

Full Length Research Paper

Ethnobotany, indigenous knowledge and unconscious preservation of the environment: An evaluation of indigenous knowledge in South and Southwest Regions of Cameroon

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Accepted 26 November, 2013

A study was undertaken to understand the contributions of indigenous knowledge in environmental management and to evaluate some useful plants in selected tribal villages of South and Southwest Cameroon. Intensive field trips were carried out and interviews were conducted with the indigenous people using questionnaires that addressed the use of each plant species for various purposes, local/traditional name of species, plant parts used methods of preparation, prescription and administration for medicinal uses. The work resulted in the documentation of fifty two species of ethnomedicinal plants belonging to thirty families. Among the documented plants, Asteraceae, Fabaceae, Acanthaceae, Euphorbiaceae, Apocynaceae, were the five dominant families with three or more species followed by Rubiaceae, Piperaceae, Lamiaceae, Poaceae, and Apiaceae with two species each. Plants used in traditional medicine are used as decoctions, infusions, macerations, powders, mixtures, squeezing, boiling, and direct eating. Thirty seven species used for varied purposes ranging from cultural, culinary, ecological, and architectural, were identified spreading over 22 families. Some of the species had some interesting uses such as plants as indicator species for rich soils, plants believed to solve boundary conflicts and witch craft, wrapping and preserving food among others. Traditions, customs, beliefs and cultural rights play an important role in environmental conservation and biodiversity of the South and South west regions of Cameroon. Hence, there is a need to utilize and vulgarize the ethnobotanical information, encourage the indigenous people as they contribute immensely in preserving the biodiversity.

Key words: Cameroon, environmental management, ethnobotany, indigenous knowledge, traditions, unconscious preservation.

INTRODUCTION

The forest has been the main source of plant materials for used by various people in Africa and the World. About 300 million depend on forests directly for their subsistence, including about 60 million people of indigenous and ethnic groups, who are almost wholly dependent on forests. WHO (2010) reported that that about 80% of Africans depend on forest resources for shelter, medicine,

rural architecture and engineering for their survival. Forests contribute tremendously to the economy of many countries (MEA, 2005; World Bank, 2003). Most urban areas often depend on forested areas for their water supply and benefit from the numerous, environmental services of forests and trees (FAO, 2007).

Indigenous knowledge has been defined as a body of

knowledge built up by a group of people through generations living in close contact with nature or a systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiments and an intimate understanding of the environment in a given culture. According to Rajasakeran and Arren (1992), Afolayan and Kambizi (2008), this knowledge has been the sole means of survival within many local communities for generations traditional knowledge greatly explains the intricate relationship between human and their natural environment and also contributes to improving forest science and forest management in many areas of the earth (Daou, 2000).

The contributions of the indigenous people to forest conservation have been ignored or belittled, even though they control most of the world's remaining natural forest areas either consciously or unconsciously through their traditional practices, with strong conservation ethics (Daou, 2000; Advice, 2009). Most of the useful tropical plants face extinction due to the extensive timber extraction, agricultural expansion and infrastructure development, all of which have increased dramatically in many parts within the tropics over the past two decades. The more recent attention given to tropical deforestation stems from concerns over various consequences, including the massive loss of biological diversity (Myers et al., 2000), loss of an important sink for atmospheric carbon dioxide, impacts on local and regional climate and negative effects on the livelihoods of people in tropical forests (Stone and D'Andrea, 2001).

Ethnobotany which is the scientific study of plant uses has led to new area of research and many drugs in use today have been discovered through ethno-botanical surveys. The classic example is the Quinine drug from the Quinine tree (*Cinchona calisaya*, *Cinchona ledgeriana*, *Cinchona succirubra*), shrub whose bark furnished quinine, one of the best anti-malaria medicine ever used. The use of plant-derived drugs for the treatment of malaria has a long and successful tradition. For example, quinine isolated from *Cinchona* and quinghaosu from *Artemisia annua* L. illustrates the potential value of investigating indigenous knowledge (traditionally used anti-malarial plants) for developing pharmaceutical anti-malarial drugs (Srisilam and Veersham, 2003).

Cameroon is one of the most diverse country in Africa in terms of plant biodiversity hosting over 7850 plant species (Onana, 2011) with 815 species being threatened (Onana et al., 2011) in different vegetation types including the Biafra forest with high rainfall, the Congolese forest, and the semi-deciduous forest with low rain fall (Letouzey, 1985). The vegetation of Cameroon ranges from lowland evergreen rainforest, semi-deciduous, deciduous, savanna woodland, and savanna grassland forest, at different altitudinal gradient of lowland, sub-montane, alpine and montane forest (Letouzey, 1985; Achoundong, 2007) and form part of the Guineo-Congolian region of endemism.

Forest management systems are primarily based on local experience of the specific society, have evolved over time and transmitted from generation to generation by word of mouth or by practice. Daou (2000) and Advice (2009), observed that this is the best way to manage our natural ecosystem since it is the same people using the resources from the environment.

This study sought to understand the contributions of indigenous knowledge, an appraisal of some useful plants species and their significance in biodiversity conservation in selected localities and villages in South and Southwest Regions of Cameroon.

MATERIALS AND METHODS

Study area

Cameroon lies on the west-central coast of Africa and occupies an area of 466,326 km² (de Wasseige, and Devers, 2009) between latitudes 2° and 13° N (about 1,200 km) and longitudes 8°30' and 16°10' E, for the most part between 200 and 800 m above sea-level. Cameroon has been described as "All of Africa" in one triangle, since the country hosts a wide range of climates and ecosystems. In the north and extreme north extending up to Lake Chad, the country is covered by Sahelian Savannah, the center has the characteristics of high altitude moist savannah and the south is covered by dense tropical rainforest. The highest point is Mount Cameroon in the southwest, and the largest cities are Douala, Yaoundé and Garoua. Cameroon is home to over 200 different linguistic groups. This study was carried within some selected localities in the South and South West regions of Cameroon (Figures 1 and 2).

The Southwest Region is located at 5 25' 00"N 9 20' 00"E and covers an area of 24,571 km² (9,487 square miles) with a population of 1.21 million people, is divided into six divisions: Fako, Koupé-Manengouba, Lebiale, Manyu, Meme, and Ndian. These are in turn broken down into subdivisions. Important towns include the capital Buea, Limbe, Tiko, Kumba and Mamfe. Limbe in particular is a popular tourist resort notable for its fine beaches. Korup National Park is also a major attraction. Buea itself, meanwhile, sits at the foot of Mount Cameroon, and possesses an almost temperate climate markedly different from the rest of the province (Figure 3).

The South region is located at 2°30'N 11°45'E and covers an area 47,110 km² with a population of 520,000 people. It is bordered to the east by the East Region, to the north by the Centre Region, to the northwest by the Littoral Region, to the west by the Gulf of Guinea (part of the Atlantic Ocean), and to the south by the countries of Equatorial Guinea, Gabon, and Congo. The major ethnic groups in the South are the various Beti-Pahui peoples, specifically the Ewondos, Fangs and Bulus.

An ethnobotanical survey was undertaken during 2011 to 2012 for systematic documentation of traditional knowledge regarding traditional herbal remedies alongside other uses of plants. This work was done following field expeditions, to the South region of Cameroon around Kribi, working with the indigenes of the villages of Bisiang, Lokoundje, Pama and Elog-Batindi; -Tombel subdivision precisely in the villages around Mount Kupe, i.e. Mbule, Nyassoso, Kupe and Tombel, Korup forest area, villages around Korup National Park precisely, Ekondo-kondo, Fabe, Ikassa, Bulu, Mundemba, Meka and Dibonda). Field trips were conducted and from each locality, the indigenous people, herbal healers, men, women and children were interviewed to get information about the plants they use. Those who were knowledgeable were taken to the

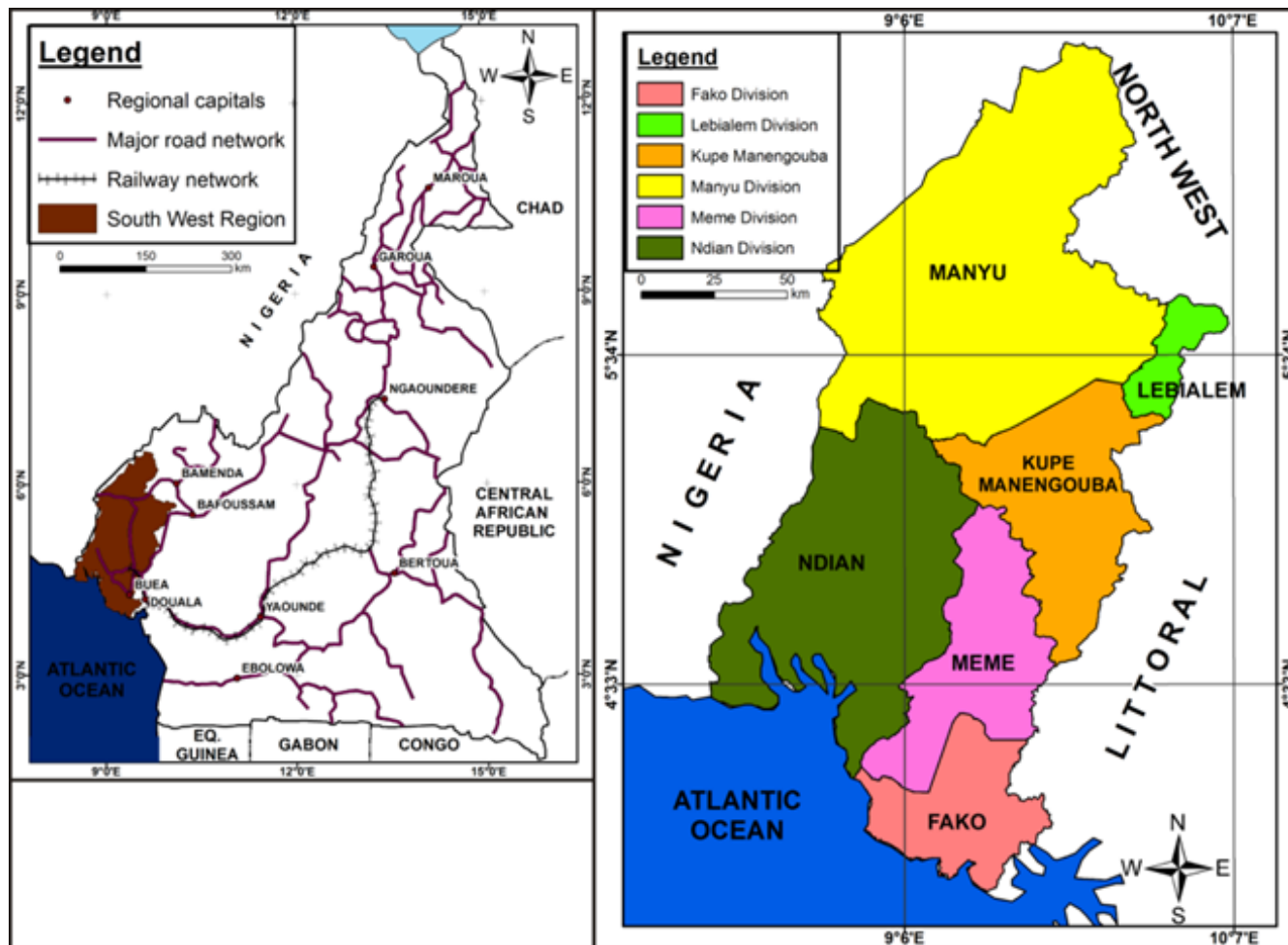


Figure 1. Map of Cameroon showing the South West Region.

field to help in the collection of specimens and care was taken to record vital information including common name, method of usage, if medicinal: method of preparation and administration. Specimens were identified using standard taxonomic methods and principles.

Ethno-botanical and indigenous knowledge survey

The following techniques were used to obtain information about the uses of plants among the indigenous people, The field method involved walking, talking and administering interviews to local people in the areas where they routinely collect and make use of plant materials. During interviews, the indigenous person picks up or shows a plant and explains its uses and in some cases gives a brief history of the plant together with its significance and impact to the community.

House-to-house interviews were done for localities where field-forest expeditions were not performed; people were interviewed with a questionnaire on the uses of plants used around their houses and the surrounding bushes. A local guide was selected in each area to explain the purpose of the study in the local language to simplify, translate and/or interpret in some cases. The questionnaire had open questions that addressed the use of the plant species, their local/traditional name of the species, parts used, and methods of preparation, prescription and administration. The focused data

collection strategy was employed whereby similar information from many participants lends some credence. Voucher specimens for all species encountered were collected identified using standard taxonomic methods and deposited at the Limbe Botanical Garden, Herbarium (SCA), Cameroon.

RESULTS

A total of 136 interviews were conducted and the men were more enthralled (72%) than the women (27%). A good number of the participants were older than 50 (35%) the other age ranges were 40 to 50 years (24%) 30 to 39 years (18%) 20 to 29 years (18%) and below 20 years (6%). Some children as young as 15 years old were able to give some very valuable information concerning some of the plants and their uses. The chief activity of most of the respondent's livelihood is farming and petty trading and majority of them had been based in their villages for more than 15 years. There is increase in the domestication of some of wild plants such as *Alstonia boonei*, *Baillonela toxisperma*, *Bidens pilosa*, *Cymbopogon*

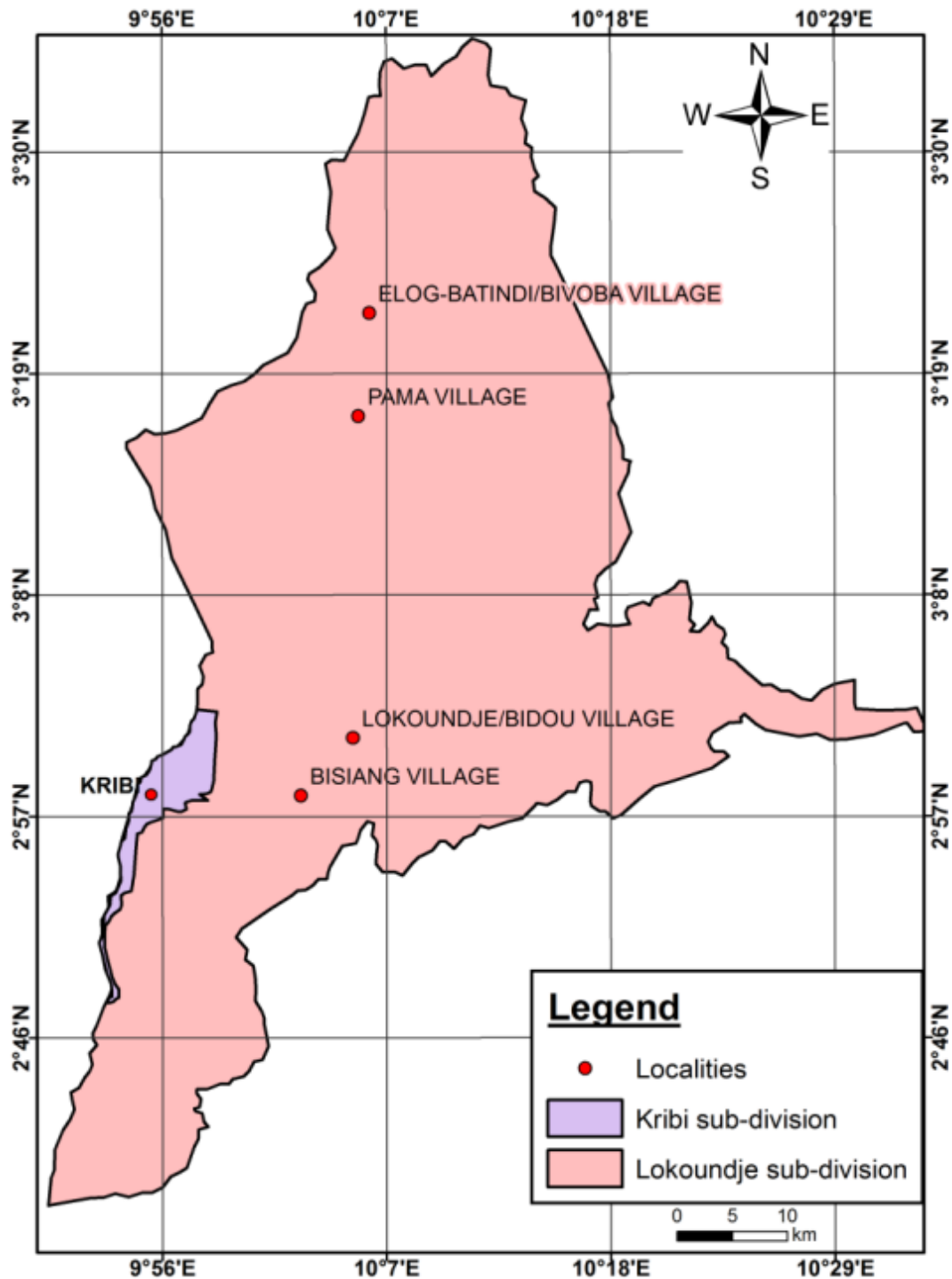


Figure 2. Map of Cameroon showing the selected localities.

citratus, *Senna alata*, *Eremomastax speciosa*, *Centella asiatica*, *Morinda lucida*, *Ricinus communis* by the indigenous people.

Table 1 enumerates the different medicinal plants identified during the study which led to the identification of 52 species of plants employed to treat various diseases, distributed over 30 families. A classification was done

based on the place of interview, and the different parts of the plant utilized. The most dominant families were the Asteraceae (7) Fabaceae (5), Acanthaceae (3) Euphorbiaceae (3), Apocynaceae (3), two species each for Rubiaceae, Piperaceae, Lamiaceae, Poaceae, and Apiaceae, while the other families had a species each, indicating some diversity.

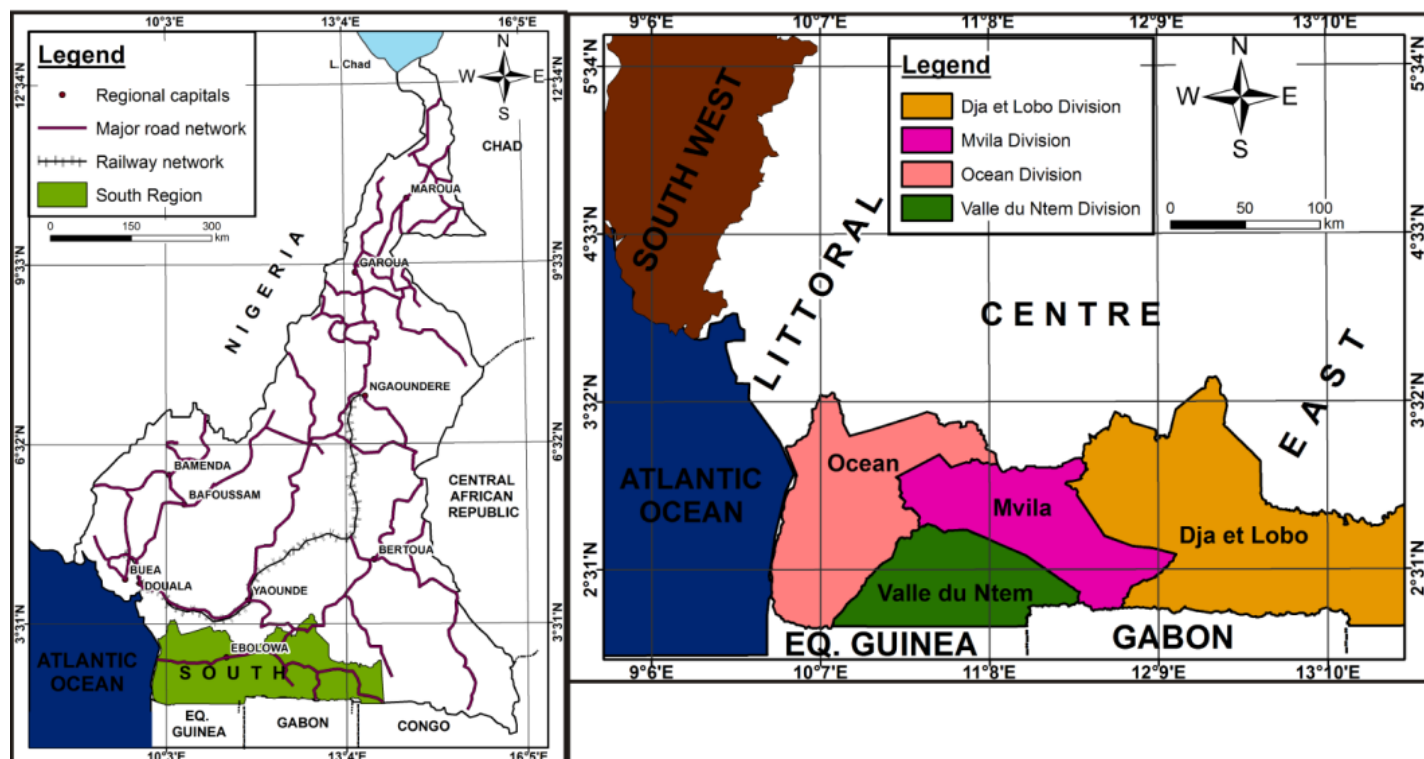


Figure 3. Map of Cameroon showing the different divisions.

Table 2 presents different methods of preparation and treatment of traditional remedies. Some twenty eight different diseases were being treated using the plants as decoctions, infusions, macerations, powders, mixtures, squeezing, boiling, and direct eating. In some cases the plants had to be mixed with oils or local gins before administration.

Different plant species are being used for varied purposes ranging from ecological, cultural, culinary/gastro-nomical and rural architectural/craft. 38 species were identified spread over 23 families as enumerated in Table 3.

Useful trees are usually planted around the farms include mango (*Mangifera indica*), coconut (*Cocos nucifera*) bush plum (*Dacryodes edulis*) avocado (*Persea americana*), papaya (*Carica papaya*) guava (*Psidium guajava*), cocoa (*Theobroma cacao*), and oil palm (*Elaeis guineensis*). Other species include tubers such as cocoyams (*Colocasia esculenta*, *Xanthosoma* sp) sweet potatoes (*Ipomoea batatas*) cassava (*Manihot esculenta*), different species of yam, calabar yam (*Dioscorea rotundata*), Water yam (*D. alata*), *D. cayeneensis*, *D. dumetorum*).

Leafy vegetables commonly grown are bitterleaf (*Vernonia amygdalina*) 'green' (*Amaranthus creuntus*), fluted pumpkin (*Telferia occidentalis*) water leaf (*Talinum fruticosum*), Garden egg (*Solanum melongena*), 'anchia' (*Solanum macrocarpon*), 'krengkreng' (*Cochorus ollitorus*) 'egusi' (*Citrullus colocynthis*) cereals and pulses such as cowpea (*Vigna unguiculata*), broad bean

(*Phaseolus vulgaris*), maize (*Zea mays*) bananas and plantains (*Musa sapientum*, *Musa paradisiaca*).

Some ornamental plants which are cultivated to some extent include; *Clerodendron* spp, *Crinum natans*, *Catharanthus roseus*, *Dracaena* spp, *Mussaenda* spp. some Orchidaceae, *Scadoxus* spp, *Spathodea* sp and *Lantana camara*

DISCUSSION

A wide variety of plants are being used by the locals or indigenous people for diverse purposes. Fifty two species of medicinal plants were identified during the study, employed to treat various diseases and conditions distributed over 30 families. Different methods were used for the interviews which revealed the exploitation of different parts of the plant for the treatment of diseases. The most dominant families were the Asteraceae (7), Fabaceae (5), Acanthaceae (3) and three each for Euphorbiaceae, Acanthaceae, Apocynaceae; two species each for Rubiaceae, Piperaceae, Lamiaceae, Poaceae, and Apiaceae, while the other families had a species each, indicating some diversity. Simbo (2010) in his findings also revealed the Asteraceae as the most dominant family and this group of plants have also been reported to possess a wide range of many biologically active compounds (Heinrich, 1998). Adjanochoun et al. (1996),

Table 1 Contd.

<i>Tabernaemontana crassia</i>	Apocynaceae	*		*	*
<i>Zea mays</i>	Poaceae	*		*	
<i>Zingiber officinale</i>	Zingiberaceae	*	*		

Table 2. Plants used by indigenous people in traditional remedies.

Specie	Method of preparation	Administration	Treatment
<i>Acanthus montanus</i> (Nees) T.Anderson Acanthaceae	Leaves are squeezed and water added.	Oral	Remedy for fever.
<i>Ageratum conyzoides</i> Linn. Asteraceae	Leaves and stems crushed and resulting liquid used for different ailments.	Oral/ External	Night poison, asthma gastritis, migraine, wounds to stop bleeding.
<i>Anchomanes difformis</i> Schott. Araceae	Leaves are crushed and liquid used as eye drops.	Oral	Eliminates worms from the eyes
<i>Aframomum melegueta</i> (Roscoe) K.Schum Zingiberaceae	A certain odd number of the seed "eye" is chewed by the nursing mother and spat on the baby and on the four corner of the room	External	Used for the protection against witchcraft especially in children crying at night as it is believed they are being frightened by evil spirits. It is also mixed with other leaves against snake bites and poison.
<i>Baillonela toxisperma</i> Pierre. Sapotaceae	Oil is extracted from the seed of this species known as "Njabe oil" and it helps to compliment medications that are difficult to take orally making them palatable.	Oral	Used to administer many plant extracts and mixtures. Used to improve the quality of the hair
<i>Alstoniaboone</i> R.Br. Apocynaceae	The thick bark is extracted from the tree and boil to extract white latex	Oral	Malaria related illnesses or complications and also to induce breast milk in breast feeding mothers
<i>Angylocalyx oligophyllus</i> (Bak) Bak.f Fabaceae	The leaves of this species is mixed with extract from <i>Ageratum conyzoides</i> (King grass) and enema is prepared for children.	Anal	Redness of the skin especially around the reproductive areas known as thrush orCandidiasis("jetty-jetty") in children
<i>Annickia chlorantha</i> (Oliv.) Setten& Maas Annonaceae	The bark is either put in alcohol or local gin (Afou-fou) and then consumed or sometimes boiled in a decoction with other plants e.g. bark of <i>Cylicodicos gabonensis</i>	Oral	Malaria related complications and body pains
<i>Aspilia africana</i> ,Thouars. Asteraceae	Leaf extract/exudates are applied to wounds		Wounds especially fresh wounds. Exudate helps in coagulation of the blood
<i>Asystasia gangetica</i> (L.) T. Anderson Acanthaceae	A mixture is prepared from the leaves together with other plant species and the paste is licked.	Oral	Prevention against witch craft and evil spirits. Used for vomiting.

Table 2 Contd.

<i>Barteria fistulosa</i> Mast. Passifloraceae	The bark and leaves are used to prepare a concoction and sometimes the ant that is associated with the plant is used to force thieves to speak the truth.	External	It is used for the treatment of rheumatism that is a common illness of elderly people and also to get the truth from thieves.
<i>Bidens pilosa</i> L. Asteraceae	Leaves and stems are infused and taken as tea.	Oral	For cough and fever
<i>Carpolobia lutea</i> G. Don Polygalaceae	Root is dug and chewed, liquid extract is swallowed for few minutes.	Oral	Stimulate and enhance erection of the penis in male
<i>Centella asiatica</i> (L.) Urb Apiaceae	Whole plant is macerated and resulting solution used. The leaves and stems eaten	Oral	Loss of memory, skin problems
<i>Commelina benghalensis</i> L. Commelinaceae	The stem of plant is harvested and mucilage squeezed out and applied on the affected portions.	External	Ringworm and skin diseases
<i>Cymbopogon citratus</i> (DC.) Stapf. Poaceae	The leaves are boiled sometimes together with, other species like <i>Carica papaya</i> and <i>Eremomastax speciosa</i> Hochst.	Oral	Prevention against malaria and upgrading blood level
<i>Drymaria cordata</i> (L.) Schultes. Caryophyllaceae	Whole plant is macerated and paste obtained.	External	For wounds and insect bites.
<i>Elaeis guineensis</i> Jacq. Arecaceae	Kernel oil (Manyanga) is prepared from the nut and used as a compliment to other medicinal plant extract by making it palatable.	Oral	Skin diseases, stomach disorder and convulsion in children
<i>Emilia coccinea</i> (Sims.) G.Don Asteraceae	Leaves are infused	Oral	Fever and gastric pains. Extract used for wounds.
<i>Entandrophragma utile</i> (Dawe & Sprague) Sprague Meliaceae	The fruits are used to prepare hot pepper soup with spices like <i>Piper guineensis</i> .	Oral/ External	Prevent internal blood clotting and abscesses from a tree fallen victim. Woody pericarp used for cough mixtures.
<i>Eremomastax specioca</i> Hochst Acanthaceae	Leaves are macerated. Leaves are boiled and the resulting solution used.	Oral	Improvement and recuperation of blood in anemic patients.
<i>Eryngium foetidum</i> L. Apiaceae	Leaves are squeezed or ground with some water and resulting solution used.	External	Used for abscesses and boils
<i>Euphorbia hirta</i> L. Euphorbiaceae	Latex and water used as eye drops, helps to eliminate foreign objects.		Eye drops, cleaning of the eyes stops redness. Used for fungal infections. Stomach disorder.

Table 2 Contd.

<i>Garcinia kola</i> Heckel. Clusiaceae	The fruit is harvested, seed peeled, and eaten by many old and middle age people	Oral	Delay ejaculation during sexual intercourse in male and also serve as a stimulant. Used for bad breath.
<i>Harungana madagascariensis</i> Lam ex Poir Hypericaceae	Decoction is prepared from the bark.	Oral	Back complication in children
<i>Kalanchoe pinnata</i> (Lam) Pers. Crassulaceae	Leaves are macerated with very little water and extract used.	External	Ear problems
<i>Lantana camara</i> L. Verbenaceae	Decoction of leaves Maceration of leaves		Diarrhea Fresh wounds
<i>Lapotea ovalifolia</i> Gaudich. Urticaceae	Enema is prepared from leaves.	Anal	Treatment of children's illness and initiate movement of the baby.
<i>Lasianthera africana</i> , P.Beauv. Icacinaceae	The leaves are squeezed, boiled and the resulting concoction taken.	Oral	Diarrhea and stomach related complications
<i>Melanthera scandens</i> J.P.Rohr Asteraceae	Leaves and stems are infused	Oral	Constipation
<i>Mimosa pudica</i> L. Fabaceae	The leaves are ground to form a paste and then applied to the painful portion and the fresh creeping stem is used to beat up young babies for the initiation of movement.	External	Speed up the process or hasten the maturity and softness of boils and abscesses. It also initiates movement in babies
<i>Morinda lucida</i> Benth. Rubiaceae	The roots are prepared with extracts from other plants by boiling for few hours	Oral	Erection problems in male and high blood patients
<i>Masularia acuminata</i> (G Don)Hoyle Rubiaceae	The roots are chewed together with the fruit of oil palm.	Oral	Enhances male erection for preparedness for sexual action.
<i>Musanga cecropioides</i> R.Br. Urticaceae	The liquid from the root of this plant is collected with a container and taken.	Oral	Induces breast milk in breast feeding mothers.
<i>Piper umbellatum</i> L. Piperaceae	The young leaves, roots or the entire plant are ground together with <i>Aframomum melegueta</i> (Mbungu or Alagata pepper) and rubbed on abscesses and swollen parts,	External	Hasten the maturity and softness of boils and abscesses

Table 2 Contd.

<i>Pterocarpus Taubert</i> Fabaceae	<i>soyauxia</i>	The bark is ground and mixed with "calabar chalk", (calcium carbonate) and rubbed on the body for decoration	External	Used for side pains. Serve as decoration powder during traditional marriage or ceremony
<i>Rauvolfia vomitoria</i> Apocynaceae	Afzel.	The latex of this species is extracted and put in water.	Oral	Highly active against malaria parasite. Patients with high blood pressure.
<i>Ricinus communis</i> Euphorbiaceae	Linn.	Leaves are boiled and a bath taken using the water.	External	Muscle weakness
<i>Senna alata</i> (l.) Fabaceae	Roxb.	The leaf extract is squeezed and applied to the affected portion, or in case of yellow fever, the leaves are boiled and the extract drunk. For stomach complications leaves are crushed and extract drunk.	External or Oral	Used for skin/dermatological problems especially fungal, yellow fever and stomach complications.
<i>Solenostemon monostacyus</i> Thonn. Lamiaceae		Leaves and flowers are crushed and rubbed on the forehead.	External	Severe headache.
<i>Spilanthes filicaulis</i> Asteraceae	Jacq.	Decoction of leaves and inflorescence mixed with <i>Aframomum melegueta</i> . The heads (capitulum) are chewed.	Oral/External	Cough and chest pain. Also used for toothache.
<i>Tabernaemontana</i> Benth. Apocynaceae	<i>crassia</i>	The wounded individual cuts the bark of this species and applies to the wounded area to stop blood flow.	External	Wounds and fresh cuts.
<i>Zea mays</i> Poaceae	Linn.	Silk is infused and drunk as tea	Oral	Diuretic especially for women suffering from edema.
<i>Zingiber officinale</i> Zingiberaceae	Rosc.	Rhizome is ground and mixed with honey and lime		Used for very serious cough

Jiofack et al. (2010), documented traditional uses of plant species that treat some important diseases and some of the plants recorded in this study have also been described in earlier literature (Focho et al., 2009a; Idu et al., 2009). The study has revealed some new and interesting uses of plants.

A number of methods were identified for the preparation of traditional remedies. These included squeezing, grinding/crushing, boiling (hot infusion), decoction and paste and these were administered internally or externally. Squeezing and decoction were the most common methods of preparation within the study area, especially in cases where plant leaves were the main parts to be used. These findings are consistent with those of Jiofack et al. (2010), where they observed the use of plants in traditional medicine as decoctions, infusions, macera-

tions, powders, mixtures, squeezing in water, boiling, and direct eating. Inhalation of vapour through breathing from boiled or warmed plant parts was one of the methods of administration of the herbal remedies. Most solutions or concoctions were either taken orally or as enema, other methods included, use of steam baths of hot infusions, application of crushed plant part directly to the skin, rubbing (plant parts are crushed and mixed with water or oil and rubbed on the body), powders, chewing and spitting. A few remedies were given with oils, mostly by use of palm and kernel oils from (*Elaeis guinensis* Jacq.) 'njabe' oil from (*Baillonela toxisperma* (Hook. f.) Benth. which is added in preparations to make them palatable to be taken orally or to increase their consistency and quality for application on the affected parts.

Preparation of the medicinal mixtures depended on the

Table 3. Species of plants used for ecological, cultural and rural architectural and other purposes by the indigenous people.

Species	Family	Common/Local name	Uses
<i>Afrostryax lepidophyllus</i> Perkins & Gilg.	Huaceae	Country onion	Spice/Preservation of food
<i>Alchornea cordifolia</i> (Schum & Thonn.) Muell. Arg.	Euphorbiaceae		Rural architecture. Used to construct life fence
<i>Alchornea laxiflora</i> (Benth.) Pax & K Hoffm.	Euphorbiaceae		Rural architecture. Used to construct life fence
<i>Bridelia micranta</i> (Hochst) Baill.	Phyllanthaceae		Rural architecture. Used to construct life fence
<i>Antiaris toxisperma</i> L.	Moraceae	Wodombo	Ecological, for trapping of animals
<i>Bambusa vulgaris</i> Schrad. ex Wendl.	Poaceae	Konga, Indian bamboo	Building and construction, furniture, baskets,
<i>Bixa orellana</i> L.	Bixaceae	Lipstick plant	Seeds used as dye and as lipstick
<i>Ceiba pentandra</i> (L.) Gaertn.	Malvaceae	Boma tree. cotton tree	Silk Ecological in farmland. Cotton from fruits is used for stuffing pillows and mattresses and cleaning purposes.
<i>Citrus aurantifolia</i> (Christm.) Swingle.	Rutaceae	Lime	Used to clean rusty iron, particularly files and farm tools. Fruits are also eaten.
<i>Cola lepidota</i> Schott and Endl.	Malvaceae	Monkey cola	Ecological in farmland, rural architecture, bark is used as fiber to make straps for baskets and bags.
<i>Cola nitida</i> (Vent) Schott & Endl.	Malvaceae	Country cola	Seeds used culturally for entertainment and for ceremonies.
<i>Crescentiacujete</i> L.	Bignoniaceae	Calabash tree	Appreciated for the large, round fruits, used to make containers for palm wine.
<i>Cylicodiscus gabonensis</i> (Taubert.) Harms.	Fabaceae	Denya	Ecological/indicator species to show the soil is rich for agriculture. Timber species.
<i>Dracaena sanderiana</i> Hort. Sander	Asparagaceae (Dracaenaceae)		Culture/boundary plant
<i>Dracaena talbotii</i>	Asparagaceae (Dracaenaceae)	Boundary plant Peace plant	Peaceful settlement of boundary conflict, demarcation of land
<i>Elaeis guineensis</i> Jacq.	Areaceae	Oil palm tree	Very useful. Almost every part of the plant is utilized. Seeds for oil, leaves for thatching, brooms, thorns for removal of jiggers and foreign particles in foot and hands, maggots from the tree are eaten, Kernel oil used medicinally and as body lotion,

Table 3. Contd.

<i>Ficus exasperata</i> Vahl.	Moraceae	Sand plant	paper	Coarse leaf surfaces used for polishing furniture and craft.
<i>Garcinia mannii</i> Oliv.	Clusiaceae			Used as chewing sticks in place of toothbrush. Dental hygiene.
<i>Gnetum buchholzianum</i> Engl.	Gnetaceae	Eru		Leaves are eaten when mixed with <i>Talinumfruticosum</i> . Very popular vegetable.
<i>Irvingia gabonensis</i> & <i>I. wombolu</i>	Irvingiaceae	Bush mango		Sees are used as condiment, soup thickener
<i>Maesobotrya dusenii</i> Benth.	Phyllanthaceae			Rural architecture/ Building poles and trap poles
<i>Megaphrynium</i> <i>Macrostachyum</i> (Benth.)Milne-Redh	Maranthaceae			Food wrapping/Roofing huts.Stems used for making mats.
<i>Mitragyna ciliata</i> Korth.	Rubiaceae			Leaves are large and round and used traditionally to wrap fruits and seeds especially kolanuts.
<i>Musanga cecropioides</i> R.Br	Urticaceae	Ikombokom Umbrella tree		Rural architecture : in farm tool
<i>Pandanus candellabrum</i> , Parkinson.	Pandanaceae			Mats are plaited from leaves. Thatching.
<i>Phyllobotryon spathulatum</i> . Muell.Arg	Salicaceae			Large leathery leaves are used for temporary roofing.
<i>Pterocarpus soyauxii</i> Taubert.	Fabaceae	Cam wood		Cultural for child birth and marriages red wood has many local uses and a red dye is extracted from it. Young leaves are used as a green vegetable. Also used for making mortars/pestles
<i>Pycnanthus angolensis</i> Welw.)Warb	Myristicaceae	Nasamba		Ecological, improves soil fertility. The seeds have a very high fat content, and will sometimes burn like candies.
<i>Raphia hookeri</i> G.Mann & H.Wendl.	Areaceae	Mat		Rural architecture/Building construction, thatching /craft, basketry
<i>Ricinodendron heudelotii</i> (Baill.)Heckel.	Euphorbiaceae	Njangsang		The wood is used for planks and making mortars. Seeds used as spice.
<i>Ricinus communis</i>	Euphorbiaceae	Castor oil plant		(groundseed used for food storage against insects. Ash from burned wood is usedinsecticide.
<i>Scyphocephalum mannii</i> Warb.	Myristicaceae	Bofi		Ecological, improve soil fertility.
<i>Spathodea campanulata</i> P.Beauv.	Bignoniaceae			Ecological, life fence and ornamental tree.
<i>Staudtia kamerunensis</i> Warb.	Myristicaceae	Matanda		Rural architecture, ecological in farmland

Table 3. Contd.

<i>Terminalia catappa</i> L.	Combretaceae	Banga school	Ecological used as shade tree, kernels are edible and used by children for games.
<i>Tetrapleura tetraptera</i> (Schum.) Taubert.	Fabaceae	Four corner	Rural architecture. The flesh from two of the four wings on the large fruits is used as a spice. The fruits are edible
<i>Thaumatococcus</i> (Benneth.) Benth. <i>danielii</i>	Marantaceae	Ngongo leaf,	Cultural, preparation of delicacies' Food wrapping which leaves a good flavour. Used for making mats.
<i>Trichoscypha acuminata</i> Hook.f.	Anacardiaceae	Mandodo	Ecological in farmland/ fruits which have a sweet sour taste are edible.
<i>Xylopia ethiopia</i> (Dunal) A.Rich.	Annonaceae		Cultural, preparation of delicacies'. Used as a spice/flavouring
<i>Truimfetta cordifolia</i> Guilleman & al.	Malvaceae		Leaf used as toilet paper. Used also for making ropes.

needs of the people as the herbalist avoided preparations in advance, undoubtedly being conscious of preservation concerns, an observation made by Omwuliri et al. (2005). However in some instances, different methods were employed for preservation of the plants or plant parts which include drying in sun or in a barn ('banda') in the traditional kitchen where wood is being used for fire, wrapping in fresh leaves such as banana leaves or Maranthaceae leaves, burying in a cool area beside settlement and in some cases the preparations are mixed with oil for long lasting use. Some of these observations corroborate findings of Focho et al. (2009a), Ngoni et al. (2011). Most of the remedies were prepared from a single plant source, for example, *Alstonia boonei* (for treating malaria and body pain, *Eremomastax speciosa* as blood tonic, an observation also made by Idu et al. (2010), where they found the roots of *Ancomanes difformis* being used for anti hypertamia. Some preparations required a mixture of two or more plants, such as was the case of redness of the skin, treated by administering a mixture of *Angylocalyx oligophyllus* and *Ageratum conyzoides*, *Cymbopogon citratus*, *Carica papaya* and *Eremomastax speciosa* for malaria and improvement of the blood, *Entandrophragma utile* and *Piper guineensis* for the treatment of blood clotting and abscesses, *Massularia acuminata* roots and fruits of *Elaeis guineensis* to accelerate maturity and softness of abscesses and boils. Mixing different plants in the preparation of remedies was also reported by Sombo (2010), where he proposed that there may be increase effectiveness when combined.

Many of the species encountered have been cited by other authors for same and different illnesses such as *Eremomastax specioca* used as blood tonic (Fongod et al., 2013); *Alstonia boonei*, as anti-malarial (Adjanohoun

et al., 1996) and Focho et al. (2009b) reported the plant in the treatment of epilepsy, hernia and snake bites. *Annickia chlorantha* is confirmed by Adjanohoun et al. (1996) in treating malaria. *Aspilia africana*, in this study is known as a very good coagulant, but Waako et al., 2005 reported it as anti-malarial. *Elaeis guineensis*, was also recorded in Focho et al. 2009b for the treatment of convulsions. *Garcinia kola*, is also confirmed by Egbe et al. (2012); Focho et al. (2009b) as an aphrodisiac.

A good majority of the common and most frequently used plants such as *Chromoelaena odorata*, *Commelina benghalensis*, *Ageratum conyzoides*, popularly known as the 'king plant', *Emilia coccinea*, *Aloe vera* and *Eremomastax speciosa* were found around homes and farms. Domestication of some wild plant species is being done by herbalists where they confirmed being unsuccessful in some instances, probably due to habitat change or differences. Domestication of some of these plants is for ease of access whenever needed, a view perceived by (Tongo and Ekwalla, 2003). Most of the interviewees interestingly knew the importance of plants around them and everything is thought out for a more unswerving supply thus contributing in their conservation, a view held by Cheek et al. (2004). Traditional knowledge of medicinal plants and their use by indigenous culture are not only useful for conservation of cultural traditions and biodiversity but also for community healthcare and drug development now and in the future (Hanazki, 2000; Pei, 2001). There is therefore, the need to encourage domestication and cultivation of medicinal plants as well as put in place conservation measures to ensure sustainable source of plant materials. The use of plants for medicinal purposes has been reported in other continents of the world, (Rajendran et al., 2012; Shailendra and Chauhan,

2012; Pandey, 2003).

Thirty eight species used for varied purposes ranging from ecological, cultural, culinary/gastronomical and rural engineering, were identified distributed over 23 families (Table 3). Some of the species had some interesting uses such as plants as indicator species for rich soils (*Cylicodiscus gabonensis* and *Pycnanthus angolensis*), plants believed to solve boundary conflicts and witch craft (*Dracaena talbothi* and *Aframomum melegueta*) wrapping and preserving food (species of Maranthaceae) among others. The indigenes showed a lot of mastery of the plants and their different parts which they exploit for diverse uses.

The indigenous people allow cherished plant species that provide services to the crops such as shade and protection of the soil from erosion and degradation. In certain areas, farmers were found working or farming around a tree because they believe it fertilizes the crop thereby leading to improved production. The indigenous people eat a variety of fruits which they cultivate around their homes such as mangoes, avocado, guavas, coconut and others as well as vegetables, cereals and pulses, roots and stems of plants. This also helps in conserving the biodiversity. The people make use of intrinsic knowledge in addressing some of their snags, for example in situations where they are lost in the forest during hunting expeditions or in their search for plants, they survive by eating food and fruits that animals such as monkeys or apes feed on as they believe these animals look much like them. Consequently, eating foods such as “monkey cola” - *Cola lepidota* or sucking fruits of “Mandodo” - *Trichocypsa acuminata* will help them during their stay in the forest as they find their way.

A number of interesting observations were made where farmers were found bending some of the leaves of *Colocasia esculenta* (L.) Schott. (“Makabo coco”- cocoyam) for the crop to increase the size and number of tubers. To them reducing the vegetative parts of the crop causes it to develop more tubers the part most consumed. They were also found taking off the reproductive parts of vegetables as was the case of *Talinum fruticosum* (L.) Juss. to increase the production of vegetative parts especially the leaves as this is what is typically consumed. Also another astonishing observation was with a species of *Xanthosoma* (cocoyam ‘Egg coco’ or “Akpana coco”). It was noticed that in majority of the communities where this crop was being grown for human consumption, the indigenes believe that when grown in an area where there are dry sticks, that would hit the crop from time to time in the field especially during heavy winds or storms, consumption will not cause itching of the cocoyam. On the other hand, if it is grown on any farmland without dry sticks from trees dropping on them, the cocoyam would only be best for pigs because of the itchy nature.

Traditions, customs, beliefs and cultural rights play an important role in environmental conservation and biodi-

versity. Many of the communities in the African countries maintain shrines and protected forests which are being used as places of worship and for other ritual. Secret parts in the forest of most these indigenous people in the study areas are considered as a place of worship and ritual grounds, so villagers are not allowed to move freely in such places to either pick up fruits such as “Bush mango” or “Country onions” or harvest vegetables such as “Eru”. Such acts are only possible with permission that must be given to individuals who intend to carry out any adventures within these secret parts. Some sites were encountered with such restrictions, for instance in the Rumpi Hills where the ethnic groups of Lepenja, Mbu-Bakundu, Upper Ballong and others share a forest that people or villagers cannot access without some cultural rites. We observed that some of these practices and beliefs about certain species contribute towards their conservation as these species are perceived to have powers to cause certain horrendous consequences for humans if destroyed. Some species improve on the soils for agriculture and others are believed to have abilities to communicate some messages to humans (Tzepo and Chaba, 2004). Eyong (2007) holds that a strong sustainability connection should exist between indigenous and modern knowledge and time-tested ancient wisdoms which when combined with modern technologies can create solid foundations for sustainable development in different regions.

Conclusion

The study revealed that over many years, the local communities have acquired valuable practical knowledge about the local natural resources and therefore to some unknown extent actively manage and conserve their resources guided by indigenous knowledge. A comprehensive proactive policy framework is the best way to conserve indigenous knowledge that can help produce, use and maintain diversity. There is a need to build on the existing resources of indigenous species by improving on their management to sustain the resources as well as further domestication of highly valued species.

Living conditions of the indigenes can be improved somehow, may be by introducing other species to complement the existing vegetation which they are so tightly attached to, improved methods of fabrication, construction or generation of some of the products from the plants could be initiated to make them highly competitive in the market.

ACKNOWLEDGEMENTS

The authors are indebted to the indigenous people for revealing very valuable information about the usage of plants and to the guides and interpreters. Authors are also thankful to the Limbe Botanic Garden (SCA), for their

their invaluable support in providing the necessary facilities for plant identification and documentation. We are also grateful to the anonymous reviewers for their comments and corrections.

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