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Author: Coe, Felix G.

Source: Journal of Ethnobiology, 28(1) : 1-38

Published By: Society of Ethnobiology

URL: https://doi.org/10.2993/0278-0771(2008)28[1:EOTROS]2.0.CO;2

Journal of Ethnobiology 28(1): 1–38 Spring/Summer 2008

ETHNOMEDICINE OF THE RAMA OF SOUTHEASTERN NICARAGUA

FELIX G. COE
Department of Ecology and Evolutionary Biology, University of Connecticut, 85 Lawler Road, West Hartford, CT 06117-2697

ABSTRACT.—The Rama are one of three indigenous groups of eastern Nicaragua. A total of 206 plant species, in 157 genera and 70 families, were documented as medicinals in three years of fieldwork. Most (75%) Rama medicinals are native to eastern Nicaragua, and are used to treat more than 30 human ailments. Over 70% have some bioactive principle, most are herbs (37%) or trees (36%), and leaves are the most frequently utilized plant part. Most herbal remedies are prepared as decoctions and are administered orally. Most medicinal plants are wild, but some important species are introduced domesticates native to the New World and Old World tropics. The Rama people are the most highly acculturated group of eastern Nicaragua, and accordingly, their use of the native flora has changed the most. In addition, this group occupies a small area, and has few unaltered traditional practices left. Therefore, this study is important because it provides a written record of the oral history of a group whose cultures and natural resources are disappearing very quickly.

Key words: Rama, ethnomedicine, medicinal plants, eastern Nicaragua.

RESUMEN.—Los Rama constituyen uno de los tres grupos Amerindios del oriente Nicaragüense. Durante tres años de estudios se documentaron los usos por éste grupo de 206 especies vegetales en 157 géneros y 70 familias. Las plantas medicinales de los Rama tratan más de 30 enfermedades y la mayoría (75%) son especies nativas del oriente Nicaragüense. Más del 70% de las especies medicinales poseen algun principio bioactivo; la mayoría son hierbas (37%) o árboles (36%). Las hojas son las partes más frecuentemente utilizadas en remedios y son preparados en forma de decocciónes y administradas oralmente. Las especies alimenticias en su mayoría son silvestres pero las más importantes son domesticadas nativas del paleotrópico y del neotrópico, solamente tres son nativas de Mesoamerica. Los Rama son uno de los grupos indigenas más aculturados del oriente Nicaragüense. Por lo tanto éste estudio es muy importante porque provee una documentación de la historia oral de un grupo cuya cultura y recursos naturales están desapareciendo rápidamente.

RÉSUMÉ.—Les Ramas constituent l'un des trois groupes indigènes de l'est du Nicaragua. Durant trois années de terrain, l'utilisation de 206 espèces, représentant 157 genres et 70 familles, a pu être documentée. Les plantes médicinales utilisées par les Ramas interviennent dans le traitement de plus de 30 maladies et la majorité (75%) sont indigènes à l'est du Nicaragua. Plus de 70% des plantes possèdent des principes bioactifs. La plupart des plantes proviennent d'herbacées (37%) ou d'arbres (36%); et les feuilles forment l'élément le plus utilisé. La majorité des remèdes tirés des plantes sont préparés sous forme de

décoctions prises oralement. Les plantes médicinales sont en grande partie d'origine sauvage, mais quelques taxons importants sont issus d'espèces domestiquées, introduites au Nicaragua, tirant leur origine des régions tropicales du nouveau et vieux monde.Le peuple rama figure parmi les groupes les plus aculturés de l'est du Nicaragua de sorte que l'utilisation de leur flore indigène a subi d'énormes changements. De plus, ils occupent un territoire restreint et peu de leurs pratiques traditionnelles sont demeurées inchangées. La culture des Ramas est soumise à d'importantes pressions liées à l'immigration. Par conséquent, cette étude est importante parce qu'elle documente par écrit l'histoire orale des Ramas dont la culture et les ressources naturelles sont en voie de disparition.

INTRODUCTION

The Rama are descendants of the Chibcha-speaking peoples of northern South America, who migrated in the 10th century to the coastal area of southeastern Nicaragua and northeastern Costa Rica (Figure 1) (CIDCA 1987; Stone 1977). The Rama original homeland in this area was the rainforest in the Rio Punta Gorda basin (Figure 1). However, in the 18th century, the Miskitu forced the majority of Rama to settle on the island of Rama Cay (***Ipang*** [words in bold face italics are from the Rama language[1]]) in the Bluefields Lagoon, approximately 15 km south of the city of Bluefields (***Tawan***) (Figure 1) (CIDCA 1987; Incer 1975; Loveland 1976). The Rama are the smallest of the indigenous groups of eastern Nicaragua. Presently, the Rama population consists of approximately 1300 individuals, less than 0.3% of the population of eastern Nicaragua (Vilas 1989). Over 80% of the population still lives on the island of Rama Cay and the remainder resides in riverine settlements south of Bluefields (Figure 1) (CIDCA 1987; Herlihy 1997).

The Rama are foraging (hunting, fishing, and gathering) agriculturists. They practice slash-and-burn agriculture, fish, hunt, and collect food and medicinal plants from the mainland rainforest. Rama interactions with outsiders (Westerners and other ethnic groups of eastern Nicaragua) are limited, probably in part because of the past abuses by the Miskitu and Spaniards in earlier times, and the subsequent geographic isolation of the Rama (CIDCA 1987).

Rama culture is the least understood of the indigenous groups of eastern Nicaragua. Most ethnographic studies have focused on the larger groups, namely the Miskitu (see Conzemius 1932), the Sumu or Mayangna (see Conzemius 1932; Houwald 2003), and the Garífuna (see Davidson 1980). Ethnographic research of the Rama is limited compared with the other groups, particularly the Miskitu. Lehmann (1914) provides a brief description of the Rama language. Conzemius (1932) gives only a brief ethnographic introduction of the Rama; there is no discussion of either ethnobotany or ethnomedicine. The cultural geographer Bernard Nietschmann (1969) discusses the distribution of the Rama in eastern Nicaragua. The most in-depth ethnographic studies of the Rama are those by Christine Loveland (1982) and Franklin Loveland (1975a, 1976, 1982, 1986). It was not until the mid 1970s that ethnobotanical studies began in eastern Nicaragua (Barrett 1994; Coe 1994; Coe and Anderson 1996a,

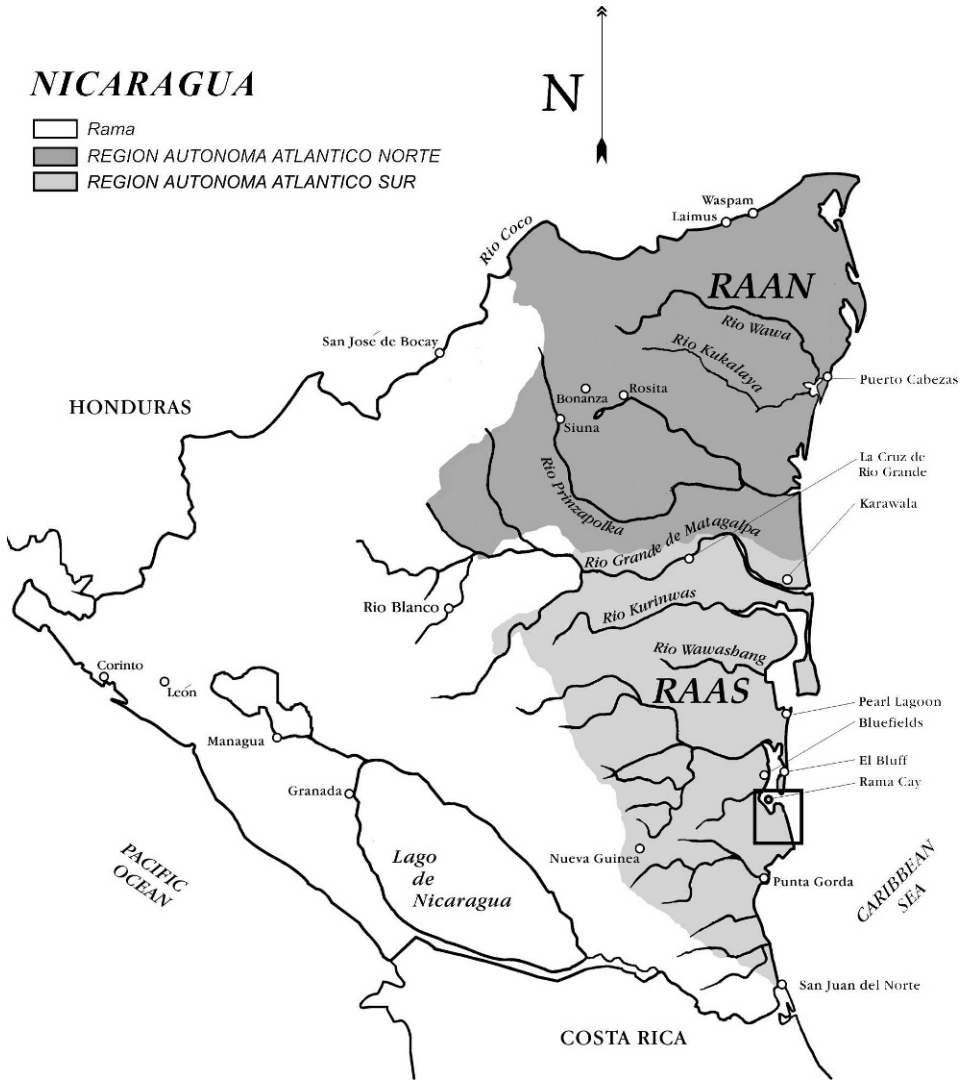

FIGURE 1.—Map of Nicaragua.

1996b, 1997, 1999, 2005; Dennis 1988; and Loveland 1975a, 1975b). Particularly lacking were ethnomedicinal studies that focused on etiology, treatment and traditional healers.

Prior to this study, documentation of Rama ethnomedicine was limited to publications by Barrett (1994) and Loveland (1975b). In this article, I present an account of the ethnomedicine of the Rama of southeastern Nicaragua. I consider Rama etiology (causes and origins of disease) and treatment, and examine Western medicine as a health care option. The objective of this study is to document and analyze the Rama uses of plant resources for medicine.

STUDY AREA

Rama settlements in southeastern Nicaragua are located in the rainforests between 11° 30′ to 11° 52′ N latitude and 83° 39′ to 84° 00′ W longitude in the Región Autónoma Atlántico Sur (RAAS), a political subdivision of the former department of Zelaya (Figure l). Elevations range from sea level to 100 m, with isolated peaks that reach 300 m. The climate is tropical, with a rainy season of six to eight months and no well-defined dry season. The average annual rainfall is 2,500 – 6,000 mm, which increases from north to south and west to east, and the average annual temperature is 25° – 30°C (Incer 1975, Stevens et al. 2001). The tropical rainforest, beach-lagoon-swamp complex, rivers, and the shallow offshore waters form the coastal environment of this region. The predominant ecosystem in the area is the broadleaf evergreen forest, which consists of the terra firma rainforest, the moist tropical forest, the swamp forest, and the mangrove forest (Stevens et al. 2001).

METHODS

Fieldwork consisted of open-ended interviews of traditional healers (herbalists, midwives, and shamans) ranging in age from 35 to 70 years. To obtain a general understanding of herbal medical practices and the names of practitioners in the communities, the tribal leader, or *headman*, was interviewed. Data on healing plants were gathered through interviews with 10 herbalists, eight midwives, and two shamans. Information was queried in order to compile a list of medicinal species used and to complete a desired profile for each medicinal species that included the following data: (a) common name(s); (b) medicinal application; (c) material used; (d) mode of preparation; and (e) mode of administration. Interviews were conducted in both Creole and Rama. An interpreter was used to help with interviews conducted in Rama. Participants were paid for their time with cash, food supplies, cooking utensils, or cloth. Field work was performed in two phases: (1) gathering of information using data sheets, field notes, and audio cassette recordings to document resource uses and to compile a species list and (2) field trips with healers (Figure 2) to collect voucher specimens. Each specimen was assigned a voucher number and labeled with a numbered tag. In addition, the voucher number was recorded on the newsprint containing the specimen prior to it being pressed in a plant press. Field notes included habitat and life form data for each species. Forest classification was based on a combination of historical records, local informants, and ecological indicators. Data and specimens were collected during field studies (May to August and December to January 1992 to 1996) by the author, a native of Bluefields who has been in contact with the Rama since the 1960's. This study was carried out primarily on the island of Rama Cay. In addition, expeditions were made to the rainforest and river settlements along the ***Dukono***, ***Kukra***, and ***Tuswani*** Rivers, and coastal settlements at Cane Creek, Monkey Point, and Wiring Cay (Figure 1).

Plants were identified and classified using Davidse et al. (1995) for the ferns and fern allies, and Cronquist (1981) and Stevens et al. (2001) for the

FIGURE 2.—Rama shaman.

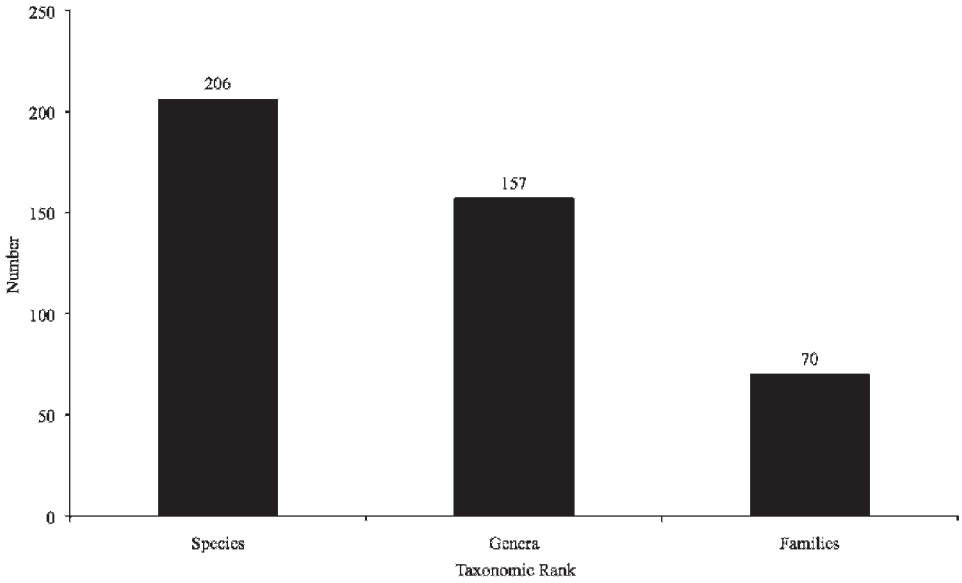

FIGURE 3.—Medicinal plants arranged by taxonomic rank.

angiosperms. The scientific names of species follow Stevens et al. (2001), author name abbreviations to Brummitt and Powell (1992), book abbreviations to Stafleu and Cowan (1976 – 1988) and Stafleu and Mennega (1992 – 2000), and journal abbreviations to Bridson (1991). The names of localities follow CIDCA (1986, 1987, 1989), Conzemius (1929, 1932), Guerrero and Guerrero (1985), Incer (1985), and Smutko (1985) and the common plant names follow CIDCA (1986, 1987, 1989), Conzemius (1929, 1932), and Smutko (1985). The names of chemical compounds follow Duke (1994), Gibbs (1974), Hegnauer (1962–2001), Stecher et al. (1960), and Tyler et al. (1988). The phytochemical screening of plants was performed using methods developed by Coe and Anderson (1996b).

Plant vouchers collected were identified by Coe, sometimes with help from the specialists listed in the acknowledgments. Voucher specimens collected for each species were deposited at the Universidad Centroamericana (HNMN), the Missouri Botanical Garden (MO), and the University of Connecticut (CONN).

RESULTS

A total of 206 species of medicinal plants documented was distributed among 157 genera and 70 families (Appendix; Figure 3). The species in the Appendix are arranged alphabetically by family and by genus[2]. For each species, the common name(s), medicinal application(s), part(s) used, mode(s) of preparation, mode(s) of administration, bioactivity, voucher number, habit, and plant source are given. The Rama obtained medicinal plants from four sources (Appendix; Figure 4). For each plant source, a brief description is provided in the text below.

The Rama obtain medicinal plants from home gardens, markets (''purchased plants''), second-growth forests (15 – 30 years since disturbance), and old-growth forests (sites with no apparent or recorded human disturbance) (Figure 4). The

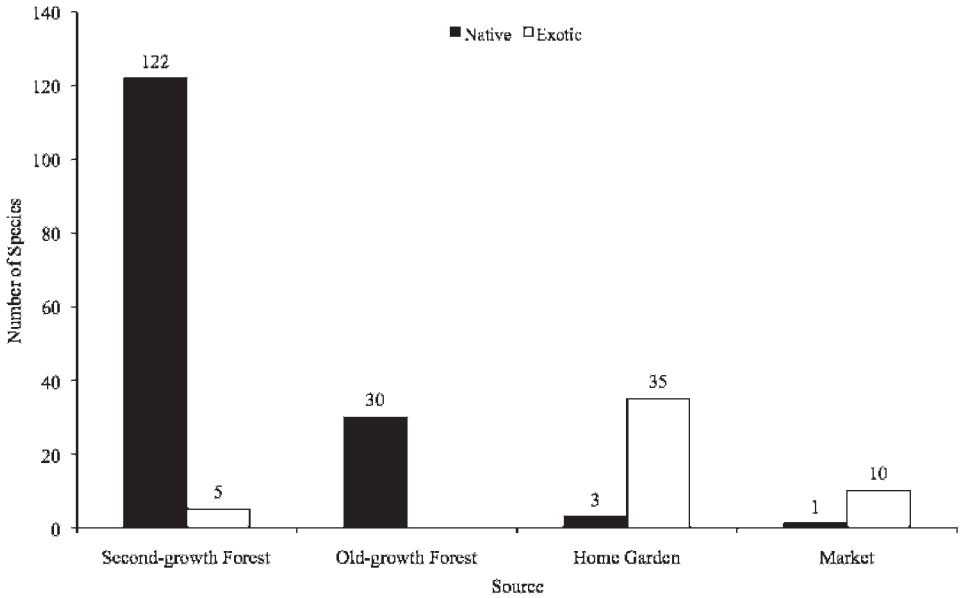

FIGURE 4.—Medicinal plants, origin and sources.

majority of Rama medicinals are native (156 species) to eastern Nicaragua and about 25% (50 species) are exotic - not native to eastern Nicaragua (Appendix; Figure 4).

Home-gardens.—The Rama get 38 medicinal species from home gardens (Figure 4). Medicinal home gardens (gardens dedicated primarily to growing medicinal species) range in size from 50 – 100 m^2 and are primarily on the Island of Rama Cay. Species composition and diversity in medicinal home gardens are determined by the following factors: (a) ownership (e.g., traditional healer, general populace); (b) size of the garden; (c) owner access to plant materials; and (d) the ability of the owner to travel to other areas. Depending on their specialty, traditional healers grow a select group of medicinal species in their home gardens. For example, a snakebite doctor would grow key species, such as *alcotán* (104 *Cissampelos pareira* L.), antidote beans (54 *Fevillea cordifolia* L.), snake root (19 *Aristolochia trilobata* L.), and *sorosi* (56 *Momordica charantia* L.). Similarly, a midwife would grow certain key species, such as *baasley* (87 *Ocimum campechianum* Mill.), ***biip kaat*** (122 *Piper auritum* Kunth), john charles (86 *Hyptis verticillata* Jacq.), and ***uriaup*** (145 *Citrus aurantifolia* [Christm.] Swingle). These home gardens are ready sources of medicinals (the ''pharmacy'' is at hand). Species similarity between medicinal home gardens is high because of multiple uses of a single species (Appendix). For instance, wild rice (153 *Scoparia dulcis* L.) is used as a snakebite remedy and a parturifacient (plant remedies used to induce or accelerate contractions during labor to hasten the delivery of the fetus) during childbirth.

The majority of medicinal species (35 of 38 species) grown in home gardens are exotics (Figure 4). These exotics are widely used as remedies because most are effective in treating a wide array of illnesses due to their bioactivity (see Appendix). Exotic medicinals grown in Rama home gardens are natives of both

the New World (NW) and Old World (OW) as follows: NW species include aloes (179 *Aloe vera* L.), ***kasuu*** (6 *Anacardium occidentale* L.), ***kuuk*** (166 *Theobroma cacao* L.), ***kuulup*** (91 *Persea americana* Mill.), *sowasap* (11 *Annona muricata* L.); OW species include ***airi*** (23 *Matricaria recutita* L.), *caña fistula* (67 *Cassia fistula* L.), castor bean (64 *Ricinus communis* L.), hog apple (137 *Morinda citrifolia* L.), ***kukunup*** (181 *Cocos nucifera* L.), ***mankruu*** (7 *Mangifera indica* L.), ***prauk*** (196 *Cymbopogon citratus* [DC.] Stapf), *sorosi* (56), ***sumuu*** (193 *Musa acuminata* Colla), and ***uriaup*** (145). Some of the most important exotic medicinals grown in home gardens are native to the OW.

Markets.—Rama participation in the market economy is minimal because of geographical isolation and poverty. Therefore, it is not surprising that only 11 of 206 medicinal species are purchased from markets by the Rama (Appendix; Figure 4). The low use of purchased medicinals by the Rama has more to do with availability than cultural preferences. In contrast, native medicinals are more widely used because they are ubiquitous and free of cost. A review of the Appendix indicates that species acquired at the market are nevertheless important as they are used in the preparation of certain remedies. Some of the most important purchased medicinal species are the following: ***airi*** (23), cloves (113 *Syzygium aromaticum* [L.] Merr. & Perry), cinnamon (89 *Cinnamomum zeylanicum* Blume), nutmeg (109 *Myristica fragrans* Houtt.), *romero* (88 *Rosmarinus officinalis* L.), garlic (189 *Allium sativum* L.), ginger (206 *Zingiber officinale* Roscoe), and onion (188 *Allium cepa* L.) - all natives of the OW. The majority of medicinals obtained from markets are exotics (10 of 11 species) and account for only 5% of species used (Figure 4).

Second-growth Forests.—The second-growth forests are the most important source of plant materials to Rama subsistence activities. The majority of Rama medicinals (127 of 157 forest species) are obtained from second-growth forests (Appendix; Figure 5). Medicinals from second-growth forests are the core of Rama ethnopharmacopoeia. Most are common ''weedy'' herbs (54 of 127 species) of second-growth forest (Appendix; Figures 4, 5). In addition, the more common a ''weedy'' plant is, the more medicinal use it has. Species growing in second-growth forests have a higher frequency of medicinal uses and include a greater percentage of species with bioactive compounds than species growing in other sites (Appendix; Chazdon and Coe 1999; Coe and Anderson 1996a, 1997, 1999). Some important ''weedy'' medicinal species found in second-growth forests are the following: *baasley* (87), ***biip kaat*** (122), *bitta wood* (154 *Quassia amara* L.), broom weed (98 *Sida acuta* Burm. f., 99 *S. rhombifolia* L.), *jackass bittas* (26 *Neurolaena lobata* [L.] R. Br), john charles (86), *piss-a-bed* (79 *Senna occidentalis* [L.] Link), red scholars (135 *Hamelia patens* Jacq.), ringworm bush (78 *Senna alata* [L.] Roxb.), *sorosi* (56), *Spanish ela* (124 *Piper jacquemontianum* Kunth), ***towtow*** (53 *Kalanchoe pinnata* [Lam.] Pers.), *vorvine* (175 *Stachytarpheta cayennensis* [Rich.] Vahl, 176 *S. jamaicensis* [L.] Vahl), and wild rice (153).

Old-growth Forests.—Old-growth forests are not a major source of Rama medicinals (Appendix; Figures 4, 5). Only 30 of 157 forest medicinal species are obtained from old-growth forests (Figures 4, 5). However, each forest type has particular species that are essential to the local ethnopharmacopoeia. Trees

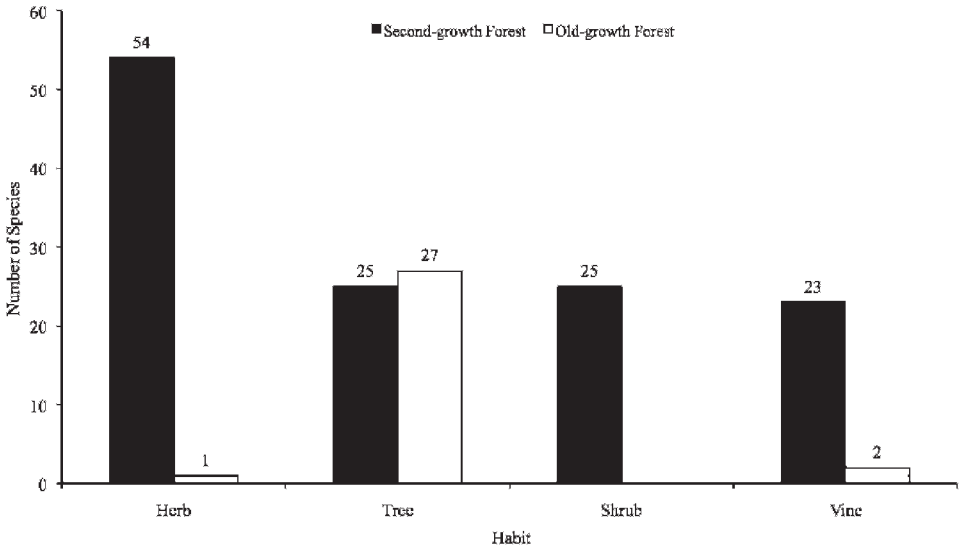

FIGURE 5.—Medicinals arranged by forest type and habit.

from old-growth forests provide an assortment of materials (e.g., bark, sap, and wood) that are used in the preparation of remedies (Appendix). The majority of medicinals (27 of 30 species) from old-growth forests are trees (Figure 5). Some of the most important medicinal tree species from old-growth forests are: *alcanfor* (37 *Protium ravenii* D. M. Porter), ***banak*** (110 *Virola koschnyi* Warb.), coal wood (155 *Simarouba amara* Aubl.), ***ebo*** (73 *Dipteryx oleifera* Benth.), ***kliis*** (108 *Ficus insipida* Willd.), *mamee* (152 *Pouteria sapota* [Jacq.] H. E. Moore & Stearn), naked man (36 *Bursera simaruba* [L.] Sarg.), *sambogum* (45 *Symphonia globulifera* L.f.), *santa maría* (44 *Calophyllum brasiliense* Cambess), ***pañkar*** (151 *Manilkara zapota* [L.] P. Royen), and ***siin*** (33 *Cordia alliodora* [Ruiz & Pav.] Oken) (see Appendix).

Plant Medicines.—Rama medicinals belong to a taxonomically diverse group of plants (Appendix; Figure 3). Many Rama plant families contain a large number of species with reputed medicinal properties (Appendix; Table 1). Families with the largest number of species are the following: Fabaceae (18 species), Rubiaceae (15 species), Solanaceae (9 species), Euphorbiaceae (8 species), and Piperaceae (8 species) (Appendix; Table 1). The majority of medicinals (155 of 206 species) are native to eastern Nicaragua (Figure 6). However, many popular medicinal species (51 of 206 species) are exotics, such as ***airi*** (23), *sorosi* (56), *romero* (88), cloves (113), and ginger (206) (Appendix; Figure 6). Exotic medicinals, even though important, are few in Rama ethnopharmacopoeia because of (a) limited access to major population centers where exotics are sold in stores and regional markets; (b) a lack of cash to purchase medicinals or the remedies made with them; and (c) the great diversity of native medicinal species.

The majority of Rama medicinal species are native herbs (57 species) and trees (53 species) (Appendix; Figure 6). The most frequently used plant part in the preparation of herbal remedies is leaves, followed by bark (Figure 7). Preference for leaf material is not unexpected because most plants tend to store

TABLE 1.—The 16 plant families with the most medicinal species used by the Rama in eastern Nicaragua (rank ordered by total). The numbers are species.

Family	Medicinal Species
Fabaceae	18
Rubiaceae	15
Solanaceae	9
Euphorbiaceae	8
Piperaceae	8
Asteraceae	7
Poaceae	6
Verbenaceae	6
Apocynaceae	5
Lamiaceae	5
Rutaceae	5
Arecaceae	4
Moraceae	4
Clusiaceae	3
Cucurbitaceae	3
Cyperaceae	2

high concentrations of bioactive compounds in these parts for protection against herbivores and microorganisms (Coe and Anderson 1996a, 1996b, 1997, 1999). In addition, leaves are easy to collect, transport, and store, and it is easy to extract bioactive compounds from them. The most frequently elicited modes of preparation are decoctions (boiling of plant parts), poultices (mashed, crushed, or chopped plant parts), juices (extracts of plant part), infusions (steeping plant parts in hot water), baths (plant parts are placed in hot water or boiled until steam is obtained), and syrups (plant parts are boiled to yield a thick paste) (Figure 8). Decoctions and poultices are the preferred modes of preparation (Figure 8). Sometimes, these are mixed with foods, spices, and pharmacological agents (e.g., aspirin, sulfur tablets). The most frequently used modes of administration of medicinal preparations are oral and topical (Figure 9). Oral and topical modes of administration are preferred because they are the most effective in delivering the bioactive compounds into the body. These findings are similar to those documented for the Garífuna (Coe and Anderson 1996a), Miskitu (Coe and Anderson 1997), and Sumu (Coe and Anderson 1999) of eastern Nicaragua.

Most (186 of 206 species) of Rama medicinals have at least one bioactive principle identified in this survey (Appendix; Figure 10). Alkaloids are the most abundant bioactive compounds (152 of 206 species), but glycosides are also present, although to a lesser extent (34 of 206 species) (Figure 10). The remaining 20 species contain other bioactive compounds such as amino acids, essential oils, hydrocarbons, phenols, saponins, and steroids. Herbs include the largest number of alkaloid-bearing species, with tree species ranking a distant second (Figure 11).

Health and Healing.—Infectious and parasitic disorders (e.g., gastrointestinal, respiratory, and dermatological disorders) are the most prevalent in the Rama community. Nonetheless, we will also briefly discuss other natural illnesses that occur at a much lower incidence and that, in most instances, are not life

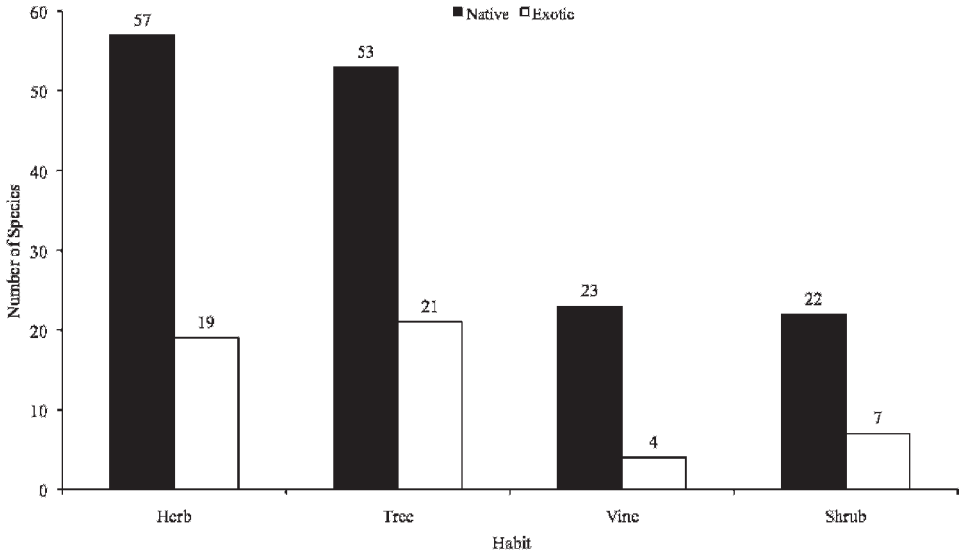

FIGURE 6.—Medicinal plant species arranged by origin and habit.

threatening (except snakebite). To treat and cure natural ailments, the Rama utilize both traditional medicine and Western medicine. Western medicine has become more accessible to the Rama with the opening of an outpatient clinic on the Island of Rama Cay in the 1980's by the Ministerio de Salud (MINSA). Yet, in most cases, people (especially the elderly) still rely on traditional medicine for treatment of their ailments (snakebite included) and seek Western medicine only as a last resort. Preference for traditional medicine is partly due to cultural

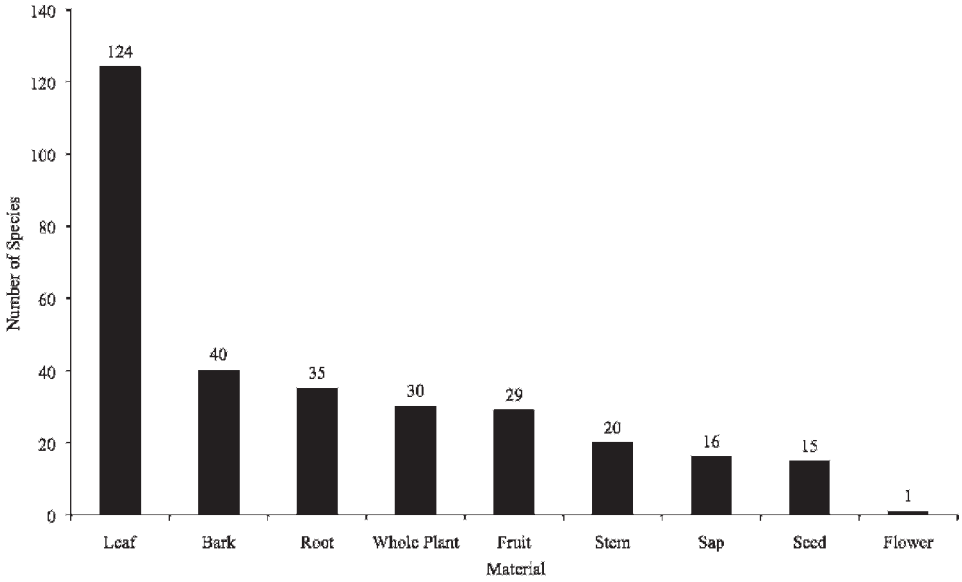

FIGURE 7.—Medicinal plants; parts used.

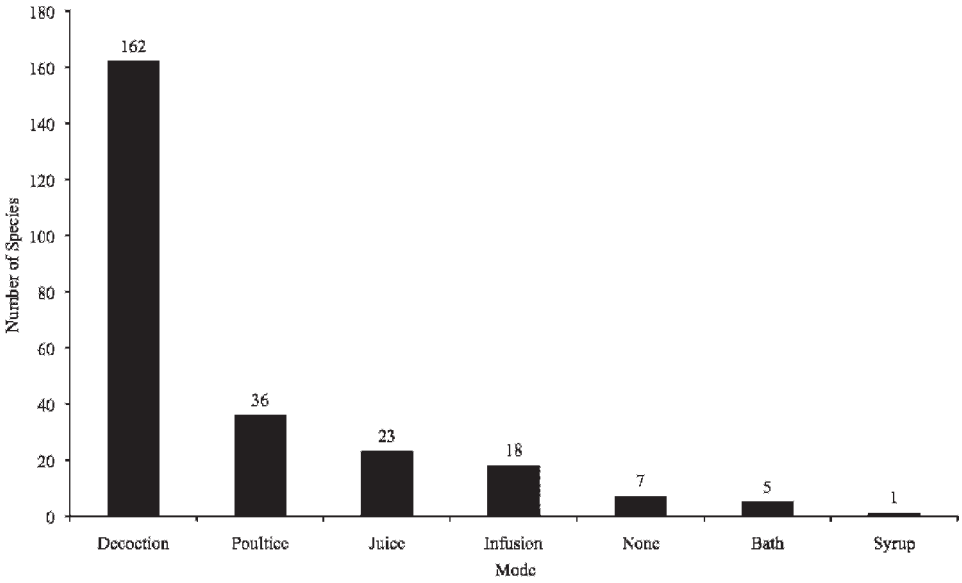

FIGURE 8.—Mode of preparation of medicinals.

beliefs, but more importantly to its lower cost (Loveland 1975a). Payment for medical treatment, whether traditional or biomedical, is still largely made through the barter system.

Causes of Illness and Treatments.—The Rama believe in a dualistic cause of illnesses - natural and supernatural. Natural illnesses symbolize the biological as well as

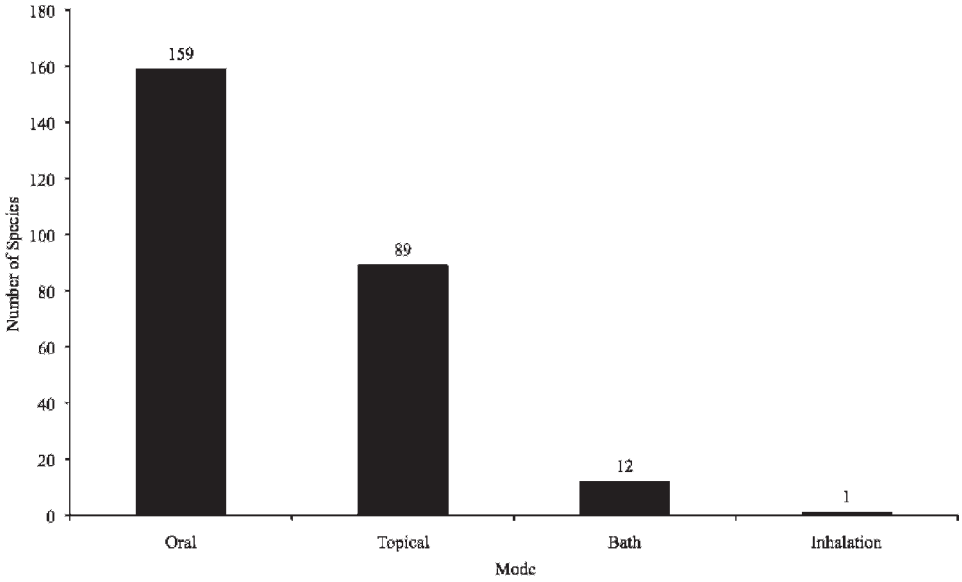

FIGURE 9.—Mode of administration of medicinal preparation.

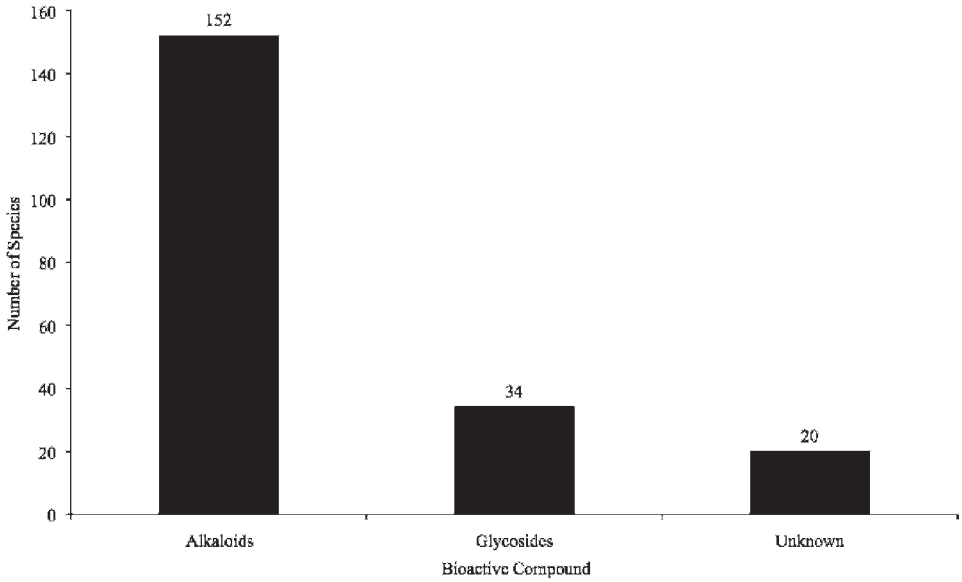

FIGURE 10.—Occurrence of alkaloids and glycosides in Rama medicinal plants.

the social order; these ailments are treated with both folk medicine and Western medicine. On the other hand, supernatural illnesses are caused by the intervention of negative forces of nature and ancestral spirits; in the past the ***turmaala*** (a shaman involved in healing and curing rituals) was responsible for treating these illnesses (Loveland 1982). The Rama believe that natural illnesses

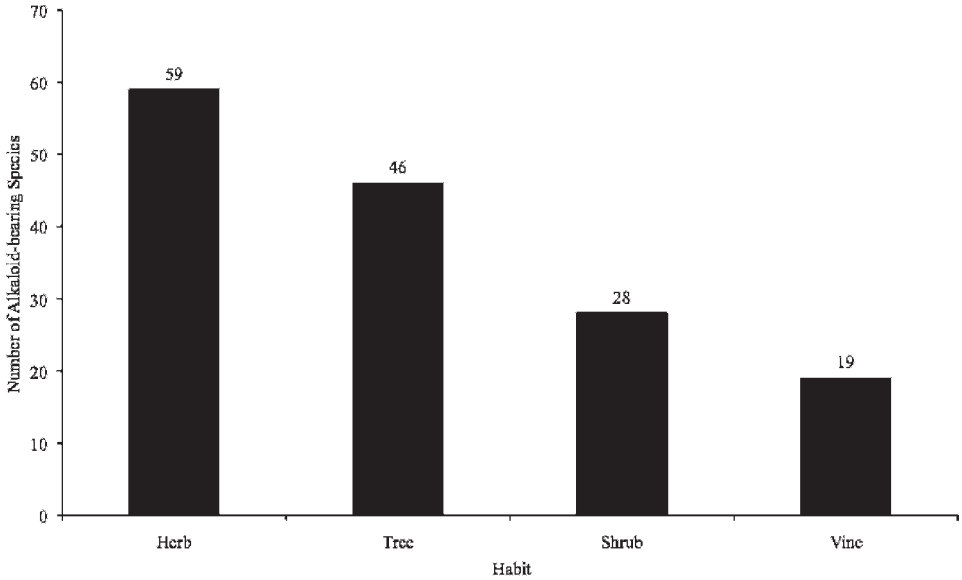

FIGURE 11.—Presence of alkaloids in relation to species habit.

are caused by humoral imbalance. According to the humoral theory, the body responds to the ''hot'' or ''cold'' properties of certain foods and medicine. Food plants eaten during illnesses are carefully selected to promote healing (e.g., during treatment for snakebite).

Representative modes of treatment are illustrated below by reference to typical illnesses or conditions as categorized by Coe. Besides infectious and parasitic diseases, other health conditions among the Rama include aches and pains, anemia, bites and stings, burns, complications during childbirth and pregnancy, cuts and hemorrhage, digestive problems, female reproductive disorders, hypertension, diabetes, and poisoning. To treat these disorders, traditional Rama healers (Figure 2) used a combination of herbal remedies and pharmaceutical products.

Infections and parasitic diseases.—Infections and parasitic diseases are the major cause of illness among the Rama, particularly skin and mucosal infections in children, and are most often due to poor sanitary conditions. Rama healers treat infections with a wide array of plant species that contain many types of bioactive compounds such as alkaloids, glycosides, and tannins - a group of polyphenols that are widely distributed in the plant kingdom (Lewis and Elvin-Lewis 1977, 2003; Stecher et al. 1960; Thomas 1985; Tyler et al. 1988) (see Appendix 1). In addition, many Rama medicinals exhibit *in vitro* antimicrobial activity (Cáceres et al., 1987a, 1987b, 1990, 1991a, 1991b; Domínguez and Alcorn 1985).

In eastern Nicaragua, diarrhea is the most common illness afflicting the population (Coe and Anderson 1996a). Fortunately, in most cases, this disorder is not life threatening and can be treated with a number of folk remedies. The Rama use a wide variety of plants as antidiarrheals, particularly species rich in phenolic compounds such as tannins. Rama antidiarrheal remedies are prepared from the bark, leaves, and roots of 66 species distributed among 35 families (Appendix 1). One of the most widely used antidiarrheal remedies is prepared from the bark of ***laulau*** (129 *Rhizophora mangle* L.). Other species used are sea grape (127 *Coccoloba uvifera* [L.] L.), *botton bush* (47 *Conocarpus erectus* L.), coal wood (155), *guácimo* (168 *Luehea seemanii* Triana & Planch.), ***kasuu*** (6), ***krabu*** (94 *Byrsonima crassifolia* (L.) Kunth), *raizcilla* (142 *Psychotria ipecacuanha* [Brotero] Stokes), *scorpion tail* (35 *Heliotropium indicum* L.), and *trompit* (41 *Cecropia obtusifolia* Bertol, 42 *C. peltata* L.).

Another common ailment in eastern Nicaragua is amebic dysentery. To treat amebiasis, the Rama use a wide variety of species such as *bitta wood* (154), snake root (19), *alcotán* (104), red scholars (135), *raizcilla* (142), sore-mouth bush (144 *Psychotria poeppigiana* Muell.), ***silbyara*** (134 *Hamelia axillaris* Sw.), and ***kukunup*** (181). However, the most widely used remedy is prepared from *bitta wood* (154); this species contains glaucarubin and the triterpenoid quassin, both reputed amebiasis treatments (Duke 1985, 1992a, 1992b; Gibbs 1974). Other species used for their anti-amebiasis properties are snake root (19) with the isoquinoline alkaloid berberine (Gibbs 1974; Raffauf 1970) and *alcotán* (104) with the isoquinoline alkaloids berberine and bebeerine (Raffauf 1970; Willaman and Schubert 1961). All remedies for amebiasis are decoctions prepared from leaves, roots, and wood, with the exception of ***kukunup*** (181) where the endosperm milk

is used. The saturated fats in ***kukunup*** (181) milk, such as capric and lauric acids, have been found to boost the immune system. In addition, ***kukunup*** (181) milk has antiviral, antibacterial, antifungal, and anti-protozoan properties (Bergusson et al. 2001; Enig 1998).

Ear infections are treated with decoctions and/or poultices prepared from roots, leaves, and flowers. One of the most widely used antimicrobial species is snake root (19), which likely owes its bioactivity to the alkaloid aristolochic acid. Other species used as antimicrobials include ***laulau*** (129), which is rich in tannin (a phenol), and ringworm bush (78), which owes its bioactivity to the anthraquinone glycosides, emodin and rhein (Duke 1985). Also very effective are certain members of the family Rubiaceae, such as *coralillo* (141 *Psychotria elata* [Sw.] Hammel), red scholars (135), ***silbyara*** (134), ethel bush (136 *Isertia haenkeana* DC.), and sore-mouth bush (144). These species contain indoles, purines, quinoline alkaloids, and the phenolic acid quercitin (Gibbs 1974). These compounds are reputed antimicrobials because of their biostatic and biocidal properties (Duke 1985, 1992a, 1992b).

The Rama treat eye infections with remedies made from roots, leaves, and flowers. Eye infection remedies are administered as eyewashes (prepared as decoctions), poultices, or plant juices that are applied directly to the eye. The most widely used eye infection remedy consists of directly applying the leaf juice of *piss-a-bed* (79). This species is a reputed antimicrobial because it contains the anthraquinone glycosides emodin and rhein (Duke 1985). Another effective eyewash is made from extracted phenolic oxides of the leaves and roots of scorpion tail (35) (Gibbs 1974).

Infections of the kidney and liver are relatively common and are treated with a variety of species. The most important remedy is a leaf decoction made from ringworm bush (78), *sorosi* (56), strong back (70 *Desmodium adscendens* [Sw.] DC.), and *burbur* (71 *Desmodium incanum* DC.). These decoctions are prepared with 6 – 10 leaves and three cups of water taken three times a day. These remedies are probably effective because the species used contain phenolic acids, the lactone glycoside furanocoumarin, and tannins (a type of phenol that is a reputed antimicrobial with biostatic and biocidal properties) (Duke 1985, 1992a, 1992b; Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Oral infections such as thrush and gingivitis that are caused by the fungus *Candida albicans* afflict primarily newborn babies and individuals with compromised immune systems (Lewis and Elvin-Lewis 1977, 2003). To treat thrush, the Rama apply honey in the mouth and/or throat. Gingival infections are treated with decoctions prepared from the leaves and roots of ***uriaup*** (145), ***uriaup supkaba*** (146 *Citrus aurantium* L.), the bark of ***laulau*** (129) and ***krabu*** (94), the leaves and stems of *alcotán* (104), the wood of ***ebo*** (73), and the leaves and roots of *coralillo* (141), red scholars (135), and sore-mouth bush (144). Decoctions from these plants are administered as mouth washes two to three times a day. The efficacy of these mouthwashes is probably due to the presence of isoquinoline alkaloids (e.g., bebeerine), anthraquinone glycosides (e.g., aloe-emodin, chrysarobin, and chrysophanol), phenols (e.g., tannins), and volatile oils (e.g., eugenol, thymol, and terpineol). Such compounds are reputed antimicro-

bials because of their biostatic and biocidal properties (Duke 1985; Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Skin rashes and sores of fungal origin are treated with the juice of the fresh leaves or a leaf decoction of ringworm bush (78). In addition, a bath made from the leaves of ringworm bush (78) is used to treat a fungal infection that causes skin depigmentation, known in Creole as ''shifting-cloud.'' Other species used are *jackass bittas* (26), ***krabu*** (94), ***laulau*** (129), and *sorosi* (56). The antimicrobial properties of these species are probably due to the presence of alkaloids and phenols (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Urinary tract infections are treated with a leaf decoction made from ***kaismitin*** (27 *Sphagneticola trilobata* [L.] Pruski). The effectiveness of ***kaismitin*** (27) is probably due to quinoline alkaloids, the flavonol glycoside, quercetin, and phenolic acids, such as gentisic and salicylic acids (Duke 1985, 1992a, 1992b; Gibbs 1974). Bioassays performed by Cáceres et al. (1987b) with the extracts of ***kaismitin*** (27) showed antimicrobial activity. Other effective remedies for urinary tract infections are prepared from ***laulau*** (129) and ringworm bush (78). A bark decoction of ***laulau*** (129) is widely used because of its effectiveness in treating urinary tract infections and its ubiquity in the lowland swamp forest; it also contains high concentrations of tannin (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). *In vitro* screening of ***laulau*** (129) using *Candida albicans*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* exhibited antimicrobial activity (Cáceres et al. 1987b). Another popular remedy for urinary tract infections is a decoction made from ringworm bush (78). The antimicrobial use of ringworm bush (78) is well documented and is one of the most widely used herbs for external and internal infections (Coe and Anderson 1996a, 1996b, 1997, 1999; Dennis 1988; Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). Ringworm bush (78) contains many bioactive compounds, such as alkaloids (isochaksine, pyridine), anthraquinone glycosides (argenin–c–glycoside, chrysarobin, aloe emodin, rhein, sennosides A & B), quercetin, tannic acid, naphthaquinones, steroids [sterols (β-sitosterol, campesterol, γ-sitosterol)], and volatile oils (cinnamaldehyde, decanal) (Cambie and Ash 1994; Duke 1985, 1994; Gibbs 1974; Tyler et al. 1988). These compounds are effective antimicrobials because of their biostatic and biocidal properties (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Parasitic worms of the intestine (e.g., hookworm, roundworm, and tapeworm) afflict mostly children and are treated with vermifuges made from a wide variety of medicinal plants. One of the most widely used vermifuges is a decoction prepared from *vorvine* (175, 176). These two species contain essential oils rich in citral, geraniol, and the glycoside stachytarphine, compounds known for their anti-helminthic properties (Morton 1981). Other vermifuges used are prepared from the whole plant of worm bush (92 *Spigelia anthelmia* L.) with the alakloid spigeline, *bitta wood* (154) with the triterpenoid quassin (Gibbs 1974), and *jackass bittas* (26), and *baasley* (87), both of which contain the essential oil thymol (Duke 1985). The compounds cited above are reputed anti-helminthics because of their biocidal properties (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Malaria is treated successfully with a combination of herbal remedies and pharmaceuticals. The Rama use a variety of species to make herbal remedies

called ''blood purifiers'' to treat malaria. These ''blood purifiers'' are considered effective antimalarials by the Rama because they taste bitter. The practice of using bitter-tasting species as anti-malarials may have some validity because a number of bitter-tasting compounds, particularly the quinoline alkaloids and neoquassin (triterpenoid), are reputed malariacidals (Duke 1985; Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). For example, one of the most highly regarded antimalarial remedies used by the Rama is a decoction made with *bitta wood* (154). *Bitta wood* (154) contains glaucarubin and neoquassin, two known malariacidals (Duke 1985, 1992a, 1992b). Neoquassin has a principle 50 times more bitter than quinine (Duke 1985), thus, the common name of this species. Other species used for their anti-malarial properties are snake root (19) that contains berberine and the nitrophenanthrene alkaloid aristolochine (Gibbs 1974; Raffauf 1970), *alcotán* (104) with the isoquinoline alkaloids, aristolochine, berberine, and bebeerine (Raffauf 1970; Willaman and Schubert 1961), and *stuco weed* (66 *Caesalpinia bonduc* [L.] Roxb.), which contains the glycoside bonducin (Cambie and Ash 1994; Kapoor 1990).

Other conditions.—Aches and pains are treated with a wide variety of plants that are sometimes mixed with pharmaceutical products. A frequent source of pain is caused by muscular strain from strenuous work. One of the most widely used remedies for muscular pain is a poultice made from the leaves of ***towtow*** (53) mixed with aspirin and applied directly to the afflicted area. Other remedies used to treat aches and pains are decoctions made from plant parts containing the analgesic compound salicylic acid, anti-inflammatory agents such as phenols (in the form of tannins), and saponins. For example, a bath made from the leaves and stems of ***kaismitin*** (27) is used to alleviate pain from muscle cramps and rheumatism, and a poultice made from its leaves is used to treat swollen joints and arthritic pain. Another pain remedy is a decoction made from the leaves and roots of strong back (70). This species contains the phenol gentisic acid (Gibbs 1974). Gentisic acid is both analgesic and anti-inflammatory (Duke 1985, 1992a, 1992b).

Anemia is treated with tonics prepared from species such as *bitta wood* (154), *chainey root* (202 *Smilax regelii* Killip & Morton, 203 *S. spinosa* Mill.), *sorosi* (56), *jackass bittas* (26), *piss-a-bed* (79), ***plingkiing*** (32 *Pachira aquatica* L.), and snake root (19). The most popular tonics and fortifiers are those prepared from *chainey root* (202, 203).

Burns occur mostly during food preparation, rendering of fats from plants or animals, and burning of forests/fields for agriculture. In most instances, burns are first degree and are treated primarily by cooling down the afflicted area with water and applying plant sap or fats. However, unfortunately, life-threatening second and third degree burns are not uncommon. One of the primary objectives in treating such severe burns is to lower the temperature of the afflicted area to stop or diminish tissue damage. To accomplish this, the Rama use a variety of remedies that includes cold water and both plant and animal materials. Plant materials used include the leaves of hog apple (137), leaf sap from aloes (179), ***sumuu*** (193, 194 *Musa acuminata* x *M. balbisiana* Colla), ***pranti*** (195 *Musa x paradisiaca* L.), and fats from both ***kuuk*** (166) and ***kwiiksa*** (182 *Elaeis guineensis*

Jacq., 183 *E. oleifera* [Kunth] Cortés). Another important element of burn treatment, particularly second and third degree burns, is control of infection. To prevent or treat infections, the afflicted area is washed with a decoction made with leaves and roots from a broad range of families and species of reputed bioactivity. Some of the most widely used species belong to the family Rubiaceae, such as sore-mouth bush (144), ***silbyara*** (134), ethel bush (136), red scholars (135), and *coralillo* (141). These species may be effective in controlling infections because they contain phenolic acids as well as indoles, purines, and quinoline alkaloids known for their biostatic and biocidal properties (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). Other important species are ***krabu*** (94) and ***laulau*** (129), both rich in phenols; *alcotán* (104), which contains the alkaloids bebeerine and berberine; ringworm bush (78) and *piss-a-bed* (79), which are rich in the anthraquinone glycosides aloe emodin, chrysarobin, and chrysophanol; and *baasley* (87), which contains the essential oils eugenol and thymol.

Purgatives are used by the Rama to purge the system of noxious products and to relieve constipation. Many flowering plants produce irritant oils and resins that can be used as effective purgatives (Lewis and Elvin-Lewis 1977, 2003; Tyler et al., 1988). The most widely used species by the Rama belong to the families Convolvulaceae, Cucurbitaceae, Euphorbiaceae, and Fabaceae, although commonly used purgatives prepared with species from these families are often very toxic. Species used as cathartics include beach morning glory (52 *Ipomoea pes-caprae* [L.] R. Br.) and antidote beans (54); both contain elatrin resins known for their cathartic properties. In addition, the Rama also use members of the family Euphorbiaceae as cathartics. The most popular cathartic is the castor bean (64); its seeds contain a purgative oil that owes its action to the triglyceride, ricinoleic acid (Morton 1981). Other cathartic species in this family include purging physic (61 *Jatropha curcas* L.) and physic nut (62 *Jatropha gossypiifolia* L.). The seed oils, plant saps, and leaves of these species contain purgative compounds (Morton 1981). Fabaceae also contains many important cathartic species, particularly in the genus *Senna*, that are rich in anthraquinones. The exotic *caña fistula* (67) is widely used as cathartic because it contains rhein, sennosides A and B, kaempferol, and fistulin, a bi-anthraquinone glycoside (Kumar et al. 1966).

The Rama use a variety of plants as antidotes for poisoning. The extracts of these species are emetics and contain primarily isoquinoline alkaloids, such as emetine, hydrastine, tubocurarine, and berberineas well as the opiate aporphine (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). Emesis is of particular importance for young children in the treatment of poisoning. A number of home remedies are used that include both plant and non-plant materials. Folk medicine is replete with plant remedies that are used to induce vomiting. Most Rama emetics are members of the family Rubiaceae. Popular emetic species include *coralillo* (141), raizcilla (142), sore-mouth bush (144), and red scholars (135); the roots and other parts of these species contain cephaeline, emetine, and psychotrine (Willaman and Schubert 1961). Other species used to prepare emetic decoctions are the flowers of ***airi*** (23), the leaves of physic nut (62), the cotyledons of antidote beans (54), and *bitta wood* (154); these decoctions contain

bioactive compounds that, in large doses, irritate the stomach, thus producing emesis (Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988).

Cough and asthma are common respiratory disorders that are treated with a decoction made with the whole plant of ringworm bush (78), *coralillo* (141), ethel bush (136), john charles (86), ***kaismitin*** (27), and *sorocontil* (80 *Senna reticulata* [Willd.] H. S. Irwin & Barneby). This remedy is probably effective because these species contain phenolic acids of reputed biostatic and biocidal properties (Duke 1994; Germosén-Robineau et al. 1998; Gibbs 1974).

The Rama use a wide variety of plants to treat toothache. Species used contain compounds with anesthetic, analgesic or anti-irritant properties. Plant materials are chewed, applied directly to the tooth cavity or on the gum, or prepared as a decoction to rinse the mouth. A popular remedy, especially for teething infants, is the stem and root sap of ***biip kaat*** (122), which acts as a local anesthetic. This species contains the anesthetic compounds eugenol, eugenol methyl ether, and safrole (Duke 1985, 1997). The seeds or a paste of ***alkiini astaiki*** (157 *Capsicum chinensis* Jacq.) are also placed directly in the tooth cavity or on the gum. *Capsicum* peppers contain both capsaicin and salicylates; these compounds are aspirin-like and can relieve pain (Duke 1997; Tyler et al. 1988). Other species that are rich in tannins are prepared as gargles and mouthwashes. Examples include ***laulau*** (129), *botton bush* (47), ***ebo*** (73), and *mamee* (152). Tannins are also known for their astringent properties (Duke 1985, 1992a, 1992b; Lewis and Elvin-Lewis 1977, 2003; Tyler et al. 1988). The Rama also use volatile plant oils of exotic species as anesthetics and anti-irritants, including many citrus species (145, 146, 147, 148) and oil of clove (113). The latter is one of the richest natural sources of the anesthetic compound eugenol (Duke 1997). However, the most widely used native remedy for toothache in eastern Nicaragua is the root of ***prauk*** (118 *Petiveria alliacea* L.), which is chewed. A decoction made from this species is also used as a mouthwash to protect against caries, tooth loss, bleeding gums, and to promote strong and healthy teeth. The effectiveness of ***prauk*** (118) in dental care may be due to the benzoic acid coumarin, myricitrin, phenols, quinine, and trithiolaniacine (Duke 2005). The teeth-cleaning practice of chewing on sticks and the use of wood ash as an abrasive powder are still practiced by the Rama. Chewing sticks are obtained primarily from the species locally called chew stick (128 *Gouania lupuloides* [L.] Urban). Tooth cleaning with wood ash is done by wetting (with saliva or water) the index finger, inserting it into the ash, and rubbing the finger back on forth on the surface of the tooth. Wood ash used for teeth cleaning is obtained from species with high silica content in their ray cells, such as ***kasuu*** (6), *alcanfor* (37), ***siin*** (33), and ***biup*** (43 *Chrysobalanus icaco* L.). The latter species is the most widely used dentifrice by the Rama because it has a high concentration of silica bodies that are both large and very rough (Carlquist 1988).

Rama midwives (***apa***) provide care to expecting mothers, those in childbirth, and also to infants. They also offer treatment for female reproductive disorders and contraception. During pregnancy, the midwife provides guidance to expectant mothers on issues ranging from social activities to diet. For example, pregnant women are not allowed to come in contact with snakebite victims because the Rama believe the child will be born with birth defects (see Coe and Anderson 2005). In addition, certain foods are forbidden because they are

considered ''hot'' and capable of inducing an early delivery or causing the fetus to abort, or they promote bleeding and hemorrhaging (e.g., ***ebo*** [73] is prohibited because of its alleged anticoagulant properties). Conversely, the use of certain plants is encouraged both pre- and postpartum because the plants are beneficial to both mother and fetus. For example, pre- and post-parturition fortifiers or ''blood tonics'' (prepared as decoctions) are made by midwives from the wood of monkey ladder (65 *Bauhinia guianensis* Aubl.), the bark of naked man (36), the bark of ***laulau*** (129), *chainey root* (202, 203), the leaves and roots of broom weed (98, 99), the leaves of *baasley* (87), the leaves of *sorosi* (56), and the leaves and roots of *piss-a-bed* (79); these species are reputed fortifiers because they contain relatively high concentrations of iron (50–1300 ppm [Duke 1985]), supplementing the iron requirement during both pregnancy and lactation.

Rama midwives use 162 species of flowering plants that are distributed over a wide range of families and genera. Some of the most prevalent female disorders and the plants that are used by midwives to treat them are discussed below. Midwives use several species to regulate menstrual flow and fertility. Remedies for reducing or inhibiting menstrual flow are decoctions made from ***kasuu*** bark (6) and the young red leaves of *trompit* (41, 42). In contrast, decoctions made from the leaves of *sorosi* (56) and *jackass bittas* (26) or from the stems of *bitta wood* (154) are used to induce menses to ''bring down the period.'' A tonic to increase fertility is made by soaking the roots of ringworm bush (78) in rum. However, common practice dictates that for the tonic to be effective, it must be drunk prior to the onset of menses. Other fertility remedies are decoctions prepared from the root and leaves of ***kaismitin*** (27) and *vorvine* (175, 176). Rama midwives use a wide array of plant species and preparations as abortifacients. The most widely used are decoctions made from the bark and/or seed of ***kuulup*** (91) and *sowasap* (11), the bark and/or leaves of ***mankruu*** (7), the bark of ***laulau*** (129), the stems of *bitta wood* (154), the leaves of *sorosi* (56), and the leaves, bark, and roots of ***uriaup*** (145).

A decoction that is prepared from the leaves and roots of ***prauk*** (118), wild rice (153), ***uriaup*** (145), and *trompit* (41, 42) is used both to induce labor and to reduce pain during childbirth. Postpartum pain is treated with a decoction made from the entire plant of john charles (86), the leaves of *vorvine* (175, 176), a root decoction of strong back (70), and the roots and leaves of sleeping bush (76 *Mimosa pudica* L.); the latter is also used as a postpartum sedative. To reduce uterine hemorrhage, a decoction is made from the skin of ***mankruu*** (7), the leaves of ***kawas*** (112 *Psidium guajava* L.), the leaves of *baasley* (87), the bark of ***laulau*** (129), and ***kasuu*** (6). Milk flow is promoted by drinking a decoction made from the rhizomes of ginger (206) and a leaf decoction of ***biip kaat*** (122) that is used to bathe the breast. After the placenta is delivered, a leaf decoction of ***biip kaat*** (122) is drunk and the stem sap is placed in the vagina to promote contraction of the uterus. A vaginal lavage made from the leaves of ***biip kaat*** (122), ***kaismitin*** (27), and wild rice (153) is used after childbirth to clean and alleviate irritation and to ''cool the inside.'' A sedative and pain reliever is made from the leaves of ***biip kaat*** (122). A leaf decoction made from ringworm bush (78) and *romero* (88) or *sorosi* (56) and *baasley* (87) is used to protect against postpartum vaginal and womb infections.

A common practice in Rama midwifery is the use of blood purifiers. Rama midwives use the leaves of *bitta wood* (154), *sorosi* (56) and *jackass bittas* (26) in the preparation of blood purifiers. In addition, midwives occasionally will use both aphrodisiacs and anaphrodisiacs (substances that reduce sexual desire). For example, a decoction prepared from *bitta wood* (154) and snake root (19) is used as an aphrodisiac ''to bring up your nature.'' In contrast, a decoction made from the roots and leaves of sleeping bush (76) is used as an anaphrodisiac ''to bring down'' or ''kill your nature.''

DISCUSSION AND CONCLUSIONS

This study illustrates that the Rama, though highly acculturated, continue to depend greatly on the natural resources of eastern Nicaragua for their basic needs. This is evident through the large number of plant species that are used in their daily lives (Appendix).

Considering the conditions under which the Rama live (isolation, poor sanitation, little protection from malaria or parasites), their overall health is good. Rama illnesses are considered to be either of natural or supernatural causes. In most instances, both the cause and severity of the illness determines which system of medicine is sought, either traditional or Western medicine. Traditional medicine is usually the first choice for the treatment of primary health care issues. Conversely, for life-threatening illnesses or injuries, often a combination of traditional and Western medicine is employed. However, since the opening of a health care clinic on the Island of Rama Cay during the 1980's, the use of Western medicine has increased dramatically, especially among younger individuals. The preference of Western medicine over traditional medicine could have adverse long-term consequences on the practice of Rama ethnomedicine. Certainly a reduction in the use of traditional medicine will result in fewer apprenticeships and eventually the loss of the ethnomedicinal lore. As with other indigenous cultures, Rama elders (general populace and practitioners) are the ones with the greatest knowledge of the local pharmacopoeia (Coe and Anderson 1996a, 1997, 1999). Even though there is a general pool of ethnobotanical lore common to most people, the core of ethnomedicinal knowledge is lost once the practitioners die - if it is not passed on to the younger generation.

Rama healers possess a rich pharmacopoeia of medicinal species that are used to treat a wide array of illnesses. The majority (127 of 157 forest species) of medicinals is obtained from second-growth forests (Appendix; Figures 4, 5). Reliance on the second-growth forests for medicinals is not a matter of choice but of necessity because of the scarcity of and limited access to old-growth forests. With few exceptions, medicinals are disturbance species - cultivars, annuals, exotics, and weeds. Preference for successional species and the use of cultivated food crops as medicinals is a sensible choice because these species are very accessible and are often rich in bioactive compounds (Appendix) (see also Coe 1994; Coe and Anderson 1996a, 1996b, 1997, 1999, 2005).

Most Rama medicinals are used for similar purposes by other indigenous groups throughout their distribution range (Morton 1981; Arvigo and Balick

1993; Coe and Anderson 1996a, 1997, 1999; Chazdon and Coe 1999). The continued widespread use of these medicinals by the Rama and others is due to efficacy of treatment provided by their chemical constituents and the bioactivity of these compounds.

Of the 206 medicinal species documented in this study, 89 (43%) are used topically, 160 (78%) are used internally, and 101 (49%) are used externally (Appendix; Figures 3, 9). These frequencies may be interpreted as indications of the most common illnesses or health problems encountered, such as aches and pains, fever, infections, asthma, wound healing, snakebite, childbirth, and colds. Conversely, they may signify the kinds of illnesses that can be treated with traditional medicine.

Similar to the Garífuna, Miskitu, and Sumu of eastern Nicaragua, the bulk of Rama plant resources are obtained from a diverse group of plants (Appendix) (see also Coe 1994; Coe and Anderson 1996a, 1997, 1999). The results suggest that certain plant families are important because of the large numbers of species used by the Rama (Table 1). Some of the plant families with the most species used are the Fabaceae (31 uses / 23 species), the Rubiaceae (18 uses / 15 species), the Euphorbiaceae (11 uses / l0 species), the Poaceae (17 uses / l0 species), the Arecaceae (17 uses / 9 species), the Solanaceae (17 uses / 9 species), and the Piperaceae (11 uses / 9 species) (Appendix; Table 1). Species in these families provide the bulk of plant materials used by the Rama for subsistence.

This study is important because it records the use of plant resources of a Mesoamerindian group for which ethnomedicinal documentation is lacking. Given the high degree of Rama acculturation, many cultural practices that were passed on by oral tradition for many generations have been lost (e.g., plant uses, medicines, and ritual practices). However, perhaps the biggest threat to the Rama is the over-exploitation of the biota by outsiders. Although the Rama population has tripled over the past 30 years and they have gained access to Western technology, their primary use of natural resources is for subsistence. Rama dependence on the natural resources of eastern Nicaragua is greater than any other indigenous group of this region (Coe 1994; Coe and Anderson 1996a, 1997, 1999). Similarly, other studies have confirmed the importance of such forest ecosystems to the people who depend on them (e.g., Boom 1987, 1990; Prance et al. 1987; Grenand 1992; Kohn 1992; Salick 1992; Phillips and Gentry 1993; Kvist et al. 1995; Voeks 1996; Caniago and Siebert 1998; DeWalt et al. 1999; Chazdon and Coe 1999; Stepp and Moerman 2001). Rama survival depends greatly on the protection and sustainability of the biota in this region.

This study is important as well because it documents the ethnobotanical lore of a highly acculturated people. The data from this study will help to preserve that knowledge for future generations of Rama who will be able to utilize the species or practices of their ancestors.

NOTES

[1] According to CIDCA (1987), the Rama alphabet consists of the following letters: a, b, d, e, g, h, i, k, kw, l, m, n, ng, ngw, o, p, r, s, t, u, w, and y; vowels that are written double as: aa,

ee, ii, oo, uu are pronounced with a long duration, such as ***aalbut*** (snake), ***bleera*** (red spider monkey), ***iik*** (manioc), and ***tuunuk*** (papaya). The vowels e, ee, o, oo are not original Rama sounds and are found only in borrowed words. For example, ***kwerko*** (pig) is derived from the Spanish word puerco and ***bokit*** (bucket) is derived from the English word bucket.

[2] In text common names are used as follows: e=Standard English, c=Creole, h=Spanish, r=Rama

[3] Scientific name of the families follow (Stevens et al. 2001), the fern and fern allies (Davidse et al. 1995), and the angiosperm (Cronquist 1981; Stevens et al. 2001), the order within families, genera, and species is alphabetical.

[4] Common Names: c = Creole English; e = Standard English; g = Garífuna; h = Spanish; m = Miskitu; r = Rama; s = Sumu; spelling follows CIDCA (1986, 1987, 1989) and Smutko (1985).

[5] Medicinal Applications: 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 = Malaria; N = Burns; O = Abortifacient; P = Worms and Intestinal Parasites; Q = Astringent; S = Skin Rashes and Sores; T = Tonic and Anemia (blood fortifier); U = Cuts and Hemorrhage; V = Venereal Diseases; W = Female Disorders (Menstruation, Hemorrhage); X = Purgative and Laxative; Y = Constipation; Z = Tooth Extraction.

[6] Material Used: B = Bark; C = Flower; E = Seed; F = Fruit; L = Leaf; M = Stem; P = Whole Plant; R = Root; S = Sap.

[7] Mode of Preparation: (See section on medicinals for further explanation.) B = Bath; D = Decoction; I = Infusion; J = Juice of crushed parts; N = None; P = Poultice; S = Syrup.

[8] Mode of Administration: (See section on medicinals for further explanation). B = Bath; I = Inhalation; O = Oral; T = Topical.

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

[10] Voucher Number: 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 accession numbers.

[11] Habit: H = Herb; V = Vine; S = Shrub; T = Tree.

[12] Source: C = Home-garden; O = Old-growth forest; P = Market; S = Second-growth forest.

This paper is dedicated to Mr. Florentine Joseph†, a Miskitu shaman, for his lifelong commitment to traditional healing and the care that he provided to so many people of eastern Nicaragua, particularly in the Pearl Lagoon area.

ACKNOWLEDGMENTS

This study was partially supported by grants from the National Science Foundation, The University of Connecticut Research Foundation, and the Department of Ecology and Evolutionary Biology. I am most grateful to the Rama for welcoming me into their homes and sharing their ethnobotanical knowledge. The field assistance of Basilio Benjamin, Harry Simmons, Jr., and Rodney Martin is deeply appreciated. I thank the staff of the Centro de Investigación y Documentación de la Costa Atlantica (CIDCA) and the Fundación Para la Autonomía y Desarrollo de la Costa Atlántica de Nicaragua (FADCANIC). Many specialists provided assistance in the identification of vouchers: William D'Arcy† (MO), Daniel Austin (FAU), Rupert Barneby† (NY), Gerrit Davidse (MO), Ronald Leisner (MO), Michael Nee (NY), Amy Pool (MO), Velva Rudd† (SFV), Warren D. Stevens (MO), and Charlotte M. Taylor (MO). I thank Virge Kask for help with illustrations.

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APPENDIX 1.—Rama Medicinal Plants and their Uses.
Superscript letters are as follows: a=Cambie and Ash 1994; b=Duke 1985, 1994; c=García-Barriga 1992; d=Gibbs 1974; e=Hegnauer 1962–2001; f=House et al. 1995; g=Morton 1977, 1981, 1987; h=Raffauf 1970, 1996; i=Tyler et al. 1988; j=Willaman and Li 1970; k=Willaman and Schubert 1961; l=Berti and Bottari 1968; m=Kapoor 1990; * = exotic species to eastern Nicaragua.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
MICROPHYLLOPHYTA									
GLOSSOPSIDA									
SELAGINELLACEAE									
1. *Selaginella* sp.	no local name	G,L	P	D,P	T	0/0	12132	H	S
PTERIDOPHYTA									
FILICOPSIDA									
ADIANTHACEAE									
2. *Acrostichum aureum* L.	krúuba kuula (r)	B,F,U,Y	L,R	D	O	+,+La	3536	H	S
SCHIZAEACEAE									
3. *Lygodium venustum* Sw.	withes (e)	A,B,S	P	D,P	O,T	−L/−L	N	H	S
MAGNOLIOPHYTA									
MAGNOLIOPSIDA (DICOTS)									
ACANTHACEAE									
4. *Blechum pyramidatum* (Lam.) Urb.	mumps bush (e)	B,D	L,P	D	O	+,+Lh	12152	H	S
5. *Lepidagathis alopecuroidea* (Vahl) R. Br. Ex Griseb.	ghost bush (e)	B,D,I	L,P	D	O	+	12086	H	S
ANACARDIACEAE									
6. *Anacardium occidentale* L. *	kasuu (r)	A,D,F,I,S,W	B,L	D	O,T	+,+Ld	2725	T	C
7. *Mangifera indica* L. *	mankruu (r)	A,D,E,O,S	B,L	D	O	+,+Ld	3391	T	C
8. *Spondias mombin* L.	biup, pasangup (r)	D,F,I,S	B,L	D	O	+Ld	2274	T	S
9. *S. purpurea* L. *	pasangup (r)	D,F,S	B,L	D	O	+Ld	NV	T	C
ANNONACEAE									
10. *Annona glabra* L.	bobapple (c)	A,C,F	E,L	D	O	+Lk	2135	T	S
11. *A. muricata* L. *,	sowasap (c)	A,I,O,P	B,E,L	D	O	+Lk	3394	T	C
12. *Guatteria amplifolia* Triana & Planch.	pruki (r)	D,S	B,L	D	O,T	+	2430	T	O
APIACEAE									

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
13. *Eryngium foetidum* L.	prouk (r)	A,B,F,G,I, L,P	L	D,I	B,O	0/+Ld	12967	H	S
APOCYNACEAE									
14. *Condylocarpon intermedium* Muell.Arg.	bean withes (e)	F,S	L	D	O,T	+	2678	V	S
15. *Echites umbellata* Jacq.	bean withes (e)	B	L	D	O	+	3489	V	S
16. *Lacmellea panamensis* (Woodson) Markgr.	sok sok (c)	D	L	D	O	+	3379	T	S
17. *Tabernaemontana alba* Mill.	milky (e)	I,S	L	D	O	+,+Lh	12116	T	S
18. *T. arborea* Rose ex. Donn. Sm.	dog egg (e)	F,I	L	D	O	+	12118	T	S
ARISTOLOCHIACEAE									
19. *Aristolochia trilobata* L.	snake root (e)	B,C,D,F,G, H,J,O,T,W	L,P	D,I	O	+,+Le	12968	V	S
ASCLEPIADACEAE									
20. *Asclepias curassavica* L.	yellow head (e)	A,B,P	L,R	D,P	O,T	+,+Lj	12969	H	S
21. *Blepharodon mucronatum* (Schltdl.) Decne.	withes (e)	B	L,P	D,P	O,T	+,+Lh	2196	V	S
ASTERACEAE									
22. *Elephantopus mollis* Kunth	no local name	A	L,P	D	O,T	+	3354	H	S
23. *Matricaria recutita* L. *,	airi (r)	F,G,L	P	D	O	+Lj	2009	H	P
24. *Mikania cordifolia* (L.f.) Willd.	guacu (c)	B,F,S	L,M,P	D,P	O,T	+,+Ld	3254	V	S
25. *M. guaco* Bonpl.	guacu (c)	B,F,S	L,M,P	D,P	O,T	+Ld	N	V	S
26. *Neurolaena lobata* (L.) R. Br	jackass bittas (c)	F,H,I,K,M, P,S,T	L	D	O,T	+,+Ld	2515	H	S
27. *Sphagneticola trilobata* (L.) Pruski	kaismitin (c)	A,B,C,I,S	L,P	D	O	+Ld	3553	H	S
28. *Synedrella nodiflora* (L.) Gaerten	nodeweed (e)	D,L	L	D	O	+Lk	12151	H	S
BIGNONIACEAE									
29. *Crescentia cujete* L.	saabang (r)	F,L	F	S	O	0/+Lc	3450	T	C
BIXACEAE									

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
30. *Bixa orellana* L. *	aliup, natam (r)	D,F,S	E,L	D,I,P	O,T	+Lb	3316	S	C
BOMBACACEAE									
31. *Ceiba pentandra* (L.) Gaertn.	puulik (r)	A,D,Q	B,L	D	O	−L/+Ld	2886	T	S
32. *Pachira aquatica* L.[$]	plingkiing (r)	D,S,T	B,E	D	O	+Lh	3396	T	O
BORAGINACEAE									
33. *Cordia alliodora* (Ruiz & Pav.) Oken[$]	siin (r)	S,T	L	D	O,T	+Ld	2908	T	O
34. *C. curassavica* (Jacq.) Roem. & Schult.	wild sage (e)	A,D,F,H	L	D	B,O,T	+,+Ld	2689	S	S
35. *Heliotropium indicum* L.	scorpion tail (e)	BDSW	L,P	D	O	+,+Lb	4042	H	S
BURSERACEAE									
36. *Bursera simaruba* (L.) Sarg.	naked man (e)	D,I,S,T	B	D	B,O	0/+Ld	2804	T	O
37. *Protium ravenii* D. M. Porter	alcanfor,camibar, copaiba (h)	A,C,G,P,U,W	B	D,P	O,T	+Lh	2461	T	O
CAMPANULACEAE									
38. *Hippobroma longiflora* (L.) G. Don.	star flower (e)	A,L,X	L,P	D	O,T	+,+Ld	12141	H	S
CAPPARIDACEAE									
39. *Polanisia viscosa* (L.) DC.	tabaquillo (h)	S	P	D	T	+,+Lh	3966	H	S
CARICACEAE									
40. *Carica papaya* L.	tuunuk (r)	P,S	F,L,S	D,J	O,T	+Li	NV	T	C
CECROPIACEAE									
41. *Cecropia obtusifolia* Bertol.	trompit (c)	B,C,D,F,L,S	L	D	O	+Lh	NV	T	S
42. *C. peltata* L.	trompit (c)	B,C,D,S,W	L	D	O	+,+Lh	4007	T	S
CHRYSOBALANACEAE									
43. *Chrysobalanus icaco* L.	biup (r)	D,Q	B	D	O	0/+Ld	3039	T	S
CLUSIACEAE									
44. *Calophyllum brasiliense* Cambess[$]	santa maría (h)	A,S	B,M,S	D	O,T	−L/0	2692	T	O
45. *Symphonia globulifera* L.f.[$]	sambogum (c)	A	M,S	P	T	+,Lh	2365	T	O
46. *Vismia baccifera* (L.) Triana & Planch.	blood wood (e)	I,D,S	L,B,J	D	T	−L/+Ld	12131	T	O

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
COMBRETACEAE									
47. *Conocarpus erectus* L.	botton bush (c)	D,S	B,L	D	T	−L/+Ld	2687	T	O
48. *Laguncularia racemosa* Gaerten	white mangrove (e)	D,S	B,L	D	O,T	−L/+Ld	12020	T	O
49. *Terminalia catappa* L. *	hamanz (c)	D,H,Q	L	D	O	−L/+La	12144	T	C
CONVOLVULACEAE									
50. *Ipomoea batatas* (L.) Lam. *	paiik (r)	B,S	L	D	T	+	3638	V	C
51. *I. mauritiana* Jacq.	taiga paw (c)	B,S	L	D	O,T	0/+Ld	12105	V	S
52. *I. pes-caprae* (L.) R. Br.	beach morning glory (e)	B,S	L	D	O,T	+,+La	N	V	S
CRASSULACEAE									
53. *Kalanchoe pinnata* (Lam.) Pers.	towtow (r)	A,F,L,S	L	D,P	O,T	0/+Lb	3620	H	S
CUCURBITACEAE									
54. *Fevillea cordifolia* L.	antidote beans (e)	A,B,E,I	E	I,P	O,T	−L/+Ld	NV	V	S
55. *Luffa cylindrica* (L.) M. Roem. *	pataste (h)	A,S	L	D,P	T	+,+Le	3636	V	C
56. *Momordica charantia* L. *,	sorosi (c)	A,B,C,H,I,J, M,O,S,T,W	L,M	D	O,T	+,+Lk	3634	V	S
EUPHORBIACEAE									
57. *Acalypha arvensis* Poepp. & Endl.	wom weed (e)	B,I,S	L,P	D	O,T	+Lh	3640	H	S
58. *Croton schiedeanus* Schlecht.	copalchil (h)	V	B	D	O	+Ld	NV	H	S
59. *Euphorbia hyssopifolia* L.	wart weed (e)	E,K,S	L,P,S	D,I	O,T	+Ld	4041	H	S
60. *E. thymifolia* (L.) Millsp.	siksik (r)	A,B,I,S	L,P,S	D	O	+,+Lh	2474	H	S
61. *Jatropha curcas* L.*	purging physic (e)	X	L,S	D	O	+Lk	N	S	S
62. *J. gossypiifolia* L.*	physic nut (e)	E,X	L,S	D	O	+Lk	N	S	S
63. *Manihot esculenta* Crantz *	iik (r)	S	L,R	D	O	0/+La	3272	S	C
64. *Ricinus communis* L.*	castor bean (e)	X	L,S	D	O	+Lk	N	S	S
FABACEAE									

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
65. *Bauhinia guianensis* Aubl.	monkey ladder (e)	B,D,Q,T	M	D	O	−L/+Ld	12164	V	O
66. *Caesalpinia bonduc* (L.) Roxb.*	stuco weed (c)	B,D,Q,V	E	D	O	+Lm	NV	V	O
67. *Cassia fistula* L. *	caña fistula (h)	X	F	D	O	0/+Le	NV	T	S
68. *C. grandis* L.f.	stinking toe (e)	L,P,S,T,X	F,L	D,J,S	O,T	0/+Lb	3440	T	O
69. *C. hirsuta* L.	juanislama (h)	G,P	L,P,R	D,J	O,T	+, +Lc	2801	H	S
70. *Desmodium adscendens* (Sw.) DC.	strong back (e)	A,B,G,I,S	L,P,R	D,I	O	+, +Lb	4115	H	S
71. *D. incanum* DC.	burbur (c)	A,B,F,I,V	L,R	D	O	+	3668	H	S
72. *Dioclea wilsonii* Standl.	quaqua (c)	S	F	D	T	+	12166	V	S
73. *Dipteryx oleifera* Benth.$	ebo (r)	A,L,Z	B,F,M	D,P	O,T	0/+Le	2327	T	O
74. *Hymenaea courbaril* L.$	locust (e)	C,L,Q	B,S	D,P	O,T	0/0	NV	T	O
75. *Indigofera suffruticosa* Mill.	blue (e)	C,I	L	D,P	O,T	+Lj	NV	H	P
76. *Mimosa pudica* L.	sleeping bush (e)	I,V	L,M,R	D	O	+,+Lj	3597	H	S
77. *Pentaclethra macroloba* (Willd.) Kuntz	kiskis (r)	B,D,F,L,Q,S	B	D	O, T	+,+Lk	2443	T	S
78. *Senna alata* (L.) Roxb.	ringworm bush (e)	A,B,C,I,L,P, S,X,Y	F,L	B,D,J,P	B,O,T	+,+Ld	3618	S	S
79. *S. occidentalis* (L.) Link	piss-a-bed (c)	B,I,K,W,X	P	D,J	O,T	+,+Ld	3523	H	S
80. *S. reticulata* (Willd.) H.S. Irwin & Barneby	sorocontil (h)	A,B,C,L,S	L,R	D	O	+,+Lh	2718	S	S
81. *Tamarindus indica* L. *,	tambran (c)	D,I,X	B,F,L	D	O	+Lb	2891	T	C
82. *Vigna luteola* (Jacq.) Benth.	frijol de playa (h)	L	P	D	O	+Lh	4172	V	S
HIPPOCRATACEAE									
83. *Salacia belizensis* Standl.	No local name	D,I	L	D	O,T	+Lj	3365	H	S
LAMIACEAE									
84. *Coleus amboinicus* Lour.	wild oregano (e)	G,L	L	I	O	−L/+Ld	NV	H	S
85. *Hyptis capitata* Jacq.	miona (h)	G,L,P	L,P	I	O,T	−L/+Ld	3559	H	S
86. *H. verticillata* Jacq.	john charles (e)	A,G,I,L,P,S	L,P,R,S	D,I,P	O,T	+,Lh	3576	S	S
87. *Ocimum campechianum* Mill.	baasley (c)	A,F,G,H,L	L	D,I	O,T	−L/+Lb	2231	H	S
88. *Rosmarinus officinalis* L. *,	romero (h)	A,C,I,S	F,L	D,I	B,O,T	+Lj	NV	H	C
LAURACEAE									

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
89. *Cinnamomum zeylanicum* Blume *	cinnamon (e)	G	B	D	O	−L/+Ld	NV	T	C
90. *Ocotea aurantiodora* (Ruiz & Pavon) Mez.	canelo (h)	L	B,L	D	O	−L/+Ld	12170	T	O
91. *Persea americana* Mill.*,	kuulup (r)	A,I,L,O,T	B,E,F,L	D	O	+Li	3356	T	C
LOGANIACEAE									
92. *Spigelia anthelmia* L.	worm bush (e)	P	L	D	O	+,+Lj	2975	H	S
LYTHRACEAE									
93. *Cuphea carthagenensis* (Jacq.) Macbr.	pica mano (h)	F,I	L	D	O	−L/+Ld	12177	H	S
MALPIGHIACEAE									
94. *Byrsonima crassifolia* (L.) Kunth	krabu (r)	A,B,D,Q	B	D	O	+,+Ld	12,182	T	S
95. *Stigmaphyllon ellipticum* (Kunth) Adr. Juss.	snake root (e)	B,Q,V,Z	L,M	D	O	−L/+Ld	2000	V	S
96. *S. puberum* (Rich.) A. Juss.	snake root (e)	B,Q,V,Z	L,M	D	O,T	−L/+Ld	3788	V	S
MALVACEAE									
97. *Hibiscus tiliaceus* L.	sarpang (r)	C,F,Y	B,L	D	O	+	2187	T	S
98. *Sida acuta* Burm. f.	broom weed (e)	A,C,F	L,P	D	O	+Lj	3656	H	S
99. *S. rhombifolia* L.	broom weed (e)	A,B,C,F,G	L	D	O	+Lb	4343	H	S
MELIACEAE									
100. *Carapa guianensis* Aubl. $	saba (s)	A,D,F	B,M	D	O	+,+Li	2741	T	O
101. *Cedrela odorata* L. $	wa (r)	A,Q,T	B,M	D	O	−L/0	2796	T	O
102. *Guarea grandifolia* DC. $	pronto alivio (h)	A,L	B,L,M	D	O,T	−L/0	2828	T	O
103. *Swietenia macrophylla* King$	unsaba (r)	F	B,M	D	O	+Li	2834	T	O
MENISPERMACEAE									
104. *Cissampelos pareira* L.	alcotán, curarina (h)	B,F,S,V	L,R	D	O,T	+Lj	4341	V	S
MORACEAE									
105. *Artocarpus altilis* (Parkinson) Fosberg *,	yiraa (r)	A	F,S	P	T	−L/+La	2726	T	C
106. *Castilla elastica* Cervantes	hule (h)	A,I	S	P	T	−L/+Ld	2901	T	O

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
107. *Dorstenia contrajerva* L.	contra hierba (h)	B,DF	P,R	D,P	O,T	+Lj	NV	H	O
108. *Ficus insipida* Willd.	kliis (r)	A,G	S	I,P	O,T	+,Lh	2812	T	S
MYRISTICACEAE									
109. *Myristica fragrans* Houtt. *	nutmeg (e)	G	F	D	O	+Lc	NV	T	P
110. *Virola koschnyi* Warb. $	banak (r),	A,D,F,Q	B,L,S	D,P	O,T	+Li	3000	T	O
MYRSINACEAE									
111. *Stylogyne turbacensis* (Kunth) Mez	no local name	G,L	L	D	O,T	−L/+Ld	2506	T	O
MYRTACEAE									
112. *Psidium guajava* L.	kawas (r)	D,F,G,H,I,P,S	B,F,L	D	B,O	+,+Lb	3997	S	S
113. *Syzygium aromaticum* (L.) Merr. & Perry *	cloves (e)	A,C,G,O	C	D	O	+Lh	4442	T	P
PASSIFLORACEAE									
114. *Passiflora edulis* Sims	maracuya (h)	S	L	D	T	+Lg	NV	V	S
115. *P. quadrangularis* L	kabuna (r)	A,F,J,O,S	L	D,J	O,T	+Lf	3514	V	S
116. *P. seemannii* Griseb.	granadilla (h)	S	L	D	T	+Lg	NV	V	S
PHYTOLACCACEAE									
117. *Microtea debilis* Sw.	no local name	G,I,L	L	D	O	−L/0	2243	H	S
118. *Petiveria alliacea* L.	prauk (r)	A,L	L,P,R	D,P	I,O,T	+Le	3957	H	S
PIPERACEAE									
119. *Peperomia pellucida* (L.) Kunth	clear weed (e)	B,I,V,W	P	D	O	+Ld	3742	H	S
120. *Piper aduncum* L.	cordoncillo (h)	A,C,T	L	D	T	+L	NV	S	S
121. *P. amalago* L.	cordoncillo (h)	A,B,C,T,W	L,R	B,D	B,O	+,+Lb	15198	S	S
122. *P. auritum* Kunth	biip kaat (r)	A,B,C,F,G,S,T,W	L	I,J,P	O,T	+,+Lb	12970	S	S
123. P. hispidum Sw.	cow tongue leaf (e)	A,F,G,S	L	B,I	B,O	+,+Le	2888	S	S
124. *P. jacquemontianum* Kunth	Spanish ela (c)	A,B,C,F,S,T	L	B,I	B,O	+	3610	S	S
125. *P. peltatum* L.	biip kaat (r)	A,B,C,F,S,T	L	D,P	B,O,T	+,+Ld	3209	S	S
126. *P. tuberculatum* Jacq.	cordoncillo (h)	A,L	L	D	O	+Lh	NV	T	S
POLYGONACEAE									

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
127. *Coccoloba uvifera* (L.) L.	sea grape (e)	D,G,Q,S	B,L	D	O	−L/+Ld	3465	T	S
RHAMNACEAE									
128. *Gouania lupuloides* (L.) Urban	chew stick (e)	I	M	N	O	−L/+Lg	15663	V	S
RHIZOPHORACEAE									
129. *Rhizophora mangle* L.	laulau (r)	D,Q,S,W	B	D	O	+Lb	2099	T	O
RUBIACEAE									
130. *Alibertia edulis* (L. Rich.) A. Rich ex DC	sul sul (c)	A,Q	B,L	D	O	−L/−L	3266	T	S
131. *Borreria assurgens* (Ruiz & Pav.) Griseb.	botton bush (c)	B,I,S	L	D	T	+	3899	H	S
132. *Cinchona pubescens* Vahl *,	quina (h)	D,F,I,M	B,M	D	O	+Lk	2817	T	P
133. *Coffea arabica* L. *	kapi (r)	F,U	E	D,N	O,T	+Lk	NV	S	P
134. *Hamelia axillaris* Sw.	silbyara (r)	B,D,I,S	L,P	D,P	O,T	+,+Ld	3704	S	S
135. *H. patens* Jacq.	red scholars (e)	A,B,D,F,I	L,P	D,P	O,T	+,+Lb	2884	S	S
136. *Isertia haenkeana* DC.	ethel bush (e)	D,E,I,F,L	R	D	O	+,+Lh	2143	S	S
137. *Morinda citrifolia** L.	hog apple (e)	A,N	L	P	T	+Lk	3044	S	C
138. *Palicourea crocea* (Sw.) Roem & Schult.	café montero (h)	D,E,H,L	L,R	D	O	+,+Lh	2483	S	S
139. *P. guianensis* Aubl.	uvilla (h)	D,L	S	D	T	+,+Lh	N	S	S
140. *P. triphylla* DC.	uvilla (h)	D,L	S	D	T	+	4005	S	S
141. *Psychotria elata* (Sw.) Hammel	coralillo (h)	D,E,I,,F,L	R	D	O	+,+Lk	12135	S	S
142. *P. ipecacuanha* (Brotero) Stokes	raizcilla (h)	D,E,F,I,L	R	D	O	+,+Lk	3046	H	S
143. *P. microdon* (DC.) Urban	no local name	F,I,S	L	D	O	+Lh	3100	S	S
144. *P. poeppigiana* Muell.	sore-mouth bush (e)	D,I,S,U	L	D	O	+,+Lk	12128	S	S
RUTACEAE									
145. *Citrus aurantifolia* (Christm.) Swingle *,	uriaup (r)	A,C,D,F,G, H,I,L,O,P	F,L,R	D,J	O	+Lc	3677	T	C
146. *C. aurantium* L. *	uriaup supkaba (r)	D,F,G,H,I,L	F,L,R	D,I,J	B,O	+Lk	4450	T	C

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
147. *C. paradisi* Macfad. *	grapeprut (r)	D,F,H	F	J	O	+Le	3679	T	C
148. *C. sinensis* (L.) Osbeck *,	uriaup (r)	D,F,H,L,P	F,L	D,J	O	+Lk	NV	T	C
149. *Zanthoxyllum panamensis* P. Wilis.	lagarto (h)	I	R	D	O,T	0/0	2745	T	O
SAPINDACEAE									
150. *Melicoccus bijugatus* Jacq. *	kinep (c)	D,Q	E,L	D	O	−L/−L	3042	T	C
SAPOTACEAE									
151. *Manilkara zapota* (L) P. Royen$	pañkar, pangkar (r)	A,D,S	S	P	T	+Le	3047	T	O
152. *Pouteria sapota* (Jacq.) H. E. Moore & Stearn$	mamee (c)	A,D,S	B,E,L	D,P	O,T	+Lj	2950	T	O
SCROPHULARIACEAE									
153. *Scoparia dulcis* L.	wild rice (e)	A,B,C,F,I,W	L,P,R	D	O	+,+Lk	3358	H	S
SIMAROUBACEAE									
154. *Quassia amara* L.	bitta wood (c)	B,F,G,H,I,M,T	M	D	O	+,+Lk	2790	T	S
155. *Simarouba amara* Aubl. $	coal wood (e)	D,F,M,P,S,W	B,E,R	D	O	+Lh	2685	T	O
SOLANACEAE									
156. *Capsicum annuum* var. *glabriusculium* (Dunal) Heiser & Pickersgill *	alkiini pulkaba (r)	A,L,S	E,F,L	D,N	O,T	+Lj	2730	H	C
157. *C. chinensis* Jacq. *	alkiini astaiki (r)	A,F,S	E,F,L	D,N	O,T	+	2748	H	C
158. *C. frutescens* L. *	alkiini astaiki (r)	I,F,S	F,L	D,J	O,T	+Lj	3600	H	C
159. *Nicotiana rustica* L.	tuu (r)	B,S	L	D,J,P	T	+	3925	H	C
160. *N. tabacum* L. *	tuu (r)	A,B	L	N	O,T	+,+Lk	NV	H	P
161. *Solanum lycopersicum* L. *	tumatis (c)	S	L	J	T	+Lj	NV	H	P
162. *S. sessiliflorum* Dunal *	naranjilla (h)	B,S	B,F,L	D,J,P	T	+	3722	H	S
163. *S. tuberosum* L. *	paikup (r)	G	R	J	O	+Lj	NV	H	P
164. *Witheringia solanacea* L'Her.	No local name	S	L	D	T	+	12172	S	S
STERCULIACEAE									
165. *Theobroma bicolor* Bonpl.	pataste (h)	S,U	E,L	P	T	+	12153	T	S
166. *T. cacao* L. *	kuuk (r)	S,U	E,L	P	T	+Lj	NV	T	C
TILIACEAE									
167. *Apeiba membranacea* Spruce ex Benth.	monkey comb (e)	L,S	B,L	D	O,T	−L/−L	14440	T	S

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
168. *Luehea seemanii* Triana & Planch.	guácimo (h)	Q	B,L	D	O	−L/−L	2287	T	S
169. *L. speciosa* Willd.	guácimo (h)	Q	B,L	D	O	−L/−L	2852	T	S
ULMACEAE									
170. *Trema micrantha* (L.) Blume	capulin (h)	I	B,L	D	O,T	−L/−L	2559	T	S
VERBENACEAE									
171. *Avicennia germinans* (L.) L.	black mangrove (e)	D,Q	B	D	O	+Lh	NV	T	O
172. *Lippia alba* (Mill.) N.E. Br. ex Britton & Wilson	juanislama (h)	C,G,I,S	L	D,I	O	+Lh	4334	S	S
173. *Phyla nodiflora* (L.) Greene	creeping bush (e)	S	P	D,P	O,T	+Li	2022	H	S
174. *Priva lappulacea* (L.) Pers.	pega pega (h)	A,C,G,P,S,X	L,R	D,P	O,T	+Lh	12143	H	S
175. *Stachytarpheta cayennensis* (Rich.) Vahl	vorvine (c)	P,X,	J,L	D	O	+Lc	3550	H	S
176. *S. jamaicensis* (L.) Vahl	vorvine (c)	P,X	J,L	D	O	+,+Li	3630	H	S
VITACEAE									
177. *Cissus erosa* L.	kapupu (r)	A,I,S	J,L	D,P	T	−L/−L	4019	V	S
178. *C. sicyoides* L.	kapupu (r)	A,I,S	J,L	D,P	T	−L/−L	3862	V	S
LILIOPSIDA (MONOCOTS)									
ALOEACEAE									
179. *Aloe vera* L. *	aloes (e)	B,N,S	L	J	O,T	+Li	3949	H	C
ARECACEAE									
180. *Bactris gasipaes* Kunth	suupa (r)	G	F	D	O	0/0	2772	T	S
181. *Cocos nucifera* L. *,	kukunup (r)	D,P,Q	F	D,I	O	+Lc	NV	T	C
182. *Elaeis guineensis* Jacq. *	kwiiksa (r)	X	F	D	O	−L/−L	NV	T	C
183. *E. oleifera* (Kunth) Cortés	kwiiksa (r)	X	F	D	O	−L/−L	NV	T	S
BROMELIACEAE									
184. *Ananas comosus* (L.) Merr. *	suurak (r)	B,I,U	F,L	D	O	+Li	NV	H	C
COMMELINACEAE									
185. *Commelina erecta* L.	parroty grass (c)	S	L,M	J	T	−L/+Ld	3594	H	S
CYPERACEAE									
186. *Cyperus luzulae* (L.) Retz.	lady grass (e)	D	R	D	O	−L/+Ld	3690	H	S

APPENDIX 1.—Continued.

Scientific name[3]	Common names[4]	Medicinal[5]	Part[6]	Prep.[7]	Adm.[8]	A[9]/G	Sp.#[10]	Habit[11]	Source[12]
187. *Kylinga tibialis* Ledeb.	red-knee grass (e)	F	R	D	O	+	4114	H	S
LILIACEAE									
188. *Allium cepa* L. *	onion (e)	L,P	R	J	O	+Ld	NV	H	P
189. *A. sativum* L. *	garlic (e)	A,H,P	R	J	O	+Ld	NV	H	P
190. *Hymenocallis littoralis* (Jacq.) Salisb.	***ngaungauk*** katuruk (r)	B,S	R	D,J	O,T	+Lk	2713	H	S
191. *Zephyranthes lindleyana* Herb.	rain lily (e)	L	R	D	O	0/0	12136	H	S
MENYANTHACEAE									
192. *Nymphoides indica* (L.) Kuntze	white lily (e)	B,S	L,R	D	O	+Lh	NV	H	S
MUSACEAE									
193. *Musa acuminata* Colla*	sumuu (r)	B,D,U	F,S	N,P	O,T	+Lj	NV	H	C
194. *M. acuminata* x *M. balbisiana* Colla*	sumuu (r)	B,D,U	F,S	N,P	O,T	+Lj	NV	H	C
195. *M.*x *paradisiaca* L. *,	pranti, tirbi (r)	B,D,S,U	F,S,M	B,N,P	B,O,T	+Lj	NV	H	C
POACEAE									
196. *Cymbopogon citratus* (DC.) Stapf *,	prauk (r)	A,F,G	L	I	O	+Li	2724	H	C
197. *Eleusine indica* (L.) Gaerten.	singsingka (r)	I,W	R	D	O	+Lj	4329	H	S
198. *Guadua angustifolia* Kunth	kauru (r)	D,F,I,N,S	E,M,R	D,P	O,T	+Li	NV	H	S
199. *Gynerium sagittatum* (Aubl.) P. Beauv.	kartuk (r)	B,I,S,V	R	D	O	−L/+Ld	3871	H	S
200. *Oryza sativa* L. *	rice (e)	D,S	E	B,I	B,O	+Lj	NV	H	C
201. *Saccharum officinarum* L. *	aikat (r)	D,I,L,S	L,M	D,J	O,T	+Ld	NV	H	C
SMILACACEAE									
202. *Smilax regelii* Killip & Morton	chainey root (c)	A,B,C,D,T,V	R	D	O	+Lc	3043	V	S
203. *S. spinosa* Mill.	chainey root (c)	A,B,C,D,T,V	R	D	O	+Lf	4358	V	S
ZINGIBERACEAE									
204. *Costus spicatus* (Jacq.) Sw.	caña de cristo (h)	G,I,K	M,P,R	D	O	−L/+Ld	NV	H	S
205. *Hedychium coronarium* (J.) König	high lili (c)	B	P	B	B	+Ld	NV	H	S
206. *Zingiber officinale* Roscoe *	ginger (e)	D,G	R	D	O	+Lh	NV	H	C