sometimes used as shade covers on huts for cooking, but this type of roof is not waterproof [1304] .

Roofs, leaves:

The Topnaar of Namibia use the leaves to cover roofs [2136] .

Rope, matting, twine, baskets, leaves:

The bantu in the more tropical parts of Africa use this species in making matting, basketware, rope and twine (Marloth 1913) [1340] .

Ropes, leaves:

Rope can be made from the leaf fibres by soaking them in mud and twisting them [1304] [2136] .

Sieves, leaves:

A special strainer made from split leaflets is used by the Kwanyama people, Namibia, to strain out coarse particles in beer [1304] .

Tooth cleaners, leaves:

In Namibia, threads are stripped from the edges of leaves to use as dental floss [5121] .

Fences, walls, stems:

Petioles of adult leaves are used for temporary fencing and hut walls [1838] .

Ropes, leaves:

The Kwanyama Ovambos soak and twist the leaf fibres to make ropes [1304] .

Leaves:

In Zimbabwe, the leaves are used for craftwork [3011] .

Baskets, clothing:

The Kwanyama Ovambos have traditionally made baskets and skirts from the fibres [1304] .

Basketry:

Used in Botswana, the most important local and export-oriented craft. The danger of depleting resources has been investigated by the government [1576] .

Baskets, ropes, mats, twine, young leaves:

The fibres in the leaves are exceptionally long, strong and pliable, particularly well suited to the production of baskets, mats, rope and twine. The most favoured parts of leaf are the leaflets. There is a large trade in both these and the manufactured products [3011] .

Other products, other leaf parts:

In Zambia, local people use the petiole for stirring a large pot or drum when brewing beer [3019] .

Baskets, woven materials, young leaves:

The basket weaving industry has recently been developed to provide income for the growing population in rural villages in north-western Botswana. Baskets are constructed of fibre coils comprising narrow strips of palm leaf pinnae wrapped around an inner core of the same material. The coils are then sewn tightly together with tough, pliable strips of palm leaf. This material is prepared by cutting and drying young, unopened palm leaves, tearing them into strips, and soaking them in water. Designs are worked into the weave of the baskets by using dyed palm leaf strips [2803] .

Baskets, young leaves:

The unopened, pliable leaves of juvenile *H. petersiana* are the primary resource on which a thriving local basketry industry relies in Namibia, producing baskets for sale as well as household use [2801] .

MATERIALS - WOOD

Beams, houses, trunk:

The trunk of the mature palm makes rafters for houses as they are light and borer resistant [3019] .

Fences, stems:

Stems of felled palms used for fencing posts in northern Namibia [2390] .

Stools, trunks:

Omulungu trunks are used in northern Namibia to make useful stools. These are protected from termite damage by treating their bases with old car oil [5376] .

Troughs, plates, trunks:

In northern Namibia the wood is used to make plates, and troughs for animal food and water. Drinking troughs are made from a 2 - 2.5 m piece of large omulunga tree-trunk, hollowed out to form a long trough that can be filled with water [5376] .

Troughs, trunks:

Hollowed out trunks of dead trees used by Kwanyama people, Namibia, to make drinking troughs for cattle [1304] .

Beams, stems:

Used for rafters [1838] .

Marquetry wood, heartwood:

Potential use - the heartwood takes a beautiful polish and could be used in marquetry [1838] .

Buildings, poles, water troughs, stems:

In Namibia, mature stems are used as building poles and water troughs for livestock [2801] .

MATERIALS - TANNINS/DYESTUFFS

Dyes, baskets, young leaves:

Young leaves soaked in water can be used to colour baskets. This use has been recorded in Sesfontein, Namibia [5095] .

MATERIALS - OTHER MATERIALS/CHEMICALS

Carved material (non wood), buttons, ornaments, kernels:

Used by the Kwanyama, Namibia, to carve into buttons and ornaments which were sewn onto leather aprons and skirts of women for special ceremonial and ritual occasions. Now being replaced by cheap plastic buttons [1304] .

Carved materials (non wood), kernels:

The ivory part of the seed can be carved into curios and ornaments [2136] [2506] [5082] [5121] .

Dolls, fruits:

Young Himba girls in Kaokoland dress the joined twin fruits in clothes reflecting the traditional stages in a girl's life. These and other games are important in preparing the child for her future role in the community [5091] [5095] .

Other products, kernels:

Coates Palgrave (1977), referring to the synonym *H. benguellensis*, remarks that the endosperm resembles vegetable ivory. It is not available in sufficient quantities for economic importance but it is used to make trinkets and curios [1279] .

Other products, fruits:

The pod yields an active charcoal with high decolourising and absorbing power (Ubaladini et al. 1932) [1340] .

Carved materials (non-wood), buttons, brooches, walking sticks, ornaments, kernels:

The mature kernel is the 'vegetable ivory', and was in the past used for buttons, curios, brooches, and the heads of walking sticks [1838] .

Other products, kernels:

In Zimbabwe the seeds are used in craftwork. Palm ivory is used to manufacture an assortment of curios. The fruits' fibrous husk is cut away revealing a hard white kernel [3011] .

Boxes, kernels:

The endocarp is thick and can be used to make box lids and goblet tops. The basic shape is ideal for making boxes [3027] .

FUELS - MISCELLANEOUS FUELS

Other leaf parts:

In Namibia, the petioles are used as a fuel [2801] .

FUELS - FUELWOOD

Cooking fuel:

In northern Namibia, palm seeds and fronds are used for cooking fuel when firewood is scarce [5376] .

Cooking fuel:

Petioles and old dried fire stalks commonly used for cooking fires, by the Kwanyama people, Namibia [1304] .

ENVIRONMENTAL USES - INDICATORS

Saline soils:

Thought to be an indicator of saline soils [5093] .

ENVIRONMENTAL USES - BOUNDARIES/BARRIERS/SUPPORTS

Other environmental materials, other types of boundaries/barriers/supports:

In Namibia, the long petioles are used as fencing droppers, and the stems are used for fencing posts [2801] .

ENVIRONMENTAL USES - AGROFORESTRY

Other agroforestry uses:

Palm fronds are used as fences around young marula trees to protect them from livestock [5376] .

USES NOTES - MISCELLANEOUS

This species is heavily utilised and cut when young for weaving and for a range of craftwork [2968] .

In Namibia, this species is considered to be the most useful woody plant, fulfilling many subsistence needs and a variety of local industries. In terms of its contribution to household food security, early European travellers to the region noted the important contribution the Hyphaene fruits made to the diet of local people [2801] .

In southern Africa the palm Hyphaene petersiana is an important species with a diverse range of uses [3029] .

NUTRITIONAL VALUE

Leaves:

In Namibia, one sample of fresh leaf tips collected in Sept 2000 was analysed. Results were as follows: Crude protein 7.47%; P 0.15%; Ca 1.06%; OM 94.06%; DM 97.58%; Crude fibre 43.42%; ADF 48.81%; NDF 66.16%; Fat 2.39%; In-vitro digestibility 32.10%; Metabolisable energy 4.30 MJ/kg) [5250] .

Sap, vitamin C, potassium, nicotinic acid:

Palm wine, made from sap, is an important dietary supplement, especially to rural men, adding substantial quantities of nicotinic acid, vitamin C and potassium to the normal starchy diet [2795] .

Fruits:

Moisture 6.6%; ash 9%; protein 4.9%; fat 0.4%; *fibre 9.6%; *carbohydrate 69.5% *energy value (kJ/100g) 1265;

Ca 103 mg/100g; *Mg 197 mg/100g; Fe 2.04 mg/100g; *K 2560 mg/100g; *Cu 0.47 mg/100g; Zn 0.56 mg/100g; P 156 mg/100g; riboflavin 0.1 mg/100g; *nicotinic acid 4.62 mg/100g; *vitamin C 19.7 mg/100g (items marked with * indicate values > 20% average daily requirement) [187] .

Fruits:

Nutritious and high in calories [1257] .

Fruits:

Dry matter - 20.9%, pH 4.51; Ascorbic acid - 0.2 mg/100 g fresh weight [3021] .

Fruits:

Data collected recently confirm the dietary significance of the fruits of this species [2801] .

CHEMICAL ANALYSES - MISCELLANEOUS

Seeds, sugar alcohols:

The seeds are rich in sugar mannitol [2357] .

TEMPERATURE

Namibia:

1.7 degrees C - 40.6 degrees C [1304] .

ALTITUDE

Southern Africa:

275 - 1,000 m [5104] .

In Burundi/Rwanda it is found at 1300 m a.s.l. [2968] .

TOPOGRAPHY/SITES

Southern Africa:

Open, sandy country, not normally alongside watercourses [1279] .

Riverine habitat, areas of high rainfall or areas with a high water-table [1257] .

Namibia:

Associated with rivers and floodplains in the north-west and north-east, and pans and oshanas in the Cuvelai [5121] .

Zambia:

Locally frequent on dambo or plain margins, in lake basins and hard pan dambo and pan margins [1838] .

Africa:

Primarily found inland away from the coast [2968] .

Zambia The palms grow on alluvium which is usually a red-brown or grey-brown clay sand derived from the hills of karoo sandstone and escarpment grits. They are confined to flatter ground in the valleys and occur mostly along the Kaulungu River valley and on slightly raised sandy deposits in long narrow strips near the Luangwa River [3019] .

SOILS

Africa:

Saline subsoil [1304] .

Found on sodic/saline alluvial soils with high water-tables [2968] .

VEGETATION

Occurs on the high water-table grasslands of Zimbabwe, Angola and Botswana [2803] .

Southern Africa:

Low altitude bushveld and along swamps, pans and rivers, often forming extensive stands [3045] .

Zambia:

Found in considerable numbers in savanna woodlands of *Kirkia-Sclerocarya* and in mopane woodland [1838] .

Rare to occasional in almost all woodland types (on Kalahari sand), in *Baikiaea* forest and on suffrutex savannas [1838] .

Africa:

Savanna or secondary vegetation, also in streamside riparian vegetation [2968] .

Zambia:

Found in association with various vegetation types. 1) In mixed riverine vegetation in tall grass and mostly under the tree canopy. 2) In woodland. 3) On hard pan sites with short grass only. 4) In dense thicket being regrowth from riverine vegetation after cultivation [3019] .

ENVIRONMENTAL FACTORS - MISCELLANEOUS

Fire:

Fire has virtually no negative influence on mature palm trees as they do not have bark that can be damaged. The fact that they are more resistant to fire than other species possibly accounts for the numerous pure stands of palm trees in the Okavango Delta [5092] .

Damage by fire is common [2968] .

POLLINATION

Pollinated by insects [3029] .

FLOWERING/FRUITING/SEED SET

Fruiting:

Fruiting takes place any time of the year and full grown fruits can last for more than two years on the stem [3029] .

Fruiting, Zambia:

Fruits available in June (Scudder, 1971 cited by Grivetti, 1981) [1188] .

Fruiting, southern Africa:

Fruits remain on the tree throughout the year [1279] .

Flowering, Botswana:

September to October [5092] .

Flowering, Namibia:

September to April, mostly December [5121] .

Fruiting, Namibia:

Mostly December to May, but throughout the year [5121] .

Fruiting, Zimbabwe:

Fruits develop in September and October [2506] .

Fruiting:

March-May [1257] .

Fruiting:

Abundant fruit is only borne after the stems have shed all the leaf bases [2255] .

DISPERSAL

Fruits dispersed by elephant and baboons [3029] [5092] .

Elephants are presumed to be the main vector. Fruits fall directly below the parent and can be dispersed by seasonal flood waters [1838] .

GERMINATION

Fire and the passing of the fruit through the digestive tract of animals facilitate germination of seeds [3029] [5092] .

Fire is a more important stimulus for germination than passing through the digestive system of an animal. The burning away of the exocarp and the simultaneous heat treatment appears to speed up germination [5092] .

Hypogeal; usually takes 5-6 months. The cotyledon expands considerably and grows downwards to a depth of 25-30 cm, carrying the root [1838] .

Germination only occurs when the fruit is buried or partly buried and absorbs 50% of its weight in water. Fruits remaining on the ground surface are mostly burned in annual bush fires. Fruits are viable for at least two seasons if kept moist [1838] .

SEEDLING DEVELOPMENT

The taproot is c. 60 cm long after 6 months, and then elongates further [2255] .

CYTOLOGY

x = 18 [5150] .

BREEDING SYSTEM

Male to female ratio is 2 - 1 [1838] .

ASSOCIATED BIRDS

The palm swift is closely associated with this species. They can be seen nesting in a vertical position underneath the leaves. These birds have evolved a unique method of preventing the eggs from falling by gluing them in place with saliva [5092] .

ASSOCIATED INSECTS

Isoptera:

Termites partly destroy dead juvenile leaves [1838] .

SEED STORAGE

Seeds were long lived in dry warm storage (21 degrees C and 55% RH); some germinability was retained after 2 to 5 years. Some seeds showed sensitivity to desiccation to low RH (21-30%) or susceptibility to -20 degrees C freezing. Thus, the seed conservation of these species under conventional seed bank conditions is not yet guaranteed for all seeds in the population [2843] .

PROPAGATION FROM SEED

Fire and the passing of the fruit through the digestive tract of animals facilitate the germination of seeds [3029] [5092] .

Fire is a more important stimulus for germination than passing through the digestive system of an animal. The burning away of the exocarp and the simultaneous heat treatment appears to speed up germination [5092] .

Difficult [1279] [2506] [5082] [5093] .

Can be propagated from seed [1257] .

Mean emergence time on 1% agar-water at 26 degrees C was 23 to 52 days. Soaking seeds in water reduced this by 21 to 56% [2843] .

Seeds do not germinate easily, plants are slow growing and the massive taproot makes it almost impossible to transplant the trees once they are established [1279] [5082] [5092] .

'CROP' MANAGEMENT

Recommendations for village level management include 1) only every 3rd leaf should be cut to ensure plant vigour; 2) leaves must be fully above-ground before being cut; 3) knife cutting preferred and hoe cutting prohibited; 4) felling of mature palms should be stopped; 5) digging up young palms and eating the palm heart should be stopped; 6) seed propagation should be encouraged and demonstrated to villagers [1257] .

In Botswana, the mokola leaf resource could be managed both at the village level and through marketing organisations (such as Botswanacraft). The following recommendations are discussed by Cunningham and Milton (1987). 1) Hoe cutting should be discouraged (perhaps by the imposition of spot fines) and leaves should be selectively cut with a sharp knife. 2) Felling of mature palms in order to obtain the edible palm nuts and palm heart should be stopped. To overcome scepticism and resistance to the idea of propagating the palms from their seeds ('nuts') demonstration plantings should be carried out near the villages by agricultural or forestry officers or Botswanacraft personnel. 3) Edible shoots (njumu) and meristem (ngadi) of the more common and less heavily utilised wild date or tsaro palm (*Phoenix reclinata*) should be substituted for the edible shoots (njumu) and meristem (gau) obtained by digging out young mokola palm suckers. 4) Ideally, mokola palm leaf harvesting should not

exceed one in three leaves produced, and leaves should not be cut before they have emerged from the ground or sheathing petiole base, as this practise wastes potential weaving material and damages underground stems and leaf buds. 5) The growing of alternative fibre plants such as sisal and yucca around fields or near homesteads would provide an alternative source of strong fibre suitable for building or craftwork. Trained staff will be able to implement the following management proposals. A) Quantity control. The annual quota of palm baskets bought should be based on the estimated sustained yield of palm communities to be exploited. B) Quality control. Buyers should purchase only high quality baskets. Quality items take more time to produce so less raw material is used over a given period. C) Alternative materials. The demand for *H. petersiana* leaves could be reduced by diversifying the resources used in the basket industry. D) New crafts. Developers of an alternative handwork industry should aim to produce items that, while dependent on freely available natural products, give a relatively high financial return [2803] .

HARVESTING

Leaves, baskets, Zimbabwe:

Harvesting of leaves for basketry changes the pattern of growth [3029] .

Leaves, baskets, Namibia:

Palm leaves for basketry should be cut through the petiole using a sharp knife, to avoid damaging the meristem and other leaves. 30% of annual leaf production is recommended for sustainable leaf harvesting [2390] .

Sap, Namibia:

In northern Namibia, sap is mainly tapped from male trees to allow the female trees to grow and provide fruit [5376] .

Leaves:

Available throughout the year [1257] .

Leaves, Namibia:

In northern Namibia, levels of harvesting in 1995 were found to be within sustainable limits, however grazing impacts were significant [2390] .

Sap, southern Africa:

The tree is tapped near the growing tip but afterwards the sap hardens as it dries to form a crust over the wound and this must be cut back before a further supply can be obtained. After 3 or 4 weeks of tapping and cutting back, the growing tip will have been entirely removed and the stem inevitably dies. Around 60 to 70 litres may be obtained from the average tree [5082] .

Leaves, baskets, Botswana:

In the 1970s, basket weavers in Botswana had a ready supply of leaves nearby; by the early 1980s, however, a four hour walk to obtain leaves was necessary [1257] .

Leaves, baskets, Botswana:

Traditional gathering of unopened leaves for basket weaving involved the selection and individual cutting of the larger leaf shoots below the base using a sharp knife. Axe or hoe cutting of the palm leaves before they have fully emerged is now common practice [2803] .

Fruits, Namibia:

The palm fruiting season peaks in September/October, coinciding with the end of the dry season before the millet harvest and at a time when wild spinaches and other indigenous fruits are not available. This timing of palm fruit production, when cultivated and other wild resources are at their scarcest, heightens the importance to rural subsistence [2801] .

YIELDS

Leaves, Zimbabwe:

Leaf production per ramet between September 1995 and January 1996 ranged from 0.3 leaves/month to 2 leaves per month. Leaf production rates in this study were considerably higher than reported values on *H. petersiana* in Botswana [3029] .

Leaves:

Variable yield, but leaves survive indefinitely if stored carefully [1257] .

Fruits, Zimbabwe:

A single palm may produce as many as 2000 fruits in its life time, and they take 2 - 4 years to mature [2506] . Leaves are produced throughout the year, and large palms produce more leaves per year [2808] .

Sap:

A tree can produce 60 - 70 litres of sap. However, this kind of exploitation frequently leads to tree death [1279] [5082] [5098] .

Leaves:

In 1964, 9000 tons of leaves existed in palm areas of Feira, Zambia, extending over some 8094 ha. Preliminary trials indicated that the quantity could be harvested annually [3019] .

Leaves:

A single-stemmed mokola palm produces 24 leaves per year when over 2 m tall, but eight to nine leaves/year when under 1 m tall. Unstemmed juvenile palms produce an average of six leaves/year [2803] .

PRODUCTION

In Zambia, in 1964, 12,000 tons of juvenile *H. petersiana* leaves were required annually to produce 1440 tons of fibre for manufacturing operations [3019] .

TRADE

Namibia:

In a survey in north-central Namibia, 68% of households interviewed regularly sold spirit distilled from the fruit [2801] .

South Africa:

There is a market for palm leaves throughout Natal both for commercial craftwork and for domestic purposes [2810] .

Botswana, exports:

Baskets made in Botswana from the juvenile leaves are in great demand in Europe and U.S.A. [1257] .

Botswana:

Craft trade recommendations include 1) baskets should be bought on a quota basis (calculated carefully for sustainability); 2) alternative species should be used; 3) synthetic dyes should be used; 4) new craft skills should be developed [1257] .

Namibia:

H. petersiana products also fulfil an important role in the generation of cash income. Distilling is a means of adding value to wild fruits, particularly when transported and sold in more affluent areas. Both distillation and basket-making are significant income earners for households which may have limited alternative access to a cash income. In Namibia, 68% of households in the palm savanna of Ovambo regularly sold olambika (a spirit distilled from the fruits). 17 out of 28 basket makers produced baskets for sale. Income generation using palm products is practised mainly by women [2801] .

RESEARCH NEEDS

Propagation (previously studied by the Department of Forestry in Maun, Botswana) [1257] .

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