

ETHNOBOTANY OF THE SUMU (ULWA) OF SOUTHEASTERN NICARAGUA AND COMPARISONS WITH MISKITU PLANT LORE¹

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LA ETNOBOTÁNICA DE LOS SUMU (ULWA) DEL SUDESTE DE NICARAGUA Y COMPARACIONES CON EL SABER BOTÁNICO DE LOS MISKITU. *Los Sumu (Ulwa) constituyen uno de los tres grupos Amerindios del oriente Nicaragüense. Durante dos años de estudios se documentaron los usos por este grupo de 225 especies vegetales en 174 géneros y 72 familias. Incluyendo 187 especies medicinales, 69 especies alimenticias y 84 especies para usos auxiliares. Las plantas medicinales de los Ulwa tratan más de 25 enfermedades y la mayoría (80%) son especies nativas del oriente Nicaragüense. Más del 70% de las especies medicinales poseen algún principio bioactivo; la mayoría son hierbas (48%) o árboles (33%). Las hojas son las partes más frecuentemente utilizadas en remedios y son preparados en forma de decocciones y administradas oralmente. Las plantas comestibles en su mayoría son domesticadas, solamente seis son nativas del neotrópico. Comparaciones de las plantas usadas por los Ulwa y Miskitu demuestran que la mayoría de las especies usadas como alimentos (98%), medicinas (90%) y aplicaciones medicinales (80%) son iguales. Los Miskitu usan un mayor número de especies, con un mayor rango de aplicaciones medicinales y mas usos singulares de plantas que los Ulwa, presumiblemente debido a su territorio mas extenso. Diferencias etnobotánicas parecen ser mas bien consecuencia de escala y no vestigios de diferencias culturales.*

We dedicate this paper to Charles B. Heiser who has inspired so many to study the relationships between plants and people.

Key Words: ethnobotany; Sumu; Ulwa; southeastern Nicaragua; medicinal plants.

The Sumu, or Mayangna (the original name of the Sumu people before European contact), are an Amerindian group of southeastern Honduras and northwestern and southeastern Nicaragua (Conzemius 1932; Hale and Gordon 1987; Nietschmann 1969; Williamson, Avilés, and

McLean 1993). Historically, the Sumu of eastern Nicaragua consisted of five subgroups: the Panamahka, Twahka, Ulwa, Bawihka, and Kukra (group names derived from local language). The latter two are extinct (Conzemius 1932; Romero et al. 1992). Today, the remaining three Sumu sub-groups are identified primarily by linguistic characteristics (Hale 1991; McLean 1996; Norwood 1997). The northern Sumu speak Pana-

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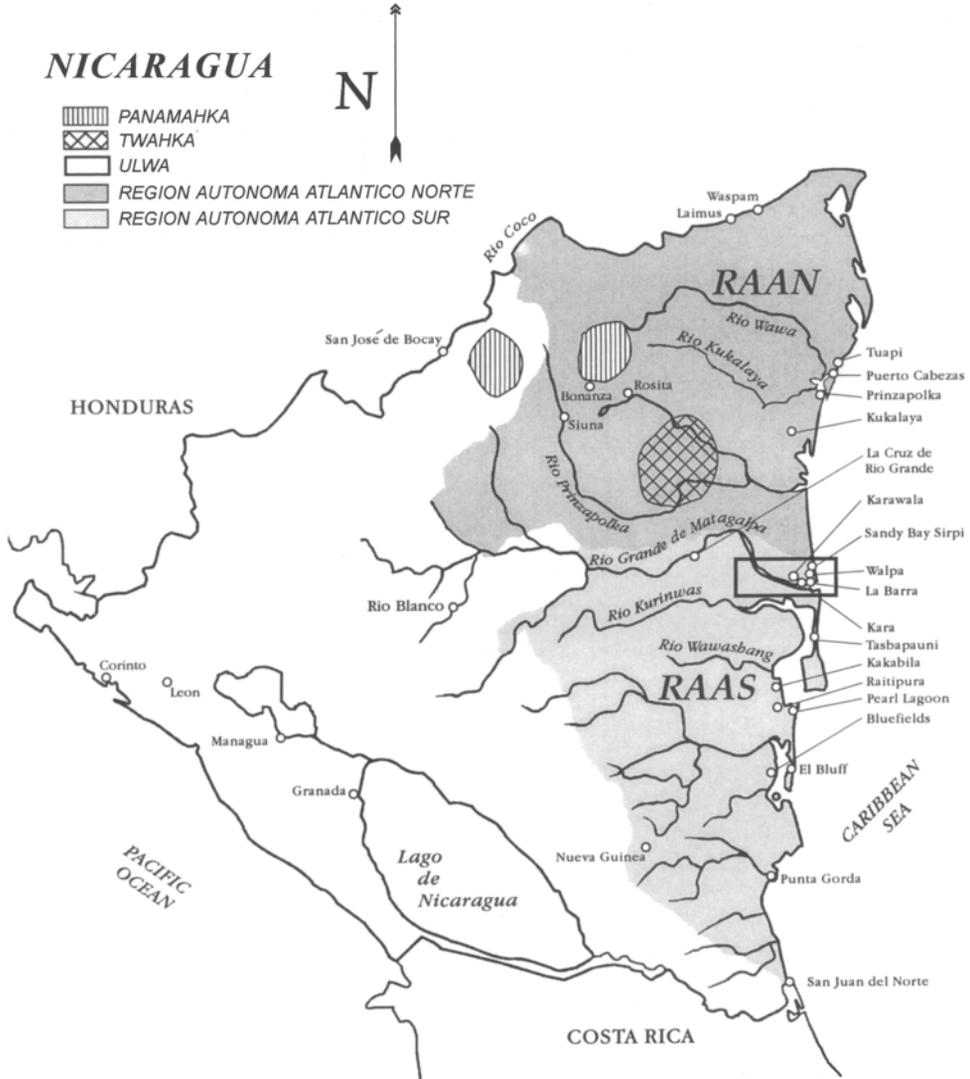


Fig. 1. Map of Nicaragua showing Ulwa settlements in eastern Nicaragua and field study sites (in rectangle).

mahka and Twahka, and the southern Sumu speak Ulwa, but 62% percent of the basic vocabulary is shared among the three Sumu languages (CIDCA 1989; Hale 1991). The Sumu languages are historically related to the Miskitu languages, and belong to the Misumalpan language group and are now structurally identical (CIDCA 1985; Hale 1991; McLean 1996; Norwood 1997). The Panamahka and the Twahka live in what is today the Región Autónoma Atlántico Norte (RAAN), and the Ulwa live in the Región Autónoma Atlántico Sur (RAAS), a political subdivision of the former department of

Zelaya (Hale and Gordon 1987; Williamson, Avilés, and McLean 1993) (Fig. 1). The Sumu population in eastern Nicaragua is estimated at 7000 to 11 000 inhabitants: 73% are Panamahka, 16% are Twahka, and only 11% are Ulwa (CIDCA 1982; Hale and Gordon 1987; Williamson, Avilés, and McLean 1993). Ulwa enclaves consist of small settlements in the lowland swamp forest along the lower margins of the Rio Grande de Matagalpa, Rio Kurinwas, and Rio Wawashang.

The Ulwa are the most highly acculturated of the three Sumu sub-groups in eastern Nicaragua.

The acculturation of the Ulwa is due to more than a century of continuous contact with outsiders—mostly missionaries and traders (Bell 1989; Conzemius 1932; Dozier 1985; Nietschmann 1979; Roberts 1827; Romero 1995; Smutko 1985). The study of Ulwa plant lore is made more urgent by the threat of it becoming completely obscured by Miskitu and/or mestizo (people of European and Amerindian ancestry) culture. An ancillary manifestation of acculturation is the irreplaceable loss of ethnobotanical information gathered over centuries of plant-people interactions. Fortunately, ethnobotanical lore is generally one of the last elements of culture to be lost (Boom 1987; Schultes 1990). Even so, without prompt documentation, this too will be gone.

Ethnobotanical studies among the Sumu have been limited to reports of a select group of medicinal plants by Barrett (1994) and Fey and Sindel (1993). Other botanical studies that include material on eastern Nicaragua are Dennis (1988), Salter (1950), Seymour (1980), and Taylor (1962, 1963). However, these include only general descriptions of plant use in the area. Exhaustive ethnobotanical studies that focus on the overall use of plants by the indigenous groups of eastern Nicaragua include Coe (1994) and Coe and Anderson (1996a, 1997).

Our study was restricted to the ethnobotany of the Ulwa of southeastern Nicaragua, the smallest of the three Sumu subgroups. Political unrest and the serious risks involved with field work restricted visits to the northern parts of the country where the other Sumu groups were concentrated (see Fig. 1). Because of their geographic proximity and long history of abundant cultural interactions (Conzemius 1932; Nietschmann 1969; Roberts 1827), comparisons were made between the Sumu and the Miskitu (Coe and Anderson 1997). Medicinals were the focus of these comparisons. Native species were the primary focus of comparisons because their use is less influenced by acculturation, and therefore is more likely to be informative regarding cultural history and contacts.

STUDY AREA

Ulwa enclaves in southeastern Nicaragua are located at 12°50' to 13°00'N latitude and 83°00' to 84°00'W longitude (Fig. 1). Elevations in this area range from sea level to 200 m. The focus of field studies was in Kara and Karawala, the

two largest Ulwa settlements of southeastern Nicaragua, both of which are shared with the Miskitu. Karawala is the larger of the two with about 1200 inhabitants; Kara has only about 30 Ulwa speakers (Coe pers. obs. 1992, 1993, 1997; Hale 1991; Williamson, Avilés, and McLean 1993). The climate is tropical with a rainy season of 6 to 8 months and no well-defined dry season. The average annual rainfall is 2000 to 4000 mm (increasing from north to south), and the average annual temperature is 25 to 30°C (Incer 1975). The predominant ecosystems in the area are broadleaf evergreen forest (consisting of the terra firma moist tropical forest and the swamp forest) and occasional patches of pine savannas. Some dominant species of the broadleaf evergreen forest are Spanish cedar (113 *Cedrela odorata* [The numbers are a guide to finding species in the Appendix, which also includes the Ulwa names, authorities and families.]), mahogany (114 *Swietenia macrophylla*), sambogum (48 *Symphonia globulifera*), samwood (36 *Cordia alliodora*), and Santa María (46 *Calophyllum brasiliense*). The dominant species of the pine savanna are saw cabbage palm (184 *Acoelorrhaphe wrightii*) and Caribbean pine (4 *Pinus caribaea*). It is estimated that 8000 species of vascular plants occur in Nicaragua (Stevens pers. obs. as part of the flora of Nicaragua project). Coe and Stevens (pers. comm.) project that about 3500 of these species grow in eastern Nicaragua, 2000 species in the northeast (RAAN) and 3000 species in the southeast (RAAS).

METHODS

Data and specimens were collected during field studies (May to July 1992, December and January 1992/1993, May to July 1993, December 1997). Field trips were scheduled to ensure representative collection of plant material to avoid temporal bias. Field work consisted of plant collecting trips and interviews with practitioners (herbalists, midwives, and shamans) ranging from 40 to 65 years old. Interview techniques used are those employed by Coe (1994) and Coe and Anderson (1996a, 1997). Interviews were conducted in Creole, Spanish, and Ulwa. An interpreter was employed to help with interviews conducted in Ulwa. Field work was divided into two phases: 1) information gathering using data sheets, field notes, and audio cassette recordings to document plant use and to

TABLE 1. PLANTS USED BY THE ULWA ARRANGED BY TAXONOMIC RANK AND USE CATEGORY.

	Food	Medicinal	Other	Total
Families	38	69	36	72
Genera	57	146	71	174
Species	69	187	84	225

compile a species list and 2) field trips with practitioners to collect voucher specimens. Ethnobotanical data and/or voucher specimens were collected in the villages of Kara, Karawala, in hamlets along Rio Grande de Matagalpa, Rio Kurinwas, and Rio Wawashang in southeastern Nicaragua (Fig. 1). To facilitate the comparative analysis of plant use between the Ulwa and the Miskitu, the latter group was divided into northern Miskitu and southern Miskitu. Miskitu living in Región Autónoma Atlántico Norte (RAAN) constitute the northern, and those in Región Autónoma Atlántico Sur (RAAS), the southern group (Fig. 1). Vouchers were collected in triplicate; one set was deposited at the Herbarium of the Atlantic Coast of Nicaragua, with duplicate sets sent to the Missouri Botanical Garden (MO) and the University of Connecticut (CONN). Specimens were identified by the authors and by specialists from several major herbaria listed in the acknowledgments. Methodology used to verify names of localities, common names of plants, names of organic compounds, and to perform phytochemical screenings of plants, are found in Coe (1994), Coe and Anderson (1996a,b, 1997), Green (1997), Guerrero and Soriano de Guerrero (1985), and Incer (1985).

PLANT SOURCES

The Ulwa use a taxonomically diverse group of plants distributed among 225 species, 174 genera, and 72 families (Appendix and Table 1). Species used include wild plants, semi-domesticates, and domesticates (Table 2). The Ulwa obtain plant products from agricultural fields, markets ("purchased plants" in Table 2), doorway gardens, and the forest. Some 187 species are medicinals, 69 are food plants, and 84 are for ancillary uses such as clothing, construction, and crafts (Table 1). The plants in these various plant use categories play a significant role in providing the Ulwa with the materials for sus-

TABLE 2. ORIGINS OF ALL THE SPECIES USED BY THE ULWA.

Status	Total	%
Wild	174	77
Domesticated	30	14
Semi-domesticated	9	4
Purchased	12	5
Total	225	

tenance, medicinal treatments, and even some cash income.

AGRICULTURAL FIELDS

Agricultural fields, known in Ulwa as "yâ-mak," are the main source of staple foods for the Ulwa. Food crops are grown in fields of 1 to 2 ha. using slash-and-burn techniques. Selected forest sites are cleared at the beginning of the dry season (March to April). During clearing of the forest, useful tree species (e.g., banak [121 *Virola koschnyi*], bittawood [155 *Quassia amara*], hog plum [9 *Spondias mombin*], samwood [36], Spanish cedar [113]) are spared and protected from fires. The selection of protected species is determined by their value as a source of food, medicine, timber, fodder, forage, or other uses. Religious beliefs also play a role in the selection and protection of tree species, as is the case of kapok (34 *Ceiba pentandra*). The kapok tree is protected because of the belief that spirits inhabit it. Once slash vegetation is dry, fields are burned (usually in late April to early May) to allow planting before the onset of the rains in late May. Planting is done with a planting staff (1.5 to 2.0 m long) or a hoe (makana). All family members participate in the cultivation, upkeep, and harvesting of crops. Most Ulwa food plants are annual crops (e.g., beans [94 *Phaseolus vulgaris*], maize [222 *Zea mays*], rice [216 *Oryza sativa*]) intercropped with perennial crops (e.g., banana [204 *Musa paradisiaca* var. *sapientum*], cacao [165 *Theobroma cacao*], cassava [71 *Manihot esculenta*]). Most Ulwa food crops are exotics from both the New World (NW) and Old World (OW) tropics (Table 3). The Ulwa cultivate a total of 30 domesticates primarily for local consumption (Table 3). The five most important Ulwa field crops are banana (204), beans (94), cassava (71), maize (222), and rice (216). The Sumu rely much more on maize (222) than do the Miskitu, Rama, and Garífuna.

TABLE 3. FOOD PLANTS OF THE ULWA, ARRANGED BY ORIGIN AND STATUS. NUMBERS IN THIS AND OTHER TABLES REFLECT THE NUMBER OF SPECIES SO USED.

Origin	Status					Total	%
	Domesticated	Purchased	Semi-domesticated	Wild			
Native to Nicaragua	6	0	3	20		29	42
Introduced	24	9	6	0		39	57
Naturalized	0	0	0	1		1	1
Total	30	9	9	21		69	
%	43	13	13	31			

However, the Ulwa are the least dependent of the three Sumu sub-groups on maize (222) as a staple food. This greater role of maize (222) in the diet of the other two Sumu subgroups is partly due to historical factors (both had a more extended contact with the mestizo population) as well as more land suitable for cultivation of maize (222). Most of the land available to the Ulwa is wet and thus more suitable for growing cassava (71) and rice (216). These crops are also successful because cassava (71) can grow in poor soils, and rice (216) along the wet river banks. Other less important field crops are pineapple (191 *Ananas comosus*), plantain (203 *Musa paradisiaca*), sugarcane (221 *Sacharum officinarum*), and guineo cuadrado (202 *Musa* sp.).

MARKETS

The Ulwa purchase only 12 of the 225 species of plants they use (Table 2). Purchased plants are of both NW and OW origin, including azafrán (224 *Curcuma longa* [OW]), cinnamon (100 *Cinnamomum zeylanicum* [OW]), cloves (123 *Syzygium aromaticum* [OW]), ginger (225 *Zingiber officinale* [OW]), garlic (201 *Allium sativum* [OW]), nutmeg (120 *Myristica fragrans* [OW]), onion (200 *Allium cepa* [OW]), peanut (74 *Arachis hypogaea* [NW]), potato (162 *Solanum tuberosum* [NW]), and tobacco (159 *Nicotiana tabacum* [NW]). There are no plants sold in the market that are native to the Ulwa territory. Most species purchased from markets are spices and condiments (7 of 12 species). When and how these spices and condiments were introduced among the Ulwa is unknown. We suspect that over time these species were passed on to the Ulwa by their Miskitu neighbors who acquired them from contact with the British and other Europeans (Coe and Anderson 1997).

HOMEGARDENS

Most Ulwa households maintain a kitchen garden where staple foods and a few medicinals are grown. Some of the important staple food plants grown in these gardens include banana (204), breadfruit (115 *Artocarpus altilis*), coco yam (183 *Xanthosoma sagittifolium*), dasheen (182 *Colocasia esculenta*), guineo cuadrado (202), peppers ([156 *Capsicum annuum* var. *glabriusculum*], [157 *C. chinensis*], [158 *C. frutescens*]), plantain (203), and yampee (198 *Dioscorea trifida*). Other popular kitchen garden species include avocado (101 *Persea americana*), cashew (7 *Anacardium occidentale*), drap (125 *Passiflora quadrangularis*), guava (122 *Psidium guajava*), hog plum (9), kinop (147 *Melicoccus bijugatus*), mango (8 *Mangifera indica*), soursop (12 *Annona muricata*), and star apple (149 *Chrysophyllum cainito*).

Some medicinal species are grown in kitchen gardens as well, and are used mostly to treat common illnesses such as cough, fever, and pain. Some of the most frequently cultivated medicinals in kitchen gardens are barsley (99 *Ocimum micranthum*), Christmas blossom (75 *Cassia alata*), culantro (14 *Eryngium foetidum*), drap (125), fever grass (210 *Cymbopogon citratus*), ghost bush (5 *Blechnum brownei*), guinea hen (126 *Petiveria alliacea*), kiskita (65 *Acalypha arvensis*), ram goat dash along (168 *Turnera ulmifolia*), tree of life (61 *Kalanchoe pinnata*), wild rice (154 *Scoparia dulcis*), wî wî (172 *Lantana trifolia*), and worm bush (102 *Spigelia antihelmia*).

FOREST

The forest is the most important source of plant materials to the Ulwa, providing all the wild species in Table 2. Wild plants are used as supplementary foods, medicinals, and for ancil-

TABLE 4. MEDICINALS OF THE ULWA, ARRANGED BY ORIGIN AND STATUS.

Origin	Domesticated	Purchased	Semi-domesticated	Wild	Total	%
Native to Nicaragua	6	0	3	138	147	79
Introduced	21	11	7	1	40	21
Naturalized	0	0	0	0	0	0
Total	27	11	10	139	187	
%	15	6	5	74		

lary purposes such as construction, crafts, dyes, and tannins. Food plants obtained from the forest account for 31% of the species of Ulwa food plants (Table 3). In contrast with the domesticateds, most Ulwa wild food plants are native to Nicaragua (20 of 21 species) (Table 3). However, though only a source of supplementary food plants to the Ulwa, the forest is far more important as a source of medicinals. The bulk of plants used in the Ulwa pharmacopoeia are wild species (139 of 187 species) (Table 4). Forest plants used for ancillary purposes (84 of 225 species; see Table 1) are also important to the Ulwa because they provide timber (14 of 84 species) for local use and for sale. Timber sales are still a major source of income to the Ulwa. Only small stands of softwood (Caribbean pine [4]) remain as a result of over-harvesting that started at the turn of the century and continued until the

late 1970s. Thus, it is mainly native hardwoods (mahogany [114], nancitón [68 *Hyeronima alchorneoides*], saba [112 *Carapa guianensis*], sambogum [48], samwood [36], Santa María [46], Spanish cedar [113]) that are harvested.

PLANT USE

Plants used by the Ulwa represent a wide range of genera and families. As with the Garífuna (Coe 1994; Coe and Anderson 1996a) and Miskitu (Coe and Anderson 1997), the largest plant-use category by the Ulwa is medicinals. Two previous studies have addressed medicinal plant uses among the Sumu (Barrett 1994 and Fey and Sindel 1993). The best early account of Sumu plant use was written by Conzemius (1932). However, since Conzemius' work, many changes have occurred in the Sumu culture. Ulwa plant lore has been greatly affected by acculturation, particularly in regard to plant species used for clothing, construction and crafts, food, and medicine, the categories discussed in the following sections.

CLOTHING

Before the arrival of missionary workers into eastern Nicaragua in the late 1800s, Ulwa clothing consisted of a bark cloth tunic (kahlau) with a hole cut out for the head and a strap tied around the waist (Conzemius 1932). The "kahlau" was made from fibers of the retted inner bark of a wild fig (118 *Ficus sp.*), and tunu (119 *Poulsenia armata*) (Conzemius 1932). While contemporary Ulwa wear Western clothing purchased from traders or markets, they still use natural fibers for making cloth and crafts (Fig. 2, 3). The most widely used natural fibers are obtained from the bark of mahoe (109 *Hibiscus tiliaceus*), sulduih (166 *Heliocarpus donnell-smithii*), tunu (119), wild fig (118), and wild pine (192 *Bromelia pinguin*). The fibers of these species are treated with lime juice (144 *Citrus*



Fig. 2. Ulwa bark cloth vest obtained from tunu (*Poulsenia armata*, Moraceae).



Fig. 3. Ulwa bag made from fibers of sulduih (*Helicarpus donnell-smithii*, Tiliaceae) and dyed with extracts of pan lalahka (*Chlorophora tinctoria*, Moraceae), limnah (*Terminalia oblonga*, Combretaceae), and azafrán (*Curcuma longa*, Zingiberaceae).

aurantifolia) to reduce oxidation and lighten their color. Subsequently, they are immersed in a bath or painted with one or a combination of the following natural dyes: black from sambogum (48); brown from mahogany (114); gray from kerosfin (53 *Terminalia oblonga*); orange, red, and yellow from annatto (33 *Bixa orellana*); red from withes (31 *Arrabidaea chica*); and yellow and pink from azafrán (224). Clothing is very simple, and personal ornaments are few. The latter consist mostly of necklaces and amulets made from Jobs' tears (209 *Coix lacrymajobi*), maklala (88 *Dioclea megacarpa*), wabala (92 *Mucuna urens*), and sea shells. Footwear is generally only used when attending church services or visiting mestizo settlements.

CONSTRUCTION AND CRAFTS

The Ulwa use both Western and traditional materials for construction (Fig. 4) and crafts. Western materials (e.g., dyes, fibers, nails, metal sheet stock) used for construction and crafts are



Fig. 4. Ulwa home made from a combination of traditional and Western building materials.

purchased from traders and rural stores. Traditional materials used for construction and crafts are obtained from 84 species. Most homes consist of independent sleeping and cooking quarters, a grain storage bin, and an animal shed. Construction materials used for home building are obtained from about 35 species. The six most preferred species used in general construction are Caribbean pine (4), mahogany (114), sambogum (48), samwood (36), Santa María (46), and Spanish cedar (113). Some species have specific applications. Framing, sidewalls, and roofing are held together with vines of guacu (18 *Aristolochia trilobata*), mahoe (109), and withes (31). Pilings are made from rot resistant species such as ebo (89 *Dipteryx oleifera*), oaka (150 *Manilkara zapota*), and sipul (151 *Pouteria sapota*). Roofs are made from palm leaves, for example hone (188 *Elaeis guineensis*), saw cabbage palm (184), and sconfra (186 *Calyptrigene ghiesbreghtiana*), and from galvanized metal sheet stock. Sidewalls are made from bamboo (208 *Bambusa vulgaris*), banak (121), Caribbean pine (4), saba (112), saw cabbage palm (184), and wild cane (212 *Gynerium sagittatum*). Household furnishings (e.g., beds, benches, tables) are scarce and are made from whatever material is available. Crafts are made for both household use and sale to tourists. Common in most households are hammocks made from tunu (119) fibers or purchased from markets or visiting mestizo merchants. Popular craft items include vests made from tunu (119) fiber (Fig. 2), and bowls, figurines, forks, model boats and canoes, made from mahogany (114), Spanish cedar (113), and rosewood ([81 *Dalbergia brownnei*], [82 *D. hypoleuca*], [83 *D. tucurensis*]).

TABLE 5. MEDICINAL PLANT SPECIES USED BY THE ULWA, ARRANGED BY ORIGIN AND LIFE FORM.

Origin	Life Form				Total	%
	Tree	Shrub	Vine	Herb		
Native to Nicaragua	49	5	22	71	147	79
Introduced	10	3	2	8	23	12
Naturalized	3	1	2	11	17	9
Total	62	9	26	90	187	
%	33	5	14	48		

FOOD

The 69 species the Ulwa use for food include domesticates, semi-domesticates, and wild plants (Table 3). As do the Miskitu (Coe and Anderson 1997), the Ulwa rely on domesticates as their major food source: species grown in agricultural fields account for 43% of the staple foods consumed by the Ulwa (Table 3). The remaining 57% of the staple food species are semi-domesticates, wild plants, and purchased plants obtained from kitchen gardens, forest, and markets. The most important food plants in kitchen gardens were given previously under "Homegardens."

MEDICINE

To deal with the many health hazards (e.g., dysentery, malaria, snakebites) associated with living in the lowland tropical habitat, the Ulwa have developed a relatively large pharmacopoeia of both wild and cultivated plants (187 medicinal species—Table 1). The majority of Ulwa medicinal plants are obtained from the wild (74%) (Table 4), and most are herbs (48%) or trees (33%) (Table 5). Most medicinals (75%)

TABLE 6. MEDICINALS: PLANT PARTS USED BY THE ULWA.

Parts used	Number of Species
Leaf	123
Bark	40
Root	32
Whole plant	28
Fruit	24
Sap	15
Stem	11
Flower	2
Seed	2

TABLE 7. MODE OF PREPARATION OF ULWA MEDICINAL PLANTS.

Mode	Number of Species
Decoction	161
Poultice	36
Juice	21
Infusion	16
None	9
Bath	4
Syrup	1

have some bioactive principle including alkaloids (87% of the species with bioactive compounds) and glycosides (13%) (see Appendix). Materials used in medicinal preparations include leaves, bark, roots, fruits, sap, stem (wood), flowers, and seeds. In some instances the whole plant is utilized, root included. The most frequently utilized plant part is the leaf (123 species), followed by the bark (40 species) (Table 6). Herbal remedies are prepared as decoctions, poultices, juice, infusions, baths, and syrups. The majority of medicinals are prepared as decoctions (161 species) (Table 7) and are administered orally (167 species) (Table 8). These findings are similar to those documented for the Miskitu by Coe and Anderson (1997).

The 15 most preferred Ulwa medicinal species (i.e., those with five or more medicinal applications) are: aguacate* (* = species shared by the Ulwa and southern Miskitu) (101), balsam pear* (63 *Momordica charantia*), bird bush (137 *Borreria laevis*), burbur (84 *Desmodium adscendens*), Christmas blossom* (75 *Cassia alata*), flor de muerto (28 *Tagetes erecta*), frailecillo (70 *Jatropha gossypifolia*), guava* (122), jackass bitters* (27 *Neurolaena lobata*), John Charles (98 *Hyptis verticillata*), lime (144), red scholars* (140 *Hamelia patens*), sorocontil (78 *Cassia reticulata*), wild sage (37 *Cordia curassavica*), and wild thyme* (174 *Lippia micromera*).

TABLE 8. MODE OF ADMINISTRATION OF MEDICINAL PREPARATION BY THE ULWA.

Mode	Number of Species
Oral	167
Topical	73
Bath	9
Inhalation	1

For these 15 medicinals, the Ulwa have 82 medicinal applications, 11 of which are unique. In comparison, the southern Miskitu have 22 such medicinals (with five or more applications) with 124 medicinal applications, 23 of which are unique. Seven of the most popular medicinals are shared by the two groups. The Ulwa have 41 medicinal applications for these shared species (three unique), whereas the southern Miskitu have 47 medicinal applications (nine unique). Thus, as one would expect, the most common medicinals are used, for the most part, in the same way by these two sympatric groups.

The Ulwa treat their illnesses and injuries with both traditional and Western medicine. Traditional medicine consists of rituals performed by the shamans (*watyu*) to treat supernatural illnesses and herbal medicine practiced by the herbalists (*dī basta talingka*) to treat illnesses deemed to be caused by natural causes. The latter provides the bulk of primary health care among the Ulwa. Western medicine, on the other hand, is accessed mostly when traditional methods of healing are ineffective. However, Western medicine is often too costly or inaccessible (despite transportation improvements from the 1980s—made partly to improve access to Western medicine). Travel is still sufficiently difficult that, in many instances, a patient reaches a clinic or hospital too late for efficacious treatment.

Ulwa medicinal plant use is similar to that of the Miskitu in being generally controlled by practitioners (herbalists and shamans). Practitioners guard their herbal knowledge with great secrecy, probably to enhance their reputation and prestige. However, a general pool of knowledge exists that is shared by most people (practitioners and the general populace). In most instances, the general populace uses the same plant materials as the shamans and herbalists, but the modes of preparation and administration are different.

DISCUSSION

The Ulwa have kept many aspects of their culture, including much of their ethnobotanical lore, and still rely on the plants for medicine. Acculturation is evidenced among the Ulwa by the cultural changes that have occurred, especially during the 1980s. Some of the most noticeable changes observed in Ulwa plant use practices (from least change to most) include: healing and curing, crafts, construction, food,

and clothing. In the discussion following, we rely on information from the Appendix, and published studies of the Garifuna (Coe 1994; Coe and Anderson 1996a,b), and Miskitu (Coe and Anderson 1997) to make comparisons with plants used by the Ulwa. We chose these two groups because they share the same ecosystem and have been in contact with the same group of outsiders.

The vast majority of species used by the Ulwa are the same as those used by the Miskitu (93% overlap in species used). This is not surprising, given the nearly complete overlap in territories. The Ulwa and the southern Miskitu share more species (91% overlap) and have a greater exchange of ethnobotanical knowledge than the Ulwa and the northern Miskitu (51% overlap). Thus, presumably the greater similarity in species use between the Ulwa and southern Miskitu derives in part from their proximity to each other. Consequently, both groups interact with the same plants,—those that makeup the lowland swamp forest communities of the central east coast of Nicaragua. They also share a number of cultural beliefs and practices (based on extended contact and cultural exchange) particularly among the inhabitants of the villages of Kara and Karawala. This extends to ethnobotanical information and rituals where Ulwa and Miskitu healers sometimes work together in treating especially serious problems.

The majority of species used and the bulk of the diet for both the Ulwa and Miskitu are domesticates, most of which were introduced by Europeans (as in Coe and Anderson 1997). However, the Miskitu utilize more wild species (37 species) than the Ulwa (21 species), a difference that presumably reflects the larger Miskitu population (which is more than 60 times that of the Ulwa), the greater area they occupy, and the isolation of some Miskitu settlements.

Some 94% of Ulwa medicinals are also used by the northern and southern Miskitu; in contrast, only 61% of the medicinal species of the southern Miskitu are also used by the Ulwa. The Ulwa obtain most of their botanical resources from a relatively small area of the lowland swamp forest (essentially around the delta of the Rio Grande de Matagalpa vs. the southern Miskitu whose territory extends from the delta of the Rio Grande de Matagalpa all the way to the south of Bluefields; see Fig. 1).

About three-fourths of the medicinal species

TABLE 9. COMPARISON OF THE NUMBER OF SPECIES AND FAMILIES OF THE MOST IMPORTANT MEDICINAL FAMILIES TO THE ULWA AND SOUTHERN MISKITU.

Family name	Number of species	
	Ulwa	Miskitu
Asteraceae	11	16
Euphorbiaceae	7	13
Fabaceae	20	41
Rubiaceae	8	20
Solanaceae	7	11
Verbenaceae	10	13

used by the Ulwa and Miskitu are native to eastern Nicaragua, and are obtained from the wild. The most frequently used medicinal plant families by the Ulwa and Miskitu (Coe and Anderson 1997) are Asteraceae, Euphorbiaceae, Fabaceae, Rubiaceae, Solanaceae, and Verbenaceae (Table 9). These two groups share a preference for plant part used (leaf), method of preparation (decoction), and mode of administration (oral). However, they differ in the preparation of herbal remedies. For example, the Miskitu prepare most of their topical remedies by soaking plant material in a mixture of water and alcohol; the Ulwa, on the other hand, boil plant material in water. The Miskitu (Coe and Anderson 1997) use more Western pharmaceuticals in their pharmacopoeia than the Ulwa. This could be due to greater access by the Miskitu to Western medicine for a longer time—in fact, more so than any other indigenous group in eastern Nicaragua (Coe and Anderson 1997). For both the Ulwa and southern Miskitu, the illnesses with the largest number of species used in treatment are: fever (66 Ulwa = u, 86 southern Miskitu = sm), aches and pains (60 u, 77 sm), skin rashes and sores (57 u, 100 sm), diarrhea (55 u, 70 sm), infections (32 u, 48 sm), bites and stings (31 u, 39 sm), and digestive disorders (30 u, 42 sm). The large number of species used to treat these particular illnesses can be attributed to the ubiquity of the illnesses and the fact that they occur year-round. Most herbal remedies are prepared as mixtures of several species. The majority of medicinals used by the Ulwa, like the Garífuna (Coe 1994; Coe and Anderson 1996a) and Miskitu (Coe and Anderson 1997) contain either an alkaloid and/or a gly-

coside, suggesting they may be biomedically effective.

In summary, the southern Miskitu use more species, and have more medical applications than the Ulwa. In addition, only nine species of medicinals are unique to the Ulwa. There are, however, some differences; there are more than 30 unique medicinal applications among the Ulwa (Table 10). For example, though both the Ulwa and Miskitu use Christmas blossom (75) and jackass bitters (27) to treat various illnesses, only the Ulwa use these species as a febrifuge and diuretic respectively. Given the broad overlap in territory of the Ulwa and Miskitu, perhaps the question is, why are there any differences at all? By far the majority of differences in plant use practices are in the medicinal applications for particular species. Species may or may not be selected by a group based on: 1) the perceived effectiveness of the species, 2) perceived undesirable effects (differences that could be culturally based), 3) local availability (patchiness in distribution), and 4) methods of preparation or application that may not be culturally acceptable. One example is provided by wild fig (118): this species is not used by the Ulwa because they believe that any contact with the plant will make the spirits angry. In contrast, this species is a highly regarded Miskitu medicinal. In some cases, species are not used, or used with extreme care, to avoid undesirable effects such as nightmares, hair loss, poisoning, and other general "illnesses."

Clearly, there is a high overall similarity of the Ulwa to the Miskitu ethnobotanical lore, particularly to the southern Miskitu, partly because of long, continuous contact between the two groups. Contact between these groups increased greatly during the eighteenth and nineteenth centuries, first encouraged by British traders and later by missionaries (Conzemius 1932; Romero 1995; Smutko 1985). However, during the past 50 years there has been a dramatic increase in access to the area (e.g., construction of roads and an inter-coastal waterway or canal) and consequent interaction among the Ulwa and other groups as well. Thus, ethnobotanical studies like this are important for documenting traditional plant use for science, but also can serve as reference for indigenous cultures.

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TABLE 10. COMMON AND UNIQUE MEDICINAL APPLICATIONS AMONG THE ULWA AND SOUTHERN MISKITU. 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; R = RITUALS; 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.

Species	Common applications	Miskitu Unique applications	Ulwa Unique applications
<i>Acrostichum aureum</i>	F, Y	A	—
<i>Aloe vera</i>	B, N, S	X	—
<i>Anacardium occidentale</i>	A, D, S	—	F
<i>Annona glabra</i>	A, C	L	—
<i>Annona muricata</i>	C, D	F	—
<i>Aristolochia trilobata</i>	B, G, L, T	H	—
<i>Artocarpus altilis</i>	A	H	—
<i>Avicennia germinans</i>	D	—	Q
<i>Bambusa vulgaris</i>	D, F	S	—
<i>Bixa orellana</i>	D, L, N	S	—
<i>Borreria laevis</i>	B, L, S, U	W	—
<i>Carapa guianensis</i>	F	D	A
<i>Cassia alata</i>	I, S, T, X	D, H, P	F
<i>Cassia reticulata</i>	A, B, I, S	—	W, X
<i>Cedrela odorata</i>	A, F, T	—	Q
<i>Ceiba pentandra</i>	E, K, Q	—	A
<i>Cinchona pubescens</i>	F, M	D	—
<i>Citrus aurantium</i>	D, F, G, H, I, L	K	—
<i>Connarus lambertii</i>	D	Q	—
<i>Cordia curassavica</i>	A, D, F, H	—	C
<i>Desmodium adscendens</i>	A, G, I, S	—	D
<i>Desmodium canum</i>	A, F, I, S, V	F, V	—
<i>Desmodium triflorum</i>	A, I	—	F
<i>Dipteryx oleifera</i>	A, Q	Z	F
<i>Elaeis guineensis</i>	X	G	X
<i>Elaeis oleifera</i>	X	G	X
<i>Elephantopus spicatus</i>	D, P	A	—
<i>Eryngium foetidum</i>	D, G, P, R	L	—
<i>Gynerium sagittatum</i>	B, I, S	K, V	—
<i>Hamelia patens</i>	B, F, I, M, S, U	W	—
<i>Hibiscus tiliaceus</i>	F	Y	C
<i>Hyptis verticillata</i>	H, I, L, S	—	A
<i>Jatropha curcas</i>	D, F, P, X	V	—
<i>Jatropha gossypifolia</i>	D, I, S, X	—	Y
<i>Lippia alba</i>	C, F, I, W	G	—
<i>Lippia micromera</i>	C, G, I, L, W	K	—
<i>Melochia villosa</i>	A, G, L	L	—
<i>Momordica charantia</i>	A, C, H, J, M, T	I, L, S	—
<i>Mucuna urens</i>	A, B, S	G	—
<i>Neurolaena lobata</i>	F, H, M, P, S	—	K
<i>Ocimum micranthum</i>	A, F	G, I, R	H, L
<i>Odontadenia puncticulosa</i>	B	—	F
<i>Pachira aquatica</i>	D, S, T	S	I
<i>Passiflora quadrangularis</i>	A, F	J, P	M, S
<i>Pentaclethra macroloba</i>	B, F, S	—	L
<i>Peperomia pellucida</i>	B, I, V	—	W

TABLE 10. CONTINUED.

Species	Common applications	Miskitu Unique applications	Ufwa Unique applications
<i>Peperomia peltata</i>	B, I, V	W	—
<i>Persea americana</i>	D, L, O, W	—	J
<i>Petiveria alliacea</i>	A, D	R	L, O
<i>Piper auritum</i>	A, C, E, G	L	—
<i>Piper peltatum</i>	A, E, G	—	C
<i>Psidium guajava</i>	D, G, H, I, S	P	F
<i>Saccharum officinarum</i>	D, I, L	—	S
<i>Sida acuta</i>	A, C, W	L	—
<i>Spondias purpurea</i>	D, F	S	—
<i>Stachytarpheta cayennensis</i>	G, P, X	—	F
<i>Stachytarpheta jamaicensis</i>	F, P, X	—	G
<i>Struthanthus cassythoides</i>	A, B, S	L	—
<i>Tagetes erecta</i>	A, L, W	—	G
<i>Wedelia trilobata</i>	B, E, L, W	I	—
<i>Zingiber officinale</i>	G, L	—	F

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APPENDIX. ULWA PLANTS AND THEIR USES. ALSO GIVEN ARE THE COMMON AND UNIQUE MEDICINAL APPLICATIONS AMONG THE ULWA AND SOUTHERN MISKITU.

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
Microphyllrophyta								
Glossopsida								
Selaginellaceae								
1. <i>Selaginella sertata</i> Spring	wí sangka (u)	M	F, I	P	D	O	+	4357
Pteridophyta								
Filicopsida								
Adiantaceae								
2. <i>Acrostichum aureum</i> L.	nawah damaska (u)	M, O	F, Y	L, R	D	O	+/+L ^a	4435
Polypodiaceae								
3. <i>Pityrogramma calomelanos</i> (L.) Link	wí pihka (u)	M, O	F	L	D	O	O/O	4058
Coniferophyta								
Coniferopsida								
Pinaceae								
4. <i>Pinus caribaea</i> Morelet	wálang panka (u)	M, O	A, L	S	P	I, T	N/O	4430
Magnoliophyta								
Magnoliopsida (DICOTS)								
Acanthaceae								
5. <i>Blechnum browniei</i> Juss.	kunsil (u)	M	B, D	L, P	D	O	+	3631
6. <i>Justicia spicigera</i> Schlecht.*	damaska sangka (u)	M, O	F	L	D	O	O/+L ^d	4463
Anacardiaceae								
7. <i>Anacardium occidentale</i> L.	kasauh (u)	F, M, O	A, D, F, S	B	D	O, T	+	2725
8. <i>Mangifera indica</i> L.	mankru, yalau (u)	F, M, O	A, D, S	B, L	D	O, T	+	3387
9. <i>Spondias mombin</i> L.	walak (u)	F, M, O	D, F, I, S	B, L	D	O	O/O	2275
10. <i>S. purpurea</i> L.	walak (u)	F, M, O	D, F	B, L	D	O	O/O	2959
Annonaceae								
11. <i>Annona glabra</i> L.	saput (u)	F, M	A, C	B, L	D, P	O, T	+L ^h	2403
12. <i>A. muricata</i> L.	saput (u)	F, M	C, D	B, L	D	O	+L ^h	3392
13. <i>Gutterria amplifolia</i> Triana & Planch.	tastala (u)	M	D, V	B, L	D	O	+	2429

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 tests ⁸	Voucher # ⁹
Apiaceae								
14. <i>Eryngium foetidum</i> L.	kisauri (u)	F, M	D, G, P, R	L	D, I	B, O	O/+L ^c	3515
Apocynaceae								
15. <i>Allamanda cathartica</i> L.	tumi lalahka (u)	M, O	E, X	F, L, S	D	O	+/+L ^d	2522
16. <i>Odontadenia punctulosa</i> (Rich.) Pull.	sakaluk (u)	M	B, F	L	D	O	+	2139
17. <i>Tabernaemontana chrysocarpa</i> Blake	waku (u)	M	F, I	L, S	D	O	+	4193
Aristolochiaceae								
18. <i>Aristolochia trilobata</i> L.	kuntribu (u)	M, O	B, G, L, T	L, P	D, I	O	+, L ^d	3923
Asclepiadaceae								
19. <i>Asclepias curassavica</i> L.	wahbara (u)	M	B, F, P, S	L	D, P	O, T	+, +L ^h	3235
Asteraceae								
20. <i>Bidens riparia</i> H.B.K.	uhdanaka di basta (u)	M	L	L	D	O	+	3225
21. <i>Elephantopus mollis</i> H.B.K.	slimsi (u)	M	D, P	L	D	O	+	3354
22. <i>E. spicatus</i> (Juss.) C. F. Baker	damaska pamkih (u)	M	A	L	J	T	+	4470
23. <i>Eleutheranthera ruderalis</i> (Sw.) Schtdl.	walalaka (u)	M	F, S	L	D	O, T	+	2219
24. <i>Lastianthaea fruticosa</i> (L.) K.m. becker *	pulu lalahka (u)	M	L	F	D	O	+	
25. <i>Matricaria chamomilla</i> L.	wālang (u)	M	G	P	D	O	+L ^s	4434
26. <i>Mikania coradiifolia</i> (L.f.) Willd.	kunsil (u)	M	A, B, F	L, M, P	D, P	O, T	+, +L ^h	3312
27. <i>Neurolaena lobata</i> (L.) R. Br	kunata paska (u)	M	F, H, K, M, P, S	L	D	O, T	+L ^d	2548
28. <i>Tagetes erecta</i> L.	baram (u)	M	A, F, G, L, W	L, P	D	O	+L ^s	2762
29. <i>Vernonia scorpioides</i> (Lam.) Pers.*	malakasa (u)	M	R, T	L, R	B, D	B, O	O/O	4347
30. <i>Wedelia trilobata</i> (L.) Hitchc.	mululuh (u)	M	B, F, L, W	F, L, M	D	O	O/O	3556
Bignoniaceae								
31. <i>Arrabidaea chica</i> (Humb., & Bonpl.) Verl.	damaska âwas (u)	M	D	L	D	O	+L ^c	4464
32. <i>Crescentia cujete</i> L.	sutak, sûtak (u)	M	D, E, L	F	D, S	O	O/+L ^c	3447
Bixaceae								
33. <i>Bixa orellana</i> L.	awal (u)	F, M, O	D, L, N	E, L	D, I	O, T	+L ^b	3267
Bombacaceae								
34. <i>Ceiba pentandra</i> (L.) Gaertn.	panya, paniki (u)	M, O	A, E, K, Q	B	D	O	O/O	4445
35. <i>Pachira aquatica</i> L.	pankasna (u)	M, O	D, I, T	B, E	D	O	O/O	3384

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
Boraginaceae								
36. <i>Cordia alliodora</i> (Ruiz & Pav.) Oken	wingkurh (u)	M, O	S, T	L	D	O, T	-L/O	4366
37. <i>C. curassavica</i> (Jacq.) Roem. & Schult.	kuyus (u)	F, M	A, C, D, F, H	L	D	B, O, T	+	3653
38. <i>C. spinescens</i> L.	kaya (u)	M	A, C, F, H	L	D	O	+	3875
39. <i>Heliotropium indicum</i> L.	wákurus umah (u)	M	B, D, S	L, P	D	O	+L ^b	4018
Bursaraceae								
40. <i>Bursera simaruba</i> (L.) Sarg.	limsi (m)	M, O	I, S, T	B	D	B, O	O/O	3824
41. <i>Tetragastris panamensis</i> (Engl.) Kuntze	sakal (u)	O	—	—	—	—	—	4383
Caricaceae								
42. <i>Carica papaya</i> L.	ulmak, ulumak (u)	F, M	P, S, U, Y	F, L, S	D, J	O, T	+L ^s	2723
Cecropiaceae								
43. <i>Cecropia peltata</i> L.	palang (u)	M	W	L	D	O	+L ^e	3462
Chrysobalanaceae								
44. <i>Chrysobalanus icaco</i> L.	tawa (u)	F, M	D, Q	B, R	D	O	O/O	2838
45. <i>C. pellocarpus</i> G. Mey.	baraska siuli (u)	F, M	D, Q	B, R	D	O	O/O	2136
Clusiaceae								
46. <i>Calophyllum brasiliense</i> Cambess	awanak (u)	M, O	A, L	B, S	D	O, T	-L/O	4371
47. <i>Garcinia mangostana</i> L.	mangosteem (c)	F	A	B, S	N, P	T	+L ^e	NV
48. <i>Symphonia globulifera</i> L.f.	paumaba (u)	O	—	—	—	—	—	2356
Combretaceae								
49. <i>Conocarpus erectus</i> L.	mankru (u)	M, O	D, Q	B, L	D	O	O/O	2775
50. <i>Laguncularia racemosa</i> (L.) Gaertn.	mankru piikka (u)	M, O	D	B	D	O	O/O	2712
51. <i>Terminalia amazonica</i> (J. F. Gmel.) Ex-ell*	limnah (u)	M, O	D	B	D	O	O/O	4465
52. <i>T. Catappa</i> L.	amans, ibu (u)	F, O	—	—	—	—	—	2708
53. <i>T. Oblonga</i> (Ruiz & Pav.) steud.	limnah (u)	O	—	—	—	—	—	4388
Connaraceae								
54. <i>Connarus lambertii</i> (DC.) Sagot	siuli pauka (u)	M, O	Q	B, L	D	O	+	2124

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 tests ⁸	Voucher # ⁹
Convolvulaceae								
55. <i>Cuscuta americana</i> L.	asang wahka lalahka (u)	M	S	L, M	D, P	T	+	2129
56. <i>Ipomoea batatas</i> (L.) Lam.	pai (u)	F, M	U	L	D	T	+	3637
57. <i>I. mauritiana</i> Jacq.	salalani (u)	M	B, S	L	D, P	O, T	O/O	4318
58. <i>I. pes-caprae</i> (L.) R.Br.	pulu kuma kungka (u)	M	F, S, T	L	D, P	O, T	+, +L ^s	2003
59. <i>I. setifera</i> Poir.*	tutuk, ulupuy (u)	M	B, S	L	D, P	O, T	+	3371
60. <i>Operculina pteripes</i> (G. Don) O'Donell	bitta tatau (m)	M	B, U	L	P	T	+	4102
Crassulaceae								
61. <i>Kalanchoe pinnata</i> (Lam.) Pers.	pan sangka (u)	M	A, L	L	D, P	O, T	O/+L ^b	3432
Cucurbitaceae								
62. <i>Fevillea cordifolia</i> L.	mula (u)	M	A, B, E, G	E	I, P	O, T	O/O	2765
63. <i>Momordica charantia</i> L.	panaminik, makalalaska, miniklatasni (u)	F, M	A, C, H, J, M, T	L, M	D	O	+, +L ^h	3635
Dilleniaceae								
64. <i>Davilla kunthii</i> A. St. Hil.	wî babatka (u)	M, O	D, Q	B, L, M	D	O	+L	2705
Euphorbiaceae								
65. <i>Acalypha arvensis</i> Poepp. & Endl.	kiskita (u)	M	B, S	L, P	D	O, T	O/+L ^d	3641
66. <i>Croton punctatus</i> L.	irik, kikis (u)	M	F, I	F, L, R	D	O	+L ^s	4046
67. <i>Euphorbia thymifolia</i> (L.) Millsp.	baska, bisini (u)	M	A, C, I	L, P	D	O	+L	2224
68. <i>Hyeronima alchorneoides</i> Allemão	nanciton (s)	O						4364
69. <i>Jatropha curcas</i> L.	pisik (u)	M	D, F, P, X	L, S	D	O	+L ^h	2749
70. <i>J. gossypifolia</i> L.	kishka (u)	M	D, I, S, X, Y	L	D	O	+L ^h	4344
71. <i>Manihot esculenta</i> Crantz	malai, maley (u)	F, M	A, D, F	L, R	D	O	O/+L ^s	3269
72. <i>Ricinus communis</i> L.	unapalan (u)	M	A, F, X	E, L	D, P	O, T	+L ^h	3507
Fabaceae								
73. <i>Abrus precatorius</i> L.	John Crowbead (c)	M	—	F, L	D	O	+L ^h	4026
74. <i>Arachis hypogaea</i> L.	pinda (c)	F	—	—	—	—	—	2752
	daka, papaih, tata, tatak							
75. <i>Cassia alata</i> L.	tah (u)	M	F, I, S, T, X	F, L	B, D, J, P	B, O, T	+, +L ^h	3202
76. <i>C. hirsuta</i> L.	kusnini (u)	M	F, W	E, L	D	O	+L ^c	3584
77. <i>C. occidentalis</i> L.	singsingya (u)	M	F, G, I, L	L, F, R	D, J	O, T	+, +L ^s	3625
78. <i>C. reticulata</i> Willd.	tistin (u)	M	A, B, I, S, W, X	L, R	D	O	+	2799

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 #
79. <i>Crotalaria retusa</i> L.	nangtal damaska (u)	M	S, U, X	L	D, P	O, T	+L ^h	4226
80. <i>C. verrucosa</i> L.	pula suyuka (u)	M	S, X	L	D	O, T	+L ^h	3718
81. <i>Dahlbergia brownii</i> (Jacq.) Urb.	rusul (m)	M, O	D, Q, S	B, L, M	D	O, T	O/O	4082
82. <i>D. hypoleuca</i> Pittier	rusul (m)	O	—	—	—	—	—	4325
83. <i>D. tuarensis</i> Donn. Sm.	rusul (m)	O	—	—	—	—	—	4391
84. <i>Desmodium adscendens</i> (Sw.) DC.	danka dangpanak (u) basaka danka Dang-	M	A, D, G, I, S	L, P, R	D, I	O	+	4117
85. <i>D. barbatum</i> (L.) Benth. & Oerst.	panak (u)	M	A, I, S, V	L, R	D	O	O/O	3309
86. <i>D. canum</i> (J.F. Gmel.) Schinz & Thell.	yamah damaska (u)	M	A, I, S	L, R	D	O	+	3673
87. <i>D. triflorum</i> (L.) DC.	kumalata (u)	M	A, F, I	L, R	D	O	+	2767
88. <i>Dioclea megacarpa</i> Rolfe	makiala (u)	M, O	A, S	L	D, P	T	+	3236
89. <i>Dipteryx oleifera</i> (Benth.) Taub.	ibu (u)	F, M, O	A, F, Q	B, F, M	D	O	+L ^d	2321
90. <i>Hymenaea courbaril</i> L.	tipi (u)	M, O	A, D, F, L	B, S	D, P	O, T	O/O	3417
91. <i>Mimosa pudica</i> L.	wabala (u)	M	A, G, P, W	L, M, R	D	O	+, +L ^h	2252
92. <i>Mucuna urens</i> DC.	timbus damaska (u)	M, O	A, B, S	S	D, P	T	+L ^h	2870
93. <i>Pentaclethra macroloba</i> (Willd.) Kuntz	sinak (u)	F	B, F, L, S	B	D	O, T	+	2441
94. <i>Phaseolus vulgaris</i> L.	samutka (u)	M, O	—	—	—	—	—	2758
95. <i>Pithecolobium dulce</i> (Roxb.) Benth.	—	M, O	D, Q	B	D	O	+L ^h	3764
Gentianeaceae								
96. <i>Coutoubea spicata</i> Aubl.	witang tusnaka (u)	M	A, F	L	D	O	O/O	2587
Lamiaceae								
97. <i>Hyptis capitata</i> Jacq.	aras kasnin nuhni (u)	M	G, L	L, P	D	O	O/O	3558
98. <i>H. verticillata</i> Jacq.	wahiwin saika (u)	M	A, H, I, L, S	L, R	D, I, P	O, T	+	2667
99. <i>Ocimum micranthum</i> Willd.	kuma sirpi (u)	F, M	A, F, H, L	L	D, I	O, T	O/O	2229
Lauraceae								
100. <i>Cinnamomum zeylanicum</i> Blume	cinnamon (c)	F, M	D, G, T	B, M	D	O	O/O	2763
101. <i>Persea americana</i> Mill.	sarin, saring, sikya (u)	F, M	D, J, L, O, W	B, E, L	D	O	+L ^s	3356
Loganiaceae								
102. <i>Spigelia anthelmia</i> L.	bil damaska, biru da-	M	P	P	D	O	+, +L ^h	4438
Loranthaceae								
103. <i>Struthanthus cassythoides</i> Millsp. Ex Standl.	dawan damaska (u)	M	A, B, S	L, P	D, P	O, T	+	3840

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 #
Lythraceae								
104. <i>Cuphea mimuloides</i> Cham. & Schltr.	asu (u)	M	D, T	P	D	O	O/O	4054
Malpighiaceae								
105. <i>Byrsonima crassifolia</i> (L.) H.B.K.	krabu (u)	F, M, O	A, D, Q	B	D	O	+	2857
106. <i>Heteropteris multiflora</i> (DC.) Hochr.	tîsikka (u)	M	L, Q	L	D	O	+	3478
107. <i>Hiraea quapara</i> (Aubl.) Morton	dakasa (u)	M	S, U	L	D	T	+	2335
108. <i>Stigmaphyllon pseudopuberum</i> Nied.	bil siwanak (u)	M	Q, V, Z	L, P	D	O, T	O/O	3793
Malvaceae								
109. <i>Hibiscus tiliaceus</i> L.	sani, wahpi (u) kataramas, sakratuni	M, O	C, F	B, L	D	O	+	2185
110. <i>Sida acuta</i> Burm. L. F.	(u) muluh, muluh alimuk	M, O	A, C, W	L, P	D	O	+L ^h	3294
111. <i>S. rhombifolia</i> L.	(u)	M, O	A, C, F, L	L	D	O	+L ^h	3587
Meliaceae								
112. <i>Carapa guianensis</i> Aubl.	saba (u)	M, O	A, F	B	D	O	+, +L ^s	4369
113. <i>Cedrela odorata</i> L.	suyun, winkur (u)	M, O	A, F, Q, T	B	D	O	-L/O	4365
114. <i>Swietenia macrophylla</i> King	pauluh, yulu	O	—	—	—	—	—	4413
Moraceae								
115. <i>Artocarpus altilis</i> (Parkinson) Fosberg	bredpuk (u)	F, M	A	S	P	T	O/+L ^a	3423
116. <i>Castilla elastica</i> Sessé	taspul (u)	F, M	A	S	P	T	N	NV
117. <i>Chlorophora tinctoria</i> (L.) Gaud.*	pan lalahka (u)	O	—	—	—	—	—	NV
118. <i>Ficus</i> sp.	taspul (u)	O	—	—	—	—	—	NV
119. <i>Poulsenia armata</i> (Miq.) Standl.	pan yaunaka (u)	O	—	—	—	—	—	NV
Myristicaceae								
120. <i>Myristica fragrans</i> Houtt.	nutmeg (c)	F, M	G	F	D	O	+L	2753
121. <i>Vitrola koschnyi</i> Warb.	pan áwas (u)	M, O	A, D, F	B, L, S	D, P	O, T	+L	2398
Myrtaceae								
122. <i>Psidium guajava</i> L.	kuru, burimak (u)	F, M, O	D, F, G, H, I, S	B, L	D, I	B, O	+L ^b	3443
123. <i>Syzygium aromaticum</i> (L.) Merr. & Perry	cloves (c)	F, M	A, C, G, O	C	D	O	O/O	4442

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
Passifloraceae								
124. <i>Passiflora biflora</i> Lam.	waiku pas-bah (u)	M	E, I, K	L, P	D	O	O/O	4105
125. <i>P. quadrangularis</i> L.	wahamtari (u)	F, M	A, F, M, S	L	D, J	O, T	+L ^h	3513
Phytolaccaceae								
126. <i>Peperomia alliacea</i> L.	surua, kiski sabatkira (m)	M	A, D, L, O	L, P, R	D, P	O, T	+L ^d	3959
127. <i>Phytolacca rivinoides</i> Kunth & Bouché	tilba pata (m)	F, M	E, X	L, R	D	O	+L ^c	3261
Piperaceae								
128. <i>Peperomia</i> sp.	muih-muih (u)	M	B, I, V	P	D	O	O/O	2242
129. <i>P. pellucida</i> (L.) H.B.K.	sumu yal (u)	M	B, I, V, W	P	D	O	O/O	3744
130. <i>Piper auritum</i> H.B.K.	kalamata (u)	F, M	A, C, F, G	L	I, J, P	O, T	+, +L ^s	2719
131. <i>P. jacquemontianum</i> (Kunth) DC.	pansan (u)	M	A, F, G	L	B, I	B, O	+	3952
132. <i>P. peltatum</i> L.	kalamata (u)	F, M	A, C, F, G	L	D, P	B, O, T	+, +L ^d	3928
Polygonaceae								
133. <i>Coccoloba uvifera</i> (L.) L.	waham (u)	F, M	D, G, S	B, L	D	O	O/O	3445
Portulacaceae								
134. <i>Portulaca oleracea</i> L.	dislah pula (u)	M	P	P	D	O	+L ^p	4035
Rhizophoraceae								
135. <i>Rhizophora mangle</i> L.	mankru (u)	M, O	D, S	B	D	O	O/+L ^s	2096
Rubiaceae								
136. <i>Alibertia edulis</i> (L. Rich.) A. Rich. Ex DC.	guayabillo (s)	F, M	A, C, Q	B, L	D	O, T	O/O	3787
137. <i>Borreria laevis</i> (Lam.) Griseb.	titiska má baka (u)	M	B, I, L, S, U	L	D, J, P	T	+	3264
138. <i>Cinchona pubescens</i> Vahl	quina (s)	M	F, M	B, M	D	O	+L ^h	4354
139. <i>Coffea arabica</i> L.	was baraska (u)	F, M	F, U	E	D, N	O, T	+L ⁱ	NV
140. <i>Hamelia patens</i> Jacq.	pauka damaska (u)	M	B, F, I, M, S, U	L, P	D, P	O, T	+	2768
141. <i>Hemidiodia octimifolia</i> (Willd.) Schum. & Schult.	kanbala (u)	M	G	L	D	O	+	3901
142. <i>Posoqueria latifolia</i> (Rudge) Roem. & Hammel	lasap, lasat (u)	F, M	D, Q	B, L	D	O	+	4314
143. <i>Ptychotria elata</i> (Sw.) Hammel	pauka kungmak (u)	M	F, L, M	F, S	D	O, T	+	4456
Rutaceae								
144. <i>Citrus aurantifolia</i> (Christm.) Swingle	líma, limus sapahni (u)	F, M	C, D, F, G, I, L, P	F, L, R	D, J	O	+L ^c	3677

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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
145. <i>C. paradisi</i> Macfad.	sadik (u)	F, M	D, E, H	F, L	J	O	+L ^d	3681
146. <i>C. sinensis</i> (L.) Osbeck	aransa (u)	F, M	D, F, H, L	F, L	D, J	O	+L ^h	4450
Sapindaceae								
147. <i>Melicococcus bijugatus</i> Jacq.	sūnaka (u)	F, M	D, Q	E, L	D	O	O/O	3435
148. <i>Sapindus saponaria</i> L.	suhnaka (u)	O	—	—	—	—	—	2771
Sapotaceae								
149. <i>Chrysophyllum cainito</i> L.	tinaka (u)	F, M	D, E, Q	F, L	D, N	O	+L ^e	3350
150. <i>Manilkara zapota</i> (L.) P. Royen	īban, sabakan (u)	F, M	A, S	S	P	T	+L ^e	2792
151. <i>Pouteria sapota</i> (Jacq.) H.e. Moore & Stearn	sipul (u)	F, M, O	A, D, G, S	B, E, L	D, P	O, T	+L ^h	2710
Scrophulariaceae								
152. <i>Bacopa procumbens</i> (Mill.) Greenm.	sapaka (u)	M	A, X	L	D, J	O, T	O/O	2781
153. <i>Lindernia diffusa</i> (L.) Wettst.ex Dugand & Jacks.	kuntitir, tipismak (u) ubitna salalaini, ubitna bikisni (u)	M	X	P	D	O	+	2728
154. <i>Scoparia dulcis</i> L.	batakka dī basta (u)	M	B, C, T, W	L, P, R	D	O	+, +L ^h	3501
Simaroubaceae								
155. <i>Quassia amara</i> L.		M	B, F, M, T	B	D	O	+, +L ^h	4353
Solanaceae								
156. <i>Capsicum annuum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill	annak (u)	F, M	A, L, S	E, F, L	D, N	O, T	+L ^h	4330
157. <i>C. chinensis</i> Jacq.	angmak, annak (u)	F, M	A, L, S	E, F, L	D, N	O, T	+	3605
158. <i>C. frutescens</i> L.	angmak, annak (u)	F, M	I, L	F, L	D, J	O, T	+L ^h	2748
159. <i>Nicotiana tabacum</i> L.	aka (u)	M, O	A, B	L	N	O, T	+L ^h	NV
160. <i>Physalis angulata</i> L.	paumak makdasi (u)	M	F, I, M	L, P	I	O	+L ^h	3695
161. <i>Solanum lycopersicum</i> L.	paumak (u)	F, M	S	L	J	T	+L ^h	2831
162. <i>S. Tuberosum</i> L.	pai (u)	F, M	G	R	J	O	+L ^h	NV
Sterculiaceae								
163. <i>Melochia villosa</i> (Mill.) Fawc. & Rendle	kalsa (u)	M	A, G	L	D	O	+	4127
164. <i>Theobroma bicolor</i> H.B.K.*	kuru (u)	M, F	N	E	J	T	+	4468
165. <i>T. cacao</i> L.	kakay (m)	F, M	S, U	E, L	P	T	+L ^h	2815

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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
187. <i>Cocos nucifera</i> L.	anau, annu, annah (u)	F, M, O	D, P	F	D, I	O	+L ^c	NV
188. <i>Elaeis guineensis</i> Jacq.	auhka (u)	F, M, O	X	F	D	O	N/O	NV
189. <i>E. oleifera</i> (Kunth) Cortés	auhka (u)	F, M, O	X	F	D	O	N/O	NV
190. <i>Raphia taedigera</i> (C. Mart.) C. Mart.	siliku (u)	O	—	—	—	—	—	NV
Bromeliaceae								
191. <i>Ananas comosus</i> (L.) Merr.	masa, másahiti (u)	F	—	—	—	—	—	2727
192. <i>Bromelia pinguin</i> L.	ahsi, wakari (u)	O	—	—	—	—	—	2737
Commelinaceae								
193. <i>Commelina erecta</i> L.	waswas (u)	M	S	L, M	J	T	O/O	4344
Cyperaceae								
194. <i>Cyperus luzulae</i> (L.) Retz.	kapalak (u)	M, O	D	R	D	O	O/O	3687
195. <i>Kyllinga tibialis</i> Ledeb.	karasmak damaska (u)	M	F	R	D	O	+	4114
196. <i>Rhynchospora barbata</i> (Vahl.) Kunth	prisisi (u)	O	—	—	—	—	—	2635
197. <i>R. ciliata</i> Vahl.	prisisi (u)	O	—	—	—	—	—	4199
Dioscoreaceae								
198. <i>Dioscorea trifida</i> L.	usi (u)	F	—	—	—	—	—	2844
Haemodoraceae								
199. <i>Xiphidium caeruleum</i> Aubl.	swilawan, umah tikbus (u)	M	A, B, S, W	L	D	O, T	O/+L ^d	2806
Liliaceae								
200. <i>Allium cepa</i> L.	onyan (u)	F, M	L, P	R	J	O	N	NV
201. <i>Allium sativum</i> L.	kyalic (m)	F, M	A, H, P	R	J	O	N	NV
Musaceae								
202. <i>Musa</i> sp.	yámanh (u)	F, M, O	B, D, U	F, S	N, P	O, T	+L ^g	NV
203. <i>M. paradisiaca</i> L.	waka, waki (u)	F, M, O	B, D, U	F, S	N, P	O, T	+L ^g	NV
204. <i>M. paradisiaca</i> var. <i>Sapientum</i> (L.) Kunth	inkini, ingkinih, pasa, wakisa (u)	F, M, O	B, D, U	F, S	N, P	O, T	+L ^g	NV
Poaceae								
205. <i>Andropogon leucostachyus</i> H.B.K.	wálang (u)	O	—	—	—	—	—	2693
206. <i>Axonopus compressus</i> (Sw.) P. Beauv.	wálang (u)	O	—	—	—	—	—	4200
207. <i>A. poliophyllus</i> Chase	wálang (u)	O	—	—	—	—	—	2615

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
208. <i>Bambusa vulgaris</i> Schrad. ex Wendl.	itikna (u)	O	D, F	R	D	O	+L ^s	2711
209. <i>Coix lacryma-jobi</i> L.	am minik, am mak (u)	M, O	A, I, S	E, R	D	O	+L ^a	2646
210. <i>Cymbopogon citratus</i> (Nees) Stapf	ti (u)	F, M	F, G, L	L	I	O	+L ^s	3682
211. <i>Dichantherium sphaerocarpon</i> var. <i>floridanum</i> (Vasey) Davidse	wālang (u)	O	—	—	—	—	—	2641
212. <i>Gynerium sagittatum</i> (Aubl.) P. Beauv.	dapa (u)	M, O	B, I, S	R	D	O	O/O	3870
213. <i>Leptocoryphium lanatum</i> (H.B.K.) Nees	wālang (u)	O	—	—	—	—	—	2625
214. <i>Mesostemum blakei</i> Swallen	wālang (u)	O	—	—	—	—	—	2639
215. <i>Olyra latifolia</i> L.	wālang (u)	M	S	L, R	D	T	O/O	2495
216. <i>Oryza sativa</i> L.	rais (u)	F	D, S	E	B, I	B, O	+L ^h	2756
217. <i>Panicum maximum</i> Jacq.	wālang sikkā (u)	O	—	—	—	—	—	2759
218. <i>P. mertensii</i> Roth	wālang (u)	O	—	—	—	—	—	2538
219. <i>P. pilosum</i> Sw.	wālang (u)	O	—	—	—	—	—	2494
220. <i>P. purpurascens</i> Raddi	wālang para (u)	O	—	—	—	—	—	2761
221. <i>Saccharum officinarum</i> L.	tisnak (u)	F, M, O	D, I, L, S	L, M	D, J	O, T	-L/O	2764
222. <i>Zea mays</i> L.	am, ama (u)	F, M, O	I	C	D	O	+L ^h	2766
Smilacaceae								
223. <i>Smilax spinosa</i> Mill.	samalai wasalanaka (u)	M	B, S, T	R	D	O	O/+L ^c	3820
Zingiberaceae								
224. <i>Curcuma longa</i> L.*	azáfran (s)	M, O	S	R	J	T	O/+L ^c	4467
225. <i>Zingiber officinale</i> Roscoe	sinsa, marid pulumi (u)	F, M	D, F, G, L	R	D	O	O/+L ^a	2826

¹ Scientific name of the angiosperm families follows Cronquist (1981), the order within dicots and monocots of families, genera, and species is alphabetical.
² Common Names: c = Creole English; s = Spanish; m = Miskitu; u = Ulwa; spelling follows CIDCA (1985, 1986, 1989) and Smutko (1985). According to CIDCA (1989) the Ulwa alphabet consists of the following letters: a, á, b, i, k, l, m, n, p, r, s, t, u, v, y. Vowels with diacritical marks are pronounced with a long duration, e.g. suiak is pronounced "suatak," wí is pronounced "wii," and yámak is pronounced "yaamak."
³ Uses: F = Food; M = Medicine; O = other (construction, crafts, fiber, dye).
⁴ 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 = Astrigent; R = Rituals; 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.
⁵ Material Used: B = Bark; C = Flower; E = Seed; F = Fruit; L = Leaf; M = Stem; P = Whole Plant; R = Root; S = Sap.
⁶ 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.
⁷ Mode of Administration: (See section on medicinals for further explanation.) B = Bath; I = Inhalation; O = Oral; T = Topical.
⁸ 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). Glycoside tests: A limited literature search for glycoside was conducted only for those species that tested negative for alkaloids; +L = present, /O = none reported.
⁹ 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; # = FG. Coe accession numbers.
^a = Cambie and Ash 1994; ^b = Duke 1994; ^c = García-Barriga 1992; ^d = Hegnauer 1962-1994; ^e = Morton 1981, 1987; ^f = Tyler, Brady, and Robbers 1985; ^g = Willaman and Hui-Lin Li 1970; ^h = Willaman and Shubert 1961.
^{**} = Species unique to the Ulwa.