A Medicinal Plant Survey
In Marketplaces of Ecuador

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ABSTRACT

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A medicinal herb survey was conducted in ten major marketplaces in Andean and coastal communities of Ecuador. Collections were made during the summer of 1997. Four plant collections from each market were pressed, dried, identified, and the medicinal information for each plant was recorded. Photographs of fresh plants, market vendors and the marketplaces were taken.

Fifty three families were represented in the 112 species collected. Forty-two species (37%) were introduced to Ecuador while seventy species (63%) were native to Ecuador. Plant taxa were grouped into 22 categories of medicinal usage. The most common 3 uses were: 1. General tonic and body purifier, represented by 42 species, 2. Stomach and digestion disorders, 30 species, and 3. Skin wash and astringent, 27 species. The coefficient of similarity indicated all marketplaces shared a coefficient of at least .243 with .674 being the highest. The dendrogram exhibited the Andean marketplaces clustered together with the exception of Otavalo. Santo Domingo is more similar to the Andean marketplaces while other coastal marketplaces clustered together.

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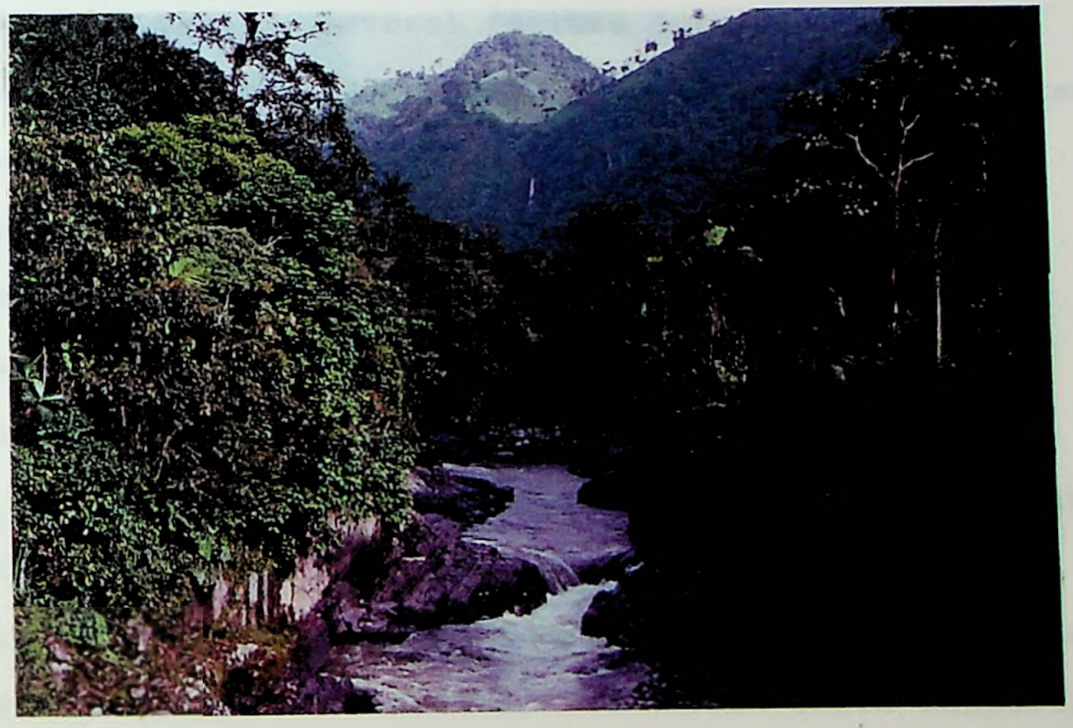
PREFACE

"Behold the seen unseen"

Ralph Ellison



CHAPTER I.

INTRODUCTION

Of 265,000 known species of higher plants, less than 3 percent have been tested for medicinal applications. This small portion serves as a source of 25 percent of modern medicines (Balick, 1990). Forty-seven major drugs have come from tropical plants to date (Balick and Mendlesoln, 1995). Ethnobotanists continue to look at indigenous healing traditions for important medicinal plants. Several factors determine which cultures to study: First, the culture should be located in a floristically diverse area such as a tropical rainforest. Second, the culture should have lived in the region for many generations. Third, the culture should pass on the healing traditions from one generation to the next (Balick et al. 1996).

Ecuador has great biodiversity and range of habitats including coastal, the Andean mountainous region through the middle of the country, and the Amazon rain forest to the east. Further, the Amazon basin supports the largest rain forest in the world (Plotkin, 1993). Plants from the rain forest, the mountains and coastal areas are available at marketplaces. Ecuador has a population of indigenous people of approximately 40 percent (Brooks, 1979). Indigenous Ecuadorian people and non-indigenous Ecuadorians of Spanish or Black

African descent are represented at various marketplaces.

In Ecuador, there are 25,000 species of higher plants identified to date. Of these, 5,115 plant species are endemic to Ecuador, with 2,625 species found in the Andean region, 1,260 species found in the coastal region, and 1,230 species found in the Amazonian region (figures from Omaere Ethnobotanical Garden; Puyo, Ecuador). Loss of biodiversity is the most important environmental problem globally. Many scientists believe that of the quarter million higher plant species, 25,000 will be extinct in the next 10-20 years (Balick et al. 1996). This is most acute in third world countries, but is often spurred by the economic interests of the United States, Japan, and Germany. Existence of undiscovered pharmaceuticals for modern medicine is another important reason to protect tropical forests (Balick and Mendlesohn, 1995) and plants in general (Foster and Duke, 1990). Preservation of the gene pool is necessary because genes cannot be recreated synthetically in a lab. Once a species is extinct it is gone forever. A further reason to maintain biodiversity is that many bioactive molecules of plants cannot be synthesized. Therefore, seed collections kept in germ plasm centers will become increasingly important. These resources allow for

opportunities to perform biotechnological research.

Field work exploring the medicinal uses of plants by indigenous people in remote parts of the world can reveal valuable medicinal plants. This, coupled with the introduction of sophisticated assays, has facilitated the discovery of bioactive molecules made by plants (Balick and Cox, 1994). There is urgency to perform this research now because remaining native cultures are rapidly losing their traditional way of life. As Mark Plotkin (1993) says,"every time one of the old shaman dies, it's as if a library has burned to the ground."

OBJECTIVES

1. Ten major marketplaces in the Andean and coastal areas of Ecuador will be surveyed. Each marketplace will be visited once, at which time a survey of the medicinal plants will be made.

2. Multiple plant collections will be pressed and dried for voucher specimen.

3. Identification and information on the use, preparation and dosage will be documented for each plant. All information obtained from market vendors will be tape recorded.

4. Photographs of plant material, the marketplace and plant vendors will be taken.

5. A comparison of the marketplaces surveyed will be

achieved by an analysis using Sorensen's Coefficient of Similarity.

6. A cross cultural comparison of medicinal plant usage by the Ecuadorian indigenous and non-indigenous populations will be made. Comparing parallel use of plants by widely separated groups shows independent origin of plant uses and, therefore, constitutes evidence for rational use (Croom, 1983). A comparison of medicinal plant use will be made with other published marketplace surveys and with NAPRALERT data.

LITERATURE REVIEW

Medicinal plant surveys of the ten selected city markets have not been accomplished to date. There is presently a survey underway of the medicinal plants sold at the Quito marketplaces; therefore, this survey made no attempt to collect in those marketplaces. However, a historical survey of ethnobotanical materials has been compiled in the southern Ecuadorian highlands by Camp and associates during 1944-1945 (Joyal, 1987). Names, uses, and collection data are given for 317 taxa. This marketplace survey is compared to the Camp survey.

Schultes and Raffauf (1990) described 1,500 species of medicinal plants used by indigenous peoples of the Amazon region. Of these, half have had little or no

real investigation of their chemical and pharmacological properties. Schultes has performed the most ethnobotanical research in the Amazon basin and his writings remain the most extensive resource on this subject (Schultes and von Reis, 1995).

Balick, Cox and Plotkin, former students of Schultes at Harvard, are major contributors to writings in ethnobotany and have been referred to in the introduction and discussion. Medicinal plant surveys by Arzeni and Nicholson (1995), Hammond et al.(1998), Rios(1991) and Van den Berg (1984) were used for marketplace comparisons. Other references that describe medicinal plants of both North and South America are those by Duke (1985,1986). The American Botanical Council is instrumental in research and education relative to medicinal herbs. Their publication, HerbalGram, is a journal of the latest research being accomplished in the area of medicinal herbs.

Few published studies deal with marketplaces in Ecuador. The Ecuadorian herbal reference, by White (1976), written in both Spanish and English, covers many of the common herbs of city markets. Perez (1988) and Kothari (1993) books, written in Spanish, include medicinal plant information and are also used as references in this study. However, these studies do not provide voucher collections to document the results.

The publication by Villacres (1995) lists plants by the Latin name, Spanish common name and English common name, is useful for plant nomenclature.

CHAPTER II.

MATERIALS AND METHODS

COLLECTION METHODOLOGY

The marketplace study undertaken in 1997, reveals medicinal uses of plants sold in the city markets of Ecuador. Voucher collections made during the study may also provide plant material for future research in plant chemistry.

A permit to collect plants in selected city markets was obtained from the government of Ecuador through Catholic University in Quito. Figure 1 is a reduced copy of the collection permit. Ten city marketplaces were chosen including those in the four coastal towns of Portoviejo, Guayaquil, Manta and Santo Domingo, and in six Andean towns including Ibarra, Otavalo, Ambato, Cuenca, Saquisili and Puyo (Figure 2). These towns represent different geographical areas of the country and provide a variety of cultures and diversity of medicinal plants. The ten coastal and Andean cities were cited by Perez (1988) as potentially important marketplaces for medicinal plants. Presently, another study of medicinal plants in the marketplaces in Quito is underway, therefore, Quito was not included in this study.

Four voucher collections of each species were purchased, pressed, and dried using the facilities at

Figure 1. Collection permit provided by the Ecuadorian Government.

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FLORA X FAUNA ÁREAS NATURALES

QUITO, 17 DE JUNIO DE 1997

Nº 29-IC INEFAN/DNANVS/VS

El Instituto Ecuatoriano Forestal y de Áreas Naturales y Vida Silvestre, INEFAN, autoriza a Dan Evans, de nacionalidad estadounidense, con pasaporte N. 013537237, para que realice en el pais la investigación denominada: PLANTAS MEDICINALES DE MERCADOS SELECTIVOS DE CIUDADES EN ECUADOR, de acuerdo con las siguientes especificaciones:

1.- Solicitud de: Dan Evans
2.- Valoración del Proyecto: PROYECTO EXAMINADO POR LCDO. SERGIO LASSO
3.- Auspicio de Institución Científica Extranjera: Marshall University
4.- Auspicio de Institución Científica Nacional: Pontificia Universidad Católica del Ecuador
5.- Complementos autorizados de la Investigación: Colección
6.- Contraparte nacional, en caso de que el proyecto de investigación sea originado en paises extranjeros: Mauricio Guerrón
7.- Contraparte del INEFAN, para propuestas de investigación originadas en otros paises o en instituciones, organismos y personas naturales del pais: Ninguna
8.- Duración: Desde el 17 de junio al 31 de agosto de 1997
9.- Obligaciones del investigador: Se compromete a entregar DIEZ COPIAS DE LOS RESULTADOS DE LA INVESTIGACION, EN CASTELLANO, MAS UNA COPIA DE LAS FOTOGRAFIAS QUE FORMEN PARTE DE LA MISMA INVESTIGACION.

Atentamente;

Dr. Jaime Enriquez F.
DIRECTOR NACIONAL DE ÁREAS
NATURALES Y VIDA SILVESTRE (E)

JE/SL
17-VI-1997

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Figure 2. Map of the ten marketplaces in Ecuador chosen for study. Quito, the capital city, was not included.


ECUADOR
Colombia
Pacific Ocean
Ibarra
Otavalo
Quito
Sto. Domingo
Manta
Portoviejo
Saquisili
Ambato
Puyo
Guayaquil
Cuenca
The Amazon Basin
Peru
SCALE
0 50 100 150KM
NORTH

Catholic University. The common name, medicinal uses, preparation, and dosage, were recorded for each plant at the time the collection was purchased (Appendix I). The name of the vendor was also recorded (Figure 3 and 4). For each new species encountered, collections were made, and their occurrence was noted at other markets (Appendix II).

Identification of 85% of the plants to genus or species were verified at the Herbarium at Catholic University, Quito (QCA). The remaining 15% were verified at the Missouri Botanical Garden Herbarium (MO). By agreement, two voucher collections were left with the Catholic University. In addition, a third collection will be sent to the Missouri Botanical Gardens, and another will be kept at the Marshall University Herbarium (MUHW).

Notes taken from vendors of the markets were recorded on paper and tape recorded at the time of the interview. At several markets, recording vendor information was accomplished with the aid of an Ecuadorian student fluent in Spanish and English. The student also aided in the translation of the vendor's conversations. Photographs (slides and prints) of fresh plants, vendors, and marketplaces were taken.

Figure 3. Author purchasing plants from vendor (Photo by Dan Evans).

Figure 4. Dan Evans and Silvia Aldas interviewing a vendor in Saquisili (Photo by Pam Bailey).

COLLECTION SITES

Markets are highly organized into groups of vendors selling similar items. For example, there is a distinction between fresh medicinal plant species and plants used for culinary purposes. The latter includes plants such as cayenne peppers, garlic and spices usually sold in a ground condition. A distinction exists between fresh medicinal plants and packaged medicinal plants. Products including tinctures, dried herb blends, soaps and salves were encountered at the largest marketplaces. All three groups of plants were sold by different vendors and sometimes in different parts of the marketplace. This survey is of fresh medicinal plants only, with one exception being the bottled sap of a tree, *Croton lechleri*, collected at a single market. This was included in Appendix I and II; however, there is no voucher specimen for *Croton lechleri*.

Otavalo.

Otavalo is located in the Imbabura province of northern Ecuador. Saturday is the busiest day for this marketplace. Otavalo, with a population of 8,000, has several market areas throughout the town. One area is dedicated to an animal market, while another area, under roof, features foods, medicinal plants, and flowers. Still another market area is for arts and

crafts, and is the most popular with tourists who come to the town for this event. In addition, streets are lined with vendors selling clothes, household goods, and hardware. As with all the markets, vendors arrive before sunrise to set up their booths. Most of the vendors at this market are Quichuan-speaking indigenous people and all the vendors of medicinal plants were indigenous. Plants were purchased from several vendors. Four medicinal plants were bought from an older man while I walked to the medicinal plant market. Ten medicinal plants were purchased from a young woman vendor, 5 plants from another young woman with a little girl, 1 plant from a third young woman, 4 plants from an older woman and the remainder from a middle-aged woman vendor. A checklist of collections and associated data appear in Appendix I. Figure 5 is an assortment of roots which were collected and identified.

Ibarra.

The Ibarra market, also located in Imbaburu Province, occurs on Sunday. Ibarra, with a population of 42,000, is the most northern city in the survey. The marketplace was held in a large municipal building. Many medicinal plants were purchased from Norma Salasar. Norma, her daughter and 3 year old granddaughter represented three generations, an example

Figure 5. Dried roots purchased in Otavalo.

Figure 6. Indoor marketplace at Ibarra.


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of passing on healing traditions. The remainder of the medicinal plants were purchased from Isabel Zambrano (Figure 6). There were three other vendors present, including an older black woman with fewer, but similar plant species.

Guayaquil.

Guayaquil is the largest city in Ecuador with a population of 1,500,000. It is located on the Guayas River, in the province of Guayas and is the most economically important port city in Ecuador. The marketplace is a large outdoor area located by the old city wharf. Although there were many medicinal species sold, a limited number were new to the study. There were six vendors of medicinal plants. Seven medicinal plants were purchased from an older woman, Maria Conya, and 8 plants were purchased from a younger woman, Teresa Yatebogatol.

Manta.

Manta, with a population of 45,000, is a coastal city, located in the Manabi Province. This marketplace was located along several streets,in front of stores, set back from the beach. This marketplace offered the least number of medicinal plants species of the ten marketplaces surveyed. There were no vendors selling only medicinal plants. Here, two new species were collected from an non-indigenous woman that also sold

fruits and vegetables.

Portoviejo.

Portoviejo, with a population of 60,000, is also located in the Manabi Province and is 35 Km. inland from the coast. The town is surrounded by a farming community. The marketplace was along the sidewalks of streets in a commercial area. Medicinal plants were purchased from an indigenous woman, Maria Gayano (Figure 7). She sold plants on the sidewalk in front of a shop owned by an non-indigenous man, Manuel Vriollo. Mr.Vriolla priced the herbs and took a portion of the profits. Maria had several unique and interesting medicinal items (Figure 8). Further, she differed in her approach to medicinal plant use by offering information on blending combinations of medicinal plants together.

Saquisili.

The town of Saquisili is located in the Cotopaxi Province where visitors have a clear view of the snow covered volcano Cotapaxi. It is a small town with a large indigenous population. Market day is Thursday. Several outdoor market areas are scattered throughout the town, similar to the market of Otavalo. Saquisili is not a popular tourist town and has but a single inn. This marketplace offered the largest number of medicinal plant species of the ten marketplaces

Figure 7. Maria Gayano selling medicinal plants in Portoviejo.

Figure 8. Some assorted items from Maria's booth.

surveyed. The medicinal market covered an area of sufficient size that two days were required to complete the survey. The food, medicinal plant and flower market was in a large open square. Present were fifteen indigenous medicinal plant vendors selling from large bundles of medicinal plants (Figure 9). The first day resulted in recording the many species offered for sale and purchasing 12 medicinal plants from the vendor Rosalina Chacha. During the second day more species were collected including 4 species from Margarita Pucuji and Maria Transitocisneros, 5 species from Ximena Velasco and 7 species from Maria Chicaiza.

Cuenca.

Cuenca, with a population of 105,000, in the Azuay Province, 395 Km. from Peru was the most southern marketplace in this survey. Cuenca is known for its historic architecture. Market day on Saturday supports a marketplace in a large open area within the city, nearby is a large building which also houses vendor booths. There were eight medicinal plant vendors at this marketplace. This market offered a large number of medicinal plants sold in the usual bundles of a single species and bundles of mixed species (Figure 10). After surveying the medicinal plants present, ten new species were purchased from an indigenous vendor, Dolores Seche.

Figure 9. Outdoor marketplace at Saquisili.

Figure 10. Mixed species in a medicinal plant bundle purchased in Cuenca.

Santo Domingo de las Colorados.

Santo Domingo, with a population of 25,000, in Pichincha Province, is located in the foothills west of the Andes. The marketplace is located on several streets. The medicinal plant vendors were located in a building with the food and flower booths and offered a large selection of medicinal plants. One indigenous vendor also sold medicinal plants at Saquisili market. The medicinal plants were surveyed and 4 species new to the survey were purchased, 2 from Maria Carman and 2 from Lola Garcon.

Puyo.

Puyo, with a population of 12,000, is in the Pastaza Province on the eastern flanks of the Andes. The market was located under roof in a large city building in town with medicinal plant vendors present. Medicinal plants were surveyed and 3 new species were purchased from Rosa Haca, an indigenous vendor.

Ambato.

Ambato, with a population of 80,000, is in the highland Tungurahua Province. The marketplace is in a large double story building in the city. Here, eleven indigenous woman vendors were selling medicinal plants, on the second floor. A large selection of medicinal plants were offered for sale. These were surveyed and one additional species was added to the collection.

METHODS OF DATA ANALYSIS

Following plant identification, market survey data was compared with two utilitarian plant studies in Ecuador. Also compared were three marketplace studies, one each from Brazil, Peru and Mexico. Similarities and differences in family, genera, and species composition at markets, were examined. Lastly, there is a comparison of the medicinal plants in this study with an extensive list of North American ethnobotany.

A comparison is made between the number of families and species reported by examining the species in common. A second comparison is of the families most frequently reported to occur in marketplaces. Medicinal plant usage is addressed and the findings are compared to the NAPRALERT database (Farnsworth, 1990).

One objective of the thesis was to determine if medicinal plants sold in the Andean highland markets were significantly different from those of the coastal markets. Market comparison was achieved by using Sorensen's (1948) Coefficient of similarity (CS). Based upon the Sorensen's Coefficient a dendrogram constructed according to the unweighted pair group method of Sokal and Sneath (1963) shows the degree of medicinal plant species similarity in the ten marketplaces.

CHAPTER III

RESULTS AND DISCUSSION

DISTRIBUTION OF MEDICINAL PLANT FAMILIES AND SPECIES

Of the 112 species collected in 10 marketplaces, 106 genera and 53 families, respectively, were represented. Forty-two species were introduced to Ecuador (37%). Seventy species were native (63%). The members of medicinal plant families and species collected at each market are summarized in Table 1.

Particular families of plants are known to contain bioactive compounds (Schultes and Raffauf, 1990). Similar pharmacological action is often shared by species within the same genus and family. The same plant families are represented in medicinal plant surveys from various cultures. Three families with the most numerous species available at the marketplaces were 15 species of Asteraceae (13%), 10 species of Fabaceae (9%) and 9 species of Lamiaceae (8%), (Table 2).

The market at Saquisili represented the greatest number of families and species of the 10 surveyed. Saquisili is inhabited primarily by indigenous people and 15 plant vendors were indigenous. Plants originating in Saquisili and other highland markets were distributed to other marketplaces (personal

TABLE 1. Number of medicinal plant families and species represented at ten marketplaces in Ecuador.

Marketplace	Number of Families	Number of Species
Andean Region		
Saquisili	35	64
Ambato	27	44
Ibarra	24	44
Santo Domingo	24	42
Cuenca	21	33
Puyo	24	37
Otavalo	20	29
Coastal Region		
Guayaguil	24	35
Portoviejo	18	24
Manta	8	10

TABLE 2. Ten medicinal plant families recorded in Ecuadorian marketplaces with the greatest number of species.

Family	Number of Species
Asteraceae	15
Fabaceae	10
Lamiaceae	9
Amaranthaceae	4
Myrtaceae	4
Polypodiaceae	4
Apiaceae	3
Brassicaceae	3
Solanaceae	3
Violaceae	3

conversations with vendors). Further, many of the plants at the Puyo marketplace were also traded from the highland area. The coastal marketplaces offered less plants for sale than highland marketplaces (Table 1). The Portoviejo and Manta markets offered the least number of medicinal plants for sale. The Puyo marketplace had few medicinal plants from the jungle, despite its location bordering the Amazon basin. Amazonian indigenous groups apparently do not sell medicinal plants in the same manner as highland Quichuan people. However, in shops with native artifacts for sale, traditional rain forest remedies such as Sangre de Drago and Anacona cream (for wounds and arthritis) were sold.

One collection, *Epidendrum evectrum* Hook (Figure 11), was confiscated by custom agents in the United States due to its protection under the CITES legislation. Convention on International Trade in Endangered Species (CITES), a coalition of over 100 countries that regulate trade of endangered species (Cox, 1997). In the United States, CITES is regulated by the U.S. Fish and Wildlife Service. Two collections of the orchid (#125 and #134) are represented in duplicate collections at the Catholic University herbarium in Quito, Ecuador (Figure 11).

Plant families with the most prevalent number of

Figure 11. *Epidendrum evectrum* Hook.,a species of Orchid.

species in sequential order are the Asteraceae, Fabaceae, and Lamiaceae (Table 2). Other families shown in the table are represented by three and four species each. The remaining 43 families (Appendix 1) are each represented by one or two species. Medicinal plant family comparisons with other recent medicinal plant surveys show similarities between medicinal plant families represented (Table 4).

The Aster family is the second largest cosmopolitan plant family, following Orchidaceae, and has approximately 20,000 species worldwide (Schultes and Raffauf, 1990). Some biodynamic constituents of the Asteraceae which have medical properties include alkaloids, sesquipenoids, diterpenoids, ethereal oils, triterpenes, saponins, and flavonoids (Schultes and Raffauf, 1990).

Fabaceae (Bean family), a family with approximately 13,000 species worldwide, is one of the richest families in alkaloids (Schultes and Raffauf, 1990). Other bioactive constituents known to occur in the family are phenolic compounds, flavonoids and phytoalexins. Fabaceae is the second most economically important family worldwide (second to Gramiaceae), because of its food value to humans and livestock (Schultes and Raffauf 1990).

Lamiaceae,the Mint family, is a large cosmopolitan

family with approximately 3,500 species worldwide. The mint family is known for an accumulation of mono-, sesquidipenes, triterpenes, flavones, and flavonoids, among others, present in the family (Schultes and Raffauf, 1990).

Comparisons are made between the results of this survey and six other published studies. Included are two Ecuadorian studies, two marketplace studies in South America and one in Mexico. Finally, a comparison is made with a comprehensive compilation of medicinal plants of North American Indians. By examining the numbers and diversity of families recorded in these surveys, a comparison can be made of the taxa the studies have in common. Further a comparison of the families most frequently reported to occur at marketplaces is also presented.

The first comparison is based upon a non-marketplace botanical survey done in 1944-1945 by Camp and others (Joyal, 1987). Camp collected from the provinces of Canar and Azuay in the southern and eastern regions of Ecuador. His survey reports medicinal plants representing 94 families and 274 species (Table 3). Thirty-nine families and 22 species (19%) are common to this survey (Table 4). Families with the most reported number of species used are Asteraceae with 33 species (12%), 19 species of

TABLE 3. Comparison of five studies to this study on the total number of medicinal plant families and species reported.

Author	Region	# of Families	# of Species
Bailey	Ecuador	53	112
Camp	Ecuador	94	274
Rios	Ecuador	46	101
Van den Berg	Brazil	33	53
Hammond	Peru	19	33
Arzeni	Mexico	38	70

TABLE 4. Comparison of five studies to this study showing the number of medicinal plant families and species in common.

Author	Region	# of families	# of Species
Bailey	Ecuador	53	112
Camp	Ecuador	39	22
Rios	Ecuador	5	6
Van den Berg	Brazil	14	3
Hammond	Peru	15	6
Arzeni	Mexico	22	15

Fabaceae (6.9%), 18 species of Poaceae (6.5%), 18 species of Solanaceae (6.5%), and by Lamiaceae with 13 species (4%). Asteraceae, Fabaceae and Lamiaceae are the three most prevalent families in the Ecuadorian marketplace survey.

The survey by Rios (1991) was conducted in the north-western region of Ecuador, north of Santo Domingo and included medicinal plants and utilitarian plants for other purposes. Forty-six families and 101 species were reported. From the tables with the list of medicinal species, only 5 families and 6 species (5%) reported were in common to the current study. The most frequently collected families of plants were Asteraceae (10.9%) Piperaceae (8.9%), Solanaceae (8.9%), Lamiaceae (4%), and Myrtaceae (4%).

The first of the three marketplace comparisons was a survey at Ver-O-Peso (Van den Berg, 1984) a large open air market in Amazonian Brazil. There were 33 families and 53 species reported in the survey. Only 3 species (2.6%) and 14 families were common between the Brazil survey and this survey. The low correlation of species in this study compared to other studies may occur because 1. the survey reflects the lower number of medicinal plants collected and 2. the Amazonian area of Brazil is geographically, botanically and culturally different from the Ecuadorian marketplace survey. A

closer correlation may exist between the Brazil survey and surveys undertaken in the Amazonian areas of Ecuador. However, there is considerable similarity at the family level. Families of plants most frequently collected were the Fabaceae with 6 species (11%), and Lamiaceae with 5 species (9%). Only 2 species of Asteraceae (3.7%) were reported.

The second marketplace study was at Callejon de huaylas, Peru, the center of the pre-Inca culture known as the Chavin (Hammond et al. 1998). Nine villages thoughout the Callejon de Huaylas were included in the survey. Data were collected from doctors, village elders, traditional doctors, and female vendors selling herbs at the markets. Hammond's survey reported 33 species from 19 families. This survey had 6 species in common (5%) and 15 families in common with my Ecuadorian marketplace study. This survey had a high correlation of families due to the similarity geographically, botanically and culturally between Peru and Ecuador. Families with the most represented number of species were the Asteraceae with 10 species (30%). the Fabaceae with 3 species (9%), and the Lamiaceae with 3 species (9%).

Finally, Arzeni (1993) surveyed marketplaces in Nuevo Leon, Mexico. The survey consisted of two marketplaces including 11 herbarias (plant vendor

stalls). Arzeni recorded 135 species from 65 genera, with 38 families represented. This survey bore substantial similarity to the Ecuadorian marketplace survey. Fifteen species (13%) and 22 families were found in common. The reasons for the similarity may include 1. the large number of specimens collected and 2. the market area of Mexico is geographically and botanically similar, which accounts for the cultivation of introduced species and native species in common. In the Mexican survey, Asteraceae was once again the most prevalent family represented at the marketplaces with 12 species (8.8 %), Lamiaceae with 8 species (5.9%), followed by Fabaceae with 4 species (2.9%).

Moerman's study (1997) of North American ethnomedicine lists ten medicinal plants that are most often used by indigenous North American tribes. These families are the Asteraceae (3 species), and one species from Acoraceae, Apiaceae, Rosaceae, Arailiaceae, Cupressaceae, Lamiaceae, and Urticaceae. Of these the families of the Asteraceae, Apiaceae, Lamiaceae, Rosaceae and Urticaceae are in common with my study. The Asteraceae is listed in surveys from around the world, because it is circumboreal and there are many species. By contrast, Lamiaceae is a relatively small family, cosmopolitan in distribution, with many introduced species in North and South America

from the Mediterranean area (Simpson and Ogorzaly, 1995). The marketplace survey includes 1 species of Apocynaceae, 1 species of Euphorbiaceae, and 3 species of Solanaceae. These families represent families high in bioactive constituents and are the subject of current medical research by the National Cancer Institute (Balick, 1990).

MEDICINAL PLANT USAGE

Plant uses were categorized into groups representing 22 ailments (Table 5). The category with the most species included plants used as a general tonic. Plants in this group are often taken as a tea or drink used for general health, for revitalizing the system and "for the blood".

The category of Hallucinogens (5 species) requires explanation. These medicinal plants are not taken by the sick person, but instead are taken by the Shaman to assist them in obtaining a vision of the ailment affecting the sick person and reason for the illness. This relationship reflects a divergent philosophy of illness, one quite different from the Western scientific approach. Disease and illness are as much an expression of the culture as any other physical artifact. This study does not attempt to delve into the philosophical differences of disease and the Shamantic

TABLE 5. Categories of medicinal plant use in marketplaces of Ecuador.

Use	Number of Species
General Tonic	43
Stomach and Digestion	30
Skin Wash and Astringents	27
Respiration Disorders	19
Elimination of Parasites	18
Kidneys	15
Nerves, Sedatives	14
Diarrhea	9
Heart	9
Colds	9
Emetic	8
Infections and Wounds	8
Liver	7
Regulation of Menstrual Flow	7
Nutritive, Vitamins	7
Pain	6
Headache	5
Mouth and Sore Throat	5
Hallucinogen	5
Cancer	3
Adjust Blood Sugar	1
Broken Bones	1

healing traditions.

In this study most of the vendors/informants were women. Gender differences with respect to plant knowledge and use are widespread in many rural societies. However, it is a fact that women are more responsible for family and particularly child health care. Medicinal plant knowledge of women also reflects a division of labor in which women often tend the fields and gardens (Caniago and Siebert, 1998).

An objective of this survey was a cross-cultural comparison of the medicinal plant use among markets of the highland and coastal areas of Ecuador. Information gathered in Otavalo, and Saquisili was from indigenous vendors. In Portoviejo, the one vendor interviewed was indigenous. However, at Manta the vendors were non-indigenous. In the other six marketplaces, there was a mix of indigenous and non-indigenous vendors. The majority of vendors overall are indigenous as were most of the vendors interviewed. Therefore, an accurate comparison of the cross-cultural use could not be adequately accomplished. Personal observations were that medicinal plants were sold to both indigenous and non-indigenous Ecuadorians.

Difference between indigenous and Western remedies seem apparent. Indigenous plant remedies are focused on gastrointestinal complaints, inflammation,

dermatological ailments and gynaecological disorders. By contrast, Western drugs focus on cardiovascular, nervous system disorders or serve as antimicrobial remedies (Cox,1994). Consideration of differences between Indigenous and Western remedies illuminates the following: Indigenous peoples do not have the same lifestyle or predicted lifespans of Western people (Cox,1994). In western culture, cardiovascular disease and cancer are more prevalent, whereas the various conditions in Table 5 are regarded as more perilous by the indigenous peoples.

Secondly, visually apparent conditions are treated that are easier to diagnose by indigenous people, such as inflammation, GI and dermatological ailments. Most cancers and cardiovascular conditions are difficult to diagnose by indigenous peoples (Cox, 1994). Further, indigenous peoples are likely to avoid plant medicines that are highly toxic in small doses. Most cardiovascular and anticancer drugs and those active on the central nervous system have a 'narrow' dosage allotment and thus would likely be unacceptable to indigenous people (Cox, 1994). Lastly, economics is a major consideration that affects Western drug research and development. Many indigenous healers continue to use traditional plant medicines because of the high cost of Western medicine and lack of availability.

Table 5 is compared to the NAPRALERT database (Farnsworth, 1990). The NAPRALERT database reports 300 types of ethnomedical uses from 41,940 computerized records worldwide. The NAPRALERT database reports the three most common conditions for which medicinal plants are used were menstrual induction with 4110 records listed, followed by induction of abortion (2630 records), and reduction of inflammation (1879 records). General tonic ranked 15th in the NAPRALERT data with 749 records of use (2%), compared to my study of 43 species used (38%). Every use that is listed in Table 3 (except for the category of plants used for broken bones) is listed in the NAPRALERT database.

MARKETPLACE SIMILARITY

Appendix II lists the 112 taxa encountered and also shows the distribution of plants among the ten study sites. This data is important to determine if there is a significant difference between the Andean highland marketplaces and coastal marketplaces with respect to species of plants sold. The distribution of species is as follows: Of 112 species collected or recorded in the study only one species, *Matricaria chamomilla*, or 0.9 percent of the total medicinal species, occurred at all ten marketplaces. Five species (4.4%) were present in nine marketplaces out of ten marketplaces. These were

Foeniculum vulgare, *Rosemarinus officinalis*, *Althaea officinalis*, *Eucalyptus globulus*, and *Ruta graveolens*. Seven species occur at eight marketplaces (6.3 %). The remaining 99 species have a more limited distribution: Five species were present at seven marketplaces, two species occurred at six marketplaces, eight species occurred at five marketplaces, eleven species occurred at four marketplaces, eleven species occurred at three marketplaces and eleven species were collected at two marketplaces. Finally, 46 taxa (41.1%) were found only at one marketplace.

Site comparison was accomplished using Sorenson's (1948) Coefficient of Similarity (CS). The similarity coefficient is $CS = \frac{2W}{A - B}$

where W is the number of species common to both sites, A is the number of species at one site and B is the number of species at the other site being compared. The Coefficient of Similarity indicated all sites shared a coefficient of at least .243 (marketplaces 4 and 6) with .674 (marketplaces 8 and 10) being the highest (Table 6).

The dendrogram of Figure 12 uses the coefficients to graphically depict the similarity among ten marketplaces. Marketplaces having many species in common cluster with a high coefficient; marketplaces

TABLE 6. Comparison of medicinal plant species at ten marketplaces using Sorensen's (1948) Coefficient of Similarity

	1	2	3	4	5	6	7	8	9	10
1.										
2.	.493									
3.	.437	.506								
4.	.256	.333	.311							
5.	.313	.323	.372	.294						
6.	.387	.537	.484	.243	.363					
7.	.451	.545	.500	.372	.245	.453				
8.	.422	.511	.545	.307	.393	.584	.506			
9.	.393	.518	.527	.382	.295	.475	.514	.607		
10.	.493	.613	.500	.333	.411	.555	.597	.674	.641	

KEY:

1.Otavalo	2.Ibarra	3.Guayaquil	4.Manta
5.Portoviejo	6.Saquisilı	7.Cuenca	8.Santo Domingo
9.Puyo	10.Ambato		

Figure 12. Dendrogram of marketplace similarity derived from Sorensen's coefficients.

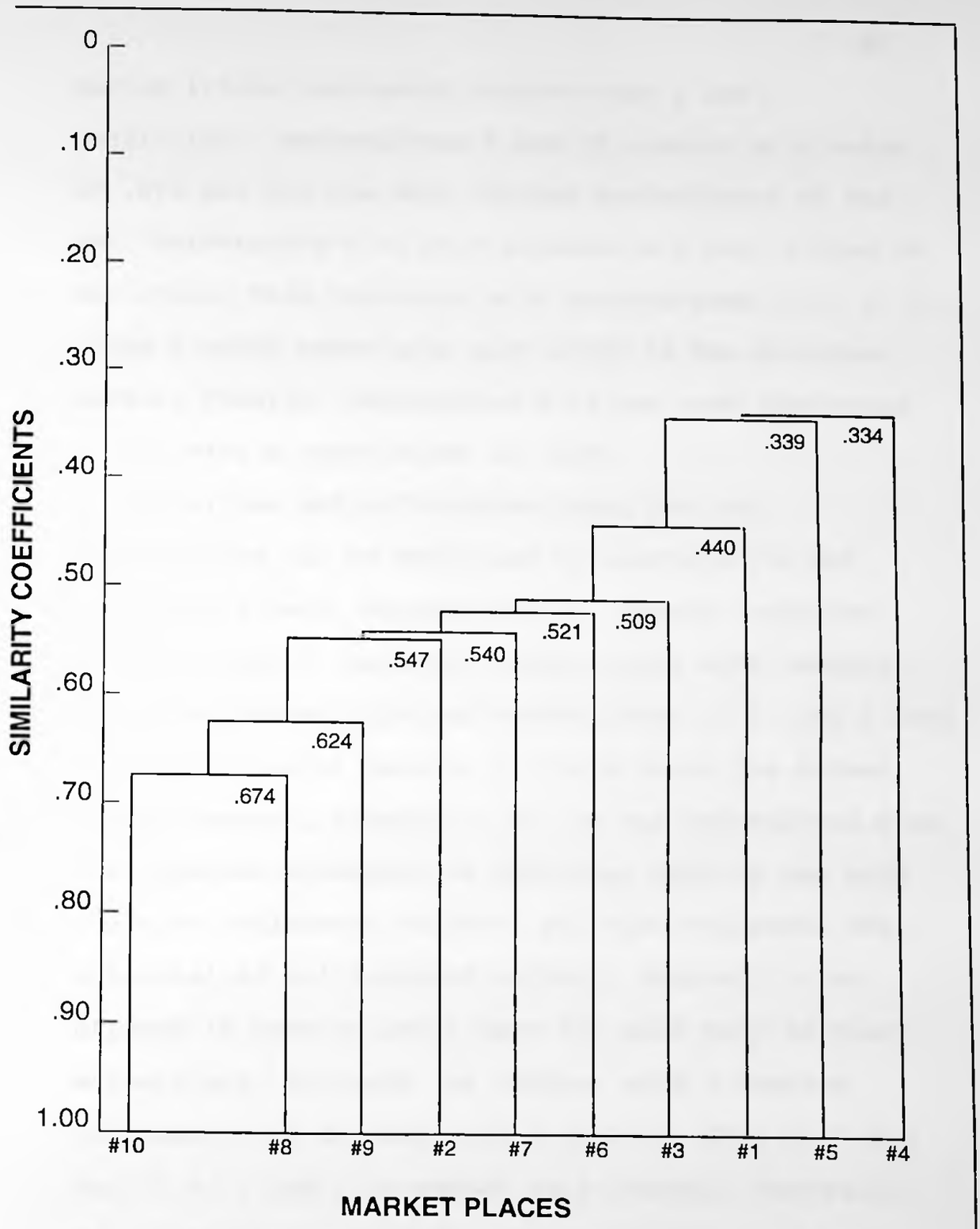

FIGURE 4. Dendrogram showing the degree of floristic similarity of 10 marketplaces in Ecuador. This method is according to Sokal and Sneath (1963).

KEY: 1. Otavalo 2. Ibarra 3. Guayaquil 4. Manta 5. Portoviejo
6. Saquisili 7. Cuenca 8. Santo Domingo 9. Puyo 10. Ambato

having little similarity cluster with a low coefficient. Marketplaces 8 and 10 cluster at a value of .674 and are the most related marketplaces of the ten. Marketplace 9 is more related to 8 and 10 than to any other. This continues with marketplaces 2, 7, 6, 3, 1 and 5 added based upon similarity to the previous market. Finally, marketplace 4 is the most dissimilar of all with a coefficient of .334.

Affinities and differences among the ten marketplaces can be explained by quantitative and qualitative data. Marketplace 10, Ambato, supplies markets 8 and 9 (personal conversation with vendors). The other Andean highland marketplaces 2, 7, and 6 form a similar cluster because of trade among the Andean market vendors. Saquisili, #6, is the marketplace with the greatest diversity of medicinal species and with the most indigenous vendors, may best represent the potential of all highland markets. Saquisili also offered 14 species which were for sale only at this marketplace, followed by Cuenca, with 5 species, Guayaquil, and Otavalo with 4 species. This accounts for 7, 6, 3 and 1 to appear as a cluster. Guayaquil, #3, is the largest of the coastal markets and has a greater similarity to the highland markets because of the great number of species available for sale. Portoviejo, #5 and Manta, #4 are coastal marketplaces

and have the fewest number of species for sale.

The most widely distributed medicinal species, *Matricaria chamomilla, Foeniculum vulgare, Rosemarinus officinalis, Eucalyptus globulus,* and *Ruta graveolens* are introduced species to Ecuador. As with many introduced species, these medicinal plants have spread and have been propagated, so they have become of much use in the pharmacopia of these people.

CHAPTER IV.

SUMMARY

I. Collections of 112 medicinal plant species representing 54 families, and 106 genera were made at 10 marketplaces in Ecuador. Labeled voucher specimens document the scientific name,the common name, date, market where collected, the medicinal use, preparation and the vendor.

II. A comparison of medicinal plant species and families represented at the ten marketplaces yielded Asteraceae, Lamiaceae, and Fabaceae as the prevalent families in common with the other studies being compared. Camp's study (Joyal, 1987) revealed Poaceae and Solanaceae were important medicinal families. Species from these families were also collected in this survey. A comprehensive study of the ethnobotany of North American indigenous peoples revealed Asteraceae, Lamiaceae, Apiaceae, Rosaceae, and Urticaceae were shared in common with this survey.

III. Twenty-two categories of medicinal use were recorded in the survey. General tonic, the most represented category in the study, ranked 15th in the NAPRALERT database.

IV. Forty-two species (37%) were introduced to Ecuador while seventy species (63%) were native. One species (.9%) was found to occur at all marketplaces.

Five species which occurred in nine out of ten marketplaces were introduced plants. Introduced species were the most widespread among marketplaces.

V. Andean marketplaces with one exception, Otavalo, are grouped together according to species available for sale. This is followed by coastal marketplaces which are grouped closely together. However, the coastal marketplaces had lower numbers of species which may account for the similarity. Santo Domingo is more related to the highland marketplaces. Trade of medicinal plants among the Andean highland marketplaces and the Coastal marketplaces is common and may explain the relationship results. Saquisili and Otavalo are the primary indigenous marketplaces. Saquisili had the largest number of vendors, greatest number of medicinal plants and most number of unique species for sale.

VI. There was no significant finding of cross-cultural usage between Ecuadorian and indigenous people. Most of the medicinal plants were sold by indigenous vendors and bought by both indigenous and non-indigenous people. All vendors providing information, with one exception, were women.

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APPENDIX I. Annotated Catalogue of the medicinal plants in marketplaces of Ecuador.

This list is arranged alphabetically by family, genus and species. Entry format for the author's collection begins with the genus and specific epithet, the authority (abbreviations according to Villacres, 1995 and Karteze,1994), the common name (either Spanish or Quichua) and the English common name if it is known. Also included are:

(A). The collector and collection number(s), the marketplace(s) where collected, and the date of collection in parentheses after the appropriate marketplace.

(B). The uses and preparation for each plant were recorded only from vendor information taken at the time the collection was made. This does not include uses listed for the plant from the literature.

(C). The native or introduced status of the plant in Ecuador.

Amaranthaceae

Aerva sanguinolenta Forsh. Escancel.
P.Bailey. 48, 128. Ibarra (15 June 1997) & Cuenca (28 June 1997). Used for liver, kidney, lung problems and inflammation Leaves prepared in an infusion. Introduced to Ecuador.

Alternanthera porrigus Jacq. Kuntze. Moradilla.
P.Bailey. 75. Guayaquil (16 June 1997). Used to stop blood hemorrhages. Make a tea and drink a glass for 3 days. Native to Ecuador.

Amaranthus caudatus L. Atacho. Amaranth.
P.Bailey. 9, 47. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used as a skin wash for external purposes, and for throat and mouth irritations. Also used for diarrhea. Flower tops used in preparations and common addition to the drink, Colada morado. Native to Ecuador.

Gomphrena dispersa Standley. Siempeviva. Globe Amaranth.P.Bailey. 80. Guayaquil (16 June 1997). Used for inflammation of the stomach. Prepare as a tea by boiling. Native to Ecuador.

Apiaceae

Arracacia xanthorriza L. Zanahoria blanca.
P.Bailey. 141. Saquisili (26 June 1997). Used as a diuretic. Prepared as a tea from the roots. Seeds used as a contraceptive (given the morning after). Introduced to Ecuador.

Coriandrum sativum L. Culantro. Coriander.
P.Bailey. 7. Otavalo (14 June 1997). Used for digestion and stomach disorders. Prepared in soups and other foods. Introduced to Ecuador.

Foeniculum vulgare Mill. Hinojo. Fennel.
P.Bailey 19, 54. Otavalo (14 June 1997) and Ibarra (15 June 1997). used for the stomach. Prepared as a tea. Introduced to Ecuador.

Apocynaceae

Plumeria rubra L. Suche.
P.Bailey 153. Ambato (28 July 1997). Used for parasites. Introduced to Ecuador.

Aquifoliaceae

Ilex guayusa Loes. Guayusa.
P.Bailey. 24. Otavalo (14 June 1997). Used as an emetic, for hangover, and for stress. Prepare leaves as a tea. Native to Ecuador.

Aristolochiaceae

Aristolochia constricta Griseb. Saragosa.
P.Bailey. 101. Portoviejo (20 June 1997). Used for colic. Mix with fennel to prepare a tea. Native.

Asteraceae

Artemisia sodoroi Hieron. Ajenjo. Wormwood.
P.Bailey. 52, 91. Ibarra (15 June 1997) & Guayaquil (16 June 1997). Use for the throat, as an antiseptic, to lower cholesterol and lower sugar in the blood (for diabetes). Prepare by soaking in cold water. Dosage is one glass three times a day. Native to Ecuador.

Artemisia sp. Ajenjo. Artemesia.
P.Bailey. 91. Guayaquil (16 June 1997). Use for parasites. Also to lower sugar in the blood (for diabeties).

Baccharis polyantha H.B.K. Chilca.
P.Bailey. 31, 74. Ibarra (15 June 1997). Used for wounds and skin infection. To prepare place a couple fresh leaves in one cup of water, and apply fresh juice. Native to Ecuador.

Chuquiraga insignis H.B.K. Chuquiragua.
P.Bailey. 40. Ibarra (15 June 1997). Used for swellings. Boil a tea and take in morning before eating for nine days. Native to Ecuador.

Culcitium reflexum L. Arquitecta.
P.Bailey. 97. Portoviejo (20 June 1997). Used for the kidneys and to clean the body. Prepare a tea with calaguala, *Polypodium calaguala* and lino, *Linum usitatissimum*. Native to Ecuador.

Cynara scolimus L. Alcachofa. Artichoke.
P.Bailey. 63. Ibarra (15 June 1997). Used for the kidneys. Prepare an infusion for the leaves. Introduced to Ecuador.

Diploslephium antisanense Hieron. Santa Maria.
P.Bailey. 112. Saquisili (26 June 1997). Use for a sick child. Native to Ecuador.

Eupatorium glutinosum Lam. Matico.
P.Bailey. 59. Ibarra (15 June 1997). Used for skin afflictions and wounds. There were two species in this bundle (both #59); the other is *Piper angustifolium* which is also known as "Matico". Both species have a pebble-like texture to the leaf. Native to Ecuador.

Franseria artemosioides Willd. Marco or Altamisa.
P.Bailey. 30, 96. Ibarra (15 June 1997) & Portoviejo (20 June 1997). Use in the bath to repel insects. Native to Ecuador.

Hypochoeris ut sessiliflora H.K.B. Achichoria. Chicory. P.Bailey. 144. Saquisili (3 July 1997). Used for the nerves. Also used for the heart; for angina. Boil water and drink as a tea. Introduced to Ecuador.

Matricaria chamomilla L. Manzanilla. Chamomile.
P. Bailey. 1. Otavalo (14 June 1997). Use for skin problems in the bath. Also mix with eucalyptus for colds. Introduced to Ecuador.

Pyrethrum parthenium (L.) Smith. Hierba De Santa Maria. Feverfew. P.Bailey. 32. Ibarra (15 June 1997). Use as a general tonic and vermifuge in the bath. Introduced to Ecuador.

Sonchus oleraceus L. Cerraja. Sow thistle.
P. Bailey. 15. Otavalo (14 June 1997). For a blood purifier. Boil in water and drink as a tea. Native to Ecuador.

Tagetes multiflora H.B.K. Sincho.
P.Bailey. 109. Saquisili (26 June 1997). Use for the stomach. Prepare as a tea. Introduced to Ecuador.

Taraxacum officinal L. Taraxaco. Dandelion.
P.Bailey. 62. Ibarra (15 June 1997). Use for kidneys and for colds. Prepare an infusion. Introduced to Ecuador.

Xanthium catharticum H.B.K. Yamarucha.
P.Bailey. 138. Saquisili (26 June 1997). Used for prostrate cancer. Prepare by boiling in water and drinking as a tea. Native to Ecuador.

Betulaceae

Alnus acuminata H.B.K. Aliso. Alder.
P.Bailey. 108. Saquisili (26 June 1997). Used as an astringent and a gargle for sore throat. Prepare an infusion. Introduced to Ecuador.

Boraginaceae

Borago officinalis L. Borraja. Borage.
P.Bailey. 12, 45. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for sore throats. Prepare a tea. Also used as a tonic because it is high in minerals. Introduced to Ecuador.

Brassicaceae

Cardamine nasturtiodes L. Berros. Watercress.
P.Bailey 130. Saquisili (3 July 1997). Used in cooking because it is nutritious (high in vitamin C and minerals). Also used for the kidneys. Prepare a tea by boiling in water. Native to Ecuador.

Capsella bursa-pastoris L. Bolsetilla. Shepard's Purse.
P.Bailey. 106. Portoviejo (20 June 1997). Used to stop hemorrhages. Also used to regulate heart action. Introduced to Ecuador.

Mathiola incana (L.) R.Br. Aleli.
P.Bailey. 71. Ibarra (15 June 1997). Used for the nerves and for heart conditions. Prepare in a tea. Introduced to Ecuador.

Caprifoliaceae

Sambucus nigra L. Flor De Tillo. Elder.
P.Bailey. 150. Puyo (25 July 1997). Flowers used for colds. Prepare a tea. Roots and bark is used as an emetic. Leaves prepared as a tea are used for the kidneys (as a diuretic). Introduced to Ecuador.

Caryophyllaceae

Dianthus caryophyllus L. Clavel. Carnation.
P.Bailey. 126. Cuenca (28 June 1997). Used for sore throats. Prepare an infusion in water. Introduced to Ecuador.

Stellaria media (L.)Villars. Chamapollo.
P.Bailey. 123. Cuenca (28 June 1997). Used for sore throat.

Celastraceae

Maytenus krukovii A.C.Smith. Chugchuguaso.
P.Bailey. 20. Otavalo (14 June 1997). Used for respiration ailments and for general health. Prepared by boiling the bark and drunk as a tea or put in alcohol, as a tincture. Native to Ecuador, Orient reg.

Chenopodiaceae

Chenopodium ambrosioides L. Paico. Wormseed.
P.Bailey. 103. Portoviejo (20 June 1997). Used in the treatment of parasites. Also used for memory. Prepare by mixing with papaya in water and drunk. Also used for memory. Mix with valarian, *Valariana officinalis* and prepare a tea. Native to Ecuador.

Convolvulaceae

Cuscuta foetida H.B.K. Aya madeja.
P.Bailey. 118. Saquisili (26 June 1997). Used for the respiratory system. Native to Ecuador.

Dipsacaceae

Dipsacus fullonum L. Cardon. Thistle.
P.Bailey. 135. Saquisili (3 July 1997). Used for broken bones, as a poutice.

Equisetaceae

Equisetum arvense L. Caballo chupa. Horsetail.
P.Bailey. 13. Otavalo (14 June 1997). Used for the kidneys. Prepare as a tea. Native to Ecuador.

Euphorbiaceae

Croton lechieri Muell Arg. Sangre De Drago.
P.Bailey. 27. Otavalo (14 June 1997). Do not have voucher specimen, only a bottle of tree sap. Used for general health , by drinking five drops in a glass of water. Also used for cuts; applied externally. Also used for ulcers and for cancer. Native to Ecuador.

Fabaceae

Cassia fistula L. Cana fistula.
P.Bailey. 102. Portoviejo (20 June 1997). Used for the flu, asthma, and bronchitis. Prepare by soaking five seeds in water to drink. Native to Ecuador.

Cassia fistilifera L. Sen.
P.Bailey. 146. Santo Domingo (6 July 1997). Used to clean all the organs. Prepare a little in a glass of water and drink two to three times a day. Native to Ecuador.

Delea mutisii H.B.K. Flor De Iso.
P.Bailey. 53. Ibarra. (15 June 1997). Used for colds. Prepare a tea. Native to Ecuador.

Desmodium abscendens (Swartz)D.C. Hierba Del infante.
P.Bailey. 122. Cuenca (28 June 1997). Used for infections and external skin wash. Also prepared as a tea and used for stomach and ulcers. Native to Ecuador.

Inga heteroptera Benth. Guabilla. Llama se garbo de norma. P.Bailey 25. Otavalo (14 June 1997). Used for the stomach. Vine boiled with water and drunk as a tea. Native to Ecuador.

Medicago sativa L. Alfalfa.
P.Bailey. 94. Manta (19 June 1997). Used as a tonic, nutritive and diuretic. Prepare a tea with mint. Make a juice form the leaves and mix with vegetable juice. Introduced to Ecuador.

Psoralea otholobium (Pursh) Rybd. Trinitaria.
P.Bailey. 139. Saquisili (3 July 1997). Used for inflamations, infections, and children's stomach ailments. Prepare a tea. Native to Ecuador in the Sierra region.

Sparitum junceum L. Retama. Spanish Broom.
P.Bailey. 116. Saquisili (26 June 1997). Used as an emetic and diuretic. Native to Ecuador.

Vicia angustifolia L. Alverjilla.
P.Bailey. 113. Saquisili (26 June 1997). Used for the kidneys and to purify the blood. Prepare as a tea. Native to Ecuador, in the Sierra region.

Unidentified seeds. "Havaleyall",
P.Bailey. 104. Portoviejo (20 June 1997).

Fumariaceae

Fumaria parviflora Lam. Pomarla.
P.Bailey. 131. Saquisili (3 July 1997). Used for kidneys and tonic. Prepare as a tea. Introduced to Ecuador and grown in the Sierra region.

Gentianaceae

Erythrae quitensis H.B.K. Canchalagua.
P.Bailey. 92. Guayaquil(16 June 1997). Used for Diabetes. Soak in water (cold) and drink a glass 3 times a day. Native to Ecuador in the Sierra region.

Geraniaceae

Pelargonium odoratissimum Ait. Malva olorosa. Apple Scented Geranium. P.Bailey. 17 & 61. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used as a tonic. Prepare in a cold juice or as a tea. Introduced to Ecuador.

Pelargonium peltatum L. Geranio. Scented Geranium. P.Bailey. 148. Santo Domingo (6 July 1997). Used for the total body. Prepare a tea. Introduced to Ecuador.

Juglandaceae

Juglans neotropica Diels. Nogal. Walnut. P.Bailey. 77. Guayaquil (16 June 1997). Used for a little baby's stomach. Prepare as a drink. Introduced to Ecuador.

Lamiaceae

Bistropogon mollis H.B.K. Tipo. Peppermint. P.Bailey. 18, 70, & 79. Otavalo (14 June 1997), Ibarra (15 June 1997) & Guayaquil (16 June 1997). Used for the stomach. Prepared as a tea. Native to Ecuador.

Melissa officinales L. Toronjil. Lemon Balm. P.Bailey. 2 & 60. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used as a tonic for general healing, prepared as a tea. Also used with Valerian for the nerves. Introduced to Ecuador.

Mentha spicata L. Herbabuena. Spearmint. P.Bailey. 147. Santo Domingo (6 July 1997). Used for stomach and digestion. Prepare a tea. Introduced to Ecuador.

Ocimum basilicum L. Albaca. Basil. P.Bailey. 145. Santo Domingo (6 July 1997). Used for colds and stomach ailment. Prepare as a tea. Introduced to Ecuador.

Origanum vulgare L. Oregano. P.Bailey. 16. Otavalo (14 June 1997). Used as a tonic and for the stomach. Prepare as a tea. Introduced to Ecuador.

Rosemarinus officinalis L. Romero. Rosemary. P.Bailey. 5, 69. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for hair. Prepare an infusion for the rinse. Introduced to Ecuador.

Salvia officinalis L. Salvia. Sage.
P.Bailey. 11. Otavalo (14 June 1997). Used as a tea for general health. Introduced to Ecuador.

Stachys lanata Jacq. Hierba del cuy. Lamb's ears.
P.Bailey. 120. Cuenca (28 June 1997). Use for throat and Bronchitis. Prepare a tea with Violet and Pata con yuyu. Introduced to Ecuador.

Thymus vulgaris L. Tomillo. Thyme.
P.Bailey. 55, 119. Ibarra (15 June 1997) & Saquisili (26 June 1997). Used for stomach and indigestion. Prepare as tea. Native to Ecuador.

Lauraceae

Acotea quixos Lamarc. Ishpingo.
P.Bailey. 105. Portoviejo (20 June 1997). Used for arthritis and cramps. Also used in the drink Colada Morada.

Lilliaceae

Aloe vera L. Savila. Aloe.
P.Bailey. 65. Ibarra (15 June 1997). Used for the liver. Prepare the juice by squeezing the fresh leaves. Introduced to Ecuador.

Linaceae

Linum usitatissimum L. Linaza. Flax.
P.Bailey. 76, 99. Guayaquil (16 June 1997) & Portoviejo (20 June 1997). Used for the kidneys and liver. Prepare a tea. Introduced to Ecuador.

Loasceae

Cajaphora latentia (Hook.)Kotzsch. Ortiguilla.
P.Bailey. 117. Saquisili (26 June 1997). Used to purify the blood.

Malpighiaceae

Banisteriopsis caapi (Spruce ex Griseb.) Mort.
Ayahuasca. P.Bailey. 23. Otavalo (14 June 1997). Used as a hallucinogen and an emetic. Native to Ecuador, from the Amazon region.

Malvaceae

Althaea officinalis L. Malva Blanca.
P.Bailey. 46. Ibarra (15 June 1997). Used as a tea for the respiration system. Native to Ecuador.

Monimiaceae

Boldus fragans G.Bon. Boldo.
P.Bailey. 152. Puyo (26 July 1997). Used for insomnia, for the nerves, to cleanse the liver and for good digestion. Introduced to Ecuador.

Moraceae

Ficus carica L. Higo. Fig.
P.Bailey. 140. Saquisili (3 July 1997). Used for colds. Prepare as a tea. Introduced to Ecuador.

Myrtaceae

Eucalyptus citriodora Hook. Eucalipto. Eucalyptus.
P.Bailey. 28. Otavalo (14 July 1997). Used for bronchial and respiratory system. Introduced to Ecuador.

Eucalyptus globulus Labill. Eucalipto. Eucalyptus.
P.Bailey. 34. Ibarra (15 June 1997). Used for colds and the respiratory system. Prepare a tea. Introduced to Ecuador.

Eugenia halli H.B.K. Arrayan. Myrtle.
P.Bailey. 10. Otavalo (14 June 1997). Used to wash the teeth, and for gums. Prepare infusion from fresh leaves and water. Native to Ecuador.

? Serrote.
P.Bailey. 66. Ibarra (15 June 1997). For the kidneys. Prepare an infusion and drink.

Onagraceae

Oenothera virgata R.& P. Shullu. Primrose.
P.Bailey. 83. Guayaquil (16 June 1997). Used as a refreshing tonic and for fevers. Boiled with water and drunk. Native to Ecuador.

Orchidaceae

Epidendrum evectrum Hook. Flor de christo. Orchid. P.Bailey. 125. Voucher specimen at QCA only, due to the CITES act. Cuenca (28 June 1997). Used to cleanse kidney and lower tract. Prepare a tea. Also used for parasites. Native to Ecuador.

Papaveraceae

Papaver rhoeas L. Amapolla. Poppy. P.Bailey. 51, 142. Ibarra (15 June 1997) & Saquisili (3 July 1997). Used for parasites, for anti-inflammatory, to regulate menstruation and circulation of the blood. Prepare a tea. Introduced to Ecuador.

Passifloraceae

Passiflora ligularis Juss. Granadilla. P.Bailey. 56. Ibarra (15 June 1997). Used as a compress for children. Native to Ecuador.

Piperaceae

Peperomia congona Sod. Congona or Pata con yuyu. P.Bailey. 110. Saquisili (26 June 1997). Used as a cardiac stimulant and for headache. Prepare as a tea. Native of Ecuador.

Piper angustifolium Rudge. Matico. P.Bailey. #4 & 59. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used as a tonic for general health. Cook and use in a bath. Native to Ecuador.

Plantaginaceae

Plantago major L. Llanten. Plantain. P.Bailey. 38, 95. Ibarra (15 June 1997) & Manta (19 June 1997). Used for the stomach. Prepare as a tea. Native to Ecuador.

Poaceae

Bromus sp. Milin. Oats. P.Bailey. 132. Saquisili (3 July 1997). Used to clean the stomach and the digestive tract. Prepare as a tea.

Cymbopogon citratus D.C.Staff. Hierba luisa. Lemon grass. P.Bailey. 6, 43. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for the stomach. Prepare as a tea. Native to Ecuador.

? Grama. #68. Ibarra (15 June 1997). Use for the liver. Prepare an infusion for a drink.

Polygonaceae

Rumex crispus L. Lengua de vaca. Yellowdock. P.Bailey. 42. Ibarra (15 June 1997). Boil and use in the bath. Native to Ecuador.

Polypodiaceae

Adiantum sp. Culantrillo de pozo. Maidenhair fern. P.Bailey. 50. Ibarra (15 June 1997). Used against fleas externally. Native to Ecuador.

Adiantum thalictroides Willd ex Schlecht. Culantrillo. Maidenhair fern. P.Bailey. 136. Saquisili (3 July 1997). Used for parasites and blood. Native to Ecuador.

Asplenium sp. Culantrillo. Fern. P.Bailey. 133. Saquisili (3 July 1997). Used for parasites. Prepare a tea with Valerian, Chuquiragua and Calaguala to drink. Native to Ecuador.

Polypodium calguala L. Calaguala. Fern roots. P.Bailey. 21, 98. Otavalo (14 June 1997) & Portoviejo (20 June 1997). Used for the prostrate and liver. Native to Ecuador.

Proteacea

Embothryum grandiflorum Lam. Cucharilla. P.Bailey. 149. Puyo (25 July 1997). Used for inflammation of the kidneys and intestinal tract.

Renunculaceae

Thalictrum podocarpum H.B.K.ex D.C. Culantrillo. Meadowrue. P.Bailey. 137. Saquisili (3 July 1997). Used for parasites. Native to Ecuador.

Rosaceae

Marygyricarpus pinnatus (Lam.)Kuntze. Piquiyuyu. Pearl berry. P.Bailey. 72. Ibarra (15 June 1997). For regulating any problems relating to menstruation. Prepare as a tea. Native to Ecuador, in the Sierra region.

Poterium sanguisorba L. Pimpinela. Great Burnet. P.Bailey. 49. Ibarra (15 June 1997). Use as an astringent and to stop the blood (hemostatic). Use externally. Native to Ecuador.

Rubiaceae

Unicaria tomentosa (Willd. ex Roem.& Schult.)DC. Una De Gato. Cat's claw. P.Bailey. 26 & 151. Otavalo (14 June 1997) & Puyo (25 July 1997). Used for general health, and for prostrate cancer. Prepare a tea or a tincture. Native to Ecuador.

Rutaceae

Citris aurantium L. Hoja de Naranja. Bitter Orange. P.Bailey. 14, 64. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for infections of the kidneys and urinary tract. A tea from the leaves is also used as a tranquilizer. Introduced to Ecuador.

Ruta graveolens L. Ruda. Rue. P.Bailey. 8 & 29. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for the stomach. Prepare in water to drink. Also used for parasites. Introduced to Ecuador.

Salicaceae

Salix humboldtiana Willd. Sauce. Willow. P.Bailey. 86. Guayaquil (16 June 1997). Used to make hair grow. Introduced to Ecuador.

Scrophulariaceae

Scorparia dulcis L. Teatina. P.Bailey. 90. Guayaquil (16 June 1997). Used for skin infections. Native to Ecuador.

Solanaceae

Brugmansia arborea Langeh. Floriguando or Floripondio. Tree Datura. P.Bailey. 36 & 127. Ibarra (15 June 1997) & Cuenca (28 June 1997). Used for pain. Flowers also used by Bruhja/Bruhjo for spiritual cleansing. Native to Ecuador.

Brugmansia sanguinea R.&P. Floriguantug. Tree Datura. P.Bailey. 37 & 127. Ibarra (15 June 1997) & Cuenca (28 June 1997). Used for pain and for spiritual cleansing. Native of Ecuador.

Solanum nigrum L. Hierba mora. Nightshade.
P.Bailey. 73. Ibarra (15 June 1997). Used for skin problems and tumors: used externally. Also used for fever by making a paste and apply externally. Used for pain in small doses. Native to Ecuador.

Urticaceae

Urtica urens L. Ortega. Nettle.
P.Bailey. 35 & 115. Ibarra (14 June 1997) & Saquisili (26 June 1997). Used to purify the blood, for Bronchitis and for diarrhea. Introduced to Ecuador.

Valarianaceae

Valariana microphylla L. Vallariana. Valarian.
P.Bailey. 22, 58, & 100. Otavalo (14 June 1997), Ibarra (15 June 1997), & Portoviejo (20 June 1997). Used for the stomach. Also used for parasites. A third use is for the heart: prepare a tea with Lemon balm, *Melissa officinales*. Introduced to Ecuador.

Verbenaceae

Lippia citriodora H.B.K. Cedron. Lemon verbena.
P.Bailey. 3 & 39. Otavalo (14 June 1997) & Ibarra (15 June 1997). Used for stomach pain. Prepare a tea with boiled water and leaves. Introduced to Ecuador.

Verbena litoralis H.B.K. Verbena. Vervain.
P.Bailey. 88. Guayaquil (16 June 1997). Used against malaria. Prepare a tea and take for several days. Introduced to Ecuador.

Violaceae

Viola odorata L. Violeta. Blue Violet.
P.Bailey. 121. Cuenca (28 June 1997). Use for the throat and for the bronchials. Prepare a tea with Lamb's ears, *Stachys lanata* and Pata con yuyu, *Peperomia congona*. Introduced to Ecuador.

Viola tricolor L. Pensamientos. Violet.
P.Bailey. 143. Cuenca (28 June 1997). Used for the throat and for Bronchitis. Prepare in water. Introduced to Ecuador.

Viola sp. White Violet (compound).
P.Bailey. 124. Cuenca (28 June 1997). For sore throat and bronchitis. Prepare an infusion in water.

Unknown

Unidentified roots. "Punozanahoria"
P.Bailey. 114. Saquisili (26 June 1997). Used for parasites. Prepare an infusion.

?Baldo. P.Bailey. 78. Guayaquil (16 June 1997). Used for pimples and the complexion Prepare by boiling in 1 liter of water for 15 minutes and using as a wash.

APPENDIX II. Occurrence of medicinal plants in ten city marketplaces in Ecuador.

This list is arranged alphabetically by family, genus and species. The collection sites are listed 1 - 10 and the key correlating the number to the marketplace is listed at the bottom of each page. The symbols o and x appear in the collection site columns: o represents a voucher specimen was collected at the site and x represents that the species was present at the site, but a collection was not made. This information is followed by the collection number(s).

MEDICINAL PLANTS OF TEN CITY MARKETS IN ECUADOR

15 JUNE 1997 - 15 AUGUST 1997

FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Amaranthaceae	Aerva sanguiniolenta		o	x			x	o	x	x	x	7	48, 128
Amaranthaceae	Alternanthera porrigus			o			x	x	x	x		5	75
Amaranthaceae	Amaranthus caudatus	o	o	x			x		x		x	6	9, 47
Amaranthaceae	Gomphrena dispersa			o								1	80
Apiaceae	Arracacia xanthorriza						o					1	141
Apiaceae	Coriandrum sativum	o		x			x	x	x	x	x	7	7
Apiaceae	Foeniculum vulgare	o	o	x		x	x	x	x	x	x	9	19, 54
Apocynaceae	Plumeria rubra										o	1	153
Aquifoliaceae	Iiex guayusa	o	x	x		x	x		x	x		7	24
Aristolochiaceae	Aristolochia constricta					o						1	101
Asteraceae	Artemisia sodoroi		o	x	x		x	x	x	x	x	8	52
Asteraceae	Artemisia sp.				o							1	91
Asteraceae	Baccharis polyantha		o				x		x			3	31, 74
Asteraceae	Chuquiraga insignis		o		x	x	x	x		x	x	7	40

KEY:
1=Otavalo 2=Ibarra 3=Guayaquil 4=Manta 5=Portoviejo
6=Saquisili 7=Cuenca 8=Santo Domingo 9=Puyo 10=Ambato

FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Asteraceae	Culctium reflexum			x		o	x				x	4	97
Asteraceae	Cynara scolimus		o			x			x	x	x	5	63
Asteraceae	Diploslephium antisanense						o					1	112
Asteraceae	Eupatorium glutinosum		o									1	59*
Asteraceae	Franseria artemisiodes		o			o	x		x			4	30, 96
Asteraceae	Hypochoeris ut sessiliflora						o					1	144
Asteraceae	Matricaria chamomilla	o	x	x	x	x	x	x	x	x	x	10	1
Asteraceae	Pyrethrum parthenium		o									1	32
Asteraceae	Sonchus oleraceus	o								x	x	3	15
Asteraceae	Tagetes multiflora						o					1	109
Asteraceae	Taraxacum officinal		o	x						x	x	4	62
Asteraceae	Xanthium cartharticum						o					1	138
Betulaceae	Alnus acuminata						o					1	108
Boraginaceae	Borago officinalis	o	o	x			x	x	x	x	x	8	12, 45
Brassicaceae	Cardaimine nasturtiodes						o		x	x		3	130
Brassicaceae	Capsella bursa-pastoris					o						1	106
Brassicaceae	Mathiola incana		o	x			x	x	x	x	x	7	71
Caprifoliaceae	Sambucus nigra			x		x	x			o	x	5	150

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FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Caryophyliaceae	Dianthus caryophyllus							o				1	126
Caryophyliaceae	Stellaria media							o				1	123
Celastraceae	Maytenus krukovii	o										1	20
Chenopodiaceae	Chenopodium ambrosioides					o	x		x		x	4	103
Convolvulaceae	Cuscuta foetida						o					1	118
Dipsacaceae	Dipsacus fullonum						o					1	135
Equisetaceae	Equisetum arvense	o		x		x	x	x	x	x	x	8	13
Euphorbiaceae	Croton lechieri	o									x	2	27
Fabaceae	Cassia fistula					o	x					2	102
Fabaceae	Cassia fistulifera								o			1	146
Fabaceae	Dalea mutisii		o				x		x			3	53
Fabaceae	Desmodium abscendens							o				1	122
Fabaceae	Inga heteroptera	o										1	25
Fabaceae	Medicago sativa				o		x		x	x		4	94
Fabaceae	Psoralea otholobium						o		x			2	139
Fabaceae	Sparitum junceum						o		x		x	3	116
Fabaceae	Vicia angustifolia						o					1	113
Fabaceae	? seeds " Havaleyall"					o						1	104

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FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Fumariaceae	Fumaria parviflora						o					1	131
Gentianaceae	Erythraea quitensis			o								1	92
Geraniaceae	Pelargonium pellatum								o			1	148
Geraniaceae	Pelargonium odoratissimum	o	o					x				3	17, 61
Juglandaceae	Juglans neotropica			o			x		x	x		4	77
Lamiaceae	Bistropogon mollis	o	o	o			x	x	x	x	x	8	18, 70, 79
Lamiaceae	Melissa officinales	o	o	x		x	x	x	x		x	8	2, 60
Lamiaceae	Mentha spicata						x		o	x	x	4	147
Lamiaceae	Ocimum basilicum								o	x		2	145
Lamiaceae	Origanum vulgare	o							x		x	3	16
Lamiaceae	Rosemarinus officinalis	o	o	x	x		x	x	x	x	x	9	5, 69
Lamiaceae	Salvia officinalis	o					x					2	11
Lamiaceae	Stachys lanata							o				1	120
Lamiaceae	Thymus vulgaris		o				o		x		x	4	55, 119
Lauraceae	Acotea quixos					o						1	105
Lilliaceae	Aloe vera		o					x	x	x	x	5	65
Linaceae	Linum usitatissimum			o		o		x				3	76, 99
Loasceae	Cajaphora iatential						o					1	117

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FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Malpighiaceae	Banisteriopsis caapi	o	x									2	23
Malvaceae	Althaea officinalis		o	x	x	x	x	x	x	x	x	9	46
Monimiaceae	Boldus fragans									x		1	152
Moraceae	Ficus carica						o			x		2	140
Myrtaceae	Eucalyptus citriodora	o										1	28
Myrtaceae	Eucalyptus globulus	o	o	x	x		x	x	x	x	x	9	34
Myrtaceae	Eugenia hallii	o	o									2	10
Myrtaceae	? " Serrote"		o									1	66
Onagraceae	Oenothera virgata			o								1	83
Orchidacere	Epidendrum evectrum						o	o	x		x	4	125, 134
Papaveraceae	Papaver rhoeas		o			x	o		x		x	5	51, 142
Passifloraceae	Passiflora ligularis		o							x	x	3	56
Piperaceae	Peperomia congona						o			x	x	3	110
Piperaceae	Piper angustifolium	o	o	x	x	x	x			x	x	8	4,59*
Plantaginaceae	Plantago major		o		o		x	x	x	x	x	7	38, 95
Poacea	Bromus sp.						o		x	x	x	7	132
Poaceae	Cymbopogon citratus	o	o	x			x	x	x	x	x	8	6, 43,
Poaceae	? "Grama"		o									1	68

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FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Polygonaceae	Rumex crispus		o									1	42
Polypodiaceae	Adiantum thalictroides						o					1	136
Polypodiaceae	Adiantum sp.		o									1	50
Polypodiaceae	Asplenium sp.						o					1	133
Polypodiaceae	Polypodium calaguala	o				o						2	21, 98
Proteaceae	Embothryum grandiflorum									o		1	149
Renunculceae	Thalictrum podocarpum						o					1	137
Rosaceae	Marygyricarpus pinnatus		o				x					2	72
Rosaceae	Poterium sanguisorba		o									1	49
Rubiaceae	Unicaria tomentosa	o								x		2	26, 151
Rutaceae	Citrus aurantium	o	o					x		x	x	5	14, 64
Rutaceae	Ruta graveolens	o	o	x	x	x	x	x	x		x	9	8, 29
Salicaceae	Salix humboldtiana			o								1	86
Scrophulariaceae	Scorparia dulcis			o								1	90
Solanaceae	Brugmansia arborea		o				x	o			x	4	36, 127
Solanaceae	Brugmansia sanguinea		o	x			x	o			x	5	37
Solanaceae	Solanum nigrum		o							x		2	73
Urticaceae	Urtica urens		o	x			x		x		x	5	35,115

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FAMILY	GENUS SPECIES	COLLECTION SITE										SP. Total	COLLECTION #
		1	2	3	4	5	6	7	8	9	10		
Valarianaceae	Valeriana microphylla	o	o			o	x		x		x	6	22,58,100
Verbenaceae	Lippia citriodora	o	o				x	x			x	5	3, 39
Verbenaceae	Verbena litoralis			o		x			x			3	88
Violaceae	Viola odorata							o				1	121
Violaceae	Viola tricolor						x	o			x	3	143
Violaceae	Viola sp.								o			1	124
?Unknown	"Baldo"			o			x					2	78
? Unknown	"Punozanahoria"						o					1	114
Totals		29	44	35	10	24	64	33	42	37	44		

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