ETHNOBOTANY OF THE GARÍFUNA OF EASTERN NICARAGUA[1]

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Coe, Felix G., *and* **Gregory J. Anderson** *(Department of Ecology and Evolutionary Biology, Box U-43, University of Connecticut, Storrs, CT 06269-3043).* ETHNOBOTANY OF THE GARÍFUNA OF EASTERN NICARAGUA. *Economic Botany 50(1):71–107. 1996.* *We report the diversity of plants used by the Garífuna focusing on medicinals. Garífuna plants documented in this study are distributed among 75 families, 193 genera, and 254 species. Included are 229 medicinals, 93 food plants, and 94 species for other uses. Garífuna medicinals treat more than 30 human ailments and most are native (74%) to eastern Nicaragua. About 70% of the medicinals have some bioactive principle, most are herbs (37%) or trees (34%), and leaves are the most frequently utilized plant part. Most are prepared as decoctions and are administered orally. Most food plants are domesticates, and only 14 of 51 domesticated food species are native to the NW tropics with only three to Mesoamerica. Garífuna culture is changing rapidly as a result of contact with immigrating mestizos from central Nicaragua. This study provides a written record of folk medicine and ethnobotany for the people of eastern Nicaragua.*

La etnobotánica de los Garífuna de Nicaragua oriental. *Presentamos un informe sobre la diversidad de plantas usadas por los Garífunas con enfoque en aplicaciones medicinales. Las plantas Garífunas documentadas en este estudio (1992–1993) representan 75 familias, 193 géneros y 254 especies. De éstas, 229 son medicinales, 93 comestibles y 94 de usos anciliares. La farmacopea Garífuna se utiliza para tratar más de 30 dolencias humanas. El 74% de las plantas medicinales son nativas de Nicaragua oriental, aproximadamente el 70% tienen algún principio bioactivo, 37% son hierbas o árboles (34%) y la hoja es la parte más utilizada. Los remedios medicinales son preparados preferiblemente en decoción y administrados oralmente. La mayoría de las plantas comestibles son domesticadas y sólo14 de 51 son nativas del neotrópico y sólo tres de Mesoamerica. Los Garífunas estan sujetos a una rápida aculturación debido a la inmigración de mestizos del área central de Nicaragua. Por consiguiente, este estudio documenta la etnomedicina y la etnobotánica para la población del oriente Nicaragüense.*

Key Words: ethnobotany; medicinal plants; Garífuna; eastern Nicaragua.

The Atlantic Coast is in many respects the most complex and varied region of Nicaragua. It is the home to three extant indigenous groups: the Miskitu, the Sumu, and the Rama. The Garífuna descendants of the Arawaks and Red Carib Islanders (Crawford 1984) also now live in this area (Fig. 1) however, when access roads were opened into once isolated areas of eastern Nicaragua and indigenous peoples' communal lands were redistributed, there has been a mass migration of outsiders into these areas as well. With this new population has come the destruction of forests for agriculture and cattle ranching, and the displacement of indigenous groups into westernized communities run by logging, mining, and fishing companies. Once in these communities, the indigenous groups rapidly adopt western customs. Missionary groups have also played a major role in the acculturation process by discouraging traditional religious and/or ritual practices within the indigenous population (Smutko 1985). The destruction of tropical rainforests in eastern Nicaragua, as elsewhere in the world, is rampant. Unfortunately ethnobotanical information is being lost at an even faster rate than species and habitat.

There are a number of compilations of ethnobotanical information from Mexico, Panama, or Guatemala. There is relatively little ethnobotanical information from Nicaragua, El Salvador, Costa Rica, and Honduras. For Nicaragua there has been little ethnobotanical research, and

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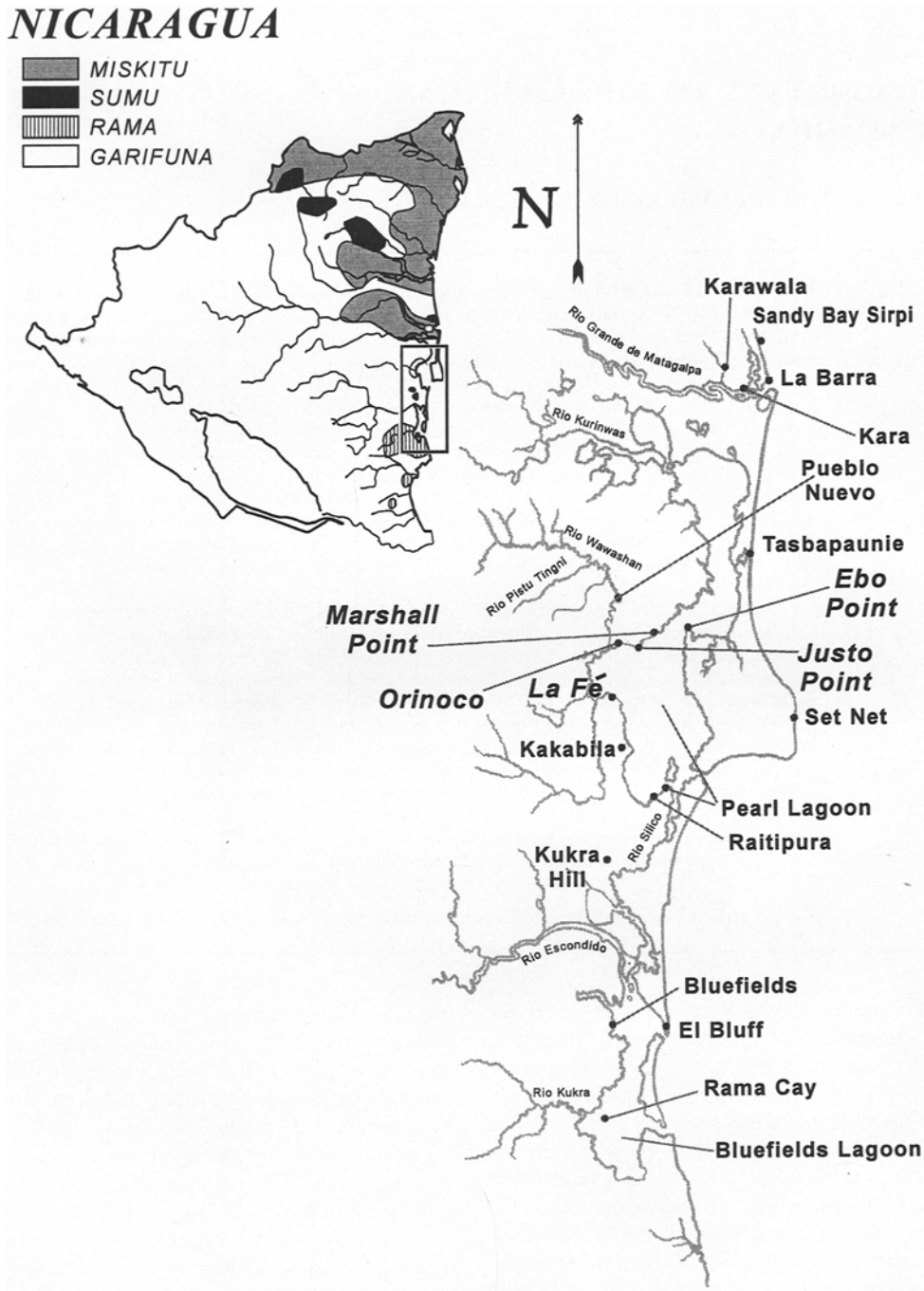

Fig. 1. Indigenous groups and Garífuna settlements in eastern Nicaragua.

almost nothing has been written concerning folk medicine. In a two volume annotated bibliography covering traditional medicine worldwide, Cosminsky and Harrison (1984) catalogued 2500 references only four of which treat material on Nicaragua and none is a major work. In contrast, almost 100 works were cross-listed under Guatemala, and almost 400 under Mexico. Enrique Peña Hernandez (1968) gave an excellent overview of folk customs and traditions in Nicaragua, but this treatment includes little ethnobotany and, more specifically, nothing about eastern Nicaragua. Miranda (1967) published a preliminary study of traditional medical practice in western Nicaragua. The Nicaraguan physician Dávila Bolaños published (1974) an excellent description of indigenous pre-historic medicine based on a lifetime of observations among the descendants of the Matagalpas and Nicaraos of central Nicaragua. In 1981, Juan B. Salas gave a brief description of medicinal plants used in the Departamento de Managua. The anthropologists Philip Dennis (1981, 1984, 1988), Mary Helms (1971, 1983), and Franklin Loveland (1975a,b, 1976, 1982), the cultural geographers W. V. Davidson (1980) and Bernard Nietschmann (1969, 1972, 1973, 1979, 1990), and the physician Bruce Barrett (1994), have published on the indigenous groups of eastern Nicaragua. Dennis (1988) offers species descriptions of 23 medicinal plants used by the Miskitu, Loveland (1975a) describes snakebite cures among the Rama, and Barrett (1994) reports on medical anthropology on Nicaragua's Atlantic coast. The objective of our study was to document Garífuna use of plant resources for food, shelter, clothing, medicine, and ritual practices, with an emphasis on medicinal plants.

The Study Area

Nicaragua encompasses about 140 000 km^2. The Eastern Lowlands of Nicaragua are the most extensive land form in the country, making up about one third (41 000 km^2), of the national territory. These lowlands run from sea level to an elevation of 200 m. The Eastern Lowlands have a tropical climate, with a rainy season of 6–8 months and no well-defined dry season. Climatic factors combine to yield a rainforest (average annual rainfall is 3810 mm) which is the most extensive in Central America.

Because of the density of the rainforest, abundance of rainfall, and regular distribution of rivers, the east coast of Nicaragua had remained undeveloped and isolated from the rest of the country until recent access roads were built. The primary means of transportation in the Eastern Lowlands are still boat or airplane. The largest city is Bluefields (Fig. 1) with 60% of the lowland population. All Garífuna settlements are located on the Northwest rim of Pearl Lagoon and are within 15 km of the Wawashan River which flows into the Pearl Lagoon. The primary forest type around the Garífuna settlements in the Pearl Lagoon area is lowland swamp forest (Sutton 1989) characterized by the abundance of mangroves and palms along the shore of the lagoon and river banks.

Methods

Data for this study were gathered over decades of personal experience by Coe, and during organized field studies (June–July 1992, December and January 1992/1993, June–July 1993). Field investigations included ethnobotanical surveys of markets and interviews in settlements which have access to undisturbed, primary forests and others in more disturbed areas. Documentation of plant use followed some of the techniques of Bye (1986), Croom (1983), Dennis (1988), Lal and Lata (1980), Lal and Yadav (1983), and Weiss (1979). Audio recording was done with a micro-cassette recorder. Informant consent was requested prior to all tape recordings. A notebook computer was used to enter data in the field whenever it was possible to do so. Market surveys were conducted as those described by Bye and Linares (1983).

Several techniques were used for gathering ethnobotanical data: the "observer/participant" technique (Briggs 1986; Crane and Angrosino 1992; Johns and Kimanani 1990), and the "interview/inventory" techniques (Boom 1987; Briggs 1986; Crane and Angrosino 1992).

Interviews were conducted primarily in English, Spanish, and Creole (English spoken in eastern Nicaragua). Because very few of the local people speak it, interviews were not conducted in the Garífuna language. Because ethnomedicine is considered a profession among the indigenous peoples of eastern Nicaragua, it is expected that practitioners receive payment for their services. In accordance with this tradition, many interviewed were paid a nominal fee of $20 dollars (or other requested materials

such as food, cooking utensils, machetes, fishing hooks).

Collections of vouchers specimens and/or ethnobotanical data were made in the settlements of: Justo Point, La Fé, Marshall Point, Orinoco, Pearl Lagoon, Pueblo Nuevo, and Wawashan River (Fig. 1). Voucher specimens were deposited at the Herbarium of the Atlantic Coast of Nicaragua in Bluefields (established by Coe in 1992), the Herbario Nacional Managua Nicaragua (HNMN), the Missouri Botanical Garden (MO), and the University of Connecticut (CONN).

The majority of voucher specimens were identified at The University of Connecticut, Storrs, CT, and the Missouri Botanical Garden, St. Louis, MO. Voucher specimens in doubt were sent to specialists at the Missouri Botanical Garden (MO) and the New York Botanical Garden (NY).

Names of localities and common names of plants were verified to the extent possible using published sources (Duke 1972; Hadel 1975; Howes 1974; Guerrero and Soriano de Guerrero 1985; Incer 1985; Martinez 1991; Morton 1981; Uphof 1968). Names of organic compounds were verified by using the *Dictionary of Organic Compounds* (Cook, Bunbury, and Hey 1965).

A literature search of major compendia (published between 1958 and 1994) was conducted to determine the presence or absence of alkaloids or glycosides in the medicinal species. Electronic searches were conducted using Chemical Abstracts Services (1958–1994) and Natural Products Alert (NAPRALERT—Quinn, pers. comm. 1994). Those species not found in the literature were then tested for alkaloids using Dragendorff's Reagent (Burns 1964; Harborne 1988; Raffauf 1962; Stahl 1969; Stermitz et al. 1989), and techniques established by Schultes and Raffauf (1990).

The Garífuna

The Garífuna are relative newcomers to the Atlantic Coast of Nicaragua. In 1797, the British put down a Carib uprising on the island of St. Vincent, after which some 5000 Garífuna were transferred to the Island of Roátan, Honduras (Coelho 1955; Conzemius 1928; Davidson 1980). From Roátan, the Garífuna spread North and South in Central America (Conzemius 1928; Taylor 1951), but have always located their settlements along the coast (Conzemius 1928; Hale and Gordon 1987). The Garífuna communities in the Pearl Lagoon area of Nicaragua were founded around the turn of the century (Davidson 1979, 1980), and are the southernmost site of Garífuna culture (Fig. 1). The Garífuna settled in the Pearl Lagoon area because jobs were available in mahogany logging. Presently there are about 1500 Garífuna living on the Atlantic Coast of Nicaragua (CIDCA 1982; Coe, pers. obs. 1992; Hale and Gordon 1987). The largest Garífuna settlement in eastern Nicaragua is Orinoco (Fig. 2) with a population of 600–700, in nearly 100 dwellings (Coe, pers. obs. 1992; Davidson 1980).

Fig. 2. The Garífuna village of Orinoco.

Garífuna plant lore is a combination of African and Amerindian knowledge passed on by oral tradition (Cosminsky 1979; Taylor 1951). The Garífuna rely on traditional medicine as their primary source of health care and on western medicine as an alternative to that (Roberto Hodgson, pers. comm. 1992).

The majority of Garífuna in eastern Nicaragua live in four small villages, namely, Orinoco, Justo Point, La Fé, and Marshall Point, all located on the southwest rim of the Pearl Lagoon (Fig. 1). They practice slash-and-burn agriculture on small plantations 1–2 ha. in size. Their major source of income is agriculture and logging, with seasonal fishing and hunting. They participate in the local market economy, and sell some of their goods in regional markets.

The Garífuna way of life remains more traditional than that of the Miskitus and Ramas, however, most speak Spanish and Creole with only a few elders speaking the Garífuna dialect, which is a combination of African and Amer-

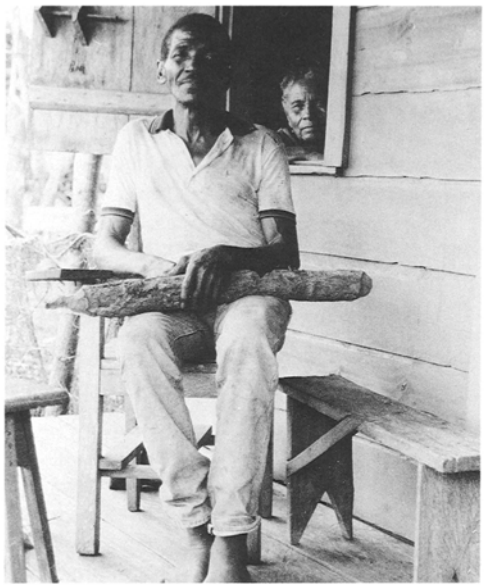

Fig. 3. Garífuna shaman Mr. Aldric Cayasso, a snakebite specialist. The "bitta-wood" (*Quassia amara*, Simarubaceae) he holds is an important component of his snakebite treatment.

indian languages and French, acquired during enslavement on Caribbean sugar plantations (Conzemius 1928; Holm 1978). Much of the culture, including food choices and crops reflect the past alliance of the peoples of eastern Nicaragua, especially the Miskitu, with the British (eastern Nicaragua was under British control during the seventeenth and eighteenth centuries) (Helms 1971; Vilas 1989). The missionary groups of various denominations have had a negative effect on the retention of customs and traditions of the indigenous groups of eastern Nicaragua (Hale and Gordon 1987). They discouraged rituals, such as the "Walagallo," a healing ritual among the Garífuna (who are Christian). In some instances, practitioners were accused of being devils or under control of the devil. Most relevant here, the practice and use of ethnomedicine was discouraged.

Participant Profile

Participants in this study ranged in age from 25 to 69 years old. They were interviewed in their native communities where most have spent all of their lives. Most wear the clothes, and have adopted many other aspects of western culture. Most speak Creole and Spanish, and a few also speak Garífuna.

Those interviewed include four shamans, one shaman apprentice, three midwives, and seven mothers. Of the four shamans, three are general practitioners, providing treatment for common illnesses, and one is a specialist in treating snakebites. (Fig. 3). The shaman apprentice studies with the snakebite specialist. Among the midwives there are two general practitioners and one specialist. The generalists perform routine deliveries, i.e., those without any complications, and the specialist performs abortions and deliveries with complications; stillbirth and breech-birth. Illnesses treated by mothers in the household are usually not life threatening.

Table 1. Food plants of the Garífuna arranged by origin and status.

Origin	Status				Total	%
	Domesticate	Purchased	Semi-domesticate	Wild		
Native to Nicaragua	10	0	3	28	41	44
Introduced	30	8	2	0	40	43
Naturalized	11	0	0	1	12	13
Total	51	8	5	29	93	
%	55	9	5	31		

Plant Sources

The Garífuna utilize wild, semi-domesticates, and domesticated species (Table 1). They obtain plant products from agricultural fields, dooryard gardens, markets ("purchased plants" in Table 1), disturbed sites, and the natural forest. Each of these plant categories and sources plays an important role in providing the Garífuna with the necessary materials for sustenance, well-being, and some income.

Agricultural Fields

Domesticates are the major food and cash sources for the Garífuna. These are grown in agricultural fields known locally in Creole English as "plantations" and in Garífuna as "plantagú." We estimate that at least 70% of plant foods consumed by the Garífuna are obtained from domesticates grown in their own fields. The remaining 30% comes from semi-domesticates, wild plants, and to a small extent, purchased foods. The very heavy rainfall in eastern

Nicaragua makes the forest inaccessible for 6–8 months of the year which enhances Garífuna dependence on their own fields and gardens for staples.

In an effort to determine the relative importance of Garífuna food crops, 10 agricultural fields near the Garífuna village of Orinoco were inventoried. These data are summarized in Table 2 to indicate the estimated area dedicated to the cultivation of each crop. Based on area cultivated, the four most important Garífuna field crops are cassava (80 *Manihot esculenta* [The numbers are a guide to finding the species in the Appendix.]), pineapple (230 *Ananas comosus*), dasheen (217 *Colocasia esculenta*) and beans (112 *Phaseolus vulgaris*). Common names of plants are given in English or Spanish where available; otherwise indigenous names are used. Cassava is the mainstay of Garífuna diet, and pineapple is their most important cash crop. Garífuna field crops are all exotics from both the Old World (OW in which we include Southeast Asia and Pacific Ocean islands) and the New World (NW) tropics introduced into eastern Nicaragua; none is native to this region.

Dooryard Gardens

Dooryard gardens include species transplanted from the wild, domesticates, and semi-domesticates. Some are used for food, others for medicine, ornament, and crafts. Food crops grown in dooryard gardens, and to a lesser extent wild gowing species collected in the forests, function as insurance in the Garífuna food supply. The two most frequently cultivated herbaceous food plants in Garífuna dooryard gardens are dasheen (217) and coco yam (221 *Xanthosoma sagittifolium*), root crops eaten with most meals. Other important dooryard garden food plants include banana (241 *Musa paradisiaca sapientum*), plantain (240 *Musa paradisiaca*), kosko (239 *Musa* sp.), greater yam (235 *Dioscorea trifida*), and coco yam (221). The most frequently cultivated tree is the mango (7 *Mangifera indica*). The two most frequently cultivated shrubs in Garífuna dooryard gardens are annatto (36 *Bixa orellana*) and sorrel (131 *Hibiscus sabdariffa*). Annatto is grown not only for red dye and medicine, but also as a condiment in cooking. Sorrel is cultivated for its red calices used for making a beverage. Growing of field crops in dooryard gardens is a common practice which provides quick and easy access to foodstuffs that otherwise would have to be obtained from distant agricultural fields. Dooryard gardens tended primarily by housewives and children receive a greater labor input per unit area than fields.

To assess the importance of dooryard gardens in the Garífuna food supply system, ownership, number, size, and species composition was determined for 36 gardens in 1992–1993 in the villages of Orinoco, La Fé, and Justo Point. All are privately owned; family and communal ownership no longer exist. Dooryard gardens have greater species diversity (15–35 species in this survey) than agricultural fields (usually about 6–10 species) the excess being semi-domesticates and species transplanted from the wild (e.g., barsley [118 *Ocimum micranthum*], used for spice and medicine).

Some dooryard gardens are specialized in the production of certain food crops for household or local demand or as cash crops. In others, plants are grown strictly for medicinal use. Dooryard gardens owned by shamans have a species composition distinct from those owned by midwives and the general populace. For example, in the dooryard garden of Mr. Aldric Cayasso (Fig. 3), the snakebite specialist, guaco (29 *Mikania cordifolia*), cuntríbo (20 *Aristolochia trilobata*), and bitta tataku (61 *Operculina pteripes*), all used in his snakebite remedy, are grown.

Markets

Garífuna settlements are isolated from urban area markets and the people lack cash. Only 9% of the species used by the Garífuna are purchased from markets (Table 1). The majority of species used for food by the Garífuna are domesticates from agricultural fields or are collected from the forest. The remaining 5% are semi-domesticates growing in disturbed sites. Though the Garífuna purchase only eight species from markets, these species are important because they are the major source of spices and condiments. Seven of the eight species purchased from markets are spices and condiments of OW origins. The long tradition of Garífuna use of OW spices and condiments was probably reinforced by contact with the British who also relied on OW spices. Beyond annatto (36), peppers (192 *Capsicum annuum* var. *glabriusculium,* 193 *Capsicum chinensis,* 194 *Capsicum frutescens*), and vanilla (*Vanilla planifolia*) there

TABLE 2. ESTIMATED AREA DEDICATED TO STAPLE FOODS BY THE GARÍFUNA BASED ON A SURVEY OF 10 AGRICULTURAL FIELDS.

Field No.	Owner	Crops	Area (m^2)
1	Aldric Cayaso	Colocasia esculenta	2,000
		Manihot esculenta	4,000
		Phaseolus vulgaris	3,000
		Xanthosoma sagittifolium	1,000
			Total 10,000
2	Presentación Sambola	Colocasia esculenta	3,000
		Manihot esculenta	6,500
		Musa paadisiaca var. sapientum	2,000
		Musa paradisiaca	2,000
		Phaseolus vulgaris	1,500
		Xanthosoma sagittifolium	2,000
			Total 17,000
3	Alejandro Estrada	Colocasia esculenta	2,000
		Manihot esculenta	4,000
		Musa paradisiaca var. sapientum	1,000
		Phaseolus vulgaris	2,000
		Zea mays	1,000
			Total 10,000
4	Clifford Hebert	Ananas comosus	5,000
		Colocasia esculenta	1,000
		Dioscorea trifida	6,000
		Manihot esculenta	1,500
		Musa paradisiaca var. sapientum	1,500
		Musa paradisiaca	1,000
		Zea mays	1,000
			Total 17,000
5	Ewald Cayaso	Ananas comosus	4,500
		Manihot esculenta	5,500
		Musa paradisiaca var. sapientum	2,500
			Total 12,500
6	Isidro Zenón	Dioscorea trifida	1,500
		Manihot esculenta	5,000
		Musa paradisiaca var. sapientum	2,000
		Phaseolus vulgaris	2,500
		Xanthosoma sagittifolium	1,500
		Zea mays	1,000
			Total 13,500
7	Julio Lopéz	Ananas comosus	5,000
		Colocasia esculenta	2,000
		Manihot esculenta	4,000
		Phaseolus vulgaris	1,500
			Total 12,500
8	Ernesto Sambola	Ananas comosus	15,000
9	Julian Velásquez	Ananas comosus	7,000
		Dioscorea trifida	1,000
		Colocasia esculenta	3,000
		Manihot esculenta	6,000
		Xanthosoma sagittifolium	3,000
			Total 20,000
10	Frank Lopéz	Oryza sativa	5,000

TABLE 3. MEDICINAL PLANTS OF THE GARÍFUNA, ARRANGED BY ORIGIN AND HABIT.

Origin	Habit				Total	%
	Tree	Shrub	Vine	Herb		
Native to Nicaragua	55	21	29	65	170	74
Introduced	19	8	3	12	42	18
Naturalized	5	2	3	7	17	8
Total	79	31	35	84	229	
%	34	14	15	37		

were no widely used Central American species for spices and condiments. Only four species, all obtained from the wild, native to eastern Nicaragua have been documented as being used as spices: barsley (118), culantro (14 *Eryngium foetidum*), ebo (105 *Dipteryx oleifera*), and wild thyme (213 *Tamonea spicata*).

DISTURBED SITES

Species growing in these areas are used primarily for medicine and to a lesser extent for food. The majority are common "weedy" herbaceous species native to eastern Nicaragua, along with a few exotics from both the NW and OW, and are known to most people. Weeds are important in the Garífuna pharmacopoeia of popular medicine, especially in the treatment of common illnesses. Generally the more commonly encountered a plant is, the more use it is given.

FOREST

The Garífuna obtain many essential items such as food, medicine, fiber, and materials for construction and crafts from the forest. Of the 254 plant species listed in Appendix 1, the majority are wild, most are medicinals, and most medicinals are forest trees (Table 3). Forest foods, as noted previously, supplant domesticates when crops fail. Of the 29 wild forest species providing food, the four most important are: hone palm (228 *Elaeis oleifera*), peach palm (223 *Bactris gasipaes*), calalu (160 *Phytolacca rivinoides*), and ebo (105 *Dipteryx oleifera*).

PLANT USE KNOWLEDGE

Garífuna plant use knowledge is determined by two factors: the source of plant material, and age and gender of individuals. The sources of plant materials are very important in determining who within the community is most knowledgeable with regards to their uses for food and medicine. Garífuna women are more knowledgeable than men about species grown in dooryard gardens and weedy species growing in disturbed areas along forest edges and roadsides. Conversely, men are more knowledgeable about field crops and wild plants than women. Older individuals are much more knowledgeable than the young in regards to plant use in general. Among both older and younger individuals, females are much more knowledgeable than males regarding plant use for food and medicine. Females are the primary health care providers in the household, and are thus taught from a very young age how to collect, prepare, and use medicinals for treating common illnesses. Gender-based plant use knowledge is also noticeable among the practitioners. The majority of shamans treat general illnesses afflicting both males and females, and a few specialize in snakebites and treatment of spiritual illnesses of both sexes and all ages. On the other hand, midwives specialize in pregnancy, childbirth, and female disorders (e.g., menstrual problems).

PLANT PROCESSING

The majority of plant materials used by the Garífuna for food and medicine must undergo some type of processing to prolong storage life and/or to make them edible or usable. Preservation of foodstuffs and medicinals is a major concern to the Garífuna. A great deal of effort is put into this endeavor, unfortunately with very little success. Spoilage is due primarily to fungal infestations.

The Garífuna process plant materials by dehydration, frying, boiling, roasting, toasting, and parching. Dehydration, (simply drying in the open air) is the most popular method. Preserving foods by dehydration with sunlight is limited to four months of the year (February–May) because of the heavy rainfall in the other months. During the rainy season plant-materials are dried by placing them next to or over a fire hearth. Frying is the second most popular method of processing foods, a method made easier by the availability of vegetable oil (many palm species), and the rapidity with which foods cook when fried.

Boiling is the third most frequent method of processing plant materials, and is used widely for preparation, not for preservation. Some root

TABLE 4. PLANTS USED BY THE GARÍFUNA ARRANGED BY TAXONOMIC RANK AND USE CATEGORY.

	Food	Medicinal	Other	Total
Families	44	71	42	75
Genera	73	175	82	193
Species	93	229	94	254

crops and grains, such as cassava (80) and maize (252), are roasted over small earthen fire hearths. Foods prepared in this manner are consumed immediately after roasting or stored for only a short time. With toasting, high temperatures are also employed but the plant material does not come in contact with the fire, but instead is heated on large metal sheets or in large metal caldrons. Like boiling and roasting, toasting is used primarily for preparing foodstuffs for short term storage. In parching the plant material is processed longer than toasting to obtain more thorough dehydration. Parched foods may also be ground into flour for long term storage.

USE OF PLANT MATERIALS

The Garífuna rely on a diverse group of plants for sustenance and well being: 254 species (Appendix 1) (see also Coe 1994) distributed among 193 genera and 75 families (Table 4). We group these species into seven use categories: food, beverage, fuel, construction and crafts, dyes and tannins, poison, and medicinals. Obviously, many species are employed in more than one way.

FOODS

The Garífuna use 93 species for food. Fifty-one are domesticates, another 30 are collected from the wild (Table 1). Of the 51 domesticates, 14 are native to the NW tropics, 21 from the OW tropics, and the remaining 16 come from nontropical areas of either the NW or OW (Table 5). Only three species are native to Mesoamerica. Staple foods are obtained from introduced species of the NW and OW tropics (Table 5)—none is native to eastern Nicaragua. The most important staple foods are seven introduced domesticates distributed among five families. In order of importance, they are: cassava (80-NW), beans (112-NW), rice (248 *Oryza sativa*-OW), dasheen (217-OW), coconut (226-OW)], coco yam (221-NW), and maize (252-NW). The main staples of their diet (with the exception of cassava) are food plants of the OW tropics (e.g., banana (241), breadfruit (145 *Artocarpus altilis*), dasheen (217).

Of the 44 families to which food plants belong (Table 4), the most important in terms of the number of species used is the Fabaceae (Table 6). The most important species of this family is the common bean (112), which, together with root crops, provide the mainstay of the Garífuna diet. The remaining eight food plants of the Fabaceae are minor and are used only as snack or famine foods. In terms of per capita consumption, availability, cultural importance (used as festival and ritual food), and as a cash source, the Euphorbiaceae is by far the most important plant family to the Garífuna. In this family as well, the high ranking derives from a single species, cassava (80). Conversely, even though a large number of species of a family are utilized, that does not imply that the family is particularly important.

Two other important families are the Brome-

TABLE 5. FOOD PLANTS OF THE GARÍFUNA ARRANGED BY GEOGRAPHICAL ORIGIN AND STATUS.

			Status			
Origin	Domesticate	Purchased	Semi-domesticate	Wild	Total	%
New World Tropics	14	—	—	23	40	43
Old World Tropics	21	5	5	1	27	29
South America	4	2	2	—	7	8
Caribbean	4	—	—	2	7	8
Mesoamerica	3	—	—	3	6	6
Asia	3	—	—	—	3	3
Africa	1	1	1	—	2	2
Pantropical	1	—	—	—	1	1
Total	51	8	8	29	93	
%	55	9	9	31		

TABLE 6. MOST IMPORTANT PLANT FAMILIES OF THE GARÍFUNA IN TERMS OF NUMBER OF SPECIES USED.

Family	Food	Medicine	Other	Total
Fabaceae	9	27	9	45
Arecaceae	5	9	7	21
Poaceae	4	9	7	20
Solanaceae	5	11	2	18
Euphorbiaceae	2	11	4	17
Malvaceae	2	7	5	14
Asteraceae	—	11	—	11
Rubiaceae	2	8	1	11
Malpighiaceae	1	6	2	9
Rutaceae	5	4	0	9
Verbenaceae	2	5	2	9
Piperaceae	2	6	0	8

liaceae and Arecaceae, the former for the wide use of pineapple (230)—including use as one of the very few cash crops. In contrast, many palm species are important sources of food and fodder. The most important palm for the Garífuna is the coconut (226), but other species are widely used too: hone palm (228), African oil palm (227), and peach palm (223). Coconut endosperm is used for food, fodder, and as a source of cooking oil. Although the Poaceae, worldwide, is the most important plant family to humans as a food source (Heiser 1990), among the Garífuna it ranks third both in number of species utilized as a food source and overall species use (Table 6). Rice (248) is by far the most important cereal, with maize (252) a distant second. Rice is grown mostly for household and local consumption, although surpluses are sold in regional markets. Maize on the other hand is cultivated primarily for making "chicha" (a beverage made by fermenting partially chewed corn, sugar, and water), locally called "Kususa," and to a lesser extent for forage and fodder. Maize never gained the overwhelming acceptance among the indigenous groups of eastern Nicaragua that it did elsewhere in Nicaragua. It was and still is identified with Spanish culture; it was the crop of the "intruders" or "invaders" (Conzemius 1928; Helms 1971; Roberts 1827). Many other food crops introduced into the Caribbean and eventually to eastern Nicaragua by the British gained overwhelming acceptance (e.g., breadfruit [145] and dasheen [217]) probably because the British were perceived by the indigenous groups as friends and trading partners.

Species of the Solanaceae, though second in number utilized for food and fourth in overall species use (Table 6), are most important as flavorings. The Rutaceae has the same ranking as the Solanaceae in number of species used for food, and is seventh in overall species use (Table 6). Its importance derives almost entirely from the citruses (grapefruit [180 *Citrus paradisi*], lime [178 *Citrus aurantifolia*], orange [182 *Citrus sinensis*], sour orange [179 *Citrus aurantium*], and tangerine [181 *Citrus reticulata*]) which, although seasonal, provide much needed vitamins and minerals in the Garífuna diet. Among food plants, the citruses are also one of the more important cash crops. Many people have small groves of grapefruit, lime, orange, and tangerine; the surpluses of these crops are sold in regional markets.

Seasonal foods provide needed food during the time between harvest of field crops and other staple foods. In addition, they are often good sources of vitamins and minerals. The majority of seasonal foods are fruits obtained from dooryard gardens and, to a lesser extent, from the wild. Two of the most frequently encountered seasonal foods of NW origin are mamee (186 *Pouteria sapota*) and neesberry (185 *Manilkara zapota*). Among seasonal foods of OW origin, the most widely distributed are citruses, but others like the Ethiopian apple (154 *Syzygium malaccensis*) and mango (7 *Mangifera indica*) are important.

In addition to the use of food plants in a purely dietary sense for daily sustenance, many of the same species play an important role in Garífuna festivals and rituals. Such foods are served at festivals and during rituals. Among the most frequently used are cassava (80) (the most important), rice (248), beans (112), dasheen (217), and coco yam (221).

In years when crop yields are low because of pests, diseases, and/or adverse climatic conditions, the Garífuna utilize other food sources. The majority of famine foods are from wild species native to eastern Nicaragua and include leaves, seeds, roots, and fruits. Some of the most frequently encountered are: calalu (160 *Phytolacca rivinoides*) leaves eaten as a pot herb and very rich in vitamin C; bull foot (166 *Piper peltatum*) leaves, that are used as pot herb and are rich in vitamin C and minerals; ebo (105) seeds

prized as a source of food and aromatic oil; provision (39 *Pachira aquatica*) seeds toasted and eaten; hone palm (228 *Elaeis oleifera*) fruit pulp eaten as food and the seeds are a source of cooking oil; and chinchin banana (218 *Montrichardia arborescens*) fruit pulp eaten boiled or toasted.

Beverages

Although the Garífuna have access to western beverages (alcoholic and non-alcoholic), they prefer traditional drinks. Traditional beverages are readily available and cost almost nothing. The two most popular alcoholic beverages among the Garífuna are *Kususa* and *Hui.* The latter is made from grated cassava (80). Both *Kususa* and *Hui* are used during festivities, rituals, and healing ceremonies. Both fermented and non-fermented beverages are made from the juice of orange (182), pineapple (230), sugarcane (251 *Saccharum officinarum*), coyol palm (224 *Bactris major*), and cashew (6 *Anacardium occidentale*) pedicels. Other non-alcoholic beverages are made from soursop (11 *Annona muricata*) pulp mixed with milk and sugar, and tamarind (114 *Tamarindus indica*), seed pulp which is used to make a very popular summer drink with reputed cooling, digestive, and purgative properties. Also popular is the ebo bean (105) used to make one of the oldest beverages—ebo—in eastern Nicaragua (Roberts 1827). The presence of the glycoside coumarin gives ebo its aroma and flavor (Tyler, Brady, and Robbers 1985). The aromatic oil from this plant is used not only as a spice, but is also highly regarded for its medicinal properties. A beverage made from the seed pulp of peach palm (223) and hone palm (228) is consumed mostly during times of crop failure. Popular holiday drinks are made from sorrel (131) and ginger (254 *Zingiber officinale*). Other non-alcoholic beverages are seasonal and are made from such fruits as watermelon (63 *Citrullus lanatus*), papaya (46 *Carica papaya*), and granadilla (158 *Passiflora quadrangularis*). Some of the most popular non-alcoholic beverages are served warm, including cacao (204 *Theobroma cacao*), a tea made from feva grass (244 *Cymbopogon citratus*), barsely (118), cow foot (163), and coffee (174 *Coffea arabica*).

Fuel

Twelve species of trees are used for fuel for processing, preserving, and cooking. According to the Garífuna, the species with the best burning qualities is ebo (105) which is used in the making of sugar, distillation of alcohol, frying, and preservation of foods. Because of their abundance in this low coastal region, mangroves are the most widely used firewood. The most widely used species for household cooking and burning of trash are pigeon bush (111 *Pentaclethra macroloba*), provision (39), black mangrove (208 *Avicennia germinans*), white mangrove (55 *Laguncularia racemosa*), and red mangrove (169 *Rhizophora mangle*). For cooking, the preferred firewood species are those that do not produce thick smoke but have good burning qualities. In addition to the above fuel plants, other tree species used for household cooking include locust (107), higo (146), and toc toc (57).

Construction and Crafts

The Garífuna rely greatly on western building techniques and materials for the construction of homes and boats. However, some dwellings and other structures are still built in the traditional way. Some 68 species were documented as being used in construction and crafts, most for house and boat construction. The major supports for homes such as corner poles and roof support poles are made of the hard, durable wood of the ebo tree. Other prominent species used are: nancitón (75 *Hyeronima alchorneoides*), sambogum (53), santa maría (51 *Calophyllum brasiliense*), samwood (40 *Cordia alliodora*), and Spanish cedar (142 *Cedrela odorata*). Roofs are thatched with a variety of palm leaves, the most important being saw cabbage palm (222 *Acoelorraphe wrightii*). Sometimes entire roofs are thatched solely with these leaves. More frequently, however, the leaves of one or more species of palms such as cola de pavo (225 *Calyptrogene ghiesbreghtiana*) and silícu (229 *Raphia taedigera*) are employed. It is common to find roofs thatched with leaves from palms that are primarily used for food, such as coconut (226), African oil palm (227), and hone palm (228). Increasingly homes have roofs over the main living area made entirely or partly from galvanized steel sheeting but thatch is still used to roof the detached kitchen, known in Garífuna as the "debacé." Roof thatch on kitchens is preferred because it is much cooler and allows better dissipation of heat and smoke. Thatch roofs are also

much quieter than sheet metal stock during rain storms.

The house framework and roof thatch are frequently held together with cordage made from the fibrous inner bark of: trumpet (48 *Cecropia peltata*), balsa (38 *Ochroma pyramidale*), and mohoe (132 *Hibiscus tiliaceus*). Other species used to a lesser extent for securing the house frame are cuntríbo (20 *Aristolochia trilobata*) and yájal (70 *Davilla kunthii*).

The sides of Garífuna homes are completely closed with vertical or horizontally spaced stems of palm, split wood, sawed lumber, or palm leaves. In the case of construction with palm, longitudinally split lengths or entire stems of saw cabbage palm (222) are most frequently used. The same species is used similarly in the construction of storage sheds, fences, and sties. It is not uncommon to find an entire house made from saw cabbage palm. Furniture is sparse: chairs, tables, and bed frames are made from Spanish cedar (142), samwood (40), banak (148 *Virola koschnyi*), saba (141 *Carapa guianensis*), pine (5 *Pinus caribaea*), mahogany (143 *Swietenia macrophylla*), santa maría (51), and sambogum (53). Mattresses and pillows are made from fibers obtained from the fruits of ceiba (37). Household utensils include industrial and traditional materials: rosewood (97 *Dalbergia brownei,* 98 *D. hypoleuca,* 99 *D. tucurensis*), ebo (105), pine (5), santa maría (51), Spanish cedar (142), mahogany (143), and saba (141). The whole plant of broom weed (136 *Sida rhombifolia*) and the rachis of the inflorescence of coconut (226), peach palm (223), and saw cabbage palm (222) are used as brooms. The sheath covering the spathe of the coconut (226) inflorescence is used as a strainer, and the exocarp is used as a scouring pad for scrubbing kitchen utensils and floors. Present in every household is a mortar usually carved out of ebo logs or other hard wood and used for grinding grains and food preparation.

Drinking gourds are always present and are made from split and hollowed-out fruits of tree-calabash (34 *Crescentia cujete*). Most kitchen utensils, especially vessels for holding liquids, are imported and are obtained as gifts or purchased in regional markets. Traditional cooking utensils made from bamboo (242 *Bambusa vulgaris*) and rosewood (97, 98, 99) are mostly replaced by aluminum and iron pots.

The most common means of transportation in eastern Nicaragua is the dugout canoe carved from mahogany (143), Spanish cedar (142), nancitón (75), saba (141), banak (148), ceiba (37), or santa maría (51). Nancitón is preferred for its resistance to rot and marine borers or barnacles. Spanish cedar and mahogany are lighter but less resistant to rot and marine borers.

The Garífuna supplement their income by making wood carvings, guitars, wooden suitcases, and other crafts. This is usually done during the rainy season when there is less fishing and agriculture. The carvings for the most part are fashioned from rosewood (97, 98, 99), Spanish cedar, mahogany, and samwood (40) for sale locally to visitors or in regional markets.

Dyes and Tannins

Annatto (36) is the only natural dye that remains in use. It is used mostly for coloring of foods, amulets, and clothing during rituals. Tannins are obtained from the bark of red mangrove (169), buttonwood (54 *Conocarpus erectus*), and black mangrove (208) and are used primarily for the curing of hides into leather.

Poison

Garífuna interviewees indicated three species as being useful as poison. In most cases, the poisons are used for controlling nuisance wild animals (e.g., anteaters, rodents) and domesticated animals (e.g., hogs, dogs). The fruits or seeds of "turtle egg" (200), used alone or mixed with commercial poisons, are used primarily for controlling rodents and cockroaches. The seeds of castor bean (83 *Ricinus communis*) and the sap of ámali (17 *Odontadenia puncticulosa*) mixed into foodstuffs are used for poisoning nuisance animals.

Medicinals

The Garífuna herbal pharmacopoeia consists of 229 species (Appendix 1) (Table 3). The majority of these medicinals (74%) are native to eastern Nicaragua (Table 3). We suggest that the high number of native species in the pharacopoeia may result from several factors. First, native species have long been in the area, allowing more time for empirical testing of medicinal properties. Second, the majority of exotics are of fairly recent introduction and the Garífuna are isolated from major population centers where the exotics are more likely to be found. Third, Garífuna believe that wild species have greater

TABLE 7. MEDICINAL PLANTS PARTS USED BY THE GARÍFUNA. TABULATED FROM COLUMN 5 OF APPENDIX.

Parts used	Total
Leaf	158
Bark	53
Root	43
Fruit	39
Sap	18
Stem	18
Seed	17
Flower	3

TABLE 8. MODE OF PREPARATION OF GARÍFUNA MEDICINAL PLANTS. TABULATED FROM CITATIONS IN COLUMN 6 OF APPENDIX.

Mode	Total
Decoction	201
Poultice	45
Infusion	23
Juice	21
None	11
Bath	5
Syrup	2

healing properties than their domesticated counterparts. Finally, the Garífuna are newcomers to eastern Nicaragua and they learned the local ethnomedicinal lore very quickly from their Miskitu neighbors, a people who have been in this region for centuries.

About one third (37%) of medicinals are herbs, and another third (34%) are trees (Table 3). Herbs are common medicinals because they are weedy species that are frequently encountered, and the Garífuna believe that the more abundant a plant is the more medicinal virtues it possesses (Coe, pers. obs. 1992). Further, there may be differences in the quantity of bioactive compounds. If herbs in the region are subject to greater predation they may have higher levels of bioactive compounds. The high percentage of tree species utilized for medicinal purposes is probably due to the high incidence of diarrheal illnesses in eastern Nicaragua. Astringents are the most frequently used treatment for diarrhea (Lewis and Elvin-Lewis 1977; Tyler, Brady, and Robbers 1985), and tannins are one of the most widely used astringents. Tannins are effective astringents because they precipitate and combine with proteins, rendering them resistant to proteolytic enzymes. When applied to living tissues, this astringent action forms the basis for the therapeutic application of tannins (Tyler, Brady, and Robbers 1985). Some of the best sources of tannins are tree bark, stems, leaves, and fruits.

Where plants grow is important, because practitioners will use those most readily available. As shown in Table 3, 74% of Garífuna medicinal plants are native to Nicaragua. There are often several medicinals used for treatment of common illnesses. Therefore, when a given species is not available, another with similar healing properties is substituted for it. This does not imply that the bioactive compounds are the same for both species, only that they presumbly have similar effects.

Deforestation threatens the availability of certain medicinal species that are found only in the forest and are used for treating serious illnesses. Some important medicinal species have become very difficult to obtain (e.g., antidote bush [65 *Fevillea cordifolia*], bitta-wood [190 *Quassia amara*] [Fig. 3], cuntríbo [20], and quina [173 *Cinchona pubescens*]). As expressed by Mr. Aldric Cayasso (Fig. 3), the local snakebite specialist, 20 years ago most of the medicinal plants he used were found within 15–20 minutes from the village. Today, he must travel 2-3 days up river by canoe or spend the same amount of time walking in the forest to find treatment ingredients.

Use of Medicinals

The most frequently utilized plant part is the leaf, followed by the bark (Table 7). Likely the preference for leaves and bark derives from the fact that therein many species store high concentrations of bioactive compounds (Moore 1994; Robinson 1974; Tyler, Brady, and Robbers 1985). In addition to efficacy, other factors that may contribute to the preference of leaves for medicinals are the ease with which they may be collected, stored, and transported and the ease with which bioactive compounds may be extracted.

The most frequently cited modes of preparation (Table 8) were: decoctions (boiling of plant parts), poultice (mashed, crushed, or chopped plant part), infusions (steeping plant parts in hot water), juice (extract of any plant part), bath (plant parts are placed in hot water or boiled

TABLE 9. MODE OF ADMINISTRATION OF MEDICINAL PREPARATIONS BY THE GARÍFUNA. TABULATED FROM COLUMN 7 OF APPENDIX.

Mode	Total
Oral	200
Topical	93
Bath	11
Inhalation	1

until steam is obtained), and syrup (plant part boiled to a thick paste). Materials prepared as decoctions or poultices are mixed with a variety of foods, spices, pharmacological agents, or even petroleum products.

The most frequently encountered modes of administration are oral and topical (Table 9) which may be preferred because they are believed to be the most effective means for delivering bioactive compounds into the body.

Comparisons of Folk Use with Known Chemical Constituents

Nearly 60 percent of the medicinal species used by the Garífuna were also recorded in Duke (1972, 1994), and Morton (1981) as having similar medicinal uses. For some ailments, there is complete overlap: e.g., all 10 species used to treat malaria, the 20 species that treat diarrhea, and the 10 used during childbirth were cited. There is a good deal of overlap in the species used as medicinals by the Garífuna and other groups in eastern Nicaragua (Coe and Anderson, in prep.); this may also be a verification of their efficacy.

About 70% of the 229 medicinals used by the Garífuna have at least one bioactive principle identified in our survey (Coe and Anderson, in prep.) and other surveys (Cambie and Ash 1994; Duke 1994; García-Barriga 1992; Hegnauer 1962, 1963, 1964, 1966, 1973, 1986, 1989, 1990, 1992; Morton 1981, 1987; Tyler, Brady, and Robbers 1985; Willaman and Hui-Lin Li 1970; Willaman and Schubert 1961). Alkaloids are the most abundant (62%) bioactive compounds; 42% were reported in the literature and 20% reported in our survey (Coe and Anderson, in prep.) (Appendix 1). Also present, even though to a much lesser extent (5%), are glycosides. The remaining 30% are not known to contain any bioactive compound.

ETHNOMEDICINE

The process of curing among the Garífuna involves accessing both traditional and western healing systems. Generally the Garífuna rely mostly on traditional medicine for primary health care; they seek "western" medicine only when traditional systems have been exhausted. Traditional medicine consists of popular medicine and folk medicine. Popular medicine is practiced by the general populace for treating common illnesses (e.g., cold and fever). Folk medicine, practiced by specialists and midwives, is used for treating illnesses perceived to be more serious (e.g., malaria). Traditional medicine is preferred because it is readily available, inexpensive, trusted, effective, and "natural." It is natural in the sense that local materials (plant and animal) are used and treatment takes place in familiar surroundings (e.g., household or village).

CAUSES OF ILLNESS

The Garífuna believe that there are two causes of illness, natural and supernatural. Natural causes of illness are of physical and organic origin, and include common illnesses such as colds, diarrhea, fever, and pains. Natural illnesses are treated by folk practitioners (shamans and midwives) and popular medicine practitioners (general populace). The Garífuna believe that most natural illness are the result of humoral imbalance. This belief system is presumably derived from the Hippocratic humoral theories of disease brought to the western hemisphere by the Spanish and Portuguese in the sixteenth and seventeenth centuries (Harwood 1971). According to the Hippocratic theory, the bodily humors (blood, phlegm, black bile, and yellow bile) vary in both temperature and moistness (Harwood 1971). The Garífuna believe that certain foods and medicines have "hot" and "cold" properties associated with them. For example hot foods (e.g., beans, seafood, game, and sea turtle) are prohibited during treatment of hot illnesses. Most herbal remedies are considered by the Garífuna to be cold, whereas western pharmaceuticals are hot.

Supernatural illnesses, believed to be caused by spirits, are treated exclusively by shamans specializing in spiritual healing. For example, the Garífuna believe that ancestral spirits will cause harm to anyone who behaves "improper-

ly" (e.g., theft, adultery). The offender becomes ill due to possession by an ancestral spirit and will recover only when the spirit is appeased. This is accomplished by performing the Walagallo ceremony, a three day event in which offerings of food, rum, and animal sacrifices are made, combined with dancing and singing (Coe and Anderson, in prep.).

Traditional Medicine

Government sources (MINSA/RAAS 1988) estimate that 70% of the population living in rural areas in eastern Nicaragua are cared for by traditional medicine.

Popular Medicine

Curing with popular medicine is performed mostly by women who are the primary health care providers in the household. Materials used in popular medicine include herbal remedies, minerals, and pharmaceutical products. This type of medicine does not include rituals as part of the healing process. We estimate that popular medicine might account for over one half of medical treatment among the Garífuna.

Folk Medicine

Folk medicine is widely accepted and might account for about one third of medical treatment among the Garífuna (Roberto Hodgson, pers. comm., 1992). It includes the use of herbal remedies and rituals such as the Walagallo and Obeah, and, as such, knowledge is restricted to a few individuals. Treatment of illnesses with folk medicine is based on a holistic approach to curing, addressing both the spiritual and physical needs of the patient. Curing consists of two phases: a period of observation followed by actual treatment of the illness. The observation phase consists of preparing the patient to understand the social and personal meanings of the curing experience. Treatment of illness involves using plant remedies alone or in combination with animal or mineral materials, western pharmaceuticals, and with ritual use of hands and objects. In the case of illnesses believed to be brought on by spirits, treatment consists mostly of manipulation and rituals. The whole curing process takes place within a well understood cultural context. For successful treatment, most practitioners require patients to undergo a period of observation, the patient staying in the practitioner's household for 2–3 days prior to the beginning of treatment. According to practitioners, this period of observation is needed because it enables them to become more acquainted with the patient, it provides a controlled setting for the patient prior to treatment, and it helps the practitioner determine the cause of the illness and the course of treatment. In some instances practitioners will refuse to treat individuals they know to be terminally ill because they are concerned about their reputations as healers. Practitioners are aware that upon accepting a patient the focus is placed on them and their abilities to treat and cure the illness. When a patient does not recover or dies, very little consideration, if any, is given to the type and severity of the illness causing the death.

Western Medicine

Curing with western medicine is relatively new to the Garífuna in comparison with the Miskitu. In 1935 Moravian missionaries built the first rural hospital in northeastern Nicaragua in Bilwaskarma, a Miskitu village (Wenger 1945). This was the first opportunity for regular contact with western medicine by indigenous groups in the region (Wenger 1945). However, not until 1960 did western medicine become available to the Garífuna in the Pearl Lagoon area (Hodgson 1967). In the 1980s western medicine became readily available because of a campaign by the national government to provide primary health care to all Nicaraguans (Bossert 1981). Even though the campaign included traditional medicine, the main focus was on western medicine. Health clinics were established in villages, or health teams made monthly visits to villages. Today that has changed. More recently, most people of rural areas, particularly eastern Nicaragua, have returned to traditional medicine as the main source of primary health care partly because changes in government health care policies limit western medicine to larger cities and towns.

Though they prefer traditional medicine, the Garífuna will use other types of treatment if necessary. It is not uncommon for them to resort to all three types of treatment (popular, folk, and western medicine) to help a patient recover. Generally illnesses are treated first in the household with home remedies (popular medicine). With no improvement, the care of a folk medicine practitioner (shaman or midwife) is sought,

and, as a last recourse, western medicine is utilized.

Presently, the only contacts the Garífuna have with western medicine are through infrequent visits by a physician and dentist from the Ministry of Health. In contrast, traditional healers can be found in almost all communities. In most cases patients give preference to practitioners of their own ethnic background unless a "specialist" (e.g., snakebites) is required. Most healers practice out of their homes and will attend patients only in the afternoon after tending the fields or returning from hunting or fishing. With the exception of emergencies (e.g., childbirth), practitioners seldom make house calls.

Comparisons and Interaction: Traditional and Western Medicine

Although traditional medicine and western medicine have different views and approaches to the causes and cures of illnesses, they can coexist in the Garífuna health care system because of the clear demarcation of illnesses treated by each system. Traditional medicine is used primarily to treat common problems (e.g., cold, fever); western medicine is used for life- threatening or unusual conditions (e.g., appendicitis, broken bones), except snakebites. For snakebites traditional medicine is preferred. The Garífuna, as do most people in rural eastern Nicaragua, believe that shamans provide better care for snakebite victims than doctors trained in western medicine (Coe and Anderson, in prep.).

Garífuna traditional healers sometimes combine western remedies with traditional herbal remedies to treat illnesses. One of us (Coe) watched a shaman prepare a pain medicine made up of tree of life (62), purple grass (233), malva mulata (133), and soursop (11), to which rubbing alcohol and aspirin were added. In another case, a shaman added sulfa tablets to a decoction made from sorosí (68 *Momordica charantia*) (Fig. 4) and quina (173). Sorosí is so widely used in medical treatments it is considered a "Cure All." Herbal remedies are often mixed with a variety of substances including spices like cinnamon (119), cloves (153), and nutmeg (147); pharmacological agents such as rubbing alcohol, Menticol®, Agua Florida®, Zepol®, Vicks®, and asafoetida; and petroleum products such as kerosene, diesel, and transformer oil; and petroleum gel and heavy grease.

When a traditional healer can no longer help a patient, a referral is made to western medicine. Conversely, patients after unsuccessful treatment with western medicine turn to traditional medicine. The interaction between traditional healing and western medicine is not formalized, but is based on necessity and is founded on the removal of barriers, mostly skepticism, that once existed between them. Traditional healers were afraid of losing their status as primary health care providers. This apprehension was addressed by a national health campaign conducted by the Ministry of Health that, in spite of promoting western medicine, recognized traditional medicine and its practitioners to be vital components of the national health care system. In an effort to elevate the status of traditional healers to a level comparable with certain western trained practitioners, some traditional healers were trained and certified in basic first aid by the Ministry of Health (Ellsberg 1982; MINSA/RAAS 1988, 1989, 1990).

Traditional medicine too has areas of specialization where practitioners undergo extensive training. The amount of time required for training depends on the specialization. In some instances apprenticeship can last for 20 years or until the shaman dies. The recognition by western practitioners that traditional practitioners undergo extensive training has contributed greatly to improve the status of traditional medicine.

Ethnomedical Practitioners

Usually they obtain their lengthy apprenticeship in herbal training early in their lives and practice their skill until they die. Most practitioners collect their own medicinals to be assured that they have the right materials. When they are too old to collect, they rely on relatives or apprentices to collect for them. This is an important part of an apprentice's training. Most apprentices will not practice in the same community as their teachers, in part due to respect, but also to avoid situations where the authority of the teacher may be challenged by the apprentice. Some practitioners who wish to keep their knowledge a secret from others swear the apprentices or relatives to secrecy, even teaching them how to grind plant material so finely that no one can recognize it.

Role of Folk Medicine Practitioners

In addition to their duties as health care providers, Garífuna traditional healers are the care-

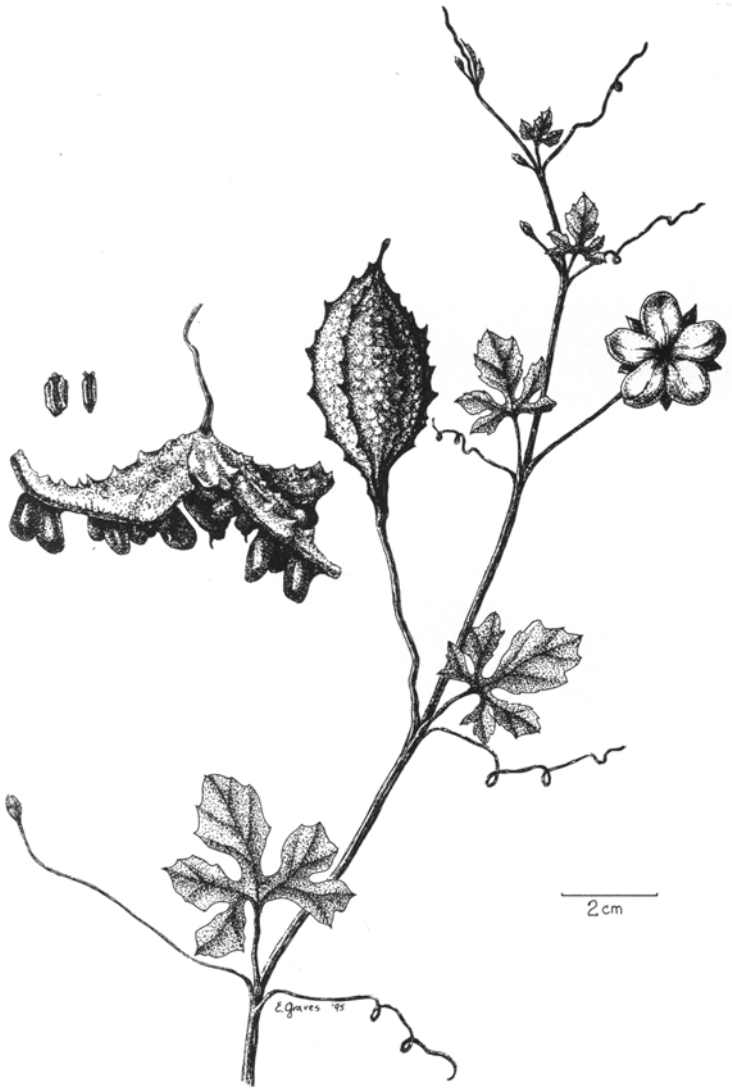

Fig. 4. Sorosí, (*Momordica charantia,* Cucurbitaceae), the most widely used medicinal plant, especially the leaves, in the Garífuna pharmacopoeia.

takers of cultural traditions. These healers represent the link between the past and the present. They are responsible for the continuum of cultural values and practices, as demonstrated by their role in healing ceremonies such as the Walagallo. They are sources of wisdom and guidance during difficult times because it is believed that they are able to communicate with ancestral spirits. Traditional healers are also figures of authority who help keep order within the communities. However, since the arrival of missionaries, traders, miners, and loggers, the authority of the traditional Garífuna healers has greatly diminished as is true of other indigenous groups (Bell 1989; Helms 1971; Roberts 1827).

Shamans

Garífuna shamans or Búyeigu are widely respected for their abilities to treat illnesses and communicate with ancestral spirits. Sometimes they are called obeah men or bush doctor, depending on the type of illness they specialize in treating. Generally a bush doctor treats bodily and physiological illness (natural illnesses),

whereas the Obeah Man treats ailments that are believed to be caused by evil spirits (supernatural illnesses). Some shamans also specialize in the treatment of snakebites (Fig. 3). The only Garífuna shamans still active live in the villages of Orinoco and Marshall Point.

Midwives

Garífuna midwives (Partera) treat illnesses considered to be brought on by natural causes. In contrast to shamans, who provide the bulk of primary health care among the Garífuna, midwive's practices are restricted to childbirth, health care of infants, and treatment of female disorders. The duties of midwives are equivalent to those of an obstetrician, gynecologist, and pediatrician in western society medical practice. The midwife's responsibilities do not begin with pregnancy and end with childbirth. In most instances both mother and female children will remain under the midwife's care throughout their lives for treatment of female disorders. Once males reach puberty, it becomes the responsibility of the shamans to provide for their well being. There are no strict rules to this practice and it may vary from community to community.

Midwives perform most deliveries in their communities, except in cases of emergencies or complications, when villagers are taken to larger communities for treatment by western-trained practitioners. In most communities there is at least one midwife.

Popular Medicine Practitioners

Popular medicine is practiced by the general populace and is used to treat common illnesses. The majority of popular medicine practitioners are females, because they are in charge of providing primary health care to all members of the household.

Interaction and Constancy of Medicinal Plant Use

Garífuna medicinal plants represent a combination of native and introduced plant species. There is a system of exchange of plant materials and plant use knowledge between the Garífuna the Miskitu, Sumu, and Rama of eastern Nicaragua. These exchanges are the result of a quasi-referral system among shamans and midwives of different indigenous groups (indirect exchange), and access to the same plant resources and proximity of settlements to each other, e.g., Miskitu and Garífuna (direct exchange). This interchange of plants is reflected in the common names of several species used by the Garífuna that are very similar in Creole, Miskitu, Sumu, or Spanish (Appendix 1) (see also Coe 1994). However, the use of a few species is restricted to particular groups; only seven medicinal species are restricted to the Garífuna alone (Coe and Anderson, in prep.).

Garífuna folk medicine practitioners share medicinal plant use knowledge among themselves and also with practitioners of other indigenous groups. However, they do not share it with the general populace. Medicinal knowledge is considered a gift from the ancestral spirits that should be kept a secret among practitioners who believe that if they divulge this information to the general populace their healing powers will be lost. It may also give them a certain authority or status within the community that otherwise would be lost once their herbal expertise was not needed. Similar observations regarding plant use knowledge were made by Bhat, Etejere, and Oladipo (1990) in rural communities in the state of Kwara in central Nigeria.

Medicinal species used for the treatment of illnesses are in most cases the same among all practitioners, with the exception of life threatening illnesses and traumas (e.g., snakebites). In the treatment of snakebites, practitioners have personal preferences for certain species and the manner in which they are prepared and administered.

Traditional Modes of Treatment

Representative modes of herbal treatments are illustrated below by references to typical illnesses or conditions.

Infectious and Parasitic Diseases

One of the most common and dangerous diseases afflicting the Garífuna and other indigenous groups in eastern Nicaragua is malaria. Virtually everyone is familiar with its symptoms, and since it has afflicted the populace for so long, most people detect it early on and seek treatment. In most cases it is treated with a combination of herbal and western remedies.

Eleven species in eight families are used by the Garífuna to treat malaria. The most widely used remedy is a decoction made from the wood of bitta-wood (190) (Fig. 3) or the leaves of jackass-bitters (30 *Neurolaena lobata*). Other

decoctions used for treatment of malaria are made from leaves of sorosí (68) (Fig. 4), quina (173), guava (152 *Psidium guajava*), and wild rice (189 *Scoparia dulcis*). The Garífuna living in the village of La Fé also utilize decoctions made from roots of strong back (101 *Desmodium barbatum,* 102 *Desmodium canum,* 103 *Desmodium triflorum*), lime (178), and piss-a-bed (92 *Cassia occidentalis*). Of these, quina or quinine of the genus *Cinchona* is a proven remedy for treatment of malaria (Tyler, Brady, and Robbers 1985). Perhaps based on the example of the bitter taste of *Cinchona* and other western drugs, the Garífuna utilize any plants that are bitter tasting for treatment.

A variety of herbal remedies and western pharmaceuticals are used to treat fevers. The most common treatment consists of making a decoction from leaves of feva grass (244), honey, and lime juice (178). The patient is usually wrapped in heavy blankets to promote sweating and break the fever. In other instances a hot bath made from the leaves of cow foot (163) or bull foot (166) and from spanish ela (165 *Piper jacquemontianum*) is utilized. The efficacy of these species may derive from their alkaloid(s), essential oils, and other bioactive compounds. To promote sweating, a tea or broth made from bird pepper (194 *Capsicum frutescens*) is drunk. Other remedies include decoctions made from sorosí (68), jackass-bitters (30), bitta-wood (190), and sleepy bush (109 *Mimosa pudica*).

Disorders of the respiratory tract are very common. Treatments include: a decoction made from leaves and roots of john charles (117 *Hyptis verticillata*); boiling to a syrup the contents of the pods of stinking toe (91 *Cassia grandis*); juice from crushed leaves or a decoction made from leaves and roots of vorvine (211 *Stachytarpheta cayennensis* or 212 *S. jamaicensis*); juice from crushed leaves of tree of life (62 *Kalanchoe pinnata*); pulp juice from tree-calabash (34); a decoction made from the leaves and roots of fitsy bush (159 *Petiveria alliacea*); an infusion from the leaves of feva grass (244); a decoction from the whole plant of culantro (14); and infusions from leaves of sour orange (179) and lime (178).

The Garífuna constantly fight fungal infections, a major problem due to high rainfall and humidity in the area. The incidence of fungal infections increases greatly during the rainy season. The majority of infections are from athlete's foot, locally known as Ground Itch. The infection, characterized by severe itching and bleeding, can become very painful. Christmas blossom (89 *Cassia alata*) is the most reputable remedy. Treatment consists of washing with a leaf decoction or juice from crushed leaves or making a leaf poultice and applying it topically. Another common fungal infection is Shifting Cloud, which causes discoloration or whitening of the skin, mostly affecting the upper parts of the body. It is called Shifting Cloud because of its ability to spread over the body. Treatment is also with Christmas blossom (89). Whole body baths are generally only used in the advanced stages, when almost the entire upper body is affected.

Other plants used by the Garífuna for treatment of fungal infections, scabies, and dandruff, all applied topically, are jackass–bitters (30), tobacco (195 *Nicotiana tabacum*), sorosí (68), barsely (118), red mangrove (169), nancite (125), john charles (117), lime (178), and hone palm (228).

Sexually transmitted diseases are common among the Garífuna. Treatment involves use of several herbal remedies such as a decoction made from the roots of strong back (101, 102 or 103), wild rice (189), broom weed (135 or 136), chicken weed (74 *Euphorbia thymifolia*), man-to-man (161 *Peperomia pellucida*), and mozote (134 *Pavonia rosea*). Some of these remedies are also used for the same purposes by other indigenous groups (Morton 1981).

The most common illnesses in eastern Nicaragua are gastrointestinal disorders and diarrhea (Hodgson 1967; Pijoan 1944, 1946a,b; Wenger 1945). Plant species with astringent properties are used for the treatment of diarrhea. The most widely used plant part for diarrhea is bark, and to a lesser extent leaves and roots, presumbly because these parts tend to have the highest concentration of tannins. More species and medicinal preparations are used to treat diarrhea than any other illness. The species used most frequently are: nancite (125), red mangrove (169), bottonwood (54), toc toc (57 *Connarus lambertii*), yájal (70), and monkey apple (177 *Posoqueria latifolia*).

Another common affliction is intestinal parasites, probably most pronounced among children. Herbal remedies used as pediatric vermifuges consist of a mixture of several species to which sugar, honey, or orange juice are added to

make the preparation more palatable. The most frequently used vermifuge for children, due to its efficacy and mild nature, is made from culantro (14), garlic (237 *Allium sativum*), vorvine (211 or 212), and juice of sugarcane (251). Adult vermifuges are prepared from the same medicinals as pediatric vermifuges, but prepared at higher concentrations and/or administered in larger dosages.

Other Conditions

Most burns are caused by open fires in the household used for cooking or when fields are being burned for agriculture. The Garífuna use both plant and petroleum products for the treatment of burns. The most commonly used plants and their extracts are sábila (216 *Aloe vera*) sap and cacao (204) butter or oil. The leaves of aloe are mashed and the juice that is removed is applied directly to the afflicted area, or the leaves are rubbed directly on the burned area. Other species widely used in the same manner are tree of life (62) and headache leaf (175 *Morinda citrifolia*). Heavy petroleum grease (locally known as Albany Grease) is also applied to the burned area. A decoction made from red scholars (170 *Cephaelis elata*) is used to wash the burned area to avoid infections and promote healing. Another treatment is to apply the sap from freshly cut stems of banana (241) or plantain (240). The sap is applied directly to the burned area. The cotyledons of quaqua (106 *Entada gigas*) are toasted and pulverized and then combined with carbonized powder made from bamboo (242). This mixture is made into a paste by adding oil or grease that is then applied to the burn. The powder mixture can also be sprinkled directly on to the burn. An infusion made from the leaves of purging physic (76), wild rice (189), barsley (118), and cow foot (163) or bull foot (166) is used to bathe the burned area.

Garífuna believe that any plant with a bitter taste is an effective contraceptive and abortifacient. The most widely used is a decoction made from the leaves and seeds of soursop (11), bobapple (10 *Annona glabra*), and avocado (120 *Persea americana*). Also used to induce labor is a decoction made from the leaves of sorosí (68) (Fig. 4) and jackass–bitters (30).

Garífuna midwives use several species to help regulate the menstrual cycle and thus effect fertility. The species most frequently used are soursop, avocado, and the roots of piss-a-bed (92). These species are made into decoctions alone or mixed. The decoction is drunk two or three times a day until the desired results are obtained. Other species used as fertility enhancers are chamomile (28 *Matricaria chamomilla*), kaisinpata (32 *Wedelia trilobata*), and vorvine (211 or 212) mixed with clove oil (153 *Syzygium aromaticum*). To avoid miscarriages and natural abortions a decoction is made from the roots of fowl foot (245 *Eleusine indica*), broom weed (135 or 136), and wild rice (189).

During pregnancy a variety of tonics is taken. The most popular is made from the roots of chainey root (253 *Smilax spinosa*). Other species used include monkey ladder (86 *Bauhinia guianensis*), naked indian (44 *Bursera simaruba*), and locust (107 *Hymenaea courbaril*).

To facilitate delivery, midwives massage the stomach of expectant mothers with crushed leaves of broom weed (135 or 136) and tree of life (62) mixed with clove oil (153). After delivery the mother is given a tea made from the roots of ginger (254), chamomile (28), cow foot (163), or bull foot (166). The mother is given a lavage with a decoction made from the leaves of wild sage (41 *Cordia curassavica*). Also, a clove of garlic (237) is mashed and made into a ball and applied over the infant's fontanelle for protection against evil spirits.

One of the main concerns following delivery is that the mother have enough milk. The most widely used species to stimulate production and flow of milk are cow foot (163) and bull foot (166), the leaves of which are heated with hone palm (228) oil and applied over the breast, or brewed in a tea to which honey and milk are added.

Toothache is treated almost exclusively with herbal remedies, the most widely used are cow foot (163) and bull foot (166). A piece of stem or root is cut to allow the sap to flow, then the sap or plant part is applied directly to the afflicted area, causing numbness. The effectiveness of these two may derive from the alkaloid piperidine and other bioactive compounds known as pyrones (Hegnauer 1966). The uses and physiological effects of cow foot (163) and bull foot (166), both native to the NW, are similar in many ways to those of kava (*Piper methysticum*), native to the OW. Kava is widely used in Southeast Asia as a popular beverage of mild narcotic and sedative effects (Cambie and Ash 1994; Cox and Banack 1991).

Headaches are treated with crushed leaves or juice from leaves of a variety of species. One of the most popular headache remedies is prepared with the crushed leaves of john charles (117), which is made into a poultice that is then applied to the head. Other preparations are made from crushed leaves and bark decoctions of soursop (11), headache leaf (175), fitsy bush (159), wild sage (41), broom weed (135 or 136), sleepy bush (109), and tree of life (62). All species used for the treatment of headaches have some bioactive principle present (Appendix 1). The preparations made from these species are sometimes mixed with western pharmaceuticals (e.g., saltpeter, sulfa tablets, aspirin) and are administered topically or orally. According to practitioners the mixing of herbs and pharmaceuticals increases the effectiveness of the preparations.

Stomach aches are most frequently treated with a decoction made from ginger root (254). Also used is a decoction made from the roots or leaves of piss-a-bed (92), a tea made from the leaves of barsley (118), and wild thyme (210) mixed with honey or sugar. Other species used to a lesser extent are bitta-wood (190) and chamomile (28).

Earaches are treated with a mixture of mashed garlic (237) and chicken fat. The mixture is heated until lukewarm, then poured into the patient's ear and capped with a clove of garlic (237) or a piece of cotton.

Tonics for weakness are very popular among the Garífuna, as evidenced by the fact that there are at least 25 species so used. Tonics are used to treat impotence and poor appetite, provide strength, increase fertility, and to strengthen the blood. Tonics are prepared for specific conditions, such as renewal of strength in women after childbirth. Others are made strictly for the elderly, the young, or for treatment following a debilitating illness. Almost all are made into teas, decoctions, or infusions that are given to the patient for several days, or even over several months. By far the most popular tonic used by the Garífuna is a decoction made from the roots of chainey root (253). Milk, honey, wine, cloves, and cinnamon are added to the chainey root to make it more palatable. This tonic is used for anemia, after childbirth, for treating jaundice and snakebites, and in many other applications. Two other popular tonics used to promote appetite and purify the blood are made by boiling the leaves of sorosí (68) (Fig. 4) and the wood of bitta-wood (190) (Fig. 3).

Discussion

Plants utilized by the Garífuna represent a wide range of genera and families, 229 medicinals and 93 food plants. This reliance on a great diversity of species appears to be an adaptation which helps to assure a year-round supply of food and medicine. Most Garífuna food comes from agricultural fields with dooryard gardens as a supplementary source. In those areas where agricultural land is scarce, dooryard gardens play a more important role in the food supply system. In addition, dooryard gardens are a place of ethnobotanical training for the young. From a very young age, children are encouraged to participate in the care of dooryard gardens, thus assuring the passage of at least some ethnobotanical information from one generation to the next.

In eastern Nicaragua, the largest use category of plant resources is for medicinal purposes. Garífuna ethnomedicine is a combination of African and Amerindian plant lore; both native and introduced plant species are used. The Garífuna rely on both traditional and western medicine for their well being. Depending on the type and severity of an illness the Garífuna will access either one or both of these two treatment systems. Traditional (both folk and popular) medicine, is usually the first to be used because it is accessable and inexpensive, but western medicine has become more readily available to the Garífuna. These two health systems have been able to coexist despite their different views and approaches to the causes and curing of illnesses.

The medicinals described in this study are still very popular among the Garífuna and enjoy a favorable reputation despite an extensive program by the Ministry of Health during the 1980s to increase access to western medicine in the Garífuna communities. The widespread use of folk herbal remedies appears to be not only a case of preference but a situation forced by lack of alternatives. Continued Garífuna reliance on ethnomedicine is likely due to traditional values, successful use of herbal remedies, isolation from major health care centers, the higher cost of western medicine, and a shortage of both western-trained health-care providers and medical supplies in rural clinics. Studies by Bhattarai (1992) in the Karnali Zone of Nepal, and by

Lentz (1986, 1993) among the Jicaque and Paya Indians of central and northeastern Honduras, show that these peoples also rely on traditional medicine out of necessity, and not by choice alone.

Much Garífuna plant lore has been passed to the present generation by oral tradition. However, the curative aspects of Garífuna plant lore is known only by a limited number of individuals, mostly elders. Deforestation in eastern Nicaragua has had a negative impact not only on the forest ecosystem but also on the way of life of people living in and depending on them. Deforestation has caused many species used in traditional medicine to become scarce and thus difficult to obtain. As a result, people are forced to find other sources, and other species to use for medicine. During the past four years, there has been an increase in the number of introduced medicinals and food plants from other areas of Nicaragua, from other Central American countries, and from México. The period of greatest culture change for the Garífuna occurred during the 1980s as a result of political unrest coupled with increased access to the region. Changes in government policies regarding land tenure and immigration have affected Garífuna livelihood. Spanish-speaking farmers (mestizos) encouraged by the government to migrate into eastern Nicaragua are entering lands traditionally farmed by the Garífuna, and held as communal property. The construction of roads and a canal dug through the Pearl Lagoon to bring oceanic transports along the coast also have increased outside influences.

The migration of Garífuna out of eastern Nicaragua is now greater than ever. The majority of migrants are young people going to Bluefields, and in lesser numbers to Managua, San José in Costa Rica, and the United States. However, even though migration may continue, the prognosis for the survival of Garífuna culture is good because they are a cohesive group. The way of life in many Garífuna villages has changed very little in the last 30 years (Coe, personal experience). Notable changes were the introduction of transistor radios, some electricity, and western building materials. Of these, transistor radios with programs in Spanish or English have had a great impact on Garífuna culture by dramatically decreasing the use of the Garífuna language. Over the last five years, however, the regional government has promoted broadcasting in the Miskitu language, and there are plans to add broadcasts in Sumu, Rama, and Garífuna in the near future. Presently, the Miskitu, Sumu, and Rama languages are being taught in their respective schools. There are plans to begin teaching the Garífuna language in Garífuna elementary schools: no one under 45 years of age converses in Garífuna in the Pearl Lagoon area.

In summary, the Garífuna are presently experiencing great changes in their way of life as a result of pressure from the outside world. The increase in migration of Garífuna young people to the outside world, migration of Spanish-speaking farmers and merchants into the area, and increased access to the Pearl Lagoon area will undoubtedly exacerbate the loss of traditional Garífuna practices. Studies like ours are important and timely because they provide a written record of plant–use practices of ethnic groups whose plant lore is fast disappearing.

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APPENDIX. GARÍFUNA ETHNOBOTANICAL CATALOG.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
Pteridophyta								
Filicopsida								
Adiantaceae								
1. *Acrostichum aureum* L.	gaígusi árabu (g)	M,O	F,U,Y	L,R	D	O	+/+L[a]	3535
Polypodiaceae								
2. *Pityrogramma colomelanos* (L.) Link	tubána harú (g)	M,O	L,R	F,H,L,U	D,I	O,T	0/0	4056
Schizaeaceae								
3. *Lygodium heterodoxum* Kuntze	púntugu (g)	M,O	A,B,S	L	D	O,T	0/0	2168
4. *L. venustum* Sw.	withes, witts (c)	M,O	A,B,S	L	D	O,T	0/0	4337
Coniferophyta								
Coniferopsida								
Pinaceae								
5. *Pinus caribaea* Morelet	gúdi (g)	M,O	A,L	L,S	D,P	I,O,T	N/0	4430
Magnoliophyta								
Magnoliopsida (Dicots)								
Anacardiaceae								
6. *Anacardium occidentale* L.	úri (g)	F,M,O	A,D,F,S	B,L	D	O,T	+	2725
7. *Mangifera indica* L.	mángu (g)	F,M,O	A,D,F,S	B,L	D	O,T	+	3387
8. *Spondias mombin* L.	siríngüela (g)	F,M,O	D,F,I,S	B,L	D	O	0/0	2275
9. *S. purpurea* L.	siríngüela (g)	F,M,O	D,F,S	B,L	D	O	0/0	2959

[1] Names of the angiosperm families follow Cronquist (1981), within dicots and monocots sequence of families, genera, and species is alphabetical.

[2] c = Creole English; g = Garífuna; h = Spanish; m = Miskitu; s = Sumu; spelling follows CIDCA (1986, 1989), Hadel (1975), and Smutko (1985).

[3] F = food; M = medicine; O = other (construction, crafts, fiber, dye).

[4] A = aches and pains; B = bites and stings (snake, scorpion, insects); C = Childbirth and Pregnancy; D = Diarrhea; E = Emetic; F = Fever; G = Digestive; (stomach ache, ulcers, etc.); H = hypertension; I = infections; J = diabetes; K = diuretic; L = respiratory-pulmonary Disorders (cold, coughs, etc.); M = rnalaria; N = burns; O = abortifacient; P = worms and intestinal parasites; Q = astringent; R = rituals; S = skin rashes and sores; T = tonic and anemia (blood fortifier); U = Cuts and Hemorrhage; V = Venereal Diseases; W = menstrual disorders, associated hemorrhage; X = purgative and laxative; Y = constipation; Z = tooth extraction.

[5] B = bark; C = flower; E = seed; F = fruit; L = leaf; M = stem; P = whole plant; R = root; S = sap.

[6] B = bath; D = decoction; I = infusion; J = juice of crushed parts; N = none; P = poultice; S = syrup.

[7] B = bath; I = inhalation; O = oral; T = topical.

[8] Alkaloid tests: N = not tested and no literature search; −L = none in literature; +L = Alkaloids reported in the literature; + (present) or 0 (absent) in Coe tests (see Methods). Glycoside tests: A limited literature search fot glycoside was conducted only for those species that tested negative for alkaloids; /+L = present, /0 = none reported.

[9] C = common introduced and or naturalized, one or no voucher collected; N = common native, only one voucher collected for all groups; NV = No voucher; P = Purchased in regional markets and stores in larger towns, not grown in eastern Nicaragua; # = F.G. Coe collection numbers.

[a] = Cambie and Ash 1994; [b] = Duke 1994; [c] = Garcia-Barriga 1992; [d] = Hegnauer 1962–1990; [e] = Morton 1981, 1987; [f] = Tyler, Brady, and Robbers 1985; [g] = Willaman and Hui-Lin Li 1970; [h] = Willaman and Schubert 1961.

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
Annonaceae								
10. *Annona glabra* L.	gasíma (g)	F,M	A,C,F,L,O	B,E,L	D,P	O,T	+L[h]	2403
11. *A. muricata* L.	gurúsulu (g)	F,M	A,C,D,F,G,O	B,E,L	D	O	+L[h]	3392
12. *Cananga odorata* L.	lang-í-lang-í (g)	M,O	R	B,C,L,R	B,D,I	B,T	+L[h]	3347
13. *Guatteria amplifolia* Triana & Planch.	wild sour sap (c)	M	D,V	B,L	D	O	+	2429
Apiaceae								
14. *Eryngium foetidum* L.	gúlantro (g)	F,M	D,G,L,P,R	L	D,I	B,O	0/+L[e]	3515
Apocynaceae								
15. *Allamanda cathartica* L.	dumári raüwa (g)	M,O	E,X	F,L,S	D	O	+/+L[d]	2522
16. *Echites umbellata* Jacq.	bean witts (c)	M	B	R	D	O	+	3487
17. *Odontadenia puncticulosa* (Rich.) Pulle	ámali (g)	M	B	L	D	O	+	2139
18. *Rhabdadenia biflora* (Jacq.) Müll. Arg.	tataku (m)	M	S	L	D	T	0/0	4065
19. *Tabernaemontana chrysocarpa* Blake	cachito (h)	M	A,I	L	D,P	O,T	+	4193
Aristolochiaceae								
20. *Aristolochia trilobata* L.	cuntríbo (g)	M,O	B,G,H,L,T	L,P	D,I	O	+, +L[d]	3923
Asclepiadaceae								
21. *Asclepias curassavica* L.	lamúruhéwe (g)	M	D,P	B,F,P,S	D,P	O,T	+, +L[h]	3235
Asteraceae								
22. *Bidens pilosa* L.	spanish spade (c)	M	L	L	D	O	+L[h]	4457
23. *B. riparia* Humb., Bonpl., & Kunth	spanish spade (c)	M	L	L	D	O	+	3213
24. *Centaurea montana* L.	pressha bush (c)	M,O	G	L	D	O	+L[g]	3303
25. *Clibadium pittieri* Greenm.	púntu (g)	M	S,T	L,P	D	O,T	0/0	2528
26. *Elephantolpus mollis* Humb., Bonpl., & Kunth	cow tongue (c)	M	L	L	D	O	+	3282
27. *E. spicatus* Aubl.	iñéñeibágasu (g)	M	A,D,L,P	L	D	O	+	2271
28. *Matricaria chamomilla* L.	bacháti (g)	F,M	A,C,G	P	D	O	+L[g]	4434
29. *Mikania cordifolia* (L.f.) Willd.	guagú (g)	M	A,B,S	L,M,P	D,P	O,T	+, +L[h]	3246
30. *Neurolaena lobata* (L.) R. Br	gúye árani (g)	M	C,F,H,K, M,S,T	L	D	O,T	+L[d]	2513
31. *Synedrella nodiflora* (L.) Gaertn.	node weed (c)	M	D,L,U	L	D	O	+L[h]	3648
32. *Wedelia trilobata* (L.) Hitchc.	kaisinpata (m)	M	B,C,F,I	F,L,M	D	O	0/0	2166
Bignoniaceae								
33. *Arrabidaea chica* (Humb. & Bonpl.) Verl.	witts (c)	M,O	D,Q,S,T	L	D	O	+L[c]	2313

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #[9]
34. *Crescentia cujete* L.	wíra (g)	M,O	D,F,L	F,L	D,S	O	0/+L[c]	3447
35. *Tabebuia rosea* (Bertol.) DC.	oaka (c)	M,O	D,F	B	D	O	N/0	4444
Bixaceae								
36. *Bixa orellana* L.	gusèwe (g)	F,M,O	C,D,K,L,N	E,L	D,I,P	O,T	+L[b]	3267
Bombacaceae								
37. *Ceiba pentandra* (L.) Gaertn.	tídibu maúru (g)	M,O	A,E,K,Q	B	D	O	0/0	4445
38. *Ochroma pyramidale* (Cav. ex Lam.) Urb.	rübü (g)	O	—	—	—	—	—	4399
39. *Pachira aquatica* L.	gumága (g)	F,M,O	D,S,T	B	D	O	0/0	3384
Boraginaceae								
40. *Cordia alliodora* (Ruiz & Pav.) Oken	samwood (c)	M,O	S,T	E,L	D,P	O,T	−L/0	4366
41. *C. curassavica* (Jacq.) Roem. & Schult.	wild sage (c)	F,M	A,C,D,F,H	L	D	B,O,T	+	2046
42. *C. spinescens* L.	wild sage (c)	M	A,C,F,H	L	D	O	+	3409
43. *Heliotropium indicum* L.	tiliáguru (g)	M	B,D,S,W	L,P	D	O	+L[h]	3946
Burseraceae								
44. *Bursera simaruba* (L.) Sarg.	surúsu wügüri (g)	M,O	C,I,S,T	B	D	B,O	0/0	3615
45. *Protium panamense* (Rose) I.M. Johnst.	copal (h)	M	A,G,P	B	D,P	O,T	0/0	2473
Caricaceae								
46. *Carica papaya* L.	abábaü (g)	F,M	P,S,U,Y	F,L,S	D,J	O,T	+L[g]	2723
Caryophyllaceae								
47. *Drymaria cordata* (L.) Willd. ex Roem. & Schult.	sumu marien (m)	M	A,L	P	D	O,T	+L[d]	4312
Cecropiaceae								
48. *Cecropia peltata* L.	trumpet (c)	M,O	A,F,G,W	L	D	O	+L[c]	3345
Chrysobalanaceae								
49. *Chrysobalanus icaco* L.	higágu (g)	F,M,O	D,Q	B,R	D	O	0/0	2838
50. *C. pellocarpus* G. Mey.	siríguela (g)	F,M	Q	B,R	D	O	0/0	2136
Clusiaceae								
51. *Calophyllum brasiliense* Cambess.	guaü (g)	M,O	A,L	B,S	D	O,T	−L/0	4371
52. *Garcinia mangostana* L.	mangosteen (c)	F,M	A	B,S	N,P	T	+	NV
53. *Symphonia globulifera* L.f.	dumári míligi (g)	M,O	A,S	B,S	D,P	T	+	2356

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #×[9]
Combretaceae								
54. *Conocarpus erectus* L.	gurúra (g)	M,O	D,Q	B,L	D	O	0/0	2023
55. *Laguncularia racemosa* (L.) Gaertn.	harú gurúra (g)	M,O	D	B	D	O	0/0	2712
56. *Terminalia catappa* L.	hamánasi (g)	F,M,O	D,L,Q	B,F,L	D	O	0/+L[a]	2708
Connaraceae								
57. *Connarus lambertii* (DC.) Sagot	toc toc (c)	M,O	D,Q	B,L	D	O	+	2119
Convolvulaceae								
58. *Cuscuta americana* L.	caluhuala (g)	M	S	L,M	D,P	T	+	2129
59. *Ipomoea batatas* (L.) Lam.	bíme mábi (g)	F,M	U	L	D	T	+	3637
60. *I. pes-caprae* (L.) R. Br.	beach morning glory (c)	M	F,X	L	D	O	+, +L[g]	2003
61. *Operculina pteripes* (G. Don) O'Donell	bitta tataku (m)	M	B,U	L	P	T	+	4102
Crassulaceae								
62. *Kalanchoe pinnata* (Lam.) Pers.	tiába laífu (g)	M	A,C,L,N	L	D,P	O,T	0/+L[b]	3429
Cucurbitaceae								
63. *Citrullus lanatus* (Thunb.) Mansf.	badía (g)	F	—	—	—	—	—	2717
64. *Cucurbita moschata* (Duchesne ex Lam.) Duchesne ex Poir.	waúyama (g)	F	—	—	—	—	—	2746
65. *Fevillea cordifolia* L.	antidote bush (c)	M	A,B,E,G	E	I,P	O,T	0/0	4432
66. *Lagenaria siceraria* (Molina) Standl.	sísira (g)	M,O	G,S,X	L,R	D	O,T	0/0	2732
67. *Luffa cylindrica* (L.) M. Roem.	pataste (h)	M,O	A,P	L	D,P	O,T	+	3400
68. *Momordica charantia* L.	sorosí (g)	F,M	A,C,F,H,I,J,L,M,S,T	L,M	D	O,T	+, +L[h]	3633
69. *Sechium edule* (Jacq.) Sw.	chocho (c)	F	—	—	—	—	—	2721
Dilleniaceae								
70. *Davilla kunthii* A. St. Hil.	yájal (g)	M,O	D,Q	B,L,M	D	O	0/0	2702
Euphorbiaceae								
71. *Acalypha arvensis* Poepp. & Endl.	worm bush (c)	M	B,S	L,P	D	O,T	0/+L[d]	3607
72. *Amanoa potamophila* Croizat	worm bush (c)	M,O	X	F	D	O	0/0	N
73. *Euphorbia hyssopifolia* L.	sagádi gáyu (g)	M	A,C,I	L,P	D	O	0/0	4040
74. *E. thymifolia* (L.) Millsp.	míliqi-míliqi (g)	M	A,C,I,V	L,P	D	O	+L[g]	2224
75. *Hyeronima alchorneoides* Allemão	nancitón (h)	O						4364
76. *Jatropha curcas* L.	purging physic (c)	M	D,F,N,P,V,X	L,S	D	O	+L[h]	2749

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #[9]
77. *J. gossypiifolia* L.	parroty grass (c)	M	D,G,I,J, S,U,X,Y	L	D	O	+L[h]	3593
78. *J. hastata* Jacq.	physic (c)	M,O	F,X	L	D	O	0/0	3518
79. *J. urens* L.	wild physic (c)	M,O	C,I,U	L,R	D	O	0/0	2789
80. *Manihot esculenta* Crantz	añaha (g)	F,M,O	A,D,F	L,R	D	O	0/+L[a]	3269
81. *Pedilanthus tithymaloides* (L.) Poit.	yauhra (m)	F,M	O,X	L,R,S	D,N	O	−L/0	2783
82. *Phyllanthus acidus* (L.) Skeels	jambalin (c)	F,M	F	L	D	O	+L[d]	2751
83. *Ricinus communis* L.	higuero (h)	M	A,F,X	E,L	D,P	O,T	+L[h]	3507
Fabaceae								
84. *Andira inernis* (Wright) Humb., Bonpl., & Kunth	dogwood (c)	M	F,P,X	B	D	O	+L/[h]	2747
85. *Arachis hypogaea* L.	pindá (c)	F	–	—	—	—	—	2752
86. *Bauhinia guianensis* Aubl.	kaléra mégu (g)	M	C,S,T	B,M	D	O,T	0/0	2800
87. *Caianus caian* (L.) Millsp.	pigeon pea (c)	F,M	L,S	F,L	D	O,T	+, +L[c]	3361
88. *Canavalia maritima* (Aubl.) Thouars	barana aífi (g)	M	F,X	E,L,R	D	O	+, +L[g]	2003
89. *Cassia alata* L.	christmas blossom (c)	M	D,F,G,H,I, P,S,T,X	F,L	B,D,J,P	B,O,T	+, +L[h]	3202
90. *C. fistula* L.	abúrucha gániesi (g)	M	L	F	D,N	O	0/0	2787
91. *Cassia grandis* L.f.	stinking toe (c)	F,M	L,P,S,T,X	F,L	D,J,S	O,T	0/+L[a]	3438
92. *C. occidentalis* L.	ganíbisi (g)	F,M	A,C,F,G,I, L,M	L,P,R	D,J	O,T	+, +L[g]	3625
93. *C. reticulata* Willd.	sorocontil (h)	M	A,B,I,S,W,X	L,R	D	O	+	2799
94. *C. tora* L.	frijolillo (h)	F,M	F,X	L	D	O	0/0	3403
95. *C. undulata* Benth.	poloborajero (h)	M	F,X	L,R	D	O	0/0	3287
96. *Crotalaria longirostrata* Hook. & Arn.	lamúruhéwe (g)	M	E,X	L	D	O	+	3335
97. *Dalbergia brownei* (Jacq.) Urb.	red fowl (c)	M,O	D,Q,S	B,L,M	D	O,T	0/0	2177
98. *D. hypoleuca* Pittier	rosewood (c)	O	—	—	—	—	—	4325
99. *D. tucurensis* Donn. Sm.	rosewood (c)	O	—	—	—	—	—	4391
100. *Desmodium adscendens* (Sw.) DC.	burbur (c)	M	A,D,G,I,S,V	L,P,R	D,I	O	+	4117
101. *D. barbatum* (L.) Benth. & Oerst.	wild peanut (c)	M	A,I,M,S,V	L,R	D	O	0/0	3307
102. *D. canum* (J.F. Gmel.) Schinz & Thell.	hére anágani (g)	M	A,F,I,M,S,V	L,R	D	O	+	3359
103. *D. triflorum* (L.) DC.	burbur (c)	M	A,F,I,M,V	L,R	D	O	+	2767
104. *Dioclea megacarpa* Rolfe	kuakua (g)	M,O	A,S	L	D,P	T	+	3238
105. *Dipteryx oleifera* (Benth.) Taub.	ebo (c)	F,M,O	A,Z	B,F	D,P	O,T	+L[d]	2321
106. *Entada gigas* (L.) Fawc. & Rendle	quaqua (c)	M	A,N,S	F	P	T	0/0	2860

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
107. *Hymenaea courbaril* L.	tídibu chagágaru (g)	M,O	A,C,D,F,L	B,S	D,P	O,T	0/0	3417
108. *Inga edulis* G. Martens	bribri (m)	F,O	—	—	—	—	—	2776
109. *Mimosa pudica* L.	gúsu nebénene (g)	M	A,F,G,O,P,W	F,L,M,P	D	O	+, +L[h]	2252
110. *Mucuna urens* DC.	quaqua (c)	M	A,B,G,S	S	D,P	T	+L[h]	2870
111. *Pentaclethra macroloba* (Willd.) Kuntze	pigeonbush (c)	M,O	B,E,F,L,S	B	D	O,T	+	2441
112. *Phaseolus vulgaris* L.	aífi (g)	F	—	—	—	—	—	2758
113. *Pithecolobium dulce* (Roxb.) Benth.	roosta (c)	M,O	D,Q	B	D	O	+L[h]	3764
114. *Tamarindus indica* L.	támparanu (g)	F,M,O	I,X	B,F	D	O	+L[b]	2783
Flacourtiaceae								
115. *Casearia aculeata* Jacq.	birdberry (c)	M,O	S	L	D,P	T	+	3852
Gentianaceae								
116. *Coutoubea spicata* Aubl.	worm bush (c)	M	A,F	L	D	O	0/0	2587
Lamiaceae								
117. *Hyptis verticillata* Jacq.	baríorúma (g)	M	A,H,I,L,S	L,P,R	D,I	O,T	+	2667
118. *Ocimum micranthum* Willd.	barsley (c)	F,M	A,F,G,H,I, L,N,R,S	L	D,I	O,T	0/0	2229
Lauraceae								
119. *Cinnamomum zeylanicum* Blume	cinnament (c)	F,M	D,G,T	B,M	D	O	0/0	2763
120. *Persea americana* Mill.	wagádi (g)	F,M	D,J,L,O,W	B,E,L	D	O	+L[g]	3356
Loganiaceae								
121. *Spigelia anthelmia* L.	worm bush (c)	M	P	P	D	O	+, +L[h]	2830
Loranthaceae								
122. *Struthanthus cassythoides* Millsp. ex Standl.	scani growd (c)	M	A,F,L,S	L,P	D	O	+	3829
Malpighiaceae								
123. *Banisteriopsis argentea* C.B. Rob. ex Small	witts (c)	M,O	S	B,L,M	D	T	+L[c]	2384
124. *B. cornifolia* C.B. Rob. ex Small	witts (c)	M	B,S	B,L,M	D	T	+	3305
125. *Byrsonima crassifolia* (L.). Humb., Bonpl., & Kunth	mureí (g)	F,M,O	A,D,G,Q,S	B,L	D	O	+	2857
126. *Heteropteris multiflora* (DC.) Hochr.	iñéñei (g)	M	L,Q	L	D	O	+	3476
127. *Hiraea quapara* (Aubl.) Morton	babú (g)	M	S,U	L	D	T	+	2333
128. *Stigemaphyllon pseudopuberum* Nied.	snakeroot (c)	M	Q,V,Z	L	D	O,T	0/0	3789

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #[9]
Malvaceae								
129. *Abelmoschus esculentus* (L.) Moench	néhu (g)	F,M	L	C,Y	D,J	O	+L[g]	4440
130. *Hibiscus bifurcatus* Cav.	amapola (h)	M,O	F,L	F,L	D	O	+	3470
131. *H. sabdariffa* L.	hamaíga (g)	F,M	K,L,T	F,L	D	O	0/0	2745
132. *H. tiliaceus* L.	maíñu (g)	M,O	C,F,Y	B,L	D	O	+	2185
133. *Kosteletzkya nentasperma* (Bertol.) Griseb.	malva mulata (h)	M,O	S,U	L	D,P	T	+	3527
134. *Pavonia rosea* Schltr.	mozote (h)	M	I,V,W	R	D	O	+	4150
135. *Sida acuta* Burm. f.	sagádi abuídagülei (g)	M,O	A,C,L,V,W	L,P	D	O	+L[h]	3232
136. *S. rhombifolia* L.	sagádi abuídagülei (g)	M,O	A,C,F,I,L,V	L	D	O	+L[h]	3587
137. *S. spinosa* L.	white broom weed (c)	M	D,I,S	L	D	O,T	+L[h]	2249
Melastomataceae								
138. *Miconia albicans* (Sw.) Triana	blueberry (c)	F,M,O	S	L	D	T	0/0	2053
139. *Miconia* sp.	bird berry (c)	F,O	—	—	—	—	—	4186
140. *Tococa guianensis* Aubl.	vigoron leaf (c)	O	—	—	—	—	—	4448
Meliaceae								
141. *Carapa guianensis* Aubl.	saba (s)	M,O	D,Q	B	D	O	+, +L[g]	4369
142. *Cedrela odorata* L.	hibúari (g)	M,O	A,F,Q,T	B	D	O	−L/0	4365
143. *Swietenia macrophylla* King	gaúbana (g)	M,O	F	B	D	O	+L[g]	4413
Menispermaceae								
144. *Cissampelos pareira* L.	tamasás, alcotán (h)	M	B,F,S,V	L,R	D	O,T	+L[h]	2532
Moraceae								
145. *Artocarpus altilis* (Parkinson) Fosberg	breadfruit (c)	F,M	A,H	L,S	D,P	T	0/0	3423
146. *Ficus insipida* Willd.	higo (g)	M,O	A,G	S	I,P	O,T	+	3483
Myristicaceae								
147. *Myristica fragrans* Houtt.	misgádu (g)	F,M	G	F	D	O	+L[c]	2753
148. *Virola koschnyi* Warb.	banak (m)	M,O	A,D,F,Q	B,L,S	D,P	O,T	+L[g]	2398
Myrtaceae								
149. *Calyptranthes chytraculia* (L.) Sw. var. *americana* McVaugh	wild lime (c)	F,M	G,L	L	D	O	0/0	4071
150. *Eugenia acapulcensis* Steud.	mansána (g)	M	F,G	L	D	O	0/0	3913
151. *E. axillaris* (Sw.) Willd.	whitebush (c)	M	D,T	L	D	O	0/0	3988

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
152. *Psidium guajava* L.	waríafa (g)	F,M,O	D,F,G,H, I,M,P,S	B,F,L	D,I	B,O	+L[d]	3441
153. *Syzygium aromaticum* (L.) Merr. & Perry	cloves (c)	F,M	A,C,G,O	C	D	O	0/0	4442
154. *S. malaccensis* (L.) Merr. & Perry	mansána (g)	F,M	A,S	B,L,S	D,P	T	+	3452
Onagraceae								
155. *Ludwigia octovalvis* (Jacq.) Raven	wild cloves (c)	F,M	C,F,G,L	F	D	O	0/0	3220
Oxalidaceae								
156. *Averroha bilimbi* L.	mimbro (h)	F,M	D,F	F,L	D,J	O	−L/0	2784
157. *A. carambola* L.	melocotón (h)	F	—	—	—	—	—	2754
Passifloraceae								
158. *Passiflora quadrangularis* L.	drap (m)	F,M	F,M,S	L	D,J	O,T	+L[h]	3513
Phytolaccaceae								
159. *Petiveria alliacea* L.	fitsy bush (c)	M	A,L,R	L,P,R	I,P	O,T	+L[d]	3566
160. *Phytolacca rivinoides* Kunth & Bouché	calalu, yocoto, yukutu (c)	F,M	E,X	L,R	D	O	+L[c]	3259
Piperaceae								
161. *Peperomia pellucida* (L.) Humb., Bonpl., & Kunth	sumu mairen (m)	M	B,I,V,W	P	D	O	0/0	3744
162. *P. peltata* C. DC.	man-to-man (c)	M	B,I,V,W	P	D	O	0/0	2225
163. *Piper auritum* Humb., Bonpl., & Kunth	ugúdi bágasu (g)	F,M	A,C,F,G,N	L	I,J,P	O,T	+, +L[g]	2719
164. *P. hispidum* Sw.	spanish ela(c)	M	A,F,G	L	B,I	B,O	+, L[d]	2457
165. *P. acquemontianum* (Kunth) DC.	spanish ela (c)	M	A,F,G	L	B,I	B,O	+	3326
166. *P. peltatum* L.	ugúdi bágasu (g)	F,M	A,C,F,G,N	L	D,P	B,O,T	+, L[d]	3210
Polygonaceae								
167. *Antigonon leptopus* Hook. & Arn.	kuráli púntugu (g)	M,O	V	R	D	O	0/+L[a]	2766
168. *Coccoloba uvifera* (L.) L.	barána baíbai (g)	F,M	D,G,S	B,L	D	O	0/0	3444
Rhizophoraceae								
169. *Rhizophora mangle* L.	gurúra (g)	M,O	D,G,S	B	D	O	0/0	2096
Rubiaceae								
170. *Cephaelis elata* Sw.	red scholars (c)	M	B,F,I,J,N,O,S	F,L,M,R	D	O,T	+	2472

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #[9]
171. *C. ipecacuanha* (Brot.) A. Rich.	raizcilla (h)	M	D,E,F,L,S	R	D	O	+L[h]	4447
172. *C. tomentosa* (Aubl.) Vahl	sore mouth bush (c)	M	B,F,I,J, N,O,S,U	F,L,M,R	D	O,T	+	2010
173. *Cinchona pubescens* Vahl	quina (h)	M	D,F,G,M,T	B,M	D	O	+L[h]	3544
174. *Coffea arabica* L.	gáfe (g)	F,M	F,U	E	D,N	O,T	+L[f]	NV
175. *Morinda citrifolia* L.	yeíawa haráchan (g)	M	A,N	L	P	T	+L[h]	2769
176. *M. panamensis* Seem.	buíruhu manzána (g)	M,O	D,X	B,L	P	T	0/0	2596
177. *Posoqueria latifolia* (Rudge) Roem. & Schult.	urágu (g)	F,M	D,Q	B,L	D	O	+	4313
Rutaceae								
178. *Citrus aurantifolia* (Christm.) Swingle	líma (g)	F,M	C,D,F,G,I, L,M,P,S	F,L,R	D,J	O	+L[c]	3677
179. *C. aurantium* L.	aránsu garühü (g)	F,M	D,F,G,H,L	F,L,R	D,I,J	B,O	+L[h]	4449
180. *C. paradisi* Macfad.	charígi, torónha (g)	F,M	D,F,H	F	J	O	+L[d]	3681
181. *C. reticulata* Blanco	tangarú (g)	F	—	—	—	—	—	4458
182. *C. sinensis* (L.) Osbeck	aránsu (g)	F,M	D,F,H,L	F,L	D,J	O	+L[h]	4450
Sapindaceae								
183. *Melicoccus bijugatus* Jacq.	kinep (c)	F,M	D,Q	E,L	D	O	0/0	3435
Sapotaceae								
184. *Chrysophyllum cainito* L.	star apple (c)	F,M	D,F,Q,V	F,L	D,N	O	+L[e]	3350
185. *Manilkara zapota* (L.) P. Royen	sagadú (g)	F,M	A,S	S	P	T	+L[e]	2792
186. *Pouteria sapota* (Jacq.) H.E. Moore & Stearn	sabúdi (g)	F,M,O	A,D,G,S	B,E,L	D,P	O,T	+L[h]	2710
Scrophulariaceae								
187. *Bacopa Procumbens* (Mill.) Greenm.	yellow bird (c)	M	A,X	L	D,J	O,T	0/0	2707
188. *Lindernia diffusa* (L.) Wettst. ex Dugand & Jacks.	bird bush (c)	M	X	P	D	O	+	2709
189. *Scoparia dulcis* L.	ri haráchan (g)	M	B,C,I,M, N,T,V,W	L,P,R	D	O	+, +L[h]	2236
Simarubaceae								
190. *Quassia amara* L.	wéwe gífi (g)	M	A,B,F,M,P, Q,T	M	D	O	+, +L[h]	3540
191. *Q. simarouba* L. f.	leskuéla (g)	M,O	D,F,M,T,W	B	D	O	0/+L[e]	4404

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/glycoside test[8]	Voucher #[9]
Solanaceae								
192. *Capsicum annuum* L. var. *glabriusculium* (Dunal) Heiser & Pickersgill	áti (g)	F,M	A,L,S	E,F,L	D,N	O,T	+L[h]	4330
193. *C. chinensis* Jacq.	áti (g)	F,M	A,L,S	E,F,L	D,N	O,T	+	3605
194. *C. frutescens* L.	áti (g)	F,M	F,I,K,L	F,L	D,J	O,T	+L[h]	2748
195. *Nicotiana tabacum* L.	iúri (g)	M,O	A,B,S	L	N	O,T	+L[h]	NV
196. *Physalis angulata* L.	dumádu haráchan (g)	M	F,M	L,P	I	O	+L[h]	2259
197. *P. cordata* Mill.	turttle egg (c)	M	K	L,P	I	O	+L[h]	3695
198. *Solanum asperum* Rich.	susul (m)	M,O	S	L	D	T	+L[h]	3255
199. *S. lycopersicum* L.	dumádu (g)	F,M	S	L	J	T	+L[h]	2831
200. *S. mammosum* L.	gañé gadáru (g)	M	A,L,S	E,F,L	D,P	O,T	+L[h]	3664
201. *S. toryum* Sw.	mirámira furúda (g)	M	A,B,F,S	L,R	D,P	T	+L[h]	4361
202. *S. tuberosum* L.	mábi (g)	F,M	G	R	J	O	+L[h]	NV
Sterculiaceae								
203. *Melochia villosa* (Mill.) Fawc. & Rendle	tea bush (c)	M	G,L	L	D	O	+	2750
204. *Theobroma cacao* L.	gábu (g)	F,M	N,S,U	E,L	P	T	+L[h]	2815
Tiliaceae								
205. *Apeiba aspera* Aubl.	fáñeimégu (g)	M,O	L,S	B,L	D	O,T	0/0	2369
206. *Luehea seemannii* Triana & Planch.	guácimo (h)	M,O	Q	B,L	D	O	0/0	2283
Turneraceae								
207. *Tumera ulmifolia* L.	ram goat dash along (c)	M	A,F,L,X	L	D	O	+L[h]	3885
Verbenaceae								
208. *Avicennia germinans* (L.) L.	würi gurúra(g)	M,O	D,Q	B	D	O	0/0	2824
209. *Lippia alba* (Mill.) N.E. Br. ex Britton & Wilson	catnip (c)	F,M	C,F,G,L,W	L	D,I	O	0/+L[c]	3495
210. *L. micromera* Schauer	wild thyme (c)	M	A,C,G,K,L,W	L	D,I	O	0/+L[c]	2247
211. *Stachytarpheta cayennensis* (Rich.) Vahl	vorvine(c)	M	C,F,G,L,P,V,X,Y	L	D	O	+L[c]	3551
212. *S. jamaicensis* (L.) Vahl	vorvine (c)	M	C,F,L,P,V,X	L	D	O	+L[g]	3628
213. *Tamonea spicata* Aubl.	wild thyme (c)	F,M	F,G,L	L	D	O	+	4333
214. *Vitex kuylenii* Standl.	fiddlewood (c)	O	—	—	—	—	—	3770

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
Vochysiaceae								
215. *Vochysia ferruginea* G. Martens	gurágura (g)	O	—	—	—	—	—	2104
Liliopsida (Monocots)								
Aloeaceae								
216. *Aloe vera* L.	sábila (g)	M	B,N,S,X	L	J	O,T	+L[g]	2743
Araceae								
217. *Colocasia esculenta* (L.) Schott	yámi(g) dasheen (c)	F	—	—	—	—	—	2788
218. *Montrichardia arborescens* (L.) Schott	chinchin banana (c)	F,M	F	F	D	O	+	3538
219. *Philodendron scandens* K. Koch & Sello	snake vine (c)	M	B	L,M	D,P	O,T	+	2155
220. *Xanthosoma mexicanum* Liebm.	wild coco (c)	M	S	L	D	T	0/0	2151
221. *X. sagittifolium* (L.) Schott	coco yam (c) wáhü (g)	F	—	—	—	—	—	2791
Arecaceae								
222. *Acoelorraphe wrightii* (Griseb. & H. Wendl.) H. Wendl. ex Becc.	harádan (g)	M,O	D	R	D	O	0/0	2782
223. *Bactris gasipaes* Kunth	pejibáyu (g)	F,M,O	G	F	D	O	0/0	2772
224. *B. major* Jacq.	coyúl (g)	F,M,O	P,X	R	D	O	0/0	3725
225. *Calyptrogene ghiesbreohtiana* (Linden & H. Wendl.) H. Wendl.	gáyu íli yaraüwa (g)	O	—	—	—	—	—	NV
226. *Cocos nucifera* L.	fáluma (g)	F,M,O	D,P	F	D,I	O	+L[c]	NV
227. *Elaeis guineensis* Jacq.	batana, murísi (g)	F,M,O	F	—	—	—	—	NV
228. *E. oleifera* (Kunth) Cortés	batana, murísi (g)	F,M,O	C,G,S,X	F	D	O	N/0	NV
229. *Raphia taedigera* (C. Mart.) C. Mart.	silícu (g)	O	—	—	—	—	—	NV
Bromeliaceae								
230. *Ananas comosus* (L.) Merr.	yeíawa (g)	F,M	B,I,U	F,L	D	O	0/0	2727
231. *Bromelia pinguin* L.	tídibu yeíawa (g)	M,O	B	L	D,P	O,T	−L/0	2737
Commelinaceae								
232. *Commelina erecta* L.	bluebird (c)	M	S	L,M	J	T	0/0	3593
233. *Tradescantia zebrina* Bosse	purple grass (c)	M	D,G,L	P	D	O	0/0	NV
Cyperaceae								
234. *Kyllinea tibialis* Ledeb.	béya sagádi (g)	M	F	R	D	O	+	4111

APPENDIX. CONTINUED.

Scientific name[1]	Common names[2]	Uses[3]	Medicinal applications[4]	Material used[5]	Mode of preparation[6]	Mode of administration[7]	Alkaloid/ glycoside test[8]	Voucher #[9]
Dioscoreaceae								
235. *Dioscorea trifida* L.	yámi (g)	F	—	—	—	—	—	2844
Liliaceae								
236. *Allium cepa* L.	sebúya (g)	F,M	L,P	R	J	O	N	NV
237. *A. sativum* L.	lai (g)	F,M	A,C,H,P	R	J	O	N	NV
Marantaceae								
238. *Thalia geniculata* L.	waha (m)	O	—	—	—	—	—	4446
Musaceae								
239. *Musa* sp.	gasíbu (g)	F,M,O	B,D,U	F,S	N,P	O,T	+L[g]	NV
240. *M. paradisiaca* L.	barúru (g)	F,M,O	B,D,N,U	F,S	N,P	O,T	+L[g]	NV
241. *Paradisiaca* L. var. *sapientum* (L.) Kuntze	bímena (g)	F,M,O	B,D,N,U	F,S	N,P	O,T	+L[h]	NV
Poaceae								
242. *Bambusa vulgaris* Schrad. ex Wendl.	bámbu (g)	M,O	D,F,I,N,S	R	D,P	O,T	+L[g]	2711
243. *Coix lacryma-jobi* L.	sagádi, agúsa (g)	M,O	I,S	E,R	D	O	+L[a]	2646
244. *Cymbopogon citratus* (Nees) Stapf	sagádi, sagádi abíruaü (g)	F,M	F,G,L	L,R	I,P	O,T	+L[g]	3682
245. *Eleusine indica* (L.) Gaertn.	sagádi (g)	M	C,F,I,W	R	D	O	+L[h]	2273
246. *Gynerium saginatum* (Aubl.) P. Beauv.	gániesiharáchan (g)	M,O	B,I,K,S,V	R	D	O	0/0	3870
247. *Olyra latifolia* L.	sagádi (g)	M	S	L,R	D	T	0/0	3323
248. *Oryza sativa* L.	ri (g)	F,M	D,S	E	B,I	B,O	+L[h]	2756
249. *Panicum maximum* Jacq.	sagádi Guinea (g)	O	—	—	—	—	—	2759
250. *P. purpurascens* Raddi	sagádi pará (g)	O	—	—	—	—	—	2761
251. *Saccharum officinarum* L.	gániesi (g)	F,M,O	D,I,L,P,S	L,M	D,J	O,T	-L/0	2764
252. *Zea mays* L.	awási (g)	F,M,O	I	C	D	O	+L[h]	2766
Smilacaceae								
253. *Smilax spinosa* Mill.	ílagülei güríngüri (g)	M	B,C,S,T	R	D	O	0/0	2161
Zingiberaceae								
254. *Zingiber officinale* Roscoe	chichámbara (g)	F,M	A,C,F,G,L	R	D	O	0/+L[a]	2826