Ethnobotanical Survey of Herbal Teas Consumed in Uíge Province, Angola: Part 1

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Research

Abstract

Background: This ethnobotanical study is the first based on the herbal teas or tisanes consumed in Angola, specifically in Uíge province. The aims of this study were to document traditional knowledge related to the use of herbal teas and then assess their floristic diversity.

Methods: Field research was conducted between January to December 2022, in both rural and urban areas of Uíge province. Ethnobotanical methods included participatory observation, semi-structured interviews, key informant interviews, and focus group discussions. These were used to obtain detailed information on plants used to brew herbal teas. A total of 150 informants (including 18 key informants) were interviewed.

Results: A total of 60 species of herbal teas distributed in 48 genera and 27 families are used by the local population in Uíge province. Of these 58.63% are indigenous and 41.37% are exotic species. The most frequently used part was the leaf (62.5%), and the most frequently used preparation methods were decoction (68.7%), and infusion (31.3%). In addition, these plants are mainly used for other purposes, such as phytomedicines (71.6%), and bioenergy (14.1%). Regarding the medicinal use of tisanes, most are used to treat or prevent coughs (23.3%), and anemia (20%).

Conclusion: It is important to implement the systematic protection of wild plant resources and the establishment of botanical gardens in order to provide a sustainable source of production of these herbal teas, which also contribute to the income of local farmers. This would benefit, the quality of the products, and support environmental and human well-being.

Keywords: Ethnobotanical survey, herbal teas, Uíge Province, Angola

Résumé

Contexte: Cette étude ethnobotanique est la première basée sur les tisanes consommées en Angola, plus précisément dans la province d'Uíge. Le but de cette étude était de documenter les connaissances traditionnelles liées à l'utilisation des tisanes, puis d'évaluer leur diversité floristique.

Méthodes: La recherche sur le terrain a été menée entre Janvier et Décembre 2022, dans les zones rurales et urbaines de la province d'Uíge. Des méthodes ethnobotaniques comprenaient l'observation participative, des entretiens semi-structurés, des entretiens avec des informateurs clés et des discussions de groupe. Ceux-ci ont été utilisés pour obtenir des informations détaillées sur les plantes utilisées pour faire la tisane. Au total, 150 informateurs (dont 18 informateurs clés) ont été interrogés.

Résultats : Un total de 60 espèces de tisanes réparties en 49 genres et 26 familles sont utilisées par la population locale de la province d'Uíge. Parmi celles-ci, 58,63% sont indigènes et 41,37% sont des espèces exotiques. La partie la plus utilisée fréquemment est la feuille (62,5%), et les méthodes de préparation les plus utilisées étaient la décoction (68,7%) et l'infusion (31,3%). De plus, ces plantes sont principalement utilisées à d'autres fins, comme les phytomédicaments (71,6 %) et la bioénergie (14,1 %). Concernant l'usage médicinal des tisanes, la pluspart est utilisée pour traiter ou prévenir la toux (23,3%) et l'anémie (20%).

Conclusion: Il est important de mettre la protection systématique des ressources végétales et la création de jardins botaniques afin de fournir une source durable de production de ces tisanes, qui contribuent également aux revenus des agriculteurs locaux. Cela profiterait à la qualité des produits, et soutiendrait le bien-être environnemental et humain.

Mots clés: Enquête ethnobotanique, tisanes, Province de Uíge, Angola.

Background

For centuries, Angola's rich and fascinating floral and faunal biodiversity has attracted many national and foreign researchers to conduct ethnobotanical and zoological studies in the region. For examples Mawunu *et al*. (2022a); Mawunu *et al*. (2022b); Mawunu *et al*. (2020); Mawunu *et al*. (2019); Mawunu *et al*. (2016); Kissanga *et al*. (2021); Monizi *et al*. (2021); Monizi *et al*. (2018); Gonçalves *et al*. (2019); Lautenschläger *et al*. (2018), FAO (2017), Domingos *et al*. (2016), and Urso *et al*. (2015).

In Angola, people are still very dependent on collecting plants from wild, and knowledge of the use of plants in their daily lives is fundamental. Even people living in urban areas have family in rural areas or have lived there for at least part of their lives (Lautenschläger *et al*. 2018). Furthermore, the population of Uíge province, both urban and rural, is familiar with many types of plants and uses some of them on a daily basis for various reasons, including food, and medicine (Monizi *et al*. 2018b). Local people derive numerous vital resources from the rich and fascinating floristic and faunal diversity of this part of Angola, largely due to the excellent mosaic of soil types, landforms, rivers, and climate conditions.

Despite the unparalleled interest of national and foreign scientists in Angolan plant diversity in recent years, few studies have explored endogenous knowledge of herbal teas consumed in Angola, particularly in Uíge province. This preliminary study focuses on the ethnobotanical inventory of herbal teas known and used by the local population in Uíge province, as well as their taxonomic, and ecological characteristics, namely life form and phytogeographical origin and distribution.

Materials and Methods

Study area

The study was conducted in Uíge province, in northern Angola, bordered to the north and east by the Democratic Republic of the Congo, to the south by Malanje, Kwanza Norte, and Bengo provinces, and to the west by Zaire province (Figure 1). Sampling was carried out between 5° 58’ 59.2” and 7° 56’ 59.4” South latitude and between 14° 33’ 53.7” and 16° 17’ 04.5” East longitude. The study area was located in the Western part of the province and included 9 contiguous municipalities of

the 16 municipalities of Uíge province (Figure 1). The province as a whole and is inhabited by more than 1.4 million people (INE 2016). Uíge province has a tropical wet or dry (Aw) savannah climate according to the Köppen climate classification (Briggs & Smithson 1986; Peel *et al*. 2007).

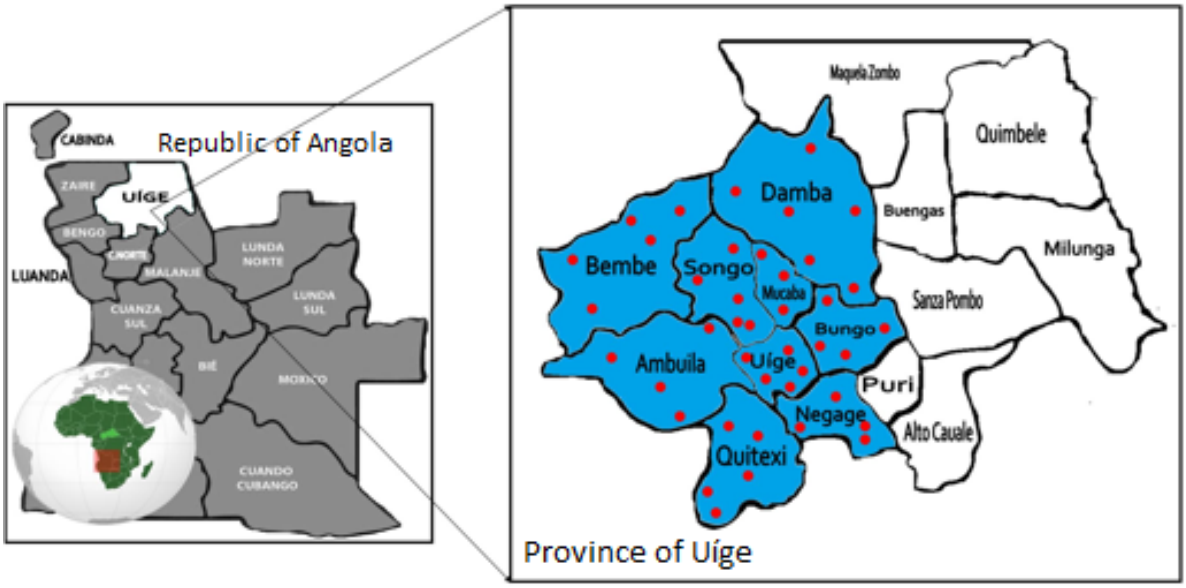

Figure 1. Location of the study area in the Uíge province mentioning the 9 target municipalities of the Republic of Angola.

This so-called Guinean-Congolese rainforest climate is characterized by a rainy season of at least 9 months, relative humidity exceeds 80%, with a typical dense fog, and dry season locally called Cacimbo, lasting 3 to 4 months (Romeiras *et al*. 2014; White 1983). This season is also called, Sivu, or Mbangala in the Kikongo language (Mawunu *et al*. 2019; Monizi *et al*. 2018a, Monizi *et al*. 2019b). According to the World Wildlife Fund (WWF) global ecoregion map, Uíge province covers the ecoregion known as the Western Congo forest-savannah mosaic (David *et al*. 2001). A more precise description of the region was given by White (1983) who classified Angola in the north between the Guinea-Congolese and Zambian regions as the Guinea-Congolese/Zambian regional transition zone. According to this classification, this zone is characterized by great complexity since elements of both climate types are present. This, in addition to the edaphic conditions and the diverse topography strongly influence the formation of distinct mosaic vegetation patterns (Barbosa 1970).

Data collection and analysis

This study of the flora was based on a qualitative analysis, essentially consisting in the inventory of different species, through careful observation at the study site. Species that were not directly identified in the field were collected and placed in the Herbarium of Kimpa Vita University for further botanic identification. Several books and scientific articles were used as references for this purpose (Mawunu *et al*. 2022a, Mawunu *et al*. 2022b; Mawunu *et al*. 2020; Lautenschläger *et al*. 2018; Latham *et al*. 2021). The following characteristics were recorded to account for each of the identified species:

(1) Life form: determined according to the habit or general appearance of the plant when developed. Various life forms were observed, depending on whether the plants were woody or herbaceous;
(2) The biological type: Raunkiaer's classification (1934), adapted by Lebrun (1960), Belesi (2009) and Lassa (2023).for tropical regions, was used;
(3) The phytogeographical distribution, which shows the area of distribution of each species over the surface of the globe;
(4) The various types of biotopes or habitats in which the species listed generally grow.
The selection of respondents was based on three essential criteria:

1. Did they know and use herbal teas in daily life;
2. Where they available,
3. Did they give individual's consent.

Finally, the data collected in this survey were processed using Microsoft Office Excel (version 2016) and presented in the form of graphs or tables.

Results

Characterization of the sociodemographic profile of informants

The data recorded in this survey reveal that women (57.1%) outnumber men (42.9%). The results obtained may be related to the matrilineal nature of the Bantu society, particularly the Bakongo of northern Angola.

The greatest majority (64.7%) of the traditional knowledge holders is in the older age group, 31.1% are adults and 4.2% of informants are youth. The fact that the young inhabitants of Uíge province were also holders of ethnobotanical knowledge related to food plants, ensures that this knowledge will be passed on to future generations.

Regarding the level of education, the greatest majority (85.4%) of informants is literate, and barely 14.6% are illiterate. Besides, of the 85.4% who were literate, 44.8% had attended primary school, 24.2% had attended secondary school, 15.4% had attended adult literacy school and 2% were university graduates. The fact that ethnobotanical knowledge about herbal teas is held by literate people shows that it is possible to preserve it in writing while remaining useful for future generations.

In what concerns these informants, agriculture is their main (83.5%) source of income, food, and employment, followed by trade (6.3%), odd jobs (5.8%), and public service for 4.4% of them. Uíge province is one of the Angolan regions with an agricultural tradition. The relationship with the land is based on subsistence production, and the sale of the surplus, using mainly family labour. Finally, Mawunu *et al*. (2016) reported that agriculture was the main source of income and employment (95.0%) in the rural municipality of Ambuila in the same Uíge province. Data from the 2014 national census conducted in Angola (INS, 2016), reported that agriculture is the largest source of income and employment (46%).

Floristic diversity of herbal tea plants

Medicinal Plants of the Family Lamiaceae as Functional Foods - a Review

This first ethnobotanical inventory carried out in Uíge province allowed us the identification a total of 60 herbal tea species, distributed among 48 genera, and 27 botanical families (Table 1). Of the 60 documented species, 56 were taxonomically identified, leaving only three species that had to be identified back in the herbarium. The best-represented botanical families in terms of number of herbal tea species were reported as Asteraceae (10 species), Lamiaceae (6 species), Rutaceae (5 species), Annonaceae (4 species), Fabaceae (4 species), and Poaceae (3 species). Some botanical families had two herbal tea species Acanthaceae, Moraceae, Myrtaceae, Rubiaceae and Verbenaceae. The remaining plant families had contributed one species of tisane (Anacardiaceae, Apocynaceae, Burseraceae, Caricaceae, Dennstaedtiaceae, Euphorbiaceae, Lauraceae, Malvaceae, Meliaceae, Moringaceae, Ochnaceae, Pinaceae, Phyllanthaceae, and Urticaceae). The predominance of certain families, namely Annonaceae, Asteraceae, Fabaceae, Lamiaceae, and Rutaceae, appears to be due to their ability to adapt and colonize various soil, and climatic conditions in the region.

In terms of taxa, angiosperms were predominant, contributing 57 species, of which 54 were dicots, and only 3 monocots. Gymnosperms contributed two species, and there was one pteridophyte species (Table 2).

The richness in terms of genera per botanical family in this study shows that the best-represented botanical families were Asteraceae (9 genera), Fabaceae (4 genera), and Lamiaceae (4 genera).

Moreover, the richest genera in terms of species used for herbal teas were *Crassocephalum* (2), *Cymbopogon* (2), *Ficus* (2), *Lippia* (2), *Ocimum* (2), *Vitex* (2), Annona (3 species), and *Citrus* with 5 different species.

Of the 60 identified plants, most were angiosperms. Most of these 54 species were dicotyledonous species (90.0%). They were: *Alchornea cordifolia*, *Annona muricata*, *Annona senegalensis*, *Annona stenophylla* subsp. *cuneata*, *Aspilia kotschyi*, *Azadirachta indica*, *Bidens pilosa*, *Brillantaisia owariensis*, *Coffea canephora*, *Carica papaya*, *Catharanthus roseus*, *Chromolaena odorata*, *Citrus x aurantium*, *Citrus x limon*, *Citrus maxima*, *Citrus x sinensis*, *Crassocephalum montuosum*, *Crassocephalum rubens* var. *rubens*, *Cupressus* sp., *Dianthera secunda*, *Dichrostachys cinerea* subsp. *africana*, *Eriosema glomeratum*, *Erythrina abyssinica*, *Eucalyptus citriodora*, *Ficus sur*, *Ficus sycomorus*, *Gardenia ternifolia* subsp. *jovis-tonantis*, *Helichrysum mechowianum* var. *mechowianum*, *Hibiscus acetosella*, *Hymenocardia ulmoides*, *Indigofera paracapitata*, *Laportea aestuans*, *Lippia abyssinica*, *Lippia multiflora*, *Mangifera indica*, *Mentha x piperta*, *Moringa oleifera*, *Ochna afzelii* subsp. *mechowiana*, *Ocimum gratissimum*, *Pachylobus edulis*, *Persea americana*, *Pleiotaxis rugosa*, *Psidium guajava*, *Pteridium aquilinum* subsp. *Centrali-africanum*, *Schwenkia americana*, *Stomatanthes africanus*, *Tagetes erecta*, *Tetradenia urticifolia*, *Uvariodendron molundense*, *Vernonella subaphylla*, *Vitex doniana* and *Vitex madiensis*. The Monocots represent only 5.0%, with three (*Cymbopogon citratus*, *Cymbopogon densiflorus*, and *Saccharum officinarum*). Finally, two Gymnosperms (*Pinus* sp., *Cupressus* sp.), and Pteridophytes (*Pteridium aquilinum* subsp. *centrali-africanum*) each occupy only 1.7%. It should be noted that the samples, that of Cupressus and Pinus are currently being examined for species identification.

Table 1. Ethnomedicinal flora, family, vernacular names, scientific name, parts used, preparation modes, habitats, life form, plant status and other uses of investigated herb teas

Botanical families and plant species	Vernacular Names	Parts used	Ecological status	Life form	Preparation modes	Habitats	Other uses of investigated plants	Fr.Cit. (%)
Acanthaceae								
Brillantaisia owariensis P.Beauv. [UNIKIVI00450]	Lemba lemba (Kik.)	Leaves	Native	Shrub	Decoction	Village	Medicinal (pneumonia, cough, bronchitis)	5(0.49%)
Dianthera secunda (Lam.) Griseb. [UNIKIVI00510] (**), (***)	Folha de Jeová (Port.), Makaya ma menga (Kik.)	Leaves	Exotic	Shrub	Decoction	Village	Medicinal (Anemia), Ornamental, Hedges	41(4.00%)
Anacardiaceae								
Mangifera indica L. [UNIKIVI00452]	Mangueira (Port.), Nti a manga (Kik.)	Leaves	Exotic	Tree	Decoction, Infusion	Village, fields	Medicinal (Hypertension, Constipation), Bioenergy (Firewood and charcoal)	19(1.86%)
Annonaceae								
Annona muricata L. [UNIKIVI00487]	Sapi sapi (Port.), Mbundu ya ngombe (Kik.)	Leaves	Exotic	Shrub	Decoction, Infusion	Village, fields	Medicinal, food	3(0.29%)
Annona senegalensis Pers. [UNIKIVI00451]	Lomboloka, Lolo kia mbulu (Kik.)	Leaves	Native	Shrub	Decoction	Savannah	Medicinal (anemia, diarrhea, dysentery), spices, Bioenergy (Firewood, charcoal), Construction materials	21(2.05%)
Annona stenophylla subsp. *cuneata* (Oliv.) N.Robson [UNIKIVI00455] (*), (**), (***)	Lolua lolua, Lolo kiandamba (Kik.)	Leaves	Native	Subshrub	Decoction	Savannah	Medicinal (anemia), Bioenergy (Firewood, charcoal), agricoltural equipement (Hoe handle)	36(3.56%)
Uvariodendron molundense (Diels) R.E.Fr. [UNIKIVI00456] (*), (**), (***)	Kikaya, Ikaya (Kik.)	Leaves	Native	Tree	Decoction, Infusion	Forest	Medicinal (anemia, Hypertension, cough, Chest pain), spice	25(2.34%)

Apocynaceae								
Catharanthus roseus (L.) G. Don [UNIKIVI00457]	Beija mulata (Port.)	Leaves	Exotic	Subshrub	Infusion	Village	Medicinal (Diabetes, Worms, Diarrhea), Ornamental	9(0.88%)
Asteraceae								
Aspilia kotschyi (Sch.Bip. ex Hochst.) Oliv. [UNIKIVI00458]	Ludini lua mbua (Kik.)	Leaves	Exotic	Annual herb	Decoction, Infusion	Village, savannah, forest	Medicinal (cough, constipation)	7(0.68%)
Bidens pilosa L. [UNIKIVI00459]	Nsoloboto, nsote za mbua, Mpote za mbwa (Kik.)	Leaves, stem	Native	Annual herb	Decoction, Infusion	Savannah	Medicinal (cough, constipation)	33(3.22%)
Chromolaena odorata (L.) R.M.King & H.Rob. [UNIK00460]	Mobutu, Kongo ya sika (Ling.)	Leaves	Exotic	Shrub	Decoction	Savannah, village, forest	Medicinal (wounds), Agriculture (Organic fertiliser)	3(0.29%)
Crassocephalum rubens (Juss. ex Jacq.) S. Moore [UNIKIVI00461] (*)	Bungudi, Bungudia (Kik.)	Leaves, inflorescences, stem	Native	Annual herb	Decoction	Savannah, village	Food (leaf vegetable)	4(0.39%)
Crassocephalum montuosum (S.Moore) Milne-Redh. [UNIKIVI00462] (*)	Bungudi, Bungudia (Kik.)	Leaves, inflorescences, stem	Native	Annual herb	Decoction	Savannah, village	Food (leaf vegetable)	3(0.29%)
Vernonella subaphylla (Baker) H.Rob. & Skvarla [UNIKIVI00463] (*)	Makutula (Kik.)	Leaves	Native	Perrenial herb	Decoction	Savannah		5(0.49%)
Gymnanthemum glaberrimum (Welw. ex O.Hoffm.) H.Rob. [UNIKIVI00465] (*), (**)	Nkutakani ya koko (Kik.)	Leaves, inflorescences, stem	Native	Shrub	Decoction	Savannah	Medicinal (fever, constipation, abortifacient)	34(3.32%)
Helichrysum mechowianum Klatt [UNIKIVI00468]	Lumpakuludi, lubini lua mbwa (Kik.)	Leaves	Native	Perrenial herb	Decoction	Savannah	Medicinal (Anemia, wound)	11(1.07%)
Pleiotaxis rugosa O.Hoffm. [UNIK00454] (*)	Ntelema katesa, Ntalamakatezi, Telema katesi, musolakatese (Kik.)	Leaves	Native	Subshrub	Decoction	Savannah	Medicinal (abortifacient bladder pain, sheath pain, diarrhea, diabetes, typhoid)	11(1.07%)
Stomatanthes africanus (Oliv. & Hiern) R.M.King & H.Rob. [UNIKIVI00467] (*), (**), (***)	Nkutanikani ya nkento, Salukia lu nkento (Kik.)	Leaves, inflorescences, stem	Native	Perrenial herb	Decoction	Savannah	Medicinal, Aphrodisiac	29(2.83%)

Tagetes erecta L. [UNIKIVI00464]	Tekulu dia mputu (Kik.)	Leaves, inflorescences, stem	Exotic		Dection, Infusion	Village	Medicinal (cough, malaria, fever)	3(0.29%)
Burseraceae								
Pachylobus edulis G. Don [UNIKIVI00469]	Nsafu (Kik.), Safou (Fr.), safueiro (Port.)	Leaves	Native	Tree	Decoction	Village, fields	Medicinal (Hypertension)	4(0.39%)
Caricaceae								
Carica papaya L. [UNIKIVI00470]	Mamoeiro (Port.), Kikila (Kik.)	Leaves	Exotic	Tree	Decoction, Infusion	Village, fields	Medicinal (cough)	4(0.39%)
Cupressaceae								
Cupresssus sp. [UNIKIVI00473]	Cipreste (Port.)	Leaves	Exotic	Tree	Decoction	Village	Medicinal (Cough)	2(0.20%)
Dennstaedtiacea								
Pteridium centrali-africanum (Hieron.) Alston [UNIKIVI00472]	Mitekua tekua (Kik.), Misili (Ling.)	Frond/Shoots	Native	Annual herb	Decoction	Savannah	Medicinal (Anemia, diabetes)	2(0.20%)
Euphorbiaceae								
Alchornea cordifolia (Schum. & Thonn.) Müll. Arg. [UNIKIVI00475]	Wunze, ngunze (Kik.)	Leaves	Native	Shrub	Decoction	Forest, Savannah, Village	Medicinal (anemia, diarrhea), Bioenergy (Firewood, charcoal)	9(0.88%)
Fabaceae								
Erythrina abyssinica Lam. [UNIKIVI00474] (*), (**), (***)	Mungoma ngoma, Lungu lungu (Kik.)	Leaves, stem bark	Native	Tree	Decoction	Savannah, village	Medicinal (yellow fever, anemia, Typhoid, Diarrhea, Back pain, fatigue), bioenergy (Firewood, charcoal)	31(3.03%)
Eriosema glomeratum (Guill. & Perr.) Hook.f. [UNIKIVI00471]	Nzolele ngienda, ndolo ngienda (Kik.)	Leaves, inflorescences, stem	Native	Subshrub	Decoction	Savannah	Medicinal (constipation, fever)	20(1.95%)
Dichrostachys cinerea (L.) Wight & Arn. [UNIKIVI00476]	Nsende za mvanga, Mvanga (Kik.)	Leaves	Native	Small tree	Decoction	Savannah	Medicinal (anemia)	16(1.56%)
Indigofera paracapitata J.B.Gillett [UNIKIVI00477] (**)	Mbaya ya londe,Diamba dia nseke (Kik.)	Leaves, inflorescences	Native	Subshrub	Decoction	Savannah	Medicinal (Anemia)	24(2.34%)

Senna occidentalis (L.) Link [UNIKIVI00484]	Dnioka nioka (Kik.)	Seeds	Exotic	Subshrub	Decoction	Village	Medicinal (Constipation, diarrhea, stomach ache)	6(0.59%)
Lamiaceae								
Mentha x piperta L. [UNIKIVI00480]	Manguentena (Kik.)	Leaves	Native	Shrub	Decoction	Savannah	Médicinale, Bioénergie (Firewood, charcoal)	2(0.20%)
Ocimum americanum L. [UNIKIVI00481]	Mansunsu nsunsu (Kik.)	Leaves, Inflorescences	Exotic	Perrenial herb	Decoction, Infusion	Village, fields	Médicinal (cough, constipation), spice	10(0.98%)
Ocimum gratissimum L. [UNIKIVI00482]	Mansunsu nsunsu (Kik.)	Leaves, Inflorescences	Native	Shrub	Decoction, Infusion	Village	Médicinale (cough, flu, broquitus, fever)	12(1.17%)
Tetradenia urticifolia (Baker) Phillipson [UNIKIVI00478]	Mutozo (Kik.)	Leaves	Exotic	Shrub	Decoction, Infusion	Village	Medicinal (Bronquitte, sinisite, Dor de estomâgo, Tosse)	2(0.20%)
Vitex doniana Sweet [UNIKIVI00483]	Mafilu, Mfilu a mfinda (Kik.)	Leaves	Native	Tree	Decoction	Forest, Savannah	Medicinal (fatigue, constipation, corperal pain, bloody diarrhoea, stomach pain, back pain), firewood, charcoal, mortar and pestle	12(1.17%)
Vitex madiensis Oliv. [UNIKIVI00485] (*), (**), (***)	Mfilu a nzanza, a londe (Kik.)	Leaves, stem bark, bark roots	Native	Shrub	Decoction, Infusion	Savannah	Medicinal (Fatigue, constipation, diarrhea, anemia, cough, diabetes, body pain)	47(4.59%)
Lauraceae								
Persea americana Mill. [UNIKIVI00486]	Abacateiro (Port.)	Leaves	Exotic	Tree	Decoction, Infusion	Village, fields	Medicinal (Anemia, Hypertension)	21(2.05%)
Malvaceae								
Hibiscus acetosella Welw. ex Hiern [UNIKIVI00453]	Ngayi-ngayi (Ling.), Usse (Port.)	Leaves, fruits	Native	Annual herb	Decoction, Infusion	Village, fields	Medicinal (Anemia)	16(1.59%)
Meliaceae								
Azadirachta indica A. Juss. [UNIKIVI00488]	Cura tudo (Port.)	Leaves	Exotic	Tree	Decoction	Village	Medicinal (diarrhea, malaria)	6(0.59)

Moraceae								
Ficus sur Forssk. [UNIKIVI00489]	Mukuzu (Kik.), Pau mulato (Port.)	Leaves	Native	Tree	Decoction	Savannah	Medicinal (Anemia)	32(3.13%)
Ficus sycomorus L. [UNIKIVI00490] (*), (**)	Nkuzu, mukuzu, nlelomoka, kienga (Kik.)	Leaves	Native	Tree	Decoction	Forest	Medicinal (Anemia)	37(3.61%)
Moringaceae								
Moringa oleifera Lam. [UNIKIVI00491]	Moringa (Port.)	Leaves	Exotic	Tree	Decoction	Village	Medicinal (Diabetes, vocal cords, skin infections)	9(0.88%)
Myrtaceae								
Corymbia citriodora (Hook.) K.D.Hill & L.A.S. Johnson [UNIKIVI00497] (*), (**), (***)	Eucalypto (Port.)	Leaves	Exotic	Tree	Decoction, Infusion	Village	Medicinale (toux, constipation), bioenergy (Firewood, charcoal)	14(1.37%)
Psidium guajava L. [UNIKIVI00493]	Ngavua, Mfuluta (Kik.)	Leaves	Exotic	Shrub	Decoction, Infusion	Village, field	Medicinal (Diarrhea)	13(1.27%)
Ochnaceae								
Ochna afzelii R.Br.ex Oliv.[UNIKIVI00494] (*), (**) [UNIKIVI00494] (*), (**)	Ngo nti, Nkosi nti (Kik.)	Stem bark	Native	Tree	Decoction	Savannah	Medicinal (anemia), bioenergy (Firewood, charcoal)	15(1.46%)
Pinaceae								
Pinus sp. [UNIKIVI00495]	Pino (Port.)	Leaves, Inflorescences	Exotic	Tree	Decoction	Village	Médicinale (cough)	4(0.39%)
Poaceae								
Cymbopogon citratus (DC.) Stapf [UNIKIVI00496] (*), (**), (***)	Nsinde sinde (Kik.), Chá caxinde (Port.)	Leaves, root	Exotic	Perrenial herb	Decoction, Infusion	Village	Medicinal (Hypertension, yellow fever	57(5.57%)
Cymbopogon densiflorus (Steud.) Stapf [UNIKIVI00492] (*)	Sangu sangu, Lusangu sangu (Kik.)	Leaves, inflorescences	Native	Perrenial herb	Decoction, Infusion	Village, fields	Medicinal (cough), spices	18(1.76%)

Saccharum officinarum L. [UNIKIVI00498]	Mukuku, Munse (Kik.), Cana-de-açucar (Por.)	Leaves	Exotic	Herb	Decoction	Village, fields	Medicinal (Hypotension)	3(0.29%)
Phyllanthaceae								
Hymenocardia ulmoides Oliv. [UNIKIVI00500]	Nkalangangula (Kik.)	Leaves	Native	Tree	Decoction	Forest, Savannah, Village	Medicinal (diarrheoa), Constructions, bioenergy (Firewood, charcoal)	3(0.29%)
Rubiaceae								
Gardenia ternifolia Schumach. & Thonn. [UNIKIVI00501] [UNIKIVI00501]	Nlemba Nzau [Kik.]	Leaves	Native	Subshrub	Decoction	Savannah, village	Medicinal (diarrhea, yellow fever); spiritual Medicinal (diarrhea, yellow fever); spiritual (Anti-witchcraft Paratrooper)	6(0.59%)
Coffea canephora Pierre ex A. Froehner [UNIKIVI00502]	Café (Port.)	Seeds	Native	Shrub	Decoction, Infusion	Village, fields	Medicinal (diarrhea), Agricultural instrument (hoe handle, machete, rake, pickaxe)	17(1.66%)
Rutaceae								
Citrus x sinensis (L.) Osbeck [UNIKIVI00506]	Laranjeira (Port.)	Leaves, fruit epicarp	Exotic	Shrub	Decoction, Infusion	Village, Orchards	Medicinal (fever, cough)	18(1.76%)
Citrus × aurantium L. [UNIKIVI00504]	Laranjeira amarga (Port.)	Leaves, fruit epicarp	Exotic	Shrub	Decoction, Infusion	Village, Orchards	Medicinal (fever, cough)	16(1.56%)
Citrus maxima (Burm.) Merr. [UNIKIVI00505]	Pamplemousse (Fr.)	Leaves, fruit epicarp	Exotic	Small tree	Decoction, Infusion	Village, Orchards	Medicinal (fever, cough)	15(1.46%)
Citrus × aurantium f. Deliciosa (Ten.) M.Hiroe [UNIKIVI00503]	Tajanrineira (Port.)	Leaves, fruit epicarp	Exotic	Shrub	Decoction, Infusion	Village, Orchards	Medicinal (fever, cough)	18(1.76%)
Citrus x limon (L.) Osbeck [UNIKIVI00507]	Limeiro grande (Port.)	Leaves, fruit epicarp	Exotic	Shrub	Decoction, Infusion	Village, Orchards	Medicinal (fever, cough)	14(1.37%)
Solanaceae								
Schwenkia americana L. [UNIKIVI00466]	Nlondo nlondo a kiana (Kik.)	Leaves, Flowers, stem	Exotic	Annual herb	Decoction, Infusion	Savannah	Medicinal (Wound, cough), afrodisiac	8(0.78%)

Urticaceae								
Laportea aestuans (L.) Chew [UNIKIVI00508]	Vidi (Kik)	Leaves	Native	Annual herb	Decoction	Forest, villages	Medicinal (Asthma, cough, anemia)	18(1.76%)
Verbaceae								
Lippia multiflora Moldenke [UNIKIVI00509] (*), (**), (***)	Bulukutu, Ikaya (Kik.)	Leaves, stem, inflorescences	Native	Subshrub	Decoction, Infusion	Savannah	Medicinal (hypertension, cough, chest pain, diabetes)	95(9.28%)
Lippia abyssinica (Otto & A. Dietr.) Cufod. [UNIKIVI00463] (**)	Kiyoyo (Kimb), Matendendela (Kik.)	Leaves, stem, inflorescences	Native	Subshrub	Decoction, Infusion	Village	Medicinal (cough, flu, constipation, bronchitis), hedges, ornamental	46(4.49%)

Legend:

- The asterisk (*) indicates popular species that are sold in markets and by travelling vendors;
- Two asterisks (**) for the most popular species; three asterisk (***) for the most popular traded species ;
- Freq. cit.: Frequency of citation (%).

Table 2. Number of tea substitutes taxa documented in Uíge Province

Taxa	Family	Genera	Species
Pteridophytes	1	1	1
Gymnosperms	2	2	2
Angiosperms	22	46	57
Monocotyledonous	1	2	3
Dicotyledonous	21	42	53
Total	**26**	**49**	**59**

Habitats, life forms, and ecological status of the investigated plants

The herbal teas consumed in Uíge province were found to come from different habitat types. Figure 2 shows the different habitats from which the tisane plants were collected in Uíge province. Home gardens or family gardens in the villages were the source of most of the species of herbal teas (40.5%), i.e. they were grown in residential areas. The remaining plants were collected from savannahs (26.2%), fields/orchards (19.0%), forests (11.9%), and fallow sites (2.4%), respectively.

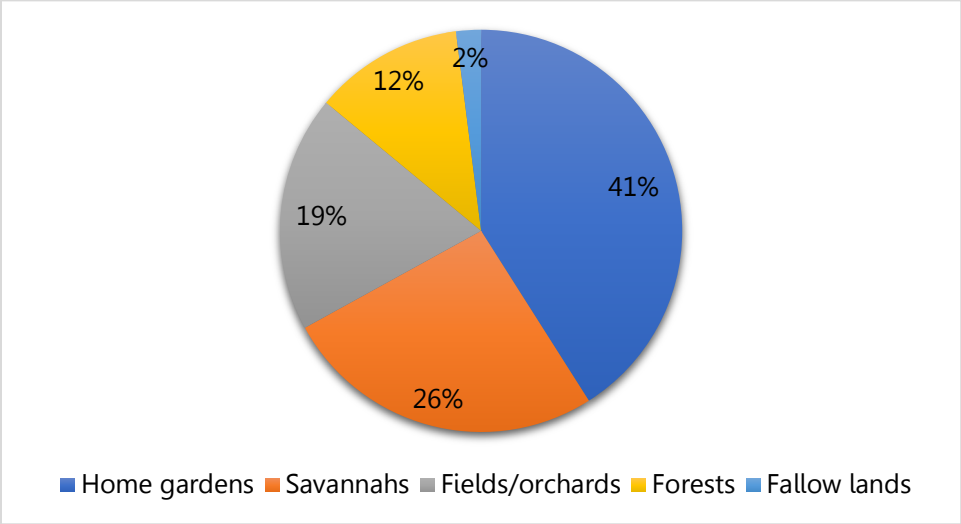

Figure 2. Percentage of habitat types from which herb teas were collected in Uíge province.

Some introduced species grow in home gardens (e.g. *Cymbopogon citratus*, *Dianthera secunda*, *Ocimum americanum*, *Senna occidentalis, Tetradenia urticifolia*), while others grow in the wild (e.g. *Aspilia kotschyi*, *Chromolaena odorata*, *Schwenkia americana*). Finally, some species grow in allotments as well as in the wild, such as *Mangifera indica*, and *Psidium guajava*.

The results of this study also documented five (5) morphological types or growth forms of herbal tea plants used by the Uíge population (Figure 3). In terms of life forms (Figure 3), trees were most frequent, representing 31.0% of the plants (27.6% large trees and 3.4% small trees), followed by herbaceous species with 30.3% (19.0% annuals and 10.3% perennials) and shrubs (25.9%).

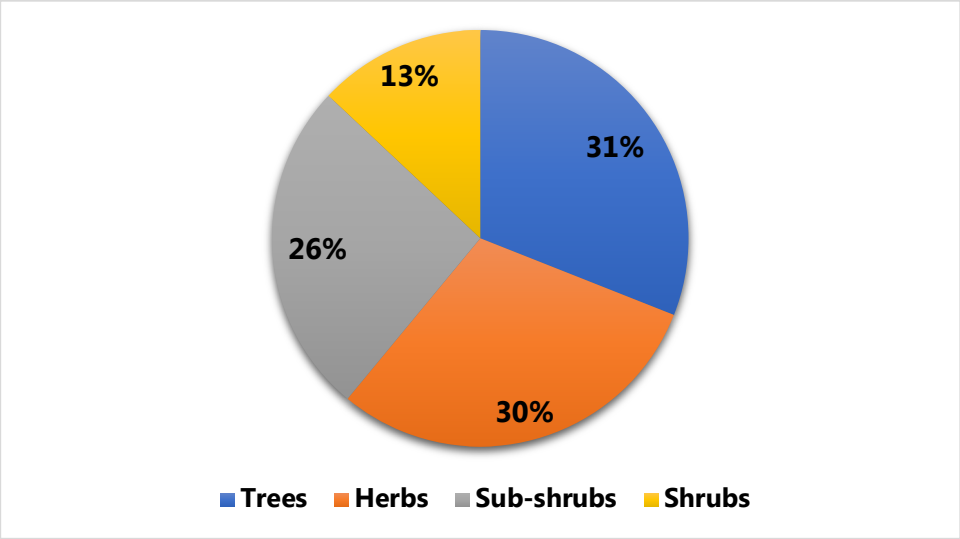

Figure 3. Percentage of life forms of herbal teas used by the population in Uíge province.

The “subshrubs” or “dwarf shrubs” which tend to be woody only at the base of the stem (13.7%), were the rarest morphological forms used for herbal teas in this study area. The diversity of morphological types show that the herbal tea sources in this part of Angola are diverse in terms of morphological types. This reinforces the point that the Angolan flora, especially that of Uíge province, is rich and has a great diversity of plants with diverse uses.

Based on the ecological status the herbal teas in Uíge province (Table 1), it can be seen that indigenous or wild plants dominate (58.6%) over exotic or introduced species (41.4%). The 34 (*i.e.* 58.6%) of the documented indigenous plants are: *Alchornea cordifolia*, *Annona senegalensis*, *Annona stenophylla* subsp. *cuneata*, *Aspilia kotschyi*, *Bidens pilosa*, *Brillantaisia owariensis*, *Coffea canephora*, *Crassocephalym montuosum*, *Crassocephalym rubens* var. *rubens*, *Cymbopogon densiflorus*, *Dichrostachys cinerea* subsp. *africana*, *Eriosema glomeratum*, *Erythrina abyssinica*, *Ficus sur*, *Ficus sycomorus*, *Helichrysum mechowianum* var. *mechowianum* , *Hibiscus acetosella*, *Hymenocardia ulmoides*, *Indigofera paracapitata*, *Gardenia ternifolia* subsp. *jovis-tonantis*, *Gymnanthemum glaberrimum*, *Laportea aestuans*, *Lippia abyssinica*, *Lippia multiflora*, *Ochna afzelii* subsp. *mechowiana*, *Ocimum gratissimum*, *Pleiotaxis rugosa*, *Stomatanthes africanus*, *Uvariodendron molundense*, *Vernonella subaphylla, Vitex doniana* and *Vitex madiensis*.

The other herbal teas (20 species) inventoried are introduced species (*Annona muricata*, *Azadirachta indica*, *Carica papaya*, *Catharanthus roseus*, *Chromolaena odorata*, *Citrus aurantifolia*, *Citrus maxima*, *Citrus x aurantium*, *Citrus x limon*, *Citrus x sinensis*, *Cupressus* sp., *Cymbopogon citratus*, *Dianthera secunda*, *Eucalyptus citriodora*, *Mangifera indica*, *Mentha x piperta*, *Moringa oleifera*, *Persea americana*, *Psidium guajava* and *Schwenkia americana*).

Regarding introduced species, some of these species grow in Family gardens, while others grow in the wild, i.e. fallow land, forests and savannahs.

Biological types and phytogeographical distribution

The analysis of the different biological types used for herbal teas is shown in Figure 4. Of the 60 species taxonomically identified, Phanerophytes were the most common biological type, with 52.2% (45.7% mesophanerophytes and 6.5% microphanerophytes), followed by Chamaephytes with 23.9% (19.6% erect chamaephytes, and 4.3% prostrate chamaephytes) and Therophytes (erect therophytes) with 13.0%. Geophytes (rhizomatous geophytes) were rare (just two species), contributiong 4.3%.

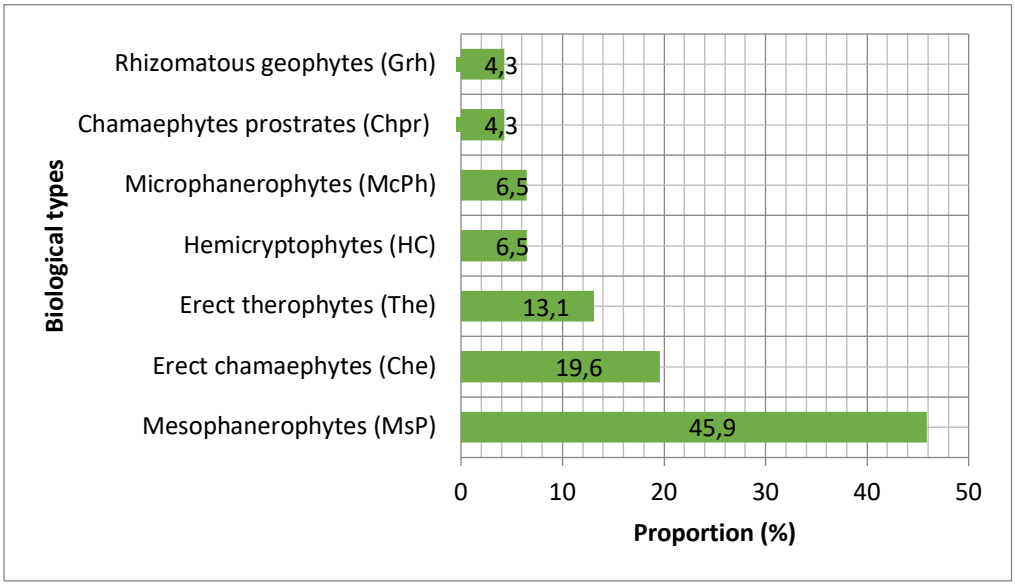

Figure 4. Proportion (%) of biological type's analysis of the flora according to Belesi (2009) and Lassa (2021).

Concerning a phytogeographical analysis of the flora, the dominant phytogeographical elements and their respective numbers are given in Figure 5. Clearly, most of these plants are from the tropical zone. Phanerophytes would be justified by the fact that the edapho-climatic conditions of the study area are favourable to these plants in such a way that they are found in large numbers compared to others.

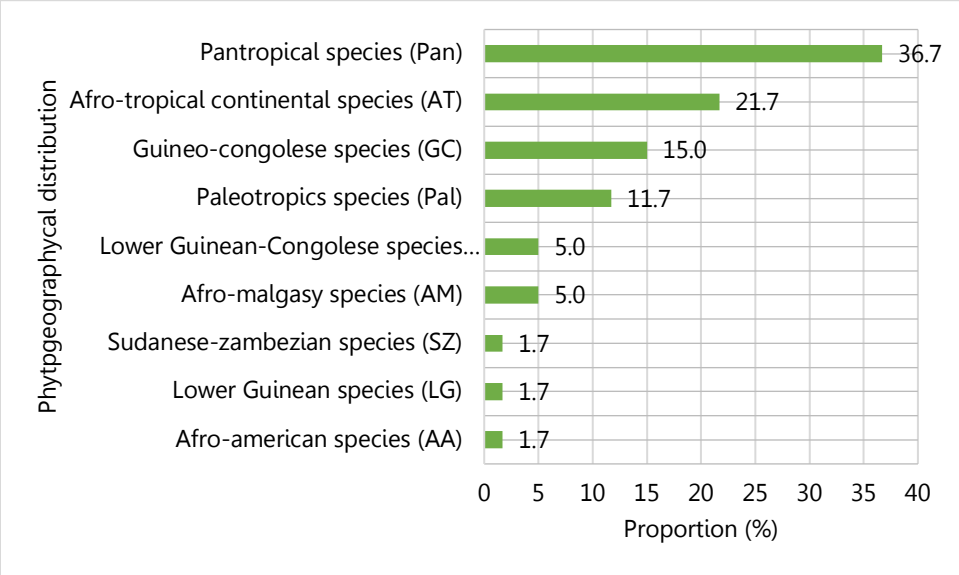

Figure 5. Proportion (%) of phytogeographical analysis of the documented plant flora based on Belesi (2009) and Lassa (2023).

Pantropical species contributed highest proportion (43.5%), followed by continental Afrotropical species (28.3%), Guinean-Congolese species (8.7%), Palaeotropical species (4.3%), and Low-Guinean species (4.3%), Guinean-Congolian species (2.2%), Low-Guinean-Congolian species (2.2%), Eastern and Southern African species (2.2%), Afro-tropical species (2.2%) and Afro-Malagasy species (2.2%).

Relationship between phytogeographic distribution and ecological status of documented plants

The data in Table 3 show that among the herbal teas of exotic origin documented in this study, the majority belong to the pantropical species group (27.59%). In contrast, in the group of native plants, Afro-tropical continental species (20.69%) and Guineo-congolese species (13.79%) were predominant.

Table 3. Relationship between phytogeographic distribution and ecological status of documented plants

Phytogeographycal distribution	**Ecological status**		
	Exotic	**Native**	**Total geral**
Afro-american species (AA)	1(1.72%)	0(0.0%)	1(1.72%)
Afro-malgasy species (AM)	1(1.72%)	2(3.45%)	3(6.25%)
Afro-tropical continental species (AT)	1(1.72%)	12(20.69%)	13(22.41%)
Lower Guinean-Congolese species (BGC)	0(0.0%)	3(6.25%)	3(6.25%)
Guineo-congolese species (GC)	1(1.72%)	8(13.79%)	9(18.75%)
Paleotropics species (Pal)	3(6.25%)	4(6.90%)	7(12.07%)
Pantropical species (Pan)	16(27.59%)	4(6.90%)	20(34.48%)
Sudanese-zambezian species (SZ)	1(1.72%)	0(0.0%)	1(1.72%)
Lower Guinean species (LG)	0(0.0%)	1(1.72%)	1(1.72%)
Total	24(41.37%)	34 (58.62%)	58 (100%)

Plant organs consumed as herbal teas

Figure 6 shows the different plant organs used to prepare tisane in the province of Uíge. The leaves were the most frequent plant parts used (59.4%), followed by inflorescences (14.9%), stem and stem bark (14.9%), epicarp or outer layer of the fruit (6.4%), root barks (1.1%), slingshot (1.1%), fruits (1.1%), and seeds (1.1%).

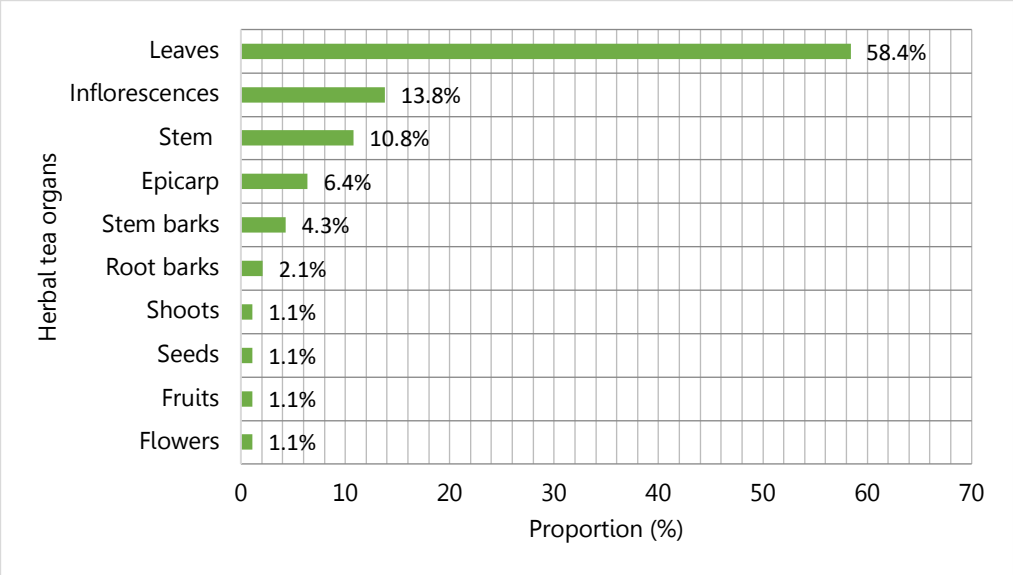

Figure 6. Proportion (%) of plant parts used in the preparation of herbal teas in Uíge province.

Preparation methods, physical condition, frequency, and periodicity of tisanes consumption

In the province of Uíge, the local population uses two methods of preparation of herbal teas based on the plant organs being used. Our surveys found that maceration was the principal method of herbal tea preparation used in Uíge province (68.7%). Infusion was the second method used with 31.3%.

Regarding the frequency of daily consumption of herbal tea in the province of Uíge, our survey (Table 1) revealed that almost all (95.5%) of the informants consume herbal tea only once a day, usually in the morning. Other people consume it twice (3.0%), and the remainder (1.5%) consume it three or more times a day (1.5% especially nursing mothers, commonly called Mualakazi in the Kikongo language) who do in order to stimulate lactation.

It should be noted that, on average in the study area, people drank herbal tea once a day, with a maximum of 5 times a day, particularly among nuersing mothers, locally known as Mualakazi in Kikongo but may also be due to the dietary and socio-cultural habits of certain people.

In the Uíge province (both in rural and urban areas), herbal teas are consumed daily (rather than Chinese tea and coffee). Most respondents (92.5%) said that they drink herbal tea, in the morning during breakfast. Some informants sometimes reported that they sometimes drink it in the evening (6.5%) after a heavy meal at dinner. Finally, in the study area, herbal tea is rarely consumed at midday (1% of respondents). There are several reasons why the inhabitants of the Uíge province consume herbal tea. The main reasons given by the informants were to stimulate the appetite, to combat the cold, to stimulate the mother's milk (in the case of Mualakazi, *i.e.* a woman with a newborn baby in the Kikongo language), to “fortify the blood”, to soothe, to facilitate digestion, and to fortify the body (gives energy by consumers). Other reasons given by consumers of herbal tea were preference, palatability, eating habits, and traditions.

Finally, of all the herbal teas known and consumed by the local population of Uíge province, the leaves of *Lippia multiflora* (Bulukutu) were the most popular of the 59 species inventoried.

15 (Fifteen) Top dominant herbal teas species consumed in Uíge province

Table 4 shows the fifteen (15) Top-dominant plant species used which herbal teas by the Uíge people.

The results in Table 4 show that *Lippia multiflora* (9.28%) was more frequently cited than other herbal teas in the comme tisanes consumed in Uíge province, followed by *Cymbopogon citratus* (5.57%), *Vitex madiensis* (4.59%), *Lippia abyssinica* (4.49%), *Dianthera secunda* (4.00%), *Ficus sycomorus* (3.61%), *Annona stenophylla* subsp*. cuneata* (3.54%), *Gymnanthemum glaberrimum* (3.32%), *Bidens pilosa* (3.22%), *Ficus sur* (3.13%), *Erythrina abyssinica* (3.03%), *Stomatanthes africanus* (2.83%), *Indigofera paracapitata* (2.46%), *Uvariodendron moludense* (2.44%), and *Indigofera paracapitata* with 2.34%.

Table 4. Fourteen (14) Top-dominant herbal teas used in Uíge province (%

Botanical families and scientic name	Freq.Cit. (%)
***Lippia multiflora* (**)**	95(9.28%)
***Cymbopogon citratus* (**)**	57(5.57%)
***Vitex madiensis* (**)**	47(4.59%)
Lippia abyssinica	46 (4.49%)
Dianthera secunda	41(4:00%)
***Ficus sycomorus* (*)**	37(3.61%)
***Annona stenophylla* subsp. *cuneata* (**)**	36(3.56%)
***Gymnanthemum glaberrimum* (*).**	34(3.32%)
Bidens pilosa	33(3.22%)
Ficus sur	32(3.13%)
***Erythrina abyssinica* (**)**	31(3.03%)
***Stomatanthes africanus* (**)**	29(2.83%)
***Uvariodendron molundense* (**)**	25(2.44%)
Indigofera paracapitata	24(2.34%)

Nine most popular traded species

The nine most popular herbal teas in the province of Uíge are traded with three stars in Table 1: *Annona stenophylla* subsp. *cuneata*, *Uvariodendron molundense, Stomatanthes africanus, Erythrina abyssinica, Vitex madiensis* , *Corymbia citriodora*, *Cymbopogon citratus*, and *Lippia multiflora* .

Furtherm*, Lippia multiflora* leaves are appreciated by all social strata of the local population of Uíge province (men, and women; civil servants, farmers and unemployed; illiterate and literate; children, young, and old). This popularity is mainly due to the organoleptic characteristics of this plant (stimulation of the senses in terms of taste, aroma, flavour and palatability), as well as its presumed medicinal properties.

Relationship between socio-demographic categories and herbal teas documented in this study

Table 5 shows the relationship between the numbers of herbal teas cited by socio-demographic categories, for example, gender (female, male), sources of income (agriculture, civil service, both and other), level of education (literate, illiterate) and age groups.

With regard to informants sex, the results in table 5 show that women cited more herbal tea species than men, 17 (28.3%) and 10 (16.7%) respectively. In addition, both sexes cited 33 (55.0%) species of herbal teas. The superiority of women in this area can be justified by the fact that in this part of Angola, women are the main pillars of household food security.

Table 5. Relationship between socio-demographic categories and herbal teas documented in this study

Sociodemographical characteristics		**Herbal teas cited**	**Freq. (%)**
Gender	**Female**	*Annona muricata* *Azadirachta indica* *Brillantaisia owariensis* *Carica papaya* *Catharanthus roseus* *Crassocephalum montuosum* *Crassocephalum rubens* *Cymbopogon densiflorus* *Dichrostachys cinerea* subsp*. africana* *Gymnanthemum glaberrimum* *Hibiscus acetosella* *Mentha x piperti* *Pachylobus edulis* *Pinus* sp*.*	17(28.3%)

		Pteridium centrali-africanum *Saccharum officinarum* *Tagetes erecta*	
	Male	*Annona senegalensis* *Chromolaena odorata* *Gardenia ternifolia* *Helichrysum mechowianum* *Pleiotaxis rugosa* *Schwenkia americana* *Senna occidentalis* *Tetradenia urticifolia* *Uvariodendron molundense* *Vitex doniana*	10(16.7%)
	Both	*Alchornea cordifolia* Annona stenophylla subsp. *cuneata* *Aspilia kotschyi* *Bidens pilosa* *Citrus × aurantium* f. *deliciosa* *Citrus × aurantium* *Citrus maxima* *Citrus x limon* *Citrus x sinensis* *Coffea canephora* *Cupresssus* sp. *Cymbopogon citratus* *Dianthera secunda* *Eriosema glomeratum* *Erythrina abyssinica* *Eucalyptus citriodora* *Ficus sur* *Ficus sycomorus* *Hymenocardia ulmoides .* *Indigofera paracapitata* *Laportea aestuans* *Lippia abyssinica* *Lippia multiflora* *Mangifera indica* *Moringa oleifera* *Ochna afzelii* *Ocimum americanum* *Ocimum gratissimum* *Persea americana* *Psidium guajava* *Stomatanthes africanus* *Vernonella subaphylla* *Vitex madiensis*	33(55.0%)
Age groups	**Young**	*Azadirachta indica* *Catharanthus roseus* *Tagetes erecta*	3(5.0%)
	Adults	*Brillantaisia owariensis* *Crassocephalum montuosum* *Crassocephalum rubens* *Dianthera secunda* *Dichrostachys cinerea* *Gardenia ternifolia* *Hymenocardia ulmoides* *Laportea aestuans* *Pteridium centrali-africanum* *Saccharum officinarum*	11(18.3%)

		Tetradenia urticifolia	
	Both	*Alchornea cordifolia* *Annona stenophylla* *Bidens pilosa* *Brillantaisia owariensis* *Citrus × aurantium* f. *deliciosa* *Citrus × aurantium* *Citrus maxima* *Citrus x limon* *Citrus x sinensis* *Coffea canephora* *Cymbopogon citratus* *Cymbopogon densiflorus* *Dianthera secunda* *Erythrina abyssinica* *Eucalyptus citriodora* *Ficus sur* *Ficus sycomorus* *Gymnanthemum glaberrimum* *Indigofera paracapitata* *Lippia abyssinica* *Lippia multiflora* *Mentha x piperti* *Ochna afzelii* *Ocimum gratissimum* *Persea americana* *Pinus sp.* *Pleiotaxis rugosa* *Stomatanthes africanus* *Uvariodendron molundense* *Vernonella subaphylla* *Vitex doniana* *Vitex madiensis*	30(50.0%)
	Olds	*Annona muricata* *Annona senegalensis* *Aspilia kotschyi* *Carica papaya* *Chromolaena odorata* Cupressus sp. *Eriosema glomeratum* *Helichrysum mechowianum* *Hibiscus acetosella* *Mangifera indica* *Moringa oleifera* *Ocimum americanum* *Pachylobus edulis* *Psidium guajava* *Schwenkia americana* *Senna occidentalis* *Tetradennia urticifolia*	16(26.7%)
Education level	**Illiterates**	*Annona muricata* *Aspilia kotschyi* *Azadirachta indica* *Brillantaisia owariensis* *Carica papaya* *Crassocephalum montuosum* *Dichrostachys cinerea*	17(28.3%)

		Hibiscus acetosella *Hymenocardia ulmoides* *Laportea aestuans* *Mentha x piperta* *Ocimum americanum* *Pachylobus edulis* *Pinus* sp. *Pteridium centrali-africanum* *Tagetes erecta* *Tetradenia urticifolia*	
	Literates	*Catharanthus roseus* *Gardenia ternifolia* *Helichrysum mechowianum* *Saccharum officinarum* *Schwenkia americana* *Senna occidentalis* *Stomatanthes africanus*	7(11.7%)
	Both	*Chromolaena odorata* *Ocimum gratissimum* *Pleiotaxis rugosa* *Vernonella subaphylla* *Alchornea cordifolia* *Annona senegalensis* *Annona stenophylla* *Bidens pilosa* *Citrus × aurantium* f. *deliciosa* *Citrus × aurantium* *Citrus maxima* *Citrus x limon* *Citrus x sinensis* *Coffea canephora* *Crassocephalum rubens* *Cupresssus* sp. *Cymbopogon citratus* *Cymbopogon densiflorus* *Dianthera secunda* *Eriosema glomeratum* *Erythrina abyssinica* *Eucalyptus citriodora* *Ficus sur* *Ficus sycomorus* *Gymnanthemum glaberrimum* *Indigofera paracapitata* *Lippia abyssinica .* *Lippia multiflora* *Mangifera indica* *Moringa oleifera* *Ochna afzelii* *Persea americana* *Psidium guajava* *Uvariodendron molundense* *Vitex doniana* *Vitex madiensis*	36(60.0%)
Source of income	**Agriculture**	*Alchornea cordifolia* *Annona muricata* *Aspilia kotschyi* *Brillantaisia owariensis* *Carica papaya* *Chromolaena odorata* *Crassocephalum montuosum*	29(48

		Crassocephalum rubens *Dichrostachys cinerea* *Eriosema glomeratum* *Ficus sur* *Gardenia ternifolia* *Helichrysum mechowianum* *Hymenocardia ulmoides* *Laportea aestuans* *Mangifera indica* *Mentha x piperta* *Ocimum americanum* *Pachylobus edulis* *Pinus* sp. *Pleiotaxis rugosa* *Psidium guajava* *Pteridium centrali-africanum* *Saccharum officinarum* *Schwenkia americana* *Stomatanthes africanus* *Tetradenia urticifolia* *Vernonella subaphylla* *Vitex doniana*	
	Civil service	*Catharanthus roseus* *Cupresssus* sp. *Moringa oleifera* *Senna occidentalis* *Tagetes erecta*	5(8.3%)
	Both	*Annona senegalensis* *Annona stenophylla* *Bidens pilosa* *Citrus × aurantium* f. *deliciosa* *Citrus × aurantium* *Citrus maxima* *Citrus x limon* *Citrus x sinensis* *Coffea canephora* *Cymbopogon citratus* *Cymbopogon densiflorus* *Dianthera secunda* *Erythrina abyssinica* *Eucalyptus citriodora* *Ficus sycomorus* *Gymnanthemum glaberrimum* *Indigofera paracapitata* *Lippia abyssinica* *Lippia multiflora* *Ochna afzelii* *Ocimum gratissimum* *Persea americana* *Uvariodendron molundense* *Vitex madiensis*	24(40.0%)
	Others	*Azadirachta indica* *Hibiscus acetosella*	2(3.3%)

As for the source of income, farmers cited more herbal tea species (29, or 48.3%) than other professions, civil service (5, or 8.3%) and others (2, or 3.3%), respectively. Both professions mentioned 24 species of herbal tea, i.e. 40.0%.

On the basis of the level of education of the informants, the illiterate cited more herbal tea species than the literate, with 17 (28.3%), and 7 (11.7%), respectively. Both cited 36 species of tisane, i.e. 60.0%. The greatest majority of illiterate people practice agriculture as their main source of income, employment and food. The proximity of farmers with nature helps them

to have a rich knowledge and use of plants, including tisanes. Finally, elders cited more species (16 or 26.7%) of tisanes than adults (11 or 18.3%) and young people (3 or 5.0%), respectively 11(18.3%), and young people 3(5.0%). Both groups cited 30 species of herbal tea (50.0%). Older people are considered to be living libraries which is why they cited more plants than the other age groups. "That is why, when an old man passes away in Africa, it is a library that burns".

Other uses of tea substitute plants

Because of their multiple uses, plants play a vital role for other beings, especially humans. Herbal tea is no exception as was demonstrated in the study area (Table 1). Among other documented uses of tisanes are as phytomedicines (71.6%), aphrodisiacs (2.7%), stimulants (1.3%), and in social contexts (1.3%). These species are also used as bioenergy sources, *i.e.* charcoal and firewood (14.1%), agricultural materials such as hoe handles, axes (2.7%), and housing construction materials (1.4%).

However, the predominant use of these species (71.6%) was in a medicinal context. In the Uíge province, herbal tea has been used locally for a long time due to its medicinal properties, which can effectively prevent, treat and regulate common diseases in the region.

Medicinal use of herbal teas

Table 1 shows that herbal teas are used to relieve several ailments, including coughs (23.3%), anemia (20%), fever (11.7%), high blood pressure (11%), diabetes mellitus (8%), diarrhoea (5%), stomachache (5%), and chest pains (3.3%).

Socio-economic value of tea substitutes

Some herbal tea species are traded locally and regionally. Most often, this trade is carried out by women and children. Sales are made at rural or urban markets, or even as a traveling trade, locally called Zunga (in Angolan Portuguese). Of the 59 herbal teas inventoried in the study area, only 18 species were traded, namely: *Annona stenophylla* subsp. *Cuneata*, *Coffea canephora*, *Crassocephalum montuosum*, *Crassocephalum rubens*, *Cymbopogon citratus*, *Cymbopogon densiflorus*, *Erythrina abyssinica*, *Corymbia citriodora*, *Gymnanthemum glaberrimum*, *Lippia multiflora*, *Lippia abyssinica*, *Mentha x piperta*, *Ochna afzelii* subsp. *mechowiana*, *Pteridium centrali-africanum*, *Pinus* sp., *Stomatanthes africanus*, *Uvariodendron molundense*, and *Vitex madiensis*. Also, the most popular herbal teas on sale are *Annona stenophylla* subsp. *cuneata*, *Cymbopogon citratus*, *Lippia multiflora*, and *Uvariodendron molundense*. As for the modes of sale of the respective plant organs, depending on the plant tissue they are sold in bundles (leaves, stem bark), in bags (leaves, seeds), and in bowls or tins (ground seeds).
It should be noted that villagers and city dwellers use local instruments that have not been standardized to market the organs of herbal plants.

Discussion

Characterization of the sociodemographic profile of informants

Similary, in the Kongo tradition, women have a historical and socio-cultural value that they acquired from their mothers and grandmothers, which allows them to play an important role in providing health care and food security for members of the household. Furthermore, in the northern part of Angola, women practicing traditional herbal medicine outnumber men (Monizi *et al.*, 2019), and family health. In agreement with Monizi *et al*. (2019), and Vasconcelos *et al*. (2001), the predominance of women would be justified by the fact that, in various societies, women have been entrusted with the responsibility for domestic chores, child-rearing, and the primary care of their households.

Floristic diversity of herbal tea plants

Geng *et al*. (2022) reported in their ethnobotanical study on herbal teas in Qianxinan, China that Asteraceae (19 species), and Lamiaceae (6 species) were the two botanical families most frequently cited by respondents. Our results were similar with 11 Asteraceae and Lamiaceae being cited by local respondents. According to Xiong *et al*. (2020), Asteraceae are one of the largest seed plant families in the world and are readily available in local communities. Species Lamiaceae are noted for their use as flavouring, food preservatives, and medicinal properties, as both curative and preventive medicines. Lamiaceae contains various secondary metabolites with potent antibacterial, antioxidant, anti-inflammatory, antimicrobial, antiviral, and anticancer activities (Carović-Stanko *et al*. 2016).

Regarding the diversity of species of the herbal tea plants used by the local population in Uíge province, this is in part explained by the diversity of the local flora which includes both indigenous and introduced species, and by the availability and physical accessibility of phyto-genetic resources, and the associated ethnobotanical knowledge of their use as tisanes.

Earlier ethnobotanical investigations conducted in the same study area in Uíge province in Northeastern Angola by Mawunu *et al*. (in press), Mawunu *et al*. (2022a, Mawunu *et al*. (2022b), Mawunu *et al*. (2021), Lautenschläger *et al*. (2018), and Mawunu *et al*. (2016). These authors reported the dietary use of the organs of certain plant species as herbal teas, namely *Annona stenophylla* subsp. *cuneata* [Lolo Kiambulu in Kikongo language], *Cymbopogon densiflorus* [Sangu sangu in Kikongo language], *Cymbopogon citratus* [Sinde dia mputu in Kikongo language], *Eriosema glomeratum* [Nzolele ngienda in Kikongo language], *Erythrina abyssinica* [Mungoma ngoma in Kikongo language], *Lippia multiflora* [Bulukutu or Ikaya in Kikongo language], *Ochna afzelii* subsp. *mechowiana* [N'gô, or Nkosi n'ti in Kikongo language], *Uvariodendron molundense* [Kikaya, diankandi in Kikongo language], and *Vitex madiensis* [Mfilu a nzanza or londe in Kikongo language]. Of all these species, only *Cymbopogon citratus* is an exotic plant. These same nine species were among the 60 herbal tea species noted in the present study. Interestingly, four of these nine species represent the most popular herbal teas sold in local markets.

Regarding the local taxonomy for various plants, several names exist for some species, while in other cases a single name can designate several species at once. In Uíge province some species have only one local name (*Brillantaisia owariensis*, locally called Lemba-lemba). However, others have two local names, like (*Lippia multiflora*, which is locally known as both Bulukutu and Ikaya in Kikongo language); others have three or even more vernacular names, for example, *Bidens pilosa*, which is locally called Nsoloboto, Nsote za mbwa, Mpote za mbwa, in Kikongo language, and *Ficus sycomorus* that is locally called by the vernacular names Kienga, Mukuzu, Nkuzu, Nlelomoka in Kikongo language or Pau Mulato in Angolan Portuguese. These observations underscore the potential confusion that may arise from the use of local names and demonstrate the value of using scientific names for the universalization of botanical, and specifically ethnobotanical knowledge.

The herbal teas consumed in Uíge province come from different habitat types, such as villages, forests, savannahs, and fields/orchards. Today most are gathered from home gardens. These results contrast with those Mawunu *et al*. (2022b), who reported that the main habitats of wild food plants in Mucaba municipality are forests (52%) and savannahs (34%). Also, Mawunu *et al*. (2016), reported that in Ambuila Municipality, 72% of wild food plants were from forest habitats (72%) and savannahs (25%).

The herbal tea sources in this part of Angola are diverse in terms of morphological types. This reinforces the point that the Angolan flora, especially that of Uíge province, is rich and has a great diversity of plants with diverse uses. Mawunu *et al*. (2016) previously reported the predominance of herbaceous (34%), and trees (32%) in a study conducted in the municipality of Ambuila. In another study by Mawunu *et al*. (2022b), it was noted that the wild food plant flora in Mucaba municipality was also dominated by herbaceous (38%), and trees (24%).

Despite the anthropization or conversion of open spaces, landscapes, and natural environments by human action of forest and savannah ecosystems in Uíge province, and the widespread practice of slash-and-burn agriculture, the wild flora of this region of northern Angola still includes many useful plants, including nutraceuticals used to combat hunger, food insecurity, and various human diseases (Mawunu *et al*. 2019).

Besides, the abudance of Phanerophytes (woody perennials) is explained by the fact that the edapho-climatic conditions of the study area are favourable to these plants such that they are found in large numbers compared to others. These results are in agreement with Mawunu *et al*. (2023, in press) who reported that the predominance of Phanerophytes in the medicinal flora of Negage City reflects the state of vegetation in the tropics.

Most of the species are tropical in origin. Similar results were found by Mawunu *et al*. (2023, in press) in their study of medicinal plants used in Negage City in northern Angola; also by Mawunu *et al*. (2023, in press) in their of study diversity floristic and socio-economic value of fruits and leafy vegetables sold in the municipality of Uíge, Angola. Finally, these results show that these plant taxa inventoried in the Uíge province are widely distributed in tropical regions of the world and particularly in Africa. Thus, their protection would merit a concerted effort at national, sub-regional, and regional levels.

The inhabitants of Uíge frequently used leaves in all but four of the 59 species investigated. Leaves are more available; they are abundant throughout the year, easy to process and use, and easy to harvest. Indeed, numerous ethnobotanical studies from around the world have shown that leaves are the most common plant organ for herbal teas (Johnny *et al*. 2022; Mawunu *et al*. 2022a, Mawunu *et al*. 2022b; Lautenschläger *et al*. 2018; Kabena *et al*. 2014). In the study area a number of identified herbal teas (14) are also made from stems, roots, and bark. Over-harvesting of these organs for consumption in Uíge province may pose a threat in the near future to herbal tea species, especially those that are commonly used. Typically, the collection

of leaves, inflorescences, and fruits does not impact the survival or regeneration of the plant (Lardon & Geelen, 2020), but damage to the roots, stems and bark may cause plant mortality.
According to Mawunu *et al*. (2022b), leaves were the most frequently consumed organs of wild food plants in the municipality of Mucaba, northern Angola. In contrast, in Ambuila Municipality, Mawunu *et al*. (2016) reported that fruits (45%) and leaves (32.5%) were the most frequently harvested structures in wild edible plants.

In the present study only one species, Catharanthus roseus, the Madagascar periwinkle, was prepared by simple infusion. Of the remaining species, 26 were prepared by decoction or infusion, and 31 were prepared by decoction alone. These contrasting methods of preparation are likely to result in the availability of different plant secondary compounds (Jäger *et al*. (2011). Similarly, Geng *et al*. (2022) reported that decoction was the most commonly used form of herbal tea preparation in Guizhou province, China. The choice of method of herbal tea preparation is based on the consistency of the plant organs or even their physical state, fresh or dry. It is noted that, in the present study, both fresh (55.6%) and dry (44.4%) plant tissues were used.

The relatively low daily consumption of herbal teas in Uige province is striking and contrasts with the findings of Kinga (n. d.), who showed, in a report on the Tsheringma tea survey in India, that the majority of the population (53.6%) drink the tea 2 to 4 times a day. This herbal tea is a blend of petals of the safflower plant (*Carthamus tinctorius*) and the root bark of the plant *Cinnamomum tamala*.

Lippia multiflora, the savannah tea, the most popular herbal tea in the region is used as a hot beverage and a tea-like infusion for fevers, gastrointestinal disturbances, enteritis, cough, and colds. *Lippia* is also used traditionally to treat hypertension, conjunctivitis; treating venereal diseases and as a laxative.

Furthermore, the results of this study, that several food plants consumed in Uíge province are also used in traditional medicine, and vice versa, was also noted by Monizi *et al*. (2018a), Monizi *et al*. (2018b), Mawunu *et al*. (2022a), and Mawunu *et al*. (2022b).

From the respective of economics, it is striking that despite the fact that Portuguese colonists introduced coffee cultivation (*Coffea canephora*, or "robusta" coffee) around 1837, and Angola became one of the major producers of this coffee, production has declined significantly by more than ten-fold, since Angola became independent in 1975. Also, it is notable that coffee is not a particularly popular drink in the region. *Coffea canephora* is easier to grow than Coffea Arabica, and although it is very popular in Portugal and the Netherlands, it is often used as a less expensive coffee bean to add bulk to the more subtly flavored *Coffea arabica*. In terms of comparison with Chinese tea (*Camellia sinensis*) data from a socio-economic survey of the sale of Chinese tea in bulk show that the average price per kg was 7.04 US$ in Uíge province. In contrast, locally the main herbal teas most widely used, and sold, were *Lippia multiflora* and *Uvariodendron molundense* which costs an average of US$ 2.35 and 1.28 per kg, respectively. Clearly, local herbal teas are much more affordable than imported Chinese tea. In short, consuming local products means saving money, enhancing their value, and eating organic. In short, consuming local products means saving money, enhancing their value, and consuming materials that are not "industrially produced". They are also known to have specific health benefits.

Furthermore, the money collected from the sale of these plants is used locally, to solve specific problems, such as enhancing food security and diversity and acquiring goods and services. Similar results were also found by Mawunu *et al*. (2023), Mawunu *et al*. (2022b), Mawunu *et al*. (2021), Mawunu *et al*. (2019), and Mawunu *et al*. (2016) who worked in the same study area.

Conclusions

This study is the first ethnobotanical survey of herbal teas consumed by the local population in the Uíge province, northern Angola. Clearly, the local flora of the Uíge province is rich in useful plants. This study provides a valuable foundation for future studies of phyto-genetic resources for herbal teas, many of which have various other uses. The study of the local flora is an essential source of phyto-genetic resources for herbal tea with various other uses. We identified 60 species distributed in 48 genera and 27 botanical families. Consumption of local products can save money for local populations, especially when compared to the cost of imported food products, such as Chinese tea and Coffee. Some of these herbal plant species are a source of potential income for both rural and urban households. Also, the results of the study revealed that all the herbal teas consumed by the population of this province could be "nutraceuticals" because they are also used in the prevention and treatment of human ailments, notably anemia, and coughs.

Declarations

List of abbreviations: AA: Afro-american species; AM: Afro-Malgasy species; AT: Afro-tropical continental species; BGC: Lower Guinean-Congolese species; GC: Guineo-congolese species; Pal: Paleotropics species; Pan: Pantropical species; SZ: Sudanese-zambezian species; LG: Lower Guinean species; MsPh: Mesophanerophytes; Che: Erect Chamaephytes; The: Erect Therophytes; HC: Hemicryptophytes; McPh: Microphanerophytes; Chpr: Chamaephytes prostrates; Grh: Rhizomatous geophytes; Fr.= French; Kik.= Kikongo; Kim.= Kimbundu; Ling.= Lingala; Port.= Portuguese.

Ethics approval and consent to participate: This study has been conducted under the provisions of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization of the Convention on Biological Diversity. Oral Prior consent was obtained from each participant. This study does not contain any experimente (s) on humans and animals. This study has been conducted under the provisions of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity. During the ethnobotanical data collection from informants a prior oral consent was taken.

Consent for publication: Not applicable-this manuscript has no personal data from the authors.

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.

Author contributions: MM conceived and designed the study. MM and DA conducted data collection integrated the inventory and its analysis, and wrote the manuscript. MM, LL, and NKN identified the plants. Review, and edit the manuscript, MM, NMF, PV, LL, LN, NKN, DM, PML, and All authors have read and agreed to the published version.

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