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# Divergence and Convergence in Traditional Plant-Based Medicinal Practices of Haitian Migrants in Montreal, Miami and Cayenne

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**Abstract :**

Migrants continue to usee their traditional herbal medicines in their new locations, but few studies have compared therapeutic practices within a diaspora spread among different countries. In order to better understand how medicinal plants and associated practices circulate in the process of transnational migrations, we examine the Haitian diaspora in the cities of Cayenne (French Guiana), Miami (United States), and Montreal (Canada). We conducted semi-structured interviews (n = 44) with Haitian migrants in all three locations, and compiled plant inventories in gardens, shops, and through interviews. Our results record a total of 185 species cited among the three localities that were sold in shops, cultivated by informants, or gathered in diverse urban spaces, demonstrating the vitality with which members of the Haitian diaspora continue to use plants from their original pharmacopoeia while highlighting marked dissimilarities among uses. The persistence of phytotherapy practices among migrant populations in different locations is fueled by transnational commercial and individual flows of medicinal plants.

**Keywords** : Diaspora, Urban ethnobotany, Medicinal plants, Traditional medicinal practices, Migrations, Haiti, Montreal, Canada, Miami, USA, Cayenne, French Guiana

## Introduction

Several earlier studies highlight the fact that migrants travel with their herbal medicines (Kujawska and Pieroni 2015; Medeiros *et al.* 2012; Pieroni *et al.* 2014; Pieroni and Vandebroek 2007; Pirker *et al*. 2012; Vandebroek and Balick 2012; Volpato *et al*. 2009; Waldstein 2006), which are then incorporated into the range of intercultural practices in urban areas (Ceuterick *et al*. 2008; Ladio and Albuquerque 2014; Ososki *et al*. 2007; Tareau *et al*. 2017; Vandebroek *et al*. 2007; Voeks 2016). Pieroni and Vandebroek (2007)have contributed to the ethnobiology of migrants, emphasizing the changes that occur in their therapeutic behaviors and practices. Ceuterick *et al*. (2008), Medeiros *et al*. (2012), van Andel and van't Klooster (2007), Vandebroek *et al*. (2007) or Volpato *et al*. (2009)have comprehensively addressed migrants' adaptation of phytotherapeutic practices to new social and physical environments. In particular, they document examples of replacements of botanical resources from countries of origin by local substitutes, as well as strategies to import plants from their places of origin. However, only few comparative works have highlighted the therapeutic practices of migrants settled in multiple different countries, although this allows for a better understanding of the adaptation capacities of migrant groups and their ability to modify their new local environment.

The Haitian diaspora has undergone the greatest expansion of any population migration during the last 50 years (Audebert 2017a; Granger 2018; Handerson 2015) due to economic and political instability, as well as natural catastrophes, particularly in recent decades, giving rise to the emergence of a true "dispersion territory" (Audebert 2011) scattered throughout the Americas and to a lesser extent in Europe. While the Haitian population approximates 11 million

in the island itself,[1] the Haitian diaspora (*moun dyaspora* in Haitian Kreyol) totals around 2.5 million people. It is thus commonly referred to in Haiti as the "10th department" (the country has nine). Massive migrations to other countries started in the 1960s under the Duvalier dictatorship and have been constant since, with peaks related to the various Haitian socio-political crises and the tragic earthquake of January 12th, 2010.

In order to better understand how medicinal plants and associated practices circulate in the process of transnational migrations, and how these practices adapt to different socio-environmental contexts, we selected the cities of Cayenne, Miami and Montreal, where many Haitian migrants have settled, for part of this case study targeting the Haitian diaspora. We selected these cities for a number of reasons, including the size of the Haitian population, and their different climates, urban densities, and administrative contexts. Although waves of Haitian immigration have been nourishing the diaspora presence in these three sites for several decades, notable differences appear in the composition of these populations. In Canada and in the USA, migrants from the urban middle classes, often intellectuals and professionals (doctors, nurses, lawyers, teachers, technicians), who fled the Duvalier dictatorship in the 1960s to 1980s, quickly integrated with the local socioeconomic environment. After fall of the dictatorship, poorer migrants have steadily arrived in North America in response to a range of stresses, including natural disasters (Audebert 2017b; Morin 1993). In French Guiana, the vast majority of Haitian migrants are peasants from the south of the island, migrating from the late 1970s to the present day (Calmont 1993; Laëthier 2011; Piantoni 2011).

[1]Haitian Institute of Statistics: http://www.ihsi.ht/produit_demo_soc.htm

Comparing phytomedicinal uses among these three Haitian migrant communities embedded in different socio-ecological realities provides a rich perspective on the dynamic processes happening within migrant diasporas. This study was prompted by both a significant demand from the Haitian community and a notable lack of recent works addressing the Haitian pharmacopoeia. Herbal medicines and treatments used in Haiti remain important (Salla 2017), particularly because of the difficulties in accessing biomedical care, but references to it are rare and/or appear in relatively old ethnobotanical works (Léon 1959; Chérubini 1988; Neptune-Rouzier 2014; Taverne 1991; Weniger *et al*. 1986a, b).

We hypothesize that people of Haitian origin residing in the three chosen study territories have adapted differently to their new living environment and do not share exactly the same herbal remedies, especially in Montreal, where the climate limits the ability of Haitian migrants to cultivate plants from their region of origin. Our study therefore has a twofold objective: first, to improve the state of general knowledge on contemporary Haitian phytotherapies and, secondly, to better understand how plant-based practices adapt and change in different urban, migratory, legislative, and climatic contexts.

## Methodology

### Ethics

All interviews were conducted in compliance with the ISE Code of Ethics and according to French law n°2016-1087 implementing the Nagoya protocol (although that USA and Canada did not ratify the Nagoya protocol). An oral description of the study (either in Haitian Kreyol or French, depending on participant) was given prior to each interview. A prior informed consent

was then read to the interviewees (in Montreal or Miami) or presented in a written format (in French Guiana).

## Data collection

We conducted semi-structured interviews with Haitian people mostly born in Haiti, which we recorded and remain anonymous, as well as inventories in Montreal (from August 11-26, 2019, and from December 03-12, 2019), in Miami (from February 28to March 12, 2020), and in French Guiana (between April 2017 and June 2018).

In Montreal, we conducted 14 interviews and a group discussion with around 20 participants, mainly in the neighborhoods of North Montreal - Ahuntsic, Montréal-Nord, StMichel, Villeray - where the majority of the Haitian population lives. We visited five Haitian stores, conducted open interviews with their owners, and recorded plant inventories. We could not visit any garden, as no garden *per se* hasyet been created by Haitian migrants in Montreal. But indirect information was provided as part of the interview process and some informants did share ideas concerning garden trials.

In Miami, we conducted 12 interviews and visited seven *botánicas*(this Spanish term has been absorbed into Haitian Creole, even though these Haitian *botánicas* are herb and magico-religious stores mainly frequented by Haitian voodoo practitioners) and six other shops (two bazaars, two street vendors, one mini-market, and one wholesaler),and also visited five gardens in the areas of Little Haiti and Miami North, where most of the Haitian community lives (Audebert 2007).

In Cayenne, we conducted 18 interviews with residents who were born in Haiti and had been settled in French Guiana from a few months to several years. We conducted additional interviews with Haitian plant sellers at the Cayenne market (no specific Haitian store exists in French Guiana but plants from Haiti are sometimes sold at the market or exchanged between Haitian individuals). We also visited and listed plants and their uses in five Haitian gardens situated in and around Cayenne.

We askedour interviewees about their uses of plants, as well as the provenance of plants. The use reports (URs) for each plant mentioned in each of the three study sites serve as a comparative criterion in most of our analysis. In a more qualitative approach, we use quotes from interviewees to complete and support our analysis. The Haitian Kreyol words (especially the vernacular names of plants) mentioned during the survey appear in italics and parentheses in the text.

## Plant identification

We collected vouchers when possible in Cayenne and Miami and deposited them respectively at the Institut pour la Recherche et le Développement's Herbarium in Cayenne (CAY) and at the New York Botanical Garden (NYBG). In Montreal, we collected no plants as no garden has yet been created by the Haitian population and they undertook almost no wild harvesting except for a few very well known plants. We listed and photographed all the herbs and related products sold In Haitian shops. Identifications of species mentioned by interviewees but that we were unable to collect are based on Haitian vernacular names from the works of Léon (1959), Weniger *et al*.(1986a, b),Barker *et al*. (1930), the TRAMIL network (Germosén-Robineau 2014),the online index made by Vedrine (http://www.potomitan.info/vedrine/kek_plant.php),

and the PlantNet Project[2].We updated these inventories as well as all the names used hereafter according to the APG IV classification (The Angiosperm Phylogeny Group 2016) and checked with the Taxonomic Name R resolution Service(Boyle *et al*. 2013). The identification of plants cited in this study is therefore based on scale of more or less reliable levels of determination (indicated for each species cited in Table 1 and Supplementary Data 1) depending on what was possible in the field: reliability ranges from low in case of plant names mentioned during the interviews (S), medium when the plant is observed dry (D), to high when observed fresh (F) or collected for herbarium specimens (H).

## Results

### Botany

A total of 185 species were cited or listed in the three study localities and can be considered a representative sample of the medicinal flora of the Haitian diaspora in the Americas. As a comparison, Léon (1959), identifies about 175 different medicinal plants used in Haiti, and Weniger *et al*. (1986b) mention only 161. During our interviews, 90 species were cited in Montreal (203 URs), 85 in Miami (193 URs), and 94 in Cayenne (243 URs), for a total of 167 medicinal species cited (Supplementary Data 1). Eighteen species were observed in Haitian stores but were not mentioned during the interviews.

We compiled an inventory of all species mentioned at least twice by our respondents ineach of the three study sites, along with their corresponding scientific and vernacular names and their respective number of citations (ranked by the total number of cumulative URs) (Table 1). The

[2]https://uses.plantnet-project.org/fr/Lexique_des_noms_de_plantes_à_Haïti.

three most cited species in French Guiana are *Momordica charantia* (23 URs), *Ricinus communis* (13 URs), and *Citrus aurantium* (10 URs). *Momordica charantia* (10 URs) also appears as the most cited species in Montreal (although unlike Cayenne, where it is used fresh, it is sold here in dried form), followed by *Annona muricata* (10 URs), and *Citrus aurantium* (8 URs), the leaves of which are imported from Haiti and purchased dried from various stores. In Miami, the three species most commonly cited by the Haitian community are, in order, *Momordica charantia* (12 URs), *Stachytarpheta cayennensis* (12 URs), and *Opuntia cochenillifera* (8 URs).

*Table 1: Medicinal plant species (with more than 2 URs) used among Haitian people residing in Cayenne, Miami and Montréal (D = Dry, F = Fresh, H = Herbarium specimens, S = Speech).*

| ***Species mentioned*** **Family** | ***Vernacular names*** | **Type of determination** | **Montreal** | **Miami** | **Cayenne** | **URs** |
|---|---|---|---|---|---|---|
| *Momordica charantia* L. Cucurbitaceae (MAT 299) | *asosi/asorosi/yesken/Jamaica bush* | Mon:S/Mia:H/Cay:H | **10** | **12** | **23** | 45 |
| *Ricinus communis* L. Euphorbiaceae (MAT 511) | *maskreti/pamakristi* | Mon:S/Mia:S/Cay:H | **6** | **6** | **13** | 25 |
| *Citrus* × *aurantium* L. Rutaceae (MAT 498) | *zorany/zorany si* | Mon:D/Mia:F/Cay:F | **8** | **4** | **10** | 22 |
| *Stachytarpheta cayennensis* (Rich.) Vahl Verbenaceae (MAT 271) | *vervenn ke rat* | Mon:S/Mia:H/Cay:H | **5** | **12** | **5** | 22 |
| *Annona muricata* L. Annonaceae (MAT 180) | *korosòl* | Mon:D/Mia:F/Cay:H | **10** | **4** | **7** | 21 |
| *Ocimum* spp. Lamiaceae | *fonbwazen/basilik/atiyayo* | Mon:D/Mia:F/Cay:H | **5** | **4** | **9** | 18 |
| *Opuntia cochenillifera* (L.) Mill. Cactaceae | *raket* | Mon:F/Mia:F/Cay:F | **4** | **8** | **4** | 16 |
| *Chenopodium ambrosoides* L. Amaranthaceae (MAT 448) | *lapoudover/simenkontra* | Mon:D/Mia:S/Cay:F | **8** | **4** | **3** | 15 |
| *Citrus* × *aurantiifolia* (Christm.) Swingle Rutaceae | *sitron* | Mon:S/Mia:S/Cay:F | **4** | **3** | **8** | 15 |
| *Chromolaena odorata* (L.) R.M. King & H. Rob. Asteraceae (MAT 228) | *langlichat* | Mon:S/Mia:H/Cay:H | **1** | **5** | **8** | 14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Cymbopogon citratus* (DC.) Stapf<br>Poaceae (MAT 165) | *sitronnel* | Mon:D/Mia:F/Cay:H | **6** | **3** | **5** | 14 |
| *Aloe vera* (L.) Burm. f.<br>Xanthorrhoeaceae | *lalwa* | Mon:S/Mia:F/Cay:F | **5** | **3** | **4** | 12 |
| *Colubrina elliptica* (Sw.) Brizicky & W.L. Stern<br>Rhamnaceae | *mabi* | Mon:D/Mia:D | **5** | **7** | - | 12 |
| *Zingiber officinale* Roscoe<br>Zingiberaceae | *jenjanm* | Mon:S/Mia:S/Cay:F | **7** | **1** | **3** | 11 |
| *Annona squamosa* L.<br>Annonaceae (MAT 181) | *kachiman kannel* | Mon:D/Mia:S/Cay:H | **4** | **1** | **4** | 9 |
| *Cajanuscajan* (L.) Huth<br>Fabaceae (MAT 486) | *pwa kongo* | Mon:S/Mia:F | **2** | **7** | - | 9 |
| *Allium sativum* L.<br>Amaryllidaceae | *(po) laj* | Mon:D/Mia:D/Cay:F | **3** | **1** | **4** | 8 |
| *Cocos nucifera* L.<br>Arecaceae | *kokoye* | Mon:F/Mia:F/Cay:F | - | **3** | **5** | 8 |
| *Gossypium barbadense* L.<br>Malvaceae (MAT 170) | *koton* | Mia:F/Cay:H | - | **1** | **7** | 8 |
| *Mentha* x *piperita*<br>Lamiaceae | *mant/ti bonm* | Mon:S/Mia:S/Cay:F | **4** | **1** | **3** | 8 |
| *Rosmarinus officinalis* L.<br>Lamiaceae | *romaren* | Mon:D/Mia:D/Cay:S | **2** | **3** | **3** | 8 |
| *Bryophyllum pinnatum* (Lam.) Oken<br>Crassulaceae (MAT 135) | *louga(r)ou/gro neg/aïgwe* | Mon:S/Mia:F/Cay:F | **2** | **3** | **2** | 7 |
| *Cinnamomum verum* J. Presl<br>Lauraceae | *kannel* | Mon:S/Cay:D | **5** | - | **2** | 7 |
| *Jatropha gossypiifolia* L.<br>Euphorbiaceae (MAT 164) | *medsiyen beni* | Mia:F | - | **7** | - | 7 |
| *Lantana camara* L.<br>Verbenaceae (MAT 298) | *bonboyen* | Mon:S/Mia:S/Cay:H | **1** | **2** | **4** | 7 |
| *Mangifera indica* L.<br>Anacardiaceae (MAT 510) | *mango* | Mon:S/Mia:F/Cay:H | **1** | **3** | **3** | 7 |
| *Petiveria alliacea* L.<br>Phytolaccaceae (MAT 173) | *ave (Maria)* | Mia:F/Cay:H | - | **4** | **3** | 7 |
| *Terminalia catappa* L.<br>Combretaceae (MAT 504) | *zanmann* | Mon:D/Mia:F/Cay:H | **1** | **4** | **2** | 7 |
| *Artemisia vulgaris* L.<br>Asteraceae (MAT 475) | *larmwaz* | Mon:S/Mia:H/Cay:S | **1** | **2** | **3** | 6 |
| *Citrus maxima* (Burm.) Merr.<br>Rutaceae | *chadek* | Mon:S/Cay:S | **3** | - | **3** | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Persea americana* Mill. Lauraceae | *zaboka (vyolèt)* | Mon:S/Mia:F/Cay:F | **1** | **3** | **2** | 6 |
| *Plucheacarolinensis* (Jacq.) G. Don Asteraceae (MAT 477) | *lachòy, tabak mawon, sage* | Mon:D/Mia:F | **2** | **4** | - | 6 |
| *Syzygium aromaticum* (L.) Merr. & L.M. Perry Myrtaceae | *jiròf* | Mon:S/Mia:S/Cay:S | **2** | **1** | **3** | 6 |
| *Tradescantia spathacea* Sw. Commelinaceae | *bouldimas* | Mon:S/Mia:F | **2** | **4** | - | 6 |
| *Chamissoa altissima* (Jacq.) Kunth Amaranthaceae (MAT 484) | *lyann pannye* | Mon:S/Mia:S/Cay:F | **1** | **3** | **1** | 5 |
| *Eugenia fragrans* (Sw.) Willd. Myrtaceae | *bwadin'* | Mon:D/Mia:D | **3** | **2** | - | 5 |
| *Illicium verum* Hook. F Schisandraceae | *gwo lanni* | Mon:S/Cay:S | **4** | - | **1** | 5 |
| *Moringa oleifera* Lam. Moringaceae (MAT 507) | *benzoliv/moringa* | Mon:D/Mia:F/Cay:H | **2** | **3** | - | 5 |
| *Phyllanthus amarus* Schumach. & Thonn. Phyllanthaceae (MAT 303) | *dèyè do* | Mon:S/Mon:S/Cay:H | **1** | **1** | **3** | 5 |
| *Plectranthus barbatus* Andrews Lamiaceae (MAT 512) | *groten (amer)* | Mon:S/Mia:H | **1** | **4** | - | 5 |
| *Carica papaya* L. Caricaceae | *papay* | Mon:S/Mia:F/Cay:F | **1** | **1** | **2** | 4 |
| *Hibiscus rosa-sinensis* L. Malvaceae (MAT 501) | *choublak* | Mia:F/Cay:H | - | **2** | **2** | 4 |
| *Hyptis suaveolens* (L.) Poit. Lamiaceae | *melis Ayiti/ti bonm* | Mon:D | **3** | - | **1** | 4 |
| *Manihot esculenta* Crantz Euphorbiaceae | *mannyòk anmè* | Mon:S/Cay:F | **1** | - | **3** | 4 |
| *Plantago major* L. Plantaginaceae (MAT 506) | *planten* | Mon:F | **4** | - | - | 4 |
| *Quassia amara* L. Simaroubaceae (MAT 452) | *kwachi* | Cay:H | - | - | **4** | 4 |
| *Allium cepa* L. Amaryllidaceae | *zonyon (rouj)* | Mon:S/Mia:S | **2** | **1** | - | 3 |
| *Azadirachta indica* A. Juss. Meliaceae | *lila (peyi)* | Mon:S/Mia:S | **2** | **1** | - | 3 |
| *Corchorus olitorius* L. Malvaceae | *lalo* | Mon:D/Mia:S | **2** | **1** | - | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Cynara scolymus* L. Asteraceae | *articho* | Mon:D/Mia:D | **1** | **2** | - | 3 |
| *Manilkara zapota* (L.) P. Royen Sapotaceae | *sapoti* | Mon:D/Mia:F | **2** | **1** | - | 3 |
| *Tetragastris balsamifera* (Sw.) Oken Burseraceae | *bwa kochon* | Mon:D | **3** | - | - | 3 |
| *Tinospora crispa* (L.) Hook. f. & Thomson Menispermaceae (MAT 265) | *lyann anmè* | Cay:H | - | - | **3** | 3 |
| *Trichilia hirta* L. Meliaceae | *monben bata* | Mon:D/Mia:S/Cay:S | **1** | **1** | **1** | 3 |
| *Zea mays* L. Poaceae | *mayi* | Mon:S/Mia:S/Cay:F | **1** | **1** | **1** | 3 |

## The role of Haitian community stores and *botánicas* in the circulation of medicinal herbs

As commonly observed in ethnobotanical studies in South America (Albuquerque *et al*. 2007; van Andel *et al*. 2012; Bussmann and Sharon 2009), markets and shops in general are important centers for supplying medicinal plants. This is also the case in the Haitian diaspora study communities, with a total of 93 species sold in shops, although with notable disparities among the three localities (Supplementary Data 2).

In Montreal, Haitian grocery stores are important sources of Haitian food, cosmetics, and medicinal products. They are often owned and run by small family households that play a central role in maintaining Haitian identity, particularly through the sale of a large amount of ethnic foods and cultural products from Haiti. They sell a large variety of medicinal plants (67 dry species and three fresh species) from the Haitian pharmacopoeia. Two main stores are situated in North Montreal and offer a choice of several dozen Haitian medicinal plants, dried

and packaged in small plastic bags (Fig. 1) and generally sold for US$1.50to$2.50. According to information we collected in these businesses, bundles of dried plants are received directly from Haiti and then repackaged before being sold. The absence of fresh plants from Haiti is explained by the difficulty of importing fresh species, which may be confiscated by Canadian customs for phytosanitary reasons. Depending on demand, plants are ordered from wholesalers located in Port-au-Prince and sometimes special orders are placed for certain customers. However, supply remains relatively uncertain as it depends on the Haiti's fluctuating socioeconomic stability.

*Figure 1 : Containers of medicinal plants from Haiti in a Haitian grocery store in Montreal. M-A Tareau, 2019.*

The other community businesses (bazaars, mini-markets, street vendors, wholesalers) also offer many medicinal plants. The near impossibility of cultivating tropical species in Montreal encourages many Haitian shop owners to import plants to meet the high demand of the community, as explained by the manager of one of these small community supermarkets:

> "It was my father who started doing this. When he saw that there was a lot of demand, he started bringing in plants from Haiti. It comes by Air Canada cargo plane, or sometimes by Air Transat."

Individual mobility also plays a central role in the circulation of medicinal plants within the Haitian diaspora. Many Haitians travel back and forth between Haiti and cities in the Americas to visit relatives. They frequently carry plants with them:

> "When I am in Haiti, the first thing I put in my suitcase before returning is a packet of leaves." (Haitian woman living in Montreal.)

According to three supermarket managers, the two species most in demand are *Momordica charantia* and *Annona muricata*, which reflects the data we collected from interviewees (Table 1). The community stores in Montreal also sell bottles (*boutey tranpe* or *boutey konpoze* in Haitian Kreyol; Fig. 2) containing various medicinal species and intended to be used for maceration by adding alcohol at home. They are sold without alcohol, as Canadian and US laws prohibit the unregulated sale of spirits; each bottle costs between US$24 and $40 . Many of these bottles are prepared by a major Haitian grocery store in order to meet the high demand for this item, consumed both for its medicinal properties and as an aperitif with a cultural twist.

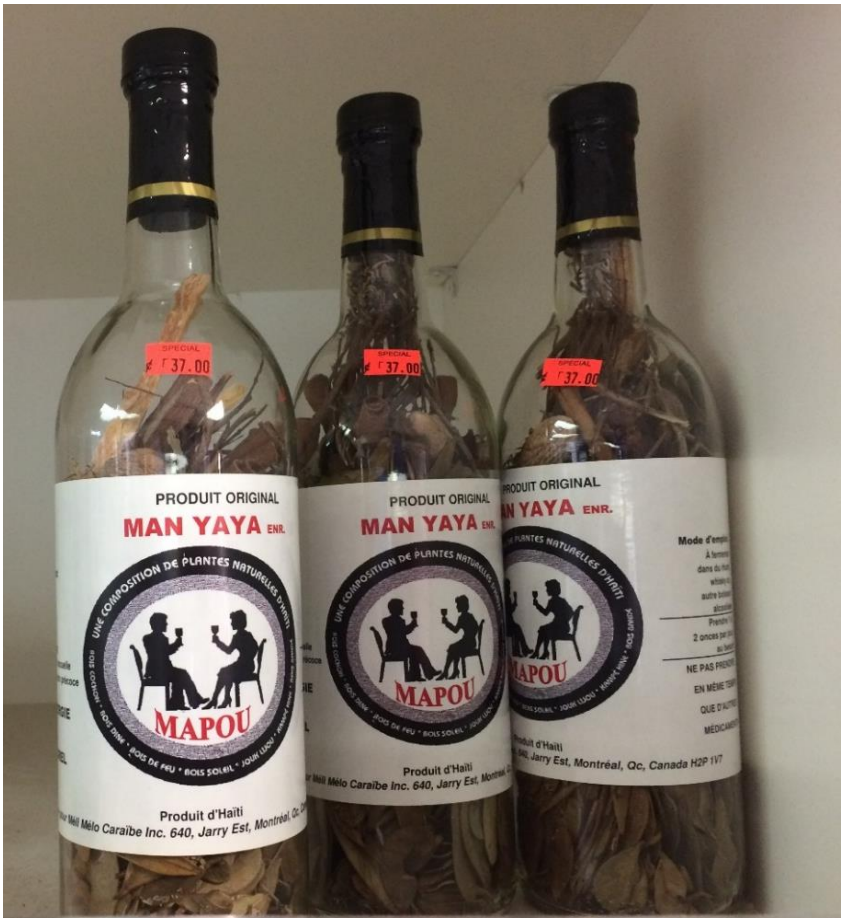


*Figure 2 : Mixtures of roots, barks and leaves from Haiti, bottled and sold in a Montreal store. A. Cuerrier, 2019.*

In Miami, 37medicinal species are sold through Haitian shops and *botánicas*: 23 as fresh and 14 as dried plants. They are sold mostly in plastic bags and their prices are higher than in Montreal, generally US$5 or even $10more per unit. As we discuss below, this is probably due to more stringent custom rules in United States than in Canada. According to dealers, these plants are often brought back by people returning from Haiti who sell them to the retailer.

The dealers can also buy from a wholesaler of Haitian products based in Little Haiti who regularly imports dry medicinal plants. Plants grown and dried locally are also sometimes sold, notably at the Haitian marketplace in Little Haiti (*Momordica charantia*, *Ricinus communis*,

*Rosmarinus officinalis*, and *Terminalia catappa*). *Boutey konpoze* are also sold in Miami, but they seem rare and are more expensive (between US$80 and $90 for a bottle) than in Montreal.

In French Guiana, where there are no specifically Haitian stores, only six imported dried species were reported at the Cayenne marketplace, while 22 fresh species are sold directly by Haitian people. Indeed, alcohol-based mixtures containing aerial parts of *Momordica charantia* macerating in rum are regularly available in informal Haitian snack bars and consumed by residents of Haitian origin. According to informants, they are used for "cleansing the blood" or “against the cold inside.” In addition, castor oil (*luil maskreti*) is also brought from Haiti and informally sold by individuals. It is generally considered to be better than the castor oil produced in French Guiana:

> " My sister-in-law in Haiti sends me *maskreti* [*Ricinus communis*] oil as soon as she has the opportunity. I keep a bottle for myself and the rest is for sale. But it goes away very quickly, because people know that the oil that comes from Haiti is of better quality than the one made here.”(Haitian woman living in Cayenne.)

## Locally cultivated plants

To be widely used, beyond their intrinsic or supposed therapeutic properties, medicinal plants have to be abundant and easily accessible (Leonti 2011; Ngokwey 1995; Odonne *et al*. 2017; Stepp and Moerman 2001; Voeks 2004), which explains how important the cultivated species are in pharmacopoeias. Moreover, home gardens can be regarded as refuges of biocultural diversity (Calvet-Mir *et al*. 2016). In our study, 64 species cultivated by our informants were mentioned or observed during the garden visits (Supplementary Data 3), including 25 with more than two occurrences.

In Montreal, only three people acknowledged that they cultivate some tropical medicinal species outdoor during summer (*Abelmoschus esculentus*, *Corchorus olitorius, Dysphania ambrosioides*) or indoors (*Aloe vera*, *Bryophyllum pinnatum*, *Citrus aurantium*, *Malpighia emarginata*, *Opuntia cochenillifera*, *Plectranthus amboinicus*, *Persea americana*):

> "Here people take this [*Opuntia cochenillifera*] for an ordinary cactus, they think it's just for decoration. But we also use it to prepare remedies. It's not only in my living room to look pretty, I also use it to clean my stomach when I have indigestion."(Haitian woman living in Montreal.)

In Miami and Cayenne, unlike Montreal, many medicinal species are cultivated around the houses of the Haitian community, sometimes from cultivars imported directly from Haiti. Among them, 25 medicinal species (although they can also fulfill other functions, such as for food and magical potions in particular) were observed frequently and seem to be particularly characteristic of these Haitian gardens.

The presence of many plants cultivated by Haitian migrants in Cayenne and Miami is made possible by the tropical climate, relatively similar to that of Haiti, which undoubtedly explains the higher proportion of fresh medicinal plants mentioned by our informants there. Moreover, in French Guiana, many Haitians practice agriculture in peri-urban gardens and sell food products from these gardens in markets or within interpersonal networks (Palisse 2016, 2020; Palisse and Davy 2018). Similar to most Caribbean "Kreyol gardens," whose apparent disorganization masks a very structured, symbolic, and utilitarian arrangement (Benoît 2000), Haitian home gardens in the French Guianese and North American urban environments are composed of many species, as described by a resident of Miami North:

> “Here in Miami, the gardens where you see the most plants around houses, you can be sure that they are either Haitians or Jamaicans.”(Haitian man from Miami.)

Finally, in accordance with "versatility theory" (Alencar *et al*. 2010), some edible and aromatic species are regularly consumed as both a staple food and for their therapeutic properties (*Allium cepa*, *A. sativum*, *Basella* sp., *Beta vulgaris*, *Brassica oleracea*, *Citrus* spp*., Cucurbita maxima*, *Curcuma longa*, *Cymbopogon citratus*, *Daucus carota*, *Ipomoea batata*, *Lactuca sativa*, *Persea americana*, *Petroselinum crispum*, *Rosmarinus officinale*, *Solanum melongena*, *Thymus vulgaris*, *Zea mays*, *Zingiber officinale*). They are generally grown locally and sold fresh by food retailers:

> "When I have a cough, especially during the winter, I prepare an onion syrup. My grandmother did this in Haiti, so I'm reproducing it here since onions are sold everywhere." (Haitian woman living in Montreal.)

## Urban plant gathering

As described by Tareau *et al*. (2019b, 2020), urban spaces offer migrants and local people many opportunities for harvesting plants or plant parts. Indeed in diverse parts of the world towns, roadsides, wastelands, urban parks, suburban woodlands, surroundings of urban gardens, and empty plots are privileged harvesting sites (Bussmann and Sharon 2009; Landy *et al*. 2017; Nguenang *et al*. 2010; Wehi and Wehi 2010). In our study, our interviewees mentioned 30 species as picked in urban spaces (Supplementary Data 4).

As noted earlier, only one wild species appears to be collected by the Haitian community in Montreal: *Plantago major*, a very abundant species in Montreal and also present in Haiti, which some residents gather during summer and then dry for winter use.

Likewise, in Miami, our informants indicated that at least 13 species are collected in urban spaces, mostly in wasteland, but also along railways (*Chromolaena odorata*, *Artemisia vulgaris*) or from branches protruding from domestic gardens (*Citrus aurantium*).

In French Guiana, of the plants mentioned by our interviews, 17 were reported as picked in urban spaces. In Cayenne, gathering activities mainly target wild species growing along paths or in urban wastelands and are well known simply because they also grow in Haiti (for example, *Chromolaena odorata* was cited eight times in Cayenne).

## Discussion

Our study illustrates the extent to which members of the Haitian diaspora continue to use plants from their original pharmacopoeia. We also highlight marked dissimilarities among the uses we observed at the three survey sites. Probably due to its cool climate, Montreal has the greatest range of Haitian medicinal plants available thanks to well-organized transnational trade flows. While Haitian residents in Montreal use a large proportion of dry plants directly imported from Haiti and sold in Haitian stores, Haitians living in French Guiana largely use fresh plants they are able to either cultivate or collect. Easily identifiable pantropical species available in Haiti and are preferred for cultivation in Cayenne, while native wild plants used for medicinal purposes do not seem to be well known among Haitian residents. However, Haitians in the city of Miami appear use both a large number of fresh cultivated species as well as dried plants

imported from Haiti by transnational commercial networks or by the users themselves. We discuss possible reasons for these differences below.

### The role of commercial and individual networks of the Haitian diaspora

The role of Haitian transnational small (and generally informal) businesses in the maintenance and dissemination of Haitian medicinal plants is central and significant. They constitute the backbone of a very dynamic distribution network of Haitian products, making them widely available in cities where members of the diaspora are located. This is especially the case in the areas where Haitian migrants are concentrated according to the logic of "spatial segmentation," based upon ethnic criteria (Audebert 2006, 2017a). These transnational small businesses produce “circulatory territories” as defined by Tarrius (1993). Several studies describe *botánicas* as places for preservation of medico-magic traditions and phytotherapeutic practices, and for the purchase of medicinal plants (Fig. 3). They often also offer additional therapeutic services (Anderson *et al*. 2008; Fisch 1968; Herrera *et al.* 2021; Vandebroek *et al*. 2007; Viladrich 2006, 2007, 2019; Zayas and Ozuah 1996).

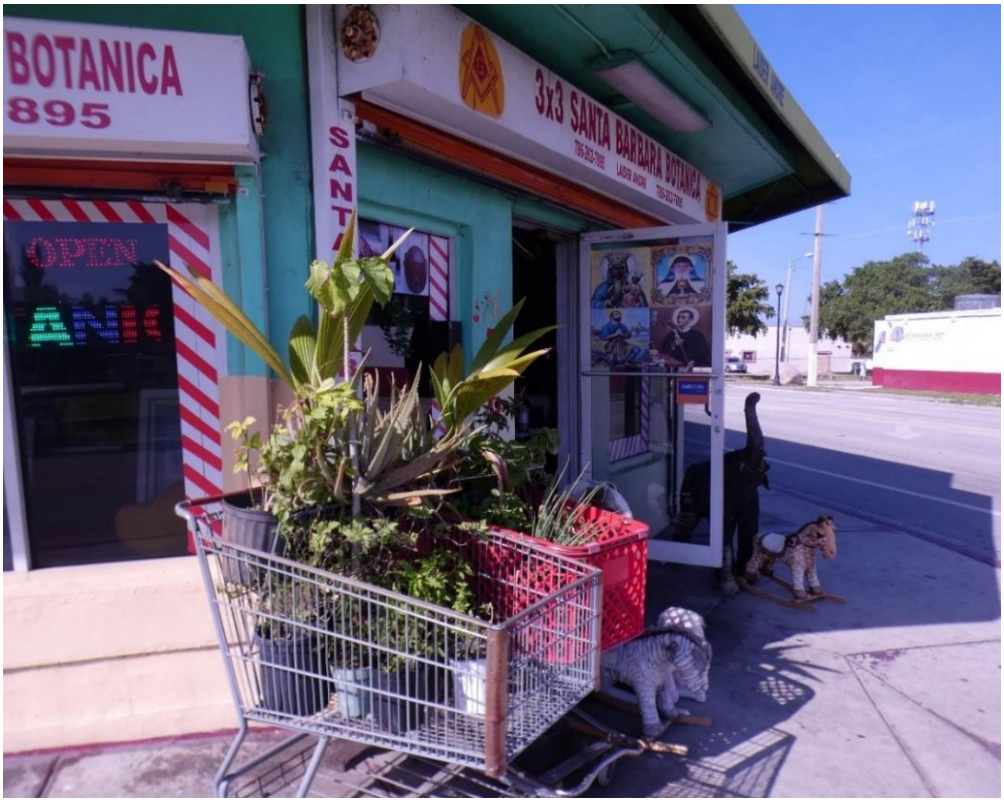


*Figure 3 : Medicinal plants on sale in a Haitian botánica of Little Haiti, Miami. M-A Tareau, 2020.*

Our informants reported that members of the Haitian diaspora regularly receive and dispatch parcels that often contain medicinal plants. Thus, intra-diaspora travels and mailings also seem to shape the transnational exchange of medicinal plants among Haitians. This constant networking of both material and people flows recall Audebert's description of "transnational reticular logics" (2006), here generating a gradual dissemination of Haitian-originated medicinal plants and related practices throughout the areas of the Americas where members of the diaspora reside. Morin (1993) highlighted this "transnationalism" as a strategy of resistance to the assimilation policies of the U.S.A. and Canada that also seems to be expressed through the active circulation of medicinal plants. In French Guiana, where many Haitian migrants are undocumented and globally less wealthy and therefore travel less frequently, these medicinal plant exchanges seem to be less common. However, it is important to emphasize that the large

number of intermediaries engaged in the distribution of plants from Haiti to the territories of the diaspora does not allow consumers to ultimately clearly trace the origin of these products. Finally, and as also noted by Tareau *et al*. (2021b), the number of species cultivated in Miami and Cayenne (Supplementary Data 3) points to herbal self-sufficiency.

## A highly valued herbal medicine at the core of the Haitian identity

Herbal medicine is a clear cultural marker in migrant communities that continue to maintain and perpetuate it outside their countries of origin (van Andel and Carvalheiro 2013; Volpato *et al*. 2008). The persistence of herbal medicinal practices within the Haitian diasporais clear even in very urban contexts marked by Western lifestyles. These cultural traditions are deeply rooted among migrants and their perpetuation helps to alleviate to some extent the stresses of leaving their native country and subsequent adjustments to different social norms:

> "When we were little, there was no doctor, only leaves. This is why we first use plants to heal, and even here we have kept this habit."(Haitian woman living in Montreal.)

Among the medicinal treatments that seem to retain a preeminent cultural importance is the use of alcohol-based mixtures, as also observed by Volpato (2008) among the descendants of Haitian migrants in Cuba and by Vandebroek (2010) among the Dominicans in New York. In French Guiana, as in Miami and Montreal, *boutey tranpe* are still regularly prepared, sold, and consumed, constituting true identity markers within the Haitian community. In addition, certain species widely used at the three sites (Table 1), like *Annona muricata*, *Citrus aurantium*,

*Colubrina elliptica,* and *Momordica charantia,* have a very marked cultural importance. For example, the fact that *Momordica charantia* stands out in all three of our study sites as the most mentioned medicinal species is not surprising. Indeed, in Cuba, it is one of the three species most cited by Haitian immigrants and their descendants (Volpato *et al*. 2009), and in French Guiana it also stands out as the most used species by the Haitian community (Tareau 2019). Furthermore, during his study in the market of the Haitian town of Fond-des-Nègres, Mintz (1961)had already noted the presence of *Momordica charantia*'s *boutey*. Weniger *et al*. (1986b), working in the Haitian Central Plateau Region, indicated that it is one of the main species of their pharmacopoeia. Likewise, Paul and Cox (1995) documented the central importance of *Citrus aurantium* in the Haitian pharmacopoeia.

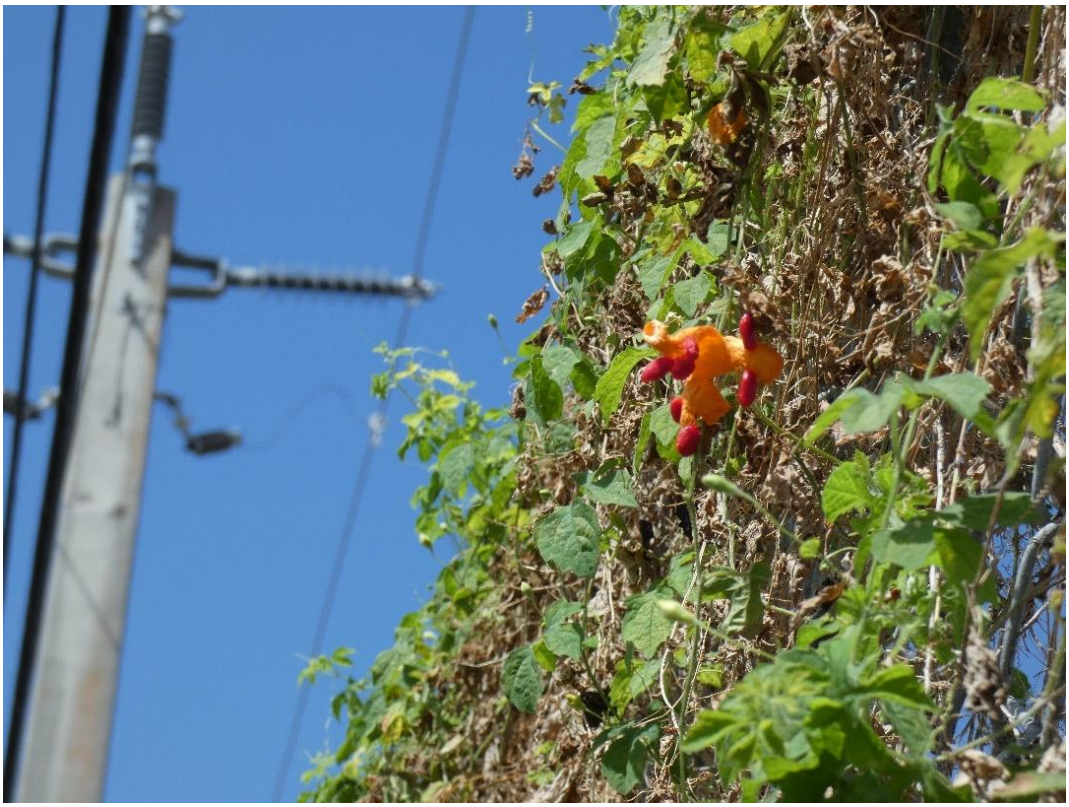

*Figure 4 :* Momordica charantia *lianas growing on a fence in Little Haiti, Miami. M-A Tareau, 2020.*

From this perspective, the important role of Haitian emic perceptions for keeping Haiti's pharmacopoeia relevant beyond its geographical borders should be emphasized. The ethnomedicinal representations of our Haitian interviewees indicate that migrants prefer plants grown in their Haitian region of origin or, at least, from Haiti over those cultivated elsewhere (see also Taverne 1991). Medicinal plants from Haiti are perceived to possess an increased therapeutic value. The relationship with the ancestors and, in the case of voodoo practitioners, with the spirits (*lwa*), grants higher healing power to plants grown in Haiti than to the same species cultivated locally (*fey yo genyen plis fòs*, literally "this plant gets more power"). For these reasons cultural familiarity with some plants is an important motivation for continuing to use them outside their country of origin, despite local availability of these species(see also Fonseca and Balick 2018). This phenomenon seems to be accentuated when the plants originate in "sacred natural sites" (Mattalia *et al*., 2019) such as the family *lakou* or any sacred forest, or from a known "healing landscape" (Pesoutova 2019),collectively designated "cultural keystone places" (Cuerrier *et al*. 2015). In addition, in the voodoo religion, the humanized character of the *lwa* assigns to these places an individual predilection for certain species (Tarter 2015)that also acts as a trigger for botanical imports (dried or living plants). Thus it is sometimes necessary to bring from Haiti plants that are specifically associated with the different *lwa*:

> "If you pray [to the goddess] Erzili, you must have a calabash tree [*Crescentia cujete*] or a palm tree planted behind your house so that you can deposit the offerings to her." (Haitian woman living in Miami.)

In addition, the voodoo care system is inseparable from the use of many magic plants (Vonarx 2011), being part of a heterogeneous *materia medica*. The importance of ceremonial plant

baths and propitiatory plants cultivated around the house are good reasons to introduce new species into the territories of migration, as also noted by Munier (2017) in Montréal. The expression *lwa rasin* (literally, « spirit-root », to designate the voodoo spirits that come directly from the ancestral homeland of Africa) takes here multiple meanings: the word "root" obviously refers to the ancestry, but also translates the intimate link that exists between voodoo and the plant world, and might lastly be considered as a spiritual connection to the original land.

Moreover, we can assume that the many roots and dried plants used by the Haitian diaspora are preferred for conservation reasons in a context of transnational circulations. But we also assume, although it was not explicitly mentioned during the fieldwork, that dried plants are a popular herbal material, as they are in other Caribbean countries such as Jamaica (Vandebroek et al. 2021).

Finally, Haitian plants resonate with a number of etiologies that remain familiar among Haitian migrants. First, they integral to a humoral perspective in which “clean” blood is an important marker of health (Farmer 1988), encouraging migrants of Haitian origin to regularly consume plants to "cleanse blood" and "unblock arteries." In this case, responding to a sensory logic (García-Hernández *et al*. 2015; Shepard 2004), bitter plants (e.g., *Artemisia absinthium*, *Colubrina elliptica*, *Momordica charantia*) mostly assume this function. Similar to observations in Peru (Odonne *et al*. 2013) and French Guiana (Tareau 2019), red plants (*Chrysophyllum cainito*, *Cordyline fruticosa*, *Gossypium barbadense*, *Tradescantia spathacea*), or plants whose decoction turns red (*Haematoxylon campechianum*, *Justicia secunda*, *Swietenia mahagoni*) will secondarily act like bitter plants. In addition, several plants (*Ruta graveolens*, *Ocimum gratissimum*, *Petiveria alliacea*, among others) are used in propitiatory or expiatory baths

against evil spirits (*mové zèr*, *mové zèspri*) and a certain number of species considered to be "hot," including some from Haiti (*Colubrina elliptica*, *Eugenia crenulata*, *Momordica charantia*, *Pimenta officinalis*, *Ricinus communis*, *Tetragastris balsamifera*), are regularly consumed by Haitian migrants from North America during the winter period:

> "As it is cold here, you have to keep the body warm. The cold is not good, it freezes the blood and you can get very sick. This is why we drink a lot of teas [decoctions] during the winter so as not to let the cold take over. From time to time we take a glass of tranpe too. In Haiti, there are very hot plants." (Haitian woman living in Montreal.)

## Different cities, different practices

Despite the common trends there are differences among phytotherapy practices of Haitian migrants in Montreal, Miami, and Cayenne (Supplementary Data 1). These variations can probably be explained partly by the "theory of heterogeneity" (Tareau *et al*. 2019b), which considers the influence of socio-environmental factors in determining the context in which medicinal plants are selected.

The different climates in the three study sites are important (Pirker *et al*. 2012). The tropical climate of French Guiana and Florida allows Haitians in Cayenne and Miami to obtain a large number of fresh plants while the temperate climate of Canada severely limits the cultivation of tropical plants used by Haitians, who thus almost exclusively import them, triggering their commercialization.

Socio-economic differences also greatly influence the use of medicinal plants. According to our interviewees at the three sites, recent migrants, most often demonstrating a daily praxis of

phytotherapy, act as real vectors of revitalization of the uses of herbal medicine within the community. In addition, differences in living standards modulate access to biomedical care (Valmy *et al*. 2015), which in turn can lead to different phytotherapy needs. As shown by Dejouhanet (2014), changes in consumption patterns may follow a transition to urban life and a "modernization" of practices, with some products considered to be more "modern" (such as dry plants) and therefore favored by urban customers.

It can also be assumed that the higher standard of living of Haitians in Miami and Montreal gives them greater mobility than those in French Guiana and consequently allows the introduction of a greater number of plants. In addition, this higher standard of living also encourages the presence of transnational businesses of which Haitian migrants are the main customers. But nevertheless, it seems that recent migrants with a strong tradition of phytotherapy contribute to a renewal of practices by using more plants than those established over a longer time and whose social status and assimilation to North American urban lifestyles have reduced the uses of Haitian herbal medicine:

> “Those who study, who are better integrated into Quebec life, distance themselves a little from voodoo. And from the medicinal plants in general”. (Haitian man living in Montreal.)
>
> "We young people who were born here don't use too many leaf remedies. We go to the hospital when we are sick. It is our parents who know the plants well, not us.”(Haitian man residing in Miami.)

Finally, the customs and excise policies of each of the host countries also have a significant impact on access to Haitian plants. According to interviewees, Canadian customs seem more tolerant than US customs in relation to the importation of medicinal plants (especially dried ones). Undoubtedly, this restriction largely explains why far fewer Haitian plants are sold in Haitian businesses in Miami than in Montreal, and at much higher prices.

### Adaptation of practices and introduction of new species

As noted above, and despite the recognized importance of medicinal plants and practices in the three cities studied, it does not seem possible to consider a single, homogeneous transnational Haitian pharmacopoeia. Several authors have recently shown that pharmacopoeias of migrants, although having a shared country of origin, inevitably undergo ethnobotanical mutations in accommodating other cultural habits and different floristic compositions in the countries of settlement, giving rise to contextual adaptations (van Andel and van't Klooster 2007; Medeiros *et al*. 2012; Pieroni *et al*. 2012; Pirker *et al*. 2012; Tareau 2019; Vandebroek *et al*. 2007). However, even if there are major differences among pharmacopoeias used at the three sites (Supplementary Data 1), there are also important similarities, highlighting a transnational space of plant uses and circulation with local and specific adaptations.

This 'interculturalization' process (Tareau 2019) operates on the phytotherapeutic practices of Haitian migrants, adapting exogenous practices and knowledge (Ladio and Albuquerque 2014)to a new social or environmental context. For example, in the adoption of urban harvesting practices, which was observed at the three study sites, and which is otherwise inherent to the rural world. Likewise, the export of Haitian voodoo outside the country is quite noticeable and

observed in Montreal (Munier 2017), Miami (Rey and Stepick 2013), and Cayenne (Laëthier 2011), as well as NewYork (Brown 2011; McAlister 1993) and Paris (Béchacq 2012). For instance, in the hills around Cayenne and Miami, offerings and ceremonial objects can be observed at the feet of the *Ceiba pentandra* sacred voodoo trees (*mapou*),which is the main Spiritual Keystone Species for the Haitian cultural community (Tareau et al. 2021a). Indeed, *mapou* trees constitute places of worship and devotion, but also healing places where protective rituals are held since they house agentive spiritual entities (*lwa*) (Fig. 5).

*Figure 5 : Magic objects placed on the trunk of a* mapou*,* Ceiba pentandra*, in Cayenne. M-A Tareau, 2019.*

At the same time, new species are also integrated into the medicinal floras of the countries receiving migrants, whether they are dry samples for the preparation of remedies as found in Haitian shops in Montreal and Miami, or plants cultivated and, in some cases, naturalized in the country of migration, like *Guazuma ulmifolia* in French Guiana:

> "I know that my father planted bwadòm [Guazuma ulmifolia] on his land. He came back [from Haiti] with seeds when we went to see the family two years ago."(Haitian woman living in Cayenne.)

### Substitutions and re-appropriation of species

Sometimes, substitutions are made between species with similar organoleptic properties, as noted by van Andel and van't Klooster (2007) in Amsterdam and by Vandebroek *et al*. (2007) and Viladrich (2006) in New-York. For example, in Montreal, European species cultivated in Quebec also replace unavailable tropical species because of their organoleptic or morphological similarity. A number of vernacular names are also common to some European, North American, or Neotropical species, which are then used interchangeably, although the taxonis non-existent in Haiti. For instance, Verbena *hastata* (the French *verveine*) is used instead of *Stachytarpheta jamaicensis/Stachytarpheta cayennensis* (*vervenn*); *Melissa officinalis* (the French *mélisse*) is a substitute for *Hyptis suaveolens* (*melis*) or even *Salvia officinalis* (the French *sauge*), replacing *Pluchea carolinensis* (*lachòy*):

> "I was taking melis [Hyptis suaveolens] and vervenn [Stachytarpheta jamaicensis] in Haiti, for better sleep. I saw that they sell it here in some naturopathic stores. I don't know if they are exactly the same plants, but I buy and use them the same way."(Haitian man living in Montreal.)

Thus, this is an interesting double ethno-taxonomic transfer, as some of these species used by migrants are from temperate genera closer to the European species (on the basis of which French colonists had named tropical species with organoleptic or morphological analogies) than to the Haitian substitute. The use of different plants for treating the same

ailment partly because they share vernacular names shows the importance of language as a vehicle of knowledge (Grenand 1995). Adding similar organoleptic properties will enhance the willingness of local people to substitute one plant with another. Downing *et al*. (2013) provided the example of Inuit who borrowed the name for rhubarb (*Rheum* sp., indicating the sourness of rhubarb) to pinpoint a different plant thriving in their territory, a mountain sorrel (*Oxyria digyna*) with a similar taste (both are of the Polygonaceae family).

Finally, the coexistence of several types of care is reflected in particular in the complementary use of Haitian plants and plants from pharmacopoeias specific to the countries in which migrants settle. In all three cities the use of many local species is the result of intercultural transmission and recent appropriation. This is the case for example, in French Guiana of native continental species that are not or only rarely present in Haiti (*Costus spicatus*, *Quassia amara, Siparuna guianensis*) or, in Montreal, with native Canadian plants (*Betula* spp., *Nepeta cataria*, *Picea mariana*, *Rhododendron groenlandicum*) that migrants have adopted for use. Further, many informants indicated that they use medicinal plants and biomedicine at the same time, demonstrating a complex medical pluralism characterized by “zigzag therapeutic itineraries” (Tareau 2019) between both types of medicine.

## 1. Conclusion

In line with current research in cultural geography on the circulation of medicinal plants (Bochaton 2019; Dejouhanet and Bercegol 2019; Tareau *et al*. 2019a), our comparative study of three cities with significant populations of Haitian migrants, mirroring other examples of diasporas (for instance, Moroccans), highlighted the persistence of phytotherapy practices in a migrant context, fueled by transnational commercial and individual flows. It also demonstrates that these practices significantly differ from one place to another (there are mostly dried plants from Haiti in Montreal, and more fresh plants grown or gathered in Miami and Cayenne), depending on climate, rural or urban residence, and socioeconomic or cultural factors (standards of living, levels of education, administrative status, length of stay in the country, religious affiliation). However, our study clearly shows that there is a transnational space for the circulation of medicinal plants and herbal medicines among these three cities, although Cayenne seems to be a little less connected to North America and perhaps more connected to the Guiana Shield, with local adaptations, but also with a rich and comparable use of medicinal plants.

This "globalization from below" (Tarrius 1993) of medicinal plant uses highlights various modes of supply (grocery stores, travels back and forth to Haiti, markets, cultivated plants, harvesting) and biocultural hybridization processes (Ladio and Albuquerque 2014)) in which all migrants are potential actors. From an ethnobiological perspective, our study makes it possible to consider the three Haitian communities as interconnected spaces where herbal medicines widely circulate and humans adapt to each socio-environmental context. It would be interesting in future works to analyze the intergenerational differences of plant-based knowledge and

practices within the same communities in order to understand the conditions of assimilation and/or resilience of this biocultural heritage over several generations.

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## Compliance with Ethical Standards

### Conflict of Interest

Theauthors declare they have no conflict of interest.

### Informed Consent

We conducted our research in accordance with the recommendations of the Code of Ethics of the International Society of Ethnobiology. Informed consent forms were given to the informants in order to clearly state the objectives of this research project and to obtain their consent to participate. Each of the interviewees was informed beforehand of the confidentiality of this

study, and of his/her right to withdraw its participation at any time, and of the objective of a publication under the form of a scientific publication.

## Data Availability Statements

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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