



Sacred weeds: common ritual plants from the urban *botánicas* of Miami-Dade County, Florida

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Research

Abstract

Background: Practitioners of syncretic religions often incorporate plants into their sacred rituals, a unique practice that helps keep them connected to their cultural history. An important example of ritual plant use is found in the *botánicas* (religious stores that cater to practitioners of Afro-Caribbean diaspora religions) of Miami-Dade County, Florida (USA).

Methods: We examined ritual plants sold in a sample of six *botánicas* in Miami-Dade County from November 2018 until April 2019. We addressed the following questions: 1) What is the ratio of native to non-native plant species found in the *botánica* stores; 2) What is the ratio of invasive exotic to non-invasive exotic plant species found in the *botánica* stores; and 3) What is the geographical origin of plant species found in the *botánica* stores?

Results: Given the study's location in South Florida, the frequency of local native flora sold as ritual plants was significantly smaller than initially predicted (27% vs. 65%). Likewise, actual frequency of invasive species was much higher than the expected frequency (32% vs. 19%). We also discovered that most of the taxa collected during the study were Neotropical (50%) and Asian (25%) in origin, while very few African taxa were documented (7 out of the 93 species identified).

Conclusion: These *botánicas* highlight the reliance of Afro-Caribbean syncretic religions in Miami-Dade County on locally common plants, particularly those taxa from the Neotropics. Future studies should further investigate how these plants are being cultivated, traded, and used by the informal economy associated with urban *botánicas*.

Keywords: African diaspora, economic botany, ethnobotany, medicinal plants, religious syncretism

Resumen

Antecedentes: A menudo los practicantes de religiones sincréticas incorporan plantas en sus rituales sagrados. Esta es una práctica única que los ayuda a permanecer conectados con su historia cultural. Un ejemplo importante de uso de las plantas en sus rituales se confirman con la existencia de las botánicas (tiendas que atienden a los practicantes de las diferentes religiones que conforman la diáspora afrocaribeña) del condado de Miami-Dade, Florida (EE.UU.).

Métodos:

Examinamos las plantas usadas para rituales vendidas en una muestra de seis botánicas en el condado de Miami-Dade entre noviembre de 2018 y abril de 2019. Planteamos las siguientes preguntas: 1) ¿Cuál es la proporción de las especies de plantas nativas y no nativas que se ofrecen en las botánicas? 2) ¿Cuál es la proporción de las especies de plantas exóticas invasoras y exóticas no invasoras que se ofrecen en las botánicas? y 3) ¿Cuál es el origen geográfico de las especies vegetales que se ofrecen y venden en las tiendas botánicas?

Resultados: Dada la ubicación del estudio en el sur de Florida, la frecuencia de la flora nativa vendida para rituales fue significativamente menor de lo que se esperaba inicialmente (27% vs. 65%). Igualmente, la frecuencia real de especies invasoras fue mucho mayor que la esperada (32% vs. 19%). También descubrimos que la mayoría de los taxones recolectados durante el estudio son de origen neotropical (50%) y asiático (25%), mientras que se documentaron muy pocos taxones de origen africano (7 de las 93 especies identificadas).

Conclusiones: Estas botánicas destacan la dependencia de las religiones sincréticas afrocaribeñas del condado de Miami-Dade en las plantas localmente comunes, en particular los taxones neotropicales. Los estudios futuros deberían investigar más a fondo cómo estas plantas son cultivadas, comercializadas y utilizadas por la economía informal asociada con las botánicas urbanas.

Palabras claves: Botánica económica, diáspora africana, etnobotánica, plantas medicinales, sincretismo religioso.

Background

Complex layers of cultural, practical, and spiritual ties often govern our relationship with plants (Scott 1974). Indeed, the use of plants has long been pivotal to the social and cultural development of humans, including the evolution of religious beliefs that have incorporated botanical knowledge into ritual practices (see Miller *et al.* 2019). Archeological records provide evidence for ritual use of plants as early as 13,500 years ago (Iriarte-Chiapusso *et al.* 2015). Like the agricultural and medicinal plant transfers that have occurred throughout human history (see Beinart & Middleton 2004, Van Andel 2010), the use of sacred plants has also spread through trade and immigration routes. This global trajectory has fueled not only the diversity of these economic plant species, but also the cross-cultural botanical knowledge that governs their use in religious practices.

Starting in the early sixteenth century, ancient West African ethnobotanical practices and knowledge made the treacherous Middle Passage, the sea journey in which 11 million Africans were transported against their will and enslaved in the New World (Carney 2013, McClure 1982). It is without question that a great number of Old-World food staples were dispersed by enslaved Africans across the Americas during this time (e.g., *Oryza glaberrima* Steud.; see Carney 2013, Carney & Rosomoff 2009, Van Andel 2010), ultimately contributing to the growing agricultural economy and the culinary traditions of the New World. Nonetheless, the ability to transport a complete botanical pharmacopeia for ritual and medicinal purposes from the shores of West Africa was likely limited (but see Van Andel *et al.* 2016, 2019). Thus, enslaved Africans potentially faced a dearth of Old-World plant taxa with known religious and medicinal purposes in their new homeland (Voeks 1997). To overcome this obstacle, some authors have suggested that enslaved people and their descendants used the environmental knowledge of Old-World plants to identify New World flora for religious and medicinal needs. For example, Van Andel *et al.* (2014) demonstrated that names for certain Surinamese flora used by modern day Maroons (descendants of escaped Africans in Suriname) correspond to the vernacular names of related African taxa. Results from this study support the hypothesis that Old World botanical knowledge (in concert with contact with local indigenous tribes; see Hoffman 2013) assisted in the Maroons' ancestors' transition to the New World pharmacopeia.

The adaptation to the vast array of New World plants was not the only cultural transition to arise out of this complicated and tragic period of human migration. The fusion of religious practices that flourished in the colonies had its roots in the animistic religions of enslaved Africans and the Roman Catholicism of the European colonists. Prominent examples of New World syncretic religions (e.g., Obeah; McClure 1982, Murrell 2010) evolved during the colonial period, when Catholicism was forced onto enslaved Africans (Odeyemi 2019). While they adopted the foreign religion, they secretly retained their African beliefs and practices (Voeks 1997). In masking the names of their deities, enslaved Africans deceived their colonizers into thinking that they were worshiping Catholic saints (Odeyemi 2019). Despite their dire conditions, this religious transformation allowed them to claim ownership of their faith.

One of the primary facets of African diasporic religions has been the connection to the spiritual world, through sacrifices of animals (Lammoglia 2008), divination (allowing deities to possess the body), and by ritual baths, also known as "*limpieza*" (Alanamu 2013) in Spanish or "*lavage*" in French Creole tradition. The cleaning of the body is a common ritual across the Caribbean in which one bathes oneself with an infusion of different ritual plants, typically ones that are aromatic (Hodges & Bennett 2006). This sacred rite occurs when another person has inflicted evil upon an individual or when an individual wishes to protect oneself from evil spirits or "*el mal de ojo*" (or "bad eye"). Another example of a religious practice that has made its way into Afro-Caribbean syncretic religions is "*ofrendas*", a practice that incorporates plants or other items of value that the practitioner provides to their pantheon of deities in an attempt to continue the bond between the believer and deity in question (Hodges & Bennett 2006). Older members of Afro-Caribbean and Latin American communities still commonly practice religious rituals such as limpiezas and ofrendas, but these rituals are fading as the older generation's oral history dies with them. Religions such as *Vudan* (Voodoo) and *Santería* are not practiced widely by younger generations, especially given our mobile society and the further separation of kinship (Udo 2020).

Starting in the mid-20th century, clusters of religious stores known as *botánicas* began to appear in major metropolitan areas, especially those with strong representation from the Latinx and Caribbean communities (Murphy 2015). *Botánicas* provide practitioners of Afro-Caribbean syncretic religions with ritual objects and plants, as well as plants and plant derivatives for medical ailments (see Reeser & Cintrón-Moscoso 2013, Viladrich 2006a, 2006b). Despite the prominent role that *botánicas* play in Miami-Dade County (MDC)'s culture and the growing interest in the cultivation and use of medicinal and ritual plants (Viladrich 2006b), to-date there has been very little documentation on the full array of native and exotic religious plants used in this South Florida county. While other studies have pointed to the conservation and sustainable extraction implications of ritual and medicinal plant collection (e.g., Lima *et al.* 2016, Melander 2007, Van Andel *et al.* 2015), the rarity (or conversely, the ubiquity) of the ritual plants of urban *botánicas* in North America is uncertain.

Accordingly, we addressed the following questions:

1. What is the ratio of native to exotic (naturalized) plant species found in the *botánica* stores and how does that compare to the ratio of native to exotic (naturalized) plant species found in MDC?
2. What is the ratio of invasive exotic to naturalized (non-invasive) exotic plant species found in the *botánica* stores and how does that compare to the ratio of invasive exotic to naturalized exotic species found in MDC?
3. What is the geographical origin of the plants found in the *botánica* stores?

Materials and Methods

Study site

The study was conducted from November 2018-April 2019 in MDC, Florida, an area of approximately 6300 km² that includes a diverse mix of metropolitan sprawl, natural areas, and agricultural lands. The region is characterized by wet (May-October) and dry (November-April) seasons, with warm subtropical summers and mild winters, similar to other areas of the Caribbean. The region is populated by a rich diversity of immigrants from Latin America (i.e., Mexico, Central America, South America, and Spanish-speaking countries of the Caribbean; Senices 2005) and the Caribbean. The prevalence of Latinx (i.e., those who were born in Latin America and/or their descendants; Salinas and Lozano 2019) and Caribbean people in MDC, paired with the wish to maintain the culture of one's home country, results in cultural-specific stores. A prime example of the Afro-Caribbean/Latinx contribution is the plethora of *botánicas* in the city (Fig. 1). These stores sell plants, figurines and candles for religious ceremonies and medicinal purposes to a variety of religions and ethnic groups.

Data Collection

Research was conducted in two Haitian *botánicas* (Haitian Creole as the major language of commerce), three Hispanic *botánicas* (Spanish as the major language of commerce) and one integrated *botánica* (Hispanic owners/ Haitian customers and English as the major language of commerce) to conduct the botanical survey. An initial search for "*botánica*" on the Google Maps platform (e.g., Hodges & Bennett 2006) found a total of 86 *botánicas* in the research area (see Fig. 1). *Botánicas* were randomly selected to reflect a representative distribution of Hispanic and Haitian stores in Miami. While there are stores and informal markets that focus on other ethnic and/or religious affiliations (e.g., those that cater to Brazilian followers of *Candomblé*, Obeah practitioners from the Anglophone Caribbean, etc.), they are not as widespread as the Hispanic and Haitian *botánicas*. Many *botánicas* offer a variety

of spiritual and religious items for several different cultures, complicating the identification of a single *botánica* to a specific syncretic religion or ethnic identity. In general, Hispanic *botánicas* are far more numerous and widespread in the urban area than those *botánicas* serving Haitian customers. Clusters of Hispanic *botánicas* are particularly common in the Little Havana and West Miami neighborhoods of the City of Miami, as well as the municipality of Hialeah (see Fig. 1). While documenting these religious stores, we also noticed that several Haitian *botánicas* originally selected for the survey were permanently closed in the Little Haiti neighborhood. While there may be several reasons for this trend, this neighborhood is undergoing a rapid transformation in terms of demographics and available services, fueled in part by “climate gentrification”, or when wealthier residents and developers seek higher ground in historically impoverished neighborhoods (see Keenan *et al.* 2018).

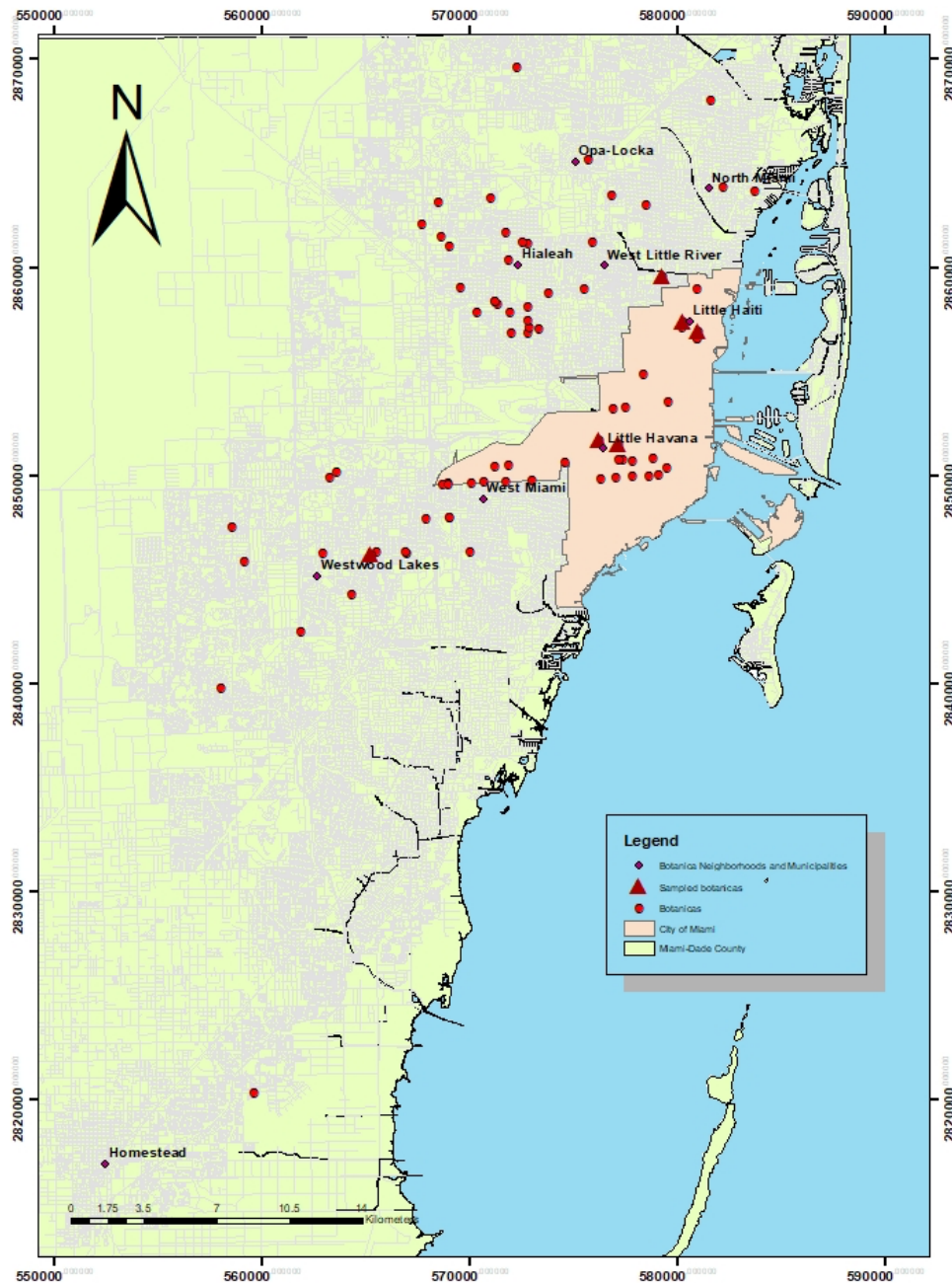


Figure 1. Locations of *botánicas* in Miami-Dade County, Florida at the time of the study.

Methods in this ethnobotanical study were adapted from Hodges & Bennett (2006). When arriving at each *botánica*, all live plants, dried seeds, fresh and dried leaves, and fruits were collected (Hodges & Bennett, 2006). Many taxa that we collected are likely used for both religious and medicinal purposes. However, for the purpose of this article, we refer to the plants in question as “ritual plants”, given their association with stores whose primary purpose is to sell items of religious importance. Tinctures, soaps, wood, roots, perfumes, and other blended-ingredient products were not collected during these surveys, as we could not identify such products to species. If the species in question was identified as already having been collected at another *botánica*, the species information was noted down, but no additional collection took place. We were able to purchase plant material online from several of the *botánicas* chosen for the survey, which avoided the possibility of missing a species that was not available in-store. The availability of certain species of plants varied throughout the course of the study, depending on which day we happened to be visiting a particular *botánica*. Thus, we visited the *botánicas* more than once during the collection period to collect additional plants, but it is highly likely we did not collect the full range of ritual plants available to practitioners.

Species identification

We organized the plant samples by store and labeled them with date of purchase, scientific name, and the common name referenced by the *botánicas*. We identified each individual sample to species and made botanical vouchers. All botanical vouchers were deposited as a reference collection in the Florida International University (FIU) International Center for Tropical Botany herbarium at Kampong Garden (Coconut Grove, FL).

Data analysis

Chi-square analysis

We analyzed the 93 plants collected and identified to species during this study to compare the expected ratio of MDC native to exotic (naturalized) plants, using the Atlas of Florida Plants (Wunderlin *et al.* 2021), which seeks to document native and naturalized plants in Florida. It is important to note that when verifying the documented non-native plants in the Florida Plant Atlas, we did not find several of our exotic species listed, as the Atlas does not include taxa known only from cultivation in Florida. To test the significance of the native vs. exotic comparison, a chi-square test was performed using the R 3.6.0 software platform, adopting methods used by other ethnobotanical studies (e.g., Stepp & Moerman 2001). We repeated the chi-square analysis to compare the expected ratio of invasive exotic to non-invasive (naturalized) exotic taxa. We verified the invasive status of the flora in question using the Florida Plant Atlas, as well as the Florida Exotic Pest Plant Council database (FLEPPC 2019). The FLEPPC list characterizes the plants as Category 1 (capable of altering native plant communities) or Category 2 (increased in abundance but not altering native plant communities).

Geographic provenance

Categories of geographic provenance of all 93 plants identified to species during this study were verified using the Kew Royal Botanic Garden Plants of the World online database (Plants of the World Online | Kew Science; accessed January 10, 2021), defined as “Asia”, “Europe”, “Madagascar”, “Mediterranean”, “Neotropics”, “North America”, “Oceania”, and “Sub-Saharan Africa”. The “Neotropics” category included all plants considered native to the tropical and subtropical climatic zones of the Caribbean, Central America, Mexico, South America, and South Florida. “North America” included temperate, arid, or cold zone taxa that have a widespread geographical range in the North American continent, including South Florida. South Florida presents a unique convergence of temperate and tropical taxa (Browder and Ogden 1999), thus species labelled as MDC “natives” fell under both the “North America” and “Neotropics” categories. Likewise, while Europe claims some portions of the Mediterranean region, we defined the “Mediterranean” category as a distinct climatic class, with respect to its extent on the Asian, African, and European continents. As such, the “Asia” category excluded those plants native to Asian countries and territories in the Mediterranean (e.g., Syria, Lebanon, Israel, and Palestine).

Results and Discussion

We collected 139 plant specimens across all six *botánicas*, of which we were able to determine 93 species (see Table 1). The origin of these plants is unclear, although informal conversation with the *botánica* owners indicated that the plants come from various suppliers (B. Herrera, *pers. obs.*). Observations of the *botánicas* and their surroundings would suggest cultivation of these plants could occur onsite, as well. However, due to the informal economy associated with the plant sales, a more precise understanding of the sources of these plants would require a follow up study.

Ethnobotany Research and Applications

Table 1. Sampled ritual plant taxa of the *botánicas* of Miami-Dade County, Florida. FLEPPC Category 1= capable of altering native plant communities; FLEPPC Category 2= increased in abundance but not altering native plant communities*. "*Botánica*" column indicates type of *botánica* where plant was located, based on primary language of commerce at time of study [H=Hispanic (Spanish); Hai=Haitian (Haitian Creole); I=Integrated (English)].

Family	Species	MDC Native	Naturalized Exotic	FLEPPC Invasive	Region	<i>Botánica</i>
Acanthaceae	<i>Justicia pectoralis</i> Jacq.		√		Neotropics	H
Adoxaceae	<i>Sambucus canadensis</i> L.	√			North America	H/I
Amaranthaceae	<i>Amaranthus spinosus</i> L.		√		Neotropics	H
	<i>Chenopodium murale</i> (L.) S. Fuentes-B., Uotila & Borsch		√		Mediterranean	Hai
	<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants		√		Neotropics	H/Hai
	<i>Mangifera indica</i> L.		√		Asia	H
Annonaceae	<i>Annona squamosa</i> L.				Neotropics	H
Araceae	<i>Colocasia esculenta</i> (L.) Schott		√	1	Asia	H/I
	<i>Pistia stratiotes</i> L.	√			Neotropics	H
Asphodelaceae	<i>Aloe vera</i> (L.) Burm. f.				Asia	Hai
Asteraceae	<i>Ambrosia artemisiifolia</i> L.	√			North America	Hai/I
	<i>Baccharis halimifolia</i> L.	√			North America	H
	<i>Bidens alba</i> (L.) DC.	√			Neotropics	H
	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	√			Neotropics	H
	<i>Eclipta prostrata</i> (L.) L.	√			North America	H/I
	<i>Koanophyllon villosum</i> (Sw.) R.M. King & H. Rob.	√			Neotropics	H
	<i>Parthenium hysterophorus</i> L.			√		Neotropics
Boraginaceae	<i>Heliotropium indicum</i> L.		√		Neotropics	H
Brassicaceae	<i>Lepidium virginicum</i> L.	√			North America	I
Bromeliaceae	<i>Tillandsia flexuosa</i> Sw.	√			Neotropics	H
Burseraceae	<i>Bursera simaruba</i> (L.) Sarg.	√			Neotropics	H
Caricaceae	<i>Carica papaya</i> L.	√			Neotropics	H
Clusiaceae	<i>Garcinia kola</i> Heckel		√		Sub-Saharan Africa	H
Combretaceae	<i>Terminalia catappa</i> L.		√	2	Asia	H
Commelinaceae	<i>Commelina diffusa</i> Burm. f.		√		Asia	H
	<i>Tradescantia zebrina</i> hort. ex Bosse		√		Neotropics	H
Crassulaceae	<i>Kalanchoe pinnata</i> (Lam.) Pers.		√	2	Madagascar	H
Cucurbitaceae	<i>Momordica charantia</i> L.		√	2	Asia	H
Cyperaceae	<i>Cyperus involucratus</i> Rottb.		√	2	Madagascar	H
Dioscoreaceae	<i>Dioscorea bulbifera</i> L.		√	1	Sub-Saharan Africa	Hai
Euphorbiaceae	<i>Acalypha arvensis</i> Poepp.		√		Neotropics	H
	<i>Cnidoscolus aconitifolius</i> (Mill.) I.M. Johnst.		√		Neotropics	I
	<i>Codiaeum variegatum</i> (L.) Rumph. ex A. Juss.		√		Asia	H
	<i>Euphorbia tithymaloides</i> L.		√		Neotropics	I
	<i>Hura crepitans</i> L.				Neotropics	H
	<i>Jatropha curcas</i> L.			√		Neotropics

	<i>Jatropha gossypifolia</i> L.	√		Neotropics	Hai
	<i>Ricinus communis</i> L.	√	2	Sub-Saharan Africa	H
Fabaceae	<i>Abrus precatorius</i> L.	√	1	Asia	H
	<i>Ceratonia siliqua</i> L.			Asia	H/I
	<i>Delonix regia</i> (Bojer ex Hook.) Raf.	√		Madagascar	H
	<i>Guilandina bonduc</i> L.	√		Neotropics	H
Lamiaceae	<i>Mimosa pudica</i> L.	√		Neotropics	H/Hai
	<i>Mentha spicata</i> L.			Mediterranean	I
	<i>Ocimum basilicum</i> L.			Asia	H
	<i>Ocimum kilimandscharicum</i> Baker ex Gürke			Sub-Saharan Africa	H/Hai/I
	<i>Ocimum tenuiflorum</i> Burm. f.			Asia	H
	<i>Plectranthus amboinicus</i> (Lour.) Spreng.			Sub-Saharan Africa	I
	<i>Pogostemon cablin</i> (Blanco) Benth.			Asia	H
	<i>Salvia officinalis</i> L.			Mediterranean	H/I
	<i>Salvia rosmarinus</i> Schleid.			Mediterranean	H
	<i>Vitex trifolia</i> L.	√	2	Mediterranean	H
Lauraceae	<i>Persea americana</i> Mill.	√		Neotropics	H
Malvaceae	<i>Abutilon theophrasti</i> Medik.	√		Asia	H
	<i>Ceiba pentandra</i> (L.) Gaertn.			Neotropics	H
	<i>Cola nitida</i> (Vent.) Schott & Endl.			Sub-Saharan Africa	H
	<i>Gossypium hirsutum</i> L.	√		Neotropics	H
	<i>Hibiscus rosa-sinensis</i> L.			Asia	H/I
Meliaceae	<i>Melia azedarach</i> L.	√	2	Asia	H
Moraceae	<i>Ficus altissima</i> Blume	√	2	Asia	H
	<i>Ficus benjamina</i> L.	√		Asia	H
	<i>Ficus religiosa</i> L.	√		Asia	H/I
Moringaceae	<i>Moringa oleifera</i> Lam.	√		Asia	H/I
Myrtaceae	<i>Psidium guajava</i> L.	√	1	Neotropics	Hai/I
	<i>Syzygium jambos</i> (L.) Alston	√	2	Asia	H
Nyctaginaceae	<i>Boerhaavia diffusa</i> L.	√		Neotropics	H
	<i>Mirabilis jalapa</i> L.	√		Neotropics	I
Petiveriaceae	<i>Petiveria alliacea</i> L.	√		Neotropics	H/I
	<i>Pilea microphylla</i> (L.) Liebm.	√		Neotropics	H/I
Piperaceae	<i>Peperomia pellucida</i> (L.) Kunth	√		Neotropics	H
	<i>Piper umbellatum</i> L.	√		Asia	H
Plantaginaceae	<i>Plantago major</i> L.	√		Europe	H/I
Plumbaginaceae	<i>Plumbago auriculata</i> Lam.	√		Sub-Saharan Africa	H
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	√		Asia	H
Portulacaceae	<i>Portulaca oleracea</i> L.	√		North America	H
Rubiaceae	<i>Hamelia patens</i> Jacq.	√		Neotropics	H
Rutaceae	<i>Murraya paniculata</i> (L.) Jack	√	2	Asia	H
Rutaceae	<i>Ruta chalepensis</i> L.			Mediterranean	H/Hai/I

Ethnobotany Research and Applications

Sapindaceae	<i>Sapindus saponaria</i> L.	√		Neotropics	H	
Sapotaceae	<i>Chrysophyllum cainito</i> L.			Neotropics	H	
	<i>Pouteria campechiana</i> (Kunth) Baehni		√	Neotropics	H	
Selaginellaceae	<i>Pouteria sapota</i> (Jacq.) H.E. Moore & Stearn			Neotropics	H	
	<i>Selaginella lepidophylla</i> (Hook. & Grev.) Spring			North America	H	
Solanaceae	<i>Brugmansia suaveolens</i> (Humb. & Bonpl. ex Willd.) Sweet		√	Neotropics	H	
	<i>Datura stramonium</i> L.		√	Neotropics	H	
	<i>Nicotiana tabacum</i> L.		√	Neotropics	H	
	<i>Solanum diphyllum</i> L.		√	2	Neotropics	H
	<i>Solanum torvum</i> Sw.		√	2	Neotropics	H
	Urticaceae	<i>Cecropia schreberiana</i> Miq.			Neotropics	H
Verbenaceae	<i>Duranta repens</i> L.		√	Neotropics	I	
	<i>Lantana strigocamara</i> R.W. Sanders		√	1	Neotropics	H
	<i>Lippia dulcis</i> Trevir.			Neotropics	H	
	<i>Stachytarpheta cayennensis</i> (Rich.) Vahl		√	Neotropics	H	

*Invasive categories designations based on FLEPPC 2019.

Common names in our study were often associated with more than one species across the *botánicas* (e.g., both *Ficus altissima* and *Ficus aurea* were sold at the same *botánica* under “*jaguey*”). Additionally, we encountered on more than one occasion specimens with a common name in Spanish that closely resembled botanical nomenclature (e.g., *Ceiba pentandra* (L.) Gaertn. is typically sold as “*ceiba*” in Hispanic *botánicas*), but which nonetheless ended up being a completely different species (or family). Most notably, these examples included *Ambrosia artemisiifolia* L. (labelled “*artemisia*” in the *botánica* where it was sampled), *Stachytarpheta cayennensis* (Rich.) Vahl (labelled “*verbena*”), and *Ficus benjamina* L. (labelled “*laurel*”). In the cases of *A. artemisiifolia* and *S. cayennensis*, these species are not as well known for medicinal properties as species of *Artemisia* and *Verbena* (but see Froelich *et al.* 2008, Schapoval *et al.* 1998), but they are in the same families (Asteraceae and Verbenaceae, respectively). In the instance of *F. benjamina*, the species is not even in the same family that one would expect with a name like “*laurel*” (typically, Lauraceae); it is in the Moraceae family. This discrepancy is even more disconcerting because the consumption of fresh fig leaves (or any other part of the plant containing sap) can lead to serious consequences for those with an allergy to latex (Hemmer *et al.* 2004).

The most common family (out of 44) was determined to be the mint family (Lamiaceae; 10%), closely followed by Euphorbiaceae (9%) and Asteraceae (8%). It is worth mentioning that these botanical families have long been recognized as some of the world’s most common medicinal plant families (Kindscher *et al.* 2013, Lima *et al.* 2016, Polat 2019, Thomas *et al.* 2009). Additionally, they have demonstrated pharmacological compounds and medicinal capacities via a combination of oral tradition and medical research results (Koc *et al.* 2014, Shing *et al.* 2002). Given that many of the plants collected in the *botánicas* are often used in the preparation of tinctures for the *limpieza* ritual, one would also expect the selected plants to be fragrant (thus explaining the abundance of Lamiaceae species, especially those in the *Ocimum* genus). These botanical families are also some of the largest in the world; thus, the probability of their value as medicinal and spiritual plants is much higher than other groups, based on their availability alone.

We found only three species that were common across the *botánica* categories (Hispanic, Haitian, and Integrated): *Ruta chalepensis* L., *Ocimum kilimandscharicum* Baker Gürke, and *Mimosa pudica* L., all of which are considered important medicinal taxa (Chaturvedi *et al.* 2017, lauk *et al.* 2004, Muhammad *et al.* 2016, Nigam *et al.* 2019). *R. chalepensis* and *O. kilimandscharicum* are also fragrant plants that are likely favored for cleaning rituals, but further investigation is needed to understand the cultural importance of these plants. We also observed that the Haitian-specific *botánicas* were smaller than the Hispanic *botánicas*, a factor (in concert with low sample size) that could explain the paucity of taxa collected in the Haitian *botánicas* (11 species, Table 1). We realize that six *botánicas* is not a substantial number comparative to the 86 found within MDC, yet when we attempted to augment the number of sampled *botánicas*, we discovered that many of the Haitian *botánicas* were permanently closed, thus limiting our ability to make a broad comparison across the *botánicas*. Additionally, these cultural stores often rely on word of mouth, increasing the difficulty in pinpointing their location or contact information. An increase in sample size across the Spanish and Haitian-specific stores would certainly lend well to a more thorough understanding of the diversity of plant use across the span of Afro-Caribbean syncretic religions. Nonetheless, despite the aforementioned limitations, our study offers a vivid snapshot of the plant diversity found within the MDC *botánica* community.

Native vs. exotic (naturalized) taxa

The ratio of MDC native to naturalized exotic plants was compared to the same ratio of plants found in the *botánicas*. The sum of 93 documented taxa did not include any repeated plants, as to avoid discrepancies in the analysis. This resulted in a total of 73 exotic and 20 native plant species documented from the *botánicas*, including native taxa that have a widespread range in both North America and the Neotropics (Table 1). Given that we were using the Florida Plant Atlas to make our comparison, we removed cultivated exotics that to-date have not been found in the wild from the analysis. This narrowing of the exotic category reduced the total number of naturalized exotic species to 54. The ratio of native vs. naturalized exotic plants in the *botánicas* (20 vs. 54), when compared to the expected ratio of 1221 native and 669 exotic plant taxa found in MDC (Table 2), was significant ($p \leq 0.0001$). This result indicates that the percentage of native plant taxa found in the *botánicas* was lower than expected, especially given the high diversity of native species in the subtropical climate of MDC (Browder and Ogden 1999).

Despite the relatively low number of native taxa documented for this study, their presence in the *botánicas* was not completely unexpected. The taxa in question are not endemic to MDC. Rather, most of the identified South Florida natives in this study are widespread throughout the Caribbean. Thus, it is likely that many *botánica* clientele had already encountered many of these MDC taxa prior to settling in South Florida, potentially ensuring a

"continuity of knowledge" concerning traditional folk pharmacopeias (see Ceuterick *et al.* 2008, Fonseca & Balick 2018). The question then remains as to why local taxa are not being used by the *botánica* clientele. In their 2018 study, Fonseca & Balick demonstrated that *Candomblé* practitioners in New York City were maintaining a high level of cultural continuity regarding the traditional botanical pharmacopeia, while also slowly incorporating plant species of their adopted homeland. The authors suggest that cultural familiarity seemed to play a much stronger role in plant selection than just availability. It is possible that a similar situation is guiding trends in the *botánica* plant market in MDC, but this can only be confirmed via a longer-term study that includes ethnographic interviews with practitioners and vendors.

Table 2. Expected proportion of native to exotic (naturalized) species in local *botánicas* of Miami-Dade County (MDC), Florida (χ^2 : 43.2; $P \leq .0001$; Df: 1).

Plant Source	Native	Exotic	Total	Proportion of MDC Natives
Botánica	20	54	74	27%
MDC	1221	669	1890	65%

*MDC native vs. exotic (naturalized) designations based on Wunderlin *et al.* 2021.

Invasive exotic vs. naturalized (non-invasive) exotic taxa

The ratio of invasive to non-invasive naturalized exotic plants commonly found in MDC was compared to that of plants collected from the *botánicas* (Table 3). A total of five Category 1 (exotics considered capable of altering native plant communities) FLEPPC species and 12 Category 2 (those exotics that have increased abundance but have yet to alter native plant communities) FLEPPC taxa were found in our survey (Table 1). These 17 species are included in the total count of 54 naturalized taxa, out of the 73 exotic species identified this study. Results of the chi square analysis were significant ($p=0.03$), indicating that the proportion of invasive plants from the *botánicas* was greater than the proportion of invasive exotic taxa (compared to non-invasive exotic species) in MDC (32% vs. 19%, respectively).

Table 3. Expected proportion of invasive vs. non-invasive exotic (naturalized) species in local *botánicas* of Miami-Dade County (MDC, Florida (χ^2 : 4.8; $P=0.03$; Df: 1).

Plant Source	Invasive exotics	Non-invasive exotics	Total	Proportion of Invasive Exotics
Botánica	17	37	54	32%
MDC	128	541	669	19%

*Invasive categories designations based on FLEPPC 2019.

Followers of Afro-Caribbean syncretic religions (as well as Neotropical indigenous communities) have historically embraced flora that tend to be abundant, something that has been noted by other authors (e.g., Grimé 1976, McClure 1982, Stepp & Moerman 2001) and reinforced in this study. The presence of invasive plants supports the idea that practitioners and *botánica* vendors alike (at least in MDC) veer towards what is common (or "weedy"), rather than what is rare. Only two native species in our collection are considered species of special concern (*Koanophyllon villosum* (Sw.) R.M. King & H. Rob., State of Florida endangered; *Tillandsia flexuosa* SW., State of Florida threatened; Wunderlin *et al.* 2021). The concept and categorization of weeds has long been a subject of debate; typically, weeds are seen as those plants that are not valued for use or for beauty (Harlan & deWet 1963). However, as this study demonstrates, even the most noxious "weeds" can have value to the point that people will pay for them. It could even be argued that several of the native flora found in the *botánicas* would likely be classified as common weeds by most urban Miami inhabitants (e.g., *Bidens alba* (L.) DC, *A. artemisiifolia* L.), given their propensity to establish in residents' yards.

Geographic provenance of plant taxa

Only one species from the temperate climate of Europe (*Plantago major* L.) was discovered in the collection, followed by three taxa from Madagascar, six from the Mediterranean, and seven species from North America (of which five are considered native to MDC; Table 1). No plants from Oceania were encountered. Geographical origin of most of the recorded medicinal/ritual plants was found to be Neotropical America and Asia (50% and 25%, respectively). Of the total number of Neotropical taxa, 30% of the plants are considered native taxa of MDC. This

strong reliance on Neotropical plants is unsurprising, considering that the syncretic religions highlighted in this study originated in the Caribbean region, where many of the collected taxa flourish in the natural environment. Additionally, South Florida is characterized by a subtropical climate, thus facilitating the cultivation of many tropical plants.

We initially hypothesized that we would find a much higher proportion of African plants in the *botánicas*, following the logic that the ancestral origin of many New World syncretic religions is West African. Instead, we found only seven plants native to sub-Saharan Africa [*Cola nitida* (Vent.) Schott & Endl., *Dioscorea bulbifera* L., *Garcinia kola* Heckel, *O. kilimandscharicum* Baker ex Gürke, *Plumbago auriculata* Lam., *Ricinus communis* L., and *Plectranthus amboinicus* Lour.] out of the 93 species highlighted in this study. The native range of four of these African taxa is still uncertain: the geographic provenance of *P. amboinicus* has yet to be verified (with some botanists claiming an origin on the Indian subcontinent, Arumugam *et al.* 2016), and *P. auriculata*, *O. kilimandscharicum*, and *R. communis* are likely native to other regions of Africa (rather than the Western coast). Ethnobotanical histories are also complicated by the fact that certain taxa were traded and cultivated in West Africa for several centuries prior to the peak of the New World slave trade. McClure (1982) highlights the example of *Abrus precatorius* L., an Asian species which was first described as being cultivated in West Africa by the end of the fifteenth century (Pickering 1879); the species is now completely naturalized in the region. Some authors have also mistakenly identified *A. precatorius* as a native of the Caribbean region, based on its abundance in island habitats and quick adoption into the Carib and Arawak cultures (see Grimé 1976).

Conclusions

Humans have long relied on plants for food, shelter, medicine, and religious practices, with some cultural and ethnic groups even regarding certain floral taxa in anthropomorphic terms (see Hall 2011). This strong bond with plants, in concert with human populations' ability to mobilize, has led to an expansion of plant usage and appreciation across many cultures and geographic regions. Worldwide, practitioners of certain religions continue to incorporate plants into their spiritual routines, even in the face of rapid societal change. For example, migration to new regions has historically forced immigrants to adapt to new environments and modify their practices, including the overhaul of their traditional plant knowledge (Geck *et al.* 2016). This shift in surroundings can result in minor or major changes taking place in the process of creating a connection between the two cultures.

The transition from rural to urban settings can cause complications, as well. Plants that were once highly accessible for practices such as *limpiezas* or *ofrendas* are not as readily available in major cities, especially given the reduced green space associated with urban landscapes (Weckmüller *et al.* 2019). Accordingly, adaptation to the urban environment has led to a proliferation of *botánicas* in most major US cities with substantial representation from the Latinx and Caribbean communities (Gomez-Beloz & Chavez 2001, Viladrich 2006a). These stores (implicitly highlighting the important role of plants via the name) serve as a haven for immigrant communities and their descendants, supplying practitioners with religious articles, tinctures, accessories of worship, plants, and most importantly, a connection to their ancestry.

MDC, Florida represents one of the most diverse metropolitan areas in the United States, with its mosaic of restaurants, local grocery stores, and cultural centers heavily influenced by the neighboring Caribbean and Latin American regions. Currently, it is considered a majority/minority population, with more than two-thirds of the population self-identifying as Latinx (Portes & Armony 2018). To help understand this community's relationship with plants, we chose to study local *botánicas* to shed light on certain cultural aspects of plant usage within these religious stores. Our investigation of six *botánicas* in MDC confirmed that vendors continue to offer plants that are familiar to their customers, regardless of the new environment, especially ones that are considered "weeds" or naturalized (almost 60% of the taxa in this study).

Indeed, the cultivation of economic plants can be an important indicator of cultural history (McClure 1982). Humans tend to adapt to the environment in which they reside and modify important traditions (including favored plant species and their uses) as a means to carry on a familiar way of life. Nonetheless, despite the resiliency of ethnobotanical knowledge in local immigrant communities, it is possible that these traditions are at risk of becoming lost in the shuffle of urban development in Miami. Long-term residents in historically Latinx and Black neighborhoods are becoming dispersed due to recent trends in climate gentrification (Feldman & Jolivet 2014), frequently settling in the outer reaches of the city, where housing prices are more affordable. This trend often leads to the loss of community, and subsequently, loss of culture, a phenomenon that is frequently studied but rarely mitigated by policymakers and urban planners. In many cases, the youth of these fractured communities might

grow up without their ancestral knowledge. Although enculturation can occur from afar, it rarely does (see Ferguson *et al.* 2016).

As for future studies, investigating the ritual and medicinal plants of the *botánicas* and their compounds could provide important information and insight into certain medical conditions for modern medicine (e.g., Menard *et al.* 2010) and into traditional medical practices still maintained by immigrant groups (Reeser & Cintrón-Moscoso 2013). Additionally, forming a dialogue with the owners of the *botánicas* could highlight where these plants are being cultivated (or collected), as many of them are considered “weedy” species and are not typically sold in large-scale nurseries. Indeed, given that we were not able to sample the full array of plants available to *botánica* clientele, it is possible that vendors are selling other plants of concern (FLEPPC or native rare taxa) not recorded in this study. As such, outreach to the *botánica* community will be important to determine if these plants of interest are being cultivated or collected from local parks and backyard gardens. Finally, the uses of these plants (according to different Afro-Caribbean religions) should be explored via communication with practitioners. It is possible that the religious importance of several species has widespread acceptance across different cultures, whilst some have more exclusivity within specific religions. Given the transitions that are taking place in many of these communities, documentation (e.g., increased use of *botánicas* during pandemics) and transfer of this valuable ethnobotanical knowledge is at a critical crossroads.

Declarations

List of abbreviations: Not applicable

Ethics approval and consent to participate: No human participants were involved with this study.

Consent for publication: Not applicable.

Availability of data and materials: Vouchers have been deposited at the Florida International University (FIU)'s International Center for Tropical Botany Herbarium at Kampong Garden, Coconut Grove, Florida.

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