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# A CONTRIBUTION TO THE ETHNOPHARMACOLOGY OF THE LOWLAND QUICHUA PEOPLE OF AMAZONIAN ECUADOR

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"The Indian tribes [of the Amazon] possess an extensive pharmacopoeia of presumed medicinal plants. Most, if not all, of these species are biodynamic, but we know the active principles in only a few; in a few more we may guess from chemotaxonomic relationships what the active constituents might be. How great a challenge! There is no way of calculating how many new chemical structures - some of possibly great importance to human life and health - lurk yet undiscovered in the flora of the Amazon. It would seem that this potentiality alone might suffice to preserve from extinction the Amazon forests as well as the indigenous cultures privy to deep knowledge of the properties of their ambient vegetation (Schultes 1979)".

Dr. Schultes' challenge is one that must be accepted with urgency. The World Health Organization has estimated that approximately 80% of the population of developing countries still rely on traditional medicines for their primary health care (Farnsworth et al. 1985). Most of these traditional medicines have never been studied scientifically to establish their efficacy and safety, and undoubtedly most national medical associations would like to be able to provide their people with modern, clinically proven drugs within a proffessional health care system. Unfortunately, for many developing countries the cost would be prohibitive to import sufficient pure synthetic drugs or construct a home-based synthetic drug industry adequate to care for the entire population.

One answer to this dilemma is to take advantage of the natural resources at hand: indigenous plants and the accumulated knowledge and experience of traditional healers. Some medical professionals are quick to discount the value of herbal remedies, yet in the United States, for example, 25% of all prescriptions dispensed from community pharmacies in 1980 contained plant extracts or active principles prepared from higher plants, such as digitoxin and vincristine. In 1980 plant-derived drugs represented an eight billion dollar industry (Farnsworth et al. 1985).

It is also true that some advocates of traditional medicines place too much faith in them. Some plants famous in Europe and North America, with centuries of traditional usage, such as pennyroyal (*Hedeoma pulegioides* (L.) Pers., Labiatae) and sassafras (*Sassafras albidum* (Nutt.) Nees, Lauraceae), are now known to contain toxic constituents which, when taken in excessive amounts, have caused serious injury. Other plants, such as comfrey (*Symphytum officinale* L., Boraginaceae), have chemical races, some of which are safe and some of which contain toxic amounts of certain constituents, in this case pyrrolizidine alkaloids (Tyler 1982). Thus a rational, scientific approach is necessary to provide reliable, standardized preparations of traditional medicines with proven efficacy and safety.

The ethnopharmacological approach to developing new medicines is not just a theory. There are currently at least 119 plant-derived drugs in professional use throughout the world. Of these, 88 (74%) were discovered as a result of chemical and pharmacological investigations to isolate the active

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principle(s) responsible for the reputed benefits of the plant's traditional use (Farnsworth et al. 1985).

## OBJECTIVES

The first objective of this ethnopharmacological investigation was to inventory the plants used as traditional medicines by the Quijos Quichua, a group of Ecuadorean Lowland Quichua people whose ethnopharmacology is poorly known. The details of medicinal plant collection, preparation, and use had to be clearly documented with plant voucher specimens, in addition to notes and photographs, to ensure accuracy.

This work was needed urgently because, as in most developing countries, the primary rainforest of Ecuador is rapidly disappearing under the plow and bulldozer, as agriculture expands to feed a growing population, and as plantations, mines, and factories expand to feed the nation's exportation requirements. Simultaneously, as the people of the Amazonian lowlands of eastern Ecuador shift from a subsistence economy and traditional lifestyle to a cash economy and modern lifestyle, the human resource of traditional healers with an intimate knowledge of the local flora and fauna is diminishing. In fact, one of the traditional healers who contributed his time and knowledge to this study has since died, without passing on most of his traditional medical lore to his children, who are much more acculturated than he and consequently have more modern, materialistic interests.

Once a base of information on the indigenous medicinal plants of these Lowland Quichua people was established, the second objective was to conduct extensive library research to establish the current extent of knowledge about the chemistry and pharmacology of those plants collected in Ecuador. In this way time and effort could be saved in setting priorities for research on traditional medicines: some medicines' efficacy and safety may already have been established, certain others may show exceptional promise due to a correlation between preliminary chemical or pharmacological research and a long history of traditional use, and some may already have been found to be ineffective or toxic.

These first two objectives have been accomplished, and the results will be summarized below. A third objective, toward which work is in progress at this time, is to perform biological assays of selected Lowland Quichua medicinal plants. Bioassay-guided fractionation is being used to isolate the chemical principle(s) responsible for the observed activities, which can then be related back to the traditional use of the plant. Once the active principles have been isolated and identified, a solid basis will have been established for the decision to recommend plants for more extensive pharmacological and toxicological evaluation, and for the determination of appropriate formulations and dosage.

The final objective of this project will be to communicate specific recommendations to the providers of primary health care in Ecuador. Interviews with medical doctors practicing at government clinics in Ecuador's eastern lowlands revealed their frustration at not being able to do enough to help the people because of the lack of adequate drugs, equipment and facilities. The doctor at the clinic in Puerto Misahuallí stated that, if he knew that a local plant was both effective and safe, and if he knew the correct preparation and dosage, he would be happy to incorporate in into his practice (E. Reinoso, pers. comm.).

Some of the traditional healers also expressed great interest in learning what modern science could discover in their traditional medicines. They know that the value of a traditional medicine in its proper cultural context lies both in the intrinsic properties of the plant and in the psychological effects of their administrations. However, they are also aware of the pressures to modernize, and know that to successfully adapt they must find a way to combine the old and the new. A traditional healer who contributed to this study is now collaborating in an educational and research program with Ecuadorean and American college students.

## BACKGROUND

### 1. *Quijos Quichua Cultural Background*

Of Ecuador's indigenous population of three million people, about 60,000 live in the tropical lowlands on the eastern side of the Andes. Approximately 25,000 of these people speak Quichua. The Lowland Quichua-speaking people living along the upper Napo River and its tributaries, especially the Arajuno, Misahuallí, and Huambuno rivers, who were visited for this research project, speak a dialect known as Quijos Quichua or Tena Quichua (Orr and Wrisley 1965, Stark n.d., Whitten 1976). Within the study area they inhabit the villages of Puerto Misahuallí and Ahuano on the Napo River, settlements at Pusuno, Campana Cocha and Gusano Llacta, and farms lining the banks of the rivers.

The Quijos Quichua are descendents of intermarriage between Quichua of the Ecuadorian highlands who migrated to the lowlands, Quijos of the Andean foothills, and the Záparo, an original rainforest people (Steward and Métraux 1948, Stark n.d.). Quijos Quichua culture is thus a product of the melding of diverse highland and lowland cultures, and four and half centuries of contact with European culture. That contact, started in 1536 with the explorations of Gonzalo Días de Pineda and Francisco de Orellana (1538), became permanent with the establishment of the Dominican mission of Canelos in 1581 near Puyo (Steward and Métraux 1948). Acculturation has been accelerated by the construction of the town of Puerto Misahuallí in the 1960's at the end of a road built to bring modern economic development to the

Oriente. Today that road has passed Puerto Misahuallí and is penetrating ever further into the heart of the primary rain forest and its indigenous cultures.

The Quijos Quichua live by subsistence farming of sweet manioc, several varieties of plantain and bananas, and sweet potatoes. Various fruits, especially papayas, breadfruit, oranges, lemons, limes, peach-palm, and pineapple are also cultivated. Corn, cacao, bananas and coffee are grown as cash crops. Farms operated by extended families line both sides of the rivers, but generally extend back only 500 m to 1 km, then giving way to primary rain forest disturbed only by foot-paths. Protein in the diet comes from small mammals and birds snared or shot with muzzle-loading shotguns, and very small fish obtained by throw-nets and dynamiting. People still possess blowguns and fish poisons, but they are rarely if ever used.

## 2. *Napo Valley Ecological Background*

The Quijos Quichua live in the western-most reaches of the tropical Amazonian rain forest, within sight of the Andes. The life zone is "Very Humid Tropical Forest", with an annual rainfall of approximately 6,000 mm making it the wettest zone of the entire Amazon region (Neill and Baker 1985).

The terrain consists of east-west oriented ridges bearing highly leached red latosol soils, which rise up to 50 m above the rich alluvial soil of the Napo River flood plain. During the wet season, the banks of the river are flooded almost on a weekly basis, due to runoff from the nearby Andean foothills. The river level often will rise two to three meters overnight, depositing some of its load of alluvium and thus enriching the soil. There is no dry season, only a "less-wet" season.

The floristic diversity of the region is very high, there being an estimated 40,000 species. Composition of the flora is significantly different from zones of less rainfall within the Amazon Basin (Neill and Baker 1985). Recent botanical investigations in the Misahuallí area have discovered that 70% of the tree species collected had not been previously recorded from Amazonian Ecuador, and 10% were species new to science, indicating the prior lack of information and botanical richness of the region (Baker et al. 1987).

## 3. *Ethnobotanical Literature Background*

Ethnobotanical studies on the Napo Quichua, who live to the east of the Quijos Quichua on the Napo river from Coca to Iquitos, have been conducted by Orr and Wrisley (1965), Alarcon Galegas (1984) and Iglesias (1985), but the first reference provides no scientific names, the second has not been published, and the third provides often misspelled scientific names for only about 50% of the medicinal plants discussed. Kvist and Holm-Nielsen (1987) have done extensive ethnobotanical research in all the lowland regions of Ecuador, but to date have only published a limited amount of their information, which includes the Napo Quichua. Irvine (pers. comm.) has been studying Napo Quichua ethnoecology in the Payamino river area, but is just now writing her dissertation. Karsten (1935) describes some medicinal plants of the Canelos Quichua, who live to the southwest of the Quijos Quichua near Puyo and Canelos, but he provides only a few scientific names. Krukoff and Smith (1939) wrote about the arrow poisons of the Canelos Quichua. There is a small amount of ethnobotanical information on the Canelos Quichua in Whitten (1976, 1985). Shemluck (pers. comm.) made a brief study of Canelos Quichua ethnobotany, but has not published it.

For neighbouring cultures the literature is quite comprehensive. Pinkley (1973) wrote his Ph.D. dissertation on the ethnoecology of the Cofán. Vickers and Plowman (1984) published the ethnobotany of the Siona Secoya. Davis and Yost (1983a, 1983b) studied the ethnobotany of the Waorani. Karsten (1935) provides a limited amount of ethnobotanical information on the Shuar, and Kvist and Holm-Nielsen (1987) provide some information on all the neighboring groups. Lowell (pers. comm.) is studying the ethnopharmacology of the Shuar and Ashuar of Ecuador as part of the same project as the study reported here. There is also literature available on the Shuar of nearby Peru (Ayala Flores 1984, Lewis and Elvin-Lewis 1984), and Amazonian natives of Colombia (e.g. Schultes 1985a and 1985b).

# METHODS

This research is part of a collaborative project between the Program for Collaborative Research in the Pharmaceutical Sciences (PCRPS) at the University of Illinois at Chicago College of Pharmacy, the Missouri Botanical Garden in St. Louis, the New York Botanical Garden, the United States Agency for International Development, and Ecuador's Dirección Nacional Forestal, Ministerio de Agricultura y Ganadería (National Forest Service, Ministry of Agriculture and Animal Husbandry), Quito.

## 1. *Study Site Selection*

Ethnopharmacological field work was conducted in the Napo province of eastern Ecuador from September 15, 1985 to November 30, 1985. Preliminary trips were made to two areas to evaluate their potential for obtaining information about medicinal plants from Lowland Quichua-speaking people living in the most traditional setting of the primary rain forest.

The region of La Joya de los Sachas ("The Jewel of the Jungles"), 0°10'S, 76°50'W, 350 m alt., near the Coca river, while inhabited by some Quichua people, proved to be an area undergoing rapid development. Both petroleum oil exploration and African oil palm plantations have destroyed much of the primary rain forest, and there is extensive cultivation of the land by a recent influx of government-sponsored colonists from the coast and sierra of Ecuador. Knowledge of medicinal plants appeared in most people interviewed to be limited to common weedy species with a wide distribution in Ecuador, thus not reflecting the traditional Quichua pharmacopoeia.

The region of Misahuallí on the Napo river, 1°S, 77°30'W, 450 m alt., also shows the impact of the modern world: western clothing, portable radios, and Yamaha outboard motors for the dugout canoes, but most of the Quijos Quichua people are still living in a fairly traditional setting of subsistance farms on the floodplains, with access to primary rainforest on ridges above the floodplains for hunting and gathering of wild foods and medicines. Two study sites were therefore established in the Misahuallí area. One study site was a farm on the Arajuno River, two and a half hours by motor-canoe or four hours by canoe and foot, from the town of Misahuallí. The second major study site was a farm at the junction of the Napo and Huambuno Rivers, two hours downstream from Misahuallí.

2. *Collection of Information and Samples*

Introduction to the medicine men was accomplished through the location of relatives of the medicine men, who would guide us to their farms. An initial short visit was made to establish whether or not the medicine man would be willing to share his knowledge with us. Once our welcome was established, several visits of three to four days were made, staying with the family of the medicine man.

Daily trips into the rainforest with the medicine man and sometimes other family members were made to collect medicinal plants. Their preparation and use was recorded in writing, on audio tape, and on slide film, and administration of traditional medicines was observed as opportunity presented itself.

Voucher specimens of every medicinal plant were collected at least in triplicate, pressed in the evenings, and fully dried at the base camp over a kerosene heater. Bulk samples (with separate voucher specimens) for pharmacognostic analysis were collected in volumes sufficient to give a dry weight of 5 - 10 kg, and were dried on tarpaulins, in partial shade, with frequent turning to prevent spoilage. Samples that molded were discarded. The dried samples were packed in woven corn sacks that would allow air circulation and thus lessen the chance of spoilage, until ready for final shipment to our laboratory in the United States.

Voucher specimens of each medicinal plant have been labelled with the collection data and a summary of their ethnopharmacological uses, and deposited with the John G. Searle Herbarium of the Field Museum of Natural History in Chicago. Duplicate sets are at the National Herbarium of Ecuador, Quito, and at the Missouri Botanical Garden, St. Louis. Botanical determination of the vouchers was done by the staff of the Field Museum herbarium, the Missouri Botanical Garden, and specialists elsewhere.

Literature information on the plants collected in Ecuador was obtained mainly from NAPRALERT, the Natural Products ALERT computer database at PCRPS, University of Illinois at Chicago. An extensive review of the literature was made to obtain information on the ethnomedical uses, biological activities, chemical constituents, and toxicity of the Quichua traditional medicines. Since particular species of plants often have a limited distribution range and in many cases other members of the same genus have similar chemical constituents, any literature information obtained for a genus has here been extrapolated to the species. This will undoubtedly be inaccurate in some cases, but in general should provide more useful information than a strict species level literature search.

## RESULTS AND DISCUSSION

During ten weeks of field work in Ecuador 140 voucher specimens of traditional Quichua medicines were collected. These represent about 120 species (105 genera in 63 families). To date 138 (99%) of the voucher specimens have been identified to the family level, 132 (95%) to genus and 115 (82%) to the species, which is encouraging when it is known that most of the voucher specimens are sterile. The short time in the field made it impossible to find fertile material in most cases. Unlike professional botanists, the medicine men seldom need flowers and fruit to identify the plant. The results of the field work are summarized in Table 1.

At least 80 different therapeutic uses are distinguished by the Quijos Quichua, but by far the most common uses are for treating symptoms suggestive of parasitic infections, e.g anthelmintic, antimyiasis, antifungal, antiinflammatory, antidiarrheal, and febrifuge remedies: 64 spp. (53%). Other common uses are for pain management: 32 spp. (27%), female fertility and its regulation: 30 spp. (25%), and as antivenoms (snake, spider, conga-ant, stingray): 12 spp. (10%).

From extensive literature research it was learned that, of the 120 species collected for this study, corroborating ethnobotanical information was obtained for at least 71 genera/species (59%): of these the information came from other South American cultures for 66 (55%), and from other regions of the world for 19 (16%). Corroboration of traditional uses by published pharmacological studies were found for 42 genera/species (35%). Information on chemical constituents that appeared to be relevant to the traditional use was found for 36 genera/species (30%). Combined pharmacological and chemical information supporting tradi-

## TABLE 1

**Preliminary Results of Lowland Quichua Ethnopharmacological Field Research and Corroborating Information from the Literature**

| FAMILY | SCIENTIFIC NAME[a] | TRADITIONAL USE | ETHNO[b] | PHARM[c] | CHEM[d] | TOXIC[e] |
|---|---|---|---|---|---|---|
| Acanthaceae | not identified yet (# 25) | sprains | | | | |
| Actinidiaceae | Saurauia prainiana | myiasis | F | Y | Y | N |
| Amaranthaceae | Alternanthera cf. brasiliana | stomach "fever" | L, F | Y | | Y/N |
| Amaranthaceae | Alternathera lanceolata | liver pain | L | | | Y/N |
| Anonaceae | Xylopia sp. | diarrhea | L, F | Y | Y | N |
| Anonaceae | Xylopia sp. | postpartum hemorrhage | L, F | | | N |
| Anonaceae | Xylopia sp. | tonic for strength | | | | N |
| Apocynaceae | Aspidosperma sp. | menorrhagia | L | N | N | Y/N |
| Apocynaceae | Himatanthus cf. sucuuba | hernia | | | | Y |
| Apocynaceae | Himatanthus cf. sucuuba | malaria | | | | Y |
| Apocynaceae | Tabernaemontana cf. sananho | contraceptive | F | Y | Y | Y |
| Apocynaceae | Tabernaemontana cf. sananho | sterilant | F | Y | Y | Y |
| Aquifoliaceae | Ilex guayusa | mouthwash | L | | | N |
| Aquifoliaceae | Ilex guayusa | polio myelitis | | N | | N |
| Aquifoliaceae | Ilex guayusa | tonic | L | Y? | Y? | N |
| Araceae | Anthurium loretense | body tremors | | | | N |
| Araceae | Anthurium loretense | foot cramps | | | | N |
| Araceae | Dracontium loretense | snakebite | L | | | Y |
| Araceae | Monstera spruceana | skin sores | L | Y | Y | Y |
| Araceae | Philodendron sp. | hepatitis | | | | Y |
| Araceae | Philodendron sp. | yellow fever | | | | Y |
| Aristolochiaceae | Aristolochia cf. cornuta | "erysipelas" | L, F | Y | Y | Y |
| Aristolochiaceae? | not identified yet (# 89) | cough | | | | |
| Aristolochiaceae? | not identified yet (# 89) | tuberculosis | | | | |
| Bignoniaceae | Crescentia cujete | abortifacient | L | | | |
| Bignoniaceae | Crescentia cujete | sedative | | | | |
| Bignoniaceae | Jacaranda glabra | pimples | L | N | Y | Y |
| Bignoniaceae | Mansoa alliacea | colds | L | Y | Y | |
| Bignoniaceae | Mansoa alliacea | pain | L | | | |
| Bignoniaceae | Mansoa alliacea | stomachache | L | | | |
| Bignoniaceae | Tynnanthus cf. panurensis | hair growth promoter | | | | |
| Boraginaceae | Cordia nodosa | snakebite | L, F | | | Y/N |
| Boraginaceae | Cordia nodosa | spiderbite | L | | | Y/N |
| Boraginaceae | Cordia nodosa | sting of conga ant | | | | Y/N |
| Boraginaceae | Cordia nodosa | sting of stingray | | | | Y/N |
| Burseraceae | not identified yet (# 144) | menorrhagia | | | | |
| Cactaceae | Epiphyllum phyllanthus | cuts | | | Y | |
| Capparaceae | Capparis sola | abortifacient | L, F | | | N |
| Capparaceae | Capparis sola | colds | F | Y | Y | N |
| Capparaceae | Capparis sola | contraceptive | L, F | | | N |
| Capparaceae | Capparis sola | pain | F | | | N |
| Capparaceae | Capparis sola | sore throat | F | Y | Y | N |
| Capparaceae | Capparis sola | tonic for strength | | | | N |
| Celastraceae | Maytenus krukovii | abortifacient | L | | | Y/N |
| Celastraceae | Maytenus krukovii | anemia | | | | Y/N |
| Celastraceae | Maytenus krukovii | cancer | L, F | Y | Y | Y/N |
| Celastraceae | Maytenus krukovii | contraceptive | L | N | | Y/N |
| Celastraceae | Maytenus krukovii | pain | L | Y | Y | Y/N |
| Celastraceae | Maytenus krukovii | rheumatism | L | Y | Y | Y/N |
| Celastraceae | Maytenus krukovii | stomachache | L | | | Y/N |
| Compositae | Clibadium asperum | fish poison | L | Y | Y | Y |
| Convolvulaceae | Ipomoea batatas | viral conjunctivitis | F | Y | Y | Y/N |
| Cucurbitaceae | Gurania spinulosa | itching pimples | | Y | | |
| Dichapetalaceae | Tapura peruviana | stomachache (severe) | | | | |
| Dioscoreaceae | Dioscorea cf. polygonoides | fungus on foot | | Y | Y | Y/N |
| Dioscoreaceae | Dioscorea samydea | boils | | N | | Y/N |
| Dioscoreaceae | Dioscorea samydea | pimples | | N | | Y/N |
| Elaeocarpaceae | Sloanea fragrans | diarrhea | | | | Y? |
| Elaeocarpaceae | Sloanea cf. robusta | bloody feces, vomiting | | | | Y? |
| Erythroxylaceae | Erythroxylum gracilipes | jaundice | | | | N? |
| Euphorbiaceae | Caryodendron orinocense | cauterize navel | | | | |

TABLE I

Preliminary Results of Lowland Quichua Ethnopharmacological Field Research and Corroborating Information from the Literature

| FAMILY | SCIENTIFIC NAME[a] | TRADITIONAL USE | ETHNO[b] | PHARM[c] | CHEM[d] | TOXIC[e] |
|---|---|---|---|---|---|---|
| Euphorbiaceae | Croton cf. lechieri | cuts | L, F | Y | Y | Y/N |
| Euphorbiaceae | Croton cf. lechieri | toothache; gingivitis | L | Y | Y | Y/N |
| Euphorbiaceae? | Croton? (# 141) | cuts | L, F | Y | Y | Y/N |
| Euphorbiaceae? | Croton? (# 141) | diarrhea | L, F | Y | Y | Y/N |
| Euphorbiaceae | Manihot brachyloba | rheumatism | | | | N? |
| Euphorbiaceae | Phyllanthus anisolobus | fish poison | L | Y | Y | Y/N |
| Euphorbiaceae? | not identified yet (# 72) | epilepsy | | | | |
| Euphorbiaceae? | not identified yet (# 72) | heart attack | | | | |
| Euphorbiaceae? | not identified yet (# 72) | seizures | | | | |
| Flacourtiaceae | Mayna odorata | cold sores | | | | |
| Flacourtiaceae | Mayna odorata | tonic for dogs | | | | |
| Gesneriaceae | Besleria barbata | stabbing muscle pain | | | | |
| Gesneriaceae | Columnea ciliata | oral candidiasis | | | | |
| Gesneriaceae | Columnea ericae | menorrhagia | L | | | |
| Gesneriaceae | Columnea ericae | postpartum hemorrhage | L | | | |
| Gleicheniaceae | Dicranopteris cf. pectinata | "mal aire" | L | | | |
| Gleicheniaceae | Dicranopteris cf. pectinata | neuromuscular disorder? | | | | |
| Gramineae | Pariana sp. | curing ceremony fan | L | | | |
| Graminae | Zea mays | curing ceremony fan | | | | |
| Guttiferae | Vismia cf. tomentosa | stop fear of water | | | | |
| Hernandiaceae | Sparattanthelium glabrum | fever | L | Y? | Y? | |
| Hernandiaceae | Sparattanthelium glabrum | pain | | Y? | Y? | |
| Hernandiaceae | Sparattanthelium glabrum | stomachache | L | Y? | Y? | |
| Icacinaceae | Calatola venezuelana | anticarie | L | | | |
| Labiatae | Hyptis pectinata | menorrhagia | L, F | Y | Y | Y/N |
| Labiatae | Hyptis pectinata | postpartum hemorrhage | L, F | Y | Y | Y/N |
| Lauraceae | Cinnamomum? (# 77) | painful urination | | Y | Y | N |
| Lecythidaceae | Couroupita guianensis | infected wounds | L | | Y | |
| Lecythidaceae | Grias neuberthii | emetic | L | | | |
| Lecythidaceae | Grias neuberthii | swellings | | | | |
| Lecythidaceae | Gustavia macarenensis | fungus of crotch itch | | | | |
| Leguminosae | Brownea ariza | cold sores | | | | |
| Leguminosae | Brownea ariza | cuts | I | | Y | |
| Leguminosae | Brownea ariza | oral candidiasis | | | | |
| Leguminosae | Lonchocarpus cf. nicou | fish poison | L | Y | Y | Y |
| Leguminosae | Macrolobium cf. stenocladum | tonic for lung strength | | | | |
| Leguminosae | Macrolobium cf. stenocladum | pain | | | | |
| Leguminosae | Macrolobium cf. stenocladum | stomachache | | | | |
| Leguminosae | Macrolobium cf. stenocladum | tonic to strengthen baby | | | | |
| Leguminosae | Myroxylon sp. | fever | L, F | Y | Y | N |
| Leguminosae | Parkia nitida | myiasis | L | | | |
| Leguminosae | Piptadenia cf. flava | vomiting | | | Y | N |
| Leguminosae | Pithecellobium macrophyllum | boils | | | | |
| Leguminosae | Pithecellobium macrophyllum | myiasis | F | Y | Y | Y |
| Leguminosae | Swartzia simplex | abortifacient | L | | | Y |
| Leguminosae | Swartzia simplex | colds | | | | Y |
| Leguminosae | Swartzia simplex | contraceptive | L | | | Y |
| Leguminosae | Swartzia simplex | pain | | | | Y |
| Leguminosae | Swartzia simplex | sore throat | | | | Y |
| Leguminosae | Swartzia simplex | stomachache | L, F | | | Y |
| Leguminosae | Swartzia simplex | tonic for strength | | | | Y |
| Leguminosae | Vigna caracalla | skin blemishes | F | Y | | |
| Loganiaceae | Potalia amara | snakebite | L | | | |
| Loganiaceae | Sanango racemosum | bath before hunting | | | | |
| Loganiaceae | Strychnos cf. peckii | "erysipelas" | F | Y | Y | Y |
| Malpighiaceae | Banisteriopsis caapi | hallucinogen | L | Y | Y | |
| Malpighiaceae | Diplopterys cabrerana | hallucinogen | L | Y | Y | |
| Malvaceae | Hibiscus abelmoschus | anuria | L, F | Y | | N |
| Malvaceae | Hibiscus abelmoschus | sting of conga ant | L | | | N |
| Malvaceae | Pavonia fruticosa | magically cause malaria | | | | |
| Melastomataceae | Clidemia heterophylla | cough | L | | | |

TABLE 1

**Preliminary Results of Lowland Quichua Ethnopharmacological Field Research and Corroborating Information from the Literature**

| FAMILY | SCIENTIFIC NAME[a] | TRADITIONAL USE | ETHNO[b] | PHARM[c] | CHEM[d] | TOXIC[e] |
|---|---|---|---|---|---|---|
| Meliaceae | Cedrela odorata | diarrhea | L | | Y | N |
| Meliaceae | Cedrela odorata | intestinal parasites | L | Y | Y | N |
| Menispermaceae | Abuta grandifolia | diarrhea | L | | | Y |
| Menispermaceae | Abuta grandifolia | fever | L | Y | Y | Y |
| Menispermaceae | Abuta grandifolia | pain | L | Y | Y | Y |
| Menispermaceae | Abuta grandifolia | stomachache | L | | | Y |
| Menispermaceae | Abuta grandifolia | tonic for strength | L | | | Y |
| Menispermaceae | Abuta rufescens | fever | L | | | Y |
| Monimiaceae | Siparuna eriocalyx | "mal aire" | L | Y | Y | Y |
| Monimiaceae | Siparuna sp. (#128) | "mal aire" | L | | Y? | N |
| Monimiaceae | Siparuna sp. (#15) | colds | L | | Y? | N |
| Monimiaceae | Siparuna sp. (#15) | fever | L | | Y? | N |
| Monimiaceae | Siparuna sp. (#15) | pain | L | | Y? | N |
| Moraceae | Artocarpus altilis | abscesses | | Y | | Y/N |
| Moraceae | Artocarpus altilis | boils | L | Y | | Y/N |
| Moraceae | Artocarpus altilis | cuts | | Y | | Y/N |
| Moraceae | Artocarpus altilis | diabetes | L | | | Y/N |
| Moraceae | Brosimum sp. | cuts | | | | N |
| Moraceae | Brosimum sp. | tonic | L | | | N |
| Moraceae | Brosimum utile | diarrhea | L | | | N |
| Moraceae | Brosimum utile | tonic for strength | | | | N |
| Moraceae | Ficus cf. insipida | intestinal parasites | L | Y | Y | N |
| Myristicaceae | Otoba parvifolia | cuts | L | | | |
| Myristicaceae | Otoba parvifolia | diarrhea | | | | |
| Myristicaceae | Otoba parvifolia | intestinal parasites | | | | |
| Myrtaceae | Psidium guajava | diarrhea | L, F | | Y | Y |
| Myrtaceae | Psidium guajava | fever | L, F | N | | Y |
| Myrtaceae | Psidium guajava | stomachache | L, F | | | Y |
| Ochnaceae | Cespedesia spathulata | abortifacient | | | | |
| Ochnaceae | Cespedesia spathulata | contraceptive | | | | |
| Ochnaceae | Cespedesia spathulata | diarrhea | | | | |
| Ochnaceae | Cespedesia spathulata | stomachache | | | | |
| Ochnaceae | Cespedesia spathulata | tonic to strengthen baby | | | | |
| Ochnaceae | Ouratea cf. williamsii | fever | | | | |
| Ochnaceae | Ouratea cf. williamsii | stomachache | L, F | | | |
| Ochnaceae | Ouratea cf. williamsii | tonic for strength | L, F | | | |
| Olacaceae | Heisteria acuminata | contraceptive | | | | |
| Olacaceae | Heisteria acuminata | sterilant | | | | |
| Olacaceae | Minquartia guianensis | intestinal parasites | L | | | |
| Olacaceae | Minquartia guianensis | pain in kidneys | L | | | |
| Olacaceae | Minquartia guianensis | pain in muscles | | | | |
| Olacaceae | Minquartia guianensis | skin irritations | L | | | |
| Onagraceae | Ludwigia hyssopifolia | toothache, abscess | | Y | | N |
| Orchidaceae | Maxillaria rufescens | hernia | | | | |
| Orchidaceae | Schomburgkia crispa | hernia | | | | |
| Palmae | Bactris gasipaes | diarrhea | L | | | |
| Palmae | Desmoncus cf. vacivus | boils | | | | |
| Palmae | Desmoncus cf. vacivus | hernia | | | | |
| Phytolaccaceae | Petiveria alliacea | colds | L | Y | Y | |
| Piperaceae | Peperomia sp. (#84) | "purple spot sickness" | | | | |
| Piperaceae | Peperomia sp. (#91) | snakebite | L | | | Y |
| Piperaceae | Pothomorphe peltata | bite of insects | | | | |
| Piperaceae | Pothomorphe peltata | cuts | L | | | |
| Piperaceae | Pothomorphe peltata | swellings | L | | | |
| Polypodiaceae | Lomariopsis japurensis | menorrhagia | | | | |
| Polypodiaceae | Lomariopsis japurensis | postpartum hemorrhage | | | | |
| Polyporaceae | Ganoderma sp. | fungus on skin | | Y? | Y? | N |
| Ranidae | small frog - not identified | stuttering | | | | |
| Rubiaceae | Duroia hirsuta | diarrhea | | | | |
| Rubiaceae | Duroia hirsuta | fever | | | | |
| Rubiaceae | Duroia hirsuta | snakebite | | | | |
| Rubiaceae | Duroia hirsuta | tonic for strength | L | | | |

## TABLE I

**Preliminary Results of Lowland Quichua Ethnopharmacological Field Research and Corroborating Information from the Literature**

| FAMILY | SCIENTIFIC NAME[a] | TRADITIONAL USE | ETHNO[b] | PHARM[c] | CHEM[d] | TOXIC[e] |
|---|---|---|---|---|---|---|
| Rubiaceae | Psychotria sp. | anticarie | | | | |
| Rubiaceae | Psychotria viridis | hallucinogen | L | Y | Y | N |
| Rubiaceae | Sickingia sp. | emetic | L | | Y | |
| Rubiaceae | Sickingia sp. | headache | L | | | |
| Rubiaceae | Sickingia sp. | hepatitis | | | | |
| Rubiaceae | Sickingia sp. | stomachache | L | . | | |
| Rubiaceae | Simira sp.? (# 23) | abortifacient | | | | |
| Rubiaceae | Simira sp.? (# 23) | contraceptive | | | | |
| Rubiaceae | Simira sp.? (# 23) | fever | | | | |
| Rubiaceae | Simira sp.? (# 23) | pain | | | | |
| Rubiaceae | Simira sp.? (# 23) | stomachache | | | | |
| Rubiaceae? | not identified yet (# 111) | arrow poison | | | | |
| Rubiaceae? | not identified yet (# 111) | infected wounds | | | | |
| Sapindaceae | Serjania inflata | intestinal parasites | L | Y | Y | Y/N |
| Selaginelaceae | Selaginella sp. | mosquito repellant | | | | |
| Solanaceae | Brugmansia sp. | hallucinogen | L | Y | Y | Y |
| Solanaceae | Brunfelsis grandiflora | cough | | | | |
| Solanaceae | Brunfelsia grandiflora | fever | L | Y | Y | |
| Solanaceae | Brunfelsia grandiflora | pain | L | Y | Y | |
| Solanaceae | Brunfelsia cf. grandiflora | severe fatigue | L | | | |
| Solanaceae | Lycianthes cf. amatitlanensis | rheumatism | | | | |
| Solanaceae | Solanum tuberosum | accelerate parturition | L | | | Y |
| Solanaceae | Witheringia solanacea | cancer of the lungs | | Y | Y | |
| Solanaceae | Witheringia solanacea | cough | | | | |
| Solanaceae | Witheringia solanacea | fever | | | | |
| Solanaceae | Witheringia solanacea | sore throat | | | | |
| Sterculiaceae | Theobroma cacao | cuts | | | Y | N |
| Sterculiaceae | Theobroma cacao | fever | | | | N |
| Sterculiaceae | Theobroma cacao | malaria | | | | N |
| Sterculiaceae | Theobroma subincana | breast eruption | | | | N |
| Sterculiaceae | Theobroma subincana | fungus on skin | | | | N |
| Steculiaceae | Theobroma subincana | malaria | | | | N |
| Sterculiaceae | Theobroma subincana | yellow fever | | | | N |
| Urticaceae | Urera caracasana | diarrhea | L | | | |
| Urticaceae | Urea laciniata | pain in back | L | Y . | Y | |
| Urticaceae | Urera laciniata | pain in kidneys | L | Y | Y | |
| Urticaceae | Urera laciniata | pain in muscles | L | Y | Y | |
| Usneaceae | Usnea sp. | contraceptive | L | | | |
| Usneaceae | Usnea sp. | sterilant | | | | |
| Verbenaceae | Petrea maynensis | contraceptive | L | | | |
| Verbenaceae | Petrea maynensis | sterilant | | | | |
| Verbenaceae | Verbena litoralis | tuberculosis | L, F | Y | Y? | N |
| Vitaceae | Cissus erosa | "erysipelas" | L, F | Y | | N |
| Zingiberaceae | Reneaimia thyrsoidea | snakebite | L | | Y | |
| not identified yet | not identified yet (# 74) | boils | | | | |
| not identified yet | not identified yet (# 74) | cancer | | | | |
| not identified yet | not identified yet (# 74) | tuberculosis | | | | |
| not identified yet | not identified yet (# 75) | snakebite | | | | |
| not identified yet | not identified yet (# 132) | tonic for lung strength | | | | |
| ............ | grey pot-clay | stop spontaneous abortion | | | | |
| ............ | soil from cicada nest | mineral deficiency | | | | |

a) Numbers in parentheses are voucher specimen numbers, included to avoid confusion where specimen identification has not been completed.

b) ETHNO = Ethnopharmacological reports in the literature on the genus, where "L" indicates "Local" corroboration, i.e. from other South and Central American cultures, "F" indicates "Fòreign" corroboration, i.e. from cultures on other continentes.

c) PHARM = Pharmacological information in the literature n the genus, where "Y" indicates "Yes", the studies reported do seem to support the traditional Lowland Quichua use, "Y?" indicates possible corroboration, "N" indicates "No", the studies reported seem to conflict with the traditional use.

tional uses was found for 34 genera/species (28%). Toxicological information was found for 58 genera/species (48%), of which 35 (29%) showed some evidence of toxicity. Support from ethnobotanical, pharmacological and chemical literature combined was found for 29 genera/species (24%). For more than 30% of the traditional Quichua medicinal uses no relevant literature could be found.

The above figures give some indication of the tremendous potential of Quijos Quichua traditional medicines to provide new therapeutic agents or new locally-available sources for therapeutic agents. The probability of random correlation between any given plant and a particular biological activity may be approximately 10%, based on the findings of antitumor activity in a random screening of over 20,500 species (Spjut and Perdue 1976). Thus the above rates of correlation between Quijos Quichua traditional medicines and supportive chemical and pharmacological literature are two to three time the probability of coincidence. This reaffirms the value of studying traditional remedies to discover new medicines.

Information in the literature apparently contradictory to the Quijos Quichua traditional use, or indicating the toxicity of certain plants used in their traditional medicine, provides an important cautionary note. In no case can it be assumed that, based on currently available information, a particular medicinal plant is both safe and effective for the traditional therapeutic use. Rather, this information should be used to set priorities for the thorough chemical, pharmacological and toxicological evaluation of those plants which appear most promising as new sources of therapeutic agents.

Once the safety and efficacy of particular medicinal plants of the Quijos Quichua have been established, particular attention should be paid to their formulation for modern therapeutic use. In most cases the pharmaceutical companies of highly industrialized nations formulate their products as pure active compounds, or simple mixtures of pure active compounds, in tablet or injectable form. This sort of expensive processing would result in a product far beyond the means of most of the people whose traditional healers discovered the medicine and who are in the greatest need of safe, effective, readily available, inexpensive drugs. Simple galenical preparations which could be done on location, and have been standardized for potency, dosage, and stability, would be of much greater benefit to the majority of the people. A good example of this method is provided by Hansson et al. (1986), who describe a proven preparation of *Ficus glabrata* (Moraceae) latex for the treatment of intestinal helminthiasis.

Finally, it will be essential to disseminate the information on proven remedies and ineffective or toxic remedies as widely as possible among the providers of primary health care, whether they are doctors, nurses, missionaries, or traditional healers. Since the traditional healers are still respected and relied upon by the majority of the population of third world countries, their cooperation must be enlisted. The enlightened exchange of information between modern medical practitioners and traditional healers will clearly result in better health care for all people.

## CONCLUSIONS

In the short period of ten weeks, field work with the Quijos Quichua of the Amazonian lowlands of Ecuador provided information on the medicinal uses of approximately 120 species of plants. A review of ethnobotanical, chemical, pharmacological, and toxicological literature provided substational corroboration of the Quijos Quichua traditional medicines, and also indications of possibly hazardous uses of some species. The fact that correlations between the literature and the field results were much higher than could be reasonably attributed to random chance confirms the value of examining traditional medicines in order to discover new therapeutic agents or new locally-available sources for therapeutic agents.

The type of information provided by studies such as the present one can serve to set priorities for the thorough evaluation of the chemistry, pharmacology and toxicology of promising medicinal plants. Those with proven safety and efficacy could then be incorporated, with suitably simple instructions for formulation and prescription, into the pharmacopoeia of their native countries, and into the practice of modern and traditional providers of primary health care. Also, the use of those plants with demonstrated toxicity or lack of efficacy could be discouraged. Thus we could significantly improve the level of health care for the majority of the population of developing countries, who still depend on traditional medicines, without the investment of large sums of hard currency for the importation or manufacture of modern pharmaceuticals.

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d) CHEM = Chemical information in the literature on the genus, where "Y" indicates "Yes", the studies reported do seem to support the traditional Lowland Quichua use, "Y?" indicates possible corroboration, "N" indicates "No", the studies reported seem to conflict with the traditional use.

e) TOXIC = Toxicological information in the literature on the genus. It must be noted that most acute toxicity studies are performed by intraperitoneal injection of extracts into rodents, and therefore do not necessarily relate to human oral toxicity. Toxicity is influenced by the plant part, method of preparation, and route of administration. Here "Y" indicates "Yes", the plant is known to be toxic to animals (LD50 $<$500 mg/kg), "N" indicates "No", the plant does not appear to be toxic to animals, "Y/N" indicates conflicting reports from different assays, extracts, or species in the same genus..

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