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Floristic and Ethnobotanical Diversity of Plants Used In Traditional Craftsmanship in the Kimvula Territory, Democratic Republic of the Congo

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Abstract

The Kimvula Territory in the Democratic Republic of the Congo exhibits intensive use of forest plants in traditional craftsmanship, encompassing agricultural tools, furniture, and household artefacts. This ethnobotanical investigation (2014–2016), based on structured interviews and field observations, aimed to document and analyse indigenous knowledge related to artisanal plant use. A total of 76 species belonging to 67 genera and 32 families were recorded, with Fabaceae, Arecaceae, Marantaceae, and Rubiaceae being the most represented families. Prominent species included Elaeis guineensis, Eremospatha haullevilleana, Raphia spp., Alstonia congensis, and Ricinodendron heudelotii, with stems identified as the most commonly used plant part. Millettia laurentii exhibited the highest ethnobotanical use value, while several species showed strong consensus among respondents. Variation in species use between communities reflected both ecological availability and socio-cultural preferences. These findings highlight the pivotal role of forest biodiversity in sustaining rural livelihoods and preserving traditional craftsmanship. They further emphasize the need to integrate indigenous knowledge into conservation planning and sustainable resource management strategies across the Congo Basin.

Keywords: Handcrafted plants; Ethnobotany; Traditional knowledge; Sustainable resource management; Kimvula Territory; Democratic Republic of Congo.

Abbreviations: VAUs: use agreement; VUs: use index; ICs: confirmation index; AHC: ascending hierarchical classification.

INTRODUCTION

Plants have long played a central role in human societies, serving as sources of construction materials, food packaging, firewood, medicines, musical instruments, and a wide range of handicrafts and household tools (Léopold et al., 2021; Kouakou et al., 2020; Monizi et al., 2018). In rural forest environments-such as the Kimvula Territory in the Democratic Republic of the Congo-plants are indispensable not only for subsistence but also for the production of artisanal objects that sustain local livelihoods and embody traditional ecological knowledge.

The reported plants have both practical uses and cultural and symbolic meanings in the local tradition. They affect how people make things, who they are, and how they deal with environmental problems. Using plants in artisanal ways is an important link between biodiversity and traditional ecological knowledge (TEK). It shows how people find new ways to use the resources in the forest. But things people do, like cutting down trees, destroying habitats, and careless harvesting, are putting both the forest ecosystems and this indigenous knowledge system at even more risk (Hadonou-Yovo at al., 2019). It is also important to keep track of the different types of craft plants and the cultural practices that go along with using them. This will help connect protecting biodiversity with rural development and preserving cultural heritage. There is more ethnobotanical research being done in the Congo Basin, but most of it has been on plants that are used for food, medicine, or religious ceremonies. There hasn't been as much research on plants that are used for crafts and other technical purposes. This split makes it hard for us to understand how local groups use ecological availability,

functional plant features, and cultural preferences in their crafts. Such documentation is very important in Kimvula, and forest products are still a major component of the economy. People learn to retain resources and pass on traditional skills. The Mayombe forest area in the south-east of the Democratic Republic of the Congo is the site of the Kimula Territory. It is known for its evergreen and humid plants and its agricultural patterns of change. People in the area depend on forests for building materials, furniture, and home tools, but the growing demand for these resources puts their replenishment at risk. This study aimed to (i) document and classifies the diversity of artisanal plants utilized in the Kimvula Territory, (ii) analyze the distribution of plant parts and usage categories among local sectors, and (iii) evaluate inter-community variations in plant knowledge and utilization through multivariate statistical methods.

To achieve these objectives, ethnobotanical surveys were conducted between 2014 and 2016 using semi-structured interviews, participatory field observations, and quantitative indices of use value and informant consensus.

MATERIAL AND METHODS

Study area

This study was conducted in the Kimvula Territory, located within the Central Kongo Province of the Democratic Republic of Congo. Figure 1 presents a map of Central Kongo, highlighting the Kimvula Territory at the eastern extremity of the province.

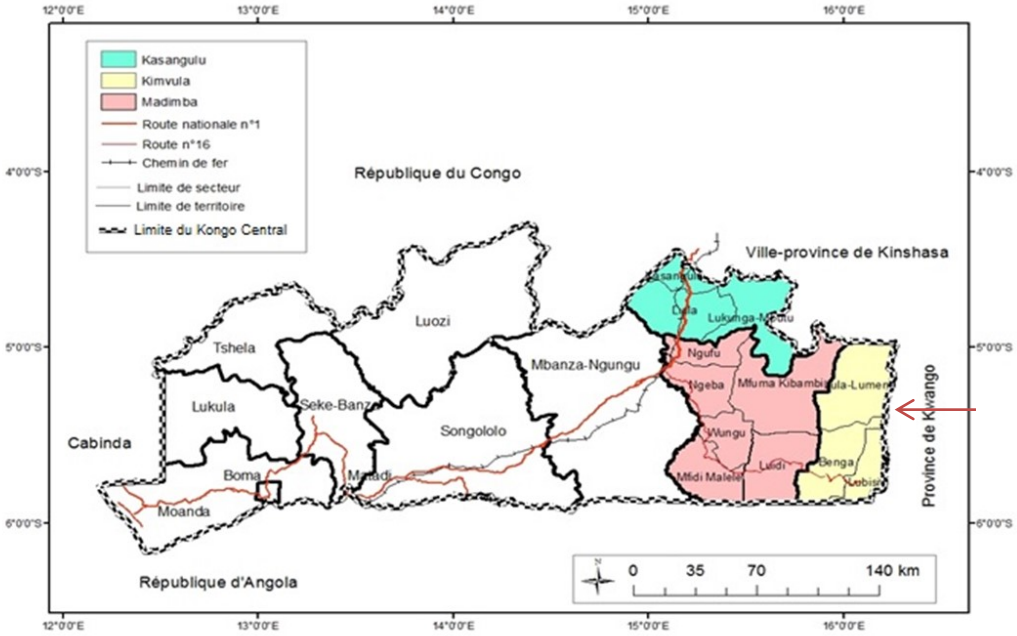

Figure 1. Map of Central Kongo Province.

Material

The study examined 76 artisanal plant species collected from villages in the Benga and Lubisi sectors and the town of Kimvula. Field inventories were conducted using a Canon PowerShot A720 IS digital camera, a laptop, a data notebook, pens and pencils, a plant press, herbarium sheets, and cardboard supports.

Methods

Data collection and analysis

The establishment of a reference herbarium is an essential foundation for any floristic inventory study. In this work, fertile specimens of leafy plants were predominantly collected in Kimvula to compile the herbarium. Species identifications were verified through comparison with specimens housed at the Kinshasa Herbarium (IUK), University of Kinshasa, Faculty of Science and Technology, Department of Biology.

Ethnobotanical method

Ethnobotanical surveys were conducted between 2014 and 2016 in the Kimvula Territory, encompassing 19 villages and four neighbourhoods (Figure 1), using semi-structured interviews. The interviews were based on a pre-tested questionnaire (Lassa, 2012). In total, 253 informants participated in the study. Data recorded on survey sheets pertained to artisanal plants used in the Kimvula area, including their local names, plant parts utilised, and specific applications. Species identifications were confirmed at the Kinshasa Herbarium (IUK; INERA and UNIKIN, Kinshasa), with reference to various floras (Renier, 1948; Liben, 1968; Leonard,

1971; Bamps, 1982). The ethnobotanical use value of each species was calculated following the methodology described by (Phillips & Gentry, 1993; Camon-Guerrero et al., 2008) using the following formula:

$$V_{u(k)} = \sum_i^n \frac{C_i}{N} \quad (1)$$

Where Vu(k) represents the ethnobotanical use value of species *k* within a specific use category, Ci denotes the use score assigned by respondent *i*, and *n* is the total number of respondents within that use category.
Local cultural importance (Ilumbe, 2010; Tardio & Pardo-de-Santayama, 2008) was determined according to the use value of each species identified (VUs), which was calculated using the simplified formula of

$$\boldsymbol{VU_s} \frac{\sum_{i=1}^n Uis}{ns} \quad (2)$$

Where Uis equals the number of uses of the species mentioned by informant i and ns equals the number of people who mentioned this species; the confirmation index (CIs) was calculated according to the formula:

$$\boldsymbol{IC_s} \frac{Na}{Nt} \quad (3)$$

Where ICs is the confirmation index, *Na* = number of people who cited this species and *Nt* = total number of people interviewed; and the usage agreement value or *VAUs* was calculated by combining the two formulae (*VUs* and *ICs*) into a single Usage Agreement Value (*VAUs*) which is defined as:

$$\boldsymbol{VAUs} = VUs\, x\, ICs \quad (4)$$

A similarity matrix, derived from Jaccard's similarity coefficient, was employed to construct hierarchies for classifying surveys or informants according to village and/or neighbourhood. Plant utilization can thus be compared between villages or neighbourhoods based on the presence or absence of species, using this similarity measure. Calculating the similarity coefficient allows quantification of the degree of association between two species or the level of similarity between villages and/or neighbourhoods in terms of their floristic composition (Kent et al., 1996; Legendre & Legendre, 1998; Stokes et al., 2000; Magurran, 2004). The Jaccard index specifically considers double presences (*a*), that is, species recorded as being used in successive villages and/or neighbourhoods. Similarity values range from 0 (no similarity) to 1 (complete similarity). The resulting matrices are visualized as dendrograms.

Results

Floristic list

A total of 76 artisanal plant species were recorded across 19 villages and six districts in the Kimvula area, representing 62 genera and 32 families. The most abundant families were Fabaceae (12 species), Arecaceae (9 species), Marantaceae and Rubiaceae (5 species each), Euphorbiaceae (4 species), and Anacardiaceae, Apocynaceae, Combretaceae, and Phyllanthaceae with 3 species each (Table 1).

Table 1 List of plant species used in handicrafts.

Families	Species
Anacardiaceae	*Lannea welwitschii*
	Mangifera indica
	Pseudospondias microcarpa
Annonaceae	*Xylopia aethiopica*
Apocynaceae	*Alstonia congensis*
	Tabernaemontana crassa
	Voacanga africana
Arecaceae	*Cocos nucifera*
	Elaeis guineensis
	Eremospatha haullevilleana
	Raphia gentiliana
	Raphia laurentii
	Raphia matombe
	Raphia sese
	Raphia sp1
	Raphia textilis
Asparagaceae	*Dracaena acutissima*
Bignoniaceae	*Markhamia tomentosa*
Burseraceae	*Canarium schweinfurthii*
Cecropiaceae	*Musanga cecropioïdes*
Clusiaceae	*Symphonia globulifera*
Combretaceae	*Combretum psidioides*
Families	**Species**
	Combretum racemosum
	Terminalia superba
Commelinaceae	*Palisota ambigua*
Dipterocarpacaeae	*Marquesia macroura*
Euphorbiaceae	*Alchornea cordifolia*
	Chaetocarpus africanus
	Macaranga monandra
	Ricinodendron heudelotii
Fabaceae	*Brachystegia spicoformis*
	Dalbergia rufa
	Dalium englerianum
	Dialium pachyphyllum
	Erythrophleum africanum
	Erytrophloeum suaveolens
	Millettia drastica
	Millettia eetveldeana
	Millettia laurentii
	Millettia macroura
	Millettia versicolor
	Piptadeniastrum africanum
Hypericaceae	*Harungana madagascariensis*
Icacinaceae	*Polycephalium poggei*
Loganiaceae	*Strychnos cocculoides*
	Strychnos pungens
Malvaceae	*Clappertonia ficifolia*
	Cola nitida
Marantaceae	*Hypselodelphis scandens*
	Marantachloa congoensis
	Megaphrynium macrostachyum
	Sarcophrynium leiogonium
	Trachyphrynium poggeanum

Meliaceae	*Entandrophragma angolense*
Moraceae	*Ficus exasperata*
	Milicia excelsa
Myristicaceae	*Pycnanthus kombo*
Ochnaceae	*Ochna afzelii*
	Rhabdophyllum arnoldianum
Olacaceae	*Olax wildemanii*
	Ongokea gore
Passifloraceae	*Barteria fustilosa*
Phyllanthaceae	*Bridelia ferruginea*
	Hymenocardia acida
	Hymenocardia ulmoïdes
Poaceae	*Bambusa vulgaris*
	Imperata cylindrica
Rubiaceae	*Coffea canephora*
	Colletoecema dewevrei
	Hallea stipulosa
	Mitracarpus villosus
Families	**Species**
	Morinda lucida
Rutaceae	*Citrus senensis*
Salicaceae	*Oncoba welwitschii*
Sapindaceae	*Blighea wildemaniana*
Verbenaceae	*Clerodendrum spinescens*
32	**76**

Informants

A total of 253 individuals were interviewed across 19 villages and four neighbourhoods, as detailed in Table 1. The distribution of respondents was uneven among locations. The villages and neighbourhoods providing the highest numbers of informants, in descending order, were Pado (36), Winda (30), Revolution (29), Kingoma (28), Kinata (22), Mvula Nlondi (15), Kilukengu (14), and Kinsakala (13), while other sites had fewer than 13 respondents. Three villages-Kilenga, Kintoyi, and Kikangala-had very few participants, with 4, 3, and 1 respondent, respectively. Ages of the informants ranged from 17 to 84 years, with the majority falling within the 20–49-year age group. Almost all participants were of the Nkanu ethnic group and demonstrated extensive knowledge of artisanal plants utilised within their communities.

Uses of artisanal plants

In Kimvula Territory, the highest species richness was recorded for plants used in the manufacture of coffins and doors (8.85% each), followed by chairs (8.58%) and windows (8.31%). In terms of citation frequency, door-making species accounted for 12.55 % (Table 2), followed by chairs (12.28 %), windows (12.23 %), and coffins (11.93 %), highlighting their central role in local artisanal practices.

Table 2 Uses of plants used in handicrafts (No. of species: number of species, Nbre de cit: number of number of citations and %: percentage).

Uses	Number of species	Percent	No. of cit.	Percent
Cupboard	12	3.22	96	0.88
Brooms	7	1.88	78	0.71
Coffin	**33**	**8.85**	1309	**11.93**
Chair	**32**	**8.58**	1347	**12.28**
Traditional chair	12	3.22	35	0.32
Display	24	6.43	1012	9.22
Armchairs	3	0.80	3	0.03
Window	**31**	**8.31**	1342	**12.23**
Guitar	1	0.27	12	0.11
Bed	28	7.51	776	7.07
Traditional bed	4	1.07	6	0.05
Mortar	22	5.90	661	6.02
Mat	15	4.02	487	4.44
Spatula	5	1.34	32	0.29
Straw	1	0.27	3	0.03
Basket	15	4.02	599	5.46
Pillar	2	0.54	8	0.07
Pestle	25	6.70	520	4.74
Piroque	1	0.27	19	0.17
Plank	5	1.34	166	1.51
Bridge	28	7.51	815	7.43
Door	33	**8.85**	1377	**12.55**
Table	15	4.02	133	1.21
Tabouret	10	2.68	68	0.62
Tam-tams	3	0.80	12	0.11
Tamis	6	1.61	55	0.50
Total	**373**	**100.00**	**10971**	**100.00**

Artisanal products derived from local plants include furniture (chairs, beds, stools, saddles, mats) and household utensils (mortars, pestles, storage units, boards, baskets, spatulas). The rachises and petioles of

Elaeis guineensis are employed in the manufacture of traditional drying racks, mats, beds, and baskets, while the central veins of the leaflets are used to produce traditional brooms. Species such as *Eremospatha haullevilleana*, *Raphia* spp., and *Raphia textilis* are utilised for basketry and mat production, with the rachis additionally used in the construction of beds, chairs, armchairs, tables, and other furniture.

Wood from *Alstonia congensis*, *Rhabdophyllum arnoldianum*, and *Ricinodendron heudelotii* is used in the manufacture of tom-toms and kitchen utensils (mortars, pestles, etc.), while *Alstonia congensis* wood also serves in the construction of pirogues, cupboards, coffins, chairs, windows, beds, guitars, bridges, doors, tables, and stools. In the Kimvula area, plants utilized for crafts and construction play a central role in daily life, reflecting their broad functional and economic significance. Basketry and other craft products, in particular, provide opportunities for generating income and supporting household livelihoods.

Organs used

Among the plant organs employed in handicrafts, stems were the most frequently utilized, accounting for 90.84% of citations. This was followed by lianas (5.20%), petioles (1.87%), and rachises (1.44%), while other plant parts were cited only rarely (Table 3).

Table 3 Parts of plants used in handicrafts (Nbre de cit: number of citations and %: percentage).

Parts used	No. of cit.	Percent
Stem bark	18	0.16
Leaf	30	0.27
Leaflet	1	0.01
Liana	570	5.20
Central ribs	13	0.12
Petiole	205	1.87
Petiolule	9	0.08
Rachis	158	1.44
Branch	1	0.01
Stem	**9966**	**90.84**
Total	**10971**	**100.00**

Ethnobotanical use value

The ethnobotanical use values of artisanal species are presented in Table 4. The following artisanal species: *Millettia laurentii* (Vuar= 5.51), Hallea stipulosa (Vuar= 5.44), *Milicia excelsa* (Vuar= 5.00), *Alstonia congensis* (Vuar= 3.46), *Xylopia aethiopica* (Vuar= 2.89), *Terminalia superba* (Vuar= 1, 89), *Symphonia globulifera* (Vuar= 1.75), *Pycnanthus kombo* (Vuar= 1.58) and *Canarium schweinfurthii* (Vuar= 1.24) have high ethnobotanical use values.

Table 4 Ethnobotanical use value of plants used in handicrafts (Ci: number of citations of the species, n: number of people interviewed and Vuar: ethnobotanical use value of plants used for various purposes).

Species	Ci	n	Vu_{ar}
Alchornea cordifolia	20	253	0.08
Alstonia congensis	876	253	**3.46**
Bambusa vulgaris	9	253	0.04
Barteria fustilosa	5	253	0.02
Blighea wildemaniana	9	253	0.04
Brachystegia spicoformis	56	253	0.22
Bridelia ferruginea	2	253	0.01
Oncoba welwitschii	9	253	0.04
Canarium schweinfurthii	313	253	**1.24**
Chaetocarpus africanus	13	253	0.05
Citrus senensis	4	253	0.02
Clappertonia ficifolia	9	253	0.04
Clerodendrum spinescens	94	253	0.37
Cocos nucifera	1	253	0.00
Coffea canephora	4	253	0.02
Cola nitida	12	253	0.05
Colletoecema dewevrei	16	253	0.06
Combretum psidioides	8	253	0.03
Combretum racemosum	36	253	0.14
Dalbergia sp	3	253	0.01
Dalium englerianum	21	253	0.08
Dialium pachyphyllum	147	253	0.58
Dracaena acutissima	2	253	0.01
Elaeis guineensis	148	253	0.58
Entandrophragma angolense	79	253	0.31
Eremospatha haullevilleana	179	253	0.71
Erythrophleum africanum	187	253	0.74
Erytrophloeum suaveolens	62	253	0.25
Ficus exasperate	15	253	0.06
Hallea stipulosa	1377	253	**5.44**
Harungana madagascariensis	207	253	0.82
Hymenocardia acida	164	253	0.65
Hymenocardia ulmoïdes	67	253	0.26
Hypselodelphis scandens	114	253	0.45
Imperata cylindrica	1	253	0.00
Lannea welwitschii	9	253	0.04
Macaranga monandra	2	253	0.01
Mangifera indica	22	253	0.09
Marantachloa congoensis	50	253	0.20
Markhamia tomentosa	151	253	0.60
Marquesia macroura	242	253	0.96
Megaphrynium macrostachyum	67	253	0.26
Milicia excelsa	1266	253	**5.00**
Millettia drastica	143	253	0.57
Millettia eetveldeana	1	253	0.00
Millettia laurentii	1395	253	**5.51**
Millettia macroura	3	253	0.01
Millettia versicolor	50	253	0.20
Mitracarpus villosus	4	253	0.02
Morinda lucida	78	253	0.31
Musanga cecropioïdes	97	253	0.38
Ochna afzelii	89	253	0.35
Olax wildemanii	81	253	0.32
Ongokea gore	5	253	0.02
Palisota ambigua	23	253	0.09
Piptadeniastrum africanum	7	253	0.03
Polycephalium poggei	52	253	0.21
Pseudospondias microcarpa	98	253	0.39
Pycnanthus kombo	399	253	**1.58**
Raphia gentiliana	17	253	0.07
Raphia laurentii	7	253	0.03
Raphia matombe	8	253	0.03
Raphia sese	19	253	0.08

Species	Ci	n	Vu_{ar}
*Raphia sp*1	18	253	0.07
Raphia textilis	110	253	0.43
Rhabdophyllum arnoldianum	179	253	0.71
Ricinodendron heudelotii	107	253	0.42
Sarcophrynium leiogonium	56	253	0.22
Strychnos cocculoides	1	253	0.00
Strychnos pungens	7	253	0.03
Symphonia globulifera	444	253	**1.75**
Tabernaemontana crassa	99	253	0.39
Terminalia superba	470	253	**1.86**
Trachyphrynium poggeanum	12	253	0.05
Voacanga africana	15	253	0.06
Xylopia aethiopica	732	253	**2.89**

Local cultural importance of craft plants

The cultural significance of artisanal plants in the Kimvula Territory was evaluated using the Value of Use Agreement (VAUs) index, calculated as the product of the Use Value (VUs) index (Phillips & Gentry, 1993) and the Informant Consensus (ICs) index (Lassa, 2012; Tardio & Pardo-de-Santayana, 2008). The VAUs, along with corresponding VUs and ICs values for artisanal plants in the Kimvula area, are presented in Table 5.

Ranking species by VUs yields different results from ranking by ICs. The VUs-based ranking prioritises plants utilized for multiple purposes, whereas the ICs-based ranking highlights plants that are widely known or employed across several villages or neighbourhoods.

Table 5 List of artisanal plants in the Kimvula territory with their use agreement values. N.I: number of informants, N.V: number of villages, N.U: number of uses, N.C: number of citations, VUs: use value of the species, ICs: confirmation index and VAUs: use agreement value.

Species	NV	NI	NU	NC	VUs	ICs	VAUs
Alchornea cordifolia	1	4	5	20	**5.00**	0.02	0.08
Alstonia congensis	19	165	13	876	**5.31**	**0.65**	**3.46**
Bambusa vulgaris	3	9	3	9	1.00	0.04	0.04
Barteria fustilosa	1	5	1	5	1.00	0.02	0.02
Blighea wildemaniana	1	9	1	9	1.00	0.04	0.04
Brachystegia spicoformis	9	56	1	56	1.00	0.22	0.22
Bridelia ferruginea	1	2	1	2	1.00	0.01	0.01
Canarium schweinfurthii	8	54	10	313	**5.80**	0.21	**1.24**
Chaetocarpus africanus	4	13	1	13	1.00	0.05	0.05
Citrus senensis	2	4	2	4	1.00	0.02	0.02
Clappertonia ficifolia	2	9	1	9	1.00	0.04	0.04
Clerodendrum spinescens	16	94	1	94	1.00	0.37	0.37
Cocos nucifera	1	1	1	1	1.00	0.00	0.00
Coffea canephora	1	4	1	4	1.00	0.02	0.02
Cola nitida	1	12	1	12	1.00	0.05	0.05
Colletoecema dewevrei	2	16	1	16	1.00	0.06	0.06
Combretum psidioides	1	8	1	8	1.00	0.03	0.03
Combretum racemosum	3	15	10	36	2.40	0.06	0.14
Dalbergia rufa	1	3	1	3	1.00	0.01	0.01
Dalium englerianum	3	21	1	21	1.00	0.08	0.08
Dialium pachyphyllum	17	147	2	147	1.00	**0.58**	0.58
Dracaena acutissima	1	2	1	2	1.00	0.01	0.01
Elaeis guineensis	18	135	3	148	1.10	**0.53**	0.58
Entandrophragma angolense	4	16	8	79	4.94	0.06	0.31
Eremospatha haullevilleana	22	179	1	179	1.00	**0.71**	0.71
Erythrophleum africanum	19	156	10	187	1.20	**0.62**	0.74
Erytrophloeum suaveolens	3	11	7	62	**5.64**	0.04	0.25
Ficus exasperate	1	3	5	15	**5.00**	0.01	0.06
Hallea stipulosa	22	226	21	1377	**6.09**	**0.89**	**5.44**
Harungana madagascariensis	9	46	9	207	4.50	0.18	0.82
Hymenocardia acida	16	154	6	164	1.06	**0.61**	0.65
Hymenocardia ulmoïdes	9	36	10	67	1.86	0.14	0.26
Hypselodelphis scandens	17	114	1	114	1.00	0.45	0.45
Imperata cylindrica	1	1	1	1	1.00	0.00	0.00
Lannea welwitschii	2	6	5	9	1.50	0.02	0.04
Macaranga monandra	1	2	1	2	1.00	0.01	0.01
Mangifera indica	3	13	5	22	1.69	0.05	0.09
Marantachloa congoensis	6	50	2	50	1.00	0.20	0.20
Markhamia tomentosa	12	55	10	151	2.75	0.22	0.60
Marquesia macroura	9	52	13	242	4.65	0.21	0.96
Megaphrynium macrostachyum	11	67	2	67	1.00	0.26	0.26
Milicia excelsa	20	206	16	1266	**6.15**	**0.81**	**5.00**
Millettia drastica	8	41	8	143	3.49	0.16	0.57

Species	NV	NI	NU	NC	VUs	ICs	VAUs
Millettia eetveldeana	1	1	1	1	1.00	0.00	0.00
Millettia laurentii	21	213	19	1395	**6.55**	**0.84**	**5.51**
Millettia macroura	1	3	1	3	1.00	0.01	0.01
Millettia versicolor	8	28	5	50	1.79	0.11	0.20
Mitracarpus villosus	1	4	1	4	1.00	0.02	0.02
Morinda lucida	3	11	6	78	**7.09**	0.04	0.31
Musanga cecropioïdes	4	14	8	97	**6.93**	0.06	0.38
Ochna afzelii	8	61	9	89	1.46	0.24	0.35
Olax wildemanii	5	28	7	81	2.89	0.11	0.32
Oncoba welwitschii	3	6	4	9	1.50	0.02	0.04
Ongokea gore	1	5	1	5	1.00	0.02	0.02
Palisota ambigua	5	23	1	23	1.00	0.09	0.09
Piptadeniastrum africanum	1	1	7	7	**7.00**	0.00	0.03
Polycephalium poggei	10	47	2	52	1.11	0.19	0.21
Pseudospondias microcarpa	1	15	7	98	**6.53**	0.06	0.39
Pycnanthus kombo	11	66	10	399	**6.05**	0.26	**1.58**
Raphia gentiliana	5	15	4	17	1.13	0.06	0.07
Raphia laurentii	1	7	1	7	1.00	0.03	0.03
Raphia matombe	1	8	1	8	1.00	0.03	0.03
Raphia sese	5	19	2	19	1.00	0.08	0.08
Raphia sp	3	18	2	18	1.00	0.07	0.07
Raphia textilis	16	110	5	110	1.00	0.43	0.43
Rhabdophyllum arnoldianum	18	149	5	179	1.20	**0.59**	0.71
Ricinodendron heudelotii	8	34	11	107	3.15	0.13	0.42
Sarcophrynium leiogonium	12	56	2	56	1.00	0.22	0.22
Strychnos cocculoides	12	67	2	67	1.00	0.26	0.26
Strychnos pungens	2	7	1	7	1.00	0.03	0.03
Symphonia globulifera	13	72	8	444	**6.17**	0.28	**1.75**
Tabernaemontana crassa	3	16	7	99	**6.19**	0.06	0.39
Terminalia superba	11	74	8	470	**6.35**	0.29	**1.86**
Trachyphrynium poggeanum	4	12	1	12	1.00	0.05	0.05
Voacanga africana	1	3	5	15	**5.00**	0.01	0.06
Xylopia aethiopica	19	122	11	732	**6.00**	0.48	**2.89**

Based on the Use Value (VUs) index, *Millettia laurentii*, *Hallea stipulosa*, *Milicia excelsa*, *Morinda lucida*, *Piptadeniastrum africanum*, *Musanga cecropioïdes*, *Pseudospondias microcarpa*, *Terminalia superba*, *Tabernaemontana crassa*, *Symphonia globulifera*, *Pycnanthus kombo*, and *Xylopia aethiopica* were the most multifunctional species (VUs ≥6). According to the Informant Consensus (ICs) index, widely recognized species included *Hallea stipulosa*, *Millettia laurentii*, *Eremospatha haullevilleana*, *Alstonia congensis*, *Erythrophloeum africanum*, *Hymenocardia acida*, *Rhabdophyllum arnoldianum*, *Dialium pachyphyllum*, and *Elaeis guineensis* (ICs >0.50). Combining these indices into the Value of Use Agreement (VAUs) highlighted *Millettia laurentii*, *Hallea stipulosa*, *Milicia excelsa*, *Alstonia congensis*, *Xylopia aethiopica*, *Terminalia superba*, *Symphonia globulifera*, *Pycnanthus kombo*, and *Canarium schweinfurthii* as the most culturally significant artisanal plants (VAUs >1).

Intra – and Inter – Village Patterns in Artisanal Plant Use

Ascending hierarchical classification (AHC) of the 76 species (Figure 2) revealed distinct patterns in artisanal plant use among villages and neighbourhoods. Group 1 (G1) comprised the Pado neighbourhood, while Group 2 (G2) included 23 villages and neighbourhoods. The similarity between G1 and G2 was <30%, with only *Millettia laurentii* and *Milicia excelsa* shared. Group 3 (G3), consisting of Kinzanzu village and the Mvula Nlondi neighbourhood, exhibited <20% similarity with G1 and G2, indicating that populations do not form a single community in craft plant use. Distinctive species characterized each group: *Imperata cylindrica* for G1, *Alstonia congensis* for G2, and both *Milicia excelsa* and *Millettia laurentii* for G3. These findings reveal significant intra – and inter-village variation in artisanal plant utilisation, reflecting both ecological availability and cultural preferences.

Classification based on the criterion ‘artisanal species used in the Kimvula territory is given Figure 2.

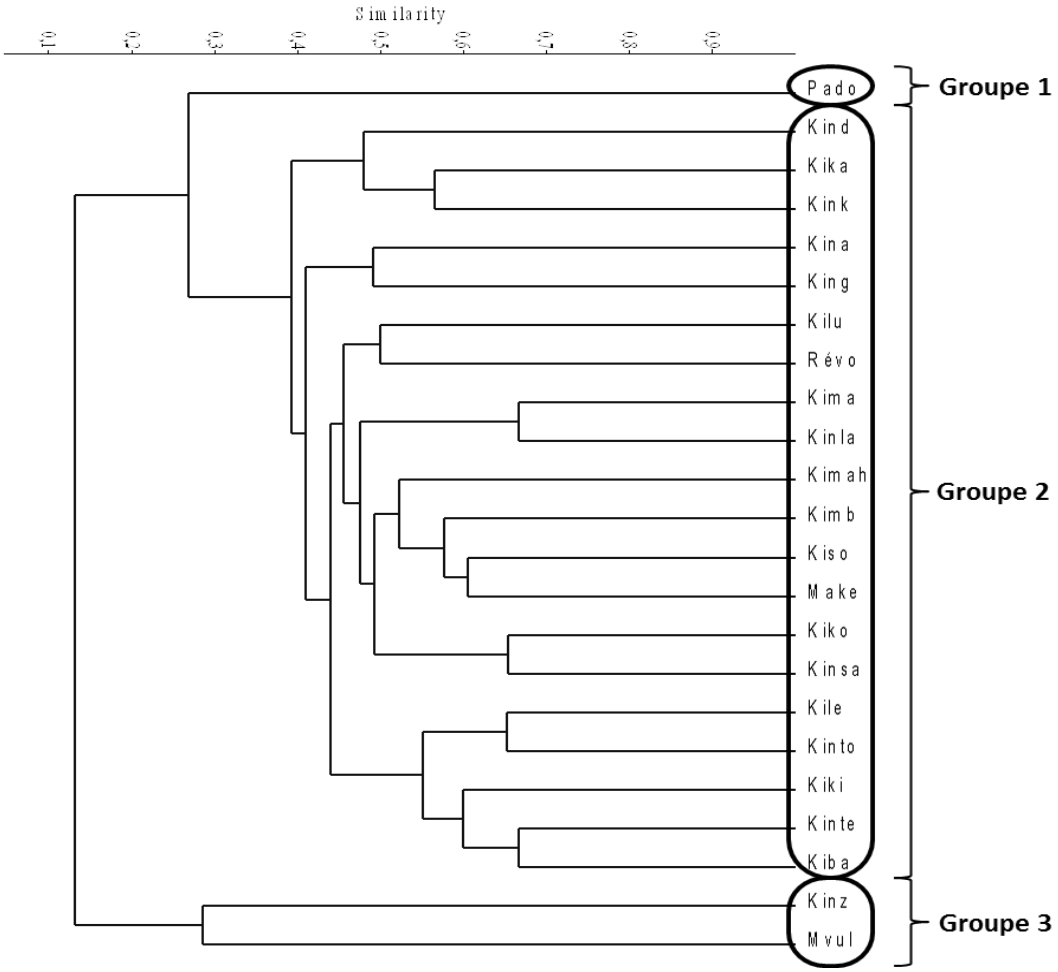

Figure 2. Dendrogram showing the different groups formed by the populations of different villages and districts in the use of artisanal plants according to the Nearest neighbour method (Kinz: Kinzanzu, Kiki: Kikiosi, Kina: Kinata, Kinl: Kinlandu, Make: Makeni, Kimb: Kimbangala, Kiso: Kisombo, Kimah: Kimahanga, Kins: Kinsakala, Kiko: Kikongomena, Kile: Kilenga, Kinte: Kintemba, Kiba: Kibasi, Kilu: Kilukengu, Kind: Kindoseta, Kink: Kinkedila, Kinto: Kintoyi, King: Kingoma, Kima: Kimafuila, Rév: Revolution, Mvul: Mvula nlondi and Kika: Kikangala).

Discussion

Species diversity and regional comparison

The floristic richness recorded in Kimvula (76 species, 62 genera, and 32 families) indicates a level of diversity comparable to that reported in other West African regions, although slightly lower than that observed in inventories conducted in Côte d'Ivoire and Benin (Léopold et al., 2021, Yao et al., 2020; Longbegnon et al., 2011). These regional differences reflect differences in vegetation structure, availability of wood resources, and local environmental degradation dynamics [Léopold AL at al., 2021].

Functional usages

Making coffins, doors, chairs, and windows are the most common uses, which shows how important functional craftsmanship is for meeting the needs of a home. This functional profile is similar to that of other African ethnobotany (Léopold et al., 2021; Soro et al., 2014). The species is chosen based on its mechanical strength, durability, functionality, and availability in the area.

Key species and selection criteria

The most commonly used species - *Elaeis guineensis*, *Eremospatha haullevilleana*, *Raphia spp*., *Alstonia congensis*, *Rhabdophyllum arnoldianum*, and *Ricinodendron heudelotii* - have desirable technological and aesthetic properties. However, some of these species show signs of decline, especially *Milicia excelsa* and *Milettia laurentii*, which are both classified as vulnerable by the International Union of Natural Resources. This situation highlights the tension between economic value and ecological sustainability.

Human activity and limited access to resources

The heavy use of forest resources, made worse by bad roads, forces local communities to take advantage of resources when they are available. This practice makes the degradation of woody stands worse and makes it less likely that they will naturally regenerate. To manage forests in a way that is good for the environment, we need to build up local skills in community-based forestry and support ecologically responsible artisanal value chains (Lugangu, 2019, Kimpouni et al., 2018).

Ethnobotanical values and importance indices

The use values (UV) and use agreement values (UAV) highlight a small group of species of outstanding artisanal and cultural importance (*Millettia laurentii*, *Milicia excelsa*, *Hallea stipulosa*, *Terminalia superba*, *Symphonia globulifera*, etc.). These species account for the majority of citations and exhibit technical properties well suited to traditional carpentry. Their high cultural value (CI ≥ 0.5) confirms their central role in the transmission of artisanal knowledge and practices.

Conservation and management challenges

The preservation of humid habitats (swampy areas and peatlands) where several of these species occur represents an ecological priority. Sustainable development policies should incorporate the valorisation of non-timber forest resources, the domestication of species with high UAV values, and the integration of environmental education into artisanal training programmes.

CONCLUSION

In the Kimvula Territory, seventy-six artisanal plant species belonging to sixty-two genera and thirty-two families were identified, with Fabaceae, Arecaceae, Marantaceae, and Rubiaceae being the most represented. Among them, *Millettia laurenti*i, *Hallea stipulos*a, *Milicia excelsa*, *Alstonia congensis*, *Xylopia aethiopica*, *Terminalia superba*, *Symphonia globulifera*, *Pycnanthus kombo*, and *Canarium schweinfurthii* showed the highest ethnobotanical use and consensus values, mainly for the production of coffins, doors, and other household artefacts.

This traditional knowledge system reflects both cultural heritage and empirical ecological understanding, offering valuable insights for the sustainable management of forest biodiversity.

Nevertheless, uncontrolled harvesting in artisanal work, construction and traditional medicine continues to undermine forest regeneration and ecological balance. Promoting sustainable crafts practices, especially through the domestication of highly used species and the valorisation of non-wood crafts such as baskets, can improve rural livelihoods at the same time and contribute to the conservation of local plant genetic resources. Finally, integrating ethnobotany knowledge into regional forest management policies will be key to reconciling cultural preservation and environmental sustainability.

***Ethics approval and consent to participate**:* The present research was executed in compliance with the stipulations of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization, pursuant to the Convention on Biological Diversity. Prior oral consent was obtained from each participant during the ethnobotanical data collection. No experiments involving humans or animals were performed in this study.

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***Availability of data and materials**:* The original data is presented in the article. There is no supplementary data. The raw data without the names of informants can be provided by authors.

***Competing interests**:* The authors declare that there are no conflits of interest between them or other authors.

***Availability statements**:* The original data is presented in the article. There is no supplementary data. The raw data without the names of informants can be provided by authors.

***Author contributions**:* LL conceived and designed the study. LL, GI and FL conducted data collection integrated the inventory and its analysis, and wrote the manuscript. LL, GI, FL, BB, and JPKNN identified the plants. Review, and edit the manuscript, AB, BB, JPH, DMM, MM, JPKNN, and All authors have read and agreed to the published version.

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