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TRAMIL Ethnopharmacological survey in Les Saintes (Guadeloupe, French West Indies): a comparative study

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ABSTRACT

Aim of the study: The aim of this study was a comparison of popular household remedies in primary health care in the communities of Terre-de-Haut and Terre-de-Bas, the inhabited islands of 'Les Saintes' archipelago (Guadeloupe, French West Indies).

Methods: Twelve ailments, with higher prevalence, were chosen in each island and a total of 216 families were interviewed using TRAMIL participative ethnopharmacological interviews.

Results: According to TRAMIL methodology (frequency over 20%), twenty-two plants uses were recorded for Terre-de-Haut and eighteen for Terre-de-Bas. The islands share only ten significant plants uses and four of them have notable different frequencies. The informant consensus factor in the use of many specific remedies was fairly high, that gave an additional validity to these popular medicines.

Conclusion: The data presented in this study show that popular knowledge on medicinal plants uses is still alive in the studied area. The difference between the two nearby islands is very narrow but on the other hand, there exist some differences possibly due to a probable declining of plant resources and a more important flux of migration and its provision of other practices of healthcare in Terre-de-Haut.

Keywords:

Ethnopharmacology, French West Indies, Informant Consensus Factor, Program of Applied Research to Caribbean Popular Medicine, Familial self-medication.

1. Introduction

Ethnopharmacology is an interdisciplinary and recent science including medicine, botany, chemistry, toxicology, pharmacognosy and anthropology. The purpose of this social and natural science is to better understand the bases and principles of traditional medicine (Edwards et al., 2005; Heinrich et al., 2009) and to develop a good and larger use of them. Moreover ethnopharmacology plays a more significant role in developed countries because they have begun to turn to alternative therapies (Aburjai et al., 2007) and it is considered as a source of potentially important new pharmaceutical substances (Magassouba et al., 2007).

Medicinal plants were used in all Caribbean countries including the French West Indies since the pre-colonized period when the first inhabitants of these areas learned from their environment by tasting and using what was available (Longuefosse and Nossin, 1996). Caribbean popular medicine is a familial self-medication based on the humoral theory, which comes from the Amerindian, European and African cultures. This popular medicine is essentially characterized by plants uses (Bougerol, 1983; Goldwater, 1983; Robineau and Weniger, 1990). At the present time, medicinal plants continue to be used as treatments for several illnesses in these areas. It is thus important to document their uses and perform studies about their pharmacological activities to assure their efficacy and safety (Andrade-Cetto, 2009). Moreover, because of the success and diffusion of modern medicine, practices and products, there is a risk of disappearance of traditional medicine in Caribbean countries, like in several countries in the world (Magassouba et al., 2004; Guarrera et al., 2005). This probable disappearance may be also due to the fact that this knowledge is principally orally inherited (Inngjerdigen et al., 2004; Kosalge and Fursule, 2009). This is the reason why ethnopharmacological studies are also considered important for the conservation of cultural patrimony.

TRAMIL (Program of Applied Research to Popular Medicine in the Caribbean), created in 1982, is a network program of applied research on the traditional and medicinal plant resources of the Caribbean zone. TRAMIL's mission is to validate the traditional uses of medicinal plants for primary health care. Scientific validations of traditional health practices are based on criteria for safety and efficacy.

So far, TRAMIL surveys have been conducted in several Caribbean countries such as Antigua, Belize, Barbados, Colombia, Costa Rica, Cuba, Dominica, Guatemala, Granada, Guadeloupe, Haiti, Honduras, Martinique, Nicaragua, Panama, Puerto Rico, Quintana Roo, Dominican Republic, Saint Lucia, Saint Martin, Saint Vincent, Tobago and Venezuela (TRAMIL, 2007).

There has been only one published report on an ethnopharmacological survey in French West Indies (Longuefosse and Nossin, 1996). In these areas, people and their lifestyles change quickly. Thus, it is urgent to encourage, with the help of ethnopharmacological studies, the preservation of the culture, traditional knowledge and sustainable utilization of medicinal plants. The objectives and experience of TRAMIL seem to be the best methodology to continue to study and preserve Caribbean popular medicine.

The aim of the research was to make an inventory and a comparison of traditional household remedies in primary health care in the communities of the two inhabited islands according to TRAMIL methodology. In this work, we focus on two small islands 'Terre-de-Haut' and 'Terre-de-Bas' of the archipelago of Les Saintes (Guadeloupe, French West Indies). Although close, they experienced quite different styles of life, and we hypothesized that they developed different choices and use of medicinal plants to treat the same conditions.

2. Materials and methods

2.1. Survey area

The Guadeloupean Archipelago is located in the Lesser Islands of West Indies at 16° 15N of latitude and 61° 35W of longitude. It is a French overseas department made up two large islands of Basse-Terre and Grande-Terre and the small dependencies of Marie-Galante, La Desirade and Les Saintes. The archipelago of Les Saintes comprises eight islands: Terre-de-Bas, Terre-de-Haut, Le Pâté, Les Augustins, La Coche, Grand Ilet, La Redonde and Ilet à Cabrit. Only Terre-de-Haut and Terre-de-Bas are inhabited and are the object of the present study (Figure 1). These islands have an uneven and volcanic relief marked by a coastal and xerophitic vegetation. This vegetation is divided in two facieses: The 'littoral' and the 'hill' vegetation. The 'littoral' vegetation is itself divided in two types of facieses: i) The 'beach' with halophilic plant species like *Stenotaphrum* sp, *Coccoloba uvifera* or *Hippomane mancinella*; ii) The 'cliff' with Cactaceae associations. The 'hill' vegetation is located in the interior zones and marked by deciduous tree and shrub species like *Lonchocarpus benthamianus*, *Bursera simaruba*, *Tabebuia heterophylla*, *Cassia* sp and *Acacia* sp (Bonniol, 1980; Portecop, 1982). This latest vegetation is more developed and preserved at Terre-de-Bas where the area are less urbanized than Terre-de-Haut (IGN, 2002). The soil at Terre-de-Haut is a vertic soil with smectite and magnesite. At Terre-de-Bas we have vertisols due to the less eroded relief (Cabidoche Y.M, personal communication 2010). The climate of Les Saintes is considered tropical with an annual temperature comprise between 19 and 33°C (data from the France Meteorological Service, [http:// www.meteo.gp/](http://www.meteo.gp/)). Terre de Haut is more dry and arid (annual mean rainfall 500-1000 mm) and Terre de Bas gets a little more rainfall (1000-1500

mm) (Lasserre, 1982). The presence of three 'ravines' (little watercourses) in Terre-de-Bas (Ravine Caraibe, Ravine Grand Fond and Grande Ravine) and no one at Terre-de-Haut (IGN, 2002) also suggest that the first island is more under the rain influence.

According to INSEE (France's National Institute of Statistics and Economic Studies) census of 2006, Terre-de-Bas and Terre-de-Haut now respectively supports 1030 and 1838 inhabitants. The linguistic characteristics of this population are the same of the French West Indies countries with an official French language and a local language, the Creole. The Guadeloupean society is a melting pot of Creole, French, African and Indian cultures. The 'Saintois' of Terre-de-Bas have the same Guadeloupean characteristics. On the other hand, an ethnic specificity could be observed at Terre-de-Haut. Until the seventeenth century white French people inhabited the island. At the present time, the inhabitants are often called 'whites' that are persons of light mixed race. The black color never prevails because the ethnic stocks was, at 19th century, in inverse proportion with a majority of Whites peoples in comparison with the Blacks in the island of Terre-de-Haut. This is a unique case of mixed race in the Caribbean (Bonniol, 1980; Bonniol and Hegešippe, 1980).

Actually, the main human activity in these islands is fishing. Indeed inhabitants have a long tradition of fishing and the Saintois are recognized as skilled carpenters and for the quality of sailing boats built. Tourism is an important economic activity since the mid 70s' supporting handicrafts activities. Terre-de-Bas has a moderate tourism while Terre-de-Haut welcomes many tourists going ashore for the day.

2.2. TRAMIL methodology

TRAMIL has a unique methodology consisting of surveys, bibliographic researches and experimental laboratory studies. TRAMIL doesn't have only a qualitative, but also a quantitative approach to the popular uses of medicinal plants. The starting point of these participative ethnopharmacological surveys is current ailments but not the plants. The number of persons to be surveyed, validated by a statistician, is defined on the basis of the number of families of each country. The equation for calculating the number of families (n) (Aday, 1989):

$$n = \frac{N \times Z_{\alpha}^2 \times p}{d^2 \times (N - 1)} + Z_{\alpha}^2 \times p \times q$$

where, n is the minimum sample size, N is the total population size, Z is the ordinate on the normal curve corresponding to α with 90% confidence ($\alpha = 0.10$; $Z_{\alpha}^2 = 1.64$), p is the expected proportion of the country population (10%), $q = 1 - p = 1 - 0.1 = 0.9$, d is the precision (5%).

Generally, the interviewed person is the mother who is generally in charge of the family's health. The list of ailments is elaborated by a local multidisciplinary group (doctor, nurse, pharmacist, botanist, social worker...) in order to adapt it to the realities of the country. The first interview question is: What did you do first the last time this health problem has happened in the family? Several possibilities were offered: traditional doctor, doctor, pharmacist or plant-homemade remedy. If the first treatment is a plant, a description of the plant is requested, with all the details concerning its use, the part of the plant used, the other plant-associations are indicated, the directions for use, the contraindications, the directions for use for children or pregnant women. The location where the plant has been collected should also be indicated. The frequency of plant uses mentioned by the interviewed groups, for a given affliction is calculated with the following formula:

$$F = \frac{Ni}{Np} \times 100$$

where F is the frequency (%); Ni is the number of informants that used this part of plant specie to treat a particular disease; Np is the number of informants that used plants as a medicine to treat this disease.

Uses of medical species signaled in the TRAMIL survey, which have been selected according to the frequency 20% or higher for a particular use during fieldwork, are included in the TRAMIL list. This minimal frequency was chosen by the TRAMIL group in order to exclude anecdotic uses. The plants' Latin names are listed with their respective families and their vernacular names. Voucher numbers, locality of the interviews, frequencies, ailments, local names ailments, plant parts used, mode of preparation and significant plants association are also included.

To identify without any doubt the plants that have required frequencies, four photos are needed (entire plant, leaf, flower and fruit), then they must be collected, identified by a taxonomist and botanical nomenclature is checked in W3Tropicos, an international botanical database. Herbarium specimens of these plants were sent to the referent herbarium of TRAMIL (the Botanical Garden of Santo Domingo Herbarium in Dominican Republic) and others were deposited in regional herbaria of the survey's country.

The traditional uses of parts of plants, which don't have any existing data, are classified as INV (under INVestigation) and are studied for the activity described by the population. Specific and different TRIGS

(TRAMIL InvestiGationS) were ordered to validate each popular use. These investigations showed efficient and non-toxic activities of plant extracts corresponding to its traditional application (Germosén-Robineau, 1995; Germosén-Robineau and Soejarto, 1996; TRAMIL, 1999; TRAMIL, 2007).

2.3. 'Les Saintes' TRAMIL survey

A TRAMIL ethnopharmacological survey, conducted between August 2008 and February 2009, was done in the islands of Terre-de-Bas and Terre-de-Haut, Les Saintes (Guadeloupe, FWI). Interviews were performed in 100 families in Terre-de-Bas and 116 families in Terre-de-Haut. The number of families (n) was calculated and majored according to Aday method (Aday, 1989). The results collected in the two islands were analyzed with the help of TRAMIL methodology and other tools in order to select the significative traditional uses of plants species and to learn more about the traditional medicine of these areas. The local multidisciplinary group of each island chose a list of ailments (Table 1).

2.4. Informants consensus factor (ICF)

Informants consensus factor indicate if the surveys' information is homogenous. When the ICF values are near 0, the plants are chosen randomly or informants disagree on the plants to be used in the treatment of an illness category. When they are near 1, it indicates that the plants are used by a large proportion of the informants (Heinrich et al., 1998; S. Al-Qura'n, 2009). This factor tells us something about the cultural coherence of the selection of a set of medical agents used in the treatment of a certain illness category (Heinrich et al., 2009). The ICF is calculated as in the following formula:

$$ICF = \frac{(Nur - Nt)}{(Nur - 1)}$$

where Nur is the number of citations of use in each category and Nt, the number of species used.

3. Results

3.1. Plant Families

The inhabitants mentioned 99 plant species distributed in 44 families at Terre-de-Bas and 71 plant species distributed in 42 families at Terre-de-Haut (Figure 2). At Terre-de-Bas, the more frequent plant families were in order: Fabaceae, Lamiaceae, Asteraceae Euphorbiaceae, Malvaceae and Verbenaceae. Eight families were specific from Terre-de-Bas: Urticaceae, Sapindaceae, Solanaceae, Sapotaceae, Nyctaginaceae, Combretaceae and Bombacaceae. At Terre-de-Haut, the more frequent families were: Fabaceae, Euphorbiaceae, Lamiaceae, Liliaceae and Poaceae. Six families were mentioned only at Terre-de-Haut: Oxalidaceae, Chrysobalanaceae, Cactaceae, Bromeliaceae, Apocynaceae and Amaryllidaceae.

The species of Fabaceae most cited was *Senna alata* (L.) Roxb. at Terre-de-Bas and *Senna bicapsularis* (L.) Roxb. at Terre-de-Haut, two tropical and perennial shrubs. The species of Lamiaceae most cited in the both islands was *Mentha* sp, a perennial herb. All of the species of Asteraceae cited by the informants are perennial shrub or forb/herb. The species of Euphorbiaceae most cited in the both island was *Ricinus communis* L., a perennial shrub. The Malvaceae most cited by the both islands inhabitants was *Hibiscus rosa-sinensis* L., a perennial shrub. The most cited Verbenaceae was *Citharexylum spinosum* L., a perennial tree at Terre-de-Haut and was *Lantana camara* L., a perennial shrub at Terre-de-Bas. The species most cited in both islands was *Allium sativum* L., a perennial herb like all of the Liliaceae. The Poaceae most cited at Terre-de-Bas was *Cymbopogon citratus* (DC. ex Nees) Stapf, a perennial herb and was *Oryza sativa* L., an annual herb at Terre-de-Haut (Watson and Dallwitz, 1992; USDA NRCS, 2010).

3.2. Parts of plants uses

Plant materials used in medicinal preparations include mature and young leaves, fruits, flowers, stems, roots, bark, seed or bulbs (Figure 3). Leaves are the most frequently used part of plant in the both islands.

3.3. Mode of preparation

The remedies are prepared as decoctions, infusions, juices, baths, syrups and oils or used 'crude' (employed to designated plant consumed without any preparation) (Figure 4). The majority of medicines were prepared from fresh material in the form of decoctions and the most frequently mode of administration is oral ingestion.

3.4. Source of found or purchase plants

Most of 'Les Saintes' inhabitants found their medicinal plants in family gardens (Figure 5).

3.5. Informants consensus factor (ICF)

Higher ICFs were recorded at Terre-de-Haut (between 0.94 and 0.50). The highest ICF was scored for “cut and little wound” problems. The lowest ICF was reported for rheumatism.

Terre-de-Bas ICF values were lower than Terre-de-Haut (values between 0.85 and 0.40). Ailments due to intestinal parasites were cited with the highest ICF value. Lower ICF values were scored for ‘sorrow’ and headaches (Table 2).

3.6. TRAMIL results

Plant species used with a frequency of 20% or higher and their uses are presented in Table 3. Twenty-two plants uses were recorded for Terre-de-Haut and eighteen for Terre-de-Bas.

At Terre-de-Bas, the most frequent plant use is the bath of *Anredera leptostachys* (Moq.) Steenis fresh leaves to treat skin ailments and the decoction of young fresh leaves of *Psidium guajava* L. used to treat diarrhea. We can note that *Coccoloba uvifera* (L.) L, used for diarrhea, is a new species for the TRAMIL list.

At Terre-de-Haut, the most frequent plant use is for the treatment of foot mycosis with topical fruit juice application of *Citrus aurantifolia* (Christm. & Panzer) Swingle.

The two islands share ten plants uses (Figure 6). Four of these ten uses have frequencies with sizeable differences:

- Decoction or infusion of *Lantana camara*'s flowers used to treat flu ailments.
- *Cymbopogon citratus*, also beneficial against flu ailments.
- Bath of *Anredera leptostachys* fresh leaves, a remedy for skin ailments
- Bath of *Annona muricata* L., also treating skin ailments.

Eight uses were typical of Terre-de-Bas (*Allium sativum* for aerophagia disturbance, *Cinnamomum verum* Berchtold & J.S. Presl for flu ailments, *Coccoloba uvifera* for diarrhea, *Mirabilis jalapa* L. for blows, *Portulaca oleracea* L. for intestinal parasites, *Punica granatum* L. for diarrhea, *Sambucus canadensis* L. for flu syndrome and *Senna alata* for skin ailments). Twelve uses were typical of Terre-de-Haut (*Allium cepa* L. for flu syndrome, *Allium sativum* for intestinal parasites, *Aloe vera* (L.) Burm.f. for skin ailments and little wounds, *Apium graveolens* L. for flu syndrome, *Citharexylum spinosum* for blows, *Citrus aurantifolia* for foot mycosis, *Kalanchoe pinnata* (Lam.) Pers for headache, *Oriza sativa* for diarrhea, *Ricinus communis* oil for intestinal parasites and constipation and *Senna bicapsularis* for skins ailments).

4. Discussion

In the present study, 99 plant species distributed in 44 families in Terre-de-Bas and 71 species distributed in 42 families in Terre-de-Haut were cited. Les Saintes inhabitants, according to TRAMIL methodology, have identified only 25 species distributed in 21 plant families as notable healing remedies.

The Fabaceae family is the most frequent family, which is probably due to its high species richness. Indeed Fabaceae are among one of the largest dicotyledonous families in French West Indian's flora (Fournet 2002). The other important families are Lamiaceae, Asteraceae, Euphorbiaceae, Malvaceae, Vernenaceae, Liliacea and Poaceae. This fact can be explained also by importance of these families in the local Flora and because they include some common plants. Moreover, all of most used species are perennial and cultivated plants (except one, *Oryza sativa* which is not cultivated in French West Indies and is exclusively bought in the shop). According to Bonet et al. (1999), ‘Seeing as the more common a family is in an area, the greater is the probability of its popular use’. It is also the experience of TRAMIL, which could notice that the plants most used, are commonly present in the area and often shared by the different islands and countries of the Caribbean area (Robineau and Weniger, 1990).

Concerning the family species specific from one island, we can observe that the species more particular from dry and arid landscapes (Cactaceae, Bromeliaceae, Oxalidaceae, Chrysobalanaceae, Apocynaceae and Amaryllidaceae) were found in Terre-de-Haut. On the contrary, plant species more specific to rainfall landscapes (Urticaceae, Sapindaceae, Solanaceae, Sapotaceae, Nyctaginaceae, Combretaceae and Bombacaceae) were found at Terre-de-Bas (Watson and Dallwitz, 1992). Here, climate and soils more favorable on Terre-de-Bas probably explain this fact.

Leaf is the most frequently part of plant used in both islands. The principal mode of preparation is teas (decoction and infusion) in both islands with a large predominance in Terre-de-Bas (71%) compared to only 49% in Terre-de-Haut. Leaves are the most frequently part of plant used and teas are one of the most used preparations. These results do not differ much from many studies in other regions of the world: in European area (Parada et al., 2009; Vitalini et al., 2009), in African area (Giday et al., 2003; Kamatenesi-Mugisha and Oryem-Origa, 2007) in Latin American area (Macia et al., 2005; Sanz-Biset et al., 2009), in Asiatic area (Poonam and Singh, 2009) and Caribbean area (Longuefosse and Nossin, 1996; Clement et al., 2005).

However a notable difference can be observed for the use of leaves between both islands. Indeed more than half Terre-de-Bas inhabitants' use leaves against only 35% in Terre-de-Haut. ‘Teas’ had predominance in

Terre-de-Bas compared to Terre-de-Haut. It is also interesting to note that Terre-de-Haut's inhabitants used the 'crude' plant more than infusions.

Most diseases and pains were usually treated with a single plant. However, for elaboration of some medicinal preparations a mixture of plants was used nearly exclusively at Terre-de-Bas. This was comparable with the results found in Martinique (Longuefosse and Nossin, 1996), Puerto Rico (Beneditti, 2001), Cuba (Hernández Cano and Volpato, 2004), Trinidad (Clement et al., 2005) and Dominican Republic (Vandebroek et al., 2010) where the inhabitants also use mixture of plants.

In our study, the majority of plant species came from families' gardens, although a few species come from out of house (neighborhood or countryside). Interview results showed that very few of Terre-de-Bas medicinal plants were available for sale at local market, shops or pharmacy (9.2%) though in Terre-de-Haut it represented 30%. This high demand in local market and in pharmacy in Terre-de-Haut may be attributed respectively to i) a probable declining of wild resources in natural habitats or cultivated plants in family garden, ii) a substitution of some traditional herbs by commercialized herbal remedies.

In the specific medicinal uses of Terre-de-Bas, only one species is commercialized herbal remedies (*Allium sativum*). In the specific medicinal uses of Terre-de-Haut, four species are exclusively bought in local market, shop or pharmacy (*Allium cepa*, *Allium sativum*, *Oriza sativa* and *Ricinus communis* oil). This fact goes in the direction of the previous explanation.

The informant consensus factor in the use of many specific remedies is fairly high, which gives an additional validity to this folk medicine. The categories recorded with lower ICF values (rheumatism with 0.50 at Terre-de-Haut, 'sorrow' with 0.41 and headaches with 0.40 at Terre-de-Bas) may be attributed to the fact that there are a variety of plants being used (Neves et al., 2009). Indeed, at Terre-de-Haut rheumatism was associated 7 different species for 13 citation uses; at Terre-de-Bas sorrow and headaches was associated with, respectively 14 and 4 different species for 23 and 6 citations.

The data of the present article clearly show that folk knowledge on medicinal plants uses is still alive in the studied area. While the islands of Terre-de-Haut and Terre-de-Bas are 3 km apart and a similar flora was utilized in both of the communities pharmacopoeias, the number and variation of remedies seemed to link to each respective culture. Indeed, in some cases the difference between the islands is very narrow but on the other hand, there exist some ones: the large predominance of teas in Terre-de-Bas compared to Terre-de-Haut, the difference of leaves more used at Terre-de-Bas, the 'crude' plants more used at Terre-de-Haut, the plants mixture used nearly exclusively at Terre-de-Bas and the commercialized herbal remedies more used at Terre-de-Haut. A possible explanation of the latter difference can be the more important flux of migration and its provision of other practices of healthcare and the actual economic development observed in Terre-de-Haut. However we cannot be unaware of the probable declining of plant resources at Terre-de-Haut, which is more urbanized and has now less vegetation than Terre-de-Bas.

Previous laboratory studies and bibliography researches conducted by TRAMIL indicated the activity and safety of some medicinal plants uses reported by the current study. These uses are already classified as REC (Recommended) by TRAMIL group (references used to validate in brackets) and included in Herbal Caribbean Pharmacopoeia (TRAMIL, 2007):

- The dried peel of pod decoction of *Allium sativum* L. use against aerophagia disturbance (Damrau & Ferguson, 1949; Sumiyoshi et al., 1984; Sitprijia et al., 1987; Al-Bekairi et al., 1990; Martinez et al., 2005(a)) is also known as a notable remedy by TRAMIL surveys in Dominican Republic (Germosen-Robineau et al., 1984), Haiti (Weniger and Rouzier, 1986), Guatemala (Giron, 1988), St Lucia (Jean-Pierre, 1988), Martinique (Longuefosse and Nossin, 1990-95) and Barbados (Faujour et al., 2003).

- The topical application of gel leaf of *Aloe vera* (L.) Burm. used for little wounds (Lushbaugh and Hale, 1953; Rovatti and Brennan, 1959; Dhar et al., 1968; Bhakuni et al., 1971; Cobble, 1975; Northway, 1975; Davis et al., 1986; Davis et al., 1989; Fulton, 1990; Davis et al., 1994 (a); Davis et al., 1994 (b); Syed et al., 1996) is a common TRAMIL plant use in Barbados (Faujour et al., 2003), Tobago (Delaigue, 2005) and Marie-Galante (Guadeloupe FWI) (Balz et al. 2007).

- The decoction of *Chenopodium ambrosioides* L. fresh leaves to treat intestinal parasites (Bliss, 1925; Fernan-Nunez, 1927; Butz and La Lande, 1937; Opdyke, 1976; Feroz et al., 1982; Kliks, 1985; Bourgeois et al., 1989; Canigueral et al., 2002) is also used commonly in Haiti (Weniger and Rouzier, 1986), Honduras (Lagos-Witte, 1988-89, 1996), Nicaragua (Sotomayor and Rueda, 1990), Venezuela (Delens, 1990-92), Martinique (Longuefosse and Nossin, 1990-95), Colombia (Herrera, 1994; Gomez et al., 2003), Mexico (Mendez et al., 1996), Panama (Solis et al., 2003) and Tobago (Delaigue, 2005).

- The oral ingestion of fruit juice of *Citrus aurantifolia* (Christm. & Panzer) Swingle for flu syndrome (Bezanger-Beauquesne et al., 1986; Caceres et al., 1987; Bala and Grover, 1989) is also known in Dominican Republic (Germosen-Robineau et al., 1984), Dominica (Charles, 1988), Honduras (Lagos-Witte, 1988-89, 1996), Colombia (Herrera, 1994), Porto Rico (Beneditti, 1994), French Guyana (Hay, 1998; Fleury, 2007, 2008), Panama (Solis et al., 2003) and Tobago (Delaigue, 2005).

- The decoction or infusion fresh leaves of *Cymbopogon citratus* (DC. Ex Nees) Stapf are considered as beneficial against flu ailments (Awuah, 1989; Carbajal *et al.*, 1989; Carballo, 1995; Moron *et al.*, 1996; Martinez *et al.*, 2000 (a); Martinez *et al.*, 2000 (b)) and are also known as a sizeable remedy from TRAMIL surveys in Dominican Republic (Germosen-Robineau *et al.*, 1984), Dominica (Charles, 1988), Guatemala (Giron, 1988), Costa Rica (Ocampo, 1988), Martinique (Longuefosse and Nossin, 1990-95), Venezuela (Delens, 1992), Antigua & Barbuda (O'Reilly, 1992), Porto Rico (Benedetti, 1994) and Mexico (Mendez *et al.*, 1996).

- The decoction of fresh flowers of *Hibiscus rosa-sinensis* L. is used for flu infections (Bhakuni *et al.*, 1969; Singh *et al.*, 1978; Trivedi and Shukla, 1980) and seems to be a common TRAMIL plant use only in the French West Indian islands of Martinique (Longuefosse and Nossin, 1990-95) and Guadeloupe (Edouard, JA., 1992).

- The hot water extract of fresh leaves of *Mentha* spp. is a remedy against aerophagia (Leslie, 1978; Taddei *et al.*, 1988; Costa *et al.*, 1989; May *et al.*, 1996; Guerra *et al.*, 2002 (a); Guerra *et al.*, 2002(b); Martinez *et al.*, 2005(b)) and seems to be commonly used in Dominica (Charles, 1988) and Guadeloupe (Edouard, 1992).

- The young leaves decoction of *Psidium guajava* L. has properties to treat diarrhea (Caceres *et al.*, 1991(a); Lutterodt, 1992; Echemendia, 1997; Echemendia and Moron, 1997; Gnan and Demello, 1999; Moron *et al.*, 1999; Betancourt *et al.*, 2000; Martinez *et al.*, 2000 (c); Martinez *et al.*, 2000 (d); Martinez *et al.*, 2000 (e); Martinez *et al.*, 2000 (f); Lozoya *et al.*, 2002) which is also known in Dominica (Charles, 1988), Martinique (Longuefosse and Nossin, 1990-95), Guadeloupe (Edouard, 1992), Grenada (Marcelle, 1996), Panama (Solis *et al.*, 2003) and Tobago (Delaigue, 2005).

- The oral ingestion of *Ricinus communis* L. seeds oil is known to heal constipation (Cecil *et al.*, 1987; Weniger, 1992; Caniguel *et al.*, 2002) is also commonly used in Dominica (Charles, 1988) and Barbados (Faujour *et al.*, 2003).

- The bath of fresh leaves of *Senna alata* (L.) Roxb. to treat skins ailments (Benjamin and Lamikanra, 1981; Caceres *et al.*, 1991(b); Palanichamy *et al.*, 1991; Fiallo and Vasquez Tineo, 1992; Damodaran and Venkataraman, 1994; Lopez *et al.*, 2005; Martinez *et al.*, 2005 (c)) is a notable TRAMIL plant use in Guatemala (Giron, 1988), Venezuela (Delens, 1990-92), Martinique (Longuefosse and Nossin, 1990-95), Dominican Republic (Castillo *et al.*, 2003), Saint-Vincent (Balland *et al.* 2004) and Tobago (Delaigue, 2005).

The decoction of *Oryza sativa* L. dried seed is an old worldwide remedy and is recommended by WHO for oral rehydration therapy against diarrhea (World Health Organization, 1985).

5. Conclusion

The data presented in this study showed that popular knowledge on medicinal plants uses is still alive in the studied area. The difference between the two nearby islands is very narrow but on the other hand, there exist some differences probably due to a possible declining of plant resources, supported by urban development and the more important flux of migration and its provision of other practices of healthcare in Terre-de-Haut. After this survey, a 'new' plant is recorded in TRAMIL waiting list as a notable remedy against diarrhea: *Coccoloba uvifera* (L.) L.

6. Future projections

Priority phytochemical, biological and toxicological studies will be carried out for this new 'TRAMIL's plant' and for the other plant uses identified during this ethnopharmacological survey in Les Saintes will be carried out by the TRAMIL network. Further others surveys also will be carried out in Guadeloupe to complete published reports on ethnopharmacological survey in French West Indies.

Notice

This study was performed according to the international, national and institutional rules considering studies that include human participants rights, protection and rights of the biodiversity. The TRAMIL program is involved in the development of community-based conservation and management plans for vulnerable species and the promotion of national legislation to protect biodiversity property rights.

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Figures

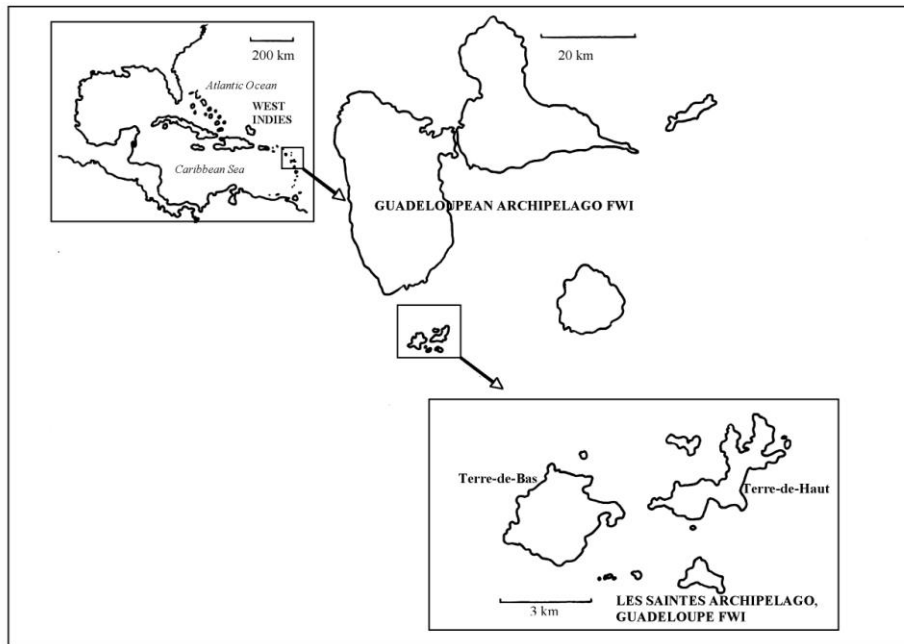


Figure 1: Survey Area: Les Saintes (Guadeloupe, FWI).

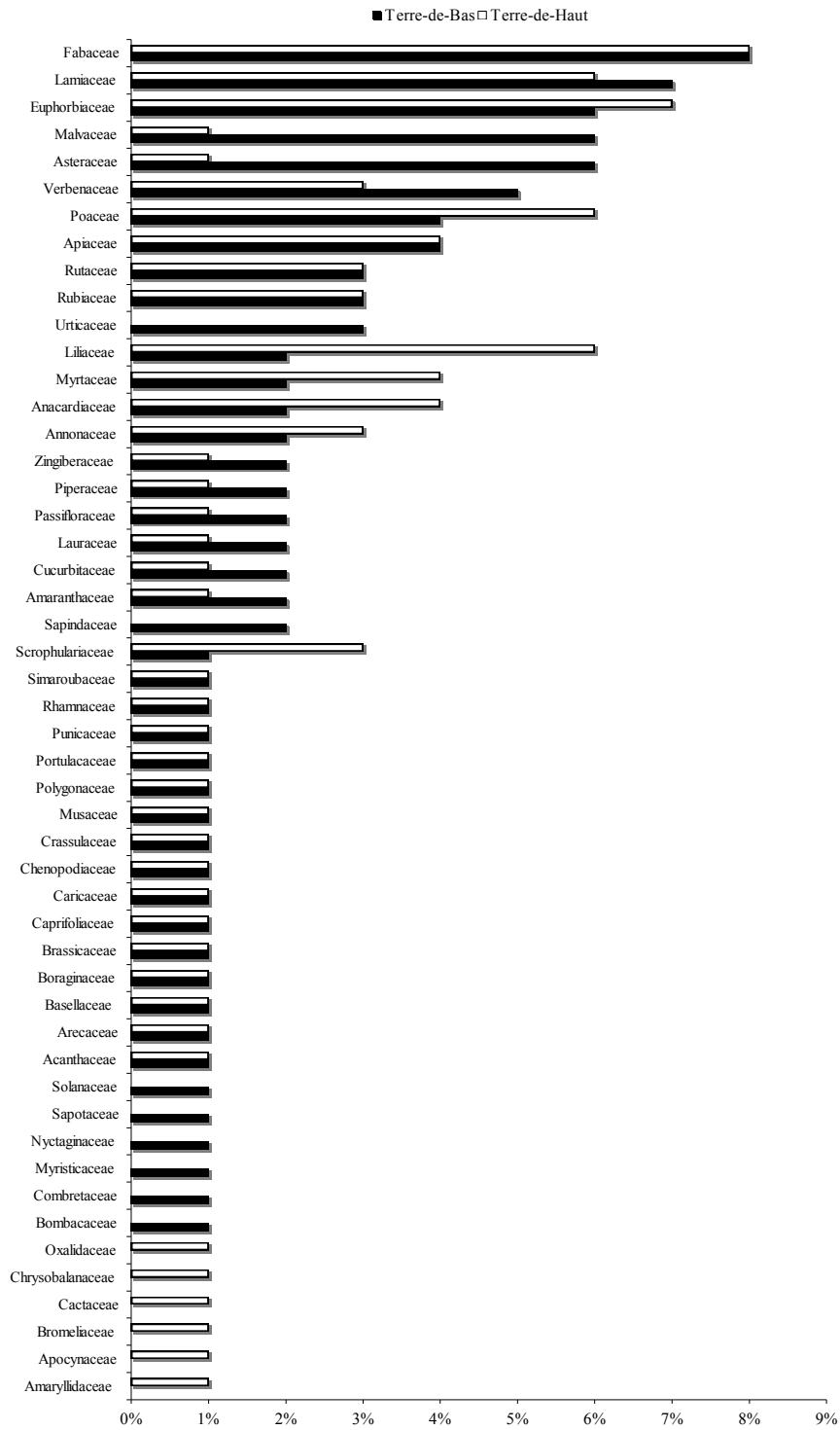


Figure 2: Plants Families used by inhabitants of Les Saintes according to TRAMIL survey

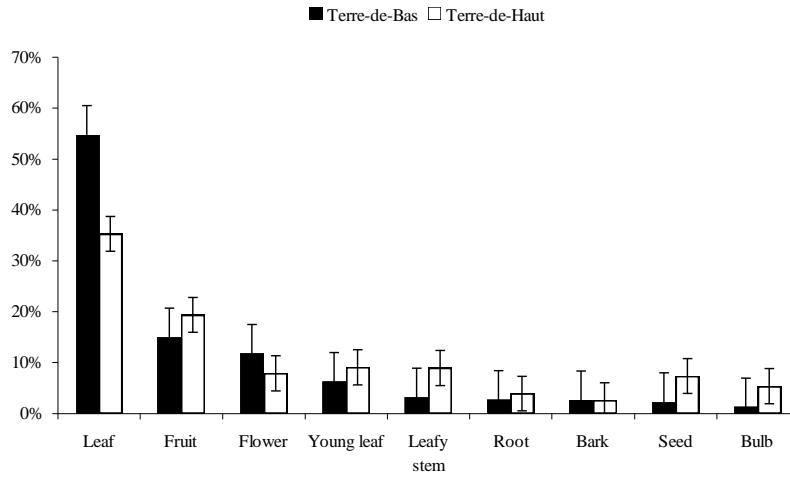


Figure 3: Parts of plants used by inhabitants of Les Saintes according to TRAMIL survey (Y error bars express the degree of uncertainty calculated with the standard error equation).

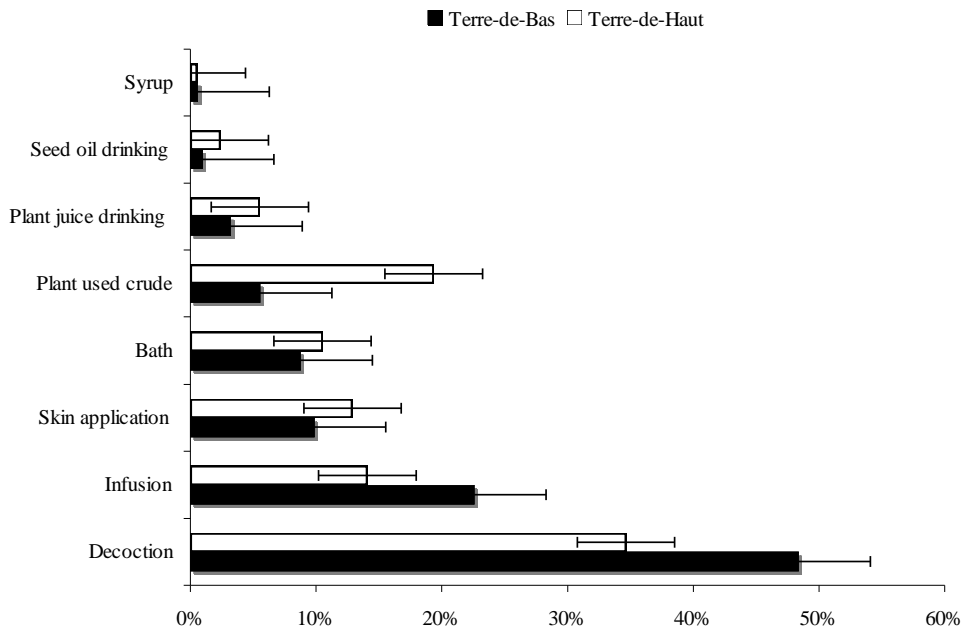


Figure 4 : Form of traditional preparation used by inhabitants of Les Saintes according to TRAMIL survey (Y error bars express the degree of uncertainty calculated with the standard error equation).

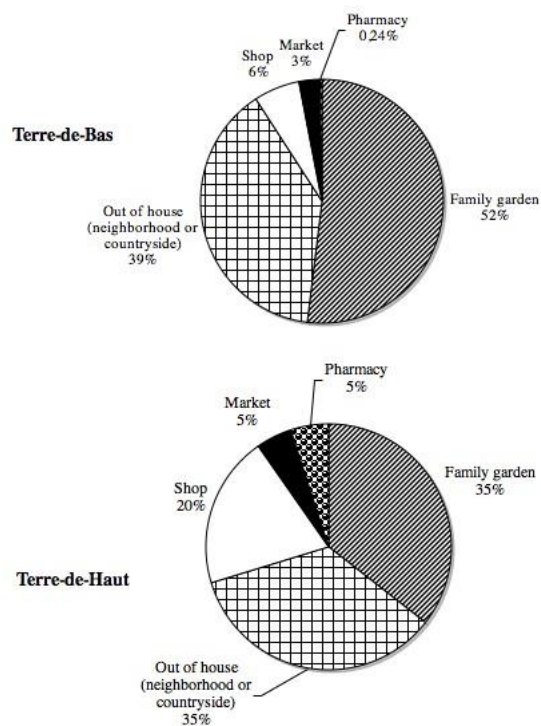


Figure 5: Source of found or purchased plants used by inhabitants of Les Saintes according to TRAMIL survey.

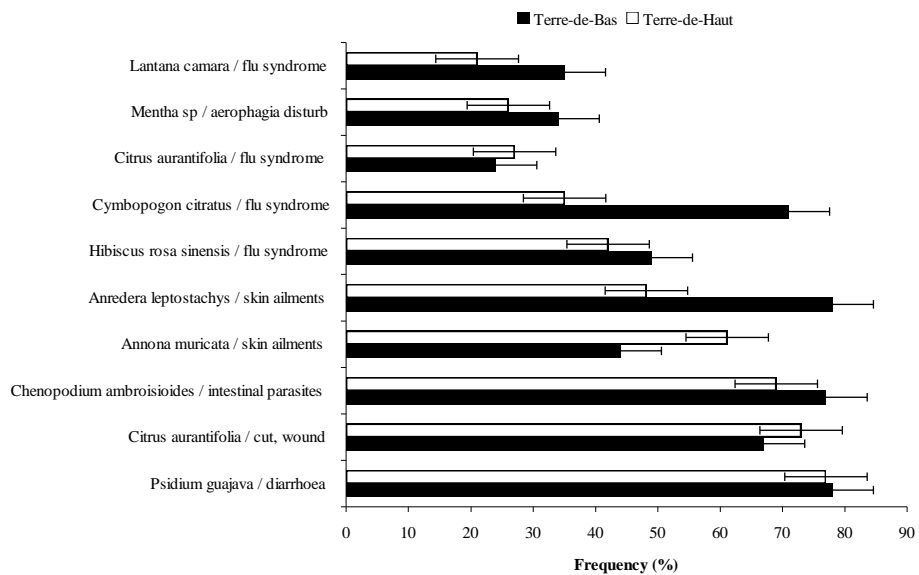


Figure 6: Frequency over 20% of shared plants uses (plants/ailments) used by inhabitants of Les Saintes according to TRAMIL methodology (Y error bars express the degree of uncertainty calculated with the standard error equation).

Tables

Table 1: Les Saintes ailments according to multidisciplinary group of each 'Les Saintes' island.

Health ailments	Local name
Flu syndrome	Coup de froid, rhume
Sprain, Bruise	Coup, entorse, bleu
Rheumatism	Rhumatisme
Cut, little wound	Coupure, petite plaie, bobo
Foot mycosis	Chofi
Emotional shock, sorrow	Choc émotionnel, chagrin
Gas, distension, aerophagia disturb	Gaz, ballonnement, coupement
Diarrhea	Diarrhée
Constipation	Constipation
Headache	Mal de tête
Worms, intestinal parasites	Vers
Eczema, skin ailments, Eruptions of heat	Boutons, gratelle, boutons de chaleur

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Table 2: Informants consensus factor (ICF) of the plants to be used in treatment of illness category by inhabitants of Les Saintes.

	Cut, Little wound	Foot mycosis	Diarrh ea	Eczema, Skin ailments	Worms, Intestinal parasites	Flu syndrome	Headache	Sprain, Bruise	Gas, Distension , Aerophagi a disturb	Emotion al shock, Sorrow	Constipation	Rheu matism
Terre-de-Haut	0.94	0.92	0.91	0.91	0.89	0.85	0.78	0.75	0.69	0.67	0.66	0.50
Terre-de-Bas	0.74	0.79	0.84	0.81	0.85	0.81	0.40	0.70	0.69	0.41	0.65	0.64

Table 3: Species, local names, families, islands, frequencies, ailments, local names' ailments, parts of plants used, mode of preparation and significant association according to TRAMIL survey results of Les Saintes. (^a TB : Terre-de-Bas, TH : Terre-de-Haut ; ^b F : Fresh, D : Dried)

Scientific names	Local name	Family	Voucher number	TB/TH ^a	%	Health issue: Common description	Health issue: Local name	Part use (F or D) ^b	Form of preparation	Frequently associated with
<i>Allium cepa</i> L.	oignon, zongnon	Liliaceae	BOULOGNE,TH,1,UAG	TH	32	flu syndrome	coup de froid	bulb (D)	decoction or syrup	
<i>Allium sativum</i> L.	ail, lay	Liliaceae	BOULOGNE,TH,2,UAG	TH	35	intestinal parasites	vers	pod (D) or peel of pod (D)	decoction	
<i>Allium sativum</i> L.	ail, lay	Liliaceae	BOULOGNE,TB,1,UAG	TB	32	aerophagia disturb	coupements, colliques	peel of pod (D)	decoction	<i>Mentha</i> sp (40%)
<i>Aloe vera</i> (L.) Burm.f.	aloe, laloé	Liliaceae	BOULOGNE,TH,3,UAG	TH	23	cut, little wound	coupure, petite plaie	leaf (F)	jelly application	
<i>Aloe vera</i> (L.) Burm.f.	aloe, laloé	Liliaceae	BOULOGNE,TH,3,UAG	TH	22	skin ailments	boutons, boutons de chaleur	leaf (F)	jelly application	
<i>Annona muricata</i> L.	corossol, korosol	Annonaceae	BOULOGNE, TH, 4, UAG/TB, 2, UAG	TB+TH	44(TB), 61(TH)	skin ailments	gratelle, boutons de chaleur	leaf (F)	bath	<i>Anredera leptostachys</i> (78% TB,42% TH), <i>Senna obtusifolia</i> (39% TH)
<i>Anredera leptostachys</i> (Moq.) Steenis	glycérine, glisérinn	Basellaceae	BOULOGNE, TH, 5, UAG/TB, 3, UAG	TB+TH	78(TB), 48(TH)	skin ailments	gratelle, boutons de chaleur	leaf (F)	bath	<i>Annona muricata</i> (47% TB, 58% TH)
<i>Apium graveolens</i> L.	céleri, sèlri	Apiaceae	BOULOGNE, TH, 6, UAG	TH	23	flu syndrome	coup de froid	leaf stem (F)	decoction	
<i>Chenopodium ambrosioides</i> L.	simenn kontra	Chenopodiaceae	BOULOGNE, TH, 7, UAG/TB, 4, UAG	TB+TH	77(TB), 69(TH)	intestinal parasites	vers	leaf (F)	decoction	<i>Portulaca oleracea</i> (22% TB)

<i>Cinnamomum verum</i> Berchtold & J.S. Presl	cannelle, kannel	Lauraceae	BOULOGNE,TB,5,UAG	TB	21	flu syndrome	coup de froid, grippe	bark (D)	decoction	
<i>Citharexylum spinosum</i> L.	bois carré, bwa karé	Verbenaceae	BOULOGNE,TH,8,UAG	TH	53	sprain, bruise	coup, entorse	leaf (F)	hot leaf application	
<i>Citrus aurantiifolia</i> (Christm. & Panzer) Swingle	citron, sitwon	Rutaceae	BOULOGNE,TH,9,UAG	TH	85	foot mycosis	chofi	fruit (F)	hot fruit juice application	
<i>Citrus aurantiifolia</i> (Christm. & Panzer) Swingle	citron, sitwon	Rutaceae	BOULOGNE,TH,9,UAG/TB,6,UAG	TB+TH	67(TB), 73(TH)	cut, little wound	coupure, bobo	fruit (F)	fruit juice application	
<i>Citrus aurantiifolia</i> (Christm. & Panzer) Swingle	citron, sitwon	Rutaceae	BOULOGNE,TH,9,UAG/TB,6,UAG	TB+TH	24(TB), 27(TH)	flu syndrome	coup de froid, grippe	fruit (F)	fruit juice drinking	
<i>Coccoloba uvifera</i> (L.)L.	raisin bord de mer, résen bodlanmè	Polygonaceae	BOULOGNE,TB,7,UAG	TB	22	diarrhea	diarrhée	bark (D or F)	decoction	<i>Psidium guajava</i> (83%)
<i>Cymbopogon citratus</i> (DC. ex Nees) Stapf	citronnelle, sitwonnèl	Poaceae	BOULOGNE,TH,10,UAG/TB,8,UAG	TB+TH	71(TB), 35(TH)	flu syndrome	coup de froid	leaf (F)	decoction(TB), infusion(TH)	<i>Lantana camara</i> (29% TB), <i>Hibiscus rosa-sinensis</i> (53% TB)
<i>Hibiscus rosa-sinensis</i> L.	rose cayenne, roz kayèn	Malvaceae	BOULOGNE,TH,11, UAG/TB,9,UAG	TB+TH	49(TB), 42(TH)	flu syndrome	coup de froid	flower (F)	decoction	<i>Lantana camara</i> (49% TB), <i>Cymbopogon citratus</i> (71% TB)
<i>Kalanchoe pinnata</i> (Lam.) Pers	herbe mal tête, èwb maltèt	Crassulaceae	BOULOGNE,TH,12,UAG	TH	78	headache	maux de tête	leaf (F)	crumpled leaf application	
<i>Lantana camara</i> L.	mille-fleurs, milflè	Verbenaceae	BOULOGNE,TH,13,UAG/TB,10,UAG	TB+TH	35(TB), 21(TH)	flu syndrome	coup de froid	flower (F)	decoction or infusion	<i>Sambucus canadensis</i> (40% TB), <i>Cymbopogon citratus</i> (64% TB), <i>Hibiscus rosa-sinensis</i> (64% TB)

<i>Mentha sp</i>	menthe, mant	Lamiaceae	BOULOGNE,TH,14,UAG/TB,11,UAG	TB+TH	34(TB), 26(TH)	aerophagia disturb	coupements, colliques	leaf (F)	decoction(TB), infusion(TH)	<i>Allium sativum</i> (37% TB)
<i>Mirabilis jalapa</i> L.	belle de nuit, beldinuit	Nyctaginaceae	BOULOGNE,TB,12,UAG	TB	71	sprain, bruise	bleu, forcement	leaf (F)	crushed leaf with salt application	
<i>Oryza sativa</i> L.	riz, diri	Poaceae	BOULOGNE,TH,15,UAG	TH	39	diarrhea	diarrhée	seed (D)	decoction	
<i>Portulaca oleracea</i> L.	pourpier, koupie	Portulacaceae	BOULOGNE,TB,13,UAG	TB	38	intestinal parasites	vers	leaf (F)	decoction or infusion	<i>Chenopodium ambrosioides</i> (45%)
<i>Psidium guajava</i> L.	goyave, gouvav	Myrtaceae	BOULOGNE,TH,16,UAG/TB,14,UAG	TB+TH	78(TB), 77(TH)	diarrhea	diarrhée	young leaf (F)	decoction	<i>Coccoloba uvifera</i> (24% TB), <i>Punica granatum</i> (52% TB)
<i>Punica granatum</i> L.	grenade, grènad	Punicaceae	BOULOGNE,TB,15,UAG	TB	44	diarrhea	diarrhée	fruit (F)	decoction	<i>Psidium guajava</i> (92%)
<i>Ricinus communis</i> L.	ricin/karapat	Euphorbiaceae	BOULOGNE,TH,17,UAG	TH	33	intestinal parasites	vers	seed (D)	seed oil	
<i>Ricinus communis</i> L.	ricin/karapat	Euphorbiaceae	BOULOGNE,TH,17,UAG	TH	20	constipation	constipation	seed (D)	seed oil	
<i>Sambucus canadensis</i> L.	surio	Caprifoliaceae	BOULOGNE,TB,16,UAG	TB	21	flu syndrome	coup de froid, grippe	flower (F)	decoction or infusion	<i>Lantana camara</i> (67%)
<i>Senna alata</i> (L.) Roxb.	datié	Fabaceae	BOULOGNE,TB,17,UAG	TB	27	skin ailments	gratelle, boutons de chaleur	leaf (F)	bath	
<i>Senna bicapsularis</i> (L.) Roxb.	séné	Fabaceae	BOULOGNE,TH,18,UAG	TH	35	skin ailments	boutons, boutons de chaleur	leaf (F)	bath	<i>Annona muricata</i> (68%)