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Full Length Research Paper

Ethnobotanical Approaches to Malaria Treatment in Cameroon

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In order to fight against malaria in Cameroon, an ethnobotanical survey of medicinal plants was conducted in the town of Maroua, Far North Region of Cameroon from 5th to 30th December 2009 with 800 persons. The survey results revealed that 49 medicinal plants species belonging to 27 families were identified in the fight against malaria. The Cesalpiniaceae family is the most exploited for treatment of malaria. The locals use far more *Azadirachta indica, Mangifera indica, Psidium guajava, Cassia occidentalis, Khaya senegalensis, Tamarindus indica, Citrus limonum, Eucalyptus* sp*., Carica papaya* and *Cymbopogon citratus* for the traditional treatment of malaria. The leaves and barks are the mostly used parts. The decoction is the method of preparation most commonly practiced.

Key words: Malaria, medicinal plants, ethnobotany, Maroua, Cameroon.

INTRODUCTION

Malaria is the world's most devastating disease (Rodriguez-Acosta et al. 1998; Klayman, 1989). An estimated 2 billions people are exposed to the global endemic among which 500 million are affected by this disease yearly (Gentilini, 1995). The presence of *Plasmodium falciparum* in some areas of the world is closely linked to the presence of vectors and to favorable conditions for their developmental cycle. In endemic areas like Cameroon, malaria transmission is permanently and intense (Saotoing, 2005). Malaria here remains a major public health problem as elsewhere in Sub-Saharan Africa (Titanji et al., 2008). *Plasmodium falciparum* , the pathogen most widespread human malaria, is becoming increasingly resistant to antimalarial drugs deal. This requires extra effort and continuous search for new drugs, especially with new modes of action (Muregi et al., 2003). In Sub-Saharan Africa, the proportion of patients utilizing antimalarial treatments outside the official circuit varies from 12 to 80% (Bloland et al., 2000; McCombie, 1996). Nowadays, plants are invariably resource for new drugs in use, namely quinine and artemisinin (Gessler et al., 1994). In some parts of China, the use of herbal "Qing Hao Su" is extracted from a medicinal plant and used as antipyretic and wormwood (Cox, 2001). It is already estimated that 122 drugs from 94 plant species have been discovered through ethnobotanical studies (Manufacturer and Farnsworth, 1966). Moreover, many existing drugs are produced from the active ingredients of certain plants and the World Health Organization (WHO) compiled a list of plants which met this definition (Anon. 5, 1986). Ethnomedical and ethnobotanical studies now recognized to be the most viable methods of identifying new medicinal plants (Adjanahoun et al., 1996; Farnworth et al., 1966; Igoli et al., 2005). The use of medicinal plants plays an important role in daily health care in most rural area. Among some ethnic groups of Southern Cameroon like Pygmées-Baka, local medicine remains more popular than western medicine (Titanji et al., 2008). Traditional plants may

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supplement and/or even replace effective drug manufacturers, often inaccessible, for the treatment of malaria (Anon. 5, 1986). Herbal medicine remains one of the common forms of therapy available for people worldwide. A wide variety of plants found in the flora of Cameroon, belonging to several families, were identified through ethnobotanical and ethnopharmacological studies as antimalarial medicinal plants (Titanji et al., 2008).

The region of Far North Cameroon seems to be a major reservoir for malaria vectors due to its Sudano-Sahelian climate. An epidemiological study conducted in this part of the country revealed that many people ignore or know very little of mosquitoes transmitted diseases, including malaria (Einterz, 2003). What makes it difficult in disease prevention is the vector control. Gordon et al. (1990) conducted a study which indicated that *Plasmodium falciparum* is resistant to chloroquine 4% among school children of Maroua. Faced with the upsurge of resistance of *Plasmodium* to synthetic chemicals and widespread poverty in this area, the town population increasingly turned to traditional medicines (Njan et al., 2007). This paper therefore sets the following as specific objectives:

1) To take stock of plants therapies used to treat malaria in Maroua town.
2) To know the local plant parts used as antimalarial drug in Maroua.
3) To make a botanical description and uses of these plants by farmers.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Maroua, the capital city of the Cameroon far North Region. A Sudano-Sahelian region that ties between the 10° and 13° of North, Latitude between 13° 15' and 15° 45' East longitude (Donfack, 1998), Maroua stretches along the shores of Mayo-kaliao (Gordon et al., 1990). It is characterized by the following:

1) A wide variety of natural landscapes.
2) A short rainy season from June to October alternating with a relatively long dry season that extends from November to May.
3) Vegetation with thorny steppes.

The Sahel is dominated by tree species like *Azadirachta indica, Balanites aegyptiaca, Anogeissus leiocarpus* and *Boswillia dalzielii* which grow on loose and rocky soils (Boutrais, 1984). With a heterogeneous population estimated to 3,480,414 inhabitants (Makon, 2010), the most populated regions of Cameroon (Boulet et al., 1972) and an average rainfall about 867 mm per year and annual temperature is about 27°C with a maximum of 38°C in March to April and a minimum of 18°C in December to January (Suchel, 1987) . Maroua remains the cosmopolitan city. It is made up of several dominant ethnic compositions like Giziga, Fulbe, Toupouri, Mundangs, Massa, Kanouri, Matakams and Mousgoum. These groups are very dynamic and practice agriculture, handicrafts, trade, and livestock as the principal economic activities.

The human subjects surveyed consisted mainly of people in five districts of Maroua, namely Domayo, Kongola, Lopéré, Makabaye and Ouro-Tchedé. Since the plant material consists of different species identified in these neighborhoods. The most common plant species cited are *A. indica, Mangifera indica, Psidium guajava, Cassia occidentalis, Khaya senegalensis, Tamarindus indica, Citrus limonum, Eucalyptus* sp., *Carica papaya* and *Cymbopogon citratus*.

The survey questionnaire was individually communicated through 800 adults of both male and female sexes and the field visit was conducted by a group of 8 investigators. Each investigator was equipped with the questionnaire on medicinal plants, their ethnobotanic and ecological characteristics and the methods of use in the treatment of malaria. The plants were snapped and their specimens collected to prepare the Herbarium for authentification at laboratory of Agriculture and Development Research Institute (IRAD) in Maroua. The names of most of the plants collected were expressed in several local languages.

RESULTS AND DISCUSSION

Of 800 people surveyed, 77% knew at least one antimalarial herb. In total, 49 species of medicinal plants distributed in 27 families were identified to possess antimalarial properties. Of these families, the most represented family was Cesalpiniaceae (Table 1). However, only the first ten plants with high frequency of citation was the subject of further study.

Local population knowledge on the first ten antimalarial plants

The percentage of most frequently used 10 plants as antimalarial herbs by ethnic groups in Maroua town is shown on Figure 1. The percentage use of the herb by the Giziga is as follows: *T. indica* (30%), *P. guajava* (26%*), A. indica* (25%) and *C. limonum* (24%). The Fulbe, the second group that utilize traditional plants to treat malaria does so to this effect, namely *C. papaya* (30%), *M. indica* (24%), *P. guajava* (23%) and *C. limonum* (20%). The Toupouri constitute the third group which used local plants to care for malaria as follows: *C. occidentalis* (25%), *K. senegalensis* (22%), *Eucalyptus* sp. (21%) and *P. guajava* (15%). The Mousgoum are the last with the least number of plant species to treat malaria. These are: *C. limonum* (10%), *C. papaya* (9%), *C. occidentalis* (8%) and *K. senegalensis* (4%).

Leaves (34%) are more frequently used plant part followed by the bark (24%) for the treatment of malaria by the inhabitants of Maroua (Figure 2). This fits well with the work of Caraballo et al. (2004) conducted in South-eastern Venezuelan Amazon, where they proved that the leaves constituted 70% of the parts used. It appears that these parts are more available and accessible to people and contain highly effective antimalarials substances.

The routine use of leaves could also be due to the fact that they are the site of the synthesis of organic substances and, therefore, antimalarial substances. Bhattarai et al. (2010) and Njoroge and Bussmann (2005)

Table 1. Antimalarial plants used in herbal preparations in Maroua.

Family names	Scientifics names	French vernacular	Local names	Frequency of Respondents (%)	Parts users
Caesalpiniaceae	*Tamarindus indica*	Tamarinier	Djabbé (fulfulde)	81	Fruits and leaves
	Cassia occidentalis	Faux kinkékiba	Kaccu-kaccunga (fulfulde)	62	Leaves
	Senna tora		Tasba (fulfulde)	4	Seeds
	Cassia italica		Wabderehi (fulfulde)	2	Leaves
	Piliostigma thonningii		Barkedji (ful)	2	Barks
Poaceae	*Cymbopogon citratus*	Citronelle	Tii (fulfulde)	16	Leaves
	Pennisetum glaucum	Mil	Gawri (fulfulde)	6	Roots and seeds
	Zea mays	Mais	Masardji(fulfulde)	4	Flowers
	Sorghum bicolor	Sorgho	Muskuwari (fulfulde)	2	Roots
Musaceae	*Musa sinensis*	Bananier	Banan (fulfulde)	14	Leaves and roots
Mimosaceae	*Acacia nilotica*	Gonakié	Gabdé (fulfulde)	12	Barks and seeds
	Acacia albida		Tsaski (fulfulde)	4	Barks
	Parkia biglobosa	Néré	Naredje (fulfulde)	2	Roots
Liliaceae	*Allium cepa*	Oignon	Tigneree (fulfulde)	16	Bulb
	Aloe vera	Aloes verra		2	Leaves
	Allium sativum	Ail	Angalajé (fulfulde)	2	Bulb
Asteraceae	*Chrysanthellum americanum*		Guité pola (fulfulde)	6	Whole plant
	Vernonia amygdalina	Ndolé	Chouwaka (haoussa)	6	Leaves
	Acanthospermum hispidum		Mazaivri (guiziga)	2	Roots and leaves
Fabaceae	*Arachis hypogea*	Arachide	Biriji (fulfulde)	2	Seeds
	Voandzei subterranea	Pois de terre	Galadji (fulfulde)	2	Seeds
	Pterocarpus erinaceus		Banohi (fulfulde)	2	Roots
Anacardiaceae	*Mangifera indica*	Manguier	Mongoro (fulfulde)	58	Leaves and barks
	Sclerocarya birrea		Eedi (fulfulde)	2	Barks
	Haemastotaphis barteri		Tursujee (ful)	6	Ripe fruits
Meliaceae	*Azadirachta indica*	Neem	Gagné (fulfulde)	104	Fruits, leaves and barks
	Khaya senegalensis	Caïlcedrat	Dalehi (fulfulde)	26	Leaves, fruits and root

Table 1. (Contd).

Rutaceae Myrtaceae	*Citrus limonum*	Citronier	Lemou (fulfulde)	80	Fruits and leaves
	Psidium guajava	Goyavier	Goyof (fulfulde)	65	Leaves and barks
Moraceae	*Ficus polita*		Litahi (fulfulde)	8	Leaves and barks
	Ficus platyphylla		Dundehi (fulfulde)	4	Leaves and barks
Malvaceae	*Hibiscus cannabinus*		Gabbaydji (ful)	4	Leaves
	Hibiscus sabdariffa		Folere (fulfulde)	2	Flowers
Lamiaceae	*Ocimum basilicum*	basilic	Jambal johi (fulfulde)	2	Leaves
	Hyptis spicigera		Fenfouré (toupouri)	2	Whole plant
Caricaceae	*Carica papaya*	Papayer	Dukudjee(fulfulde)	80	Leaves, fruits and roots
Myrtaceae	*Eucalyptus* sp.	Gommier		42	Leaves and barks
Burseraceae	*Boswellia dalzielii*		Andakedje (fulfulde)	14	Barks
Solanaceae	*Capsicum frutescens*	Petit piment	Tchitta (fulfulde)	10	Fruits
Bromeliaceae	*Ananas comosus*	Ananas		6	Barks
Annonaceae	*Annona senegalensis*	Papayer de brousse	Dukuhi Laddee (fulfulde)	6	Leaves
Polygalaceae	*Securida longepedonculata*		Alali (fulfulde)	6	Roots
Asclepiadaceae	*Leptadenia hastata*		Zaraji (fulfulde)	6	Roots
Lauraceae	*Persea americana*	Avocatier		4	Leaves
Balanitaceae	*Balanites aegyptiaca*	Savonnier	Tanni (fulfulde)	4	Barks
Tiliaceae	*Corchorus olitorius*		Lalo (fulfulde)	2	Seeds
Thymelaeaceae	*Gnidia kraussiana*		Madam mada (fulfulde)	2	Leaves
Rhamnaceae	*Ziziphus mauritiana*	Jujubier	Livi (daba)	2	Roots
Combretaceae	*Anogeissus leiocarpus*		Zignet (mousgousm)	2	Leaves and barks
Total				800	

found roots as dominant part. To conserve these plants, it is important for the local population to be well informed of sustainable harvest of medicinal plant parts (Njoroge and Bussmann, 2005). Studies have shown that uncontrolled a large-scale harvest of roots, bark, leaves and flowers can have a negative effect on the existence and survival of medicinal plants and, of course, a multipliers effect on sustainable use (Lulekal et

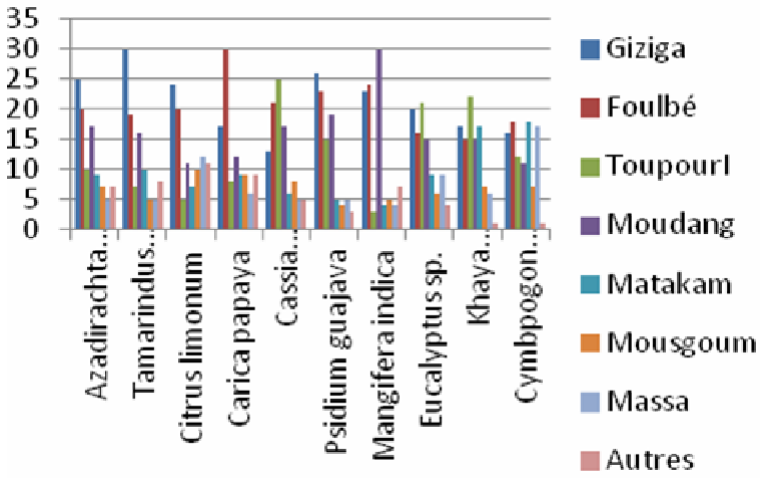

Figure 1. Proportions used of antimalarial plants according to ethnic groups, proportion of plant parts used to treat malaria in Maroua.

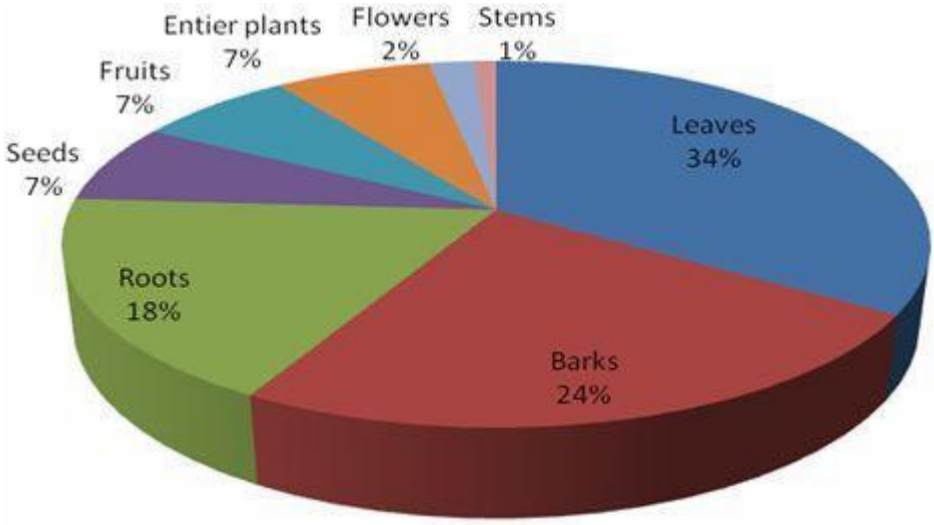

Figure 2. Proportions of plant parts used to treat malaria in Maroua.

al., 2008).

Description and instructions for use of ten plants malaria in the city of MarouaNîm or Neem (*A. indica* A. Juss.)

Neem tree belongs to the Meliaceae family, (Figure 3) and it can reach 30 m in height. Its compound leaves are toothed and sharp pointed tips.Its small white flowers in clusters emit a delicate fragrance and bear fruit, with small drupes oval fruits when ripe, the fruits are almost cylindrical green, clear yellowish. The nucleus is quite hard covers of a viscous and slightly sweet flesh (Anon. 5, 1986).

User manual

Maroua population boils 250 g of dried leaves of *A. indica* in a liter of water with 10 pinches of sugar for 15 to 20 m. The solution is cooled and then filtered. For children, the dosage administered is two tablespoons thrice daily for five days, but rather a half glass three times daily for adult. The taking of the drugs is not discontinued until the patient is healed. In most cases, the dosage is not strictly enforced and can be drunk as desired. Sometimes patients also boil leafy shoots in 10 to 15 L of water, to be used when the solution becomes warm, the patient takes hot bath twice a day with the warm solution. After each bath, the patient drinks a few sips of decoction set aside. Some authors like Asase et al. (2005) proposed to pound

Figure 3. *Azadirachta indica* L. Location: Maroua (Ward Domayo) Date: 7/12/2009.

bath, or even boiling the leaves of indicators with those of the leaves of *A. indica* and the filtrate diluted to serve *Jatropha gossipifolia* and *Combretum* sp. The local population has no standard dose for administering the extracts from medicinal plants in treating malaria.

Moreover, Titanji et al. (2008) and Asase et al. (2005) by conducting similar studies have found forty five preparation methods that combine more than one species of plants. However, most of these preparations include boiling the leaves and drinking the infusion. In the Northern part of Peru, Bussmann et al. (2010) have reported the presence of a total of forty nine herbal preparations from 2001 to 2009 to treat malaria. The methods of use decoction, drying, steam bath, laundry and so on, and the composition of the ingredients of treatment vary from one household to another. The lack of standard dose, control, quality of ingredients is considered to be one of the main drawbacks of traditional
medicine (Evans, 1986; Sofowora, 1982). According Schwikkard and Van Heerden (2002), Meliaceae family have been used for generations to generation in Africa, India and tropical America to treat malaria. Mackinnon et al. (1997) also shows that *A. indica* is widely used in Africa to fight malaria. The plant *A. indica* is also as an antimalarial in Ghana (Asase et al., 2005), Kenya (Njoroge and Bussmann, 2005), Venezuela (Caraballo et al., 2004), India and Sudan (Aminuddin et al., 1993; El-Kamali and El-Khalifa, 1997).

Tamarind (*T. indica* L.)

Perennial plant (more than 200 years) of the Ceasalpiniaceae Family, tamarind (Figure 4a) can reach 20 m in height. It has alternate, compound leaves with a glabrous rachis and finely hairy. The yellow flowers give and contains 5 to 7 seeds semi-arid (Anon. 5, 1986)

Users manuals

The preparation involves soaking 500 g of at least one year old fruits (Figure 4b) in 3 L of water. After two hours, the prepared solution is filtered. The malaria suffering patient drinks one-quarter glass three times daily for 5 to 7 days. In some households in Maroua, some pieces of the crushed *Allium cepa* are added to the preparation. Asase et al. (2005) studies in Ghana show that instead of leaf decoction, bark decoction can effectively be used to treat malaria. Moreover, the use of fruits in the treatment pods thick, woody gray red when ripe containing brown bitter pulp with interwoven fibers. The pod is often curved by their antimalarial substances composition.

Lemon (*C. limonum*)

The lemon tree (Figure 5) belongs to the Rutaceae

Figure 4a. *Tamarindus indica* L. Location: Maroua (Ward Ouro-Tchede) Date: 7/12/2009.

Figure 4b. Fruits of *Tamarindus indica.*

Figure 5. *Citrus limonum.* Location: Maroua (Ward Ouro-Tchede) Date: 06/12/2009.

Figure 6. *Carica papaya* L. Location: Maroua (Ward Ouro-Tchede) Date: 17/12/2009.

family. Its size varies from 2 to 15 m. It is a perennial plant with leathery leaves that adapts to all types of tropical and warm temperate climates. It grows on sandy and clay soils (Anon. 5, 1986).

Operating modes

The people of Maroua collect fresh ripe fruit of *C. limonum* and to extract the juice, they heat the fruit in water. The resulting is used to trigger hot sweating which is intended to reduce patients fever. The *C. limonum* fruits contain antimalarial substances and the studies conducted by Titanji et al. (2008) showed that *C. limonum*is effective against malaria in the Southern part of Cameroon. Adjanohoun et al. (1996) also show that *Citrus sinensis* species is best known as an antimalarial herb among members of Rutaceae.

Papaya (*C. papaya L.*)

Sudano-Sahelian fruit tree of the Caricaceae family that can reach 10 meters in height, papaya (Figure 6) has a straight bole occasionally branched. Its leaves are grouped at the top, supported by a fleshy stem for rapid growth. This trunk is covered with the scars of fallen leaves. *C. papaya* is a perennial plant with fleshy fruit. The fruit contains a sweet yellow or orange pulp and determines an empty central cavity containing numerous black seeds (Anon. 5, 1986).

Operating modes

People of Maroua town do collect some mature leaves which are showing a yellow color of *Carica papaya*, as also indicated by Titanji et al. (2008). After proper cleaning, the leaves are placed in a pot containing 5 to 7 L of water and boiled for 20 m. The patient bathes with the obtained solution every night for 3 to 5 days in a row, and then drinks a glass of the decoction previously set aside. Asase et al. (2005) describes the preparation as follows: Boil leaves of *C. papaya* with those of *A. indica*, drink the filtrate as desired and use some for bath. Its use as an antimalarial drug is justified by the presence of high concentrations of active compounds in this plant (Titanji et al., 2008). These authors have shown that an extract of the seeds of the species has a very significant antimalarial activity. This species is also known as an antimalarial in Brazil and Surunam (Lorenzi, 1991; Milliken, 1997). This plant used for the treatment of malaria in Maroua, is also used for the same cause in other areas of Cameroon like West, South-west and South (Titanji et al., 2008), Ghana (Asase et al., 2005) and Venezuela (Caraballo et al., 2004).

False combretum (*C. occidentalis*)

Subshrub growing annual Ceasalpiniaceae family, coffee-

Figure 7. *Cassia occidentalis*. Location: Maroua (Ward Ouro-Tchede) Date: 11/12/2009.

Figure 8. *Mangifera indica.* Location: Maroua (Ward Ouro-Tchede) Date: 11/12/2009.

negro (Figure 7) can reach one meter in height or more. Small fine hairs covering almost all parts of the plant. Its leaves are usually composed of 8 pairs of oval leaflets terminating in a point. Its yellow flowers produce small pods and archea in medium containing each 12 small seeds (Anon. 5, 1986).

Operating modes

The leaves of *C. occidentalis* are dipped in water and then left herein for a few hours until maceration. The solution is taken in the morning and evening. A few *C. occidentalis* leaves can be picked and consumed immediately after cleaning and grinding. *C. occidentalis* has other therapeutic properties. Its roots are used to treat gastritis (Kleda, 2006). Its leaves are laxative and purifying (Igoli et al., 2005).

Guava (*P. guajava* L.)

Perennial shrub of the Myrtaceae family, guava (Figure 8) has a height of 2 to 5 meters and has a twisted trunk with smooth bark whitish gray stain in the shell. The leaves are opposite, elliptical, forming a semi-circle. Its fruits are

Figure 9. *Psidium guajava*. Location: Maroua (Ward Ouro-Tchede) Date: 20/12/2009.

green turning yellow when ripe, round or oval and have a pink flesh containing many seeds (Anon. 5, 1986).

Manuals

The guava tree is combined with other herbs. The leaves of *P. guajava*, *M. indica*, *Eucalyptus* sp., and *C. papaya* are mixed in equal amounts and boiled in water. The obtained solution is to be drunk, one glass three times per day for adults and half a glass three times a day for the children until recovery. The P*. guajava* leaves may be mixed with *Ocimum basilicum* bark, *C. limonum* leaves, and *Pterocarpus erinaceus* leaves. Besides malaria, *P. guajava* treats many diseases like diarrhea and cough. Substances against malaria have been isolated. The boiled leaves of this plant have antimicrobial properties. Extracts of the leaves showed "cough-suppressing (Jaiarj et al., 1999).

Mango (*M. indica* L.)

Belonging to Anacardiaceae family, Mango (Figure 9) is a fruit tree that reaches 20 to 30 m in height. Its fruits have a juicy yellow flesh and contain large and flat nucleus. (Anon. 5, 1986).

Manuals

The use of *M. indica* to treat malaria is usually done in combination with other plants. It is for this reason that we can have several recipes: People of Maroua pick a quantity of *M. indica*, *C. papaya, P. guajava* leaves andsome *C. limonum* fruits*,* clean properly and place them in a pot of relatively equivalent water quantity and boil them for 15 to 20 m. After cooling, the resulting product is filtered, the filtrate is used to treat malaria. Adults must take it as a drink every six hours (morning, noon and evening) for 4 days to be healed. For children under 12 years, half a glass per day of the product is recommended. The *M. indica, C. papaya, A. indica, C. occidentalis* leaves and some *C. limonum* fruits for decoction are used. The patient washes his body every night for 3 to 5 days in a row and after each warm bath, drinks a glass of the decoction. According Asase et al. (2005), the barks of *M. indica* are to be boiled and drunk

Figure 10. *Eucalyptus* sp. Location: Maroua (Ward Domayo) Date: 20/12/2009.

or the unripe fruit eaten. The lack of control of dosage is sometimes the cause of an overdose due to high concentrations of toxic compounds in certain species (Rates, 2001). Using this case as control is also indicated by Titanji et al. (2008) in other areas of Cameroon and by Asase et al. (2005) in Ghana. *M. Indica* is used against headaches and diarrhea (Betti, 2004). The leaves or bark are anti-inflammatory drugs (Burkill, 1985; Oliver -Bever, 1986; Kambu et al., 1989; Das et al., 1989). The tender leaves are used as diuretics (Anon. 5, 1986), for the treatment of hypertension and of infertility (Igoli et al., 2005). According to Das et al. (1989), this species is used to treat dental problems.

Eucalyptus sp.

Called Gum, *Eucalyptus* sp (Figure 10) belongs to Myrtaceae family with at least 600 species. Its high species diversity results in varied sizes, from small shrub less than 4 m as *Eucalyptus macrocarpa* to the largest, *Eucalyptus regnans* (100 m high). All of them grow in the Sudanese region. The leaves are alternate and lanceolate bluish-gray, wrinkled, with a strong odor. The oils of the leaves are used in perfumery, medicine and preservation of seeds. It is a tree which greatly consumes water and dries up the environments in which they are planted. It also prevents native neighboring plants to grow (Mercier, 2010).

Manuals

To treat malaria, the population of Maroua use *Eucalyptus* leaves. They are properly washed and placed in a container of fresh water. The mixture is then boiled for 15 to 20 m and the decoction obtained is drunk from the first signs of malaria. People also gather a sufficient quantity of *Eucalyptus* sp., *M. indica* and *P. guajava* leaves which are boiled in a suitable quantity of water and the decoction obtained is used morning and evening. In another ways, the *Eucalyptus* sp bark and few leaves are also boiled in ten liters of water for baths. The antimalarial properties of this species are known in Southern Cameroon (Titanji et al., 2008), Kenya (Njoroge and Bussmann, 2006), Venezuela (Caraballo et al., 2004). Besides malaria, *Eucalyptus* sp. also treats specific diseases. In China, it is used for treating bacterial infections (Schwikkard and Van Heerden, 2002).

Caïlcédrat (*K. senegalensis* Desr.)

Large tree 25 to 30 m, bole usually short and stocky,

Figure 11. *Khaya senegalensis*. Location: Maroua (Ward Ouro-Tchede) Date: 27/12/2009.

K. senegalensis (Figure 11) may exceed 2 feet in diameter. Its bark is grayish, dark, scaly leaves are glabrous, paripinnate mainly grouped around the ends of branches with 3 to 7 pairs of leaflets opposite or subopposite. The distribution is from Senegal, Uganda and present eastern Sudan (Kerharo and Adam, 1974).

Manuals

The leaves bark and even the seeds are taken into account in the treatment of malaria by the Maroua urban town population. In fact, some people do chew fresh leaves and swallow the juice when then feel the first symptoms of malaria. The decoction of bark or leaves the mixture is drunk morning, noon and evening after being boiled until cured. From seeds cons, people first extract the oil, then drink a very small quantity, a teaspoon, 3 times daily until healed. There is no real precision in the preparation. For Asase et al. (2005) boil the *K. senegalensis* bark and drink the solution as desired.

Lemongrass (*C. citratus* (D. C, Strapf))

Lemongrass (Figure 12) is a plant of the Poaceae family that looks like a perennial herb with aromatic leaves banned forming clumps up to one meter in height. Lemongrass repents a citrus smell. It rarely fades, and it requires regular irrigation (Anon. 5, 1986).

Manuals

This plant helps in treating malaria as it reduces the fever. The leaves of this plant are boiled with a suitable amount of water for 10 to 20 m, and then the solution is drunk as desired. In some cases, the patient may add *C. limonum* fruits in the preparation. Dry or fresh leaves are used as insect repellent or to treat stomach upset (Anon. 5, 1986). Generally, this plant is used in combination with other plant species like *Mangifera indica, P. guajava, T. indica, Eucalyptus, C. limonum,* and *Carica papaya*. Most preparations are decoctions, administered 3 times daily until the patient recovers (Caraballo et al., 2004). These plant combinations may have an additive or synergistic effect often acting sequentially at different stages of the parasite cycle (Togola, 2002) or increase the effectiveness of the medicine (Bhattarai et al., 2010). But after Asase et al. (2005), this combination makes more complex the selection and evaluation of anti-malarial compounds in these herbs. Moreover, almost all plant parts are used for treating malaria.

Conclusions

At a time when the world stands up against this malaria endemic in the quest for a new therapy, the Maroua population (Cameroon) has a traditional medicine that still seems not to be known to the outside world. An ethnobotanical survey conducted among this population revealed 49 species of medicinal plants belonging to 27

Figure 12. *Cymbopogon citratus* (D. C) Strapf. Location: Maroua (Ward Ouro-Tchede) Date: 27/12/2009.

families as antimalarial drugs. The top ten most widely used plants by the Maroua people were recorded and described. The Giziga, the Fulbe and Toupouris use these plants much more to treat malaria. Leaves (34%), bark (24%) and roots (18%) are the parts most commonly used to treat malaria. It is important that the scientific community, Governments and donors get involved in the operation of these antimalarial plants which are effective against malaria that plagues our society. Research on active principles present in these plants of the region should be studied in order to spread the results of this work at the national as well at the international level.

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