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Assessment of the medicinal uses of plant species found on termitaria in the Pendjari biosphere reserve in Benin

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Medicinal plants are important in the life of African populations and there is nowadays an increasing need to gathering information related to them. In order to highlight the importance of termitaria to local populations, we investigated within the Pendjari Biosphere reserve the medicinal uses made from plant species found in association with them. We laid out plots in fields and fallows surrounding the Pendjari National Park to assess fifty six termitaria and identify plant species on them. By using specimen and local names of species, group interviews were conducted with the 3 major ethnic groups in the Biosphere reserve. Results show that people perceive termitaria as fertilization materials, and plants in association with them are considered more efficient in traditional medicine than those collected in mounds vicinities. Indigenous people used, for various medicinal purposes, twenty-two (22) plant species consisting of 21 woody and 1 herbaceous belonging to fourteen (14) families. Species used as medicine were relatively different according to the ethnic group. Furthermore, Combretaceae was the most used plant family. A total of thirty (30) diseases and illnesses were treated by plants, and bark was the most used part followed by leaves and roots. We suggest that conservationists and other scientific advisers use our findings to well define conservation programs and increase people's awareness on the sustainable management of termitaria and their ecosystems.

Key words: Medicinal plants, illnesses, termitaria, Pendjari biosphere reserve, Benin.

INTRODUCTION

Since time immemorial, people have gathered plant and animal resources for their needs. Examples include edible nuts, mushrooms, fruits, herbs, spices, gums, game, fodder, fibres used for construction of shelter and housing, clothing or utensils, and plant or animal products for medicinal, cosmetic or cultural uses (Schippmann et al., 2002). In developing countries, even today hundreds of millions of people derive a significant part of their subsistence needs and income from gathered plant and animal products (Walter, 2001). Similarly, Jones et al. (2002) reported that gathering of high value products such as mushrooms (morels, matsutake, truffles), medicinal plants (ginseng, black cohosh, goldenseal) also continues in developed countries for cultural and economic reasons. Medicinal plants play a great role among all the uses and almost 70 to 80% of the world populations use those plants for their primary healthcare (Cunningham, 1993). Moreover, plant species are mostly

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harvested from the wild to satisfy the pharmaceutical factories demands and for the local informal trade (Adjanohoun, 1982; Hamilton, 2004; Grace et al., 2004).

In many parts of the world, the use of medicinal plants has led to close relationships between local populations and their nature. In order to ensure a long term availability of medicinal plants for people, there is a recognition that much attention should be focused not only on the diversity of plants used for that purpose but also on the conservation of the different kinds of habitats including hotspots where these plants are harvested. Among those hotspots, termitaria are recognised as habitats for many plant species (Konate et al., 1999; Loveridge and Moe, 2004; Traoré et al., 2008). Termitaria are also habitats for animal species such as Andros Iguana *Cyclura cyclura cyclura* (Knapp and Owens, 2008) and small vertebrates (Fleming and Loveridge, 2003). Moreover, termite mounds may contribute to sustaining populations of mega herbivores in miombo woodland (Loveridge and Moe, 2004; Frost, 1996; Mobæk et al., 2005).

With regards to the role of termitaria in animal and plant species conservation, it is important to state local perception about them. In order to identify strategies to reduce wind erosion in Burkina-Faso, Leenders et al. (2005) focused their research on the farmer's perception of the role of scattered vegetation in this erosion control. Moreover, Vodouhê et al. (2010) have recently stated that Pendjari's local populations' perceptions of biodiversity conservation were strongly related to locally perceived benefits. These investigations confirm the necessity to take people's perception of termitaria and associated plants into account. So, this paper focused on: (i) The perception of indigenous people about termitaria and plants found in association with them, (ii) the diversity of plants species found on termitaria in fields and fallows surrounding the Pendjari National Park and the medicinal uses that local people make from them.

The aim behind this publication is to highlight the importance of termitaria to Pendjari's local populations through the investigation of the medicinal uses of plant species found in relation with them. Elsewhere, we do hope that conservationists and other scientific advisers from NGOs use our findings to increase people's awareness on the importance to conserve termite mounds and to well define conservation programs towards them. This no doubt constitutes a way to sustain medicinal plants in the Biosphere Reserve of Pendjari.

METHODOLOGY

Study area

The study was carried out in Pendjari Biosphere Reserve located between 10° 30' to 11° 30' N and 0° 50' to 2° 00' E (Figure 1). The reserve covers 471,140 ha of which the Pendjari National Park covers approximately 56.47% and the Pendjari hunting zone only 43.53%. The dry season starts from mid-October to mid-May. The annual mean temperature ranges between 18.6 and 36.8°C in the northern Reserve and in the southern, between 20.5° and 34.2° (Sogbohossou, 2004). Temperatures are highest in March and April and lowest from December to January. Vegetation consists of savannas, dry forest, woodlands and gallery forests. *Terminalia*, *Combretum* and *Acacia* are the predominant genera in shrub savannas (Sinsin et al., 2000) and the most abundant species are *Combretum glutinosum*, *Crossopteryx febrifuga*, *Acacia seyal*, *Acacia senegal*, *Acacia gourmaensis* (MAB UNESCO, 1990). Tree savannas are dominated by *Acacia sieberiana*, *Pseudocedrela kotschyi*, *Terminalia macroptera*, *Detarium microcarpum*, *Burkea africana*, *Afzelia africana* and *Vitellaria paradoxa*. Lastly, gallery forests are mostly characterized by *Diospyros mespiliformis*, *Borassus aethiopium*, *Ficus capensis*, *Khaya senegalensis*, *Parinari congoensis* and *Syzygium guineense*. Almost thirteen ethnic groups surround the Reserve and mainly three groups are predominant: Gourmantché (G), Berba (B) and Wama (W). The main activities generating income in the Biosphere Reserve are crop production, animal raising, trade and ecotourism services.

Termite mounds sampling

Prior to people's perception and the medicinal uses documentation, we investigated plant species found on termitaria by laying out plots sized 50 m × 50 m in order to take inventory of termite mounds. Then plant species on each mound were noted. A total of 56 mounds were surveyed in fields and fallows. Only the agricultural lands were taken into account as the local populations are not allowed to collect plants from the park. Plant species of which names were not determined in field had been identified at the National Herbarium.

Surveying people's perception about termitaria and mounds-related species

In each of the three ethnic groups (Gourmantché, Waama and Berba), we conducted group interview. The survey groups were made based on age and gender and old people and traditional healers were the most representative (almost 75%) in each group as they are supposed to be guards of traditional knowledge in African societies. Interviewees were asked to list the different categories of termitaria found in their area and the criteria they use to distinguish each one. We also ask participants to list the various beliefs related to termitaria and plants in relation with them. We conducted field trips in the Biosphere Reserve with participants to observe termitaria and identify some plants found on them as well as their local names.

Medicinal plants and uses surveys

In order to gather the diversity of uses as well as similarity, one group of people were interviewed in each of the three major ethnic groups: Gourmantché (G), Berba (B) and Wama (W). Participants were shown specimen and asked to provide the local name. Then they were asked to list the different diseases and illnesses that they treat using the species as well as the parts exploited and modes of preparation applied. There is however some species in our paper of which local names were not provided generally because of the non use of the species concerned by the ethnic group.

Statistical analysis

We performed an X^2 independent test to state whether the plant families used as medicine depend on the ethnic groups that

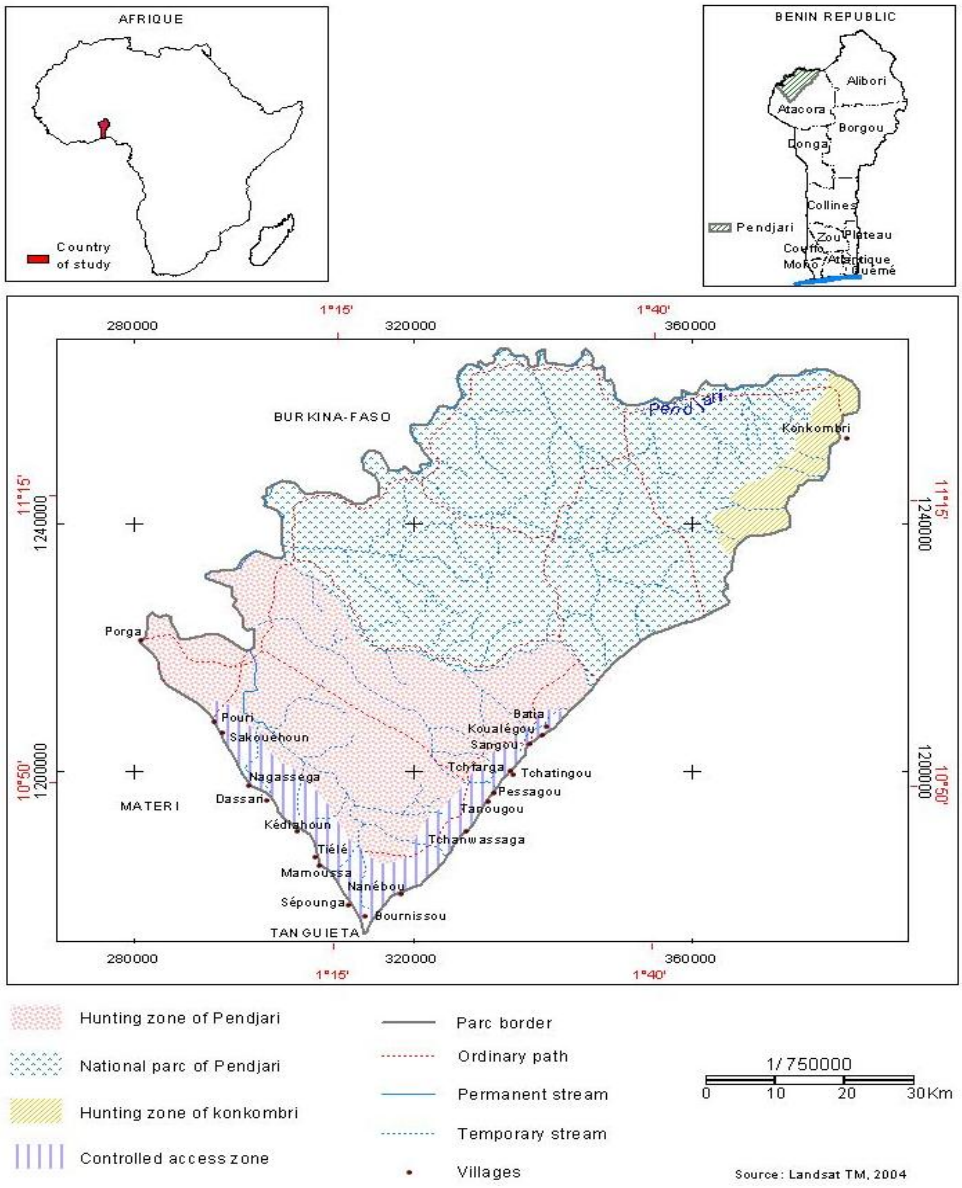

Figure 1. Maps showing the location of the study country Benin in West Africa as well as the study area Biosphere Reserve of Pendjari in Northern Benin. The Atakora chain is the southern border of the reserve whereas it is the Pendjari River which constitutes its north- western border.

Pendjari's people belong to. We considered 0.05 as level of probability. All proportions and graphs presented in this paper were computed using Excel software package.

RESULTS AND DISCUSSION

Indigenous people's perception about termitaria and mounds-related plant species: Ecology and traditional knowledge

Participants in the Pendjari Biopshere Reserve identified termitaria based on four major criteria: The height of the termite mound, its hardness, colour and the size of termite inside the mound. Two categories of termitaria were defined by local populations. The first group is characterised by mounds with height less than 1.2 m, often hard with black colour and small termites inside mounds. The second group is composed of big termitaria (height more than 1.2 m), soft and generally wet. According to indigenous people, big termites are found inside. Termites found in the small mounds (those of the first category) are sometimes used to feed poultry. Local people mentioned the big termitaria as the most common in the Biosphere Reserve of Pendjari. According to the

ethnic groups surveyed, termitaria are places where their ancestors' spirits and other religious spirits dwell. As a consequence, termitaria are respected and for instance, it is forbidden to urinate on termitaria for fear to be punished by ancestors' spirits. Termitaria are also used by hunters to hide from dangerous wild animals that may be possessed by "bad" spirit during hunting party. Elsewhere, according to participants, the presence of large termitaria on crop lands is evidence of fertile soil. Farmers preserved termitaria that occur on their farms and they avoid breaking the termite mounds for fear that termites might devastate their crops.

Plants that occur on termitaria are considered to be medicinally more efficient than plants in the savannah because these plants are connected to the spirit of the anscetors. Participants emphasized that termitaria plant species such as *Capparis sepiaria*, *Combretum micrantum* and *Tamarindus indica* are highly used in traditional medicine. To harvest medicinal plants on termitaria, harvesters take specific precautions. The trunk of the tree is first cut at four sides. In Berba communities prior to plant bark harvest, termitaria were first surrounded with fresh ash the night before harvest. Such harvesting takes place at dawn. This belief was the only one peculiar to Berba communities that we noticed during our research.

The perception of local people that termitaria are housing ancestors' spirit and improve the fertility of their lands was the main reasons why termitaria are preserved. This perception matches with Omari (1990) who found that traditional Africans viewed land and its resources as communal property that belonged not only to the living but to their ancestors and to future generations. Furthermore, it certainly contributes to the conservation of termites diversity.

The taxonomy and the feeding group are the major criteria often used by scientists to classify termite (Eggleton and Tayasu, 2001; Donovan et al., 2008). This study shows that farmers have their own criteria to distinguish termitaria. Linking farmer's knowledge to Western classification, we suggest that termites classify-cation based on their feeding materials be completed by the height of mounds those termites built. This aspect could somehow lead to knowing whether species feeding on the same matter has the same building capacities and then investigate the causes of likely difference in mounds architecture. The indigenous people's perception that plants on termite mounds are more efficient may take off the pressure on these species outside savanna. In addition, the need to observe some ceremonial rites before harvesting plant on the termitaria help limit the amount of material harvested from the limited population of plants on termitaria. So since termitaria materials and plant associated are profitable to Pendjari's populations, all perceptions towards them leads to traditional conservation practices. Similarly, Vodouhe et al. (2010) had recently noticed that Pendjari's local populations' perceptions of biodiversity conservation were strongly related to locally perceived benefits.

Termitaria-related plants species used as medicine

A total of 42 woody plant species and 32 herbaceous were recorded on mounds in fields. Woody species were represented by 35 genera and belonged to 23 botanical families whereas the herbaceous were represented by 24 genera and belonged to 14 families. In fallows, there were 33 woody species represented by 29 genera and belonging to 16 families. In this management area type, 17 herbaceous species represented by 14 genera and belonging to 7 families were recorded. The relative abundance of various families in terms of species recorded on mounds in the various area types is presented in Table 1. Populations in the Biosphere Reserve of Pendjari used as medicine from termitaria, overall twenty-two (22) plant species. These species belong to eighteen (18) genera and fourteen (14) families (Table 2). Among these plants, twenty-one (21) woody and one herbaceous species *Euphorbia convolvuloides* were recorded (Table 2). Among the species used as medicine, *Feretia apodanthera* and *Grewia lasiodiscus* were the most frequent recorded on termitaria in fields. Similarly, *F. apodanthera* and *Flueggea virosa* were recorded as most frequent on mounds in fallows. With regards to the abundance, *F. virosa* was more abundant on mounds both in fields and fallows. In addition, *Diospyros mespiliformis* was also more abundant on termitaria in fields.

Regarding the similarity in plant species used as medicine, we notice (Figure 2) that the most important proportion (55%) of recorded species were mentioned only by one ethnic group (that means by G or B or W). In contrast, a relatively low proportion of species (36%) were mentioned by two of the three ethnic groups while only 9% of the recorded plants were commonly mentioned by all the 3 ethnic groups. Results showed that the plant families used for medicinal purpose were dependent on the ethnic group that people belong to (X^2_{obs} = 15.4 and X^2_{th} = 19.4; df = 26). Combretaceae species [with 4 species (18.18%), 2 genera (11.11%) of which Combretum and Anogeissus] were the most recorded as medicinal plants.

The diversity of termitaria plant species used as medicine in the Pendjari Biosphere Reserve denotes the variety of knowledge that Pendjari's populations have from their nature. Besides, the relation between ethnic groups and plant families used as medicine added to the low proportion of medicinal plant species commonly mentioned by the 3 ethnic groups may reflect the diversity of origins of indigenous people and the variety of ethno botanical knowledge that they inherit from their ancestors. In fact, contrary to Berba and Wama communities that originate from Benin, Gourmantché people are

Table 1. Relative abundance of plant families per type of management area.

Family	Number of genus	Percentage	Number of species	Relative species importance	Species abundance	Relative abundance
Anarcadiaceae	3	8.571428571	4	9.523809524	4	2.631578947
Balanitaceae	1	2.857142857	1	2.380952381	1	0.657894737
Bombacaceae	1	2.857142857	1	2.380952381	1	0.657894737
Boraginiaceae	1	2.857142857	1	2.380952381	3	1.973684211
Capparaceae	2	5.714285714	2	4.761904762	11	7.236842105
Celastraceae	1	2.857142857	1	2.380952381	2	1.315789474
Caesalpiniaceae	3	8.571428571	3	7.142857143	9	5.921052632
Combretaceae	2	5.714285714	4	9.523809524	12	7.894736842
Curcubitaceae	1	2.857142857	1	2.380952381	8	5.263157895
Ebenaceae	1	2.857142857	1	2.380952381	16	10.52631579
Euphorbiaceae	2	5.714285714	2	4.761904762	21	13.81578947
Fabaceae	1	2.857142857	1	2.380952381	1	0.657894737
Liliaceae	1	2.857142857	1	2.380952381	1	0.657894737
Loganiaceae	1	2.857142857	1	2.380952381	2	1.315789474
Malvaceae	1	2.857142857	1	2.380952381	1	0.657894737
Meliaceae	1	2.857142857	1	2.380952381	3	1.973684211
Mimosaceae	2	5.714285714	4	9.523809524	12	7.894736842
Moraceae	1	2.857142857	2	4.761904762	2	1.315789474
Rhamnaceae	1	2.857142857	2	4.761904762	7	4.605263158
Rubiaceae	3	8.571428571	3	7.142857143	15	9.868421053
Sterculiaceae	1	2.857142857	1	2.380952381	1	0.657894737
Tiliaceae	1	2.857142857	2	4.761904762	17	11.18421053
Vitaceae	2	5.714285714	2	4.761904762	2	1.315789474
Total	34	97.14285714	42	100	152	100

Figure 2. Illustration of diversity of knowledge related to termitaria plant species in the Pendjari Biosphere Reserve. A high proportion (55%) of plant species was listed as medicine by one of the ethnic groups while a low proportion (9%) of species were commonly mentioned by the 3 ethnic groups.

from Burkina-Faso. Combreatceae, the most abundant species in sudanian bioclimatic zones (Thiombiano et al., 2006) were the most used as medicine. Whether Combretaceae species are commercialized, this activity added to their medicinal uses can negatively affect the conservation of the botanical group (Painter and Durham, 1995). As a result, we suggest that further researches are needed to state the part of termitaria plant species commercialized in the Pendjari Biosphere Reserve.

To predict termitaria ecosystems viability, we also suggest the documentation of the impacts of the species gathering on their sustainability. The high proportion of medicinal species (55%) mentioned by one of the three ethnic groups reflects the variety of knowledge on plants

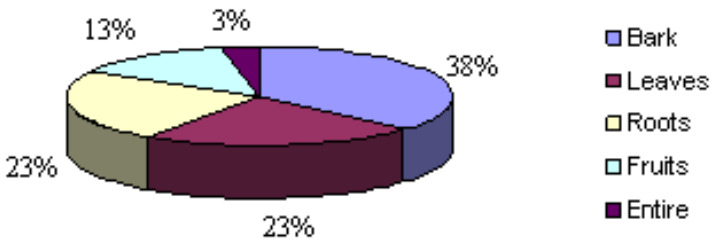

Figure 3. Proportion of diseases treated by plant parts. It reveals that bark is the most used part of plant species found on termitaria in the Biosphere Reserve of Pendjari. Leaves and roots rank respectively second and third in terms of medicinal uses.

among communities. So, the destruction of termitaria will signify not only the loss of cultural knowledge of potential pharmaceutical drugs for the developed world but also the erosion of the sole health care option for many of Pendjari's rural and urban poor. Africa and particularly Benin is a reservoir of knowledge about medicinal plants, however there is within the country no botanical garden installed to conserve medicinal plants. The conservation of termitaria as well as the establishment of gardens for the conservation of medicinal plants for their future and sustainable utilizations is adviced. These gardens and termitaria can also be valued through ecotourism activities that are known to provide employment to people and consequently generate local income.

Diseases and illnesses

A total of thirteen (30) diseases and illnesses are treated using the twenty-two (22) plant species. Dysentery and headaches were the most mentioned diseases and three species were used in their treatment. Against dysentery, people used *A. leiocarpa, D. mespiliformis* and *Flueggea virosa*. The latter as well as *C. febrifuga* and *G. lasiodiscus* were used against headaches. Stomach aches and diarrhoea rank second as most mentioned and respectively two species *A. leiocarpa* and *G. venusta*, *F. virosa* and *V. paradoxa* were used in their treatment. Among the mentioned plants, *C. febrifuga* has been positively tested as antioxidant species in Mali (Maiga et al., 2005). We remark that *F. virosa* is used to fight against a relatively important number of diseases. So the species may have a great importance to the local population. Among the diseases treated using termitaria plant species, we have malaria against which African nations are fighting in order to reach the Millennium Development Goals. Thus, the sustainable management of termitaria and their ecosystems will somehow contribute to reach these goals. The important number of illnesses (30) treated using termitaria plant species proves that medicinal plants are relevant healthcare alternatives in the Biosphere Reserve of Pendjari. Although indigenous people do not have any Western knowledge, they hold a relevant experience related to illnesses and their treatments since decades. So, there is a need to prioritize the ethno botanical knowledge of medicinal plants in Africa and particularly in Benin for ensuring that this knowledge will be available for future generations.

Plant parts used

The leaves, unripe fruits, bark and roots were the parts used in treatment and the entire plant in the case of the herbaceous *Euphorbia convolvuloides* was used to treat scorpion bites. This latter use represents a threat of overcollection for *E. convolvuloides*. Figure 3 shows that in the treatment of the 30 diseases and illnesses, bark was the most used part (38% of total diseases), followed by leaves and roots in equal proportion of diseases and illnesses (23%). While considering the concept of sustainability according to Prescott-Allen and Prescott-Allen (1996), a society is thought as sustainable when the system consisted of both human conditions and the condition of the ecosystem are satisfactory and improving. This system improves only when both of the conditions improve. So, with regards to the use of bark and roots which can in long term be prejudicial to the species conservation, and in order to ensure an availability of the plant species for future generations, we deeply advise to sensitize local populations about the importance to conserve termitaria and rationally use plants in relation with them.

Conclusion

Apart from the known role of termitaria as game ranching where termites are collected for food purposes, our research reveals that the populations in the Biosphere Reserve of Pendjari have great knowledge of the medicinal uses of plant species in relation with termitaria. Plants harvested from termitaria are used to treat diseases and illnesses and the bark is the most used part. As a result, we suggest future studies to be focused

Table 2. List of medicinal plants and diseases treated. It shows the variety of knowledge that Pendjari's people have of plant species found on termitaria.

Scientific name	Local name	Parts used	Disease/illness treated	Usage	Ethnic group using the treatment
Combretum fragrans (Combretaceae)	Tantamanni (G) Tantam (B) Kurutêdé (W)	Leaves	Abscess	New leaves are passed through fire and laid on the abscess	Gourmantché
Combretum glutinosum (Combretaceae)	Tantapienni (G) Kurudé (W) Tantampui (B)	Leaves	Anaemia	Decoction is prepared and given to kids	Gourmantché
Combretum collinum (Combretaceae)	Fampienni (G) Kurupodé (W) Tantam (B)	Roots	Fever	Decoction prepared	Gourmantché
Anogeissus leiocarpa (Combretaceae)	Bussiébu (G) Séika or Koubu (W)	Bark	Dysentery	Decoction prepared and used to clean kids	Gourmantché
	Qwark (B)		Stomachaches	Porridge prepared with decoction and maize flour	Berba
Diospyros mespilliformis (Ebenaceae)	Bugabu (G) Kabu (W)	Fruits	Dysentery	Fruits are pounded and juice is mixed with cow milk for drinking	Gourmantché
Tamarindus indica (Cesalpiniaceae)	Bupurbou (G)	Fruits	cold and cough	Non-ripe seeds with pulp added to water and sugar for drinking	Gourmantché
	Pussika (W)	Leaves	Rheumatism	Decoction is used for bathing	Gourmantché
			wound	Leaves are triturated and laid on mound.	Gourmantché
Piliostigma thonningii (Cesalpiniaceae)	Nambabu (G)	Leaves	Body impurities	Decoction used to clean kids	Gourmantché
			muscle pain	Decoction used	Berba
	Bakambu (W)		snake bite	Decoction prepared for drinking with leaves of Prosopis africana. Annona senegalensis and Securidaca longepedun-culata	Berba
	Lamangue (B)	Roots	Dysentery	Decoction is used to cook porridge with flour of Sorghum bicolor	Berba
Flueggea virosa (Euphorbiaceae)	Ichilimu (G)	Bark	Headaches	Dried and transformed in powder with 3 corns of Aframomum meleguetta. Head scars are done with the powder	Berba
	Buluyédu(B)	Roots	Diarrhoea	Drinking of decoction	Gourmantché

Table 2. Contd.

Crossopteryx febrifuga (Rubiaceae)	Warambu (G)	Fruits	Convulsion	Unripe fruits are burnt and the smoke is used to treat kids	Gourmantché and Wama
	Samitiré (W)	Leaves	Any persistent illness	Bath with triturated leaves	Berba
	Lapekoe (B)	Bark	Headaches	Use of smoke to treat the sick person	Berba
Feretia apodanthera (Rubiaceae)	Kwalabkanga (G) Yablicataca (W)	Roots	Non drink of milk by babies	Not available	Gourmantché
Grewia lasiodiscus (Tiliaceae)	Yuapienni (G) Arguipodé (W)-	Roots	Hard headaches	Roots are burned and transformed into powder used to make scars	Gourmantché and Wama
Grewia venusta (Tiliaceae)	Yuamoahoun (G)	Leaves+Bark	Delay in baby walking	Use of decoction to clean kids	Berba
	Arguitêdé (W) Sarroui (B)	Roots	Stomach aches	Use of decoction to prepare a porridge with Sorghum bicolour flour	Berba
Ziziphus abyssinica (Rhamnaceae)	Congoanugu G)	Fruits	Non straight look	Crushed and powder used to beautify eyelash	Gourmantché
	Santchiku (B)	Roots	Delay in dentition	Drinking of decoction and its use to clean kids	Berba
Lannea acida (Anacardiaceae)	Ngbantchablidjaga (G) Wassawému (W) Ndoougou (B)	Bark	Swollen body parts	Decoction with cloves of Parkia biglobosa. Application to the swollen part.	Gourmantché et Wama
Lannea microcarpa (Anacardiaceae)	Ngbantchabli (G) Tchiendafa (W) Sebeck (B)	Bark	Premature childbirth	Premature children are laid on bark	Gourmantché et Wama
Annona seneglensis (Annonaceae)	Namussakpê-chibu (G) Nouak (B)	Leaves	Excrements with viscous liquid	Leaves are transformed in powder and drunk with porridge.	Gourmantché et Wama
Azadirachta indica (Asteraceae)	Nimu (G) Neem (W) Titusik (B)	Leaves	Malaria	Triturated leaves are mixed with water and the ill person takes bath with	Gourmantché.. Wama et Berba
Vitellaria paradoxa (Vitaceae)	Bussambu (G) Taambu (W) Tanga (B)	Bark	diarrhoea	Bark is collected from 2 opposite side of the tree and decoction is drunk by the ill person.	Berba

Table 2. Contd.

Balanites aegyptica (Balanitaceae)	Bukpakpakabu (G) Kpakpakabu (W) Koomwack (B)	Bark	Hiccups	Not given	Gourmantché
Ficus sycomorus (Moraceae)	Mukankanbu (G) Kanyjakasire (W) Kank (B)	Bark	Bad luck	The tree is surrounded with fresh ash the night before harvest. The harvest takes place at dawn. The bark is pounded with salts and the water is drunk looking for luck.	Berba
Bombax costatum (Bombacaceae)	Bufuobu (G) Fokubu (W) Sankwaoun (B)	Bark	Pain prior to menstrual cycle	Drinking of decoction	Berba
Euphorbia convolvuloides (Euphorbiaceae)		Entire plant	Bite of scorpion	The entire plant is triturated and strike against the part.	Gourmantché

on the commercialization of termitaria plant species. The added to the local medicinal uses of the concerned species will help know whether there are threats or not towards plant species found on termitaria.

Results from this paper can also serve as argument for scientific advisers and any stake-holders in order to increase people's awareness on the importance to use rationally plant species found on termitaria and to conserve termitaria and their ecosystems.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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