Medicinal Plants Used Against Typhoid Fever in Bamboutos Division, Western Cameroon

Roger Tsobou, Pierre Marie Mapongmetsem, and Patrick Van Damme

Research

Abstract

Typhoid fever is a serious infectious disease that has been a public health concern for millennia. An impressive number of plant species are traditionally used in the management of typhoid fever in the Bamboutos Division of the West Region of Cameroon. In the present ethnobotanical survey an attempt has been made to document the different medicinal plants used traditionally by traditional healers and elders to treat typhoid fever. Ethnobotanical interviews on medicinal plants used to treat typhoid fever were conducted with traditional healers and elderly persons using open-ended semi-structured questionnaires. Field trips were made to the sites where they harvest plants, and specimens were collected and identified. A total of 59 medicinal plant species belonging to 56 genera and 33 families were recorded during the study. The most commonly used plant families recorded were Asteraceae (17%); Fabaceae (7%); and Bignoniaceae, Malvaceae, and Moraceae (5.0% each). The most frequently utilized medicinal plant parts were leaves (48.6%), followed by bark (28.9%), stem (7.8%), whole plant (6.5%), roots (5.2%), and fruits (2.6%). while shrubs (35,5%) were the primary source of medicine, followed by herbs (32.2%) and trees (30.5%). Most of the medicinal plant species (40.6%) were harvested from the wild compared to 38.9% from cultivated land and 20.3% semi-cultivated. Decoction was the most common method of traditional drug preparation. Oral administration was the only mode of dispensing of herbal medicine. Most of the plants were used in combination to increase effectiveness in the treatment of the disease. Knowledge of the use of plants as medicines remains mostly with traditional healers and older generation who are illiterate. It is recommended that research institutes and university researchers carry out research on these species so as to conserve and improve their genetic constitutions. Also, attempts must be made to encourage the documentation of plants, so that they can be readily accessible to a larger number of populace.

Introduction

Cameroon is a country located in Central-Africa, with an area of approximately 475,442 km² for an estimated 19.4 million inhabitants. The country is composed of various climatic zones and a diversity of ethnic groups (around 260 ethnic groups with 260 vernacular languages). The life expectancy in Cameroon is about 51 yrs for males and 52 yrs for females. This disturbingly short life expectancy is due to the predominance of infectious disease such as typhoid fever and parasites (WHO 1993).

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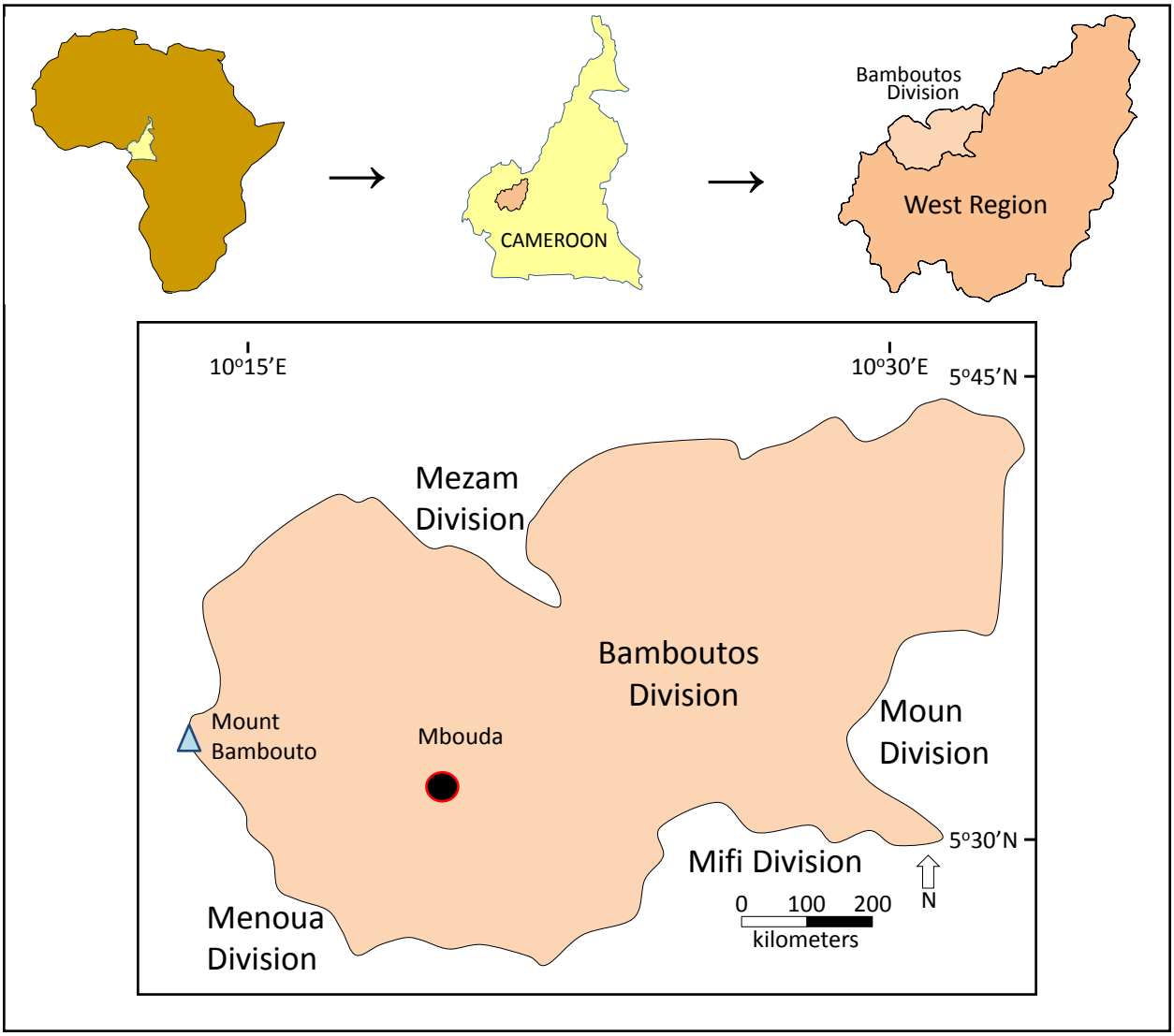

Figure 1. Location of the study site, Bamboutos Division, West Region, Cameroon, Africa.

common in regions where sanitary conditions are poor, particularly in Africa, South East Asia, and Latin America (WHO 1993). Annual reports from the Ministry of Public Health in Cameroon showed that 1800 and 5300 patients were affected in 1987 and 1989, respectively (Ghangha 1991), showing a rise in the number of cases diagnosed. Recent reports suggest that the diagnosis of typhoid fever is becoming more and more frequent in health facilities in Cameroon (Ministry of Health 1996), resulting in a public scare. According to Zofou *et al.* (2009), typhoid fever is one of the more endemic infectious diseases in Bamboutos Division after malaria. The WHO (1993) estimates that the global prevalence of typhoid fever is between 16 million and 33 million cases annually, with 500,000 to 700,000 deaths. To improve their health and both treat and prevent the disease, people use both conventional and traditional medicine.

Traditional medicine still remains the main means of treatment for a large majority of people suffering from typhoid fever. Being a comprehensive knowledge system, traditional medicine encompasses the utilization of substances, dosages, and practices based on socio-cultural norms and religious beliefs as well as witnessed experiences and observations of a specific group. This knowledge is handed down from generation to generation in order to diagnose, prevent, and eliminate a physical, social, or spiritual imbalance (Diallo & Paulsen 2000). More than 80% of the world's population relies on traditional medicine for their primary health care, and a majority of them use plants or their active principles (Gupta *et al.* 2005). Plants used in traditional medicine contain a wide range of ingredients that can be used to treat chronic as well as infectious diseases (Okafor 2001). These natural resources are widely relied upon by rural communities in developing countries because of inefficiencies or lack of hospitals

and social services in these areas. For this reason, many people are currently resorting to traditional medicine for primary health care due to high costs in accessibility, cultural incompatibility, and self-reliance among others (Kamatenesi-Mugisha *et al*. 2005). They also employ herbal medicines because of cultural preferences and perceived effectiveness (WHO 2002).

Ethnomedicinal studies are still in the initial stage in most parts of Cameroon, and studies made so far are not comprehensive. Also, ethnobotanical surveys carried out in Cameroon by Adjanohoun *et al.* (1996) reported only eleven (11) medicinal plants in the Bamboutos Division. There is, therefore, a need for exhaustive documentation of the medicinal plants of the Bamboutos Division. This paper seeks to identify medicinal plants that can be used to treat deadly typhoid fever and the mode of their use in the Bamboutos Division, West Region of Cameroon.

Materials and Methods

The study area

The Bamboutos Division is located in the western highlands and extends between 5–6° N and between 9–11°E (Figure 1). It's one of the eight divisions which make up the West Region of Cameroon and is bordered to the north by Mezam Division, to the south by Mifi and Menoua divisions, and to the west by Noun Division. The Bamboutos division covers an area of 1155 km² which represents 8.31% of the total area of the West Region of Cameroon. Located on the eastern slope of the Bambouto Mountain from which it is named, Bamboutos Division is characterized by the great diversity of its relief, climate, vegetation, and soils. Mount Bambouto is the third highest mountain in Cameroon (2740 m) after Mount Cameroon (Fako) (4100 m) and Mount Oku (3008 m).

The total population of the division was about 300,000 (232,116 rural and 60,294 urban) according to a 2005 census (RGPH 2005). The rural population comprises 78% of the total population. Population density is 300 people per square kilometer. The main occupation in the community is farming. There are two seasons: the dry season from November to March and the rainy season from March to October. The climate is subtropical with an annual rainfall estimated at 1621.5 mm and an mean annual temperature of 24–29°5C (MINEF 1999).

Table 1. Demographic characteristics of informants from Bamboutos Division of the West Region of Cameroon. Informants willingly responded to a research questionnaire and open-ended conversations regarding use of medicinal plants for treating typhoid fever. Informants were identified with the help of the traditional ruler of each participating village.

	Count	% of Total
Occupation		
Traditional healers	40	57
Farmers (elders)	30	43
Age (yrs)		
40-50	29	41
50-60	18	26
>60	23	33
Marital Status		
Married	68	97
Divorce	-	-
Single	-	-
Widow(er)	2	3
Gender		
Male	68	97
Female	2	3
Education		
University	-	-
Secondary school	-	-
Primary school	47	67
No formal education	23	33

Data collection

An ethnobotanical survey was carried out in the Bamboutos Division January–November 2009. Traditional healers and elderly persons were considered the target key informants in the study, and the selection process was based on the knowledge base, experience, and current practices in ethnobotany medicine of the target individual. Informants were identified with the help of the traditional ruler of each village.

After seeking their consent, the traditional healers were interviewed using semi-structured questionnaires as described by Martin (1995) and open-ended conversations. Trips were made to the sites where traditional healers usually go to harvest plants. The interviews and discussions were carried out in the local language for each of the villages visited. Since the author is a native of the division, data on the local names of the plants, the plant parts used, mode of usage and administration, and mode of preparation were obtained. These plants were classified as wild, semi-cultivated, or cultivated. Semi-cultivated plants were those that some informants harvested wild while others tried to preserve them in their gardens and farmlands. Plants were also classified into different types of growth forms: herbs, climbers, shrubs, and trees. Plants had to be mentioned by at least two informants as treating typhoid fever in order to confirm their use. Occupation status age, marital status, and level of education of the healer were also recorded.

Voucher specimens and sample collection

Voucher specimens of the documented plant species were collected according to standard practice, including roots, leaves, flowers, and fruits where possible (Martin 1995). Collection only involved samples that were iden-

tified by the informants. The collected specimens were taxonomically identified in the Laboratory of Applied Botany at the University of Dschang, Cameroon, and further confirmation was made at the National Herbarium in Yaoundé, Cameroon. Voucher specimens were deposited in the University of Ngaoundéré, Department of Biological Sciences.

Results

Demographics of the informants are presented in Table 1. A total of 40 traditional healers whose ages ranged 40–95 years and 30 elders with ages ranging 50–80 years were interviewed; 59% were 50 years or older. Most of the informants were men, and the study included only 2 women.

The scientific names, local names, family names, habit, habitat, part used, combination of plants, methods of preparation, status, frequencies, and dosage for each plant are shown in Table 2. A total of 59 medicinal plants species that belonged to 56 genera and 33 families were recorded as being used to treat typhoid fever. The most represented plant families on the list of medicinal plants were the Asteraceae with 10 species (17%), followed by Fabaceae with 4 species (7%) and Bignoniaceae, Malvaceae, and Moraceae with 3 species (5%) each. Out of 59 medicinal plants recorded from study area, the highest number of plants were shrubs (36%) followed by herbs (32%), trees (30%), and climbers (2%). Twenty three plants (39%) were categorized as cultivated due to their economic and feeding importance, while twelve plants (20%) were listed as semi-cultivated and twenty four (41%) as wild plants. Leaves were reported as the most commonly used plant part and were identified for usage in 49% of the total recorded medicinal plants. Bark was also frequently used (29%), followed by stems (8%), whole plants (6%), roots (5%), and fruits (3%).

In all cases, oral administration was reported as the only mode of dispensing of herbal medicines against typhoid fever. Decoction was by far the most reported method of preparation (~70% of all plants mentioned). This was followed by crushed extract in cold water (12%), infusion (10.5%), maceration (6.5%), and concoction (1%). Some of the medicines were reported to be traditionally prepared in combination with other plants (Table 3). Notably, *Bidens pilosa* L. is used in combination with every other species. In addition to the combinations listed in the table, *Senna alata* (L.) Roxb. was reported as being mixed with limestone, and *Vernonia purpurea* Sch. Bip. ex Walp. was reported as being mixed with *Citrus limon* (L.) Burm. f. *Laggera alata* (D. Don) Sch. Bip. ex. Oliv. was reported as being optional in some combination treatments, but no specific plants were mentioned.

Discussion

Demographics

Many more men than women were identified as informants and participated in the study. This gender disparity could be due to the fact that men were more available at homes while some women did not want to divulge their knowledge in the practice of herbal medicine. Similar results have been reported in Mali by Togola *et al.* (2005), who reported that men dominated the practice of traditional medicine, and women seem to have less knowledge than men about traditional medicine. They attributed this to the fact that women mainly treat children and typical child diseases, while men treat both children and adults.

Plant identity and usage

The high percentage of medicinal plants obtained from the family Asteraceae may be due to a wide range of biologically active compounds in that family, and also because it is one of the largest families in the plant kingdom (Heinrich *et al.* 1998, Thomas *et al.* 2009). It could also be attributed to their relative abundance in the study area and their assumed efficacy as reported by the key informants. For instance, where a medicinal plant was reported as used in combination with other plants, *Bidens pilosa* L. appears in each of these mixtures.

The preferential use of shrubs and herbs for medicinal purposes may be due to easy availability and high effectiveness in the treatment of ailment in comparison to other growth forms or because the study area is located in grassland savannah which favors the growth of shrubs and herbs over trees. The common use of shrubs and herbaceous medicinal plants was also reported in other parts of the world (Addo-Fordjour *et al*. 2008) and could be attributed to their wide range of bioactive ingredients (Gazzaneo *et al.* 2005).

One reason for the high rate of usage of wild harvested plants over semi-cultivated or cultivated plants, according to key informants, is because cultivated medicinal plants have less therapeutic efficacy compared to wild plants. And although some informants reported that there was a potential to domesticate medicinal plants as some of them were already being planted in gardens, the fact that the majority of the plant species recorded were sourced from the wild may imply that many indigenous plant species may be difficult to propagate. Kisangau *et al.* (2007) supports the observation that only a few herbal practitioners were involved in cultivation of medicinal plants and that most of them were indeed gathering from the wild. Furthermore, some of the informants thought that cultivating the medicinal plants in their gardens would expose their medicinal plants to other traditional healers. Similar findings have been reported by Addo-Fordjour *et al*. (2008),

Table 2. Medicinal plants used to treat typhoid fever in the Bamboutos Division, West Cameroon. Local names are reported in [1]Megaka, [2]Ngiembon, [3]Ngomba'a, and [4]Ngombalé. Nativity status is listed as cultivated (C), semi-cultivated (C/W), or wild (W). Habit is listed as either climber (C), herb (H), shrub (S), or tree (T). Habitat is classified as abandoned garden (AGa), edges (E), forest (F), garden (Ga), grassland (Gr), homestead (H), open grassland (OGr), roadside (R), under trees (U), and wooded grassland (WGr). Part used include bark (B), fruit (F), leaf (L), root (R), stem (S), stem-with-leaves (SwL), tuber (T), and whole plant (W). Methods of preparation (Prep.) are concoction (C), crushed extract (Ce), decoction (D), infusion (I), and maceration (M). Frequency (Freq.) refers to the number of times a species appeared in an interview. Mode of administration in all cases is oral.

Scientific name	Local name	Status	Habit	Habitat	Part used	Prep.	Freq.
ACANTHACEAE							
Dyschoriste perrottetii (Nees) Kuntze	**Mekonbi**[3]	W	H	OGr, R	W	D, I	5
Eremomastax speciosa (Hochst.) Cufod.	**Kouokmegar**[1] **Pankuzem**[3] **Panzemmock**[2] **Piezeumok**[1,4]	C/W	H	Ga, H	L	D, I	20
ANACARDIACEAE							
Mangifera indica L.	**Mangoure**[1,2,3,4]	C	T	H	B, L, R	D	15
Pseudospondias microcarpa Engl.	**Gueme**[3]	C/W	T	F, WGr	B	D	2
ANNONOCEAE							
Annona muricata L.	**Corossole**[1,2,3,4] **Saba saba**[1,2,3,4] **Sour-sop**[1,2,3,4]	C	S	Ga	B, L	D	5
APOCYNACEAE							
Picralima nitida (Stapf) T. Durand & H. Durand	**Djicka**[2,3]	C	S	Ga	F, R	D, M	10
Rauvolfia vomitoria Afzel.	none given	C/W	S	Ga, H	B, R	D	5
ASPARAGACEAE							
Aloe vera (L.) Burm. f.	**Lelan**[1,2,3,4] **Melan**[1,2,3,4]	C	H	Ga	L	M	18
Dracaena fragrans (L.) Ker Gawl.	**Kikeng**[1] **Kion**[2,3,4]	C	S	E, Ga, H	L,R	Ce, D, I	15
ASTERACEAE							
Acmella caulirhiza Delile	**Ehengui**[1] **Pento'o**[3] **Pentouo**[2,3,4]	C/W	H	Ga, OGr	L, S	Ce, C, D	23
Ageratum conyzoides L.	**Chouamou**[1,2,3,4] **Nekouada**[1,2,3,4] **Tsomamou**[1,2,3,4]	W	H	E, OGr, R	W	D, I	20
Aspilia africana (Pers) C.D. Adams	**Packben**[1,2,3,4]	W	H	AGa, OGr, R	S	D, I	25

Scientific name	Local name	Status	Habit	Habitat	Part used	Prep.	Freq.
Bidens pilosa L.	**Lietmik**[2,3,4] **Lipiliep**[1] **Metsemik**[1,4]	W	H	OGr	L, W	D, I	40
Crassocephalum mannii (Hook. f.) C. Jeffrey	**Kepang**[2] **Neponlou**[3] **Poupou**[2,3,4]	C/W	S	Ga, H	L	Ce, D	10
Emilia coccinea (Sims) G. Don	**Mafopa-son-lume**[3]	W	H	OGr	L	D, I	18
Erigeron floribundus (Kunth) Sch. Bip.	**Negigu**[1,3,4] **Negigume**[3] **Vengume**[2]	W	H	OGr	L	D, I	13
Laggera alata (D. Don) Sch. Bip. ex. Oliv.	**Depackkenan**[3] **Negikock**[3]	C/W	H	Ga, OGr	L	D	7
Vernonia colorata (Willd.) Drake	**Bitali**[1,2,3,4] **Mekang**[2,3,4] **Melute**[3,4]	W	S	OGr	L	Ce, D	2
Vernonia purpurea Sch. Bip. ex Walp.	**Vougnang**[1]	W	H	OGr	S, T	M	4
BIGNONIACEAE							
Markhamia tomentosa (Benth.) K. Schum. ex Engl.	**Ware/Watè**[2,3,4] **Watè kufo**[1,2,3,4]	C/W	S	F, WGr	B, L	D, M	1
Spathodea campanulata P. Beauv.	**Foufougue**[1] **Foukfouk**[3,4]	C/W	T	F, WGr	B, L	D, M	3
Stereospermum acuminatissimum K. Schum.	**Watefè**[3]	C/W	T	F, WGr	B	D, M	2
BORAGINACEAE							
Cordia platythyrsa Baker	**Fapbè**[3,4]	C/W	T	F, WGr	L	Ce	4
BURSERACEAE							
Canarium schweinfurtii Engl.	**Ailé**(common name) **Berè**[2,3,4] **Pui**[2]	C	T	F, WGr	B	D	3
Dacryodes edulis (G. Don) H.J. Lam	**Zo'o**[1,2,3,4]	C	T	Ga, H	B, L	D	8
CARICACEAE							
Carica papaya L.	**Papaye**[1,2,3,4] **Popo.o**[1,2,3,4]	C	T	Ga	F, L, R	D	27
COMBRETACEAE							
Terminalia glaucescens Planch. ex Benth.	**Ti-sa'a**[3]	W	T	OGr	B	D	11
CONVOLVULACEAE							
Ipomoea batatas (L.) Poir.	**Kopgoua**[3] **Makiok**[2,4] **Voukop**[1,3]	C	H	Ga	S	Ce	4

Scientific name	Local name	Status	Habit	Habitat	Part used	Prep.	Freq.
CUCURBITACEAE							
Zehneria scabra Sond.	**Laplap**[1,2,3,4] **Lelap**[1,2,3,4] **Liepliep**[1,2,3,4]	W	H	E, Ga, U	SwL	D	17
CUPRESSACEAE							
Cupressus lusitanica var. *benthamii* (Endl.) Carrière	**Sapin**[1,2,3,4]	C	T	Ga	SwL	D	5
DENNSTAEDTIACEAE							
Pteridium aquilinum (L.) Kuhn.	**Koukoumazong**[3]	W	H	OGr	L	D	3
DIOSCOREACEAE							
Dioscorea dumetorum (Kunth) Pax	**Leliock**[2,4] **Meliock**[1,4] **Neliock**[3]	C	H	Ga	L	D	3
EUPHORBIACEAE							
Croton macrostachyus Hochst. ex Delile	**Tsam**[3,4]	C/W	T	E, Ga, WGr	B, L	Ce, D	2
FABACEAE							
Bauhinia thonningii Schum.	**Tikwen**[1]	W	S	OGr	B	D	3
Entada abyssinica A. Rich.	none given	C	T	WGr	B	D	3
Pseudarthria confertiflora (A. Rich.) Baker	none given	W	H	Gr	L	D	2
Senna alata (L.) Roxb.	**Foupan**[3,4]	C	S	Ga	L	D	21
HYPERICACEAE							
Harungana madagascariensis Lam. ex Poir.	none given	W	S	OGr	B	D	5
LAMIACEAE							
Ocimum gratissimum L.	**Kotemadjo**[1,2,3,4] **Masep**[1,2,3,4] **Masepo**[1,2,3,4]	C	S	Ga, H	L	D	15
Vitex doniana Sweet	**Vounetane**[2,3,4] **Voutane**[1]	W	S	F, WGr	B	D	6
LAURACEAE							
Persea americana Mill.	**Piar**[1,2,3,4]	C	T	Ga, H	B	D	12
MALVACEAE							
Gossypium barbadense L.	**Coton**[1,2,3,4] **Sisti**[3]	C	S	Ga	L	D	10
Theobroma cacao L.	**Caca**[1,2,3,4]	C	S	Ga	B, L	D	2
Thespesia populnea (L.) Sol. ex Correa	**Kepfou**[3]	W	S	E, Ga, Gr	L	Ce	6

Scientific name	Local name	Status	Habit	Habitat	Part used	Prep.	Freq.
MELASTOMATACEAE							
Dissotis perkinsiae Gilg.	none given	W	H	Gr	L	D	2
MELIACEAE							
Azadirachta indica A. Juss.	**Neem**[1,2,3,4]	W	T	WGr	B	D	1
MORACEAE							
Ficus exasperata Vahl	**Kokguèmè**[2,3,4]	W	T	Gr, WGr	L	Ce	5
Ficus sur Forssk.	**Gack**[2,3,4] **Gaia**[1]	W	T	E, Ga, Gr, WGr	B	D	5
Ficus thonningii Blume	**Ngueme**[2,3,4]	C/W	T	E, F, Ga, WGr	B, L	D	7
MORINGACEAE							
Moringa oleifera Lam.	**Moringa**[1,2,3,4]	C	S	Ga	L	D	2
MUSACEAE							
Musa acuminata × *balbisiana* Colla	**Kadong**[1,2,3,4] **Kedond**[1,2,3,4]	C	S	Ga, H	L	D	22
MYRTACEAE							
Eucalyptus globulus Labill.	**Calitusse**[1,2,3,4] **Fousiga**[1,2,3,4]	C	T	E, Ga	L	D	22
Psidium guajava L.	**Goyave**[1,2,3,4] **Gravou**[1,2,3,4]	C	S	Ga	B, L	D	22
POACEAE							
Imperata cylindrica (L.) Raeusch.	**Kenick**[2,3,4] **Neuck**[1,2,4] **Nick**[2,3,4]	W	H	OGr	W	D	4
SAPINDACEAE							
Paullinia pinnata Linn.	**Dzick**[3]	W	C	F, WGr	L	D	3
SOLANACEAE							
Solanum rudepannum Dunal	**Chichifoun**[1,2,3,4] **Tichie**[2,3,4]	C	S	Ga	L	D	11
RUBIACEAE							
Gardenia ternifolia Schumach. & Thonn.	**Metouc-bouor**[1]	W	S	WGr	B	D	2
Mitracarpus villosus (Schwartz) DC.	none given	W	H	OGr	W	D	3
VERBENACEAE							
Lantana camara L.	**Lantana**[1,2,3,4]	C	S	E, Ga	L	D	7

Bako *et al.* (2005), and Okello and Ssegawa (2007). These results highlight a need to train herbal practitioners on appropriate propagation techniques of these plant species for sustainable utilization. According to Edwards (2004), about two-thirds of 50,000 medicinal plants in use worldwide are still harvested from their natural habitat, and about one-fifth of them are now endangered. The increased percentage of species obtained from the wild has a direct effect on the availability of these resources and is likely to contribute to their vulnerability to over-exploitation.

Above all other plant parts, leaves were reported as being used most often. The common use of leaves in the preparation of remedies could partly be due to the relative ease of finding this plant part. Leaves remain green and available during most months of the year. The common use of leaves is also due to their easy availability in the area. The observed variation in plant parts used could also be explained by the process of photosynthesis. Secondary metabolites often convey to plants their medicinal properties (Husain 1991). Thus, during photosynthesis there is synthesis of primary metabolites that are converted to secondary metabolites and stored in different parts of the plant. Some traditional healers are knowledgeable of this and usually collect certain medicinal plants in either the morning (06:00–10:00) or the evening (17:30–18:30). Leaves of plants have also been reported to accumulate chemical components such as inulins, tannins, flavonoids, coumarins, terpenoids, sterols, saponins, and other alkaloids (Okoegwale & Omefezi 2001), which may be responsible for their various medicinal properties hence explaining their wide usage.

In general the use of leaves as the chosen plant part is a more sustainable practice as opposed to where roots and/or the bark are used. The prevalence in the use of leaves for preparation of traditional herbal remedies has been re-

Table 3. Medicinal plants used to treat typhoid fever in the Bamboutos Division, West Cameroon, that are typically used in combination with other plants. Plants in this list may either be used alone or with any of the plants marked with an "x" in a corresponding cell.

Scientific name	*Ag. conyzoides*	*As. africana*	*B. pilosa*	*Ca. papaya*	*Cu. lusitanica* var. *benthamii*	*D. perrottetii*	*Em. coccinea*	*Ere. speciosa*	*Eri. floribundus*	*Eu. globulus*	*F. sur*	*F. thonningii*	*Mu. acuminata* ×*balbisiana*	*Ps. guajava*	*Pt. aquilinum*	*S. alata*	*Z. scabra*
Ageratum conyzoides L.		x	x			x	x				x	x	x				
Aspilia africana (Pers) C.D. Adams	x		x			x	x	x			x	x	x				
Bidens pilosa L.	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x
Carica papaya L.			x													x	x
Cupressus lusitanica var. *benthamii* (Endl.) Carrière			x	x												x	x
Dyschoriste perrottetii (Nees) Kuntze	x	x	x				x	x			x	x	x				
Emilia coccinea (Sims) G. Don	x	x	x			x		x			x	x	x				
Eremomastax speciosa (Hochst.) Cufod.	x	x	x			x	x				x	x	x				
Erigeron floribundus (Kunth) Sch. Bip.	x	x	x			x	x	x			x	x	x				
Eucalyptus globulus Labill.	x	x	x				x	x					x	x			
Ficus sur Forssk.	x	x	x				x	x				x	x				
Ficus thonningii Blume	x	x	x				x	x			x		x				
Musa acuminata ×*balbisiana* Colla	x	x	x				x	x			x	x					
Psidium guajava L.	x	x	x				x	x		x			x				
Pteridium aquilinum (L.) Kuhn.			x													x	x
Senna alata (L.) Roxb.				x	x										x		
Zehneria scabra Sond.			x	x												x	

ported in other studies (Amri & Kisangau 2012, Focho *et al*. 2009, Muthu *et al*. 2006, Panghal *et al*. 2010). This practice helps to increase the chances of species survival and enhances the sustainable management of plants, as long as only an appreciable amount of leaves is harvested (Abede & Ayehu 1993, Tadesse *et al*. 2005).

Some of the medicines reported here were prepared by combining different plants. The plants used for these combinations are listed in Table 3. According to the traditional healers, medicines prepared by combining two or more plants are more potent than those prepared with single plants. This has been attributed to the additive effects of the plants (Addo-Fordjour *et al*. 2008, Okello & Ssegawa 2007) where the combination of several medicinal plants increases the quality and efficacy of medicine. Similar observations have also been recorded amongst the Kani communities in India (Ayyanar & Ignacimutum 2005).

It was not surprising that decoction was the preferred preparation method. Decoction is known to be an effective extraction method compared to use of crushed extract in cold water, since boiling also preserves the medicine longer and allows the killing of microorganisms potentially associated with the harvested plants. Plant parts were generally prepared using water as the solvent, likely because water is a readily available and cheap solvent and provides good solubility of the active components.

Oral administration was the only mode of dispensing of herbal medicines against typhoid fever. This is because the causal bacterium is located in the intestinal tract. This mode of administration of herbal medicine was also reported elsewhere (Bhattarai *et al*. 2010, Kamatenesi & Oryem-Origa 2006). Most treatments were given for one to 4 weeks, and the majority of drugs were taken twice a day.

Medicinal plant knowledge secrecy, mode of transfer, and threats

A majority of the informants interviewed were aged above 50 years (Table 1); these findings are in agreement with Togola *et al.* (2005) and Diame (2010), who observed that only a few healers were below 40 years. While traditional healing methods continue to be well used, the younger generation's knowledge of them is diminishing fast as certain plants disappear from the environment and the older practitioners die without passing on their specialist knowledge. Naranjo (1995) argued that modernization also contributes to the fast-eroding and corroding and, at times, total disappearance of such precious knowledge.

Table 1 shows that the informants either have education only to primary school (47 informants) or no formal education (23 informants), and presumably their interest is more in medicinal plant activities. This is likely why traditional healers and others do not keep records; the information is mainly passed on verbally from generation to generation. This knowledge, however, is dwindling rapidly due to movement towards a more western lifestyle, modern agricultural practices, cultural changes within the community, housing colonies, and modern education. These changes are leading to not only the destruction of habitats of medicinal plants but also the vanishing of traditional knowledge, and medicinal plant species are threatened day by day in the area. Similarly the threat to traditional knowledge observed in other parts of the world (Panghal *et al*. 2010) is also due to a lack of interest of the younger generation.

Conclusion

Some 59 medicinal plants species that may be cultivated, semi cultivated, and wild types are widely utilized for treating typhoid fever by people living in the Bamboutos Division area. Plants have become the most revered and treasured friends of people in this study area.

Informants know which part of the plants should be taken and at which time. In preparation and administration of dosages other ingredients may be added. Loss of medicinal plants and the associated knowledge will hamper the existing health care system in the area. Therefore, in order to use traditional medicine as a valuable alternative to conventional Western medicine, further investigation must be undertaken to determine the validity, efficacy, and dosage of the plants to make it available as an alternative medicine.

It is recommended that research institutes and university researchers should carry out research on these species so as to conserve and improve their genetic constitutions. Also, attempts must be made to encourage the documentation of plants so they are readily accessible to a larger number of the populace.

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