

*Full Length Research Paper*

# An ethnobotanical study of medicinal plants used in the Kalamaloué National Park, Cameroon

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**An ethnobotanical survey was conducted from 1st April to 30th September 2005 among populations living inside and around the National Park of Kalamaloué in the far north of Cameroon. The survey aimed at identifying the plants used in the general pharmacopoeia among local ethnic groups using interviews with households who have a rich knowledge on the plants. A total of 36 medicinal plants were recorded from 37 informants comprising 30 genera and 23 families. Diarrhoea, malaria/fever, rheumatism, wound and cough were the major ailments treated in these households. *Piliostigma reticulatum*, *Tamarindus indica*, *Balanites aegyptiaca*, *Azadirachta indica*, and *Mitragyna inermis* were the most cited plants. These plants are also known for similar usages in other African countries and some of them are confirmed in literature to possess biological activity related to ailments indicated.**

**Key words:** Medicinal plants, general pharmacopoeia, Kalamaloué National Park.

## INTRODUCTION

According to the Cameroon forestry and wildlife law, a national park is a protected area managed mainly for ecosystem protection and recreation; a natural area of land and/or sea designated to: (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation inimical to the purposes of designation of the area; and (c) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible (MINEF, 1996). The main target of Cameroon Government regarding biodiversity conservation is to transform 30% of the total land area into protected areas composed mainly of national parks and natural reserves. To date, the Cameroon Government has created more than 14 national parks and 8 natural reserves (Tieguhong and Betti, 2008). The problem is that most of those areas face the pressure of local populations who live in abject

poverty. The protected areas constitute for them their unique source for food and medicines. This paper analyses the usage of medicinal plants among populations living inside and around the Kalamaloué National Park, in the far north of Cameroon.

## MATERIALS AND METHODS

### The study site

The Kalamaloué National Park is located in the far north region of Cameroon, in the Logon and Chari division, and in the Kousséri subdivision to be précised. The Kousséri city is situated in the limit between Cameroon and the Republic of Chad. The Kalamaloué National Park covers a total area of 4500 ha and is situated between 12°05' and 12°11' latitude north, and 14°49' and 14°90' longitude East. The climate is the soudano sahelian type and is characterized by a long dry season (October to May) and a short rainy season (June – September). Annual rainfall is weak and irregular; varying from 230 to 700 mm, with an average of 529 mm. The temperature varies from 21.7 to 35.7°C with an average of 28.4°C. Kalamaloué belongs to the domain of the lac Chad floor. The vegetation of the Kalamaloué National park corresponds to a typical Sudano-sahelian type constituted with shrubby and abusive steppes. The major ligneous trees include *Acacia*, *Balanites*, and

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*Ziziphus*. The shrubby strata are largely composed of *Pennicetum* and *Imperata*. The major ethnic groups include: Arab-choa, Bornoa, Kotoko, Massa, and Mosgoum. They practise agriculture, livestock farming, and fishing (Letouzey, 1968).

### Ethnobotanical survey

The method used in this study (method for the popular pharmacopoeia), consists of gathering data on the popular use of medicinal plants in a given area (e.g. village). Following this method, the data for this study were obtained from direct interviews with the local people conducted from 1st April to 30th September 2005 in villages settled in the periphery of the Kalamaloué National Park. The survey aimed at identifying plants used in the popular pharmacopoeia among local people. The household was considered as the sample unit. In each household who accepted to respond to our questions, data were mostly recorded from adult women (mothers), because they knew the plants better than men and younger people. They provided useful and firsthand information on the popular use of medicinal plants. During the survey, we made enquiry "as to what ailments were treated by which plant species" For each health problem cited, the name of the plants and the plant parts used were carefully recorded.

The vernacular names of the plants were recorded as much as possible, and we collected the plants mentioned by the informants. The plants were identified with the help of Mr. Ndong Atchike, a botanist and lecturer at the Wildlife School of Garoua, Cameroon. Voucher herbal specimens are kept at the Herbarium of the Wildlife School of Garoua. The therapeutic judgements were made based on specific disease, symptom or physiological effect. Information on the diagnosis of ailments was provided through a semi-structured interview of nurses or local health attendants. The ailments were grouped according to the classification proposed by the World Health Organisation and adapted by the African Unity Organisation (AUO) for the Cameroonian pharmacopoeia (Adjanooun et al., 1996).

## RESULTS

### Sample

A total of 37 informants aged 42 years provided data on the traditional use of medicinal plants around the Kalamaloué National Park (Table 1). The informants belong to 13 villages of five ethnic groups (Arab-choa (18 informants), Bornoa (5), Kotoko (6), Massa (5), Mousgoum (3)).

### Ailments

The survey led to the collection of 368 citations involving 36 medicinal plants in the treatment of 31 ailments (Table 2). The importance of each ailment was evaluated based on the number of citations made by the villagers. The 31 ailments recorded are classified into 13 broad categories as shown in Table 3. Digestive system, specific symptoms and parasitic diseases in this order, were the most cited ailment groups by people living inside and around the Kalamaloué National Park.

Figure 1 illustrates the relative importance of the Ailments cited. Here, only the ten most important ailments

are illustrated: diarrhoea (20.9% of the citations), malaria/fever (11.6%), rheumatism (8.4%), wound (7.3%), and cough (5.7%), which indeed were frequently mentioned by the local people.

### Plant parts cited

A total of 9 plant parts were recorded including branches, bulbs, fruits, leaves, roots, resins, saps, seeds, stem barks. Leaves (45.7%), fruits (23.6%), stem barks (13.8%) and roots (10.8%) are the most cited plant parts (Figure 2).

### Plants cited

The 36 medicinal plant species cited comprise 30 genera and 23 botanical families (Table 4). The Mimosaceae (5 species), Caesalpiniaceae (4), Capparaceae (3) and Rhamnaceae (3) families are more frequently represented than other families. Table 5 presents the distribution of plant species in different ailments. Only the plants indicated for the ten most cited ailments are presented. The total number of citation is 280, representing 76% of all the 368 citations recorded among the populations living inside and around the Kalamaloué National Park. Some plants are largely cited for treating some ailments. For example, *Pilliosigma reticulatum* is largely cited for treating diarrhoea, rheumatism and wound; *Tamarindus indica* for treating stomach pain, wound, gonorrhoea, and diarrhoea; *Mitragyna inermis* is highly mentioned against rheumatism, diarrhoea and malaria; *Balanites aegyptiaca* is largely cited against cough and diarrhoea; *Azadirachta indica* is indicated for treating malaria and diarrhoea and *Ziziphus mauritiana* is highly indicated against malaria, haemorrhoid, and diarrhoea. Those plant species are cited with more than 20 citations. Plant species cited with more than 10 citations included: *Acacia nilotica* (haemorrhoid), *Khaya senegalensis* (diarrhoea), *Diospyros mespiliformis* (diarrhoea), *Calotropis procera* (diarrhoea), *Crateva adansonii* (rheumatism), and *Ziziphus mucronata* (diarrhoea). Ten plant species were cited for treating only one ailment, while five plants were not cited for any of the ten most cited ailments.

## DISCUSSION

### Relative importance of ailments

In terms of the number of citations for medicinal uses, the ailments in the digestive system category (Table 1) are most important, followed by the specific symptoms category. In the Cameroonian pharmacopoeia report (Adjanooun et al., 1996) and in the survey conducted at the markets of Yaoundé (Betti, 2002), the digestive ailments appear to be the most important group to be treated. Diarrhoea, malaria/fever, wound, cough and

**Table 1.** List of informants who cited medicinal plants around the Kalamaloué National Park.

Village	Code of informant	Age
Ambalal	ar1	60
Andara	ar2	50
Angre	ar3	65
	ar4	30
Ankefal	ar5	53
	ar6	40
	ar7	40
Apdala	ar8	60
	ar9	65
	ar10	50
Bounou	ar11	50
	ar12	36
Chalamtini	ar13	30
	ar18	45
	ko1	60
	ko2	60
	ko3	50
Fadje	ko4	55
	ma1	36
	ma2	30
	ma3	35
	mo1	35
Gao	mo2	40
	mo3	35
	ar14	40
Maltam	bo1	35
	ko5	45
	ko6	50
	ar15	40
	ar16	57
Marako	bo2	54
	bo3	60
	bo4	50
	bo5	58
Naga	ar17	45
Seiba	ma4	40
	ma5	64
Average		42 years old

Code of informant: the two first letters designate the initial of the ethnic group, ar = arab-choa; bo = bornoa; ko = kotoko; ma = massa; mo = mousgoum. The number designates the order number of the informant in a given ethnic group.

**Table 2.** Citation of medicinal plants by populations of the Kalamaloué National Park.

Scientific name	Plant part	Ailment	Informant (citations)
<i>A. nilotica</i>	Fruit	Abscess	bo1, 2
<i>A. sieberiana</i>	Leaf	Abscess	ko1
<i>B. senegalensis</i>	Leaf	Abscess	ar15, 16, 5
<i>C. procera</i>	Leaf	Abscess	ar1, 4, bo4, ko5
<i>C. adansonii</i>	Leaf	Abscess	ar1
<i>B. aegyptiaca</i>	Fruit	Asthma	bo3, ko4
<i>A. indica</i>	Leaf	Bone pain	ar6, 7
<i>C. procera</i>	Leaf	Bone pain	ko5
<i>G. senegalensis</i>	Leaf	Chicken pox	ar3, ko1, ma5
<i>M. pigra</i>	Leaf	Chicken pox	ar17, ko3, mo2
<i>B. aegyptiaca</i>	Fruit	Cough	ar1, 11, 13, 17, 18, 3, 4, 6, 8, bo1, 2, 3, 4, 5, ko2, 3, 5, 6, ma3, mo3
<i>Citrus spp</i>	Fruit	Cough	ko2
<i>A. nilotica</i>	Fruit	Diarrhoea	ar7, ma1, 5
<i>A. seyal</i>	Stem bark	Diarrhoea	ar13
<i>A. indica</i>	Leaf	Diarrhoea	ar3, 5, 7, bo4, ko6
<i>B. aegyptiaca</i>	Seed	Diarrhoea	ar3, ko3, 5, 6
<i>C. procera</i>	Fruit	Diarrhoea	ar4, ko3, 5
<i>C. procera</i>	Leaf	Diarrhoea	ar18, 6
<i>C. procera</i>	Seed	Diarrhoea	ar9
<i>D. mespiliformis</i>	Fruit	Diarrhoea	ar1, 12, 14, ko1, 2, mo3
<i>E. hirta</i>	Leaf	Diarrhoea	ar8, ko1
<i>F. platyphylla</i>	Stem bark	Diarrhoea	ma2
<i>F. sycomorus</i>	Stem bark	Diarrhoea	ma3, mo3
<i>G. senegalensis</i>	Leaf	Diarrhoea	ar3, ma1, 5
<i>K. senegalensis</i>	Leaf	Diarrhoea	ar6, ko5
<i>K. senegalensis</i>	Stem bark	Diarrhoea	ar18, 3, bo1, ko2, ma4
<i>K. africana</i>	Seed	Diarrhoea	ar11, ko1
<i>Mi. inermis</i>	Leaf	Diarrhoea	ar16, 17, ko6, ma1, 5, mo2
<i>M. inermis</i>	Sap/Resin	Diarrhoea	ar15, ko3
<i>P. reticulatum</i>	Fruit	Diarrhoea	arab9
<i>P. reticulatum</i>	Leaf	Diarrhoea	ar10, 11, 15, 16, 18, 3, 4, 6, bo3, ko2, 6, ma4
<i>P. guajava</i>	Leaf	Diarrhoea	ko2
<i>T. indica</i>	Fruit	Diarrhoea	ar17, 9
<i>T. indica</i>	Fruit	Diarrhoea	mo2
<i>T. indica</i>	Leaf	Diarrhoea	bo2
<i>Z. mauritiana</i>	Stem bark	Diarrhoea	ar17, ma2, mo1, 2
<i>Z. mucronata</i>	Root	Diarrhoea	ar1, 10, 15, 16, ko3
<i>A. nilotica</i>	Fruit	Ear pain	ar3, bo1, ko4, ma1
<i>B. aegyptiaca</i>	Leaf	Ear pain	ko2
<i>C. melo</i>	Root	Ear pain	ko4, ma5
<i>A. nilotica</i>	Leaf	Eye pain	ar3
<i>F. sycomorus</i>	Leaf	Eye pain	ko3, 5
<i>B. diffusa</i>	Leaf	Female infertility	ar17
<i>K. africana</i>	Stem bark	Female infertility	ar17
<i>T. indica</i>	Stem bark	Female infertility	ar17
<i>K. senegalensis</i>	Stem bark	Gonorrhoea	bo1, 2
<i>T. indica</i>	Fruit	Gonorrhoea	bo1, 2
<i>T. indica</i>	Root	Gonorrhoea	ar1, 13, ko4
<i>Z. mauritiana</i>	Root	Gonorrhoea	ar1, 13, ko4
<i>Z. mucronata</i>	Root	Gonorrhoea	ar1, 13, ko4

Table 2. Contd.

<i>A. nilotica</i>	Fruit	Haemorrhoid	ar10, 17, 4, 9, bo1, 3, ko1, 3, mo2
<i>A. nilotica</i>	Stem bark	Haemorrhoid	ar3
<i>C. occidentalis</i>	Fruit	Haemorrhoid	bo3
<i>C. occidentalis</i>	Leaf	Haemorrhoid	ko4
<i>D. mespiliiformis</i>	Seed	Haemorrhoid	ar14, ko2
<i>K. senegalensis</i>	Leaf	Haemorrhoid	ar7
<i>K. senegalensis</i>	Stem bark	Haemorrhoid	ar18, ma4
<i>M. inermis</i>	Leaf	Haemorrhoid	ar11
<i>P. reticulatum</i>	Fruit	Haemorrhoid	ar13, bo4
<i>P. reticulatum</i>	Leaf	Haemorrhoid	ko5
<i>S. persica</i>	Leaf	Haemorrhoid	ko1
<i>T. indica</i>	Root	Haemorrhoid	ar10, 13
<i>Z. mauritiana</i>	Root	Haemorrhoid	ar10, 13
<i>Z. mauritiana</i>	Stem bark	Haemorrhoid	ar12, 14, ko1
<i>Z. mucronata</i>	Root	Haemorrhoid	ar10, 13
<i>B. aegyptiaca</i>	Seed	Headache	ko3, 5
<i>D. mespiliiformis</i>	Leaf	Headache	ko5
<i>F. platyphylla</i>	Sap	Headache	ma2, mo1
<i>G. senegalensis</i>	Leaf	Headache	ma1, 5
<i>P. reticulatum</i>	Leaf	Headache	ko6
<i>A. indica</i>	Leaf	Jaundice	ma3
<i>B. aegyptiaca</i>	Branch	Jaundice	bo3
<i>B. aegyptiaca</i>	Leaf	Jaundice	ar10, 18, 4, bo4, ko4, 6, mo3
<i>B. rufescens</i>	Leaf	Lactation failure	ar1, 11, 8, ko3
<i>C. occidentalis</i>	Leaf	Lactation failure	bo3
<i>K. africana</i>	Leaf	Lactation failure	ar17, mo2
<i>T. indica</i>	Fruit	Lumbago	ko5
<i>T. indica</i>	Stem bark	Lumbago	ar14, ko2, mo3
<i>Allium cepa</i>	Bulb	Malaria/Fever	ar14
<i>A. indica</i>	Leaf	Malaria/Fever	ar1, 11, 18, 3, 5, 7, 8, bo4, ko2, 3, 6, ma1, 3, 4, 5, mo1
<i>C. frutescens</i>	Fruit	Malaria/Fever	ar14
<i>C. adansonii</i>	Leaf	Malaria/Fever	ar14, ma2, mo1
<i>D. mespiliiformis</i>	Fruit	Malaria/Fever	ar1, 12, mo3
<i>K. senegalensis</i>	Leaf	Malaria/Fever	ar5
<i>M. inermis</i>	Leaf	Malaria/Fever	ar16, 17, ko4, 6, ma2, mo1, 2
<i>P. reticulatum</i>	Leaf	Malaria/Fever	ar6, ko5
<i>T. indica</i>	Fruit	Malaria/Fever	ar14, ko2
<i>T. indica</i>	Leaf	Malaria/Fever	ar17
<i>Z. mauritiana</i>	Leaf	Malaria/Fever	ko1
<i>Z. mauritiana</i>	Root	Malaria/Fever	ar17, ko4, 6
<i>Z. mauritiana</i>	Stem bark	Malaria/Fever	ar12, 14
<i>B. aethiopicum</i>	Root	Male sexual impotence	bo1, 2
<i>P. reticulatum</i>	Leaf	Male sexual impotence	ko3, 5
<i>S. persica</i>	Root	Male sexual impotence	ar4
<i>A. indica</i>	Leaf	Moving placenta	ko2, ma4
<i>P. reticulatum</i>	Leaf	Moving placenta	bo1, ko3
<i>K. senegalensis</i>	Stem bark	Purgative	ar3
<i>T. indica</i>	Fruit	Purgative	ko5
<i>C. adansonii</i>	Leaf	Rheumatism	ar14, 17, 5, bo4, 5, ko3, ma3
<i>G. senegalensis</i>	Leaf	Rheumatism	ar3, ma5
<i>M. inermis</i>	Leaf	Rheumatism	ar10, 15, 16, 17, bo5, ko4, 6, ma1, 2, mo1, 2

Table 2. Contd.

<i>P. reticulatum</i>	Leaf	Rheumatism	ar11, 17, 3, bo3, 5, ko2, 3, 6, ma4, mo2
<i>Z. mauritiana</i>	Fruit	Rheumatism	ko5
<i>C. glaucum</i>	Bulb	Scorpion bite	ar13
<i>Tamarindus indica</i>	Stem bark	Skin burn	ar12, ko1
<i>Cassia occidentalis</i>	Fruit	Skin itching	bo3
<i>C. adansonii</i>	Leaf	Skin itching	ar17
<i>F. sycomorus</i>	Stem bark	Skin itching	ko2, ma4
<i>M. inermis</i>	Leaf	Skin itching	ko1
<i>P. reticulatum</i>	Leaf	Skin itching	ar17, mo2
<i>Z. mauritiana</i>	Stem bark	Skin itching	ko1
<i>C. farinosa</i>	Leaf	Snake bite	ar12, ko1
<i>C. glaucum</i>	Bulb	Snake bite	ar10, 15
<i>T. indica</i>	Fruit	Stomach pain	ar10, 11, 13, 18, 2, 6, 9, bo3, ko4, 6, mo2
<i>T. indica</i>	Leaf	Stomach pain	ar4
<i>E. hirta</i>	Leaf	Syphilis	ar8
<i>B. aegyptiaca</i>	Seed	Tiredness	ar17
<i>B. aethiopicum</i>	Root	Tiredness	bo1
<i>P. reticulatum</i>	Leaf	Tiredness	ar16
<i>T. indica</i>	Fruit	Tiredness	mo2
<i>S. persica</i>	Branch	Tooth steak	ma2
<i>S. persica</i>	Root	Tooth steak	ar10, 13, 4, ko3
<i>A. nilotica</i>	Fruit	Toothache	ar4, bo1, 2
<i>B. aethiopicum</i>	Root	Toothache	bo1
<i>C. procera</i>	Root	Toothache	ma3
<i>F. sycomorus</i>	Stem bark	Toothache	ma3, mo3
<i>P. reticulatum</i>	Fruit	Toothache	bo4
<i>S. persica</i>	Root	Toothache	ma2
<i>Z. mauritiana</i>	Fruit	Toothache	ko5
<i>Z. mauritiana</i>	Root	Toothache	ar1, 3, 8, ko1
<i>A. erythrocalyx</i>	Stem bark	Wound	ar12, ko1
<i>B. senegalensis</i>	Leaf	Wound	ar1, 5, ko1
<i>C. farinosa</i>	Leaf	Wound	ar12, ko1, mo3
<i>C. procera</i>	Leaf	Wound	ma3
<i>D. mespiliformis</i>	Leaf	Wound	ar14, ko2
<i>E. hirta</i>	Leaf	Wound	ar8, ko1
<i>K. senegalensis</i>	Stem bark	Wound	ar3, bo3
<i>P. reticulatum</i>	Stem bark	Wound	ar17, 3, 4, bo3, ko4, ma4
<i>T. indica</i>	Fruit	Wound	ar15
<i>T. indica</i>	Stem bark	Wound	ar14, 16, 4, bo5, ko6

In the table, each informant in front of a given plant species, plant part and ailment represents a citation. For example, the use of *A. nilotica*'s fruit in the treatment of abscess is mentioned in two citations.

toothache were the specific ailments most frequently cited in the Cameroonian pharmacopoeia report (Adjanohoun et al., 1996).

### Relative importance of medicinal plants

There are many similarities in the use of medicinal plants among populations settled in the periphery of the

Kalamaloué National Park. Hence, for treating malaria, all the five ethnic groups cited *A. indica*.

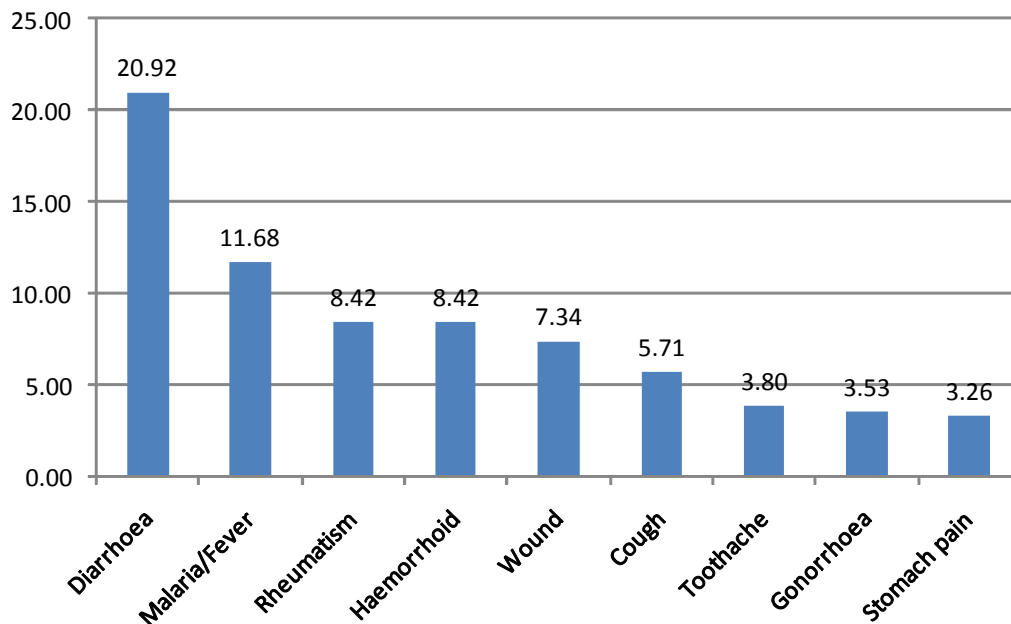
Same observations can be made for *M. inermis* and *P. reticulatum* in the treatment of rheumatism. Other plants cited in four ethnic groups for similar usages included: *K. senegalensis*, *M. inermis* and *P. reticulatum* for treating diarrhoea, *M. inermis* (malaria), *C. adansonii* (rheumatism), *A. nilotica* (haemorrhoid), and *P. reticulatum* for wound.

**Table 3.** Citations of ailments and ailment groups by people living around the Kalamaloué National Park.

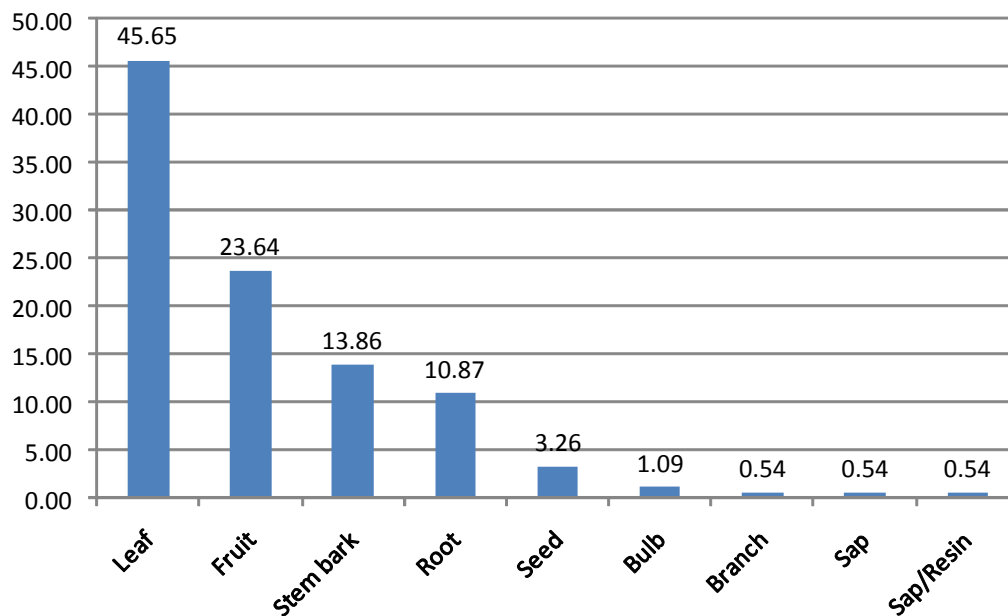
<b>Ailment group</b>	<b>Ailment</b>	<b>Citations</b>
Cardio vascular system	Haemorrhoid	31
	Diarrhoea	77
	Purgative	2
Digestive system	Stomach pain	12
	Tooth steak	5
	Toothache	14
Eye diseases	Eye pain	3
Female genital system: obstetrics and gynaecology	Female infertility	3
	Lactation failure	7
	Moving placenta	4
Infectious diseases	Chicken pox	6
	Syphilis	1
Male genito-urinary system	Gonorrhoea	13
	Male sexual impotence	5
Musculo-skeletal system	bone pain	3
	Lumbago	4
	Rheumatism	31
Nose, ears, and throat	Ear pain	7
Parasitic diseases	Malaria/Fever	43
Respiratory system	Asthma	2
	Cough	21
Skin diseases		10
	Skin burn	2
Specific diseases	Skin itching	8
	Abscess	11
	Scorpion bite	1
Specific symptoms	Snake bite	4
	Headache	8
	Jaundice	9
	Tiredness	4
	Wound	27
<b>Total</b>		<b>368</b>

The plants used by people living inside and around the Kalamaloué National Park were compared with the plants used in other parts of Africa, mostly in the same soudano

sahelian areas. Table 6 presents such a data. Most of the plants largely cited by populations of the Kalamaloué National Park are also known for the same usages in



**Figure 1.** Relative importance of ailments cited among villagers living around the Kalamaloué National Park of Cameroon.



**Figure 2.** Relative importance of plant parts cited among villagers living around the Kalamaloué National Park of Cameroon.

other African regions and countries. Some examples are: *A. indica* (malaria, diarrhoea, jaundice), *C. adansonii* (haemorrhoid), *D. mespiliformis* (diarrhoea), *K. senegalensis* (diarrhoea), *P. reticulatum* (rheumatism, diarrhoea, wound), *T. indica* (diarrhoea, malaria, wound), and *Z. mauritiana* (diarrhoea, malaria). There are also

plants for which the usages mentioned by the Kalamaloué people are not yet known in the literature. For example, *B. aegyptiaca* is largely cited by the Kalamaloué people in the treatment of cough. Same observations were made for *B. aegyptiaca* in the treatment of jaundice, *T. indica* in the treatment of gonorrhoea



**Table 4.** List of medicinal plants of the Kalamaloué National Park.

<b>Espèce</b>	<b>Famille</b>
<i>Acacia erythrocalyx</i> Brenan	Mimosaceae
<i>Acacia nilotica</i> (L.) Willd. Ex Del.	Mimosaceae
<i>Acacia seyal</i> Del.	Mimosaceae
<i>Acacia sieberiana</i> DC.	Mimosaceae
<i>Allium cepa</i> L.	Lilliaceae
<i>Azadirachta indica</i> A. Juss.	Meliaceae
<i>Balanites aegyptiaca</i> (L.) Del.	Zygophyllaceae
<i>Bauhinia rufescens</i> Lam.	Caesalpiniaceae
<i>Boerhavia diffusa</i> L.	Nyctaginaceae
<i>Borassus aethiopicum</i> Mart.	Arecaceae
<i>Boscia senegalensis</i> (Pers.) Lam. Ex Poir.	Capparaceae
<i>Cadaba farinosa</i> Forsk.	Capparaceae
<i>Calotropis procera</i> (Ait.) Ait. F.	Asclepiadaceae
<i>Capsicum frutescens</i> L.	Solanaceae
<i>Cassia occidentalis</i> L.	Caesalpiniaceae
<i>Citrus</i> sp.	Rutaceae
<i>Crateva adansonii</i> DC.	Capparaceae
<i>Crinum glaucum</i> A. CHEV.	Lilliaceae
<i>Cucumis melo</i> L.	Cucurbitaceae
<i>Diospyros mespiliformis</i> Hochst. ex A. DC.	Ebenaceae
<i>Euphorbia hirta</i> L.	Euphorbiaceae
<i>Ficus platyphylla</i> Delile	Moraceae
<i>Ficus sycomorus</i> L. subsp. <i>gnaphalocarpa</i> (Miq.) C.C. Berg (Syn.: <i>F. gnaphalocarpa</i> )	Moraceae
<i>Guiera senegalensis</i> J.F. Gmel.	Combretaceae
<i>Khaya senegalensis</i> (Desv.) A. Juss.	Meliaceae
<i>Kigelia africana</i> (Lam.) Benth	Mimosaceae
<i>Mimosa pigra</i> L.	Rubiaceae
<i>Mitragyna inermis</i> (Willd.) O. Ktze.	Caesalpiniaceae
<i>Pilliosigma reticulatum</i> (DC.) Hochst.	Myrtaceae
<i>Psidium guajava</i> L.	Salvadoraceae
<i>Salvadora persica</i> L.	Nymphaeaceae
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	Caesalpiniaceae
<i>Tamarindus indica</i> L.	Rhamnaceae
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae
<i>Ziziphus mucronata</i> Willd.	Rhamnaceae
<i>Zizipus spina-christi</i> (L.) Desf. var. <i>spina-christi</i>	Rhamnaceae

and stomach pain, and for *Z. mauritiana* in the treatment of haemorrhoids. Such usages constitute our contribution in ethnobotanical and drugs development researches. Further activities should be conducted to better investigate the efficiency of those usages.

Some plant species are confirmed in literature to possess biological activity related to ailments indicated. For example, *A. indica* is cited for treating diarrhoea, jaundice and malaria. All those usages are confirmed by Arbonnier (2000). Fortin et al. (1990) and the African pharmacopoeia (OUA, 1985) confirm the activity of this plant species in the treatment of malaria, while Kerharo and Adam (1974) found no activity. Makindé and Salako

(1991) showed a real activity against malaria, mostly for prevention.

Fortin et al. (1990), Oliver-Bever (1986) and Pousset (1989) agree on the activity of *A. indica* against fever. *A. nilotica* is cited for its usage against diarrhoea. Activities related to those usages are confirmed in the literature (Arbonnier, 2000; Fortin et al., 1990; Pousset, 1989). *K. senegalensis* is less cited in the treatment of malaria or fever (10% of citations made for that plant species) by Kalamaloué populations; the plant is confirmed for its activity against fever by many authors (Fortin et al., 1990; Kerharo and Adam, 1974; Oliver-Bever, 1986; Pousset, 1989). *T. indica* is cited for being purgative and treating

**Table 5.** Distribution of medicinal plants in different ailments cited around the Kalamaloué National Park.

	Diar.	Mala.	Haem.	Rheu.	Woun.	Coug.	Toot.	Gono.	Stom.	Absc.	Total
<i>P. reticulatum</i>	13	2	3	10	6		1				35
<i>T. indica</i>	4	3	2		6			5	12		32
<i>M. inermis</i>	8	7	1	11							27
<i>B. aegyptiaca</i>	4					20					24
<i>A. indica</i>	5	16									21
<i>Z. mauritiana</i>	4	6	5	1			2	3			21
<i>A. nilotica</i>	3		10				3			2	18
<i>K. senegalensis</i>	7	1	3		2			2			15
<i>D. mespiliformis</i>	6	3	2		2						13
<i>C. procera</i>	6				1		1			4	12
<i>C. adansonii</i>		3		7						1	11
<i>Z. mucronata</i>	5		2					3			10
<i>B. senegalensis</i>					3					3	6
<i>G. senegalensis</i>	3			2							5
<i>E. hirta</i>	2				2						4
<i>F. sycomorus</i>	2						2				4
<i>C. farinosa</i>					3						3
<i>Zizipus spina-christi</i>							3				3
<i>A. erythrocalyx</i>					2						2
<i>C. occidentalis</i>			2								2
<i>K. africana</i>	2										2
<i>A. seyal</i>	1										1
<i>A. sieberiana</i>										1	1
<i>A. cepa</i>		1									1
<i>B. aethiopicum</i>							1				1
<i>C. frutescens</i>		1									1
<i>Citrus spp</i>						1					1
<i>F. platyphylla</i>	1										1
<i>P. guajava</i>	1										1
<i>S. persica</i>							1				1
<i>S. persica</i>			1								1
<i>B. rufescens</i>											0
<i>B. diffusa</i>											0
<i>C. glaucum</i>											0
<i>C. melo</i>											0
<i>M. pigra</i>											0
Total	77	43	31	31	27	21	14	13	12	11	280

Diar: diarrhoea; Mala: malaria; Haem: haemorrhoid; Rheu: rheumatism; Woun: wound; Coug: cough; Toot: toothache; Gono: gonorrhoea; Stom: stomach pain; Absc: abscess

diarrhoea; those usages are confirmed by Pamplona (1999).

## Conclusions

Through the ethnobotanical survey of medicinal plants conducted among populations living in the periphery of the Kalamaloué National Park, a total of 36 medicinal

plants were recorded from 37 informants of the Arab Choa, Bornoa, Kotoko, Massa, and Mousgoum ethnic groups. Some plants with higher number of citations were found to be widely used in other regions of Africa for the same purposes. There are also other plants cited which are known in the literature for their effective properties against certain ailments, which gives credibility to the popular pharmacopoeia used by the Kalamaloué people. Similar research using the same method should be

**Table 6.** Use of medicinal plants of Kalamaloué National Park in other African regions.

Plant species	Ailment	References (country/area)
<i>A. nilotica</i>	Toothache	Ar (Wa)
	Abscess	Ar (Wa)
	Haemorrhoid	Ar (Wa), Fo (Af)
	Diarrhoea	Ar (Wa), Ke (Se), Po (Se), Ri (Ni, Se)
<i>A. sieberiana</i>	Abscess	Au (Wa)
<i>A. indica</i>	Malaria	Ar (Wa), Ma (Se), Ri (Be, Ci)
	Diarrhoea	Ar (Wa)
	Jaundice	Ar (Wa), Fo (Af), Ke (ma), Ri (Be, Ci, To)
<i>B. aegyptiaca</i>	Diarrhoea	Ar (Wa)
	Tiredness	Ar (Wa)
<i>B. senegalensis</i>	Wound	Ar (Wa)
	Abscess	Ar (Wa)
<i>C. farinose</i>	Wound	Ar (Wa)
<i>C. procera</i>	Toothache	Ar (Wa)
<i>C. adansonii</i>	Rheumatism	Ar (Wa)
<i>D. mespiliformis</i>	Malaria	Ar (Wa)
	Diarrhoea	Ar (Wa)
	Wound	Ar (Wa)
<i>E. hirta</i>	Wound	Ha (Se)
<i>F. platyphylla</i>	Diarrhoea	Ar (Wa)
<i>G. senegalensis</i>	Diarrhoea	Ar (Se), Ke (Se)
<i>K. senegalensis</i>	Gonorrhoea	Ar (Wa)
	Malaria/fever	Ar (Wa), Ri (Be, Se)
	Diarrhoea	Au (Wa), Ar (Wa)
<i>K. Africana</i>	Female infertility	Ar (Wa)
	Diarrhoea	Au (Wa), Ar (Wa)
<i>P. reticulatum</i>	Haemorrhoid	Ar (Wa)
	Toothache	Ar (Wa)
	Rheumatism	La (Af), Po (Af)
	Diarrhoea	Ar (Wa)
	Wound	Ar (Wa)
	Headache	Ar (Wa)
<i>S. persica</i>	Toothache	Ar (Wa)
<i>T. indica</i>	Diarrhoea	Ar (Wa)
	Malaria	Ar (Wa)
<i>Z. mauritiana</i>	Diarrhoea	Ke (Se)

References: Ar: Arbonnier (2000), Au: Aubreville (1950), Fo: Fortin et al. (1990), Ha : Haaby et al. (1989), Ke : Kerharo and Adam (1974), La : Larousse Afrique (1984), Ma : Maydell (1983) , Pa : Pamplona (1999), Po : Pousset (1989), Ri : Richel (1995). Country/area : Af : Africa, Am : America, Na : North Africa, Wa : West Africa, Be: Benin, Ci: Côte d'Ivoire, Ma : Mali, Ni: Niger, Se : Senegal, To: Togo.

conducted among people living inside and around the Waza National Park found in the same region. Also, further research should be conducted for identifying

active chemical substances of the plants with higher number of citations which are not yet cited in the literature.

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