

Diversity of Healing Plants Used in the Traditional Treatment of Malaria in four Municipalities of Niger

Mounkaila Soumaila^{1,2,*}, Karim Saley³, Inoussa Maman Maarouhi¹ and Mahamane Ali^{1,4}

¹Abdou Moumouni University of Niamey ; Faculty of Sciences and Techniques
P. O Box 10662 Niamey, Niger.

²Université of Agadez ; Faculty of Sciences and Techniques
P. O Box 465 Agadez, Niger

³University of Maradi; Faculty of Sciences and Techniques
P. O Box 465 Maradi, Niger

⁴University of Diffa
P. O Box 78 Diffa, Niger

* Courresponding author's email : Soummo2 [AT] yahoo.fr

ABSTRACT— *The study was conducted in four municipalities in Niger. The objective is an ethno-medical survey of medicinal plants that local people are used against malaria. Open semi-structured interviews technique was used to collect information. The study has identified twenty-six species traditionally used in the treatment of malaria. These species are divided into sixteen families and twelve genera. Besides of malaria, these plants can cure others pathologies like. Species morphological type analysis show that trees and shrubs are most represented. For different organs used, the leaves are the most used while decoction is the most common drug preparation method. These results show the medicinal plants diversity in malaria treatment in Niger. This study can be a base for new molecular research in the treatment of malaria*

Keywords— Malaria, species, medicinal, plants, Niger.

1. INTRODUCTION

Malaria remains one of the diseases of strong prevalence in the tropical zone, with 200 to 450 million cases of infection per year in the world, she talks up to 2.7 million deaths. This disease remains endemic in more than 100 tropical development countries [24]. In spite of the performances of the modern medicine, African pharmacopoeia occupies, today an important place in health care in Africa [31]. According to world health organization [27], 80 % of the undeveloped countries population use traditional medicine with healing plants for primary health care. Healing plants constitute a precious Inheritance for the humanity and more particularly for the majority of deprived communities of the developing countries which depend on it to assure their primary health care and their subsistence [34]. The knowledge on healing plants are hold by people who today have transmission difficulty because their offspring doesn't want any more to fall into step with them. And according to [2], in rural area, every inhabitant knows and uses the virtues of one or several plants. It is very important to translate this traditional knowledge into a scientific knowledge to revalue, preserve it and use it in a rational way [7].

In In Niger malaria is the first cause of morbidity and mortality with a rate 68,51 % and 33,45 % respectively, and it is the main cause of death at the children from 1 to 4 years old with 59,97 % [11]. Malaria is responsible for substantial economic losses particularly in the rural area and constitutes an important brake for the economic and human development. He constitutes a real problem of public health which affects generally all the population and particularly the children of less than five years old and the pregnant women.

The malaria is a worrisome affection, an affection which arouses a lot of concern among the populations today [24]. Niger is classified among the poorest countries of the world, what makes difficult the access to healthcare of the populations which make appeal to the pharmacopoeia [23]. Thus it is necessary to look for less expensive and easily accessible, new therapeutics.

It is necessary to add that in Niger, the antimalarial medicinal plants haven't be the object of specific works of inventories. But it is necessary to note that certain authors made case partially of antimalarial plants during their ethnobotanic inquiries which concerned the traditional medicine of Niger ([1], [32]). Face to this, it is important to lead an ethnobotanic study, to sit a database of antimalarial medicinal plants in Niger. The main objective of this work consists to inventory plants used by the population in malaria treatment. The specific objectives are: to identify organs and method of preparation; and finally to collect the maximum of information concerning all the therapeutic uses of these plants.

2. MATERIALS AND METHODS

➤ Study Sites

This study was conducted in the municipalities of Gaya, Tanda, Tamou and urban community of Niamey (Figure 1).

Niamey is located between 13°31' N latitude and 2° 26' E longitude. The town is built on the terraces of Niger River, at 218 m of height. The climate of the area is sahelian (Semi-arid) type characterized by a rainy season (4 to 5 months) with total precipitation varies from 500 to 750 mm a year and a drying season (8 to 7), longer than the previous one[23] . The vegetation is characterized by undergrowth consisted mainly species from Combretum kind, on lateritious trays and steppes on the sandy terraces in dry valleys and on dunes [37].

The municipalities of Gaya and Tanda are located in the department of Gaya (Region of Dosso). Gaya is centered on 3°10'35" - 3°37'48" E longitude and 11°48' - 12°11'32" N latitude. Tanda is situated between 3° 17' - 3° 16' E longitude and 12° 6' - 12°6' N latitude. The climate of the zone is the Sudanese north with two seasons: a dry season (6 to 7 months) and a rainy season (6 to 5 months). The rainy season extends from May till October, with more than 750 mm precipitation [33]. The vegetation is established by varied formations going from forest to savanna [5].

Tamou is located in the department of Say (Region of Tillabery). The area is situated between 11°54' - 12°35' N latitude and 02°4' - 02°50' E longitude [12]. The annual precipitation average calculated over 28 years of observation (1981-2008) is 632±25mm. The precipitation varies from 600 to 800 mm of rain a year. The climate is sahelo-Sudanese with two seasons: a dry season of more long-lasting (7 in 8 months) and a season of short-term rains (4 in 5 months). Generally the vegetation of the zone is characterized by raised and shrubby savannas, with forest galleries along streams [6].

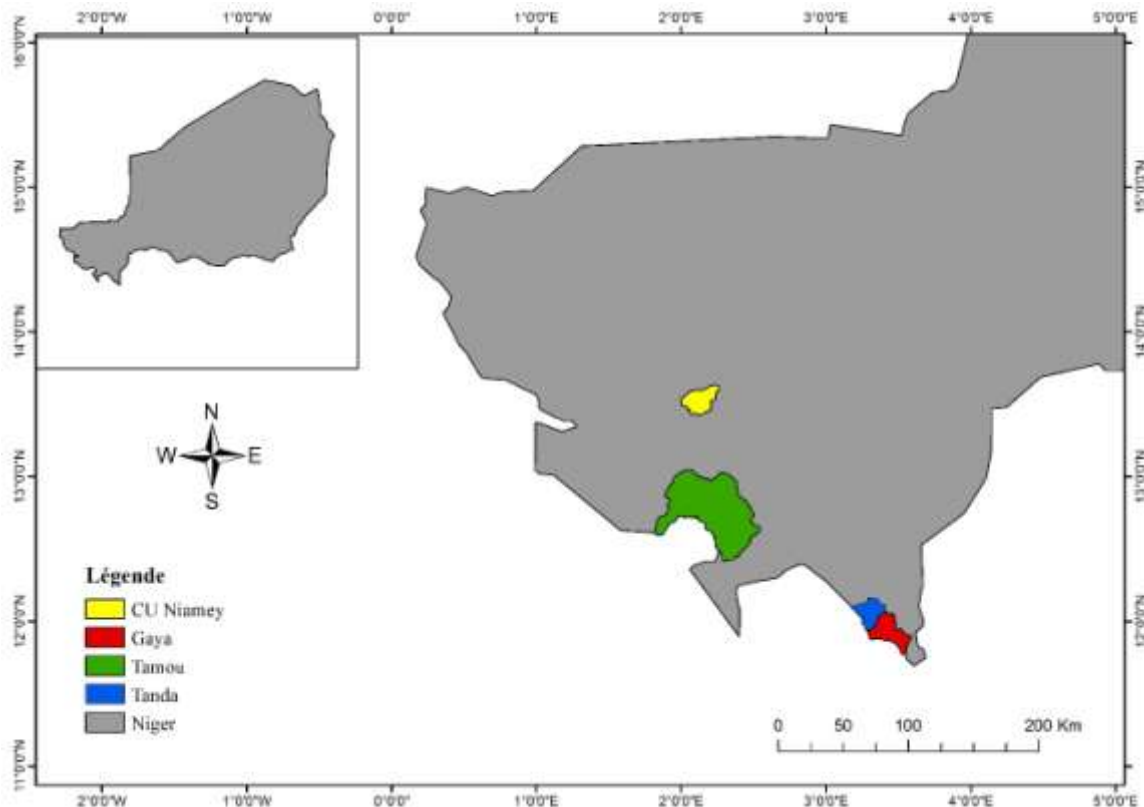


Figure 1: Location of study sites

➤ Ethnobotanic methods of data collection

Data were collected through a survey employing an random open semi-structured interviews technique with a questionnaire. The questionnaire concern precise information on the informant, the identity of the plant as well as the used part, the method of preparation and the method of administration. The approach is based on a local language dialogue, accompanied with the collection of the samples of the quoted plants.

➤ Data analysis

Fidelity Level (FL) which is the percentage of informants having quoted the use of a species given in the treatment of the malaria was calculated according to the technique of Trotter and Logan [36] used by several authors ([10], [14]): $FL (\%) = \frac{I_p}{I_u} \times 100$ with I_p number of informants having asserted the employment (use) of a species given to handle the malaria and I_u total number of questioned people (informants).

3. RESULTS

➤ Anti-malarial plants diversities

During this investigation, 27 healing plants used against the malaria in the traditional pharmacopoeia of Niger have been count.. These plants are distributed in 17 families and 22 kinds. For family diversities, Fabaceae and Combretaceae are the most represented with 5 and 3 respectively. Then come Rutaceae, Myrtaceae and Chlospermaceae with 2 species each. Other families are represented by one spicy (Table 1). Most of these plants were shrubs and trees.

On top of malaria, these plants can care other diseases (Table 1).

➤ Anti-malarial plants origin

Among anti-malaria plants used by the population, 19 plants (68 %) are spontaneous, while 14 plants (32%) are introduced (Figure 2). Among these last, five plants are cultivated in garden or houses.

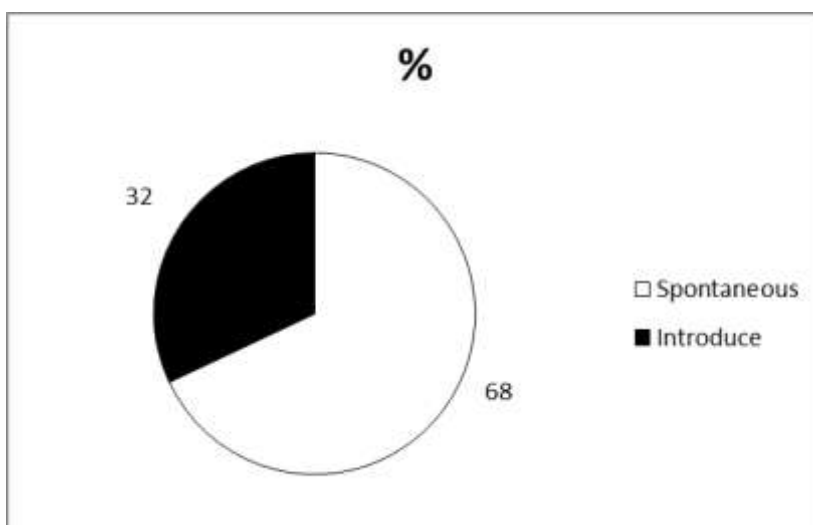


Figure 2: Species origin proportion.

➤ **Morphological types**

For morphological types censuses, Trees and shrubs with 10 species (40%) each come before grasses with 5 species (20 %), (Figure 3).

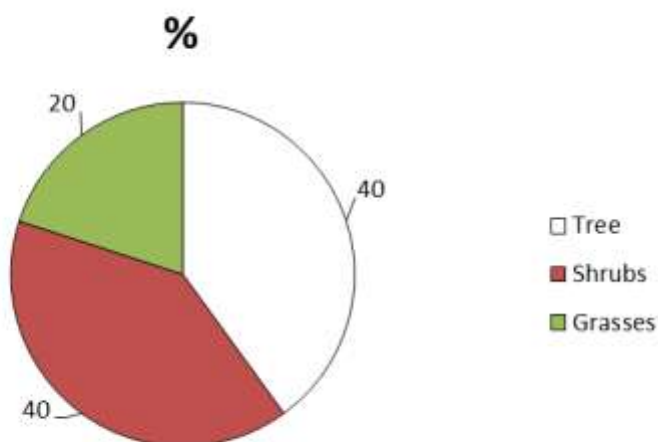


Figure 3: Morphological type's proportion.

➤ **Fidelity index**

Fidelity index analysis show that the higher number has been registered with *Cassia occidentalis* (66, 67) ; *Azadirachta indica* (58,33) ; *Combretum micranthum* (56,67) *Khaya senegalensis* (51,67) ; *Citrus limon* (48,33) ; *Eucalyptus camaldulensis* (46,67) ; *Combretum nigricans* (44, 67) et *Citrus aurantifolia* (40). Meanwhile the smallest number are registered for *Limeum pterocarpum* (5) ; *Moringa oleifera* (8,33) ; *Vitex doniana* (11,67) ; *Psidium guajava* (15), *Coclospermum tinctorium* et *Cochlospermum planchonii* (18,33) (Table 1).

Tableau 1: Plants used in the treatment of malaria

Family Names	Scientific Name	Parts uses	Therapeutic indication	Preparation	IFL
Aizoaceae	<i>Limeum pterocarpum</i>	Whole plants	Malaria	Decoction	5
Anarcadiaceae	<i>Mangifera indica</i>	Leaves	Malaria	Decoction	21,67
Capparaceae	<i>Cleome gynandra</i>	Whole plants	Malaria	Decoction	15
Caricaceae	<i>Carica papaya</i>	Feuilles	Malaria	Decoction	25
Chlospemaceae	<i>Cochlospermum planchonii</i>	Leaves	Malaria	Decoction, powder	18,33
		Roots	Malaria, hemorrhoid, jaundice	Decoction, powder	
	<i>Cochlospermum tinctorium</i>	fruit	Malaria, Gonorrhea	Decoction	13,33
Combretaceae	<i>Combretum micranthum</i>	leaves	Malaria, give birth	Decoction, Maceration	56,67
		Roots	Malaria, hemorrhoid, against snake bite	Decoction, Powder	
	<i>Combretum nigricans</i>	Leaves	Malaria, diarrhea	Decoction, maceration	44,67

		Roots	Malaria, Stomach ache	Decoction	
	<i>Guiera senegalensis</i>	Leaves	Malaria , hemorrhoid, wound, Stomach ache, vomiting; itch ; evil spirit	Maceration, decoction, powder	26,67
Cucurbitaceae	<i>Momordica balsamina</i>	Whole plants	Malaria, , hemorrhoid, jaundice	Decoction	33,33
Myrtaceae	<i>Eucalyptus camaldulensis</i>	Leaves	Malaria hemorrhoid, women wash	Decoction	46,67
	<i>Cassia occidentalis</i>	Whole plants	Malaria, hemorrhoid	Decoction	66,67
	<i>Tamarindus indica</i>	Leaves	Malaria	Decoction	30
	<i>Cassia siamea</i>	Leaves	Malaria, hemorrhoid, women wash	Decoction	25
	<i>Pterocarpus erinaceus</i>	Barks,	Malaria, , hemorrhoid, dysentery, skin disease	Decoction, powder	30
		Roots	Malaria, hemorrhoid, dysentery, skin diseases	Decoction, powder	30
	<i>Alysicarpus ovalifolius</i>	Whole plants	Malaria	Decoction	36,67
	<i>Khaya senegalensis</i>	Barks,	Malaria, hemorrhoid; Stomach ache; evil spirit	Decoction	51,67
	<i>Pseudocedrela Kotschyi</i>	Barks,	Malaria	Decoction	35
		Roots	Malaria Stomach ache, hemorrhoid	Decoction	
	<i>Azadirachta indica</i>	Leaves	Malaria	Maceration, decoction	58,33
Moringaceae	<i>Moringa oleifera</i>	Leaves	Malaria	Decoction	8,33
	<i>Psidium guajava</i>	Leaves	Malaria ; tonic	Decoction	15
	<i>Eucalyptus camaldulensis</i>	Leaves	Malaria, tonic	Decoction	46,67
	<i>Securidaca longipedunculata</i>	Barks	Rheumatism , hemorrhoid	Decoction	22,16
		Roots	Malaria, anguish, stress, hemorrhoid	Decoction	
Rubiaceae	<i>Crossopteryx febrifuga</i>	Roots	Malaria jaundice	Decoction	23,33
	<i>Citrus aurentifolia</i>	Leaves	Malaria, women wash	Decoction	40
	<i>Citrus limon</i>	Leaves	Malaria, women wash	Decoction	48,33
Verbenaceae	<i>Vitex doniana</i>	Leaves	Malaria	Decoction	11,67

➤ **Plants parts use**

The leaves with 55 % are the main plant parts that are used to care malaria, and then come in second position roots, whole plants, barks and fruits with 17%, 14 %, 10% and 4% respectively (Figure 4).

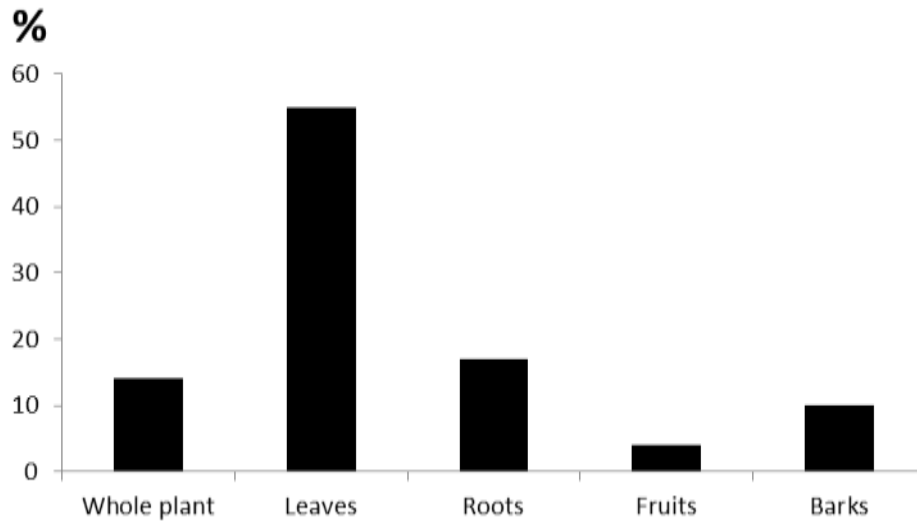


Figure 4: Plants different parts used proportions

➤ **Drug preparation**

For drug administration, three methods of preparation (Figure 5) are used to care malaria: decoction (76%), powder (16%) and maceration (8%).

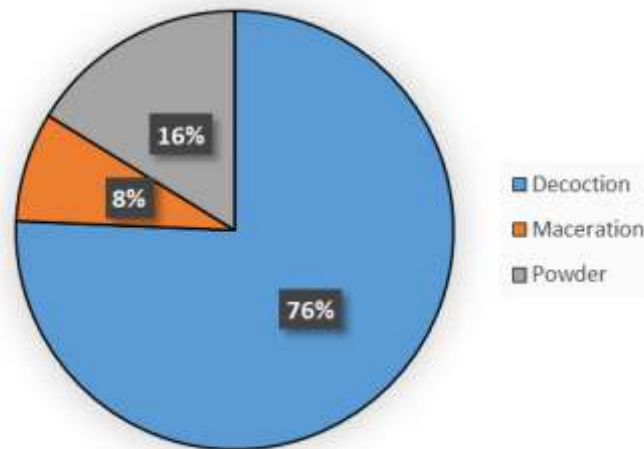


Figure 5 : Drug preparation proportion

➤ Others therapeutic indications

The antimalarial plants of this study can care other diseases, like hemorrhoid, jaundice, snake bite, Women wash after given birth, stomach ache (Fig 6).

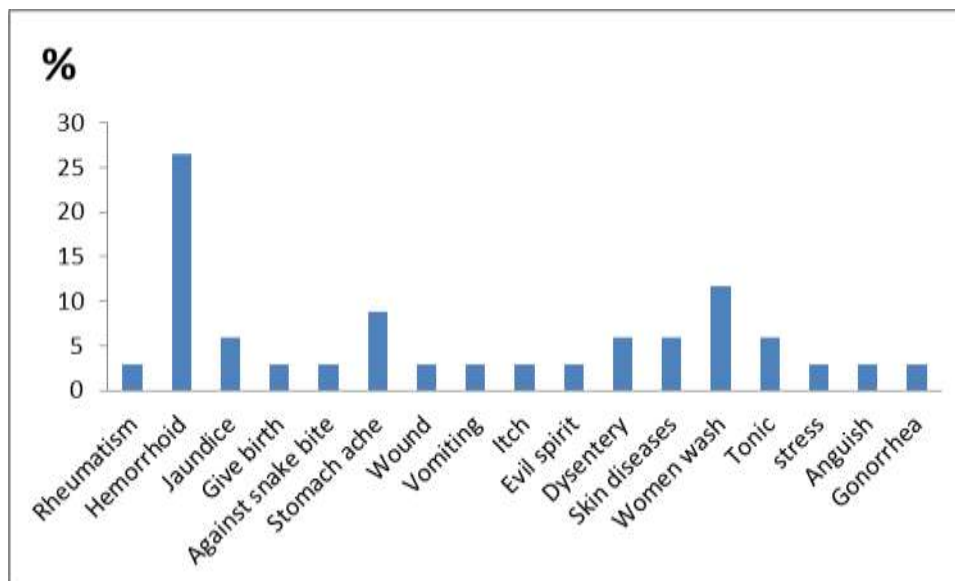


Figure 6: Others diseases proportion

4. DISCUSSION

This study indicates that traditional medicine has wide acceptability among people with 95 % of questioned people who used plants parts for medicine. This is in agreement with [27] which notify that 80 % of the undeveloped countries populations are using plants for primary health.

For plants origin, spontaneous (native) species are the most used than the introduce ones. This can be justifying by ancestor's knowledge on these plants. The population has more information on local plants than introduce ones; the evidence is the uses of plants to care many diseases. On top of these plants, introduce ones are used against the same disease (Malaria) in many countries. It is the case of: *Azadirachta indica*, *Cassia siamea*, *Eucalyptus camaldulensis*, *Mangifera indica* and *Psidium guajava* which are used against malaria in Niger, these plants are mentioned by [16] to care the same disease in Burkina Fasso. According to [19], the population of Bangui use *Mangifera indica*, *Carica papaya*, *Citrus aurantifolia*, *Azadirachta indica* against malaria and these plants appear on the list of this study. In Nigeria, [28] indicate *Carica papaya*; *Azadirachta indica*, *Mangifera indica*, *Citrus aurantifolia* and *Psidium guajava* as antimalarial healing plants; these plants appear on the list of this present study. In Cameroon [13] mentioned the use of *Carica papaya* and *Psidium guajava* against malaria by Bassa people of Douala. The use of introduce species for the same disease in many countries show that these species can really treat the disease and also the knowledge on these plants is known. The common knowledge on herbal medicines used in the treatment of malaria with introduce species are common in Niger as well in other countries. So the knowledge, attitudes and practices related to malaria treatment are the same in these countries.

The therapeutic uses of some plants recorded during this study are recognized in other countries: *Tamarindus indica*, *Khaya senegalensis*, *Mangifera indica*, *Carica papaya*, *Citrus aurantifolia* and *Azadirachta indica* find themselves on the list of the antimalarial healing plants of [19] during their studies in Bangui city (Centrafrique). So during their investigations, [16] listed in Burkina Fasso 72 species for their use (alone or in association) in the traditional treatment of the malaria. Of this list 13 species: *Azadirachta indica*, *Cassia occidentalis*, *Cassia siamea*, *Cochlospermum planchonii*, *Combretum micranthum*, *Crossopteryx febrifuga*, *Eucalyptus camaldulensis*, *Guiera senegalensis*, *Khaya senegalensis*, *Mangifera indica*, *Psidium guajava*, *Pterocarpus erinaceus* and *Securidaca longepedunculata* were mentioned as antimalarial during the present study. Studies led by [4] in SouthWest of Niger confirm the use of *Alysicarpus ovalifolius* and *Azadirachta indica* against malaria. *Cochlospermum planchonii* is used in Ivory Coast [17] and in Burkina Fasso [29] against malaria. In Democratic Republic of the Congo, [35] listed nine antimalarial plants, among them only *Cassia occidentalis* is present for this study. In Kenya [26] listed *Cassia occidentalis*, *Azadirachta indica* and *Securidaka longepeduculata* as healing plants to care malaria and all of them have been recorded during this study.

In Niger, [30] listed 15 antimalaria plants recorded in Niamey, five (*Annona senegalensis*, *Anogeissus leoicarpus*, *Combretum glutinosum*, *Momordica charantia* and *Tephrosia broncheolata*) doesn't appear on the present list.

It is also necessary to note that in Nigeria, [28] indicate that *Hyptis suaveolens* is used as an antimalarial healing plant, while during this study; people listed the plant as an anti-mosquito. People are collecting the stems with leaves, which are pulled down in houses and the odor will drive away mosquitoes.

Among the medicinal species used by the population, the spontaneous plants are the most used. This confirms the results of [22] who counted 34 spontaneous plants against 8 exotic plants during their investigation in Morocco. This strong use of the local species can give some explanation by the availability of the resource. It is necessary to note a low difference between the local species and those introduced during this present study. Thus the use of the introduced species is growing, because they are accessible to all during all the season.

Medicinal plant mixture preparation varies according to the relative importance of plants parts, some preparation methods and administration [3]. According to plants parts use, leaves are the most used. For [9], this frequency of higher use of leaves is due to the easy and to the speed of the harvest. According to [8], leaves are the photosynthesis site and sometimes the storage of the secondary metabolites responsible for biological properties of the plant.

Decoction is the most used preparation method and according to [34], it allows collecting chemical compound group and also limits or cancels the toxic effect of some plants mixture. Thus this is why most of the traditional drugs are prepared by decoction.

This work, allowed listing a number of diseases handled by healing plants besides of malaria. The results show that hemorrhoids (29, 41 %), wash of the women (11, 76 %), stomach ache (8, 82 %), jaundice, dysentery and tonic (5, 88 % respectively) (Figure 5), are the diseases after which these antimalarial plants look most. The number of species listed for hemorrhoid treatment is the most important, because this disease is frequent in Niger republic.

5. CONCLUSION

The results obtained during this study, allowed collecting several information on the medicinal plants species used by the population in the treatment of malaria which is the first cause of morbidity and mortality in Niger. Diverse plants parts (Leaves, fruits, roots and whole plants) coming from 27 botanical species are used by the populations against malaria. To note that three drugs preparation method (decoction, maceration, and powder) were registered.

This work represents an information source which is going to contribute to the knowing of antimalarial healing plants and to safeguard the local knowledge. So he can be a database for the valuation of these antimalarial medicinal floras to discover new chemical compounds.

It would be interesting to spread this kind of work to all country municipalities for recording the maximum of information about the antimalarial medicinal flora which will be of use to the science, by establishing a catalog of these plants.

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