CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Tropical AgriSciences

Department of Crop Sciences and Agroforestry

Traditional use of medicinal plants among local healers in Bié province, Angola

Master thesis

Prague, 2015

Supervisor:

doc. Ing. Zbyněk Polesný, PhD.

Student:

BA. Barbora Novotná

Declaration of Autorship

I hereby declare that this thesis entitled Traditional use of medicinal plants in Bié province, Angola is my own work and all the sources have been quoted and acknowledged by means of complete references.

In Prague, 24/04/2015

Barbora Novotná

Acknowledgment

I would like to acknowledge the herbalists of Bié province, who have decided to participate in our study.

I would like to thank to the staff of Czech organisation People in Need in Angola, who ensured the accommodation and transportation during the time of the research. I would like to thank to Adilson Valentimo Samala from Kuito and Maria Manuela Blabolil from Kuemba for their help as the mediators of contact with traditional healers and local authorities, as well as for occasional translation of information to the local languages.

I would like to thank my supervisor, doc. Ing. Zbyněk Polesný, PhD., for the patient guidance and advice he has provided for the thesis and research.

I would like to acknowledge the members of Tropical Botanic Garden of The Tropical Research Institute (IICT), Lisboa, Portugal, namely Head of the Tropical Botanic Garden Dr. Maria Cristina Duarte who worked on the identification of botanical specimen.

This research was supported by the Internal Grant Agency of the Faculty of Tropical AgriSciences of the Czech University of Life Sciences Prague (grant number IGA FTZ 20135122).

Abstract

The indigenous medicinal plant knowledge in Angola has not been properly studied yet due to the recent Angolan Civil War, which has influenced the Angolan population, culture and traditions as well as the infrastructure. The traditional knowledge is now endangered by globalisation, continuous migration and rapid modernisation, however it remains strong due to its spiritual background. This study documented and analysed the traditional knowledge in two localities in Bié province in Angola through participatory observation, semi-structured interviews and transect walks. In total, 10 traditional healers shared information on their knowledge. Plant samples were collected and identified by Tropical Botanic Garden of The Tropical Research Institute (IICT), Lisboa, Portugal. A total 56 plant species distributed among 54 genera and 30 botanical families have been documented. Quantitative ethnobotanical indices were calculated to compare traditional knowledge and to determine the cultural importance of each plant species or genera. The most represented botanical families encountered were Fabaceae (16 species), Apocynaceae, Asteraceae, Rubiaceae and Euphorbiaceae (4 species). The study has revealed 12 plant species not previously documented for the medicinal use, several of them with considerable local cultural importance: *Scleria induta*, *Vernonia britteniana*, *Oxygonum pachybasis, Droogmansia dorae, Brachystegia gossweileri* and *Aeschynomene dimidiate* or *Searsia squalida.* The plants with the highest cultural value in our study are commonly used in surrounding countries and Africa: *Securidaca longipedunculata, Garcinia huillensis, Annona stenophylla*, *Afzelia quanzensis, Strychnos cocculoides* or *Eriosema affine*. Roots were the major plant parts used (70%), while decoction was the most common way of preparation (57%) and trees (34%) and shrubs (37%) were the prevailing plant life forms used in the traditional medicine of Bié province. Surprisingly, both genders were presented equally among the herbalists (50% male, 50% female). The study has documented a diverse system of traditional plant knowledge which urges for continuous research in Angola as well as for further pharmacological studies to validate the use of selected medicinal species.

Key words: Angola, Bié province, *Chokwe*, medicinal plants, quantitative ethnobotany, traditional healers, *Umbundu*

Abstrakt

Domorodá znalost angolských léčivých rostlin nebyla doposud důsledně zkoumána, především kvůli nedávné Angolské civilní válce, která ovlivnila lokální populace obyvatelstva, tamější kulturu, tradice i infrastrukturu. Nyní jsou tradiční znalosti ohroženy globalizací, modernizací a stále trvající migrací, nicméně nadále přežívají především díky duchovním kontextům, jejichž jsou součástí. Tato studie dokumentovala tradiční znalosti ve dvou lokalitách v provincii Bié v Angole skrze zúčastněné pozorování, semi-strukturované rozhovory a metodu "transect walk". Deset místních herbalistů sdílelo své znalosti léčivých rostlin a související domorodé klasifikace. Rostliny používané místními herbalisty byly sebrány a následně uchovány a identifikovány v Tropické botanické zahradě Institutu tropického výzkumu v Lisabonu, Portugalsku. Zdokumentováno bylo celkem 56 botanických druhů náležejících do 54 rodů a 30 čeledí. Kvanititativní metody analýzy dat byly použity pro určení kulturního významu jednotlivých druhů. Nejvíce využívanou čeledí byly čeledi Fabaceae (16 druhů), Apocynaceae, Asteraceae, Rubiaceae a Euphorbiaceae (4 druhy). Studie odhalila 12 druhů rostlin, které nebyly dříve citovány jako léčivé rostliny, přičemž některé z nich měly značný kulturní význam v provincii Bié: *Scleria induta*, *Vernonia britteniana*, *Oxygonum pachybasis, Droogmansia dorae, Brachystegia gossweileri, Aeschynomene dimidiate* nebo *Searsia squalida.* Následující druhy s největším kulturním významem byly také rostlinami často studovanými či citovanými v souvislosti s tradičním africkou medicínou: *Securidaca longipedunculata, Garcinia huillensis, Annona stenophylla*, *Afzelia quanzensis, Strychnos cocculoides* or *Eriosema affine*. Kořeny byly nejčastěji používanou částí roslin pro přípravu léčiv (70%). Odvar byl nejčastějším způsobem přípravy léčiv (57%) a stormy (34%) a keře (37%) byly nejčastějším habitusem používaným v tradičním lékařství v Bié province, Angole. Překvapivě, oba gendery byly mezi herbalisty rovnocenně zastoupeny (50% žen a 50% mužů). Tato studie zdokumentovala různorodý systém tradičních vědomostí, který vyžaduje další výzkumy stejně tak jako farmakologické studie pro ověření účinnosti vybraných druhů léčivých rostlin.

Klíčová slova: Angola, Bié province, *Chokwe,* léčivé rostliny, kvantitativní etnobotanika, tradiční léčitelé, *Umbundu*

Contents

List of Tables and Figures

List of Tables:

List of Figures:

List of Contractions and Abbreviations

CVi:	Cultural Value Index
FL:	Fidelity level
IAR:	Informant Agreement Ratio
ICF:	Informant Consensus Factor
RFC:	Relative Frequency of Citations
sp., spp.:	species (singular, plural)
et al.:	*et alii/et aliorum;* and others/and of other
i.e.:	*id est*; that is

"The traditional medicine is a tree. The tree is only one. It is divided because there is your conception of medicine and our own, but they both have the same roots".

– Israel Kusuma, Angolan traditional healer (Bossard, 1996).

1. Introduction and Literature review

1.1. Vulnerable traditional knowledge of medicinal plants

Traditional medicine encompasses knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures that are used to maintain health, as well as to prevent, diagnose, improve, or treat physical and mental illnesses (WHO, 2008). The use of plants to cure diseases and relieve physical sufferings has started from the earliest times of mankind's history (Hill, 1989). Even nowadays, WHO (2010) estimated about 60% of the world's population in developing countries rely on plants for the treatment of various diseases, especially due to lack of modern health care facilities (Calixto, 2005).

Furthermore, about 25% of medicines used by humans are extracted from tropical plants (Principe, 2005; Ugulu *et al*., 2009). Much of traditional medical knowledge is being lost before it is documented, studied or even noticed by science (Hui and Xu, 2000). Tens of thousands of plant species are at risk of extinction, including plants used for the maintenance of livelihoods, nutritional, medicinal, cultural and spiritual purposes. These plants are needed to alleviate poverty, provide food security and ensure sustainable development in many nations (WLBC, 2013). Therefore there is an urgent need to document the medicinal plant associated traditional knowledge, because this knowledge is traditionally passed on orally from one generation to the next and thus, it is highly vulnerable (Kala, 2005).

1.2. The use of medicinal plants in Africa and in Angola

Millions of African people rely on the medicinal plants for their primary healthcare (Antwi-Baffour *et al*., 2014). The reasons can be their close proximity (Muthu *et al*., 2006) and the high cost of western pharmaceuticals and health care (Cunningham, 1988). According to King and Homsy (1997), traditional healers provide client-centred, personalized health care that is culturally appropriate and tailored to meet the needs and expectations of the client by paying special attention to the social and spiritual concerns of the client. African cultures possess a huge store of undocumented traditional knowledge of applying herbal remedies to treat various diseases. Africa is considered to be the cradle of mankind with a rich biological and cultural diversity marked by regional differences in healing practices (Gurib-Fakim *et al.,* 2006).

Knowledge in cultural context is derived from the web of interactions between humans, plants, animals, natural forces, and land forms. Therefore, social, ethical, and spiritual relationships also have an ecological foundation (Kassam *et al*., 2010). Documenting the results of scientific research on traditional uses of medicinal plants may significantly help to conserve the cultural heritage for future generations.

Angola's diverse flora embraces hundreds of plants with locally recognised therapeutic value (Gossweiler, 1953). Over 95% of the population uses these therapeutic plants alone or together with drugs manufactured by the pharmaceutical industry, and in most rural areas they are the only medicines available (FAO, 2009).

Studying indigenous knowledge on plant uses and resource management practices is also extremely important in order to support biodiversity conservation programs. In southern parts of Africa, the roots of many plant species are a significantly dominant part of the plant used for medicinal purposes (Semenya and Potgieter, 2013; Steenkamp, 2003; Mahwasane *et al*., 2013; Maroyi, 2011). When collecting the root, herbalists standardly uproot the whole plant, leaving the damaged remainder of the plant behind.

Additionally, Angola suffers from significant deforestation, while the deforestation rate in Miombo woodlands in the last decade is found to be seven times higher when compared with the official figures reported for the entire country (Cabral *et al*., 2010).

Mainly, there is a sharp increase in land clearing, which is performed not only in compact patches of agricultural fields that were expanding again around the main cities in 1990, but also in a scattered pattern that started around the year 2000 and greatly expanded in 2009. Land clearing processes are accompanied by significant losses in the area of Miombo in the period 2000 and 2009 (Cabral *et al*., 2010). Deforestation also continues due to the high population pressure. Currently, 95% of households in Angola are subsistence farmers, with very little access to agricultural inputs besides low-tech equipment. The redistribution of the population during the Angolan Civil War, forced people to settle in large numbers in small areas, which has resulted in accelerated degradation of vegetation and soil (WFP, 2005).

1.3. The consequences of the civil conflict in Angola

Until the independence of Angola in 1975, rural populations had adequate living conditions provided by extensive agriculture and commercial activities, as well as a good commercial network (Birkeland, 2000). The degradation of the road network and the impact of the war that followed independence affected rural livelihoods and influenced the reshaping of land use patterns (Cabral *et al*., 2010).

The continuous shift of populations from rural to urban areas has changed the demography of the country from one predominantly rural-based to one in which around 60% of the population now live in urban areas. The majority of them have been displaced several times, lost many members of their family and have lost ties with their home communities (FAO, 2009). After the end of the war, with the Luena Peace Agreement in April 2002, most people returned to their areas of origin (WFP, 2005). According to IDMC (2007), millions of people displaced by Angola's civil wars were no longer considered to have a special status by the government. This change promoted a fast return to the places of origin and drove the instalment of many new patches of agricultural fields (Cabral *et al*., 2010).

The average size of the household is five persons. According to WFP (2005) surveys, 12% of the households in the region have mentally and/or physically

handicapped members. Illiteracy among household heads is especially high in Bié province, which correlates highly with female household headship. This suggests that education embeds in it as potential gender-bias. The lack of education is likely to extend to the next generation, as children in Bié province also have one of the lowest primary and secondary enrolment rates (WFP, 2005).

The region has very poor health infrastructure. Only 13% of communities in Bié province had a medical centre in 2005 (WFP, 2005). The average distance to the nearest health facility is more than 20 km while only one third of the health structures in the area are staffed with qualified health professionals. Most women deliver with traditional midwives (47%) or at home (36%). Only 13% deliver in maternity and general hospitals or clinics. More than 70% of the communities had vaccination campaigns during the year 2005 (WFP, 2005). As medicines are re-sold by nurses, prices are high and households have to do extra work or sell assets to deal with health problems. The situation is worse for poorer groups that have a small asset base and limited income diversity. In WFP (2005) surveys, most people referred to making their own medication and buying medicines directly on the local markets. Families in Bié province are considered the most vulnerable in terms of food security and health within the measured provinces in Angola (WFP, 2005).

1.4. Angola's natural diversity in literature

In spite of its richness and diversity, the flora of Angola presented a serious gap in the knowledge of the southern African plant diversity which has been referred to in the literature (Huntley and Matos, 1994; Soares *at al.,* 2007; Figueiredo and Smith, 2008; Figueiredo *et al*., 2009). According to Flora of Angola: first record on diversity and endemism (Figueiredo *et al*., 2009), Angola has a total number of 6,735 indigenous species, and a total vascular flora of 7,296 taxa, of which 1,069 taxa (997 species and 72 infraspecific taxa) are endemic. However, the flora of Angola remains poorly known. Compared to other southern African countries, the flora of Angola

appears to be the second richest in diversity, after that of South Africa. The Fabaceae, Poaceae and Asteraceae are the most diverse families and the Fabaceae, Rubiaceae and Euphorbiaceae are those with the highest levels of endemism (Fugueiredo *et al.,* 2009).

During the 20th century, botanists, ecologists, missionaries, farmers and many visiting scientists added to the collections in the herbaria of Europe and in the scientific institutions of Angola. The three main collectors who operated in Angola were Friedrich Welwitsch, Hugo Baum and John Gossweiler (Figuereido and Smith, 2008). The need for a Flora of Angola was soon recognised, and this was founded as the Conspectus florae angolensis by Luis Wittnich Carrisso (1886–1937) (Figuereido and Smith, 2008). To present, existing collections of Angolan plant material available to researchers are still mostly those kept in several European herbaria, dating from the pre-war years. Unfortunately the conservation of the herbariums in Angola is of serious concern as, following the years of the civil conflict, considerable damage has occurred to part of herbariums and their specimens as reported by several researchers who examined the collections (Figuereido and Smith, 2008). Sadly, following independence in 1975 and the nearly three decades of civil war that followed, little opportunity existed for field research, and the government's attention had to focus on security and socio-economic priorities (Figuereido and Smith, 2008). After the end of the civil war, some areas are still inaccessible owing to the threat of landmines (Costa *et al.,* 2004). Even before the war, the poor condition of some roads prevented explorers from reaching many isolated habitats in this country. This situation still prevails to some extent today. With certain areas of the country becoming increasingly accessible, a new interest in the botanical wealth of Angola is surfacing (Klopper *et al.*, 2009).

According to our knowledge, there is no recent study of traditional use of medical plants published from Angola, notably from Bié province. Nevertheless, there is a book of ethnographic value published in French by Eric Bossard (1996), focusing on the traditional knowledge of medicinal plants, and an article published on the Angolan medicinal plants used also as pesticides or soaps by the same author (Bossard, 1993). Another study on medicinal plants in Portuguese language was published by Van-Dúnem and Bathala (1994). Angola was one of the countries

screened for the plants used for antimalarial activity (Silva *et al*., 2011). Klopper *et al.* (2009) documented the use of Aloe species in Angola. Urso (2013) published the survey on Angolan ethnobotanical uses of *Ximenia americana* L. Some information were also reported by Gossweiler (1953) and other pre-war botanists working in the country.

Nonetheless, the surrounding countries are better documented with ethnobotanical studies published, notably from South Africa (Bisi-Johnson, 2010; Tschikalange *et al*., 2008; Cock, 2014, Vuuren 2014, Semenya and Potgieter, 2013, Steenkamp, 2003; Mahwasane *et al*., 2013; York *et al*., 2011 etc.), from Zimbabwe (Gelfand *et al*., 1985; Maroyi, 2011; Lukwa *et al*., 2001; Ngarivhume *et al*., 2015), from DR Congo (Bitsindou *et al*. 1996; Schmelzer and Gurib-Fakim,2008; Dibwe *et al*., 2012), from Zambia (Mkonda, 2003; Vongo, 1999; Turner, 1967) and Namibia (Cheikhyouseff *et al*., 2011; Van Damme *et al*., 1992).

2. Objectives of the thesis

The objective of the present study was to identify and document the diversity of medicinal plants and related ethnomedicinal knowledge of the local people in Bié province, Angola. We aimed to estimate the level of cultural importance of the documented species and patterns of medicinal use through quantitative methods. The proposed research intended to examine the variety of plant species which are used for medical purposes, their folktaxonomy as well as social and cultural value, regarding its role in savanna and open forest ecosystems.

3. Materials and methods

3.1. Study area

The Republic of Angola covers an area of 1 246 700 km^2 in southwest-central Africa. Its western boundary is 1 650 km along the Atlantic Ocean and it is bordered by Namibia in the south, the Democratic Republic of Congo in the north and northeast, and Zambia in the east. The detached province of Cabinda has a border the Democratic Republic of the Congo in the southeast and with the Republic of Congo in the north (Figure 1).

Figure 1. Map of the study area

The Bié province is the area of 71 000 Km sq., located in the central plateau of Angola (10°34´-14°18´S, 15°42´-19°13´E) with general altitude around 1600 m (Kuito 1,695 m). One third of the rural population of Angola live in the central highlands, due to its importance in terms of agro-economic activities. The spatial distribution of the population is highly correlated with the quality of agricultural land, resulting in high population concentrations in areas with better soils (WFP, 2005). The central plateau has an altitude of 1 200– 1 800 m and consists of rolling plains and low hills with

scanty vegetation. The plateau descends in the east to the basins of the Congo and Zambezi Rivers and merges with the sandy Namib Desert in the south. Several small rivers arise in the mountain belt and drain to the western sea. The largest of these are the Cuanza and Cunene Rivers (Klopper *et al.,* 2009).

It is an area with fertile soils, with the plantations of manioc, corn, sugar cane, coffee and peanuts, however the agricultural potential is not fully developed yet. The vegetation consists mostly of Miombo woodland, dry evergreen forests, dry deciduous forest, grassland and savannas with Afromontane formations in the highlands (Airy-Shaw 1947; Costa *et al*. 2004, Klopper *et al*., 2009). The dominant tree genera in the Miombo floristic formation are Brachystegia spp., Combretum spp., and Julbernardia spp., whereas in savannas the dominant grasses (Graminae family) are Hyparrehenia spp. and Androgon spp. (Cabral *et al*., 2010). Two types of soils are dominant in the central highlands: ferralsols on the plateau are dominant but they have a low agricultural productivity and the productive luvisols are found in depressions and valleys. However, there is a high population pressure on these soils and not all households have access to these. Located in the lowlands and valleys, luvisols often suffer from problems related to excessive water (WFP, 2005) .

Miombo is one of the more ecologically relevant land cover types in Angola and consists of woodlands of very rich biodiversity, with about 8.500 plant species of which over 54% are endemic (Desanker *et al*.,1997). In addition to their ecological value, these woodlands provide food, fibre, medicinal plants, and cattle feed to local populations (Cabral *et al*., 2010) The climate is subtropical, however humid and moderate, allowing the growth of both tropical and subtropical plants. Temperatures do not fluctuate much over the year, with an average of 18°C in Kuito. The temperatures in Kuito are unusually cool due to its high altitude. September and October are the hottest months with low precipitation, the period from May to August is cool with almost no rain falls, the main rainy season from November to April comes with heavy rain falls. The mean annual rainfall is 1.227 mm (McSweeney *et al*., 2008).

3.2. Research localities

The research was undertaken in two cities in the Bié province in Angola. First locality, Kuito, the capital of the Bié province, is an urban area with a dense infrastructure. The second locality, Kuemba, is situated about 100 km away from Kuito; but due to lacking infrastructure it is difficult to bypass this distance from Kuito, the travelling time is around 10 hours and difficult roads makes the locality a great distance from the capital city and surrounding towns. The community in Kuemba is dependent on subsistence agriculture and more traditionally on hunting of wild animals; Kuito is a purely urban area, but surrounded by open woodlands and agricultural lands, therefore the traditional knowledge of natural resources notably prevails in the outskirts of the city. Bié province is one of the areas most significantly damaged by the recent war (1975-2002), therefore lacking infrastructure and the presence of landmines, influences significantly the lives of local people together with the work of the local herbalists, as they usually use one or few very well explored localities to search for the medicinal plant.

The population in Kuito is 185,302, in Kuemba it is about 4.500, whole Bié province has 1,338,923 inhabitants (WFP, 2005). The *Umbundu* and *Chokwe* ethnicities are prevailing in the area. Kuemba is said to be the domestic locality for *Chokwe* people, *Umbundu* population is rather based in Kuito, where many *Chokwe* live too. This division is based only on the statements of local inhabitants, because the exact statistics on the ethnicities does not exist. However, *Umbundu* people inhabit the central plateau of Angola (Huambo, Bié) and western coastal parts of Angola (Benguela, Kuanza Sul), while *Chokwe* people inhabit eastern parts of Bié province, and eastern parts of Angola, bordering with Zambia (Bossard, 1996). The *Chokwe* speak *Chokwe* language. The *Umbundu* speak *Umbundu* language, both languages are of the Bantu origin from the Niger-Congo language family, however the languages have only small similarities. Agriculture is the recent main economic activity for *Umbundu* people. This group results from a mixture of other groups of diverse origin and varying size, and is the outcome of the historically high migration in the region (Birkeland, 2000).

3.3. Data collection

The survey was undertaken between September 2013 and November 2013. The herbalists were identified in each town through the purposive sampling and the snowball method, with the significant help of one local mediator in each locality. The mediator helped to identify the first herbalist, through the questioning of local community members, especially elderly people and local authorities. The contact with the other herbalists was again established with the help of the local mediator, who was a trustworthy member of the community and master of local languages. Because not all information could be discussed in Portuguese with herbalists, the local mediators used their native languages to discuss further consequences of the research with herbalists. Nevertheless, the information on the use of medical plants was always shared directly in Portuguese, without additional translation. 80% of the interviewed herbalists did not welcome the idea of sharing their knowledge with the foreign researcher at first, however following further contacts with the researchers and with the respectable people from the community, they have all decided to participate in the study within a few days or weeks.

Because most of the interviewed herbalists perceived their knowledge either as a secret for spiritual reasons or as a secret for business reasons; they did not wish to share their knowledge within the area, especially not with other herbalists. That is the reason why focus group discussions could not be organised in the area. A similar situation was described by the study in Zimbabwe (Ngarivhume *et al*., 2015). However, the herbalists had no objections in sharing their knowledge with the international scientific community, they expressed their consent with the publication in the English language, which is perceived as not frequently spoken or understandable in their locality. However, they were not ready to openly share all the information, for example exact information on the preparation of the herbal remedy or some information of magical and spiritual value. We believe that this distance between the herbalists and the researcher could be overpassed by time, as this approach from the herbalists had some features of "game", and it appeared that in the final stage of the research, the herbalists were ready to share more information or continue with the research further. The small fiscal rewards were shared with the

herbalists. Those were agreed before the beginning of the cooperation, as a reward for the time directly spent with the researcher on the transect walk.

Semi-strucutred interviews were conducted with the herbalists during the transect walks. The herbalists were encouraged to note any medical plant that they know and use. They were asked to provide the following for each of the medicinal plants they have stated to be used to treat diseases: local name, medicinal use, parts of the plant used, modes of preparation and administration, habit, status of plant species, seasonal availability; and any other additional information, important signs or effects of the plant.

Personal and socioeconomic data regarding each informant were also gathered. All interviews were complemented with direct participant observation (Martin, 2014). Additionally, brief opened interviews were held with local people of any age group and socioeconomic situation, who played any role in the snowball method, in order to complement the data for the further understanding of the traditional use of medicinal plants in Bié province in Angola.

In total, the 10 specialized respondents were interviewed, 5 in each locality. 5 of them were men, 5 of them women. In Kuemba, the number of 5 respondents appeared to be the total number of specialized herbalists in the town, contrary wise in Kuito, the 5 respondents were rather the representative sample. Age range of the herbalists was 51 – 73, with the mean age 60 years.

For further taxonomic identification of plant material, gathered data was complemented by preparation of herbarium reference collection including photos of all species studied. During the transect walks, the plants identified by the herbalists were collected, tagged, and wrapped in blotting paper. After the walk, they were pressed and dried. The identification of the plant samples was carried out later by the Tropical Research Institute in Lisabon, Portugal, where the voucher specimens were deposited.

3.4. Data analysis

Quantitative analysis was based on the descriptive data gathered during the field work and on the additional taxonomic identification of plant material. The relative frequency of citations, informant consensus factor, informant agreement ratio, fidelity level, cultural value index and Sørensen similarity index was used to verify the cultural value of the used species.

Primarily, collected ethnobotanical information was converted into use reports. One use report corresponds to the event when the informant mentions the use of a species for the treatment of an ailment category (Chellappandian *et al*., 2012). The health disorders reported by informants were classified into ailment categories according to Cook (1995), with slight adaptation to the main characteristics of medicinal plant use in Angola.

3.4.1. Relative Frequency of citations

This index, which does not consider the variable use categories, is obtained by dividing the number of informants who mention the use of the species, also known as frequency of citation (FC), by the number of informants participating in the survey (N). This index theoretically varies from 0, when nobody refers to the plant as useful, to 1 in the case that all the informants would mention the use of the species according to the following formula (Tardío and Santayana, 2008).

(1) RFCs $\frac{FCs}{N} = \frac{\sum_{i=i1} URi}{N}$

3.4.2. Informant Consensus Factor

To measure the homogeneity of the ethnomedicinal knowledge, Informant Consensus Factor (ICF) suggested by Heinrich (2000) was calculated. The calculation of ICF reflects if there is an agreement among respondents in the use of plant species in particular ailment category. This factor estimates the relationship between the number of use reports in each category (Nur) minus the number of taxa used (Nt) and the number of use reports in each category (Nur) minus 1. ICF is calculated using the following formula:

$$(2)\ \text{Fic} = \frac{Nur - Nt}{Nur - 1}$$

The outcome of this factor ranges from 0 to 1. The high value indicates that a low number of taxa are used by high proportion of people, while the low result shows that informants disagree on the use of the taxa for the treatment within the category of the illness. The informant consensus factor was calculated both for species and families in our study.

3.4.3. Informant Agreement Ratio

The importance of the individual species was estimated by calculating the Informant Agreement Ratio (Trotter and Logan, 1986) for each species. IAR was calculated using the formula:

$$(3)\ \text{IAR} = \frac{Nr - Na}{Nr - 1}$$

In this equation, Nr is the total number of use reports registered for species and Na is the number of ailment categories that are treated with this species. This value

varies between zero and one, reaching one when all the respondents agree upon the use of the species for ailments just of one ailment category.

3.4.4. Fidelity level

Fidelity level ratio developed by Friedman et al. (1986) was used to identify the most frequently used species to treat a particular ailment category. Fidelity level was calculated for each species in particular ailment category using the formula:

$$(4)\ \text{FL}\ \% = \frac{Np}{Nx100}$$

Np is the number of use reports cited for a particular plant species in a particular ailment category and N is the total number of use reports cited for the same plant species (Rokaya et al. 2010; Dey and De, 2012). Medicinal plants with the highest fidelity level are understood to be the most or only preferred for a particular ailment category. The low fidelity level of the species reveals it is used in many other ailment categories.

3.4.5. Cultural Value Index

Cultural value index, developed by Reyes-García *et al*. (2006), is calculated using the following formula:

$$(5)\ \text{CVs} = \frac{NUs}{NC} \times \frac{FCs}{N} \times \sum_{u=u1}^{uNC} \sum_{i=i1} \frac{URui}{N}$$

The first factor is the relationship between the number of different uses (NUs) reported for the species ("ethnospecies" in the original work) and the total number of use-categories (NC) in the study. The second factor is the relative frequency of citation of the species (as previously defined). Finally, the third factor is the sum of all the use reports for the species i.e. the sum of the number of participants who mentioned each use of the species, divided by N. These three factors are then multiplied together (Tardío and Santayana, 2008). This index varies from 0 to number of use categories in the study. Consequently, the species with the highest cultural value are those species that have been cited in many categories by many informants.

3.4.6. Sørensen similarity index

The widely used Sørensen similarity index (Magurran, 2004) measures similarity in species composition for two sites, A and B, by the equation where *a* is the number of species found in site A; *b* is the number of species in site B and *ab* is the number of species shared by the two sites (Diserud and Ødegaard, 2007). This index uses the following formula:

(6) CS= $\frac{2ab}{a+b'}$

4. Results

4.1. Medicinal plant categorisation

In the present study, the local healers shared information on 224 vernacular names of plants used to treat various diseases in the Bié province in Angola. Out of 256 collected specimens, 56 plant species distributed among 54 genera and 30 botanical families have been documented. However, 12 specimens were identified only down to the genus level and 10 specimens only down to the botanical family level. 47 plant specimens remained unidentified. 2 plant species were collected without any vernacular name, because the herbalist could not remember it.

Fabaceae was the most represented family with 16 species, followed by Apocynaceae, Asteraceae, Rubiaceae and Euphorbiacaeae with 4 species, and Verbenaceae, Sapotaceae, Ochnaceae, Laminaceae, Chrysobalanceae, Celastraceae, Annonaceae represented by 2 species.

As shown in Table 1, the 302 use reports were mostly distributed in the group of gastro-intestinal disorders, with 84 use reports within the category; followed by 49 use reports in pregnancy/birth/puerpuerium disorders use category; and 37 use reports in infections-infestations use category. From all species, the highest number of use reports belonged to *Securidaca longipedunculata* Fresen. (15 URs), followed by *Annona stenophylla* subsp. cuneata (Oliv.); subsp. Nana (Exell) N.Robson (14 URs) and *Garcinia huillensis* Welw. (12 URs). Use categories for each medicinal plant are shown in Table 6.

Table 1. The number of use reports per medicinal plant use categories

Medicinal plant use categories	Number of use reports
Blood system disorders	7
Circulatory system disorders	6
Dental and mouth care	3
Gastro-intestinal system disorders	84
Genitourinary system disorders	23
Infections – infestations	37
Injuries	8
Neurological system disorders	22
Skin disorders	15
Pregnancy/birth/puerpuerium disorders	49
Respiratory and throat disorders	20
Skeleto-muscular system disorders	16
Others	12

4.2. **Plant life-forms used, mode of preparation and administration**

92% of used plants were local and only 8% exotic. The plant life-forms used in traditional medicine in Bié province are trees (34%), shrubs (37%), herbs (24%) or whole plants, grasses, vines or succulents. The review of the use of medicinal plants is shown in Figure 2.

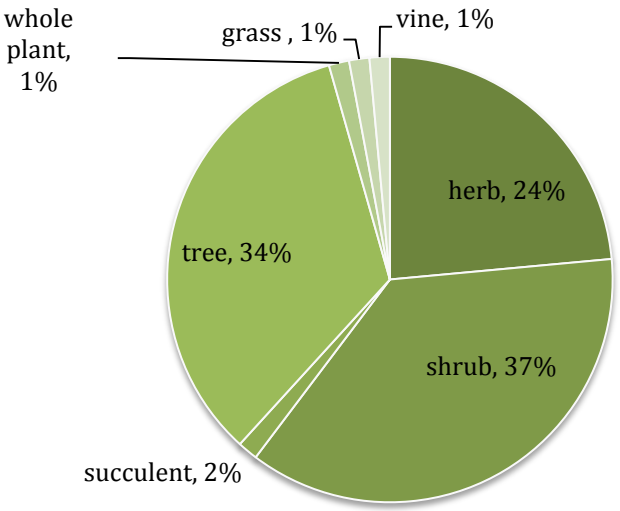

Figure 2. Total share of plant life-forms used in percentage

The herbal remedies were prepared in various ways. We have noticed several herb mixtures. *Bacopa* is used together with *Annona stenophylla* cuneata (Oliv.) N.Robson in order to ease labour. *Eriosema affine* De Wild is used together with *Securidaca longipedunculata* to prepare the decoction that cures stomach pain. *Albizia antunesiana* Harms is used together with *Annona stenophylla* (Exell) N.Robson and *Garcinia huillensis* to treat impotence. *Vernonia britteniana* Hiern is used with *Phyllanthus* and *Cissampelos mucronata* A. Rich. as a treatment after labour. *Macrotyloma africanum* (Wilczek) Verdc*.* is used together with *Scleria induta* Turrill to prepare the decoction that helps to stimulate children's appetite. The use of more than one plant species as an additive treatment is attributed to the additive or synergistic effect that they have during the ailment treatment (Bussman *et al*., 2006).

The most frequent mode of preparation was decoction (57%), followed by washes in form of massage (12%), baths (8%) and infusions (7%). Massages, where the fresh plants were applied topically on the body and baths with the plant infusions lasting from 30 minutes to 24 hours were related not only to skin disorders, but mainly to pregnancy related ailments. The tea was pre-dominantly prepared from the fresh or dried, chopped or ground, roots with hot water and it was supposed to be drank as long as the health problem remained. The precise measures of the dosage were usually not specified by the herbalists. In 5 cases, the drink was prepared with the local beverage kisangua. All forms of preparation are presented in Figure 3. Simplified descriptions of the administration and preparation of the medicinal remedies are listed for each species in Table 6. Most of plant remedies were applied both topically and orally. *Afzelia quanzensis* Welw. and *Droogmansia dorae* Torre are characterised by only topical modes of application. *Garcinia huillensis*, the third most commonly used plant species is consumed only orally in form of decoction and in large amounts. *Scleria induta* and *Xylopia* are also used only orally as decoction.

The different plant parts used are presented in the Figure 4. Roots were used in 70% of use reports, while only 14% of medical remedies were prepared from leaves and 8% more from roots and leaves together. The fresh fruit, bark, roots together with bark or whole plant were used very rarely. There was no report for use of stems or seeds.

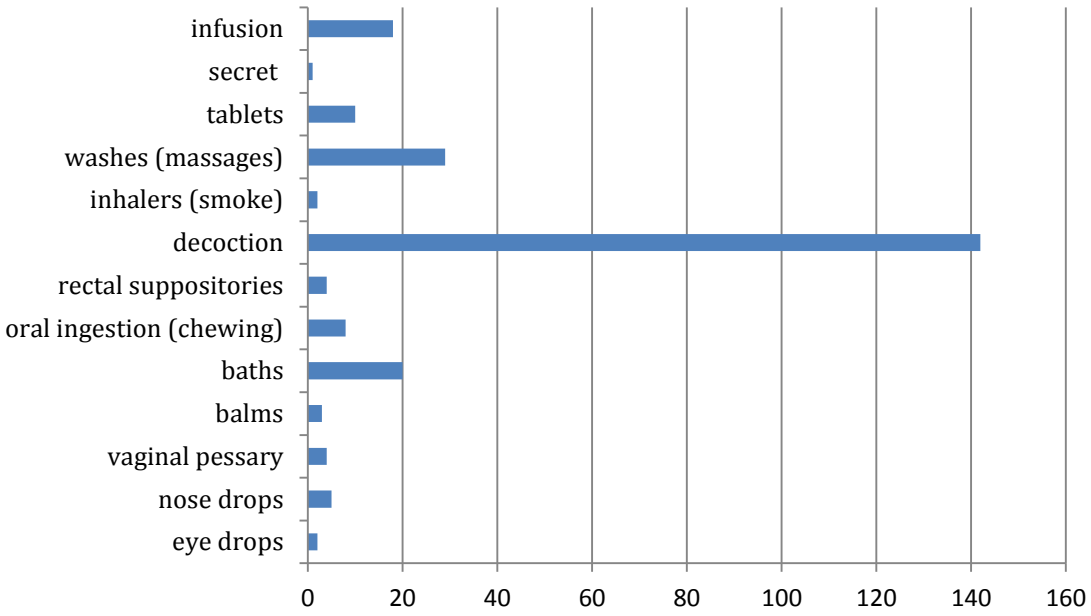

Figure 3. Number of use reports for each mode of preparation

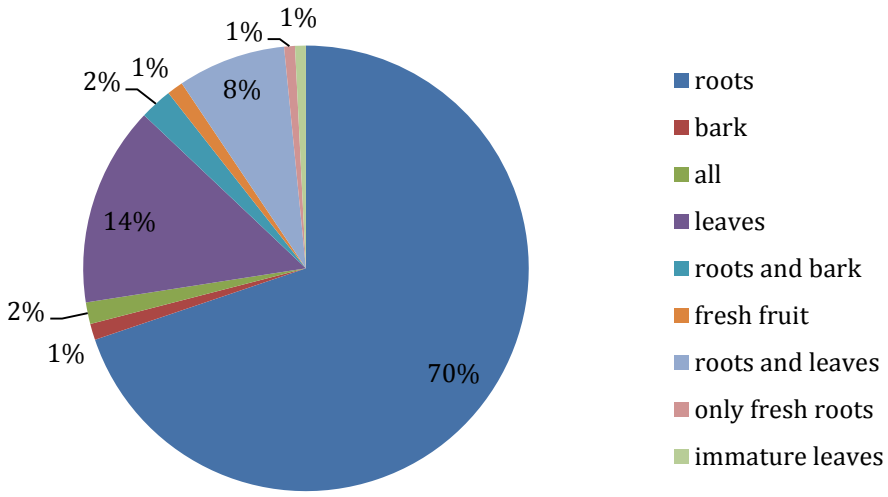

Figure 4. Total share of plant parts used for medicinal purposes

4.3. Quantitative ethnobotany

Through the calculation of relative frequency of citations (RFC), we assumed that 26 species were cited only by 1 herbalist and 37 species were cited by 2 or more herbalists. The most frequently cited species were *Securidaca longipedunculata*, cited by all 10 informants, followed by *Annona stenophylla*, cited by 9 informants and *Garcinia Huiliensis*, cited by 8 informants. *Strychnos cocculoides* Baker*, Psorospermum febrifugum* Spach*, Holostylon robustum* (Hiern) G.Taylor and *Eriosema affine* were cited by 6 informants and *Albizia antunesiana* and *Albizia adianthifolia* (Schum.) W.Wight and *Aframomum* sp. were cited by 5 informants. All the RFC values are shown in Table 6. The plants with the highest RFC are presented in Table 2.

Table 2. Plants with the highest Relative frequency of citations (RFC)

RFC	Plants
0.5	*Aframomum* sp.
0.5	*Albizia adianthifolia*
0.5	*Albizia antunesiana*
0.5	*Paropsia brazzaeana*
0.6	*Eriosema affine*
0.6	*Holostylon robustum*
0.6	*Psorospermum febrifugum*
0.6	*Strychnos cocculoides*
0.8	*Garcinia huillensis*
1	*Annona stenophylla*
1	*Securidaca longipedunculata*

The Informant Consensus Factor (ICF) values are related to the ailment categorisation shown in Table 1. Those demonstrate the consensus of informants on the use of particular families or species within the given category. The ICF values vary from 0 to 1, with the mean value 0.24 for species and 0.45 for families in the whole study. The highest informant consensus factor was calculated in the category gastro-intestinal disorders (ICF=0.70 for 65 URs and 20 families) for botanical families and in the category gastro-intestinal disorders (ICF=0.46 for 64 URs and 36 species) and infections-infestations (ICF=0.46 for 29 URs and 16 species) for species. The lowest

value with no consensus at all was estimated in the category of dental and mouth care for families and in 3 categories for species: dental and mouth care, circulatory system disorders and blood system disorders. The overall review of ICF results are shown in Figures 5 and 6.

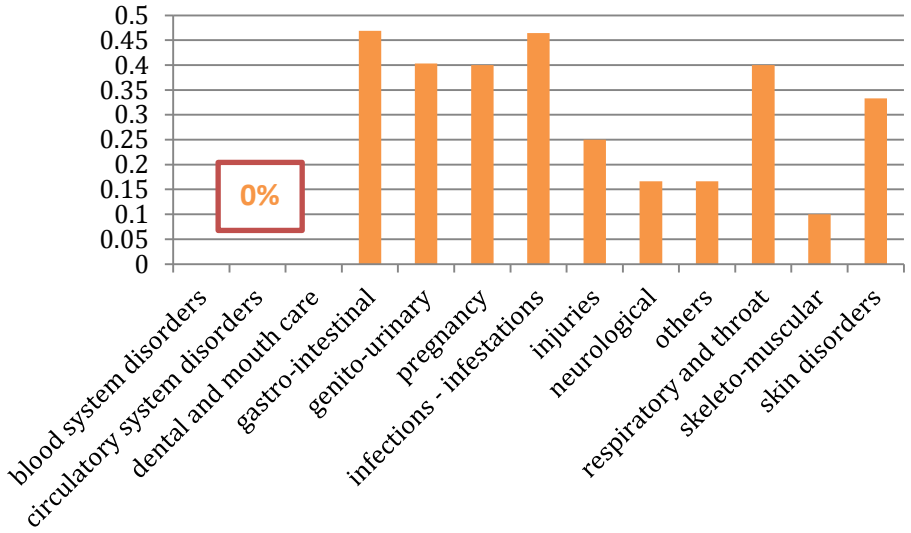

Figure 5. Informant Consensus Factor per medicinal plants use category, count for Species

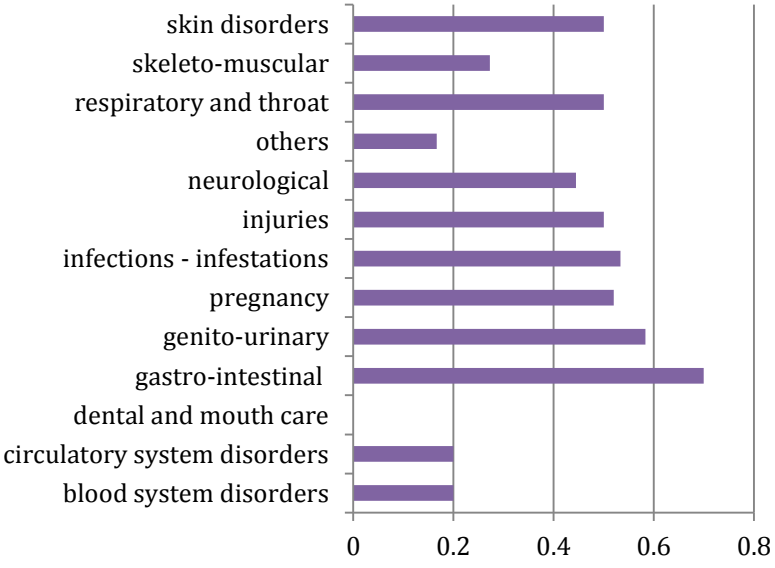

Figure 6. Informant Consensus Factor, count for Families

An agreement on use of individual plant species in particular ailment category was calculated through Informant Agreement Ratio. The values of this index (between 0 and 1) are reported in Table 6. The species with the highest informant agreement ratio are listed in Table 3. There are 19 plants with IAR above 0.5, 8 plants with IAR bellow 0.5 but higher than 0.

41 plants had the IAR value equal to 0. Out of 41 plants with 0 IAR, 26 plants were cited only once, therefore only 15 plants actually had no IAR at all. The review of IAR overall results can be viewed in the chart (Figure 7). The 6 species *Clitoria kaessneri* Harms*, Erythrina abyssinica* Lam.*, Gymnema sylvestre* (Retz.) R.Br. ex Sm.*, Psorospermum febrifugum, Uapaca benguelensis* Müll.Arg, *Vernonia britteniana* and *Diplorhynchus condylocarpon*, were the species that have shown the 100% IAR among all informants.

Through the Fidelity level (FL) ratio, we assumed the most preferred plant species within the ailment categories. *Clitoria kaessneri* reached 100% FL in the category of infections-infestations as a treatment of malaria with fever. *Psorospermum febrifugum* reached 100% FL as a treatment for elephantiasis in the same category. *Erythrina abyssinica* reached 100% FL in the category of gastro-intestinal disorders as a treatment of stomach pain for children. The species that reached the Fidelity level higher than 50% are shown in the Table 4.

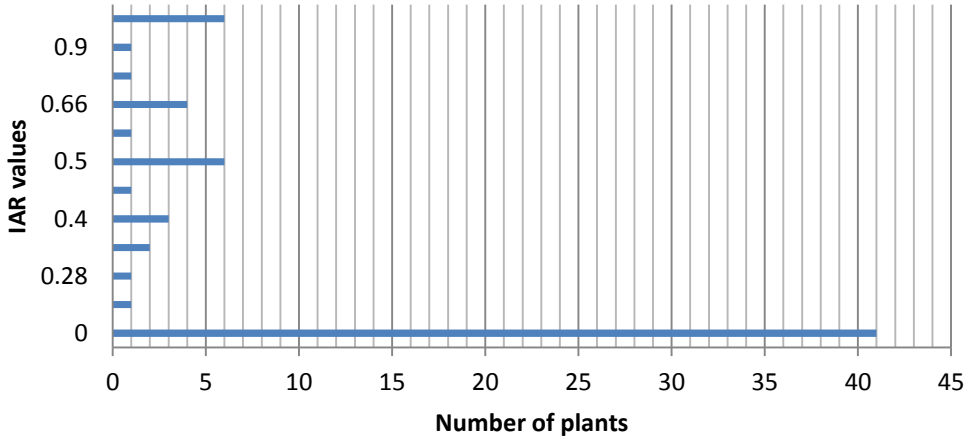

Figure 7. Total share of Informant Agreement Ratio values (IAR values) per the number of plants

Table 3. Plant species with the highest Informant Agreement Ratio (IAR)

IAR	Species
0.5	*Afzelia quanzensis*
0.5	*Brackenridgea arenaria*
0.5	*Eriosema affine*
0.5	*Garcinia huillensis*
0.5	*Rhynchosia minim*a
0.5	*Scleria induta*
0.57	*Securidaca longipedunculata*
0.66	*Aeschynomene dimidiata*
0.66	*Albizia adianthifolia*
0.66	*Lippia plicata*
0.8	*Albizia antunesiana*
0.9	*Annona stenophylla subsp. Cuneata + subsp. Nana*
1	*Clitoria kaessneri*
1	*Diplorhynchus condylocarpon*
1	*Erythrina abyssinica*
1	*Gymnema sylvestre*
1	*Psorospermum febrifugum*
1	*Uapaca benguelensis*
1	*Vernonia britteniana*

Table 4. Plant species with Fidelity Level index (FL) higher than 50%

FL	Species	Medicinal plants categorisation	Particular diseases treated
100%	*Clitoria kaessneri*	inections-infestations	malaria with fever
100%	*Diplorhynchus condylocarpon*	gastro-intestinal disorders	diarrhoea
100%	*Erythrina abyssinica*	gastro-intestinal disorders	stomach pain, children
100%	*Psorospermum febrifugum*	inections-infestations	elephantiasis
75%	*Lippia plicata*	respiratory and throat	sore throat
66%	*Afzelia quanzensis*	skin disorders	balm for legs
66%	*Albizia adianthifolia*	gastro-intestinal disorders	diarrhoea
66%	*Brackenridgea arenaria*	skin disorders	lip balm
66%	*Vernonia britteniana*	genitourinary disorders	inflamation genitals
60%	*Gymnema sylvestre*	gastro-intestinal disorders	stomach pain
60%	*Rhynchosia minima*	pregnancy/birth/puerperium	pregnancy early after last delivery
57%	*Eriosema affine*	inections-infestations	malaria

The relative importance of locally used species was assessed by calculation of the Cultural Value Index. Highest Cultural Value Index was calculated for *Securidaca longipedunculata* (CVi = 0.73), followed by *Garcinia huillensis (CVi = 0.5), Annona stenophylla* (CVi = 0.32), *Afzelia quanzensis* (CVi=0.23), *Strychnos cocculoides* (CVi = 0.18), *Eriosema affine* (CVi = 0.17) and *Aframomum* sp. (CVi=0.14). The Cultural Value Index values are shown in the Table 6. The plants with the highest CVi are listed in Table 5.

Table 5. Plants with the highest Cultural Value Index (CVI)

SPECIES	CVi
Albizia antunesiana	0.08
Chrysophyllum bangweolense	0.09
Sclerocroton cornutus	0.09
Paropsia brazzaeana	0.11
Sclerocroton cornutus	0.11
Aframomum sp.	0.13
Holostylon robustum	0.16
Eriosema affine	0.17
Strychnos cocculoides	0.19
Afzelia quanzensis	0.23
Annona stenophylla	0.32
Garcinia huillensis	0.5
Securidaca longipedunculata	0.73

Sørensen similarity index compared the knowledge of plants in 2 different localities of the study and in two different ethnicities. 19 plant species were used commonly by both *Umbundu* and *Chokwe* people, both in Kuemba and Kuito. The values for the number of species used in each locality and by each ethnicity, and commonly between them, are shown in Figure 8.

Sørensen similarity index for comparison of knowledge between Kuito and Kuemba is 0.3367, and for the comparison of knowledge between *Chokwe* and *Umbundu*, it is 0.2765. The Sørensen similarity index for comparison of interethnical *Chokwe* and *Umbundu* knowledge distributed in 2 different localities is 0.3896 for *Chokwe* people and 0.3972 for *Umbundu* people. The graphical scheme of Sørensen similarity index is shown in Figure 9.

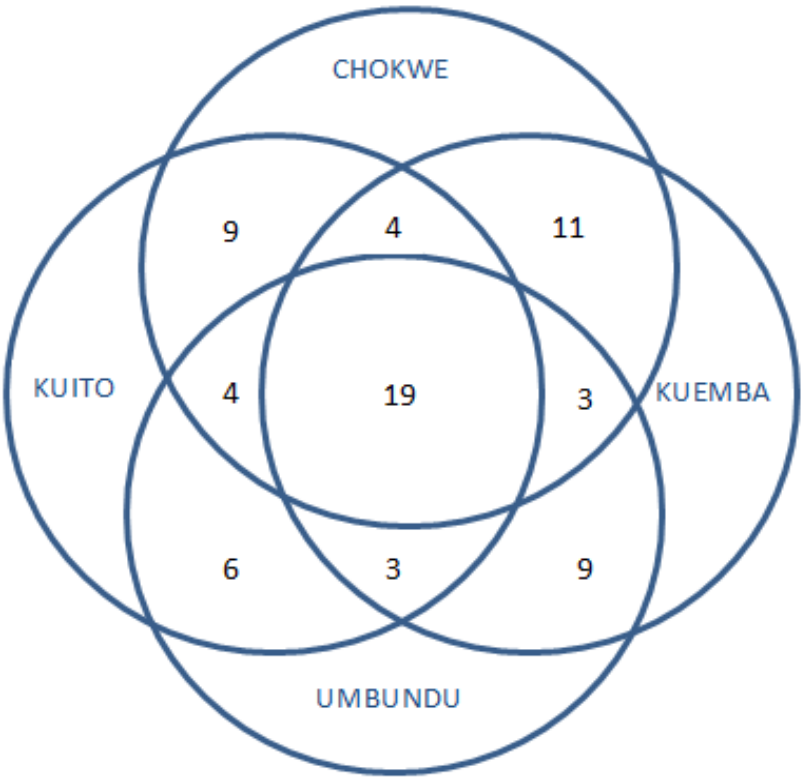

Figure 8. The common share of plants in two examined localities (Kuemba and Kuito) and in two examined ethnicities (*Chokwe* and *Umbundu*)

Table 6. Ethnobotanical survey of medicinal plants used in Bié province, Angola

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi**	IAR"
Acacia sieberiana DC., BNKT207	Usonge	Fabaceae	tree	bark	pregnancy, respiratory	abortion (chopped bark, bath); astma (decoction)	0.1	0.003	0
Aeschynomene dimidiata Baker, BNKT205	Kaleuka, Chite	Fabaceae	shrub	roots, leaves	infections, gastro	elephanthiasis (chopped root, massage); ascites (chopped root, clyster); stomach pain (leaves, roots, decoction)	0.3	0.0184	0.66
Aframomum sp., BNKT257	Kahafu, Mutfuntu, Matundu, Olongombe	Zingibera-ceae	herb	roots	infections, skeleto, pregnancy, circulatory, gastro, genito	yellow fever (root, decoction); rheumatic pain (root, decoction); abortion (root in hot water, bath); hemorrhoids, stomach pain (chopped root, decoction); dysmenorrhea (chopped root, heated, applied on the skin)	0.5	0.13846	0.25
Afzelia quanzensis Welw., BNKB109	Mualatoulo Mulimbo	Fabaceae	tree	roots	skin, others	balm for legs (chooped root, applied on skin); black magic (no information)	0.2	0.2307	0.5
Albizia adianthifolia (Schum.) W.Wight, BNKB27, BNKB102, BNKT148	Mucasa, Olumbala	Fabaceae	shrub	roots, leaves, bark	gastro, genito	constipation - children (clyster); vomiting (chopped leaves, cold water,infusion); diarrhoea (chopped root,decoction); dysmenorrhea (root, decoction)	0.5	0.0461	0.66

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Albizia antunesiana Harms, BNKB42, BNKB107	Enduramos, Kakuata, Osese, Ungolo	Fabaceae	shrub	roots, leaves	genito, gastro, pregnancy, neuro, infections	dysmenorrhea (root, decoction); impotence (leaves, roots, decoction); stomach pain (grinded leaves, cold water, infusion); hemorrhoids after labour (chopped leaves, warm water, 30 minutes bath); worms (root , decoction); cerebral fever (roots)	0.5	0.0807	0.8
Aloe zebrina Baker BNKT223	Chandala	Xanthorrhoe-aceae	succulent	roots, leaves	circulatory	hemorrhoids in eyes (root and leaves, boiled in water, applied on mouth and eyes)	0.1	0.000769	0
Annona stenophylla subsp. cuneata (Oliv.) BNKB55 ; subsp. Nana (Exell) N.Robson, BNKB5, BNKB26, BNKB77, BNKB90, BNKB120	Mupepe, Eyolo, Mulolo, Ondulu	Annonaceae	shrub	roots	gastro, genito, pregnancy	stomach pain, constipation (grinded root, decoction); abortion, contraceptive (root, , decoction); dysmenorrhea (root, decoction); impotence (root, cold water or kisangua,infusion), to facilitate labour together with bacopa (root, decoction)	1	0.323	0.9
Bacopa BNKT267	Casati	Scrophulari--aceae	shrub	roots	pregnancy	to facilitate birth together with *Annona stenophylla* (root, decoction)	0.1	0.000769	0
*Bobgunnia madagascariensis (*Desv.) J.H.Kirkbr. & Wiersema, BNKB31	Onganja, Ganja	Fabaceae	shrub	roots - only used as small plant, fruit	Infections, gastro, pregnancy	malaria and vertigo after malaria (roots, hot water, decoction or application on eyes); stomach pain (fresh fruit), desinfection of womb after the labour (dry fruit, warm water, bath)	0.2	0.013846	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Brachystegia gossweileri Burtt Davy BNKB74, BNKT261	Mosamba	Fabaceae	tree	roots, leaves	circulatory, others	hemorrhoids (root, boil in water, decoction); magic - brings good luck (leaves, warm water, bath)	0.2	0.0061	0
Bridelia BNKB110	Munukenuke	Euphorbiace-ae	tree	leaves	gastro	diarrhoea (chopped root, decoction)	0.1	0.000769	0
Burkea africana Hook., BNKT302	Muehe	Fabaceae	tree	leaves	gastro, respiratory	diarrhoea (leaves, decoction); cough (chewing of the leaves)	0.2	0.0061	0
Campylospermum sp., BNKB23	Omia	Ochnaceae	tree	roots	gastro	diarrhoea, vomiting (roots, decoction)	0.1	0.000769	0
Cassytha filiformis L. BNKB14	Lavava	Lauraceae	whole plant	roots	gastro	stomach pain, constipation, vomiting, diarrhoea (roots, decoction)	0.1	0.000769	0
Chrysophyllum bangweolense R.E.Fr. BNKT134, BNKT260, BNKT268	Filanganga, Olonganga, Mumbanko Umondoyo	Sapotaceae	tree	roots, leaves	infections, gastro, blood, pregnancy	malaria (roots, leaves, decoction); appetite stimulant (roots, leaves, decoction); worms (roots, leaves, decoction or chopped roots, clyster); constipation - children (roots, decoction); epistaxis (boiled roots applied inside nose); to facilitate labour (boiled roots, applied in vagina)	0.4	0.0921	0.4
Cissampelos mucronata A. Rich. BNKB4, BNKB48	Cacapa, Chitangila, Nofungi	Menispermac eae	vine	roots, leaves, bark	neuro, blood, pregnancy, genito	headache (roots, decoction); epistaxis (roots, leaves, boiled, applied inside the nose); cough (chew the bark); closure of genitals after labour, medicine for genitals (roots, decoction)	0.4	0.0614	0.4

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Clitoria kaessneri Harms BNKB78, BNKB87	Omue, Mungantu	Leguminocea e	shrub	root, bark	infections	malaria with fever (chopped roots, decoction of cold beverage; or pill)	0.2	0.00307	1
Ctenium newtonii Hack BNKB18	no name known	Poaceae	herb	whole plant	infections	persistent malaria (whole plant, decoction)	0.1	0.000769	0
Cyphostemma, BNKT187	Gombendakul-anda	Vitaceae	tree	roots	pregnancy	loss of blood during pregnancy (roots boiled in water, decoction, 3 times a day)	0.1	0.000769	0
Diodia BNKT236	Kalumbulu Chindumula	Rubiaceae	herb	roots, leaves	skin, pregnancy, neuro, dental, others	boils (chopped leaves, cold water, applied on skin); prevents abortion (leaves, warm water, bath); headache (leaves, warm water, applied on head); toothache (leaves, cold water, applied on tooth); new pregnancy early after previous birth (roots, decoction) - consumed by both mother and the child; medicine/magic - infertility(roots, hot water, decoction)	0.2	0.0246	0
Diplorhynchus condylocarpon (Müll.Arg.) Pichon BNKB10, BNKB99	Chingole, Olofifa	Apocynaceae	tree	roots, leaves, fruits	gastro	stomach pain (fresh fruit), diarrhoea with blood - children (roots, cold water, infusion),	0.3	0.003	1
Droogmansia dorae Torre, BNKB15, BNKT216	Kopokambun-da, Mununganun-ga	Fabaceae	tree	roots	circulatory, skeleto	hemorrhoids (grinded root, warm water, bath); fracture (grinded root, warm water, applied on wound)	0.2	0.0061	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Englerophytum magalismontanum (Sond.) T.D.Penn., BNKB19, BNKB75, BNKB118	Mupepe, Usakalala	Sapotaceae	tree	roots	respiratory, blood, others	cough (root, hot water, infusion); epistaxis (fresh root applied in nose); magic/cures everything (root, decoction)	0.3	0.0207	0
Entada cf. BNKB125	Chieke	Fabaceae	shrub	roots	gastro	big stomach for no reason (root, decoction)	0.1	0.000769	0
Eriosema affine De Wild, BNKB39, BNKB131	Ondembi	Fabaceae	shrub	roots, leaves	infections, skin, pregnancy, gastro	malaria (grinded leaves, roots, decoction); malaria - children (grinded roots, leaves, applied on whole body); stomach pain, diarrhoea (root, decoction); boils (grinded root, massage the skin); hemorrhoids after labour (chopped root, warm water, 30 minutes bath)	0.6	0.1661	0.5
Erythrina abyssinica Lam. *BNKB121*	Mulunku	Fabaceae	shrub	roots - only used as small plant	gastro	children - stomach pain, constipation (grinded root clyster or root, decoction)	0.4	0.0069	1
Eulophia cucullata (Afzel. ex Sw.) Steud., BNKT266	Casangalala	Orchidaceae	herb	roots	gastro	children - constipation (boiled root placed on the stomach)	0.1	0.000769	0
Felicia muricata (Thunb) Nees, BNKT269	Camalo	Asteraceae	herb	whole plant	genito	dysmenorrhea (wash the whole plant, decoction)	0.1	0.000769	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Garcinia huillensis Welw. , BNKB38, BNKB56, BNKB98, BNKT150, BNKT172	Kachingole, Lueni, Munjindo, Ochingole, Ometi	Clusiaceae	tree	roots, bark, leaves	genito, skeleto, gastro, circulatory, respiratory, pregnancy	impotence (boiled root, infusion with cold water or kisangua); arthritis (root, repeated decoction); haemorrhoids, worms, diarrhoea (root, decoction); stomach pain (grinded root, decoction 3xday); cough (leaves, decoction); abortion (roots, decoction)	0.8	0.4984	0.5
Gymnema sylvestre (Retz.) R.Br. ex Sm. BNKB76, BNKT152, BNKT199, BNKT231	Ndondo	Apocynace-ae	herb	roots	gastro, pregnancy, skin	stomach pain, constipation (washed root with cold water or boiled root in water, decoction. cold beverage); pains in pregnancy (root, decoction), balm	0.4	0.0461	1
Gymnosporia senegalensis (Lam.) Loes. BNKB13	Sasambia	Celastraceae	tree	roots	gastro	diarrhoea with blood (chopped root, decoction)	0.1	0.000769	0
Holostylon robustum (Hiern) G.Taylor, BNKB89, BNKT144, BNKT250	Calapa, Chicamba, Epombisa-muku	Lamiaceae	herb	roots, leaves	others, gastro, genito, injuries, skin	cures everything (juice from leaves on the spoon); appetite stimulator, food alergy (juice from leaves on the spoon); wounds (root, water, apply on wound); boils- children (grinded roots applied on the skin); microbes in stomach, stomach pain (roots, decoction); impotence (roots, decoction)	0.6	0.1615	0.33
Hypoxis polystachya Welw. Ex. BNKT219, BNKT230	Tumbanjale, Withomahon-do	Hypoxidaceae	herb	roots	skeleto, genito, circulatory, blood	rheumatism (roots, decoction); dysmenorrhea (roots, decoction); hemorrhoids (roots, hot water, bath); anemia (roots, hot water, bath)	0.1	0.0123	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Indigofera sutherlandoides Baker, BNKT146	Mujindagelo	Fabaceae	shrub	roots	gastro	worms in stomach - children (roots, cold water,infusion)	0.1	0.000769	0
Laggera crispata (Vahl) Hepper & J.R.I.Wood, BNKT255	Chipolela, Muyoyo, Upu	Asteraceae	herb	roots, leaves	genito	dysmenorrhea (roots, decoction); constipation (roots, clyster); mental diseases (leaves, warm water, bath)	0.3	0.0207	0
Landolphia camptoloba (K.Schum.) Pichon, BNKB53, BNKB99	Mupemba	Apocynaceae	tree	roots	blood	blood from ears (roots, decoction)	0.1	0.000769	0
Lantana angolensis Molden-ke BNKB127	Mundugu-dududu	Verbenaceae	herb	roots	pregnancy	pregnancy - big stomach (roots, decoction or roots, hot water, bath)	0.1	0.000769	0
Leptactina benguelensis (Welw. ex Benth. & Hook.f.) R.D.Good, BNKB100	Chambolog-ingi	Rubiaceae	shrub	roots	gastro	stomach pain, constipation (roots, decoction)	0.1	0.000769	0
Lippia plicata Baker BNKB6, BNKB43, BNKT222	Ondembi	Verbenaceae	herb	roots, leaves	respiratory	Sore throat (roots or leaves boiled in water, decoction, cold beverage), muscle relaxant (roots, massage)	0.3	0.0183	0.66
Macrotyloma africanum (Wilczek) Verdc., BNKB1	Cacunde	Fabaceae	herb	roots	gastro	appetite stimulator - children, pregnant women (roots, decoction)	0.1	0.000769	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Maytenus sp., BNKB35	Ovanga, Uteke	Celastraceae	tree	roots, leaves	genito, respiratory, neuro	dysmenorrhea (roots, decoction); cough (roots, leaves, decoction); calms baby from crying (root, warm water, wash or bath morning and evening)	0.2	0.0138	0
Mucuna stans Baker BNKT201	Eyumbi	Fabaceae	shrub	roots	skeleto	weak legs (roots, massage with hot water)	0.1	0.000769	0
Brackenridgea arenaria (De Wild. & T. Durand) N. Robson BNKB20	Lipi, Omia, Mufuco	Ochnaceae	tree	roots, leaves, fruit	skin, neuro	balm (fresh plant, root, applied on body, lips); epilepsia (boiled root, decoction)	0.3	0.0138	0.5
Ocimum cf., BNKT127	Mununga-nunga	Lamiaceae	shrub	roots, leaves	skeleto, injuries	leg fracture, injury from land-mines (heated in the pot, applied on wound)	0.1	0.000769	0
Oxygonum pachybasis Milne-Redh, BNKB63	Mucocoto, Musoso	Polygonaceae	herb	roots, leaves	gastro, genito, infections	diarrhoea, diarrhoea with blood (boiled roots, decoction of cold beverage); fever - children (roots, decoction); dysmenorrhea(leaves chopped and applied on the whole body)	0.3	0.0207	0
Parinari capensis Harv. BNKB49	Toma-toma	Chrysobalan-aceae	herb	leaves	gastro	diarrhoea, stomach pain (roots, decoction)	0.1	0.000769	0
Parinari curatellifolia Planch. ex Benth. BNKT156	Mutongo	Chrysobalan-aceae	tree	roots	pregnancy	to make baby turn head down in the womb before labour (roots, decoction)	0.1	0.000769	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Paropsia brazzaeana Baill., BNKT147, BNKT188, BNKT248	Muanga, Uvanga, Osalala	Passifloracae-ae	shrub	roots, leaves	neuro, respiratory, infections, gastro, skin	insomnia, baby cries at night (chewed leaves, spitted on the child or grinded root, applied on the body); madness, calming (roots, hot water, decoction); cough (grinded leaves, applied in the water, decoction and inhalation); malaria (roots, decoction); constipation (roots, clyster); boils (fresh leaves, applied on the skin)	0.5	0.1076	0.44
Pentanisia rubricaulis (K.Schum.) Kårehed & B.Bremer, BNKT204	Uso	Rubiaceae	herb	leaves	skin	boils (grinded leaves, applied on the skin)	0.1	0.000769	0
Phyllanthus sp. *BNKT237*	Kalomenko, Mucula	Euphorbia-ceae	shrub	roots	dental, neuro, skeleto, pregnancy, genito	tootache, tooth harmed to flesh (grinded root, applied on the tooth) ; headache (grinded roots, decoction); to close fontanella - children (roots , decoction); genitals after labour, genitals men (grinded root, applied on the skin)	0.3	0.0061	0
Psorospermum febrifugum Spach, BNKT167	Cutalala, Kachingole, Muhota, Musele, Capilangao, Chihoho	Hypericacea-e	tree	roots, leaves, not grown leaves	infections, gastro	Elephanthiasis (chopped root, leaves, water or oil, massage the leg - when it dries, it must be changed); diarrhoea (boiled root, decoction)	0.6	0.0276	1

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Psychotria eminiana (Kuntze) E.M.A.Petit, BNKB44	Ndombua wasalala	Rubiaceae	shrub	roots	pregnancy	stomach pain after labour (root, hot water, infusion), infertility (root, hot water, infusion)	0.1	0.0061	0
Pteris friesii Hieron., BNKB112	Mungayava	Pteridophyta	shrub	leaves	infection	worms (boiled leaves, decoction)	0.1	0.000769	0
Rhynchosia minima (L.) DC, BNKB92, BNKT138	Chisango, Kunambambi	Fabaceae	herb	roots, bark, leaves	pregnancy, gastro, skeleto	repeated pregnancy short time after birth (root, bark, leaves, decoction, drank over 1 week for both mother and child, child can bath in the water with roots); weak legs children (roots, cold water, massage of legs); diarrhoea (grinded root, decoction or pill)	0.4	0.0461	0.5
Rytigynia, BNKT252	Mutomatoma	Rubiaceae	shrub	leaves	others	when you are cursed by sorcerel, you need to bring back good luck (leaves, hot water, bath)	0.1	0.000769	0
Scleria induta Turrill, BNKB2, BNKB40	Casinde, Esinde Uovosenge	Cyperaceae	herb	roots	gastro, genito	Appetite stimulant - children, pregnant women (roots, decoction); impotence (boiled root, decoction); dysmenorrhea (root, decoction)	0.3	0.0138	0.5

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Sclerocroton cornutus (Pax) Kruijt & Roebers , BNKB93, BNKT153	Kachila Misombo, Obongengeti, Ongengete	Euphorbiac-eae	shrub	roots, leaves, fruits	blood, neuro, pregnancy, others	snake bite (chewed leaves applied on the wound, when the skin is stretched); pains (eating fresh fruit cures pain in head, stomach, dysmenorrhea); blood flows from the mouth and nose (fresh root applied in the mouth and nose), muscle relaxant – uterine muscles (eating of fresh fruit)	0.4	0.1076	0.33
Searsia squalida (Meikle), BNKB73	Bunguasana, Mulima	Anacardiace-ae	shrub	roots	genito, pregnancy	impotence (boiled root, decoction of the cooled beverage), after labour treatment, hemorrhoids after labour (boiled grinded roots, decoction)	0.2	0.0123	0
Securidaca longipedunculata Fresen. , BNKB132, BNKT251	Muchacha, Mulesese, Utata	Polygalaceae	tree	roots, stems	respiratory, skin, injuries, genito, gastro, neuro, pregnancy, infections	sore throat (boiled root, applied on the chest, massage); balm on boils (boiled root, applied on the skin); impotence; wounds (grinded root, hot water, massage); stomach pain (root, hot water, decoction); headache with diarrhoea - children (raze the stem, warm water, bath baby for 24 hours); helps to concieve (root, hot water, decoction)	1	0.7269	0.57
Smilax anceps Willd., BNKT182	Asangalala, Mucalale	Smilacaceae	shrub	roots	genito, skeleto, others	prolonged menstruation (boiled root, decoction); child cannot speak well (root, hot water, decoction); snake bite (fresh root applied on wound)	0.2	0.0138	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Strychnos cocculoides Baker, BNKB71, BNKB95	Mueila, Tugambombo, Chisumbi, Mulolo, Upole	Loganiaceae	tree	roots, leaves	genito, gastro , neuro, pregnancy, skin, injuries	dysmenorrhea (roots, hot water, decoction); stomach pain - newborns (boiled root, decoction); anemia celebral (grinded root, warm water, bath); boils on leg (grinded root, warm water, bath); loss of blood due to injury or delivery (root, hot water, decoction)	0.6	0.1846	0.28
Syzygium cordatum Hochst. ex Kra, BNKB34	Mucula, Ogitundua, Ukulakula	Myrtaceae	tree	roots, leaves	skeleto, pregnancy, gastro	rheumatism (roots, hot water, massage); abortion (grinded leaves, warm water, bath); diarrhoea (roots, hot water, decoction)	0.3	0.0207	0
Tithonia diversifolia (Hemsl.) A.Gray, BNKB114	Mumono	Asteraceae	shrub	roots	infections	worms in stomach (chopped roots, hot water, decoction)	0.1	0.000769	0
Uapaca benguelensis Müll.Arg., BNKB84, BNKB123	Lombola, Mungengo-dengo	Euphorbiac-eae	tree	roots	gastro	diarrhoea, stomach pain (roots, hot water, decoction)	0.2	0.003	1
Vernonia britteniana Hiern, BNKT220, BNKT265	Kamahantu, Musese, Kambumbi	Asteraceae	shrub	roots, leaves	pregnancy, genito	boils on genitals, treatment for genitals after labour (boiled roots, decoction, bath); dysmenorrhea (boiled root, decoction of cooled beverage)	0.3	0.0069	1
Vitex madiensis Oliv. BNKT243	Muchiluchilu	Lamiaceae	shrub	roots	neuro	headache (roots, hot water, decoction)	0.1	0.000769	0

Table 6. Continued

Botanical species name (or genus) and voucher specimen number	Vernacular name (*Umbundu* or *Chokwe*)	Botanical family	Plant life-form	Used part	Use category[i]	Therapeutic uses (preparation, administration)	RFC*	CVi*	IAR"
Xylopia, BNKB17, BNKB57	Mujimbajimba, Muvunbaloca, Olohasa, Onjamba	Annonaceae	shrub	roots	infections, pregnancy, gastro, circulatory, genito	malaria (roots, hot water, decoction); morning sicknesses in pregnancy (roots, hot water, decoction); prevents abortion (roots, hot water, decoction); water in stomach (roots, hot water, decoction), pain in heart (roots, hot water, decoction); dysmenorrhea (roots, hot water, decoction); diarrhoea (roots, hot water, decoction)	0.4	0.0738	0.4

[i] Use category: Blood (Blood system disorders); Circulatory (Circulatory System disorders); Dental (Dental and mouth care); Gastro (Gastro-intestinal system disorders); Genito (Genitourinary system disorders), Infections (Infections-infestations), Neuro (Neurological system disorders), Skin (Skin disorders), Pregnancy (Pregnancy/birth/puerpuerium disorders), Respiratory (Respiratory and throat disorders), Skeleto (Skeleto-muscular system disorders)

*RFC (Relative Frequency of Citations)

*CVi (Cultural Value Index);

"IAR (Informant Agreement Ratio)

5. Discussion

5.1. Traditional medicine and beliefs in Bié province

Traditional knowledge and use of medicinal plants remain important in the two observed localities in Bié province and probably also in other areas of Angola. Traditional medicine is quickly accessible and affordable, mostly for the rural communities. Furthermore, the respondents in our study frequently mentioned various negative experiences with the healthcare provided in hospitals; while there were no similar stories observed about negative consequences of the healthcare of traditional healers. Additionally, the prevailing belief in spiritual and magical origin of diseases was observed both during the interviews held with the local people and with herbalists. Surprisingly, only one out of 36 interviewed Angolans denied any possible interconnection between the spiritual matters and medicine, while most of respondents understood the spiritual condition together with external magical forces, mostly curses or evil spirits, to be the elemental causes of any medicinal disorders.

Amongst the Southern Bantu people, there is the belief in the immortal ancestors who influence and direct the affairs of the living and to whom propitiatory practices such as food and drink are offered (D. Hammond-Tooke, 1975). Lack of health and misfortune are believed to often stem from ancestral wrath, witchcraft or ritual pollution (Hammond-Tooke, 1998), but often also point more deeply to disturbed social relations (Sobiecki, 2014). Under those circumstances, it is obvious that ailments are supposed to be treated mostly by the traditional healers, who are equally sorcerers; and by traditional herbal remedies, of which many may be associated with spiritual powers. In our study, some plants were cited to bring luck, to protect the holder, to be used as weapons against enemies, to protect the house, to cure all the diseases, to make someone invisible or to reveal the evil sorcerer. Those were listed together with the plants used to cure various diseases. The herbalists insisted those are part of traditional medicine with no different status, because also

ailments as headache or sore throat are only consequences of acts of spiritual agents. Bossard (1996) mentions, that *Umbundu* people would not accept westernised medicine, because it only treats the body, but not the soul. The secret of any ailment is placed in deep for Angolan people, and it is difficult to penetrate it. The plants used for spiritual practices were recently documented in South Africa by Sobiecki (2014) and the documentation of those plants in Angola would be desired too.

Basic or advanced magical rituals were commonly practised by 8 out of 10 traditional healers interviewed for this study. No division between traditional healers, diviners or sorcerers was pronounced or apparent in Bié province, however it was cited by Bossard (1996) in Angola or by Sobiecki (2014) in South Africa. According to our observation, the herbalists were healers, diviners or sorcerers according to current needs, as they all possessed some level of spiritual power. Magical practices frequently complemented treatment by the medicinal plants. However, the plants with spiritual powers were mentioned only by 3 herbalists during the transect walks; and only once preparation of such protective remedy was demonstrated directly in front of the researcher. It involved powder from bark of two trees (the herbalist wished to keep them secret), powder scratched directly from the dried head of the snake, ground tooth of rat, ground mirror pieces and few more secret herbal ingredients in symbolic doses. Such medicine was placed in small polythene bag and it was supposed to be carried constantly near to the body to protect the individual. As there was also believe that those magical practices can be only effective on "black souls", the researcher had restricted access to it as a representative of "white soul", although it could possibly do no harm or favour to a "white soul". Moreover, the herbalists reasoned that information on their magical practices might not be essential for our study. However, the researcher was secretly examined through simple ritual dance, which revealed her eligibility to be provided with any information, and only after this procedure, the agreement for a transect walk was expressed. As mentioned previously, it would probably be a matter of time to build relationships deep enough to be introduced to the secret information.

I believe it can be concluded that Angolan medicine is still deeply bounded with the spiritual understanding of the world, and the role of traditional healers remain on the border of the world of living and the world of death, as described in Bossard

(1996). This can be supported by the fact that unsuccessful application of herbal remedy is commonly reasoned by the evil spirit force or curse upon the treated individual and further medication with magical practices is developed. Only very rarely, the patient would be sent to a hospital after the remedy failed. This was also documented in Zimbabwe (Ngarivhume *et al*., 2015). The traditional healers were often speaking in parables and their description of the health problems could eventually have more meanings or could easily be misinterpreted. This was described in South Africa by Sobiecki (2014), who insists that when the traditional knowledge is translated into other languages such as English, these metaphorical descriptions of medicinal plant use can seem to incorrectly reflect mysticism and/or superstition with no scientific basis.

5.2. Gender aspects of medicinal plant use

The healers interviewed were 50% men and 50% women. The high percentage of female healers can be extraordinary, because it is documented that Africans believe that traditional healers should be male (Okello and Segawa, 2007; Bekalo *et al*., 2009; Cheikhyoussef *et al*., 2011). However, rare studies also show the gender equilibrate tendency, as for example one study from Zimbabwe (Ngarivhume *et al*., 2015).

Yet, in our opinion, there is significant Angolan cultural feature, by which whole system of traditional medicine is influenced. In our study, the second largest number of use reports (49 URs) was for the use category of pregnancy/birth/puerperium disorders. There is significant focus given on the necessity of women to have many children, and to give births repeatedly. The socially accepted or even required age for first delivery is approximately 15 years, which makes Angola to be the country with the second highest adolescent fertility rate in the world (UN, 2012).

In our study, several herbalists mentioned that by the age of 20 years, if the woman does not yet give birth, the family will probably consider her to consult

traditional healer and start medication for the reason of infertility. The same treatment would be demanded by women who, after previous delivery, cannot conceive again for more than 2 years. Traditionally, the Angolan woman is respected mostly or even only as mother. We believe this to be the clear reason for high percentage of female gendered herbalists in our study, as the treatment of pregnant mothers and children is extremely common.

5.3. **Domestication and conservation status**

Because roots are the most frequent plant part used, and trees and shrubs are the most frequent habits of the local medicinal plants (69%), and the weather is not changing dramatically over the year, the seasonal availability is highly invariable and almost all species were cited to be accessible throughout the whole year. The herbal remedies were rarely stored in the form of dried plant material or ground dried root, more traditionally they are collected and used fresh.

Trees and shrubs were the mostly used habits in our study. Similar results were documented in Zimbabwe (Maroyi, 2011). In general, the prevalence of the use of trees and shrubs is explained the fact that they are rather available in every season (Albuquerque, 2006). All the plants from our study were gathered from the wild, while only one plant was observed to be commonly planted in the houses or house gardens: aloe species. There is prevailing belief that plants gathered from the wild are more effective than the planted species. This agrees with the findings of Bussmann (2006) in South Turkana, Kenya, Okello and Segawa (2007) in Uganda, and Simbo (2010) in Babungo and Cameroon and Musa *et al*. (2011) in Sudan and Ngarivhume *et al*. (2015) in Zimbabwe. The cultural significance of this gathering strategy can be strongly stressed by the fact that the gathering of wild plants is still not completely safe due to the presence of landmines in the examined areas of Bié province in Angola. Only a few species were mentioned to be planted near the houses, however usually not strictly for medicinal purposes. *Macrotyloma africanum* (Wilczek) Verdc,

Solumbanda (vernacular name) and *Aframomum* sp., were observed to be grown near households.

In this context, it might be mentioned that most of the herbalists did not wish to invite the researcher directly to their houses, however they were proud to present the flora in their farms and surroundings. Medicinal plants were not cultivated in their farms, however the herbalists possessed perfect knowledge of the surrounding environment. They knew where to find any wildly growing plants. The farms were all incorporated in the forest, in quite a large gathering distance, since the farms or the locations to collect medicinal plants were in all cases from 1 to 10 km distance from the house of the herbalist. No medicinal plants were collected near the houses, although some were observed to grow there.

The herbalists who did not own any farm, have gathered the medicinal plants in the forest. Those forests were Miombo woodlands of low altitude, usually maintained by continuous slash-and-burn practice. This was observed in Angola but also in other regions of Africa where local populations explore preferential vegetation types with lower wood densities, which takes less effort to clear for agriculture, and relied on areas with a heavier woody component only when the former are absent or the latter are degraded (Cabral *et al*., 2010). Most herbalists would also cut a part of the bark from the tree in order to present the tree to the researcher, to show the structure of the bark and the wood. This practice was also documented in the study of Zerbo *et al*. (2011) in Burkina Faso.

All herbalists had perfect knowledge of the place they went to collect their plants, and they were intimating it was due to the presence of land-mines. Consequently, they knew where they can go to collect the plant and in the case they saw a medical plant, even few steps away from the path, they would not collect it, at least not during the transect walk. The herbalist agreed that they would not collect any medicinal plants close to cemeteries or any sacred places.

The conservation status of the collected plants has been checked by consulting the IUCN Red List of Threatened Species (IUCN, 2014). Only 6 species were listed as the species of Least concern. The online Catalogue of Life website (Roskov, 2015), showed no further conservation issues on any of the reported plants. However, the fact that unsustainably harvested roots are the most commonly used parts in the

preparation of remedies, it suggests that the continuous collection of plants together with the land clearing practices may threaten local populations of plants in the future.

5.4. Root doctors

The roots are very important for the local healers, as they tend to describe and demonstrate a particular medical scent of the roots, and they characterise them as the only real medicine. Some of them are also calling themselves "root doctors". Sometimes, it was observed that the herbalist could fully recognize and distinguish the plants through seeing or even smelling the root, while not being sure when observing the part above ground. The dominant use of roots was reported in Zimbabwe (Maroyi, 2011), with over 60% roots used in traditional medicine, leaving behind leaves and other plant parts bellow 20%. A similar pattern was reported in South Africa (Semenya and Potgieter, 2013; Steenkamp, 2003; Mahwasane *et al*., 2013). Healers believe that the roots are more effective than any other plant part. Studies in other countries have shown that the roots have high concentrations of bioactive compounds (Kunwar *et al*., 2006).

Decoction was the most common way of preparation, with a plant part, usually root, prepared as a solvent. This is similar to the findings in traditional Zimbabwean medicine (Gelfand *et al*., 1985; Maroyi, 2011) and in the medicine of South Africa (York *et al*., 2011). Decoction was generally recommended to be drank continuously until the problem passed away.

5.5. The herbalists and the transmission of their knowledge

The herbalists were mostly small-scale farmers, only one of 10 herbalists claimed he can live only out of his incomes from medicinal practices. Another herbalist ceased to do the farming due to her old age and physical disability, however she used to farm in the past. During the application of the snowball method and prospective sampling, we faced the difficulty to distinguish who was a professional herbalist and who was not. Being a herbalist means to be acknowledged by the local society as a traditional healer, to be perceived to possess healing and spiritual power, and to be addressed by the local people with their health issues; however being herbalist is only a particular source of income for the individual. Being a small-scale farmer is of good added value for a herbalist, as they usually use the farm also as a territory to collect medicinal plants. Even herbalists living in Kuito, therefore in purely urban area, were living in suburbs and practising small-scale farming.

According to Bossard (1996), the herbalist in *Umbundu* society is perceived as separate from the others, situated rather in the world of immortals. This is supported by the fact that he is usually well known for the successes in the treatment in the community and even outside of it, and respected by the local chiefs (Bossard, 1987). Bossard also implies that the power of *Umbundu* traditional healers can reach beyond the medical field, as through the magical practices it necessarily reaches political level (Bossard, 1987).

Most of the herbalists did not share their knowledge with the local people.Yet they were members of the community, however with a slightly different status, as described by Bossard (1996). Hence, medicinal plant knowledge was in some level transmitted only vertically, as herbalists always kept certain essential secrets and know-hows. Besides, there were several common species known and discussed in the community. Those were said to be ”plants for women” by one of the interviewed herbalist, and after the inquiry from the part of the researcher, it was observed that some of the herbalists would not mention those commonly used species during the transect walk, as these are not of his business. The use of such species is transmitted also horizontally. Further study of those medicinal plants used by common people would probably be interesting.

8 out of 10 herbalists were keeping their practices secret, and they would share it only with selected family descendants or other few carefully selected individuals. One herbalist mentioned he would never reveal the secret of the medicinal plants he uses even to his wife. That can be also the reason of high percentage of plant species cited only once. Likewise, the herbalists claim that part of their knowledge comes from dreams. It is therefore very individual. Nevertheless, the basis of their knowledge was always claimed to be obtained from the older herbalist.

5.6. The local names of plants

Nouns and names in *Umbundu* and most of Bantu languages are composed of prefix and radical, common prefixes are Otchi-, Olo-, Ovi-, O- , On-, (Bossard, 1996). The variety of the vernacular names used for one plant species in our study can be partially explained by the linguistics of Bantu languages. Therefore names like *Filanganga* and *Olonganga* for the same plant can only signify different prefix used to the same radical, as in the case of *Chrysophyllum bangweolense* R.E.Fr. Another reason for the variety of vernacular names can be the fact that *Umbundu* and *Chokwe* people use different names for the plants, and the only exception to this rule was the commonly cited plant *Eyolo (Annona stenophylla*). Although different names were known for the plant, name *Eyolo* was quoted by all informants who cited this species. However, some of the herbalists knew and cited the names of plants also in the other local languages (*Umbundu* or *Chokwe* or other unspecified languages). The names of plants were mostly cited to have no other meanings, however *Eriosema affine* was cited once as *Calungajava*, while Calunga means God in *Umbundu* language. *Securidaca longipedunculata* was once cited as *Onganga*, while Bossard (1996) translates this term as Sorcerel. *Laggera crispata* (Vahl) Hepper & J.R.I.Wood, which is named *Chipolela* in our study, was cited to be named from the name of the river Tchignigni. The same species was also cited with the vernacular name Upu, which was said to mean “In Noah times, Korugu animal could not fly”. The plant with the

vernacular name *Eliminambomue*, identified to belong to the Fabaceae family, was quoted to mean "cattle teeth". Bambi is the *Umbundu* name of antelope or gazelle and it was also part of a few names of plants, *Rhynchosia minima (*L.) DC is named *Kunambambi*. *Albizia antunesiana*, with the vernacular name *Kakuata* was quoted to mean "wherever you go, you pay". No other meaning could be attributed to the vernacular names without further linguistic analyses.

5.7. Plants known in Kuito and Kuemba, by *Chokwe* and *Umbundu* ethnicities

People in Kuemba are dependent on the use of medicinal plants. Although there is one local hospital, it does not provide trustworthy care according to the common local opinion. In Kuito, the medical care in hospitals is perceived to be more credible, therefore in the area, it is recommended to travel from Kuemba to Kuito in case of any serious health problems. Consequently, people in Kuito are less dependent on the use of medicinal plants and with regard to the urban life style, they also visit hospitals (Golden, 2002). However, according to our observation, the herbalists living in the outskirts of Kuito, are frequently consulted too. The *Chokwe* people are said to have had a long association with the forest, throughout the hunting and gathering practices, and they are therefore described to be the experts in traditional medical plant knowledge in the area compared to *Umbundu* people. This does not have much support in the literature, however Bossard (1996) concluded in his study, that *Umbundu* people are less bound to traditional knowledge and traditional medicine than other ethnicities he studied. In our research, among the people who did the traditional medicine in the area, the number of *Umbundu* and *Chokwe* people was equal.

When local people have been briefly interviewed about the medicinal plants they know, there was an apparent difference between the knowledge of local people from Kuito and Kuemba. In Kuemba, young people unrelated to the herbalist could easily

mention a few medicinal species together with their use, however in Kuito, only people with a familiar relationship to the herbalist knew something about traditional medicine. We have met two particularly knowledgeable people of very young age (under 20) in the area, one male in Kuito and one female in Kuemba, both were the descendants of the herbalists and both were invited for our transect walk by the herbalist in order to learn more about the use of medicinal plants.

Most of the plants used were used in common with Kuemba in Kuito or in *Umbundu* and *Chokwe* ethnicities and 19 plants were used commonly by all examined groups. Those were: *Albizia antunesiana, Albizia adianthifolia, Annona stenophylla, Chrysophyllum bangweolense, Cissampelos mucronata, Diodia* sp., *Eriosema affine, Garcinia huillensis, Gymnema sylvestre, Holostylon robustum, Laggera crispate, Brackenridgea arenaria, Psorospermum febrifugum, Rhynchosia minima, Sclerocroton cornutus, Securidaca longipedunculata, Strychnos cocculoides, Syzygium cordatum* and *Xylopia* sp..

The comparison through Sørensen similarity index indicates the knowledge is a little more consistent within the ethnicities than within the localities, although the difference is not of high significance. In general, local people would say that people from Kuemba and people from *Chokwe* ethnicity are more knowledgeable than people from Kuito and people from *Umbundu* ethnicity. Although the number of species cited in Kuemba or by *Chokwe* people was slightly above, the difference was not outstanding. This would suggest that there is no stronger decrease in traditional knowledge in urban areas with westernised medical centres and hospitals, than in the rural area, which does not have any proper access to institutionalized medical care.

However, the additional explanation can be reasoned by the fact that people in Kuito were far more opened to share their knowledge either with the researcher, other herbalists or local people. Therefore the transmission of their knowledge could be easier than in Kuemba, where sharing information on the use of medicinal plants was almost unthinkable. People from Kuito were also more frequently sharing information about magical use of the plants with the researcher, which can paradoxically suggest the descending tendency of their belief in the spiritual powers of medicinal plants. The loss of this belief could be eventually first step to abandon the traditional practices and knowledge (Carruthers, 1998).

5.8. Medicinal plant species diversity

There are 16 different species represented in the most frequently used family of Fabaceae. *Eriosema affine* De Wild is represented 9 times*, Albizia antunesiana* 7 times, *Albizia adianthifolia* 6 times, *Rhynchosia minima*, 5 times, *Aeschynomene dimidiata* Baker 4 times. The family was 19 times used for the category of gastro-intestinal disorders. Surprisingly, 3 different species of this family were cited as a treatment for weak legs for either children or adults (*Rhynchosia minima, Mucuna stans* Baker, *Afzelia quanzensis* Welw.).

Fabaceae was also the most represented family (or among) in the studies from South Africa (Mahwasane *et al*., 2013; Semenya and Maroyi, 2012; Afolayan *et al*., 2013; Olorunnisola and Afolayan, 2011; Bisi-Johnson, 2010) and in Ethiopia (Lulekal *et al*., 2013), in Turkey (Kaval, 2014), in India (Gairola, 2014), in Iran (Amiri, 2014) and in Brasil (Ribeiro *et al*., 2014). A majority of the plants from a study area in Pakistan belonged to the Fabaceae (Ullah *et al*., 2014). Less, but significanly represented in Kenya (Gukuya *et al.,* 2013), in Turkey (Sargin *et al*., 2013) and in Iran (Ghasemi and Tardit, 2013). Fabaceae is also one of the most representative family in European ethnoveterinary medicine (Mayer, 2014).

Compared to the rest of well represented families, Polygalaceae, Annonaceae and other families are among the highly cited families because they are represented by 4 or less very frequently used species.

In our study, 29 species or genera were cited only by 1 herbalist, 39 species or genera were cited by 2 or more herbalists. Out of those 39 species and genera that were reported more than once, *Scleria induta*, *Vernonia britteniana*, *Oxygonum pachybasis* Milne-Redh and *Droogmansia dorae*, *Brachystegia gossweileri* Burtt Davy & Hutch and *Aeschynomene dimidiate* and *Searsia squalida* Meikle were not cited in any literature resources and appear to be reported for the first time as medicinal species. *Scleria induta* was cited in 3 categories, gastro-intestinal, genitourinary and pregnancy/birth/puerperium disorders. *Vernonia brittaniana* was cited in the category of pregnancy/birth/puerperium and genitourinary disorders and *Oxygonum pachybasis* in the category of gastro-intestinal disorders, pregnancy/birth/puerperium and infections – infestations and *Searsia squalida* cited

in the category of genitourinary disorders and pregnancy/birth/puerperium. *Droogmansia dorae* was cited for treatment of circulatory system disorders and injuries. Except *Vernonia britteniana*, those plants didn't show significant agreement of informants on their use.

Species that were cited only once in our study and their use as medicinal plants cannot be supported by any literature resources are the following *Indigofera sutherlandoides* Baker, *Landolphia camptoloba* (K.Schum.) Pichon, *Lantana angolensis* Moldenke, *Macrotyloma africanum* and *Pentanisia rubricaulis* (K.Schum.) Kårehed & B.Bremer. However, in the genus level, the majority of those plants are also used as medicinally informant plants. On the other hand, the rest of the 30 species or genera that have been cited only once in our study were confirmed to be used as medicinal plants in other countries in the internationally published literature resources, as some of them will be mentioned in the text bellow.

To our knowledge, 32 out of 68 plants identified in our study were subjected to phytochemical research to date. There are several plant species that has significant cultural value index, fidelity level or informant agreement ratio in our study, which have not been subjected to further analyses. Those are *Aeschynomene dimidiata*, cited twice in our study for the treatment of elephantiasis and twice as a treatment of stomach pain. This plant did not previously appear in any publication, however it appears to be present only in Angola and Zaire, the two countries with scarcity of ethnobotanical researches (Roskov, 2015). *Chrysophyllum bangweolense* which was cited in our study mostly as a treatment of malaria, as appetite stimulant, and as a treatment of constipation or worms, was cited to be treatment for diarrhoea in Tanzania (Ruffo, 1991). *Eriosema affine*, cited by 6 herbalists in our study, with 57% FL index as the treatment of Malaria, has not been previously cited in any international resources except the study of Bossard (1996) from Angola, where it was reported to prevent abortion and nightmares. This plant appears to be an important species in traditional medicine of Bié province. *Holostylon robustum*, previously only documented as a treatment of tuberculosis and cough in Angola by Bossard (1996) was once reported as magical plant that cures everything in our study. Otherwise, it was reported mostly for treatment of gastro-intestinal system disorders and treatment of wounds and impotence. *Clitoria kaessneri* was cited twice as a treatment

of malaria and reached 100% FL. This species can be found only in southern Africa. *Lippia plicata* Baker, reported in our study to treat a sore throat with 75% FL, was only reported to be used for treatment of coughs in Tanzania (Quattrocchi, 2012) and to be eaten by chimpanzees, presumably for medicinal reasons (Huffman, 1996; Takasaki and Hunt, 1987). *Scleria induta*, not previously reported in any study, was cited as a treatment of dysmenorrhea, impotence and lack of appetite in our study. *Uapaca benguelensis* reported with value 1 of IAR by 2 herbalists as a treatment of stomach pain and diarrhoea was previously cited by Quatrocchi (2012) as an emetic, leaf sap used for subcutaneous parasitic infection in Africa. Locally important species, *Vernonia britteniana,* previously not reported in any study, although medical potential of the genus *Vernonia* has been stated and assumed by a study (Toyang and Verpoorte, 2013). *Vernonia britteniana* was reported as a treatment of dysmenorrhea, genitals after labour, or in case of skin inflammation on genitals with 66% of FL and value 1 of IAR, and therefore is an important medicinal species highly suitable for further phytochemical analyses. *Psorospermum febrifugum* was cited in our study as a treatment for elephantiasis with 100% FL. Although this species was previously screened and proved to have anticancer activity (Meyer *et al*., 1982, Abou-shoer et. al., 1988), the screening for the possible treatment of elephantiasis would be desired.

5.9. Informant consensus and agreement

In our study, the highest informant consensus was counted for gastro-intestinal disorders and infections and infestations category. Those are 2 of 3 most reported categories, therefore from our study it can be concluded that where more uses were reported in the category, the consensus of informants increased. Accordingly, there is a suggestion of well-developed knowledge in those categories.

The categories with zero ICF are the categories with least citations. The consensus was above 0.4 in the categories genitourinary, pregnancy/birth/perpeutetium and respiratory and throat disorders, where the numbers of citations were also among the 4 most cited categories. On the other hand, skeleto-muscular and neurological

disorders had informant consensus rather small, although the number of citations was not neglectable. The high disagreement on the plant use in certain categories can be attributed to the fact that herbalists in Bié province hardly share their knowledge, as they prevent economic loss of customers or they guard ancestry of spiritual secret. However, we have noticed that there were 2 familiar relationships (in total 2x2 siblings) between our informants, despite of the fact that it was never one of the siblings who informed us about the other herbalist in their family. The plants used by the two siblings were more similar in terms of the vernacular names than plants used by 2 different people, however the differences in the plant use were still prevailing among the siblings, this can be also explained through the fact that they were working in different localities.

However it can be assumed that the species cited by only one informant were usually identified as medicinal species with corresponding uses in other literature resources. This can support our our statement that the share of the knowledge in Bié province is not easily transmitable.

5.10. Medicinal plant use categories

5.10.1. Gastro-intestinal system disorders

Gastro-intestinal disorders have been documented as the most common category of ailment disorders with 84 use reports, where the prevailing problems are stomach pain and diarrhoea. This can be attributed to the situation in most African countries, where sanitation and difficult access to clean water is common. Africa as a continent is not on track for meeting the MDG sanitation target, while only 38% of the population is covered with improved sanitation. Over 10 million people live without an improved sanitation in Angola (WHO, 2008). In Angolan rural areas this situation is even more deepened, as rural areas remain far behind urban area in terms of

access to sanitary services. Therefore while 56% of people live with improved sanitation in urban areas, only 16% of people have improved sanitation in rural areas, where even open defecation is still very common (75%) (WHO, 2008). Difficulty accessing rural areas due to dilapidated roads and the slow process of clearing mines leftover from the Angolan Civil War further constrain sanitary improvements (USAID, 2012).

Annona stenophylla subsp. Nana was the most popular plant to release stomach pain, followed by *Albizia adianthifolia* used to treat various kinds of gastro-intestinal sickness. Both of those plants are very common in their natural habitat. *Eriosema affine* De Wild, *Erythrina abyssinica*, *Garcinia huillensis* Welw., *Gymnema sylvestre* (Retz.) R.Br. ex Sm., *Holostylon robustum* (Hiern) G.Taylor were equally cited at least 3 times for problems concerning constipation, stomach pain and diarrhoea. Interestingly, in this category, 10 species were reported to be used as a medicine for children.

Beside the other various specific uses, *Annona stenophylla* subsp. *cuneata* (Oliv.); subsp. *Nana* (Exell) N.Robson is frequently used in Africa for the treatment of gastro-intestinal diseases, its traditional uses include mainly treatment of stomach pains (Munodawafa, 2013). Infusion of *Annona stenophylla* root or bark is used to treat stomach pains, constipation and diarrhoea in Zimbabwe (Gelfand *et al.,* 1985). It has been reported to have antiparasitic, antiinfective, antiviral, antioxidant and antidiabetic activities (Gelfand *et al*., 1985; Taderera *et al*., 2015).

Albizia adianthifolia (Schum.) W.Wight is a commonly used medicinal plant in Africa, however its uses are of various categories, while the gastro-intestinal uses are not prevailing. Nevertheless, the decoction of stem bark is drunk in the treatment of stomach pains in Cameroon (Tamokou, 2012). The root extracts of *Albizia adianthifolia* showed antibacterial, anti-inflammatory and anticholinesterase effects (Eldeen *et al.,* 2005) and it is used as enemas in Africa (Cunningham *et al*., 1993). It is only mentioned in unpublished resources that the extract from the bark is used to cure internal parasites in South Africa (Wildcard, 2010) . In our study, *Alibizia adianthifolia* achieved 100% fidelity level for the treatment of diarrhoea.

To our knowledge*, Eriosema affine*, *Erythrina abyssinica*, *Gymnema sylvestre* and *Holostylon Robustum* have not been previously cited as medicinal species treating

gastro-intestinal problems. *Erythrina abyssinica* obtained 100% FL for treatment of children stomach pain and *Gymnema sylvestre* 60% FL for the treatment of stomach pain.

On the other hand, *Garcinia huillensis* was among the plants cited the most as a treatment of diarrhoea in Congo (Bitsindou *et al*. 1996). *Garcinia huillensis* was screened for cytotoxicity and it was found that the damnacathal has potent preferential toxicity against human pancreatic cancer (Dibwe *et al,* 2012).
Diplorhynchus condylocarpon obtained 100% FL. It is widely used to treat indigestion, diarrhoea in Africa (Adebooye, 2004). In Tanzania, the root decoction is used to treat rectal prolapse. In Malawi a leaf infusion is used to treat stomach problems. Root powder is used with food to treat anorexia and in porridge to treat pain in the digestive tract (Schmelzer and Gurib-Fakim, 2008).

5.10.2. Pregnancy/birth/puerperium disorders

The second most commonly treated category in our study was pregnancy/birth/puerperium with 49 use reports. This is very obvious in Bié province in Angola, where the culture relates to women's fertility, early age of first birth and repeated pregnancies throughout the life. While good Angolan women would be pregnant, giving birth, and breast-feeding most of her fertile age, child and maternal mortality rates are among the highest in the world, with almost one child in five not surviving to age five, while maternal mortality is 610 per 100,000 live births (UN, 2012). Total birth rate is 6.5 children per women. The cultural value of having numerous children and birth is supported by the fact that women without children are of no value in Angolan common speech. Women in Angola also describe themselves as uncommonly fertile. In our study, there were 8 use reports for 6 species of medicinal uses totreat women infertility, while there was small agreement on the species used and their use had not been supported in any internationally published resources.

Additionally, there were 8 use reports for using medicinal plants to provoke abortion, while it is suspected that most of herbalists would not even share information on abortive plants, according to Bossard (1996), the herbalists say "we are here to heal not to take life away" and we have heard this quotation repeatedly from the herbalists during our interviews. Abortion was usually not pronounced but described by other worlds, as for example "baby will clean" or "pregnant woman drinks it and the blood comes in few days" etc. The plant that was cited four times for abortion or early (post) prevention of pregnancy was *Annona stenophylla* subsp. cuneata (Oliv.); subsp. Nana (Exell) N.Robson, however its use was not documented in any other published resources.

The most cited ailment in the category was pain during pregnancy, while the genus Albizia was the most commonly cited for the treatment of pain, *Albizia adianthifolia* and *Albizia antunesian*a, both 2 times. This does not have direct support in other resources, however, it was reported that the roots of *Albizia antunesiana* are widely used in tropical Africa to treat stomach pains, infertility in women, painful and swollen legs and to prevent abortion (Maroyi, 2013). The use of *Sclerocroton cornutus* (Pax) Kruijt & Roebers can be supported in the research from DR Congo, the root bark, crushed in water, is taken to facilitate childbirth, as it contracts the uterine muscles (Schmelzer and Gurib-Fakim, 2008). In our study it was documented that *Sclerocroton cornutus* helps with the contracts of the uterine muscles, however it was only cited a single time. Use of *Cissampelos mucronata* was cited twice in our study. It can be confirmed by other resources that this species is used to provoke the birth in Africa (Schmelzer and Gurib-Fakim, 2008).

The highest fidelity level in this category was for *Rhynchosia minima*. It reached 60% as a treatment in case of new pregnancy soon after previous birth. The decoction of the root is drunk by both mother and child to get stronger. This use is not supported by internationally published resources. Moreover, *Rhynchosia minima* leaves are used as abortifacient in India (Khare, 2007). Fruits of *Bobgunnia madagascariensis (*Desv.) J.H.Kirkbr. & Wiersema were cited as a disinfection of womb and genitals after labour, and this use can be confirmed as a infusion of bark has been reported as used to clean cuts and warm root was reported to cure veneral diseases and as a disinfection of wounds (Mojeremane, 2012; Lemmens *et al.,* 2012).

In this category, medicinal plants are also used to cure haemorrhoids after giving birth, to turn the baby in the womb before labour or as a cleansing treatment for womb after the labour.The use of other medicinal plants in this category does not meet much agreement within informants and within published studies. It can be attributed to the fact that many of those treatments are rather of ritual or spiritual character. On the other hand, the knowledge in this field is presumably well developed in Angola due to the high cultural focus on fertility and it can therefore be of high value.

5.10.3. Infections-infestations

The category that had the third largest number of use reports was the category of infections and infestations (37 use reports). The most common diseases in this category were malaria (cited 14 times), followed by elephantiasis (cited 9 times) and worms (cited 8 times). Other diseases treated were hepatitis (cited 4 times) and yellow fever (cited 4 times).

As for treatment of elephantiasis, there was high informant consensus on the use of *Psorospermum febrifugum,* which reached 100% FL. This use does not have a direct support in the published literature, however it was said that the claims on *Psorospermum febrifugum* have a special merit (Moshi, 2006). The species was primarily associated with malaria treatment in previous studies in Angola (Van-Dúnem and Bathala, 1994; Bossard 1996). The plant is used for the treatment of cancerous wounds, which was supported by the results of tests carried out using cancer cell lines and the subsequent isolation of an active compound (Abou-shoer et. al., 1988, Meyer *et al.,* 1982).

Aeschynomene dimidiata, although it was cited twice in our study for the treatment of elephantiasis, did not show any medicinal use throughout the further research in published literature and it appears to have been previously documented only in Angola and Zaire (Roskov, 2015).

The most common disease in this category was malaria. In 2012 approximately 207 million cases of malaria occurred globally with most cases (80%)

and deaths (90%) occurring in Africa. Most deaths (77%) occur in children under the age of five (WHO, 2014). Malaria is endemic in most areas of the Angolan territory, with *Plasmodium falciparum* as the predominant infecting species (WHO, 2005).

Eriosema affine was cited 4 times for the treatment of malaria and reached 57% FL, however its medicinal use cannot be supported by any other published resources, except the particular note from the previous study in Angola where this plant species helps from nightmares and prevents abortion (Bossard, 1996).

Clitoria kaessneri was cited twice as a treatment of malaria and reached 100% FL. *Clitoria kaessneri* is endemic for South Africa, distributed in Angola, Zambia and Southern Zaire (Fantz, 1977) and there is no support in literature resources on the medicinal use of this species. However, genus *Clitoria* is used for the treatment of various diseases, including fevers (Fantz, 1977*).*

Securidaca longipedunculata was reported twice for the treatment of malaria and it was also reported to cure malaria in Congo (Dibwe *et al*., 2012). Extracts from *Securidaca longipedunculata* have shown activity against a variety of microorganisms, as bacteria (Pallant and Steencamp, 2008; Maiga *et al*., 2005), fungi, viruses and protozoa (Maiga *et al.,* 2005). There are suggestions that extracts of *S. longepedunculata* have prospects in the treatment of malaria (Meyer *et al.,* 2008; Maiga *et al.,* 2005; Atawoli *et al,.* 2003; Rakuambo *et al*. 2004; Adiele *et al.* 2013).

Aframomum sp., was cited only once in this category, however it was stressed to be a very important species to cure yellow fever. There is no evidence of such use in the literature. Acording to Ayimele *et al.* (2014), the seeds of contain essential oils able to arrest development of the intraerythrocytic stages of the malaria parasite (Ayimele *et al*., 2004).

Bobgugnnia madagascariensis was also cited only once in this category, as a treatment of malaria and it can be confirmed by the study from Namibia, since Ovambo people use this species for treatment of malaria (Mojeremane, 2012). However, in many areas it is believed to be a poisonous species (Lemmens *et al.,* 2012) and therefore its oral ingestion may not be completely safe.

5.10.4. Genitourinary disorders

The group of genitourinary disorders was cited in 23 use reports. 10 use reports were for the treatment of impotence or empowerment of men's sexual performance. One species was cited as aphrodisiac, 7 plant species were cited for the treatment of dysmenorrhea or prolonged menstruation and 5 for the boils on genitals. *Garcinia huillensis* was cited twice as a treatment of impotence. There is no reference to such use of this species, however in Congolese medicine, *Garcinia huillensis* was reported to cure venereal diseases (Dibwe *et al*., 2012). *Vernonia britteniana* was cited twice for venereal diseases with 66% FL. Medical potential of the genus *Vernonia* has been stated and assumed by a study (Toyang and Verpoorte, 2013). *Vernonia amygdalina* was proven to have contractile effects on uterine myometrial cells as well as analgesic, diuretic, and febrifuge potentials (Attah *et al*., 2012). *Cissampelos mucronata* which was cited only once in our study as a treatment of genitals, and it was reported also in published literature as widely used in the tropics and subtropics to manage various ailments including venereal diseases (Kidane, 2014).

5.10.5. Neurological disorders

In the category of neurological diseases there was 10 reports concerning headache, 4 medicinal treatments for insomnia, 2 reports were on the use to treat madness or 2 to calm children from crying, 2 uses were for epilepsia and 2 for anemia celebral. *Paropsia brazzaeana* was cited 3 times in this category, however for different particular treatment (headache, insomnia and baby crying too much). It is cited in the literature resources that fruit juice of *Paropsia brazzaeana* is taken to treat headaches (Porta, 2008). *Vitex madiensis* Oliv. (cf) was cited only once as a treatment of headache, however it can be confirmed in the international literature, since the roots and aerial parts of the species are used for medicinal purposes against headaches (Hutchison and Dalziel, 1963; Kerharo and Adam, 1974; Mapongmetse,

2006). *Laggera crispeata* was cited as a treatment of madness in our study with no correspondances in literature.

5.10.6. Respiratory and throat disorders

Respiratory and throat diseases were mostly represented by the species that could treat cough (9 reports), followed by the treatments for sore throat (7 reports), tuberculosis, asthma and repeated respiratory sicknesses.

Lippia plicata Baker reached 77% FL for the treatment of sore throat, however through research in literature it appears that its roots are reported to be drank for stopping coughs in Tanzania (Quatrocchi, 2012). It was also reported to be swallowed by chimpanzees, presumably for antiparasitic or medicinal function (Huffman, 1996, Takasaki *et al*, 1987). *Securidaca longipedunculata* was reported 3 times for the treatment of sore throat. In Congo, it was reported to cure coughs (Dibwe *et al*., 2012). *Paropsia brazzaeana* was twice reported for the treatment of cough, however there is no support in literature for this use of this species. Although *Burkea africana* Hook. was reported only once to treat cough, bark decoctions or infusions are used to treat fever, cough, catarrh and pneumonia in Africa (Schmelzer and Gurib-Fakim, 2008). *Englerophytum magalismontanum* (Sond.) T.D.Penn. was also once cited for the treatment of cough. Since it cannot be confirmed in literature, it was only found that it is used as a chewing stick in South Africa (Tshikalange *et al*., 2008).

5.10.7. Skeleto-muscular disorders

In the category of skeleto-muscular disorders, the most common health problem was rheumatism. Although there was no agreement within our respondents on te use of plants in this category, *Syzygium cordatum* Hochst. ex Krauss was cited as a treatment of rheumatism in our study and it has been also quoted as South African

medicinal plant with potential for the prevention of rheumatoid arthritis (Cock, 2014, Vuuren 2014). Another treatment for rheumatism, the plant identified only to the genus level, *Aframomum* sp. can be partially affirmed by the use *Aframomum melegueta* for rheumatism in Ghana (Dokosi, 1998; Enti 1998). In this category *Garcinia huillensis* was cited twice, once with a note of special importance, as a species that cures pain in columna vertebral. However this has no support in other published studies. *Mucuna stans* was cited once as a medicament that gives strength to legs, while the related species *Mucuna poggei* Taub*.* is used in Togo, where root decoction is used as a wash to treat paralysis of the legs (Jansen, 2006). *Smilax anceps* Willd. was also documented to be used for rheumatism in another study (Soladoye *et al.*, 2013), although in our study it has been cited only once in this category for the treatment of not descended laryngeal prominence in children.

Although the category of skeleto-muscular disorders had no informant agreement in the level of species used, through the research in international literature resources, some of the medicinal uses might be approved.

5.10.8. Skin disorders

The most common medicinal use in the category of skin disorders was balm, cited 8 times. Only one use mentioned balm for lips, 7 use reports were for balm for the body. This was 2 times reasoned by the fact that black skin needs much more hydratation.

Afzelia quanzensis showed 66% FL as a balm for legs and although the use can not be supported by literature, it can be interesting that this balm is used only for legs, as a basic poison was found in the root by a government chemist in Dar es Salaam. It has been reported that people have been killed by ingesting the roots (Hines and Heckman, 1993), therefore it could be problematic to apply *Afzelia quanzensis* closer to the face. However, It was also proven that its extract contains compounds with therapeutic antifungal potential against *Candida albicans* (Steenkamp, 2007), which can theoretically justify the use on legs. *Brackenridgea*

arenaria (De Wild. & T. Durand) N. Robson, endemic to Africa, was cited as a balm for lips and reached 66% FL.. There is no evidence of use of *Brackenridgea arenaria* as a medicinal plant, however the related and rare species *Brackenridgea zanguebarica* is cited as the most wanted medicinal tree in Limpopo Province in South Africa (Netshiungani and Van Wyk, 1980), mostly used for magical purposes. However, there is no evidence on the use of *Brackenridgea* spp. as a balm in international literature resources.

7 use reports were for skin inflammation, while *Securidaca longipedunculata* was cited 3 times as balm or anti inflammatory and can be affirmed by the use in Congo, it was reported to cure inflammation (Dibwe *et al*., 2012). Root extract of this plant have shown remarkable anti-inflammatory benefits (Ojewole, 2005, Muanda, 2011). *Gymnema sylvestre* was reported only once as skin balm, however it was also reported to treat skin infections and inflammations in Nigeria (Kang *et al*., 2012).

5.10.9. Injuries

It can be surprising that there were a little use reports in the category of injuries. Beside the official statistics of morbidity in Angola, it is well known in the area that many deaths happen on the road and around the road in form of motor car and car accidents. Besides, there was an unfortunate period of high frequency of injuries caused by landmines, and those injuries occur up to the present day (UNDP, 2012). 5 use reports were done on the treatment of wounds. *Securidaca longipedunculata* was cited twice to treat wounds. *Droogmansia dorae* which has been reported to treat broken bones after the landmines, was cited only once and has not been approved by literature resources. *Holostylon robustum* was mentioned as a treatment of wounds in our study. It appears that this species was previously observed as medicinal species only in Angola by Bossard (1996), who mentioned it as a part of treatment of cough and tuberculosis. The plant identified only down to the genus level, *Ocimum* sp. was mentioned as a treatment of fractures of legs and legs harmed by land-mines. This can be supported by the number of citations on the species *Ocimum sanctum*

Linn, which is used and also pharmaceutically examined for various kinds of diseases, including injuries and it has also been suggested to possess antifungal, antimicrobial and analgesic actions (Prakash and Gupta, 2005).

5.10.10. Blood system disorders

In the category of blood system disorders there were prevailing citations (5 citations) on the epistaxis, anemia or blood flowing from the ears. In this category, there was no informant agreement on the use of species neither within the local herbalist, neither with other literature resources. *Strychnos cocculoides* Baker, which is widely used medicinal plant for various disorders, was first reported for treatment of anemia.

5.10.11. Circulatory system disorders

In the category of circulatory system disorders, the prevailing citations were on haemorrhoids (5 use reports) and pain in heart. There was no informant agreement on the use of medication for haemorrhoid, and there were no affirmations in the literature too. Xylopia was identified only to the genus level and reported as a treatment of pain in heart, while *Xylopia aethiopica* is used as treatment for any kind of pain, notably in chest and ribs and pain in the nerves in Liberia (Iwu *et al*., 1999).

5.10.12. Dental disorders

In the least cited category of dental disorders, genus *Phyllanthus* was cited once as a remedy to treat toothache in our study and it can be found also in the study

from Niger, where *Phyllanthus* species are used as a sure treatment for toothache (Blessing, 2007). Furthermore, the alkaloid contents in *Phyllanthus* is used as a treatment of toothache, in Nigeria (Mensah *et al*., 1988, Keay, 1989). *Phyllanthus amarus* is also used as a treatment of toothache in Nigeria (Awomukwu *et al.,* 2014). Diodia, also identified only to the genus level, which has been equally cited once, affirms to be used for toothache in Africa (Quattrocchi, 2012).

5.10.13. Other health disorders

In the category others, *Sclerocroton cornutus* was reported twice to treat snakebites and it can be confirmed through literature, as it is reported to treat insect and snakebite in Africa (Iwu, 2014). *Holostylon robustum* and *Englerophytum magalismontanum* were reported to cure everything, while this is probably attributed to a magical belief. *Brachystegia gossweileri* was reported to bring good luck. Genus Rytigynia was reported to bring good luck over the cursed person. *Afzelia quanzensis* was twice reported purely as "fetisso", apparently for its poisonous characteristics, since basic poison was found in the root by a government chemist in Dar es Salaam. It has been reported that people have been killed by ingesting the roots (Hines *et al*., 1993). It is supposed that most of the herbalists did not share much information about magical use of plants during the guided walks with the researcher.

6. Conclusion

Our study has documented 56 plant species distributed among 54 genera and 30 botanical families in Bié province, Angola. The amount of medicinal plants used for the variety of ailments reflects the rich ethnomedicinal. The preservation of this knowledge appears to be particularly secured due to the continuing reliance of the local people on primary healthcare ensured by the medicinal plants resources and traditional healers. The belief in spiritual and medicinal effects of the wild plants is extremely high in Bié province in Angola, however some patterns of the use slightly differ in urban and in distanced rural area, and those could eventually be signals of the upcoming change in the traditional use of medicinal plants.

The collection of certain botanical families and species correspond with other studies conducted in Subsaharan Africa, notably in southern African countries, where especially the Fabaceae family being the most prevalently used and the species *Securidaca longipedunculata, Garcinia huillensis, Annona stenophylla, Afzelia quanzensis, Strychnos cocculoides* or *Eriosema affine* are the important medicinal plant species. The review of pharmaceutical importance of medicinal plants used in the Bié province in Angola as well as the documented indigenous medicinal practices can contribute to the national or local drug development as well as to the increased understanding and maintenance of biological resources and their ecological value.

All species in this study were collected from the wild, while only a small number of species was documented to be also planted near households. However, almost all plant species were gathered in great distance from human habitats. Since the roots were the plant parts mostly used (70%) and collection from the wilderness is extremely prevailing in Bié province in Angola, the risk of loss of plant resources is increased in the area, where the land clearing is common.

The results of this study suggest that there is a need for validation of several locally valuable species for their efficacy. Those could be *Aeschynomene dimidiata*, *Chrysophyllum bangweolense*, *Eriosema affine*, *Holostylon robustum*, *Clitoria kaessneri*, *Lippia plicata*, *Scleria induta*, *Uapaca benguelensis*, *Vernonia britteniana, Psorospermum febrifugum*, *Oxygonum pachybasis*, *Droogmansia dorae, Searsia*

Squalida or *Brachystegia gossweileri*. Further study is urgently needed to document the knowledge of medicinal plants in Angola together with its spiritual richness.

The people in the Bié province in Angola are the owners of the knowledge in this paper and any benefits that should arise from their knowledge should be shared with them.

References:

Abou-Shoer M., Boettne FE, Chang C, Cassady JM. 1988. Antitumour and cytotoxic xanthones of *Psorospermum febrifugum*. Phytochemistry 27: 2795-2800.

Adebooye OC. 2004.Resources of Tropical Africa 2: Vegetables. Leiden, Netherlands: PROTA Foundation. 568p.

Adiele RC, Fakae BB, Isuzu IU. 2013. Anthelmintic activity of *Securidaca longepedunculata* (Family: Polygalaceae) root extract in mice, in vitro and in vivo. Asian Pacific Journal of Tropical Medicine 27: 841-846.

Afolayann AJ, Grierson DS, Mbeng WO. 2014. Ethnobotanical survey of medicinal plants used in the management of skin disorders among the Xhosa communities of the Amathole District, Eastern Cape, South Africa. Journal of Ethnopharmacology 153: 220-232.

Albuquerque UP. 2006. Re-examining hypotheses concerning the use and knowledge of medicinal plants: a study in the Caatinga vegetation of NE Brazil. Journal of Ethnobiology and Ethnomedicine 2: 30-41.

Amiri MS, Joharchi MR, Taghavizadehyazdi ME. 2014. Ethno-medicinal plants used to cure jaundice by traditional healers of Mashhad, Iran. Iranian Journal of Medicinal Science 13: 157-62.

Antwi-Baffour SS, Bello AI, Adjei DN, Mahmood SA, Ayeh-Kumi PF. 2014 . The place of traditional medicine in the African society: the science, acceptance and support. American Journal of Health Research 2: 49-54.

Airy-Shaw HK. 1947. The vegetation of Angola. Journal of Ecology 35: 24–48.

Atawoli SE, Bulus T, Ibrahim S, Ameh DA, Nok AJ, Mamman M. 2003. In vitro trypanocidal effect of methanolic extract of some Nigerian savannah plants. African Journal of Biotechnology 2: 317-321.

Attah AF, O´Brian M, Koehbach J, Sonibare MA, Moody JO, Smith TH, Gruber CW. 2012. Uterine contractility of plants used to facilitate childbirth in Nigerian ethnomedicine. Journal of Ethnopharmacology. 143: 377-82.

Awomukwu D, Nyananyo BL, Onukwube ND, Uka CJ, Okeke CU, Ikpeama AI. 2014. Comparative Phytochemical Constituents and Pharmacognistic Importance of the Vegetative Organs of Some Phyllanthus Species in South Eastern Nigeria. International Journal of Modern Botany 4: 29-39.

Ayimele GA, Tane P, Connolly JD. 2004. Aulacocarpin A and B, nerolidol and b-sitosterol glucoside from *Aframomum escapum*. Biochemical Systematics and Ecology 32: 1205–1207.

Bekalo TH, Woodmatas SD, Woldemariam ZA. 2009. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, southern nations, nationalities and peoples regional state, Ethiopia. Journal of Ethnobiology and Ethnomedicine 5: 26–40.

Birkeland N. 2000. Forced migration and deslocados in the Huambo province, Angola. Norwegian Journal of Geography 54: 110-115.

Bisi-Johnson MA, Obi CL, Kambizi L, Nkomo M. 2010. A survey of indigenous herbal diarrhoeal remedies of O.R. Tambo district, Eastern Cape Province, South Africa. African Journal of Biotechnology 9: 1245-1254.

Bitsindou M. 1996. Enquêtes sur la phytothérapie traditionnelle à Kindamba et Odzala [PhD.] Bruxelles: Université Libre de Bruxelles. 152p.

Blessing OG. 2007. Significance and efficacy of medicinal plants in the Niger Delta. Continental Journal of Pharmaceutical Sciences 1: 23-29.

Bossard, E. 1987. La medicine traditionelle chez les Ovimbundu [BA.]. Neuchâtel, Suisse: Université de Neuchâtel. 108p.

Bossard E. 1993. Angolan medicinal plants used also as piscicides and/or soaps. Journal of ethnopharmacology 40:1-19.

Bossard, E. 1996, La medicine traditionnelle au centre et a l'ouest de l'Angola. Lisboa: Instituto de Investigação Científica Tropical. 531p.

Bussmann RW. 2006 Ethnobotany of the Samburu of Mt. Nyiru, South Turkana, Kenya. Journal of Ethnobiology and Ethnomedicine, 2: 35-45.

Cabral AI, Vasconcelos MJ. Ooma D, Sardinha R. 2010. Spatial dynamics and quantification of deforestation in the central-plateau woodlands of Angola. Applied Geography 31: 1185-1193.

Catarino L, Martins ES, Abreu JA, Figueira R. 2013. Revision of the family Dipterocarpaceae in Angola. Blumea 57: 263–274.

Calixto JB, 2005. Twenty five years of research on medicinal plants in Latin America: a personal review. Journal of Ethnopharmacology 100: 131–134.

Carruthers M. 1998. The craft of thought. Mediation, rhetoric and the making of Images. Cambridge: Cambridge University Press. 456p.

Cheikhyouseff A, Shapi M, Matengu K, Ashekele HM. 2011. , Ethnobotanical study of indigenous knowledge on medicinal plant use by traditional healers in Oshikoto region, Namibia. Journal of Ethnobiology and Ethnomedicine 7: 10-19.

Chellappandian M, Mutheeswaran S, Pandikumar P, Duraipandiyan V, Ignacimuthu S. 2012. Quantitative Ethnobotany of Traditional Siddha Medical Practitioners from Radhapuram Taluk of Tirunelveli District, Tamil Nadu, India. Journal of Ethnopharmacology 143: 540–547.

Cock IE, van Vuuren SF. 2014. Anti-Proteus activity of some South African medicinal plants: their potential for the prevention of rheumatoid arthritis. Inflammopharmacology 22: 23-36.

Cook FEM. 1995. Economic Botany Data Collection Standard. Prepared for the International Working Group on Taxonomic Databases for Plant Sciences (TDWG). Kew: Royal Botanic Gardens. 146p.

Costa E, Martins T, Monteiro F. 2004. A checklist of Angolan grasses - Checklist das Poaceae de Angola. Southern African Botanical Diversity Network Report No. 28. Pretoria: SABONET. 42p.

Cunningham AB. 1988. Ethnobotany: Medicinal Plants and Their Conservation. Pietermaritzburg: University of Natal. 137p.

Cunningham AB. 1993. African medicinal plants: setting priorities at the interface between conservation and primary health care. People and Plants working paper 1. Paris. UNESCO.

Desanker PV, Frost PGH, Justice CO, Scholes RJ. 1997. Certification of products from Miombo: development of social criteria and indicators. IGBP Report 41. Bangor: Environmental Forestry. University College of North Wales. 109p.

Dey A, De NJ. 2012. Ethnobotanical Survey of Purulia District, West Bengal India for Medicinal Plants Used Against Gastrointestinal Disorders. Journal of Ethnopharmacology 143: 68–80.

Dibwe DF, Awale S, Kadota S, Tezuka Y. 2012. Damnacanthal from the Congolese medicinal plant *Garcinia huillensis* has a potent preferential cytotoxicity against human pancreatic cancer PANC-1 cells. Phytotherapy Research 26: 1920–1926.

Diserud OH, Ødegaard F. 2007. A multiple-site similarity measure, *Biology Letters* 3: 20–22.

Dokosi, OB. 1998. Herbs of Ghana. Accra: Ghana University Press. 538p.

Eldeen IMS, Elgorashi EE, Van Staden J. 2005. Antibacterial, antiinflammatory, anti-cholinesterase and mutagenic effects of extracts obtained from some trees used in South African traditional medicine. Journal of Ethnopharmacology 102: 457-464.

Enti AA. 1998. The Rejuvinating Plants of Tropical Africa. San Francisco: The North Scale Institute. 89p.

Fantz, P.R. 1977. A monograph of the genus *Clitoria* (Leguminosae:Glycineae). [PhD.]. University of Florida; Gainesville, Florida. 812p.

FAO, 2009. Monitorização e Avaliação de Recursos Florestais Nacionais de Angola – Guia para recolha de dados. Rome, Luanda: National Forest Monitoring and Assessment Working Paper, AVISO A série de estudos. 179p.

Figueiredo E, Smith GF. 2008. Plants of Angola. Pretoria: South African National Biodiversity Institute, Strelitzia 22. 292p.

Figueiredo E, Smith GF, César J. 2009. The flora of Angola: first record of diversity and endendemism. Taxon 58: 233-236.

Friedman J, Yaniv Z, Dafni A, Palewitch D. 1986. A Preliminary Classification of the Healing Potential of Medicinal plants, Based on a Rational Analysis of an Ethnopharmacological Field Survey among Bedouins in the Negev Desert, Israel. Journal of Ethnopharmacology 16: 275–287.

Gairola S, Sharma J, Bedi YS. 2014. A cross-cultural analysis of Jammu, Kashmir and Ladakh (India) medicinal plant use. Journal of Ethnopharmacology 155: 925-86.

Gakuya DW, Itonga SM, Mbaria JM, Muthee JK, Musau JK. 2013. Ethnobotanical survey of biopesticides and other medicinal plants traditionally used in Meru central district of Kenya.. Journal of Ethnopharmacology 145: 547-553.

Gelfand M, Mavi S, Drummond RB, Ndemera B. 1985. The Traditional Medical Practitioner in Zimbabwe: His principles of Practice and Pharmacopoeia (Zambeziana). Mambo Press, Gweru: Vol 17. 47p.

Ghasemi M, Tradit AJ. 2013. Ethnobotanical study of medicinal plants used by Kurd tribe in Dehloran and Abdanan districts, Ilam province, Iran. Complementary and Alternative Medicine 10: 368-385.

Golden M. 2002. A report into investigation of the recurrent epidemics of Pellagra in Kuito, Angola. Food and Nutrition Technical Assistance. Available at: http://www.eldis.org/vfile/upload/1/document/0708/DOC22297.pdf: Accessed 23-04-2015.

Gossweiler J. 1953. Plantas espontâneas e cultivadas pelos indígenas para efeitos de alimentação, in Anais V 10 Nº 3. Fasc.2, Lisboa: do Instituto de Medicina Tropical. 214p.

Gurib-Fakim A. 2006. Medicinal plants: Traditions of yesterday and drugs of tomorrow. Molecular Aspects of Medicine 27: 1-93.

Hammond-Tokke WD. 1975. The Bantu-Speaking Peoples of Southern Africa. Anthropos: 70: 965-967.

Hammond-Tokke WD. 1998. Selective Borrowing? The Posibility of San Shamanistic Influence on Southern Bantu Divination and Healing Practices. The South African Archaeological Bulletin 53: 9-15.

Heinrich M. 2000. Ethnobotany and its Role in Drug Development. Phytotherapy Research 14: 479– 488.

Heinrich M, Edwards S, Moerman ED, Leonti M. 2009. Ethnopharmacological Field Studies: A Critical Assessment of Their Conceptual Basis and Methods. Journal of Ethnopharmacology 124: 1–17.

Hill AF. 1989. Economic Botany: A text book of useful plants and plant products. New York: McGraw Hill Book Company. 538p.

Hines AD, Eckman K, 1993. Indigenous multipurpose trees of Tanzania: Uses and economic benefits for people. Ottawa: FAO. 276p.

Hui HY, Xu JC. 2000. Indigenous Knowledge: An Inexhaustible Information 'Bank' to Toxin Research. Toxicon 38: 745–746.

Huntley BJ, Matos EM . 1994. Botanical diversity and its conservation in Angola. Strelitzia 1: 53–74.

Huffman MA, Page JE, Sukhdeo MVK, Gotoh S, Kalunde MS. 1996. Leaf-swallowing by chimpanzees, a behavioral adaptation for the control of strongyle nematode infections. International Journal of Primatology 17:475-503.

Hutchison J, Dalziel JM. 1963. Flora of West Africa, 2nd ed., Crown Agent, London. UK. 2: 445-447.

IDMC. 2007. Former IDPs share the common challenge of recovery and reconstruction. Available at: http://www.internal-displacement.org/sub-saharan-africa/angola/2007/former-idps-share-the-common-challenge-of-recovery-and-reconstruction: Accessed 19-04-2015.

IUCN. 2014. The IUCN Red List of Threatened Species. Version 2014.3. Available at: http://www.iucnredlist.org: Accessed 19-04-2015.

Iwu MM, Duncan AR, Okunji CO. 1999. New Antimicrobials of plant origin. In Janick, J. (ed) Perspectives in New crops and New uses. Alexandria: ASHS Press. p457-462.

Iwu, MM. 2014. Handbook of African Medicinal Plants (2nd ed.) Boca Raton: CRC Press, 437p.

Jansen PCM. 2006. Mucuna poggei Taub. Record from Protabase. Wageningen, Netherlands: PROTA (Plant Resources of Tropical Africa). Available at: http://database.prota.org/dbtw-wpd/exec/dbtwpub.dll?ac=qbe_query&bu=http://database.prota.org/recherche.htm&tn=protab~1&qb0=and&qf0=Species+Code&qi0=Mucuna+poggei&rf=AfficherWeb: accessed 19-04-2015.

Kala CP. 2005. Current status of medicinal plants used by traditional Vaidyas in Uttaranchal state of India. Ethnobotanical Research Application 3:267-278.

Kang MH, Lee MS, Choi MK, Min KS, Shibamoto T. 2012. Hypoglycemic activity of *Gymnema sylvestre* extracts on oxidative stress and antioxidant status in diabetic rats. Journal of Agricultural and Food Chemistry 60: 2517–252.

Kassam KA, Karamkhudoeva M, Ruelle M, Baumflek M. 2010. Medicinal Plant Use and Health Sovereignty: Findings from the Tajik and Afghan Pamirs. Human Ecology 38: 817–829.

Kaval I, Behcet L, Cakilcioglu U. 2014. Ethnobotanical study on medicinal plants in Geçitli and its surrounding (Hakkari-Turkey). Journal of Ethnopharmacology 155: 171-184.

Keay RWJ. 1989. Trees of Nigeria. London: Oxford Science Publisher. 476p.

Kerharo J, Adam, JG. 1974. La Pharmacopée Sénégalaise traditionnelle: plantes médicinales et toxiques. Vigot Frères Paris. 11p.

Khare CP. 2007. Indian Medicinal Plants (An illustrated Dictionary). Delhi: Springer, Rajkamal electric press. 900p.

Kidane B, ven der Maesen LJ, Van Andel T, Asfaw Z. 2014. Ethnoveterinary medicinal plants used by the Maale and Ari ethnic communities in southern Ethiopia. Journal of Ethnopharmacology 153: 274-282.

King R, Homsy J. 1997. Involving traditional healers in AIDS education and counselling in sub-Saharan Africa: a review. AIDS: A Year in Review 97: 217–225.

Klopper RR, Matos S, Figueiredo E, Smith GF. 2009. Aloe in Angola (Asphodelaceae: Alooideae). Bothalia 39,1: 19–35.

Kunwar RM, Nepal BK, Kshhetri HB, Rai SK, Bussmann RW. 2006. Ethnomedicine in Himalaya: a case study from Dolpa, Humla, Jumla and Mustang districts of Nepal. Journal of Ethnobiology and Ethnomedicine 2:27-38.

Lemmens RHMJ, Louppe D, Amoako AA. 2012. Timbers 2, Plant Resources of Tropical Africa. Wageningen, Netherlands: Prota. 802p.

Lukwa N, Mutambu SL, Makaza N, Molgaard P, Furu P. 2001. Perceptions about malaria transmission and control using anti-malarial plants in Mola, Kariba, Zimbabwe. Nigerian Journal of Natural Products and Medicine 5: 4–7.

Lelukal E, Asfaw Z, Kelbessa E, Van Damme P. 2013. Ethnomedicinal study of plants used for human ailments in Ankober District, North Shewa Zone, Amhara Region, Ethiopia. Journal of Ethnobiology and Ethnomedicine 9: 63.

Magurran A. 2004. Measuring biological diversity. Oxford, UK: Blackwell Publishing. 186p.

Mahwasane ST, Middleton L, Boaduo N. 2013. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. South African Journal of Botany 88: 69–75.

Maiga A, Diallo D, Fane S, Sanogo R, Paulsen BS, Cisse B. 2005. A survey of toxic plants on the market in the district of Bamako, Mali: traditional knowledge compared with a literature search of modern pharmacology and toxicology. Journal of Ethnopharmacology 96: 183-193.

Mapongmetse PM. 2006. Domestication of *Vitex madiensis* in the Adamawa highlands of Cameroon: Phenology and propagation. Akdenz unverstes zraat fakultes dergs 19: 269-278.

Maroyi A. 2011. The gathering and consumption of wild edible plants in Nhema communal area, Midlands Province, Zimbabwe. Ecology of Food and Nutrition 50:506-525.

Maroyi A. 2013. Traditional use of medicinal plants in south-central Zimbabwe: review and perspectives. Journal of Ethnobiology and Ethnomedicine 9: 31 -45.

Martin GJ. 1995. Ethnobotany: a methods manual, Volume 1 of People and plants conservation manuals. London: Chapman and Hall. 268p.

Mayer M, Vogl CR, Amorena M, Hamburger M, Walkenhorst M. 2014. Treatment of Organic Livestock with Medicinal Plants: A Systematic Review of European Ethnoveterinary Research. Journal Forsch Komplementmed 21:375–386.

Mensah JL, Gleye J, Moulis C, Fouraste I. 1988. Alkaloids from the leaves of Phyllanthus discoideus. Journal of Natural Products 51(6): 1113-1115.

Meyer BN, Ferrigini RN, Jacobsen LB, Nicholas,DE., Laughlin, JL. 1982. Brine shrimp: A convenient general bioassay for active plant constituents.Planta Medica 45: 31-35.

Meyer JJM, Rakuambo NC, Hussein AA. 2008. Novel xanthones from *Securidaca longepedunculata* with activity against erectile dysfunction. Journal of Ethnopharmacology 119: 599-603.

McSweeney C, New M, Lizcano G. 2008. UNDP Climate Change Country Profiles: Angola Available at: http://countryprofiles.geog.ox.ac.uk/index.html?country=Angola&d1=Reports: accessed 18-04-2015.

Mkonda A, Lungu S, Maghembe JA, Mafongoya PL. 2003. Fruit- and seed-germination characteristics of *Strychnos cocculoides* an indigenous fruit tree from natural populations in Zambia. Agroforestry Systems 58: 25-31.

Mojeremane W. 2012. *Bobgunnia madagascariensis* (Desv.) J.H.Kirkbr. & Wiersema. Netherlands: Wageningen: Prota (Plant Resources of Tropical Africa). Available at: http://www.prota4u.org/protav8.asp?p=Bobgunnia+madagascariensis: Accessed 21-04-2015.

Morris JB. 2008. *Rhynchosia minima* (L.) DC. - regeneration, characterization and potential uses for natural products and flavonoids. Plant Genetic Resources Newsletter 153: 15-19.

Moshi JM, Mbwambo ZH, Nondo RSO, Masimba PJ, Kamuhabwa A, Kapingu MC, Thomas P, Richard M. 2006. Evaluation of Ethnomedical claims and brine shrimp toxicity of some plants used in Tanzania as traditional medicines. African Journal of Traditional, Complementary and Alternative Medicines, 3: 48-58.

Muanda F, Koné D, Dicko A, Soulimani R, Younos C. 2011. Phytochemical composition and antioxidant capacity of three Malian medicinal plant parts. Evidence-Based Complementary and Alternative Medicine 4: 122-128.

Munodawafa T, Chagonda LS, Moyo SR.2013. Antimicrobial and Phytochemical Screening of some Zimbabwean Medicinal Plants, Journal of Biologically Active Products from Nature 3: 5-6.

Musa SM. Abdelrasool AE, Elsheikh LA, Ahmed MN, Mahmoud ALE, Yagil SE. 2011. Ethnobotanical study of medicinal plants in the Blue Nile State, South-eastern Sudan, Journal of Medicinal Plants Research 5: 4287–4297.

Muthu CM, Ayyanar N, Ignacimuthu S. 2006. Medicinal plants used by the traditional healers in Kancheepuram District of Tamil Nadu, India. Journal of Ethnobiology and Ethnomedicine 2: 43-57.

Netshiungani EN, Van Wyk AE. 1980. Mutavhatsindi - mysterious plant from Venda. Veld and Flora 9: 87-90.

Ngarivhume T, van Klooster CHIEA, de Jong JTVM, Van der Westhuizen JH. 2015. Medicinal plants used by traditional healers for the treatment of malaria in the Chipinge district in Zimbabwe. Journal of Ethnopharmacology 159: 224-237.

Olorunnisola OS, Afolayan AJ. 2011. *In vivo* antimalaria activity of methanolic leaf and root extracts of *Sphenocentrum jollyanum* Pierre. African Journal of Pharmacology 5: 1669-1673.

Okello J, Segawa P. 2007. Medicinal plants used by communities of Ngai Subcounty, Apac District, northern Uganda, African Journal of Ecology 45: 6–83.

Ojewole JAO. 2008. Analgesic, anti-inflammatory and hypoglycaemic effects of *Securidaca longepedunculata* (Fresen.)[Ploygalaceae] root-bark aqueous extract. Inflammopharmacology 15: 174-181.

Pallant CA, Steenkamp V.2008. *In-vitro* bioactivity of Venda medicinal plants used in the treatment of respiratory conditions. Hum Expl Toxicol 27(11): 859-866.

Prakash P, Gupta M. 2005. Therapeutic uses of *Ocimum sanctum* Linn (Tulsi) with a note on eugenol and its pharmacological actions: a short review. Indian Journal of Physiology and Pharmacology 45: 125-131.

Principe P. 2005. Monitoring the pharmacological benefits of plants. Washington DC: US Enviromental protection Agency. 1991p.

Quattrocchi U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology (5 Volume Set). London: CRC Press 3690p.

Rakuambo NC, Meyer JJ, Hussein A. 2004. Xanthone isolated from *Securidaca longepedunculata* with activity against erectile dysfunction. Fitoterapia 75: 497-499.

Reyes-García V, Huanca T, Vadez V, Leonard W., Wilkie D. 2006. Cultural, Practical, and Economic Value of Wild Plants: A Quantitative Study in the Bolivian Amazon. Economic Botany 60: 62–74.

Reyes-Garcia V. 2010. The Relevance of Traditional Knowledge Systems for Ethnopharmacological Research: Theoretical and Methodological Contributions. Journal of Ethnobiology and Ethnomedicine 6: 32.

Ribeiro DA, Macedo DG, Oliveira LGS, Saraiva ME, Oliveira SF, Souza MMA, Menezes IRA. 2014. Potencial terapêutico e uso de plantas medicinais em uma área de Caatinga no estado do Ceará, nordeste do Brasil. Brazilian Journal of Medicinal Plants 16: 912-930.

Rokaya BM, Munzbergova Z, Timsina B. 2010. Ethnobotanical Study of Medicinal Plants from the Humla District of Western Nepal. Journal of Ethnopharmacology 130: 485–504.

Roskov Y, Abucay L, Orrell T, Nicolson D, Kunze T, Culham A, Bailly N, Kirk P, Bourgoin T, DeWalt RE, Decock W, De Wever A. 2015. Species 2000 & ITIS Catalogue of Life, 2015 Annual Checklist. Species 2000: Naturalis, Leiden, the Netherlands.

Available online at: www.catalogueoflife.org/annual-checklist/2015: Accessed 19-04-2015.

Ruffo CK. 1991. Traditional Medicinal Plants. A Survey of medicinal plants in Tabora region, Tanzania Tanzania: Dar Es Salaam University Press - Ministry of Health. 391 p.

Sargina AS, Akcicekb E, Selvic S. 2013. An ethnobotanical studyof medicinal plants used by the local people of Alaşehir (Manisa) in Turkey. Journal of Ethnopharmacology 150: 860-874.

Schmelzer GH, Gurib-Fakim A. 2008. Resources Végétales de l'Afrique Tropicale. Plantes médicinales 1. Wagenigen: Prota. 680p.

Semenya SS, Maroyi A. 2012. Medicinal plants used by Bapedi traditional healers to treat diarrhoea in the Limpopo Province, South Africa. Journal of Ethnopharmacology 144: 395-401.

Semenya S, Potgieter MJ. 2013. Bapedi traditional healers in the Limpopo Province, South Africa: their socio-cultural profile and traditional healing practice. Journal of Ethnobiology and Ethnomedicine 10: 4 1-56.

Silva JR, Ramos AS, Machado M, Moura DF, Neto Z, Canto-Cavalheiro MM, Figueiredo P, Rosario VE, Amaral AC, Lopes D. 2011. A review of antimalarial plants used in traditional medicine in communities in Portuguese-Speaking countries: Brazil, Mozambique, Cape Verde, Guinea-Bissau, São Tomé and Príncipe and Angola. Rio de Janeiro: Memórias do Instituto Oswaldo Cruz 106: 142-158.

Simbo DJ. 2010. An ethnobotanical survey of medicinal plants in Babungo, Northwest Region, Cameroon, Journal of Ethnobiology and Ethnomedicine, 6: 8-12.

Soares M, Abreu J, Nunes H, Silveira P, Schrire B, Figueiredo, E. 2007. The Leguminosae of Angola: diversity and endemism. Systematics and Geography of Plants 77: 141–212.

Soladoye MO, Ikotun T, Chukwuma EC, Ariwaodo JO, Ibhanesebor GA, Agbo-Adediran OA, Owolabi SM. 2013. Scholars Research Library Our plants, our heritage:

Preliminary survey of some medicinal plant species of Southwestern University Nigeria Campus, Ogun State, Nigeria. Annals of Biological Research 4:27-34.

Sobiecki JF. 2014. Psychoactive Plants: A Neglected Area of Ethnobotanical Research in Southern Africa. EthnoMed 8(2): 165-172.

Steenkamp V. 2003. Traditional herbal remedies used by South African women for gynaecological complaints. Journal of Ethnopharmacology 86: 97-108.

Steenkamp V, Fernandes AC, Van Rensburg CEJ. 2007. Screening of Venda medicinal plants for antifungal activity against *Candida albicans*. South African Journal of Botany 73: 256-258.

Taderera T., Chagonda L.S., Gomo E., Shai L.J., 2015. Inhibitory activity of α-glucosidase and α-amylase by *Annona stenophylla* root extract as mechanism for hypoglycaemic control of DM. International Journal of Pharmacy Photon 106: 436-444.

Takasaki H, Hunt K. 1987. Further medicinal plant consumption in wild chimpanzees. African Studies Monographs 8: 125-128.

Tamokou JD, Mpetga DJS, Lunga PK, Tene M, Tane P, Kuiate JR. Antioxidant and antimicrobial activities of ethyl acetate extract, fractions and compounds from stem bark of *Albizia adianthifolia* (Mimosoideae*).* Complementary and Alternative Medicine 12: 99-112.

Tardío J, Santayana MP. 2008. Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain). Economic Botany 62: 24–39.

Toyang NJ, Krause MA, Fairhurst RM, Tane P, Bryant J, Verpoorte R. 2013. Antiplasmodial activity of sesquiterpene lactones and a sucrose ester from *Vernonia guineensis* Benth. (Asteraceae). Journal of Ethnopharmacology 147: 618-621.

Toyang N, Verpoorte R. 2013. A Review of the Medicinal Potentials of Plants of the Genus *Vernonia* (Asteraceae). Journal of Ethnopharmacology 146 :681-723.

Trotter R, Logan M. 1986. Informant Consensus: a New Approach for Identifying Potentially Effective Medicinal Plants. In: Etkin NL ed. Plants in Indigenous Medicine and Diet: Biobehavioural Approaches. New York: Redgrave Publishers: 91–112.

Tshikalange TE, Meyer JJM Hussein AA. 2005 Antimicrobial activity, toxicity and the isolation of a bioactive compound from plants used to treat sexually transmitted diseases. Journal of Ethnopharmacology 96: 515–519.

Tshikalange TE, Meyer JJM, Lall N, Muñoz E, Sancho R, Van de Venter M, Oosthuizen V. 2008. *In vitro* anti-HIV-1 properties of ethnobotanically selected South African plants used in the treatment of sexually transmitted diseases. Journal of Ethnopharmacology 119:478–481.

Turner V, 1967. Betwixt and Between: The Liminal Period in Rites de Passage, in The Forest of Symbols. Ithaca, NY: Cornell University Press. 345p.

Ugulu I, Baslar S, Yorek N, Dogan Y. 2009. The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir province, Turkey. Journal of Medicinal Plants Research 3: 345-367.

Ullah S, Rashid KM, Ali Shah N, Afzal Shah S, Majid M, Asad Farooq M. 2014. Ethnomedicinal plant use value in the Lakki Marwat District of Pakistan.Journal of Ethnopharmacology 158: 412-422.

UN. 2012. Country profile: Angola. Available at: http://data.un.org/CountryProfile.aspx?crName=angola: Accessed 19-04-2014.

UNDP. 2012. Landmine clearing efforts help to boost Angola's recovery. Available at: http://www.undp.org/content/undp/en/home/presscenter/articles/2012/04/02/landmine-clearing-efforts-help-boost-angola-s-recovery.html: Accessed 22-04-2015.

Urso V, Signorini MA, Bruschi P. 2013. Survey of the ethnobotanical uses of *Ximenia americana* L. (mumpeke) among rural communities in South Angola. Journal of Medicinal Plants Research 7: 7-18.

USAID. 2012. Angola Water and Sanitation Profile , Advancing the Blue Revolution Initiative(ABRI): Available at: http://pdf.usaid.gov/pdf_docs/PNADO925.pdf: accessed 18-04-2015.

Van Damme P, Van Den Eynden V, Vernemmen P. 1992. Plant uses by the Topnaar of the Kuiseb valley Namib desert. Africa Focus 8: 223-252.

Van-Dúnem A, Batalha M. 1994. Plantas medicinais de Angola: medicamentos ao alcance de todos. Luanda: Cooperação Portuguesa, Embaixada de Portugal, 78 p.

Vongo R. 1999. Traditional medicine on antimalarials in Moshi: RITAM Conference, Tanzania. 13p.

WFP. 2005. Food Security and Livelihood Survey in the Central Highlands of Rural Angola. Available at: http://one.wfp.org/country_brief/africa/angola/docs/Food_Security_and_Livelihood_Survey_in_CH_June_2005.pdf: Accessed 2015-04-18.

WHO. 1993. Guidelines on the Conservation of Medicinal Plants. Gland: International Union for Conservation of Nature. 154p.

WHO. 2005. World Malaria Report. Available at: http://www.who.int/bulletin/volumes/87/11/08-052514/en/: Accessed 19-04-2015.

WHO. 2008. Fact sheet N°134. Available at: http://www.who.int/mediacentre/factsheets/2003/fs134/en/: Accessed 2015-04-18.

WHO. 2010. Monographs on Medicinal Plants Commonly Used in the Newly Independent States (NIS). Available at: http://apps.who.int/medicinedocs/en/d/Js17534en/: Accessed 23-04-2015.

WHO. 2014. World Malaria Report. Available at: http://www.who.int/malaria/publications/country-profiles/profile_ago_en.pdf: Accessed: 19-04-2015.

WILDCARD. 2010. Flat-crown *Albizia adianthifolia* Tree no 148. Available at: http://www.wildcard.co.za/blog.htm?action=view-post.id=1317: Accessed 19-04-2015.

WLBC. 2013. A Global Program on Conservation of Useful Plants and Traditional Knowledge: A Call to Action. Available at: http://www.wlbcenter.org/pdfs/Global_Program_on_Conservation_of_Useful_Plants.pdf: Accessed 18-04-2015.

York T, van Vuuren SF, deWet H. 2012. An antimicrobial evaluation of plants used for the treatment of respiratory infections in rural Maputaland, KwaZulu-Natal, South Africa. Journal of Ethnopharmacology 144: 118-127.

Zerbo P, Millogo-Rasolodimby J, Nacoulma-Ouedraogo OG, Van Damme P. 2011. Plantes médicinales et pratiques médicales au Burkina Faso: cas des Sanan. Bois et Forets des Tropiques 307: 41-49.

Appendix: **Table A.** Ethnobotanical survey of medicinal plants used in Bié province, Angola (unidentified plants)

Vernacular name	Plant family	Plant life-form	Used parts	Use category$_i$	Therapeutic uses
Mutetembolonga	Asteraceae	herb	roots	infections	hepatitis (root, decoction)
Muteto	Boraginaceae	Tree	roots	pregnancy	infertility women (boiled grinded root, decoction)
Uvandenenu	Fabaceae	shrub	roots	skeleton	painful legs after hard work (root, decoction of cooled beverage)
Eliminambomue	Fabaceae	Tree	leaves	genito	aphrodisiacs for women (leaves, decoction)
Etiambolo	Lamiaceae	Tree	roots	gastro	diarrhoea (roots, decoction); fever (boiled grinded root, decoction)
Losilulu	Polygonaceae	shrub	roots	genito	dysmenorrhea (roots, decocton)
Musole	Rubiaceae	shrub	folha	infections	hypermiopia (boiled leaves, warm water, bath)
Olohojungu	Rubiaceae	herb	roots	pregnancy	abortion (roots, continuous decoction for several days)
Musole	Rubiaceae	Tree	roots	gastro	diarrhoea with blood (roots, decoction)
Mulesa	Rubiaceae	shrub	leaves	blood	epistaxis (grinded leaves, applied in nose)
Gilasonde		Tree	roots, stem	gastro	diarrhoea with blood (grinded roots, decoction)
Ombula		shrub	roots	gastro	diarrhoea with blood (grinded roots, decoction)
Usinusinu		Tree	roots	pregnancy	Infertility – 20 years old women (boiled root, decoction)
Ohongolo		herb	roots	infections	hepatitis (sliced root, decoction)
Epumbisamuku		Tree	roots	gastro	worms (cutted root, decoction)
Utoyopotambunda		Tree	roots	neuro	epilepsia (root, decoction)
Chilavi usenge		herb	roots	infections	hepatitis (root, decoction)
Melakava		herb	roots, leaves	skin	balm for peeling skin (root, decoction or bath)
Mutazumbi		herb	roots, leaves	neuro	headache (leaves drinded by hands, applied in the nose)
Casapulamembe		Tree	roots	genito	impotence (root, decoction)
Mulimbue		shrub	leaves	others	black magic/poison/murder (applied on the skin it kills, leaves no traces, the one who applied it won't be punished)
Mucalale		shrub	roots, leaves	skeleton	laryngeal prominence, problems with speach (grinded root, applied in throat); snake bite (boiled leaves, applied on the wound)
Muhala		herb	leaves	others	magic, neutralisation of enemy (powder from dried leaves, blowed on your enemy)
Mucoso, Umbulungu		Tree	roots,	others	magic/poison - reveals sorcerels (boiled root, boiled leaves,

Table A. Continued

Vernacular name	Plant family	Plant life-form	Used parts	Use category$_i$	Therapeutic uses
			leaves		decoction) - if you are sorcerer, you vomit and die after consomption; if not, nothing happens
Mumumbus		tree	roots, leaves	gastro	peptic ulcer (chewed leaves, or teared leaves, bath)
Calimboli		herb	roots	skin	boils (boiled root, decoction)
Chihoho		tree	roots	blood	loss of blood (washed and boiled root, clyster or decoction)
Mosese		shrub	roots	gastro	worms (cutted root, , decoction)
Uingonguino		shrub	roots, leaves	dental, infections	toothache (grinded roots, boied, applied on mouth); tuberculosis (chewed leaves)
Ososo		shrub	roots	respiratory	sore throat (boiled root, decoction)
Ulu ulu		shrub	roots	pregnancy	infertility (boiled root, decoction); diarrhoea, constipation children (root, hot water, decoction)
Kosambi		shrub	leaves	infections	hepatitis (washed leaves, water, decoction)
Mueila		shrub	roots	genito	dysmenorrhea (roots, decocton)
Capilangao		tree	whole plant	gastro	worms, vomits (cutted root, hot water, decoction)
Chineni		shrub	leaves, roots	injuries, gastro	wounds (leaves applied on skin or fresh root applied on the wound); constipation (roots, hot water, decoction)
Muniagagila		herb	roots	gastro	pain in stomach (roots, decoction)
Mahuma		shrub	roots	gastro	pain in stomach (roots, decoction)
Muvulia		tree	roots, whole plant	skeleto	arthritis (roots, decoction)
no name known		herb	leaves	gastro	worms in womb (grinded leaves, packed into small bag, applied through vagina)
Olohojungu		tree	roots	genito	dysmenorrhea (roots, decoction)
Eyundu		shrub	roots	gastro	Stomach pain (grinded dry roots, hot water, decoction)
Ondilasonde		shrub	roots	gastro	vomits (roots, decoction)
Casapola		tree	roots	skin, injuries	wounds, balm (root, applied on skin)
Ohamba hamba		shrub	roots	gastro	stomach pain (roots, clyster)
Obortoto		tree	roots, bark	others	cures everything (roots, bark, hot water, decoction or applied on skin)
Sulumbanda		shrub	roots, bark	infections	malaria (root, decoction); tuberculosis (roots and bark, hot water, decoction)
Mucangalo		tree	leaves	neuro	headache (boiled leaves, wash applied on head, massage)

Table A. Continued

Vernacular name	Plant family	Plant life-form	Used parts	Use category[i]	Therapeutic uses
Mohulha		tree	roots	gastro	worms (cutted root, decoction)
Munukenuke		shrub	leaves	gastro	stomach pain (roots, decoction)
Musala		shrub	roots	gastro	constipation (roots, hot water, decoction and massage of head); rheumatism (roots, , decoction)
Mufungefogongo		shrub	leaves	gastro	vomits (grinded roots, hot water, decoction)
Chikoko		tree	roots	neuro	headache (cutted roots, hot water, inhalation)
Ohotahota		tree	roots	neuro	insomnia, bad dreams (burned root, inhalation)
Muhanto		shrub	leaves	skeleton, neuro	painful body (boiled leaves, warm water, bath); bad dreams (root, hot water, inhalation)
Muneku		tree	leaves	respiratory	loss of breath (boiled leaves, warm water, bath)
Muchila Wakawa		herb	leaves	neuro	insomnia - children (boiled leaves, bath)
Tatembula		herb	roots	gastro	diarrhoea with blood (boiled roots, decoction)

[i] Use category: Blood (Blood system disorders); Circulatory (Circulatory System disorders); Dental (Dental and mouth care); Gastro (Gastro-intestinal system disorders); Genito (Genitourinary system disorders), Infections (Infections-infestations), Neuro (Neurological system disorders), Skin (Skin disorders), Pregnancy (Pregnancy/birth/puerpuerium disorders), Respiratory (Respiratory and throat disorders), Skeleto (Skeleto-muscular system disorders)