

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 professional 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 it 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 ministrations. 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 Wisley 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 Díaz 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 subsistence 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, anti-diarrheal, 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 of. brasiliana	stomach "fever"	L, F	Y		Y/N
Amaranthaceae	Alternanthera lanceolata	liver pain	L			Y/N
Anonaceae	Xylopiia sp.	diarrhea	L, F	Y	Y	N
Anonaceae	Xylopiia sp.	postpartum hemorrhage	L, F			N
Anonaceae	Xylopiia 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	snake bite	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. parturensis	hair growth promoter				
Boraginaceae	Çordia 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 1

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FAMILY	SCIENTIFIC NAME ^a	TRADITIONAL USE	ETHNO ^b	PHARM ^c	CHEM ^d	TOXIC ^e
Euphorbiaceae	<i>Croton cf. lechleri</i>	cuts	L, F	Y	Y	Y/N
Euphorbiaceae	<i>Croton cf. lechleri</i>	toothache; gingivitis	L	Y	Y	Y/N
Euphorbiaceae?	<i>Croton? (# 141)</i>	cuts	L, F	Y	Y	Y/N
Euphorbiaceae?	<i>Croton? (# 141)</i>	diarrhea	L, F	Y	Y	Y/N
Euphorbiaceae	<i>Manihot brachyloba</i>	rheumatism				N?
Euphorbiaceae	<i>Phyllanthus anisolobus</i>	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	<i>Mayna odorata</i>	cold sores				
Flacourtiaceae	<i>Mayna odorata</i>	tonic for dogs				
Gesneriaceae	<i>Besleria barbata</i>	stabbing muscle pain				
Gesneriaceae	<i>Columnnea ciliata</i>	oral candidiasis				
Gesneriaceae	<i>Columnnea ericae</i>	menorrhagia	L			
Gesneriaceae	<i>Columnnea ericae</i>	postpartum hemorrhage	L			
Gleicheniaceae	<i>Dicranopteris cf. pectinata</i>	"mal aire"	L			
Gleicheniaceae	<i>Dicranopteris cf. pectinata</i>	neuromuscular disorder?				
Gramineae	<i>Pariana sp.</i>	curing ceremony fan	L			
Graminae	<i>Zea mays</i>	curing ceremony fan				
Guttiferae	<i>Vismia cf. tomentosa</i>	stop fear of water				
Hernandiaceae	<i>Sparattanthelium glabrum</i>	fever	L	Y?	Y?	
Hernandiaceae	<i>Sparattanthelium glabrum</i>	pain		Y?	Y?	
Hernandiaceae	<i>Sparattanthelium glabrum</i>	stomachache	L	Y?	Y?	
Icacinaeae	<i>Calatola venezuelana</i>	anticarie	L			
Labiatae	<i>Hyptis pectinata</i>	menorrhagia	L, F	Y	Y	Y/N
Labiatae	<i>Hyptis pectinata</i>	postpartum hemorrhage	L, F	Y	Y	Y/N
Lauraceae	<i>Cinnamomum? (#77)</i>	painful urination		Y	Y	N
Lecythidaceae	<i>Couropita guianensis</i>	infected wounds	L		Y	
Lecythidaceae	<i>Grias neuberthii</i>	emetic	L			
Lecythidaceae	<i>Grias neuberthii</i>	swellings				
Lecythidaceae	<i>Gustavia macarenensis</i>	fungus of crotch itch				
Leguminosae	<i>Brownea ariza</i>	cold sores				
Leguminosae	<i>Brownea ariza</i>	cuts	L		Y	
Leguminosae	<i>Brownea ariza</i>	oral candidiasis				
Leguminosae	<i>Lonchocarpus cf. nicou</i>	fish poison	L	Y	Y	Y
Leguminosae	<i>Macrolobium cf. stenocladum</i>	tonic for lung strength				
Leguminosae	<i>Macrolobium cf. stenocladum</i>	pain				
Leguminosae	<i>Macrolobium cf. stenocladum</i>	stomachache				
Leguminosae	<i>Macrolobium cf. stenocladum</i>	tonic to strengthen baby				
Leguminosae	<i>Myroxylon sp.</i>	fever	L, F	Y	Y	N
Leguminosae	<i>Parkia nitida</i>	myiasis	L			
Leguminosae	<i>Piptadenia cf. flava</i>	vomiting			Y	N
Leguminosae	<i>Pithecellobium macrophyllum</i>	boils				
Leguminosae	<i>Pithecellobium macrophyllum</i>	myiasis	F	Y	Y	Y
Leguminosae	<i>Swartzia simplex</i>	abortifacient	L			Y
Leguminosae	<i>Swartzia simplex</i>	colds				Y
Leguminosae	<i>Swartzia simplex</i>	contraceptive	L			Y
Leguminosae	<i>Swartzia simplex</i>	pain				Y
Leguminosae	<i>Swartzia simplex</i>	sore throat				Y
Leguminosae	<i>Swartzia simplex</i>	stomachache	L, F			Y
Leguminosae	<i>Swartzia simplex</i>	tonic for strength				Y
Leguminosae	<i>Vigna caracalla</i>	skin blemishes	F	Y		
Loganiaceae	<i>Potalia amara</i>	snakebite	L			
Loganiaceae	<i>Sanango racemosum</i>	bath before hunting				
Loganiaceae	<i>Strychnos cf. peckii</i>	"erysipelas"	F	Y	Y	Y
Malpighiaceae	<i>Banisteriopsis caapi</i>	hallucinogen	L	Y	Y	
Malpighiaceae	<i>Diplopterys cabrerana</i>	hallucinogen	L	Y	Y	
Malvaceae	<i>Hibiscus abelmoschus</i>	anuria	L, F	Y		N
Malvaceae	<i>Hibiscus abelmoschus</i>	sting of conga ant	L			N
Malvaceae	<i>Pavonia fruticosa</i>	magically cause malaria				
Melastomataceae	<i>Clidemia heterophylla</i>	cough	L			

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FAMILY	SCIENTIFIC NAME ^a	TRADITIONAL USE	ETHNO ^b	PHARM ^c	CHEM ^d	TOXIC ^e
Meliaceae	<i>Cedrela odorata</i>	diarrhea	L		Y	N
Meliaceae	<i>Cedrela odorata</i>	intestinal parasites	L	Y	Y	N
Menispermaceae	<i>Abuta grandifolia</i>	diarrhea	L			Y
Menispermaceae	<i>Abuta grandifolia</i>	fever	L	Y	Y	Y
Menispermaceae	<i>Abuta grandifolia</i>	pain	L	Y	Y	Y
Menispermaceae	<i>Abuta grandifolia</i>	stomachache	L			Y
Menispermaceae	<i>Abuta grandifolia</i>	tonic for strength	L			Y
Menispermaceae	<i>Abuta rufescens</i>	fever	L	Y	Y	Y
Monimiaceae	<i>Siparuna eriocalyx</i>	"mal aire"	L		Y?	N
Monimiaceae	<i>Siparuna</i> sp. (# 128)	"mal aire"	L		Y?	N
Monimiaceae	<i>Siparuna</i> sp. (# 15)	colds	L		Y?	N
Monimiaceae	<i>Siparuna</i> sp. (# 15)	fever	L		Y?	N
Monimiaceae	<i>Siparuna</i> sp. (# 15)	pain	L		Y?	N
Moraceae	<i>Artocarpus altilis</i>	abscesses		Y		Y/N
Moraceae	<i>Artocarpus altilis</i>	boils	L	Y		Y/N
Moraceae	<i>Artocarpus altilis</i>	cuts		Y		Y/N
Moraceae	<i>Artocarpus altilis</i>	diabetes	L			Y/N
Moraceae	<i>Brosimum</i> sp.	cuts				N
Moraceae	<i>Brosimum</i> sp.	tonic	L			N
Moraceae	<i>Brosimum utile</i>	diarrhea	L			N
Moraceae	<i>Brosimum utile</i>	tonic for strength				N
Moraceae	<i>Ficus</i> cf. <i>insipida</i>	intestinal parasites	L	Y	Y	N
Myristicaceae	<i>Otoba parvifolia</i>	cuts	L			
Myristicaceae	<i>Otoba parvifolia</i>	diarrhea				
Myristicaceae	<i>Otoba parvifolia</i>	intestinal parasites				
Myrtaceae	<i>Psidium guajava</i>	diarrhea	L, F		Y	Y
Myrtaceae	<i>Psidium guajava</i>	fever	L, F	N		Y
Myrtaceae	<i>Psidium guajava</i>	stomachache	L, F			Y
Ochnaceae	<i>Cespedesia spathulata</i>	abortifacient				
Ochnaceae	<i>Cespedesia spathulata</i>	contra ceptive				
Ochnaceae	<i>Cespedesia spathulata</i>	diarrhea				
Ochnaceae	<i>Cespedesia spathulata</i>	stomachache				
Ochnaceae	<i>Cespedesia spathulata</i>	tonic to strengthen baby				
Ochnaceae	<i>Ouratea</i> cf. <i>williamsii</i>	fever				
Ochnaceae	<i>Ouratea</i> cf. <i>williamsii</i>	stomachache	L, F			
Ochnaceae	<i>Ouratea</i> cf. <i>williamsii</i>	tonic for strength	L, F			
Olacaceae	<i>Heisteria acuminata</i>	contra ceptive				
Olacaceae	<i>Heisteria acuminata</i>	sterilant				
Olacaceae	<i>Minquartia guianensis</i>	intestinal parasites	L			
Olacaceae	<i>Minquartia guianensis</i>	pain in kidneys	L			
Olacaceae	<i>Minquartia guianensis</i>	pain in muscles				
Olacaceae	<i>Minquartia guianensis</i>	skin irritations	L			
Onagraceae	<i>Ludwigia hyssopifolia</i>	toothache, abscess		Y		N
Orchida ceae	<i>Maxillaria rufescens</i>	hernia				
Orchida ceae	<i>Schomburgkia crispa</i>	hernia				
Palmae	<i>Bactris gasipaes</i>	diarrhea	L			
Palmae	<i>Desmoncus</i> cf. <i>vacivus</i>	boils				
Palmae	<i>Desmoncus</i> cf. <i>vacivus</i>	hernia				
Phytolaccaceae	<i>Petiveria alliacea</i>	colds	L	Y	Y	
Piperaceae	<i>Peperomia</i> sp. (# 84)	"purple spot sickness"				
Piperaceae	<i>Peperomia</i> sp. (# 91)	snakebite	L			Y
Piperaceae	<i>Pothomorphe peltata</i>	bite of insects				
Piperaceae	<i>Pothomorphe peltata</i>	cuts	L			
Piperaceae	<i>Pothomorphe peltata</i>	swellings	L			
Polypodiaceae	<i>Lomariopsis japurensis</i>	menorrhagia				
Polypodiaceae	<i>Lomariopsis japurensis</i>	post partum hemorrhage				
Polyporaceae	<i>Ganoderma</i> sp.	fungus on skin		Y?	Y?	N
Ranidae	small frog - not identified	stuttering				
Rubiaceae	<i>Duroia hirsuta</i>	diarrhea				
Rubiaceae	<i>Duroia hirsuta</i>	fever				
Rubiaceae	<i>Duroia hirsuta</i>	snakebite				
Rubiaceae	<i>Duroia hirsuta</i>	tonic for strength	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
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
Selaginellaceae	Selaginella sp.	mosquito repellent				
Solanaceae	Brugmansia sp.	hallucinogen	L	Y	Y	Y
Solanaceae	Brunfelsia 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
Sterculiaceae	Theobroma subincana	malaria				N
Sterculiaceae	Theobroma subincana	yellow fever				N
Urticaceae	Urera caracasana	diarrhea	L			
Urticaceae	Urera 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	Renealmia thyrsoides	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 "Foreign" corroboration, i.e. from cultures on other continents.

c) PHARM = Pharmacological 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.

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 times 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 substantial 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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