

Knowledge and Traditional Uses of Some Aromatic and Cosmetic Plants Species in the Western Highlands of Cameroon

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Abstract

The valorisation of plant genetic resources following the Access and Benefit Sharing (ABS) process of the Nagoya Protocol requires the mastery of traditional knowledge associated with their uses by local populations. The objectives of this study were to survey the aromatic or cosmetics plants species used by the populations and to collect information on the knowledge associated with their uses in the Western highlands of Cameroon. Ethnobotanical surveys were carried out in 12 localities, where 251 individuals, including 206 men and 45 women, whose ages ranged from 25 to 81 years were interviewed. Information on each of the plant species mentioned and their different uses were recorded. A total of 103 species in 81 genera and 46 families were cited for aromatic or cosmetic uses, of which the most represented were the Lamiaceae (18 species), Asteraceae, and Zingiberaceae (7 species each). The identified plants were grouped into four categories of use: medicinal (56.31%), cosmetic (10.68%), food (6.80%), and cultural (1.94%). Most of the species surveyed were herbaceous (66%) with leaves being the most used part. The diversity index values of the respondents showed 10 species that were very well known and used by the populations: *Eryngium foetidum*, *Chenopodium ambrosioides*, *Ocimum gratissimum*, *Piper umbellatum*, *Cinnamomum zeylanicum*, *Aframomum melegueta*, *Citrus limon*, *Costus afer*, *Cyperus rotundus*, and *Mondia whitei*. These species were mainly used for: cough, spiritual protection, sexual weakness, cysts, diabetes, prostate, rheumatism, filaria, insomnia, female sterility, jaundice, scabies, haemorrhoids, high blood pressure and asthma. The results obtained constitute a valuable source of information

that can contribute to the establishment of value chains allowing the effective valorisation of species following the ABS process.

Keywords

ABS, Valorisation, Aromatic Plants, Ethnobotanical Survey, Highlands

1. Introduction

Plants have always played a major role in the survival of humanity and have been traded between countries for years because of their ability to synthesize a large number of complex organic molecules with biological activities [1]. This is the case, of *Prunus africana* in Cameroon, whose fresh bark has been exported since the 1980s, nearly 1500 tonnes in 1980 and 2000 tonnes in 1990 [2] [3]. This trade has gradually given rise to rapid exploitation of the species, resulting directly in an alarming destruction and regression of supporting ecosystems [4] [5]. According to FAO (1995) and [6] the preservation of the biodiversity and the sustainable and rational use of natural resources is becoming imperative without which the sustainable development of future generations cannot be ensured.

The Convention on Biological Diversity (CBD), ratified in 1992 in Rio, is an international treaty, which recognises the sovereign right of states over their biological resources and reaffirms their responsibility for the conservation and sustainable use [7]. Because of some limits of this treaty, member states met in 2010 at the 10th Conference of the parties in Nagoya and adopted a protocol on Access and Benefit Sharing (ABS) from the utilisation of genetic resources. This protocol takes into account the intellectual property and traditional knowledge of indigenous peoples and local communities. Indeed, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recognises that the culturally and socially diverse environmental knowledge of indigenous people and local communities contributes greatly to the assessment and formulation of policies on biodiversity and ecosystem services, and needs to be taken into account in the process of conservation and sustainable use of biological resources [8]. Therefore, the Nagoya Protocol on access to genetic resources and fair and equitable sharing of benefits arising out of their utilization appears to be the ideal solution [9]. According to the International Union for Conservation of Nature (IUCN), the ABS process is a concrete example of valuing biodiversity and ecosystem services, but also a good way to promote conservation and sustainable use of natural resources.

Cameroon has one of the greatest biological diversities in the Congo Basin with aromatic and medicinal plants that are a source of essential oils. Despite this wealth, which could constitute an important source of revenue as confirmed by the high global demand recorded in recent years [10], the country is still struggling to set up value chains for these products according to the ABS princi-

ples. However, Cameroon's commitments to ABS have been formalized in a legal framework adopted by its government in 2021. Since 2012, the pilot project for the development of the *Echinops giganteus* plant in the Bamboutos Mountain has enabled the Cameroonian government to take a pragmatic approach to achieve this result. As *E. giganteus* is certainly not the only species that can be exploited in the area, it was necessary to have an idea of the species that can potentially be exploited under the ABS process. Knowing that the virtues of plants and their uses are very old and are transmitted through generations over time, ethnobotanical surveys seem to be one of the reliable approaches for the discovery of new compounds likely to be valorised by the ABS process [11] [12]. The present study is a contribution to the valorisation of natural resources used in the Western highlands of Cameroon following the ABS principles. The general objective of the work is to make an inventory of the ancestral knowledge held by the populations of Western Highlands of Cameroon on aromatic and/or cosmetic plant resources. More specifically, plant resources used as aromatics and/or cosmetics were identified and their associated traditional knowledge was presented.

2. Materials and Methods

2.1. Study Site

The Western highlands of Cameroon is located between latitudes 05°20' and 7°00'North and between longitudes 10°03' and 12°00'East. This region is characterised by a diversified relief with altitudes varying between 800 and 2740 m. The climate is of the Sudano-Guinean type with temperatures varying from 16°C to 27°C and relative humidity between 40% and 100%. The average rainfall is 1900 mm/year. The soils are mainly red ferralitic soils, though hydromorphic soils can also be observed. The vegetation is essentially made up of dense forests and swamps [13] [14]. The data collection areas are shown in **Figure 1**.

2.2. Ethnobotanical Surveys

Ethnobotanical surveys were conducted between July 2017 and May 2018 among traditional practitioners, herbalists and healers in 12 localities spread over five divisions as presented in **Table 1**. Semi-structured questionnaires were used with the assistance of traditional practitioners. Information was collected on the aromatic and cosmetic plants exploited, their vernacular names, the parts used, the activities of the local population in relation to the management and sustainable use and the importance of cited species in food, health, and socio-cultural life.

2.3. Collection and Identification of Species

Species were identified *in situ* with the help of botanists. Fertile samples of unidentified species were collected with secateurs, filmed with a camera, wrapped in newspaper, pressed, dried and further identified at the National Herbarium in Yaoundé.

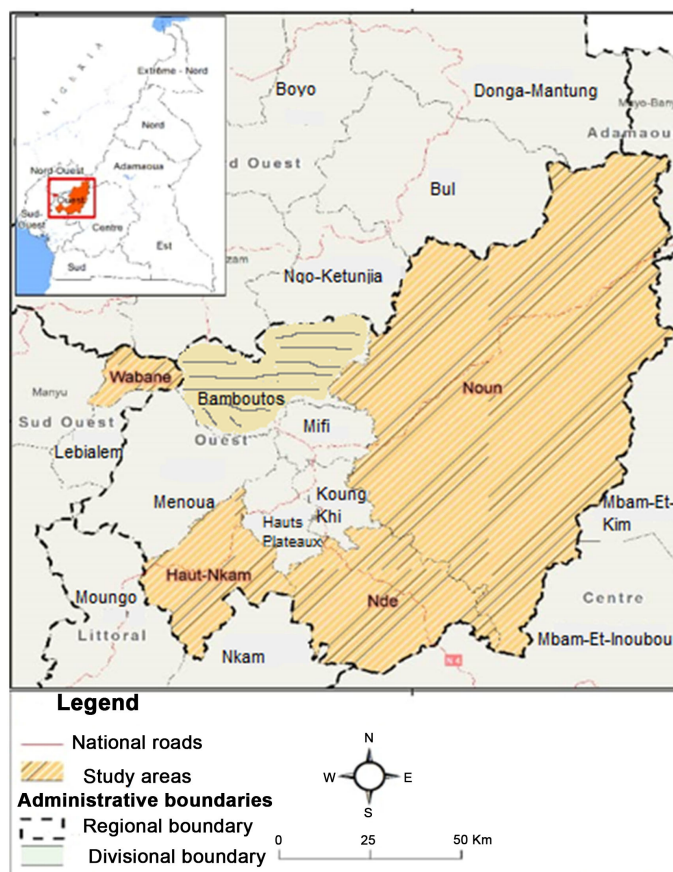


Figure 1. Location of data collection areas in the Western Highlands of Cameroon.

Table 1. Collection sites.

Administrative Divisions	Localities
Noun	Massangam, Malentouen, Kouoptamo
Haut-Nkam	Bapoutcheu-Ngaleu
Ndé	Tonga, Bassamba, Bitchoua
Lebialem	Wabané, Alou, Essoh-attah
Mbaboutos	Galim, Mbouda

2.4. Data Processing and Analysis

XLSTAT software was used for data analysis. The importance of each species was evaluated from the relative frequency of citation [15] calculated as follows:

$$RFV = \frac{N_u}{N_p} \times 100 \quad (1)$$

where N_u represented the number of people who cited the species and N_p the total number of surveys.

Similarly, the ethnobotanical importance of the identified aromatic plants was assessed by calculating the diversity index and the fairness index of the survey.

The diversity index (ID) indicates the number of respondents who use the species and how this knowledge is distributed among them [16]. It varies between 0 and 1 and is obtained using the following formula:

$$ID = \frac{U_x}{U_t} \times 100 \quad (2)$$

where U_x is the number of uses cited by a respondent and U_t the total number of uses.

If ID is low (< 0.5), then few people know the species; but if ID is high (> 0.5), then the species is well known.

The fairness index (FEI) measures the degree of agreement between respondents regarding the different uses of the species [16]. It varies between 0 and 1 and is obtained using the following formula:

$$FEI = ID / ID_{\max} \quad (3)$$

where ID_{\max} is the value of the highest diversity index found.

3. Results

3.1. Information about the Respondents

A total of 251 individuals having knowledge on aromatic and/or cosmetic plants were surveyed. **Table 2** presents the socio-cultural characteristics of the people surveyed in each of the selected localities. Among them, 82.1% were males while 17.9% were female. The age of the respondents varied between 25 and 81 years. People over 50 years of age were the most represented with 56.2%. Of all the people surveyed, traditional practitioners were the most represented (38.6%), followed by herbalists (31.1%) and healers (25.1%). In all the localities surveyed, the Bamilékés ethnic group was the most represented with 55.3%, followed by the Bamoun with 29.5%.

3.2. Floristic Composition of the Plants Recorded

A total of 103 species of aromatic and/or cosmetic plants were identified during the survey. They were distributed in 81 genera and 46 families, the most represented of which were: Lamiaceae (18 species), Asteraceae (10 species), Euphorbiaceae and Zingiberaceae (7 species each), the Fabaceae (5 species), Apiaceae and Piperaceae (4 species). Bignoniaceae, Anacardiaceae, Campanulaceae, Peperaceae, Olacaceae, Myristicaceae, Ruscaceae, Guttiferae, Passifloraceae and Acanthaceae were the less represented families with one species each.

3.3. Morphological Types

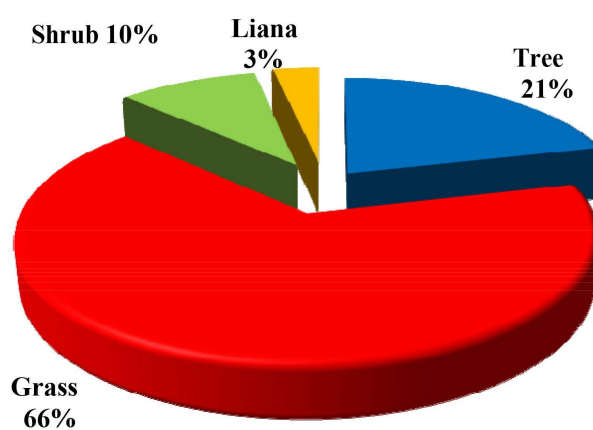
Grasses represented 66% of the species recorded, followed by trees (21%), with the shrubs and lianas representing only 10% and 3% respectively (**Figure 2**).

3.4. Usage Categories of Identified Species

Several categories of uses were identified, namely: medicinal (56.31%), food (6.80%), cosmetic (10.68%) and cultural (1.94%) (**Figure 3**). In all categories of

Table 2. Summary of respondents' socio-cultural information.

Parameters	Administrative division					Total	Percentage
	Lebielem	Nde	Noun	Bamboutos	Haut-Nkam		
Gender							
Male	43	46	71	4	42	206	82.1
Female	0	10	5	2	28	45	17.9
Age group							
≤50	28	26	24	6	26	110	43.8
>50	15	30	52	0	44	141	56.2
Ethnicity							
Bamiléké	6	36	2	6	64	114	45.4
Bamoun	0	8	73	0	0	81	32.3
Achon	10	2	0	0	0	12	4.7
Bagnwa	20	0	0	0	0	20	8.0
Haoussa	5	8	1	0	0	14	5.6
Other ethnicities	2	2	0	0	6	10	4.0
Profession							
Traditional healers	12	37	32	0	16	97	38.6
Cultivator	0	9	1	0	0	10	3.9
Herbalist	18	3	9	6	42	78	31.1
Healer	13	7	31	0	12	63	25.1
Restorer	0	0	3	0	0	3	1.2

**Figure 2.** Proportion of the morphological types of aromatics and/or cosmetics plants recorded.

use, leaves (111 citations) were the most used organ followed by barks (32 citations), fruits (27 citations) and roots (25 citations).

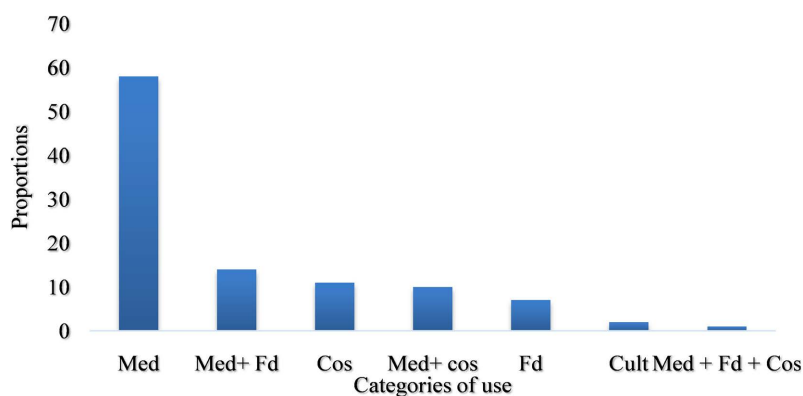


Figure 3. Proportions of the different categories of use of the listed species. Caption: Med: medicine, Med + Fd: medicine + food, Cos: cosmetics, Med + cos: medicine + cosmetics, Ali: food, Cult: cultural, Med + Fd + cos: medicine + food + cosmetics.

3.5. Relative Frequency of Citation, Diversity and Equitability of Use of the Plants Listed

The results of the various indices and the frequency of quotations for each species surveyed are presented in **Table 3**. The 10 most cited species were *Eryngium foetidum* (9.52), *Chenopodium ambrosioides* (5.56), *Ocimum gratissimum* (5.56), *Piper umbellatum* (4.37), *Cinnamomum zeylanicum* (3.97), *Aframomum melegueta* (2.78), *Citrus limon* (2.38), *Costus afer*, *Cyperus rotundus* and *Mondia whitei* (1.98 each). Among the least cited species are *Satureja punctata*, *Pycnostachys meyeri*, *Pychnantus angolensis*, *Robus forticorpus*, *Plectranthus madagascarensis*, *Premna zenkeri*, *Physalis angulata*, *Peperomiavulcanica*, with a citation frequency of less than 0.5.

Overall the diversity index values were below 0.5 and varied between 0.02 and 0.22, which means that the plants are not very well known by the respondents.

Low values for the species use equitability index were recorded. This reflects a low degree of homogeneity of knowledge among the respondents. However, the highest values were observed for the 10 species mentioned above, which indicates that knowledge of the uses of these species is evenly distributed among the surveyed populations.

3.6. Traditional Knowledge Associated to the Use of the Identified Plants

The traditional knowledge held by the populations of the different localities in relation to aromatic and cosmetic plants is presented in **Table 4** below. This table shows that:

- ✓ The populations make use of the genetic resources of aromatic and cosmetic plants in several fields, but especially to treat illnesses such as coughs, sexual weakness, cysts, diabetes, prostate, rheumatism, filaria, insomnia, female sterility, jaundice, scabies, haemorrhoids, arterial hypertension, asthma, but also for mystical-magical illnesses;

Table 3. Frequency of citation, diversity, and equitability of uses of the identified aromatic species.

Families	Common/vernacular names	Species	Number of citations	RFC	ID	IE
Apiaceae	Leetar, Gamolombo, glass breaker	<i>Eryngium foetidum</i>	24	9.52	0.22	1.00
Chenopodiaceae	Lam-fafam. casse oil	<i>Chenopodium ambrosioides</i>	14	5.56	0.16	0.73
Lamiaceae	Befeunembeu. Samveu. Cotémadjo. Masep	<i>Ocimum gratissimum</i>	14	5.56	0.16	0.73
Piperaceae	Mbeupout	<i>Piper umbellatum</i>	11	4.37	0.14	0.62
Lauraceae	Kobe-dedam. Cinnamon. Laurel	<i>Cinnamomum zeylanicum</i>	10	3.97	0.13	0.58
Zingiberaceae	Soockoua. Sooc	<i>Aframomum melegueta</i>	7	2.78	0.10	0.45
Rutaceae	Lemon	<i>Citrus limon</i>	6	2.38	0.09	0.40
Annonaceae	Chuchu	<i>Annona sp.</i>	5	1.98	0.08	0.35
Costaceae	Goutcheu. Twin Cane	<i>Costus afer</i>	5	1.98	0.08	0.35
Cyperaceae	Kadjidji	<i>Cyperus rotundus</i>	5	1.98	0.08	0.35
Apocynaceae	Koukoudja	<i>Mondia whitei</i>	5	1.98	0.08	0.35
Fabaceae	Seunassah. Nfou-bibi	<i>Cassia alata</i>	4	1.59	0.07	0.30
Apiaceae	Wild parsley	<i>Caucalis melanantha</i>	4	1.59	0.07	0.30
Asteraceae	Pankouen. Baniamtcheu	<i>Eremomastax speciosa</i>	4	1.59	0.07	0.30
Verbenaceae	Bankounfue. Mensouen Tea	<i>Lippia rugosa</i>	4	1.59	0.07	0.30
Fabaceae	4 sides	<i>Tetrapleura tetraptera</i>	4	1.59	0.07	0.30
Sapindaceae	Zeufeu	<i>Allophylus bullatus</i>	3	1.19	0.05	0.24
Poaceae	Keugania. horse grass. lemongrass	<i>Cymbopogon citratus</i>	3	1.19	0.05	0.24
Moraceae	Ngandou	<i>Dorstenia sp</i>	3	1.19	0.05	0.24
Hypericaceae		<i>Hypericum lanciolata</i>	3	1.19	0.05	0.24
Moringaceae	Moringa	<i>Moringa oleifera</i>	3	1.19	0.05	0.24
Piperaceae	Bibot	<i>Piper capense</i>	3	1.19	0.05	0.24
Rosaceae	Prunus. Pidium	<i>Prunus africana</i>	3	1.19	0.05	0.24
Fabaceae	Bikang	<i>Scorodophloeus zenkeri</i>	3	1.19	0.05	0.24
Zingiberaceae	djidja	<i>Zingiber officinale</i>	3	1.19	0.05	0.24
Euphorbiaceae	Meche	<i>Alchornia laxiflora</i>	2	0.79	0.04	0.17
Apiaceae	Angelique	<i>Angelica archangelica</i>	2	0.79	0.04	0.17
Lamiaceae	Lady's mantle	<i>Archemelia vulgaris</i>	2	0.79	0.04	0.17
Rutaceae	Tchenmegneu Assa babagon	<i>Clausena anisata</i>	2	0.79	0.04	0.17
Asteraceae		<i>Crassocephalum biafrae</i>	2	0.79	0.04	0.17
Euphorbiaceae	Dialé	<i>Croton oligandrun</i>	2	0.79	0.04	0.17
Rubiaceae	Hantchou	<i>Zanthoxylum heitzii</i>	2	0.79	0.04	0.17
Asteraceae	Tabac-Biché	<i>Laggera pterodonta</i>	2	0.79	0.04	0.17

Continued

Verbenaceae		<i>Lantana camara</i>	2	0.79	0.04	0.17
Lamiaceae	Basil	<i>Ocimum basilicum</i>	2	0.79	0.04	0.17
Lamiaceae	Nkeusiè Red	<i>Ocimum sp1</i>	2	0.79	0.04	0.17
Zingiberaceae	Ginseng	<i>Panax ginseng</i>	2	0.79	0.04	0.17
Pentadiplandraceae	Afap	<i>Pentadiplandra brazeana</i>	2	0.79	0.04	0.17
Pinaceae	Fir	<i>Picea abies</i>	2	0.79	0.04	0.17
Apiaceae		<i>Pimpinella</i>	2	0.79	0.04	0.17
Guttifereae	Comdo	<i>Psorospermum mannii</i>	2	0.79	0.04	0.17
Apocynaceae		<i>Rovolfia vomitoria</i>	2	0.79	0.04	0.17
Myrtaceae	Cloves	<i>Syzygium aromaticum</i>	2	0.79	0.04	0.17
Combretaceae		<i>Terminalia gluceses</i>	2	0.79	0.04	0.17
Asteraceae	Jealousy flower	<i>Tithonia diversifolia</i>	2	0.79	0.04	0.17
Annonaceae	Long pepper	<i>Xylopia aethiopica</i>	2	0.79	0.04	0.17
Bombacaceae	Baoba	<i>Adansonia digitata</i>	1	0.40	0.02	0.10
Zingiberaceae		<i>Aframomum chlamydentum</i>	1	0.40	0.02	0.10
Zingiberaceae	Jujube	<i>Aframomum dalzielii</i>	1	0.40	0.02	0.10
Zingiberaceae	Choac	<i>Aframomum danielli</i>	1	0.40	0.02	0.10
Zingiberaceae	Mbè	<i>Aframomum sp.</i>	1	0.40	0.02	0.10
Asteraceae	King of the Grass	<i>Ageratum conyzoides</i>	1	0.40	0.02	0.10
Euphorbiaceae		<i>Alchornia cordifolia</i>	1	0.40	0.02	0.10
Liliaceae	Garlic	<i>Allium sativum</i>	1	0.40	0.02	0.10
Xanthorrhoeaceae	Aloe vera	<i>Aloe vera</i>	1	0.40	0.02	0.10
Gentianaceae	Dzikiliking	<i>Anthocleista sp</i>	1	0.40	0.02	0.10
Asteraceae		<i>Artemesia annua</i>	1	0.40	0.02	0.10
Canabaceae	Cannabis	<i>Cannabis sativa</i>	1	0.40	0.02	0.10
Solanaceae	Agata peper	<i>Capsicum sp</i>	1	0.40	0.02	0.10
Fabaceae	Nkeu	<i>Cassia sp</i>	1	0.40	0.02	0.10
Lamiaceae	Maleulè	<i>Clerodendrum sp.</i>	1	0.40	0.02	0.10
Euphorbiaceae	Nkon	<i>Croton macrostachyus</i>	1	0.40	0.02	0.10
Burseraceae	Safoutier	<i>Dacryodes edulis</i>	1	0.40	0.02	0.10
Asteraceae		<i>Emilia coccinea</i>	1	0.40	0.02	0.10
Asteraceae		<i>Ethulia conizoides</i>	1	0.40	0.02	0.10
Euphorbiaceae	Peumoo	<i>Euphorbia hirta</i>	1	0.40	0.02	0.10
Rubiaceae		<i>Zanthoxylum lemarier</i>	1	0.40	0.02	0.10
Rubiaceae		<i>Zanthoxylum tesmanii</i>	1	0.40	0.02	0.10
Clusiaceae	Kola	<i>Garcinia lucida</i>	1	0.40	0.02	0.10

Continued

Asteraceae		<i>Helichrysum bifranum</i>	1	0.40	0.02	0.10
Asteraceae		<i>Helichrysum foetidum</i>	1	0.40	0.02	0.10
Asteraceae		<i>Helichrysum sp</i>	1	0.40	0.02	0.10
Malvaceae	Hibiscus	<i>Hybiscus rosa-sinensis</i>	1	0.40	0.02	0.10
Bignoniaceae	Kigélia	<i>Kigelia africana</i>	1	0.40	0.02	0.10
Campanulaceae		<i>Lobelia columnaris</i>	1	0.40	0.02	0.10
Euphorbiaceae		<i>Macaranga oxidentalis</i>	1	0.40	0.02	0.10
Anacardiaceae	Wild mango	<i>Mangifera indica</i>	1	0.40	0.02	0.10
Fabaceae		<i>Mimosa pudica</i>	1	0.40	0.02	0.10
Euphorbiaceae	Rammarama	<i>Neoboutonia glabrescens Prain</i>	1	0.40	0.02	0.10
Lamiaceae	Maram	<i>Occimum sp</i>	1	0.40	0.02	0.10
Lamiaceae	Nkeusiè White	<i>Ocimum sp2</i>	1	0.40	0.02	0.10
Olacaceae	Nchu	<i>Olox subscorpoidea</i>	1	0.40	0.02	0.10
Pacifloraceae	Passion fruit. babadi	<i>Passiflora edulis</i>	1	0.40	0.02	0.10
Piperaceae		<i>Peperomia vulcanica</i>	1	0.40	0.02	0.10
Solanaceae		<i>Physalis angulata</i>	1	0.40	0.02	0.10
Pinaceae	Pine	<i>Pinus silvestris</i>	1	0.40	0.02	0.10
Piperaceae	Black pepper	<i>Piper guineensis</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Plectranthus epilepticus</i>	1	0.40	0.02	0.10
Lamiaceae	Aqua	<i>Plectranthus laterifolia</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Plectranthus madagascarensis</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Plectranthus sp1</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Premna zenkeri</i>	1	0.40	0.02	0.10
Myristicaceae		<i>Pychnantus angolensis</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Pycnostachys meyeri</i>	1	0.40	0.02	0.10
Rosaceae	Keukam	<i>Robus forticorpus</i>	1	0.40	0.02	0.10
Agavaceae		<i>Sansevieria quercifolia</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Satureja punctata</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Satureja robusta</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Satureja sodosinensis</i>	1	0.40	0.02	0.10
Lamiaceae		<i>Satureja sp</i>	1	0.40	0.02	0.10
Verbenaceae		<i>Stachytarpheta jamaicensis</i>	1	0.40	0.02	0.10
Clusiaceae	Mahogany	<i>Symphonia sp</i>	1	0.40	0.02	0.10
Rutaceae		<i>Zanthoxylum xanthoxyloides</i>	1	0.40	0.02	0.10

Table 4. List of species identified with their use patterns.

Families	Scientific names	Treated diseases	Organs used	Reparation method	Administration	
Agavaceae	<i>Sesuvium portulacastrum</i>	Dermatoses	Leaves	Infusion	Oral	
Anacardiaceae	<i>Mangifera indica</i> Linn.	Prostate	Barks	Decoction	Oral	
		Madness	Barks	Decoction	Bath and oral	
Annonaceae	<i>Annona</i> sp.	Snake bites	Barks	Take some powder from this bark and mix it with red oil	Cataplasm and oral	
		Dartre	Leaves	Crush the leaves into a paste	Cataplasm	
	<i>Xylocarpus</i> sp.	Female infertility	Fruit	Decoction	Oral	
		Seasoning of meals	Fruit	Crush before introducing it into the meal during cooking		
Apiaceae	<i>Angelica archangelica</i>	Toothache	Roots	Mash to a paste	Cataplasm (on the affected tooth)	
		Bloating	Roots	Decoction	Oral	
	<i>Caucalis melanantha</i>	Hepatitis B	Whole plant	Decoction	Oral	
		Kidney disease	Whole plant	Decoction	Oral	
	<i>Cf Pimpinella</i>	Solidification of muscles	Whole plants	Decoction	Oral	
		Chasing away evil spirits	Leaves	Incineration (combining the leaves with the oil palm inflorescence and burning over a wood fire)	Fumigation	
		Fractures	Leaves	Trituration	Massage	
		Night fire	Leaves	Trituration	Cataplasm	
Mystical illnesses or bad dreams		Whole plant	Trituration	Bath		
Cysts		Leaves	Crush	Oral		
Apocynaceae	<i>Eryngium foetidum</i>	Rheumatism	Leaves		Scarification	
		Counterpoison	Whole plant	Decoction	Oral	
		Female infertility	Leaves	Decoction	Oral	
		Jaundice	Aerial part	Decoction	Bath and oral	
	<i>Mondia whitei</i>	Sexual weakness	Roots	Decoction	Oral	
		Traditional meal seasoning	Roots	Dry and grind before introducing into the meal		
		<i>Rauwolfia vomitoria</i>	Wired	Root or bark	Infusion	Bath and oral
			Stomach ache	Root and bark	Decoction	Oral

Continued

Apocynaceae	<i>Artemisia annua</i>	Malaria	Leaves	Infusion	Oral	
	<i>Crassocephalum biafrae</i>	Stimulates breast flow	Leaves	Decoction or infusion	Oral	
	<i>Emilia coccinea</i>	Fungal skin infection	Leaves	Trituration	Cataplasm	
	<i>Eremomastax speciosa.</i>	Itching of the body	Leaves	Trituration	Bath	
		Red butts	Leaves	Crush with a few leaves of massep	Oral and poultice	
		<i>Ethulia conyzoides</i>	Female infertility	Stems and leaves	Trituration	Oral
	<i>Helichrysum foetidum</i>	Painful periods	Leaves	Trituration	Oral	
	<i>Laggera pterodonta</i>	Treating wounds	Leaves	Trituration	Cataplasm	
				Inflorescences	Crush	Anal and oral
<i>Tithonia diversifolia</i>	Wireworm. scabies	Leaves	Trituration	Bath and oral		
Bignoniaceae	<i>Kigelia africana</i>	Eczema	Fruit	Dry then crush and mix with black palm kernel oil	Cataplasm	
Bombacaceae	<i>Adansonia digitata</i>	Prostate	Barks	Decoction	Oral	
Burseraceae	<i>Dacryodes edulis</i>	Anti-venom	Barks	Dry and crush	Cataplasm (at the bite)	
Campanulaceae	<i>Lobelia columnaris</i>	Zona	Leaves	Trituration	Cataplasm	
Canabaceae	<i>Cannabis sativa</i>	Muscle pain	Leaves and seeds	Decoction	Oral	
		To ward off evil spirits or dreams	Whole plant	Decoction or trituration	Bath and oral	
	Chenopodiaceae	<i>Chenopodium ambrosioides</i>	Intestinal worms	Leaves	Trituration	Oral
			Cysts	Leaves	Decoction	Oral
Clusiaceae	<i>Garcinia lucida</i>	Stain on the skin	Leaves	Crush	Cataplasm	
		Cough	Fruit		Oral	
		Chronic stomach ache	Leaves and bark	Decoction	Anal	
Combretaceae	<i>Terminalia glaucescens</i>	Stomach and kidney pain	Barks	Decoction	Oral	
		Prostate	Stems and leaves	Decoction	Oral	
Costaceae	<i>Costus afer</i>	Facilitates childbirth	Leaves	Trituration	Oral	
		Cough in children	Rods	Maceration	Oral	
Cyperaceae	<i>Cyperus rotundus</i>	Rheumatism. threadworm	Roots	Decoction	Oral	
		Protection against evil spirits	Roots	Dry. crush and mix into cleansing milk	Massage	

Continued

	<i>Alchornia cordifolia</i>	Stomach ache	Leaves	Decoction	Oral
	<i>Alchornia laxiflora</i>	Darter	Leaves	Crush	Cataplasm
Euphorbiaceae	<i>Croton macrostachyus</i>	Female infertility	Barks	Decoction	Oral
	<i>Croton oligandrus</i>	Aphrodisiac	Barks	Dry and crush	Oral
		Muscle pain	Barks	Dry and crush	Massage and oral
	<i>Euphorbia hirta</i>	Moth	Leaves	Crush	Cataplasm
	<i>Macaranga occidentalis</i>	Clogged trumpets	Leaves	Decoction	Oral
	<i>Neoboutonia glabrescens</i>	Pimples and itchy skin	Leaves	Decoction	Bath and oral
		Darter	Leaves	Crush	Cataplasm
	<i>Senna alata</i>	Jaundice	Leaves	Decoction	Oral
		Yellow fever	Leaves	Trituration	Oral and steam bath
	<i>Senna sp</i>	Risk of miscarriage	Fruit	Burning and crushing	Massage and oral
	<i>Mimosa pudica</i>	Filaria. liver perforation	Seeds	Decoction of crushed seeds	Oral
Fabaceae		Night Poison	Barks	Decoction	Oral
	<i>Scorodophloeus zenkeri</i>	Seasoning of meals	Barks	Crush or grate before introducing into the meal during cooking	Oral
		Infertility	Fruit	Decoction	Oral and anal
	<i>Tetrapleura tetraptera</i>	Seasoning of meals	Fruit	Dry and crush before introducing into the meal during cooking	
Rutaceae	<i>Zanthoxylum heitzii</i>	Powerlessness	Bark	Powder decoction	Oral
Gentianaceae	<i>Anthocleista sp</i>	Female infertility	Barks	Decoction	Oral and anal
Hypericaceae	<i>Psorospermum mannii</i>	Hernia. stomach ache	Leaves	Decoction	Oral
		Antiviral	Leaves	Maceration	Oral
	<i>Hypericum lanceolatum</i>	Heartburn	Leaves	Infusion	Oral
		Antifungal	Leaves	Trituration	Cataplasm
	<i>Clerodendron sp.</i>	Hernia	Leaves	Decoction	Oral
	<i>Ocimum basilicum</i>	Vaginal infections	Leaves	Trituration	Anal
		Sore throat	Leaves	Infusion	Oral
Lamiaceae		Red butts	Leaves	Trituration (in combination with Pafechu leaves)	Oral
	<i>Ocimum gratissimum</i>	Dermatitis or skin irritation	Leaves	Trituration	Cataplasm
		Chickenpox. fever in children	Leaves	Trituration	Bath and oral

Continued

		Darter. ringworm	Leaves	Crush	Cataplasm
		Keeping evil spirits away	Flower and leaves	Trituration	Bath and oral
	<i>Ocimum gratissimum</i>	Counter poison	Leaves	Decoction	Oral
		Seasoning of meals	Leaves	Throwing leaves into soups	
	<i>Ocimum sp 1</i>	Fever	Leaves	Decoction	Oral and steam bath
	<i>Ocimum sp 2</i>	Joint pain	Leaves	Decoction	Massage
	<i>Plectranthus lateriflora</i>	Chest pain	Leaves	Decoction	Oral
	<i>Plectranthus sp 1</i>	Respiratory problems	Leaves	Decoction	Oral
Lamiaceae	<i>Plectranthus epilepticus</i>	Convulsion	Leaves	Trituration	Oral
	<i>Premna zenkeri</i>	Bad body odour	Leaves	Decoction	Bath
	<i>Pycnostachys meyeri</i>	Stomach ache	Leaves	Infusion	Oral
	<i>Satureja punctata</i>	Stomach ache	Leaves and flowers	Decoction	Oral
	<i>Satureja sodosinensis</i>	Malaria	Stem and leaves	Decoction	Oral
	<i>Satureja sp</i>	Digestive problems	Aerial parts	Infusion	Oral
	<i>Satureja robusta</i>	Meat preparation	Leaves	Throwing something into the pot	
		Against poison	Bark		Oral
		Protection of children	Barks	Crush	Cataplasm
Lauraceae	<i>Cinnamomum zeylanicum</i>	Diabetes	Bark and leaves	Decoction	Oral
		Traditional food seasoning	Barks and leaves	Grate the bark before introducing it into the meal	Oral
		Insomnia	Barks	Decoction	Oral
Liliaceae	<i>Allium sativum</i>	Hypertension	Pods	Maceration	Oral
Malvaceae	<i>Hybiscus rosa-sinensis</i>	Facilitating childbirth	Leaves	Trituration	Oral
		Palpitation	Roots	Crush	Oral
Moraceae	<i>Dorstenia sp</i>	Rate	Roots	Crush	Oral
		Seasoning of meals	Roots	Decoction	Oral
		Diabetes	Barks	Decoction	Oral
Moringaceae	<i>Moringa oleifera</i>	Galle	Leaves	Crush	Cataplasm
		Sexual weakness	Roots	Decoction	Oral
Myristicaceae	<i>Pycnanthus angolensis</i>	Hepatitis B	Barks	Decoction	Oral
Myrtaceae	<i>Syzygium aromaticum</i>	Aphrodisiac	Seeds	Decoction	Oral

Continued

Olacaceae	<i>Olex subscorpoidea</i>	Epilepsy	Barks	Decoction	Oral
Passifloraceae	<i>Passiflora edulis.</i>	Insomnia	Leaves	Infusion	Oral
Pentadiplandraceae	<i>Pentadiplandra brazzeana</i>	Convulsion	Leaves	Trituration	Oral
		Sexual weakness	Roots	Decoction	Oral
Periplocaceae	<i>Mondia whitei</i>	Seasoning of meals	Roots	Dry and crush before introducing into the meal	Oral
Pinaceae	<i>Picea abies</i>	Fever	Leaves	Decoction	Oral
Pinaceae	<i>Pinus silvestris</i>	Respiratory problem	Needles	Infusion	Oral
Piperaceae	<i>Piper capense</i>	Sales Evil	Leaves and fruits	Decoction	Oral
		Mystical illnesses	Leaves	Decoction	Bath and oral
Piperaceae	<i>Piper guineensis</i>	Vaginal itching	Leaves	Decoction	Vaginal bath
Piperaceae	<i>Piper guineensis</i>	Seasoning of meals	Seeds	Crush before introducing into the meal during cooking	Oral
Piperaceae	<i>Piper guineensis</i>	Jaundice	Leaves and roots	Decoction	Oral
		Hemorrhoids	Leaves and seeds	Decoction	Oral
Piperaceae	<i>Piper guineensis</i>	Shielding	Leaves	Trituration	Massage after scarification
Piperaceae	<i>Piper guineensis</i>	Asthma	Leaves	Infusion	Oral
Piperaceae	<i>Piper umbellatum</i>	High blood pressure	Leaves	Decoction	Oral
Piperaceae	<i>Piper umbellatum</i>	Seasoning of meals	Leaves	Crush	
Piperaceae	<i>Piper umbellatum</i>	Vaginal itching	Leaves	Decoction	Vaginal bath
Piperaceae	<i>Piper umbellatum</i>	Female infertility	Leaves	Prepare with pistachio paste	Oral
Piperaceae	<i>Piper umbellatum</i>	Respiratory problems	Leaves	Infusion	Oral and inhalation
Poaceae	<i>Cymbopogon citratus</i>	Fever	Leaves	Infusion	Oral
Rosaceae	<i>Alchemilla vulgaris</i>	Disorder of the female reproductive system	Leaves	Decoction	Oral
Rosaceae	<i>Alchemilla vulgaris</i>	Painful or heavy periods	Aerial part	Infusion	Oral
Rosaceae	<i>Prunus africana</i>	Prostate	Barks	Decoction	Oral
Rosaceae	<i>Robus forticorpus</i>	Scabies. wired	Fruit	Dry and crush	Cataplasm
Rubiaceae	<i>Fagara lemarier</i>	Seasoning of meals	Seeds	Crush before introducing into the meal during cooking	Oral
Rubiaceae	<i>Fagara tesmanii</i>	Sexual weakness	Barks	Decoction	Oral

Continued

	<i>Citrus limon</i>	Stomach ache	Fruit	Squeeze and collect the juice	Oral
		Acnes	Fruit		Cataplasm
Rutaceae	<i>Clausena anisata</i>	Infertility	Leaves	Decoction	Oral
	<i>Zanthoxylum xanthoxyloides</i>	Seasoning of meals	Seeds	Crush before introducing it into the meal during cooking	Oral
Sapindaceae	<i>Allophylus bullatus</i>	Pushing away bad people or spirits	Barks	Dry then crush	
		Cough	Fruit		Oral (eating the fruit)
Solanaceae	<i>Capsicum sp</i>	Wounds. antibiotic	Fruit	Crush	Cataplasm
	<i>Physalis angulata</i>	Constipation	Leaves	Decoction	Oral
	<i>Lantana camara</i>	Malaria. fever	Leaves	Decoction	Fumigation and oral
		Colic	Leaves	Trituration	Oral
Verbenaceae	<i>Lippia rugosa</i>	Muscle fatigue	Leaves	Infusion	Oral
		Fever	Leaves	Decoction	Oral
	<i>Stachytarpheta jamaicensis</i>	Infertility	Leaves	Infusion	Oral
Xanthorrhoeaceae	<i>Aloe vera</i>	Zone	Leaves	Extracting frost	Cataplasm
	<i>Aframomum dalzielii</i>	Protection	Fruit		Oral (eating the seeds)
	<i>Aframomum danielli</i>	Pimples and itchy skin	Roots	Decoction	Bath
		Teething in infants	Fruit	Crush some seeds	Massage (infant gums)
	<i>Aframomum melegueta</i>	Cough	Fruit		Oral (eating the seeds)
Zingiberaceae		Protection. mystical diseases	Whole plant	Decoction	Bath
		Sexual weakness	Fruit	Decoction	Oral
	<i>Panax ginseng</i>	Prostate	Roots	Decoction	Oral
		Increase libido	Roots	Decoction	Oral
	<i>Zinziber officinale</i>	Colds	Roots	Grate and extract the juice and mix with honey	Oral
		Hypertension	Roots	Combine with garlic, crush and leave to ferment for 7 days	Oral

- ✓ Decoction is the most widely used method of preparing phytomedicines;
- ✓ The oral route is the most commonly used method of administering phytomedicines. However, for dermatoses or diseases related to the epidermis

(threadworms, scabies, shingles, etc.), poultices and baths are the most popular methods.

4. Discussion

The results (**Table 2**) showed that the majority of respondents were male (82.1%) and range in age from 25 to 81 years. The high representation of men may be due to the fact that the surveys were more oriented towards traditional medicine professionals. Moreover, it would seem that there are very few women in this sector of activity because women who frequently use plants with medicinal potentials are very badly regarded [17]. In previous works, some authors justified the low representation of women in the traditional health sector by the fact that there is an ancestral belief that women's role in society is limited to taking care of the home and family [17] [18]. Ngoule and collaborators found similar results (60.41% men) in their surveys of essential oil medicinal plants in Douala markets [19]. According to the same authors, activities related to plant health generate significant income allowing men to support their families, which is why they are more represented than women in this sector of activity.

The age group over 50 years was the most represented (**Table 2**). Indeed, older people are more likely to provide the most reliable information, as they hold much of the endogenous knowledge, which is part of oral traditions [20], [21]. In addition, knowledge about the virtues of plants is generally transmitted from father to son over generations [22]. But nowadays young people are increasingly disinterested in traditional knowledge, which could result in the disappearance of knowledge on plant use [23]. Several authors agree, showing that knowledge of the virtues and uses of plants is acquired with age through years of experience and passed on from one generation to another [24].

The Bamiléké represent 55.3% of the population surveyed (**Table 2**). The high representation of Bamilekes can be justified by the location of the study area, since the Western Highlands are populated in great majority by the Bamilekes. Moreover, this ethnic group strives to maintain and safeguard their culture and traditions with the help of traditional leaders whose authority is established and respected by all [19].

Among the species listed, the Lamiaceae was the most represented botanical family. This could be explained by the fact that the Lamiaceae includes most of the aromatic and condiment plants and species therefore are highly prized by the cosmetic industries. Indeed, Alliaceae, Apiaceae and Lamiaceae are the three main botanical families of aromatic plants [25]. By comparison, the study by Mpondo and collaborators carried out in the upper Nyong division shows rather a strong representation of Euphorbiaceae [23]. This is probably due to the fact that the agro-ecological zone of the studies differs and therefore the farmer's conception of plant use will also vary. In addition, the present work concerns aromatic and cosmetic plants while that of Mpondo and collaborators was based only on medicinal plants and in a single division.

The majority of the respondents appeared to use grasses for different purposes (Figure 2). The high use of grasses could be an indicator of their abundance in the study area. In addition, the herbaceous stratum is represented by small species that grow and regenerate rapidly and are therefore permanently available [26]. Mpondo Mpondo having obtained similar results had found during their raids on the study sites that the areas close to the dwellings were covered with grass, thus justifying the high use of it in traditional medicine by the different ethnic communities of Douala [27].

Leaves were the most commonly used organs (Figure 3). The frequent use of leaves can be justified not only by the fact that the organ is easy to harvest but also by the abundance of chemical compounds they contain. Indeed, they are the site of synthesis of several metabolites responsible for the biological properties of plants [28] [29] [30]. The plants listed were mainly used for therapeutic purposes (Figure 4), which could be in line with the popular belief that all plants are healing, provided that one knows how to use them. Moreover, the use of plants for medicinal purposes is a common and ancestral practice in Africa. Today, more than 80% of the African population do not have access to modern health care and medicines and therefore rely on traditional medicine for treatment [23].

The results show that traditional knowledge related to aromatic and cosmetic plants is mainly health-related (Table 4). And in particular for questions related to the mystical order. In fact, we counted 07 plants used for these purposes, namely *Eryngium foetidum*, *Chenopodium ambrosioides*, *Ocimum gratissimum*, *Piper capense*, *Cinnamomum zeylanicum*, *Aframomum melegueta* and *Cyperus rotundus*. But of these, one in particular, *Eryngium foetidum*, is known by local people in almost all the study locations for its mystical-magical powers. Such knowledge is held only by the indigenous communities that hold the ancestral knowledge and cannot be exploited without their agreement and without

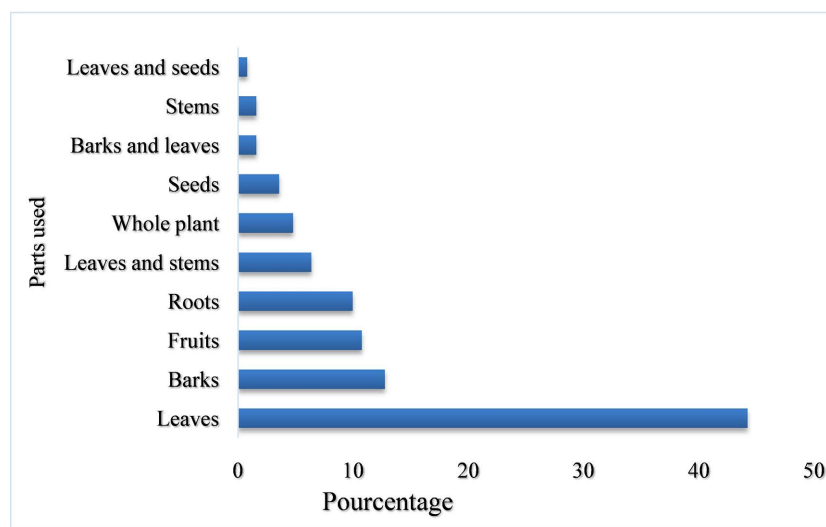


Figure 4. Proportions of organs used.

compensation because, as stipulated in Article 8 of the CBD, States must ensure that the traditional knowledge of the people is respected, preserved and promoted by all users of its resources.

5. Conclusion

This study highlighted the ethnic knowledge in the Western Highlands of Cameroon on the aromatics and/or cosmetic plants used by the population. A total of 103 species from 81 genera and 46 families were recorded in the area, having four (04) principal categories of uses, medicinal, food, cosmetic and cultural. These populations use several organs of these species, notably: leaves, barks, roots and fruits. Ten species: *Eryngium foetidum*, *Chenopodium ambrosioides*, *Ocimum gratissimum*, *Piper umbellatum*, *Cinnamomum zeylanicum*, *Aframomum melegueta*, *Citrus limon*, *Costus afer*, *Cyperus rotundus* and *Mondia whitei* are very well known and used by the populations. The knowledge held by the local populations is of great interest to the scientific community, to governments and even to industrialists who could see in these aromatic and cosmetic plants and their derivatives a means of further enrichment. Thus, at the end of this work, we can say that there are many plants in the West Cameroon Highlands that can be valorised according to the principle of access and benefit sharing.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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