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Marketplace plants used in ceremonial cleansing among Andean Qechuans of Ecuador

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Marketplace plants used in ceremonial cleansing among Andean Qechuans of Ecuador

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TO MY FAMILY and INDIGINOUS PEOPLE AROUND THE WORLD

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ABSTRACT

Ceremonial cleansing plays a vital role in indigenous societies where ‘folk illnesses’ such as *susto* (fright) are common. Indigenous Andean Qechuans commonly use cleansing plants to treat *susto*, and related ‘folk illnesses’.The purpose of this study was to characterize and compare market plants and to define methods and knowledge used in ceremonial cleansing among Ecuadorian Qechuans. Interviews were conducted with 22 vendors at 13 marketplaces. Regression Analysis (RA) determined preferentially selected plant families and residual value of RA determined the highest and lowest preferentially selected plant families.Hierarchical cluster analysis and coefficient of similarity demonstrated the relationship between marketplaces and cleansing plants. Intracultural comparision determined if plant species from the Amazonion region were being used in the Andean markets for cleansing purposes. A total of 101 species from 50 plant families was reportedly used for cleansing. Two types of ritual cleansing (*limpia*) methods were recorded: internal and external cleansing. Both methods employed *dulc*e (sweet) and *amargos (*bitter) plants. *Mal aire (*bad air), *mal energia* (bad energy) and *susto* were prominent ailments treated. Cluster analysis demonstrated that markets of Pujilli and Otovalo were the most floristically related while Cuenca was the least related of the 13. Lamiaceae had the highest number of plant species (15) used. According to residual of RA, Lamiaceae (14.4757) was the most selected and Orchidaceae (- 4.9433) was the least selected family. Highest residual of RA demonstrated preferential selection of the Lamiaceae. According to coefficient of similarity, all 13 markets share 0.75 (out of value 1) similar plant species. Similarity in market flora can be partially explained by similarity in geographic location. Further, limited markets having the fewest species shared a similar flora despite being widely separated. No significant number (11 speceis) of Amazonion plants were used in the Andean markets. Knowledge of plants used in ceremonial cleansing was prevalent throughout the study area with minor variations in species employed.

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CHAPTER I

INTRODUCTION

Nonbiomedical healing systems vary across cultures but conceptually they often focus on balance and harmony, which may be treated mentally, physically or spiritually (Bodekar 1994; Hewson 1998; O'Conner 1998). Indigenous societies around the world use plants for cleansing ceremony, a nonbiomedical healing system to "wash away" or remove physical, emotional or spiritual ailments. Indigenous people of Ecuador treat folk illness or culture bound syndrome via cleansing (Bailey 1999). Although anthropological studies have been done on numerous rituals and rites of aboriginal communities, few studies have focused on the identification of plants used for cleansing rituals. Since 3.5 million inhabitants of developing countries still rely on traditional herbal remedies for their primary health care (Balick and Cox 1996), studies such as this could provide valuable insights into indigenous traditions, their concepts and cure of ailments.

Use of various parts of plants for cleansing ceremonies for physical, emotional or spiritual reasons is neither novel nor a rare tradition. Mayas and Incas used St. John's wort, chicory, roses, marigolds, chamomile, peppermint, sage, thyme, rosemary, lavender and basil during ceremonial "florecidas" (flower bath) for spiritual purposes (Arvigo and Epstein 2003).Wiccans took cleansing baths in order to remove negative energy from their body (Arvigo and Epstein 2003).

Similarly, Q'eqchi Mayans of Belize burnt *Adiantum latifolium* (Broadleaf maidenhair) and *Adiantum tetraphyllum* (Fourleaf maidenhair) to make smoke around the patient to treat susto, a cultural bound syndrome (Bourbonnais et al. 2005). Similarly, Western North American Indians use sage, cedar and sweet grass to make smoke in a ceremony called "smudging", a cleansing ceremony "to drive out bad spirits, feelings or influences" (Borden and Coyote 2006). Similarly, Mayans also had basil- floor washing ritual to ward off envy and draw in luck (APA 2000). Ritual plants also play important role among the Shuhi ethnic group of south- western China. Shui use cleanisng plants to keep the environment clean of malevolent spirits and to maintain a good relationship with the deities (Weckerle et al. 2006).

Questions may arise regarding the placebo effect and the role of plants in healing after the cleansing ceremony. Since it is scientifically established that secondary compounds present in plants have a wide array of effects on humans, it can be implied that cleansing plants do heal. Secondary chemical compounds or bioactive chemicals such as alkaloids, glycosides, essential oils and resins have been extensively studied and researched in order to discover cure for human diseases. Secondary chemical compounds not needed by the plant for its growth but are used as chemical weapons against pathogens, animals and insects which indicates the potency of the secondary chemical compounds.

To study a culture of cleansing ceremonies, countries like Ecuador with a large population of indigenous interacting with their flora for a long time is an ideal place. Ecuador is an ecologically and culturally diverse country. About the size of the state of Colorado, Ecuador represents 25,000 species of vascular plants of which 26% percent are endemic (Jorgenson et al.1999).

The abundance of biodiversity can be credited to the country's geographical diversity. Range of habitats including the coastal plains in the west, Andean mountains running through the middle of the country and the Amazon rainforest to the east makes Ecuador an ecological wonderland that supports wide variety of flora. Changes in climates due to changes in elevation and precipitation also affect the vegetation types and diverse flora of Ecuador (Jorgensen 1999).

The Andean mountain in which this research was conducted is also referred as the "Sierra of Ecuador". According to White (1985), "the Sierra of Ecuador is conducive to growing a very wide variety of herbs because of the constant and rather mild climate. Almost every market whether it be a weekly market or a daily market will have a small variety of the most commonly used herbs: chamomile, lemon balm, mint, matico, and lemongrass".

The Ecuadorian Andes consists of lower montane rain forest occurring on the western and eastern Andean slopes between 700 m and 2500 m elevation. The southern and central Andes, between 2800 to 3200m consist mostly of vegetation dominated by species of genus *Myricanthancus* of Eucalyptus family. Eucalyptus vegetation is also common in the central Andean valleys in the North. Common eucalyptus (*Eucalyptus*

globulus Labill.) was introduced from Australia in 1860's for timber production. Most of the original vegetation is now found only in steep ravines since the original forests have been destroyed for agricultural purposes ((Jorgensen 1999).

The Andean region of Ecuador sustains the highest number of species of plants (9,865 species) or 64.4% of the total flora, more species than the Ecuadorian Amazon. Out of 23 endemic genera of plants, Andean region supports 12 of them (Jorgenson, 62). The highest number of species present in the Andes are of Orchidaceae (2322) and Asteraceae (754).

Besides its ecological diversity, Andean mountains are culturally rich since it is also the home of Qechuan Indians, the largest indigenous group living in Ecuador, Peru Bolivia, Chile and Argentina (Lonely Planet 2005). Qechuans speak Qechua, the language of Incas. Out of 11 indigenous groups (40% of the total population of Ecuador), Qechuan Indians are the largest in number. Majority of Qechuan Indians are farmers, largely growing corns, beans, tomatoes and potatoes. Some cultivate medicinal plants while few are medicinal plant vendors at various marketplaces.

In the past, studies of Ecuadorian flora have included medicinal plants and halucigenic plants, especially those of the Amazonian region. Schultes has done the most ethnobotanical research in the Amazonian basin (Schultes and Von Reis 1995). White (1976), Ramon et al. (1988) and Kothari (1996) have written about the common Andean medicinal plants but these studies do not provide voucher collections as references. Bailey (1997) collected medicinal plants sold in marketplaces in different regions of Ecuador including few Andean markets. The Andes of Ecuador is less studied although it is an area of diverse vegetation and home to Qechuan Indians whose intact cultural belief system still incorporates the knowledge and uses of plants in curing various ailments including folk illness or cultural bound syndromes (CUL).

Cultural bound syndromes (CUL) are product of a belief system and/or the psychological product of an individual or the society, most common to indigenous communities of the South America, Mexico and Asia. Thus, American Psychiatric Association (APA) defines culture bound syndromes as "recurrent, locality specific patterns of aberrant behaviour and troubling experience that may or may not be linked to a particular Diagnostic Statistical Manuel (DSM-IV) diagnostics category"(APA 2000) .

Susto (soul loss), *mal aire* (bad/evil air), and *mal energia* (bad/negative energy) are some of the names given to CUL in Mexico and South America.

Susto is probably the most studied cultural bound syndrome. It is believed to be caused due to sudden fright or traumatic experiences that lead to loss of "soul" (Klien 1978). *Susto* is well known in Mesoamerica and is said to be more frequent among children or infants (Amiguet et al. 2005; Bourbonnais et al. 2005). Symptoms include- appetite loss, inadequate or excessive sleep, troubled sleep or dreams, lack of motivation, muscle aches, headaches and diarriah (APA 2000). Ceremonial cleansing is performed to call the soul back to the body and to restore bodily and spiritual balance (APA 2000). APA and WHO (1993) relates *susto* symptoms to major depressive disorder and post traumatic stress disorder (Bourbonnais et al. 2005).

Marketplaces of Ecuador is an ideal place to pursue research on ceremonial cleansing plants since it is a place of congregation of long - time plant vendors who have access to plants from various habitats and geographical regions. Vendors or the "Mountain shaman" are extremely knowledgeable of plants and their curative powers and act as the urban medicinal man or woman. The accessibility of markets and the large number people involved make markets a rich source of ethnobotanical information (Alexiades 1996)

Modernization and technological development brought about by globalization are affecting indigenous cultures around the world and Qechuans are no exception. Increasing number of Qechuans are leaving their traditional professions and home villages migrating to the nearby towns and cities. Most Qechuans still inhabit the Andean mountains in communities and are referred as highland Qechuans. There are Qechuans living in the upper Amazonian basin and are called low land Qechuans.

With the disappearance of the traditional living environments, the Qechuan Indians have begun to lose their traditional life style along with the irreversible loss of traditional knowledge of plants used for medicinal purposes. The colorful hats, alpaca ponchos, cloth shoes and other bodily attire of an Indian have been replaced by jeans, baseball caps and tennis shoes. Benz et al. (1999) reported that the plant use knowledge among the indigenous community in the Sierra de Manantlan, Mexico declined with

increasing modernization and acquisition of nontraditional community services such as literacy and housing quality.

Inventory of plants and the recording of traditional plant knowledge have become even more important for these reasons. Undoubtedly, with the demise of the culture plant related knowledge it holds die as well. In addition, loss of habitat has just fastened the speed of extinction of plants. It is estimated that out of quarter million higher plant species, 25,000 will be extinct in the next 10-20 years (Balick et al. 1996).

Thus, it is urgent to first and foremost to record the knowledge of various plants such as ceremonial cleansing plants for the future reference. Studies such as this one are an important step in making strategies for ecological conservation and sustainable uses of plant species. Recording the knowledge of the plants provides the basis to research on analyzing potential biological activities and bioactive ingredients and other biotechnical and pharmaceutical investigations.

During a medical ethnobotanical survey of the marketplaces, Bailey and Evans (1999) reportedly encountered plants used for cleansing among Ecuadorians. The purpose of this study is to characterize and compare market plants and to define methods and knowledge used in ceremonial cleansing among highland Andean Qechuan Indians of Ecuador. The study answers the following questions:

1. Does cleansing tradition occur in Ecuador as reported by Bailey and Evans (1999)?
2. Is knowledge of cleansing plants prevalent throughout study area or regional in nature?
3. Is there a variation in plant used from north to south? Is there similarity between markets?
4. Are the plants from the Amazonian region prevalent in large numbers in the study sites near to the region?

Objectives

The objectives of the research are as follows:

1. Define the methods of cleansing
2. Taxonomic identification of the cleansing plants
3. Characterize the cleansing plant flora of the market (status, life form, origin and the most frequently used plant species and families)
4. Preferential selection of cleansing plant species and families by the vendors.
5. Comparison of cleansing plant families
   - Marketplace comparison
   - Intracultural (Amazonian and Andean) and intercultural comparison

CHAPTER II

METHODS

Ethical approval

The Intellectual Property Rights Law requires specific permission to collect plants in the host country. Usually such permits allow patenting active principle compounds identified from a plant but not the plant or folk information relating to medicinal properties of the plant (Barton, J.H. 1994). Permission to collect and bring back the plant specimens were facilitated by Catholic University, Quito, Ecuador. However, it was necessary to sign a government document that plants would not be examined for chemical constituents and that no DNA would be extracted from the collection. Plants collected were taken to the Catholic University for further scientific identification and documentation.

Study area

Ecuador with an area of 283,000km^2 is the smallest of the Andean countries. It is 1˙ 30’ north to 5˙ south latitude and 75˙ 20’ west to 81˙ west longitude (Jorgensen 199). Ecuador borders Columbia on its north, Peru on its south, Pacific Ocean on the west and the Amazonion regaionin the east (Figure 1). Four geographical regions- the coastal Pacific in the west, the Amazon in the east, the Andean mountains in the center (Figure 2) and the Galapagos Island support a diversity of climates and ecosystems. This study was conducted in the marketplaces along the Andean Mountain from north to south (Figure 1 and 2).

Figure 1. Map of Ecuador bordering Columbia on its north, Peru on its south and pacific Ocean on the west (Gomez 1999). The rectangular boxes represent the extent of the marketplaces visited in the north and south of Ecuador.

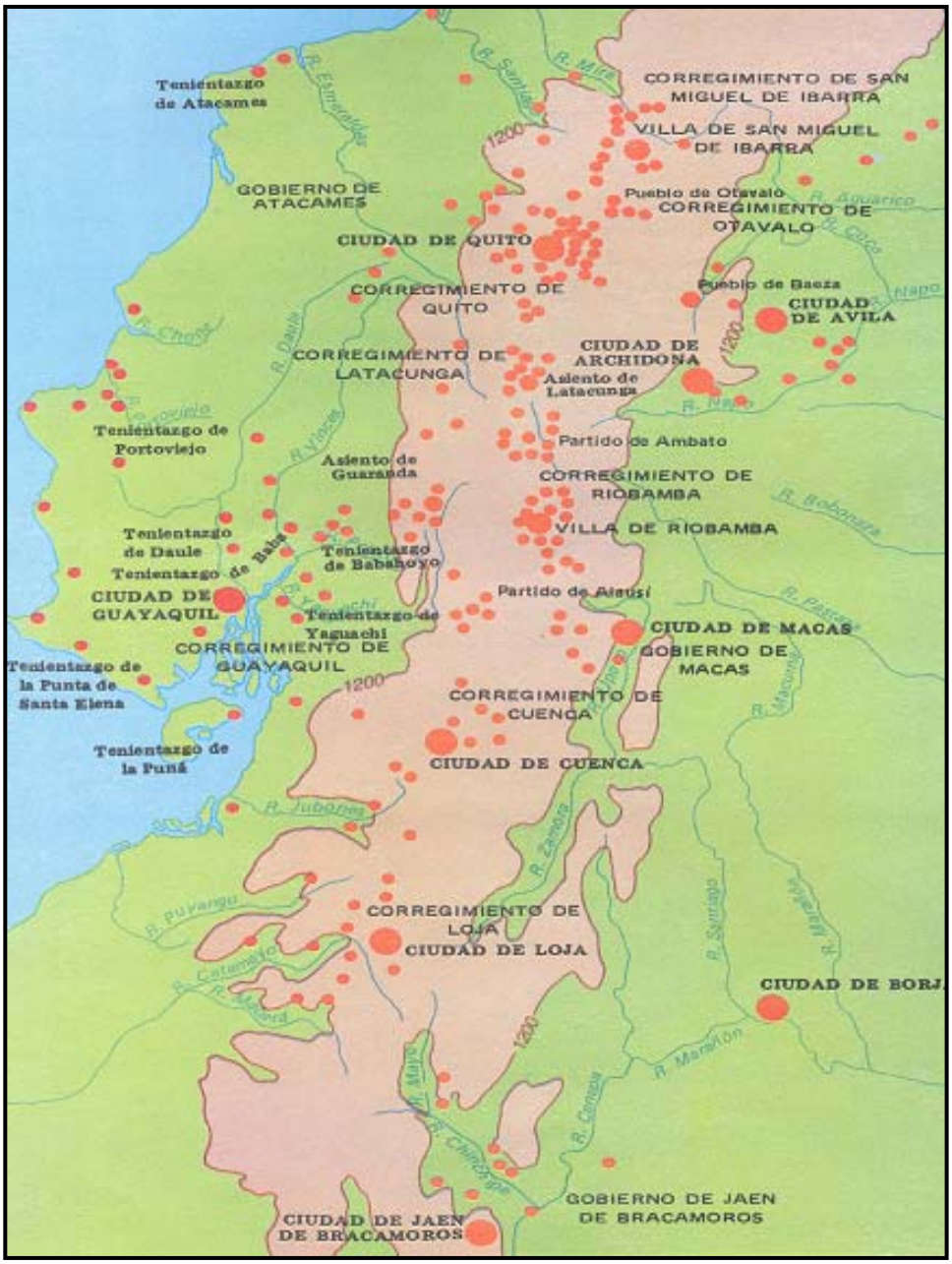


Figure 2. Map of three main geographical reasons of Ecuador - the coastal Pacific in the west, the Amazon in the the east and the Andean moun tains in the centre is marked with pink color (Gomez 1999). The Galapagos Islands are not included.

Market places

Marketplaces surveyed extended from Ibarra and Otovalo in the north, southward to Latchunga, Saquisalli, Pujjili, Ambato, Guamote, Riobamba, Puyo, Banos and Cuenca (Figure 1). Local buses were used as travelling means to reach all the marketplaces except for Cuenca. Each marketplace had a specific day when they were most busy. Fifteen marketplaces were surveyed during months of June, July and August of 2006. Only 13 are included in the study. Marketplaces in Banos and Calderon are excluded since no significant medicinal plant stalls were located. Among the sites studied, Cuenca was located the farthest south and Otovallo the farthest north (Figure 1).

Markets of Ecuador are dominated by the indigenous vendors. Qechuans with their colorful attire, especially the hats and ponchos, are seen in the markets. Different colors of the hats represent Qechuans of different regions. Among the markets visited, Guamote of southern Ecuador had the most visible number of Qechuans.

Market places were organized according to materials being sold. Two distinct types of plant vendors were represented in most markets. Food plant vendors only sold vegetables and fruits. Vendors selling cleansing plants also sold a wide variety of medicinal plants for a wide range of treatments. Fresh cleansing plants were purchased from the vendors, most of whom were women.

Interviews

An assessment of cleansing plants and their use was established through interviews. Twenty-two vendors (Twenty women and two men) and two indigenous informants were interviewed. Vendors were randomly chosen and questioned individually. The information provided by each vendor was validated in interviews with another vendor from the same or different marketplaces. Medicinal uses, local plant names and methods of preparation of cleansing plants were recorded in field notebooks.

Four cleansing ceremonies were observed and the author participated in one. The cleansing rituals observed were being performed on an adult and two female toddlers in the Ambato market. Personal participation at Santa Clara market provided more insights on the methods of cleansing rituals. Plants were purchased and collected .Photographs (prints) of collected fresh plants were taken along with the vendors and marketplaces.

The informants were asked the following sets of questions and their responses were recorded in the field notebook.

1. What are the plants used for cleansing?
2. What is the preparation method?
3. Are there additional (medicinal) uses of the cleansing plants?
4. Availability list of cleansing plants with each vendor.
5. Are there special plants used for cleansing for women and her child following childbirth?

Herbarium collection

Plants bought from the vendors were pressed and dried as voucher specimens. Three sets of voucher specimens were distributed among three universities: the herbarium at Catholic University, Quito (QCA), Ecuador; the herbarium of Marshall University (MUHW), and the herbarium at Missouri Botanical (MO) Garden. The informants or the plant vendors were paid for the plants and the information when interviews were complete.

Upon the completion of field research, the Flora of Ecuador (Jorgenson 1999) and herbarium collections at QCA were used for taxonomic identification of collected plants (Appendix A). Some plants could not be identified to species level and were sent to Missouri Botanical Garden for further identification. Personal observation, both in the field as well as in the QCA herbarium, indicates that all collected plants are of different species.

Review of the collected specimens

Older specimens deposited at QCA herbarium as well as the literature were reviewed to establish the validity of information gathered from the vendors as it relates to cleansing and other medicinal uses. Systematic surveys of marketplaces on cleansing plants did not seem to exist in the Quito herbarium. Further limited published studies deal with cleansing plants and with the methods of preparation. Ramon et al. (1988), Coral et al. (1992) and Kothari (1993) make mention of cleansing plants in their books but these

works are written in Spanish and thus, are not accessible to those who are unfamiliar with the Spanish language. Further, these studies do not provide voucher specimens for either herbarium or literature reviews. Additional uses, especially medicinal uses of each collected cleansing plants were recorded directly from vendors whenever possible or from literature mentioned above or from QCA herbarium specimens. QCA Specimens collected and described by A. Arguello (1982), L. Elleman (1988-1989) and J. Jarmillo (1983) further established the validity of the information given by the vendors on the use of collected plants.

Characterization of the marketplace flora

Origin and distribution of plants collected were obtained from The Vascular Flora of Ecuador (Jorgenson et al.1999). Geographical distribution of marketplace plants included the Andean, coastal, Amazonian and Galapagos region (Table 5). Origin of plants was determined according to their nativity, non-nativity or introduced status (Figure 9). Geographical distribution of plants helped determine plants from other regions being sold in the Andean markets.

Data analysis

Marketplace Comparison

In each marketplace, the list of available cleansing plants was recorded. The variation among the markets in terms of five most used cleansing plant families and plant species was determined using the binary system of Sokal and Sneath I of the SPSS system (Microsoft 2006). Cluster analysis showed which individual markets are similar and dissimilar on the basis of plant family and plant species present. Based on hierarchical cluster analysis, dendogram (Figure 11 and Figure 12), and coefficient of similarity (Table 2) were obtained showing how similar or dissimilar the marketplaces are on the basis of cleansing plant species and families present.

Intracultural Comparison

The Vascular Flora of Ecuador (Jorgenson et al. 1999) was used to determine if any of the cleansing plants are native to the four geographical regions. It was hypothesized that significant number of plants from Amazonia will be seen in the Andean marketplaces. Markets in the south such as Puyo, which is the gate way to the Amazon and also inhabited by lowland Qechuans, would have the highest number of Amazonian plant species and families used as cleansing plants.

Preferential Selection

To determine the importance of the cleansing plant families, Regression analysis developed by Moerman (1991) was used. Regression analysis helps to evaluate if certain families of the plants are preferentially selected by the vendors for cleansing ceremonies. Regression was calculated using Excel program (Microsoft 2003) in the computer. Y-values in the regression represented the number of species in families that are sold as cleansing plants and the x-values were the total number of species represented by the family in the total flora (Figure 10) recorded in The Vascular Flora of Ecuador (Jorgenson et al.1999).

Families were then ranked according to their decreasing residuals (Appendix F). Residual values reflect the proportion of cleansing plants used in a certain family. Negative residuals indicated underused families and the positive values suggested preferential selection (Moerman 1999). Residual value was calculated as the difference between the number of plants species predicted by the regression analysis and the actual number of plants recorded for cleansing ceremony throughout the study area. The predicted value is obtained using the following formulae:
Predicted value = Intercept + (Slope*Total of number of the family in the flora).
Where, intercept and slope is obtained from the linear regression line.

Following the method used by Moerman et al. (1999), Leonti et al. (2003) and Amiguet et al. (2006), only angiosperm families were used for the regression analysis in order to secure the comparability of the sets of data. Thus, the Podocarpaceae and

Cupressaceae (Gymnosperms) were not included in the analysis. Some of the plant families were combined: Amaryllidaceae or Iridaceae into Liliacea and Caesalpiniaceae into Fabaceae.

Ranking of the most used cleansing plants

To determine similarities and differences in ranking the most used cleansing plant family collected in this study with previous studies (Bailey 1999; Joyal 1987; and Rios 1991) done in Ecuador and other regions of the world (Treyvaud et al. 2006; Bourbonnais et al. 2005; Leonti et al. 2003) was considered.

Literature research for the top ranked families on their secondary compounds, uses and potential reasons for them being the most frequently used family was described. The preference ranking of plants based on sales volume could not be calculated since most vendors could not decide upon specific plant that sold the most.

CHAPTER III

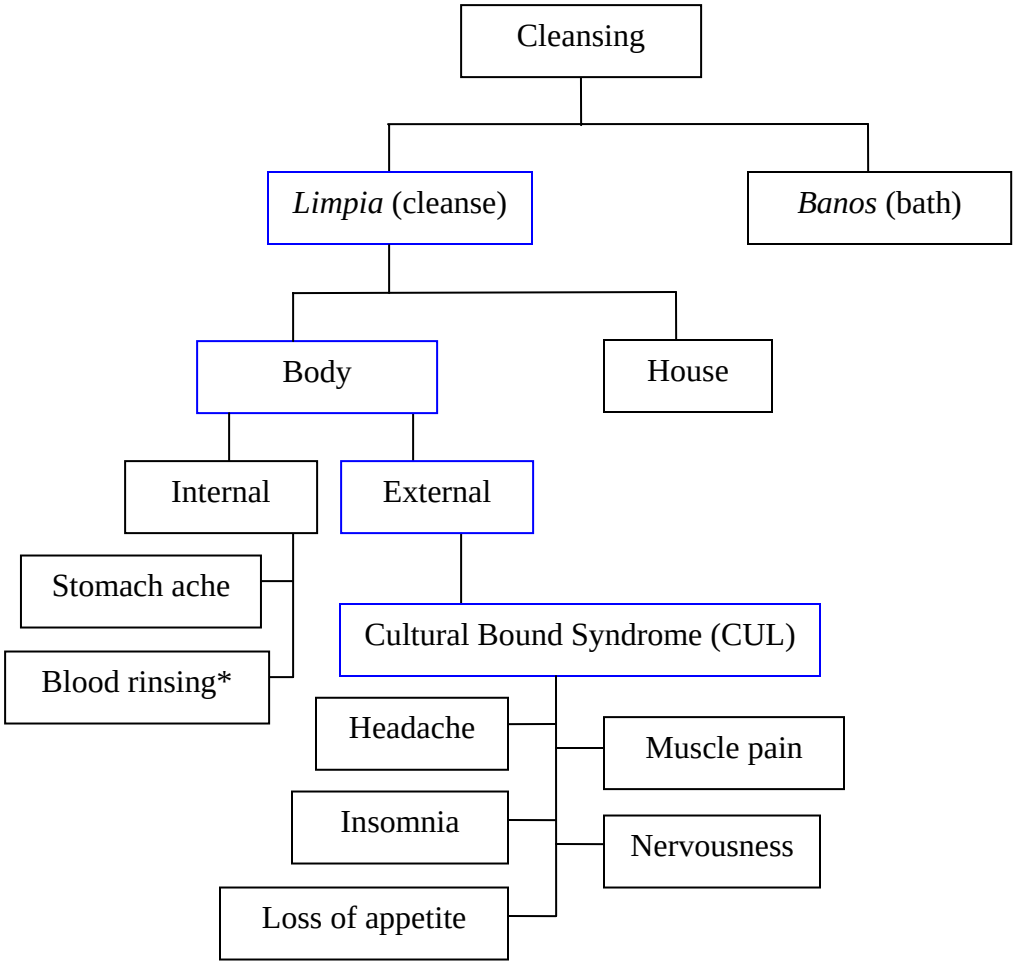
RESULTS AND DISCUSSION

Vendors referred to ceremonial cleansing as *limpia* (cleansing). Two types of *limpia* were reported: i) external cleansing and ii) internal cleansing (Figure). It must be noted that the ceremonial aspect of internal cleansing could not be established due to time limitation. According to the vendors, *limpia* could also be preformed through *banos* (bath). Since, we did not observe any ceremonial cleansing for *banos*, this study is limited to *limpia* only. Details on cleansing methods for *banos* and plants used are presented in Appendix B.

Results show that Qechuan Indians use cleansing plants for two purposes: 1) to cleanse the house and 2) to cleanse the body so that affliction caused by culture bound syndromes (CUL): *mal energia* (bad energy), *mal aire* (bad air), *susto* or *espanto* (fright) are cured. According to Mellado et al. (1996) defined CUL as illnesses whose signals and symptoms have multiple origins and their diagnosis and treatment are chosen from within specific cultural and symbolic contexts (Estomba et al. 2006). Definitions of each CUL encountered in this study are defined in Appendix C. Qechuans believe that these folk illnesses or CUL are caused by *mal espirtos* (bad spirits). Cleansing ceremonies are considered effective in treatment.

The plants used in ritual cleansing listed in Appendix A are categorized as *dulche* (sweet) and *amargo* (bitter) plants. Although no scientific reasons can be provided, it was affirmed by the vendors that sweet and bitter plants are categorized mostly because of their organoeleptic characteristics i.e. their sweet and bitter smell and taste. Plants like *Tanacetum parthenium* (L.) Sch. Bip (Santa Maria), *Ambrosia arborescens* Mill. (Marco) and *Ruta graveolens* L. (Ruda) are commonly mentioned bitter plants whereas *Melissa officinalis* L. (Tronjil), *Rosmarinus officinalis* L (Romero) and *Myrica parvifolia* Benth. (Laurel) are commonly called sweet plants. *Limpia* done using sweet plants are considered to please good spirits to bring good luck (Vilma Theresa and Chilinguinga Jimene, personal interview), good health and positive energy to an individual or to his/her family (Ramon et al. 1988). *Limpia* performed with bitter plants are used to evict *mal espiritos* (evil spirits) or *mal aire* or bad air (all vendors and informants, personal

interview). However, both bitter and sweet plants are combined in a single pack to for cleansing ceremonies.



* For women following a child birth

Figure 3. Hierarchy of ceremonial cleansing methods, Blue rectangle boxes represent the extent to which thesis is limited

Although the same species repeatedly occurred at the marketplaces, each market provided new species used for cleansing. There was no uniformity in cleansing pack. Each vendor had his or her own version of the packs with one or two species different than the other markets. There were no plant species that were restricted for only male or female (Bertha Yolunda, personal interview) use. On the other hand, several vendors mentioned certain cleansing plants selected only for women and her child following childbirth which is administered through *banos* (Appendix B). However, it must be noted that plants used for both mother and babies are normally used in regular cleansing packs as well.

Besides being valued for cleansing ceremonies, personal interviews, literature and herbarium reviews revealed that most cleansing plants were reported to have other medicinal uses. *Borago officinalis* L. (Borraja), a cleansing plant is also used to treat strong cold, disorderly menstruation, fever and diahrria (Cecilia de Torres 1973). *Aristequietia glutinosa* (Lam.) R.M. King & H. Rob (Matico) is used to cure stomach ulcer (A. Arguello 1982), skin infection, rheumatism and vaginal washes (Ramon et al. 1988). Similarly, *Peperomia peltigera* C. DC. (Patacon yuyu) and *Valerina microphylla* Kunth (valeriana) are drunk as tea against nervousness (Laura Dennis, personal interview).

I. **External Cleansing**

Cleansing the house (Limpiar de la casa)

Qechuans cleanse their houses with a mixture of sweet and bitter plants to get rid of evil spirits from their houses (Luis Valesco and Maria Lucrecia, personal interview) or to create an environment that would be protected from evil or negative influence (Ramon et al. 1988).

Method: The special pack of plants is used as broom (*escoba*) to sweep the house.

Cleansing the body

The pack of plants is used to cleanse the body of person afflicted with *susto, mal aire* and *mal energia*. The pack of plant used for the body is same as that used for cleansing the house. Vendors and informants emphasized that no water is used for *limpia* (Bertha Yolanda; Carmelo, personal interview).

Method: Most vendors and informants applied same method to cleanse a person. The basic application was to hit the bare skin of the person repeatedly with the pack of plants. An observation of a cleansing at Ambato marketplace is mentioned below in detail.

Cleansing an infant (10-12 months old) suffering from *Susto* (Figure.4)

- Two packs of plants were taken
- Strike the baby's body with the plant pack.
- Rub the plants to bare hands, back and the legs of the baby
- The vendor drank water from the bottle and blew it on the face and bare back of the baby.
- The vendor discarded the plants as waste.
- Finally, she rubbed the baby's face, bare back and legs with rose petals.

Figure 4. A Qechuan toddler being cleansed for *susto* at Ambato marketplace by a vendor. The father is holding the infant and the mother stands (on the left) watching the cleansing (Photo by Dr. Evans).

Cleansing of an adult (20-25 years old) suffering from *mal aire* (Figure 5 and 6)

- The patient was told to take off clothes from the upper part of the body.
- Two packs of plants were used to stike the front and back of the entire body repeatedly. Following the treatment, red spots were seen on the skin.
- Vendor then spit water on the patient's body and rubbed *Tanacetum parthenium* (L.) Sch. Bip (Santa Maria) and *Urtica Urens* L. (Ortiga) on the bare back, face and leg.
- The patient was told to spit on the plant pack that was used to treat him and the pack was thrown away as a waste.
- Vendor smoked a cigarette and blew the smoke on the face of the patient and a whole (intact) egg was rubbed over his body. The raw egg is believed to suck out any remaining affliction. The egg was thrown away as waste.

- Finally the vendor rubbed *Dianthus caryophyllus* L. (Claveles) perfume on the bare back, face and leg.

Figure 5. Vendor at Ambato marketplace using cleansing plants to treat an adult Qechuan for *mal aire* (Photo by Dr. Evans)

Figure 6. Vendor at the marketplace of Ambato using raw egg to suck out negative energy from a *mal aire* patient after the cleansing ceremony that used cleansing plants (Photo by Dr. Evans).

Following the *limpia* session, the vendor gave the patient *Bidens andicola* Kunth (Niachag) and *Melissa officinalis* L. (Tronjil) with instructions to drink it as tea several times in order to cure the nervousness brought about by *mal aire*. The cleansing process for both the infant and the adult took approximately 3-5 minutes each.

From personal participation at the Santa Clara market (Quito), it was concluded that the force with which vendors strike the susto patient is forceful enough to produce red patches on the skin that stings but is soothed afterwards with extracts of plants such as *Rosa sp.* (roses) and *Dianthus caryophyllus* L (Claveles) are applied. It is likely that the cleansing ritual is not simply a placebo effect but could be pharmacologically significant in actual treatment of ailments. It is possible that the plants when rubbed produced liquid (exposing more chemicals) which is absorbed through skin and thus, become effective in healing.

It is known that transdermal nicotine patches used to treat tobacco addiction, topical ointment used to cure headache (ex-Head On), sore muscles (ex-Icy Hot) are few

examples that are directly applied and absorbed by the skin. Discussion on herbal remedies use by Poarch Creek Indian reported the use of *Solanum carolinense* (teadash briar) fruits on toddlers and infants to alleviate teething pain and accompanying discomfort of runny nose (Alexander and Paredes 1998). Alexander and Paredes (1998) tentatively proposes that the string of beads hung around toddler's neck may indeed have functioned as a mild sedative and had other therapeutic effects through the mechanisms of skin absorption. A similar remedy is reported in Southern Black and North Carolinian Cherokee folk cultures respectively (Alexander and Paredes 1998).

Identical use of fruits of *Solanum caripense* Dunal (Chimbalo) shown in Figure 7 was reportedly used for cleansing among the Qechuan Indians for *mal energia* and *espanto* in infants (Sarah Aredia; Laura Dennis, personal interview). Both *Solanum carolinense* L. and *Solanum caripense* Dunal belong to Solanaceae (nightshade family) which is particularly rich in tropane alkaloids that are known to have physiological effects on humans. In the case of cleansing ceremony, it is also likely that cleansing is effective because of the skin stimulation that occurs due to pressure and friction of plants when the patient's bare body is struck.

Figure 7. Fruit of *Solanum caripense* Dunal (Chimbalo) strung on threads to be worn by children around their neck when afflicted by *susto* (Photo by Dr. Evans)

II. **Internal cleansing**

Vendors- Maria Esa, Esidero Sanchez and Blanca Ubidea and an informant- Bertha Yulanda, also emphasized internal cleansing as oppose to external cleansing. Internal cleansing meant taking cleansing plants as tea to cleanse internal body parts to cure stomach aches, diarriah and other ailments. Certain plants like *Spartium junceum* L. (Retama), *Amaranthus caudatus* L. (Ataco), *Taraxacum officinale* Weber (Taraxacum), *Equisetum gigantum* L.(Caballo), Grass species (*grama spp*.), *Plantago major* L. (plantain) and *Malva sylvestris* L. (Malva) are boiled together and drunk as tea for internal cleansing for women who recently gave birth to a child. Blanca Ubidea suggested using *Mathiola incana* (L.) R.Br. (Aleli), *Campyloneurum amphostenon* (Kunze ex Klotzsch) Fee (Calawala), *Papaver rhoes* L. (Amapola) and *Adiantum concinnum* Humb & Bonpl ex. Willd (Culantro de pozo) was useful as a tea to cleanse the blood.

This study illustrates that inspite of significant cultural changes Qechuans have experienced since the Spanish conquest in early 1500's, they still maintain their old tradition of *limpia* (cleansing) and use numerous plants for that purpose. The knowledge of cleansing is prevalent throughout the study area with minor variations in species of plants employed.

Characterization of the marketplace flora

A total of 101 species in 50 families of cleansing plants were recorded and identified (Appendix A). Among the collected specimens, 45 plants (44%) are identified to family and 95 plants (93%) to genus level. Eighty five percent of plants were identified to both genus and species, remaining 15% are sent to Missouri Botanical Garden Herbarium for further identification.

Plants were analyzed according to the most frequently reported and represented by vendors (Figure 8). Among these, the most frequently used families were Lamiaceae (15), Asteraceae (12), Solanaceae (6), Fabaceae (5), Piperaceae (5) and Rosaceae and Malvaceae 3 species each. The high use of plant families such as Lamiaceae, Asteraceae, and Fabaceae is not surprising given the fact that these families are common in the temperate regions worldwide. Tropical families Apocynaceae and Rubiacaea used for

medical purposes in many cultures of the world (Bennet et al. 2000) are not represented in cleansing plants.

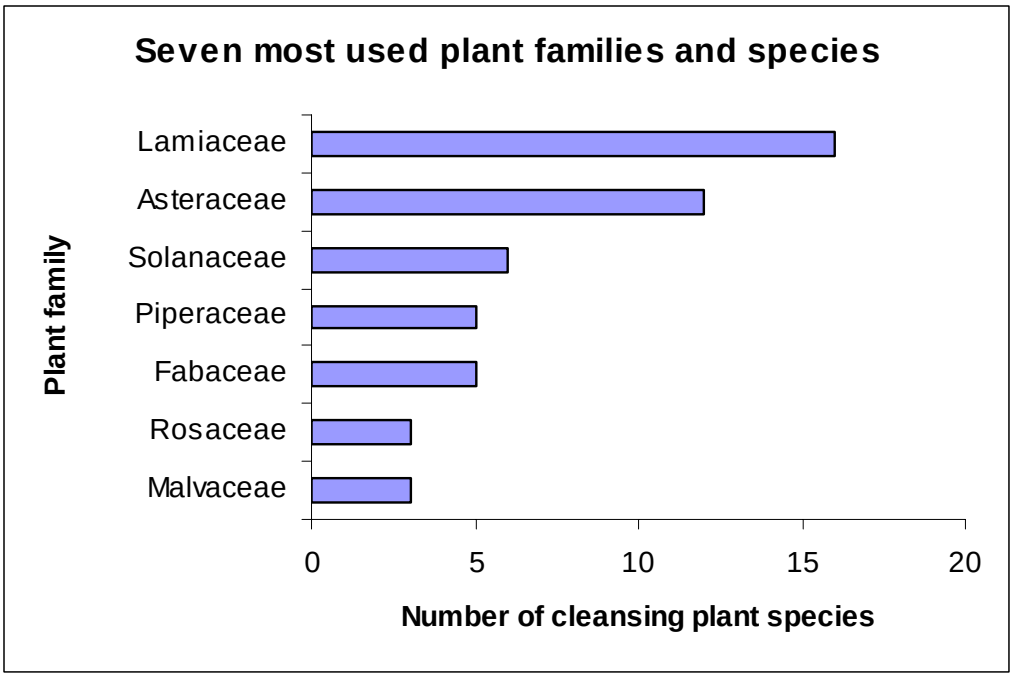


Figure 8. Most frequently used plant families among 101 collected cleansing plants.

The greatest numbers of plants were woody species (shrubs and trees) rather than herbs (Appendix D). Four species collected were epiphytes and five species were vines (Appendix D). Although new world tropics are rich in epiphytes (Bennet et al. 2000), only *Peperomia peltigera* C. DC , *Epidendrum sp.* , *Adiantum concinnum* Humb & Bonpl ex. Willd (Culantro de pozo), and *Campyloneurum amphostenon (Kunze ex Klotzsch) Fee* (Calawala) were used in cleansing. Interestingly, *Cuscuta foetida* Kunth (Ayamadeja) is the only parasitic plant mentioned by several vendors as a cleansing plant. Accessibility is likely to affect the utilization of plants (Wekerle et al. 2006; Treyvaud et al. 2005). The high use of herbs and shrubs is perhaps because they are quite accessible in the wild.

The number of species without an unknown region region is 16 (15.8%). Not considering the 16 species without a recorded region, 52 (52%) species were native, 27

(26.7%) species were introduced and 5 (4.9%) were endemic to Ecuador (Figure 9). The origin and life form of each species is included in Appendix D. Fifteen species are both introduced and cultivated while eight species are native to Ecuador and are cultivated (Figure 9). None of the endemic species are cultivated so they are most likely collected from the wild. Cultivation of the plants used in cleansing suggests the importance of these plants in the Andean pharmacopeia. The Andean region provided the highest number of native plants. This is not surprising since, out of 273 plant families, Andes supports 254 (93%) families that are native to Ecuador.

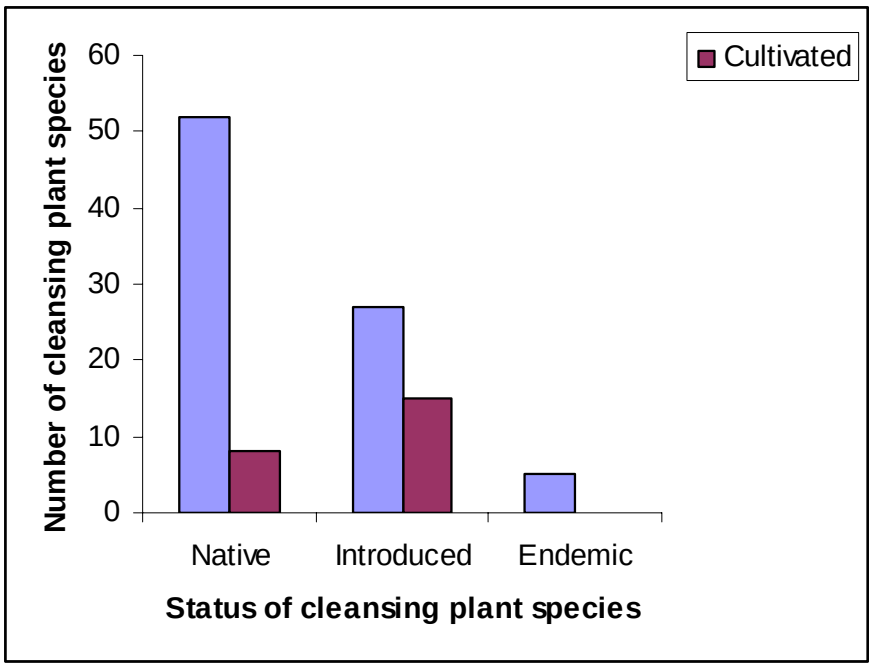


Figure 9. Number of reported cleansing plants and their status and origin.

Cleansing pack contained one or more of the following introduced species: *Cymbopogon citratus* (hierba Luisa), *Eucalyptus globulus* (Eucalipto), *Maticaria recutitta* (Manzanilla) and *Rosemarinus officinalis* (Rosemary). All of these species are aromatic in nature and are widely used for medicinal purposes. Widespread use of introduced species reflects the incorporation of plants from other culture into cleansing rituals. It is believed that the use of introduced species in many cultures is partly due to therapeutic values of those plants (Bennet et al. 2000).

The determination of the frequency of use is important in order to analyze the cohesiveness of the tradition and to further select ethonobotanically significant species for future studies (Amiguet et al. 2005). Over 53 % of the recorded cleansing plants were reported more than three times by the vendors. Appendix F includes the frequency with which a plant was reported included in the cleansing pack by the vendor. Table 1 illustrates only those plants that are mentioned 10 or more times by vendors. The most frequently mentioned plant was *Matricaria recutita* L. (Manzanilla) which was reported in 13 of 14 markets. Plant species- Aristequietia *glutinosa* (Lam.) R.M. King & H. Rob (Matico), *Aloysia triphylla* (L'He'r.) Britton (Cedron) and *Melissa officinalis* L. (Tronjil) were also named more than ten times by the vendors as cleansing plants (Table 1). All these species were always used in combination with other species mentioned in Appendix A for cleansing ritual.

Cleansing plants with high use frequency can be good candidates for investigation of photochemistry and pharmacological studies for alternative medicines. When information on plants collected were compared with the information on the herbarium specimens at QCA and literature researches, many cleansing plants were also found to be used as medicine for various ailments ranging from heart problems to skin diseases.

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Table 1. Cleansing plants that are mentioned ten or more times by the vendors and are most often included in the cleansing plant pack.

Plants	Frequency
Matricaria recutita	13
Cymbopogon citratos (DC. Stapf.	12
Melissa officinalis L.	12
Aristequietia glutinosa (Lam.) R.M. King & H. Rob	11
Aloysia triphylla	11
Ambrosia arborescens Mill	11
Rosmarinus officinalis L.	11
Ruta graveolens L.	11
Eucalyptus globulus Labill.	10
Malva sylvestris L.	10
Tanacetum parthenium	10
Peperomia inaequalifolia Ruiz and Pav.	10
Juglans Neotropica Diels	10
Peperomia galiodes Kunth	10

Preferential selection

The collection of 101 cleansing plants was classified into 40 families for the purpose of the present study (see method section). Fourty Ecuadorian plant families and their corresponding residual value are listed in Appendix F. Any plant family above the regression line with positive residual values are most preferred by the Qechuans than the families below the regression line and with higher negative residual values (Figure 10). Thus, families with the lowest residual value have the lowest level of usage.

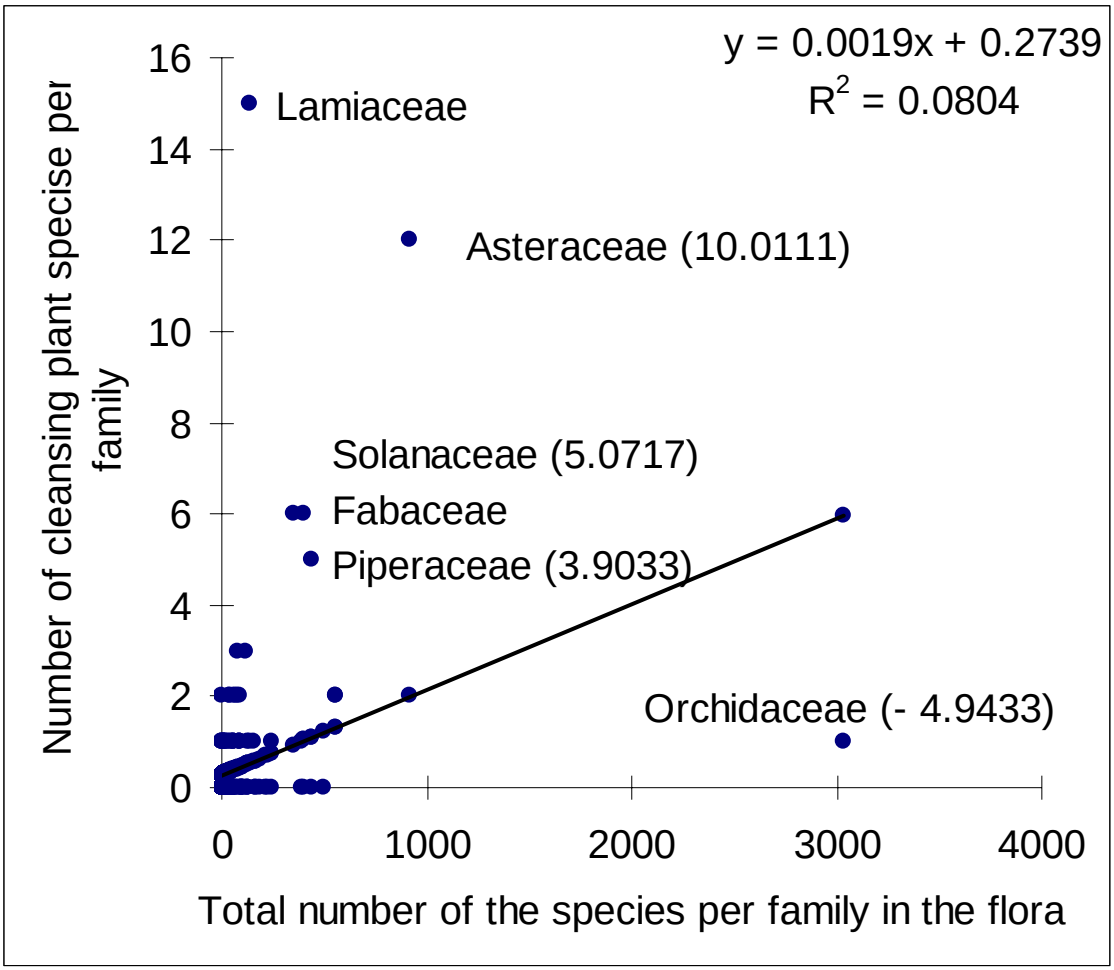

Figure 10. Regression analysis of the cleansing plant flora of Ecuador. X-axis, number of species per family in the flora; Y-axis, number of the cleansing plants per family

When plant families were classified directly based on the number of cleansing species per family, the top most frequently used families were (1). Lamiaceae (2). Asteraceae (3). Solanaceae (4). Fabaceae and (4). Piperaceae. According to the residuals of regression analysis (y = 0.0019x + 0.2739) of the cleansing flora, the top families used by the Qechuans are also ranked similar as the most frequently used plants (Figure 10).

Figure 10 shows the residual of most preferred families as follows: Lamiaceae (14.4757), Asteraceae (10.0111), Solanaceae (5.0717), Fabaceae (4.9725) and Piperaceae (3.9033). Lamiaceae, Asteraceae and Solanaceae remained in top three but, Piperaceae which was previously ranked fourth is ranked fifth according to residual of regression.

With the regression residual, change in ranking was expected but the top five families stayed in top except Piperaceae. The change in ranking was expected since regression analysis (Moerman 1991) takes in account the sizes of the plant families. This method highlights the importance of small families and reduces the impact of large families which might be expected to produce more medicinal plants (Amiguet et al. 2006).

These results differ from those obtained in other studies (Moerman 1999; Leonti et al. 2003), where they found that that the Asteraceae family ranked first in the medicinal usage whereas in the present study and the study by Bourbonnais et al. (2005), Asteraceae ranks second in the usage category. In addition, Piperaceae preferentially selected for cleansing ceremony is not the top ranking family in ethnobotanies of a study by Moerman et al.(1999) but, Piperaceae is among top five plants chosen in this and other studies (Bourbonnais et al. 2005; Amiguet et al. 2006; and Leonti et al. 2003).

In this study, 192 families displayed negative residual value above standard deviation (Standard error = 0.1) indicating that they were underselected for cleansing. Out of 230 families, Orchidaceae (-4.9433), Rubiaceae (-1.2052) Bromeliaceae (-1.0948), Araceae (-1.0275), Monimiaceae (-1.0013)) are five least preferred (not used as often as predicted). This result is similar to study done among Q'eqchi Mayans of southern Belize (Bourbonnais et al. 2005) and Veracruz, Mexico (Leonti et al. 2003) in which Orchidaceae was under selected. The Ecuadorian Andes supports 2322 species of orchids, the largest among the families represented, but, Orchidaceae contributed very little to the diversity of cleansing flora. Studies Bourbonnais et al. (2005) suggest that the reason for under selection of Orchidaceae is because of its inaccessibility due to its rare and epiphytic nature.

The regression analysis is highly significant (p - value < 0.005), but r^2 value is very low (0.080), which indicates that only 8 % of the variability can be explained. The low value of r^2 is probably due to the fact that the analysis was performed with a specific set of usages (cleansing) rather than the study of overall medicinal usages of plants. The r^2 in this study is similar to other r^2 value (obtained from other study that also focused on particular category of use of plants (Bourbonnais et al. 2005; Amiguet et al. 2006). This shows that variability is reduced when the particular categorical use of plants are studied

since the sample size of these studies are much limited than the sample sizes of the general medicinal flora studies.

Comparison of cleansing plant families

Marketplace Comparison

There is no definite pattern among the markets in the north and south in terms of availability of plant species. Marketplaces with species in common, clustered together (Figure 11). In terms of plant species, markets at Pujilli and Otovallo are the most similar (Figure 11). Pujilli and Otovallo paired together since both have the lowest number of plant species and families represented and therefore they contribute very little to the variation of marketplace flora (Table 3). Cuenca is the most disimilar of thirteen marketplaces (Figure 11). It must be noted that Cuenca is the southernmost study site and the last one to be surveyed (Figure 1). Thus, few of the new plants listed by the vendor could not be further validated with vendors of other markets.

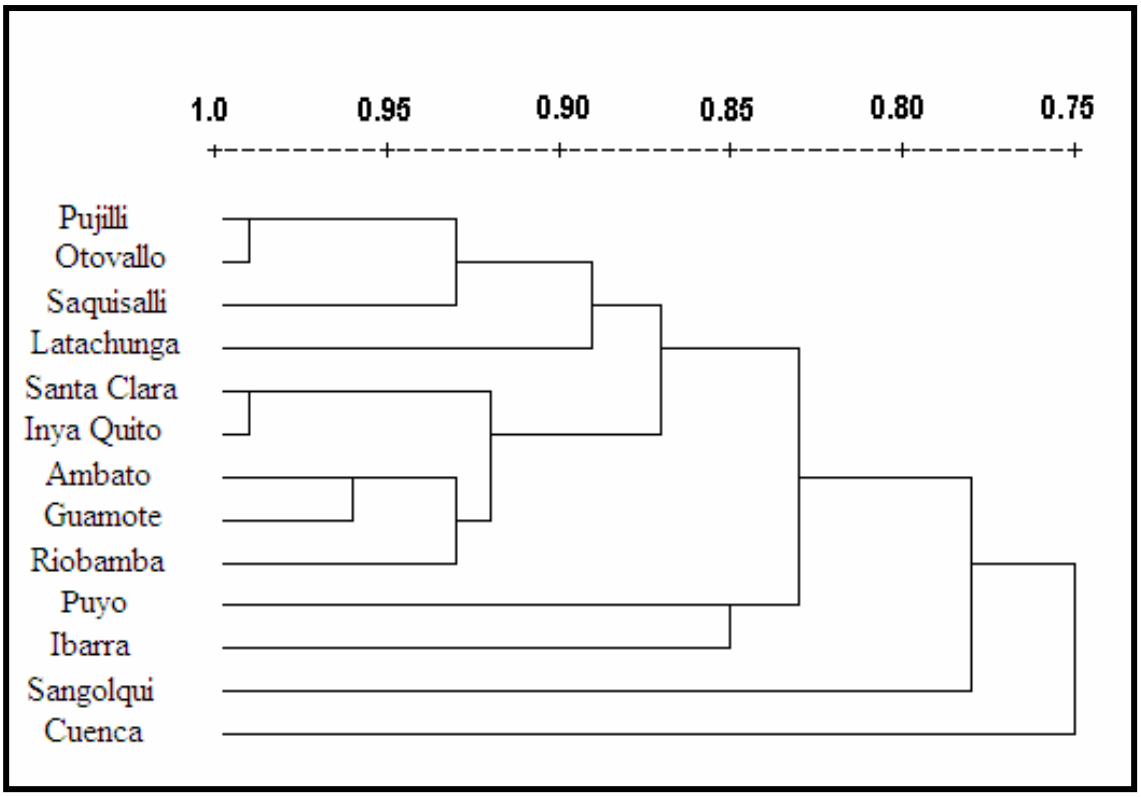

Figure 11. Dendogram showing the degree of plant species similarity of 13 marketplaces. Coefficient of similarity values extend from 1.0 to 0.75. Clusters closer to 1.0 are most floristically related and the clusters away from 1.0 represent least floristically related marketplaces

Pairing of Saquisali-Latachunga and Santa Clara - Inya Quito, Ambato, Riobamba and Guamote (Figure 11) can be explained by the closer geographical distance between them. Since market days are different for different markets, vendors from nearby markets could be selling plants from close by markets increasing their chances of higher trade. Geographical closeness of many of the marketplaces also suggests that plant species sold in these markets could have been obtained from the same source. Although Puyo is in the south and Ibarra is in the northern Andes (Figure 11), clustering between them suggests that similar cleansing plants are used throughout the study area which indicates a higher consensus of plant used for cleansing.

Coefficient of similarity (Table 2) further validated the information obtained from clustering. Pujilli and Otovallo are 92.1% similar, Santa Clara and Inya Quito are 91.5% similar and Guamote and Riobamba are 87.9% similar. Cuenca, the most dissimilar

market, is most related to Otovalo and least related to Sangolqui. Santa Clara, the first market studied in the south and with the highest number of plants species (Table 3), was least similar to Cuenca, the last market studied in the south. They shared 73.8 % of similar plant species (Table 2). Santa Clara also shared similar plant species with 5 marketplaces- Inya Quito (.915), Ambato (.868), Latachunga (.835), Sangolqui (.788) and Cuenca (.738). Affinities of these markets with Santa Clara are most likely because of Ambato from where these markets get most of their plant supplies (Personal interview with vendors). Previous studies by Bailey (1997) and Corporation of promotion Ecuador (2003) mention Ambato as the centre for plant trade. Input data of the cluster analysis are presented in Appendix E.

Table 2. Coefficient of similarity in terms of plant species between 13 markets. High coefficient value represents high similarity between the markets.

Cluster Combined		Coefficients of similarity
Cluster 1	**Cluster 2**	
Pujilli	Otovalo	.921
Santa Clara	Inya Quito	.915
Ambato	Guamote	.897
Ambato	Riobamba	.876
Pujilli	Saquisalli	.876
Santa Clara	Ambato	.868
Latachunga	Pujilli	.852
Santa Clara	Latachunga	.835
Puyo	Ibarra	.821
Sangolqui	Puyo	.804
Santa Clara	Sangolqui	.788
Santa Clara	Cuenca	.738

Table 3 shows the highest number of plant species present in Santa Clara (46) and Riobamba (44). However, the two markets do not show close affinities since plant

species at each are quite different. The two northern Andean markets surveyed- Otovalo and Ibarra, did not show close affinities. This is accounted by the fact that Ibarra had an organised marketplace with 10 plant stalls whereas Otovalo had only two stalls with less diversity (Table 3). This result deviates from previous study that mentions Otovalo as the third diverse marketplace (Bailey 1997; White 1985). Banos (not included in this study due to absence of plant vendors) and Otovalo were previously recorded by White (1985) as diverse marketplace with 20 to 50 different kinds of herbs either do not exist or have diminished. The few plant stalls and vendors in Otovalo and absence stalls in Banos are suggestive of the vanishing plant trade and usage among the indigenous Qechuans. Thus, there is a greater need for additional market studies of the herbs and the herbalists now more than ever.

Table 3. Number of cleansing plant species and families represented at thirteen marketplaces in Ecuador with the number of stall present in each market.

Marketplaces	Number of vendor stalls	Number of plant families	Number of plant species
Santa Clara	3	24	46
Inya Quito	8	20	38
Latachunga	5	20	36
Pujilli	3	8	16
Saquisalli	13	18	28
Sangolqui	7	21	31
Ambato	26	18	31
Puyo	1	22	31
Otovalo	2	12	17
Ibarra	10	24	36
Guamote	12	22	40
Riobamba	6	29	44
Cuenca	11	24	36

In terms of plant family represented, Saquisalli, Otovalo and Sangolqui are more similar than other market places (Figure 11).Guamote and Riobamba, Santa Clara and Inya Quito are clustered together both in terms of families and species of plants (Figure 11). Table 4 shows that these market sites are clustered due to similarities in number of plant families they share. For instance, Santa Clara represents eight and Inya Quito represents six Lamiaceae families. Inya Quito is dissimilar to Santa Clara in terms of Lamiaceae family, by only two plant species but, it is similar by six species (Table 4). Further, clustering of these markets can again be explained by the geographical closeness of the markets themselves.

The number of vending stalls is unrelated to the number of cleansing plant families and species available (Table 3). For example, Santa Clara (Quito) market with three vendor stalls provided 24 families and 46 species whereas, Ambato with 26 vendor stalls contributed 18 families and 31 species.

Table 4. Five most used plant families represented by 13 marketplaces.

Study Site	**Family**				
	Lamiaceae	Asteraceae	Solanaceae	Piperaceae	Fabaceae
Santa Clara	8	6	5	2	2
Inya Quito	6	6	4	0	2
Latachunga	4	5	4	3	0
Pujilli	3	5	2	2	0
Saquisalli	4	3	2	2	1
Sangolqui	0	4	0	3	2
Ambato	4	6	3	2	0
Puyo	2	7	2	0	0
Otovallo	3	3	0	2	0
Ibarra	5	8	1	2	1
Guamote	5	7	5	3	0
Riobamba	4	7	4	3	2
Cuenca	4	6	2	3	1

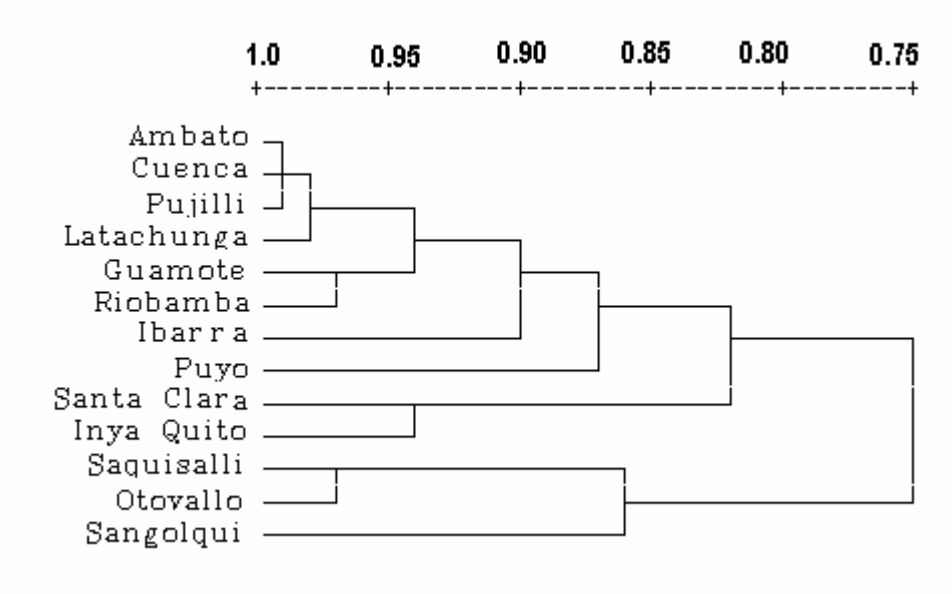

Figure 12. Dendogram showing the degree of plant families' similarity in 13 marketplaces. Coefficient of similarity values extend from 1.0 to 0.75. Clusters closer to 1.0 are most floristically related and the clusters away from 1.0 represent least floristically related marketplaces.

Intraclutural comparison

Since all study sites were in the Andean mountains, 63 or 62.5 % of the plants had Andean origin (Table 5). This is not surprising considering that
Andes has 9865 number of plant species, the greatest number of any Ecuadorian region (Jorgensen 1999). Eight species of cleansing plants are from the Andean-Amazonian region, 12 from the Andean-Coastal region and 11 from both the Andes and the Galapagos regions (Table 5). Thus, it can be suggested that the plants from other geographical regions of Ecuador are being incorporated in the ethnopharmacoepia of the Andean Qechuans.

Table 5. Number of cleansing plants found in different regions of Ecuador and their origin

Region	Andean	Amazonian	Coastal	Galapagos
Andean	63	8	12	11
Amazonian	8	1	1	5
Coastal	12	1	1	5
Galapagos	11	5	5	0

Although the contribution of Amazon on the cleansing plant species was expected to be higher, only 11 plants are from the area. The marketplace at Puyo is the closest in distance to the Amazon region, was expected to have more plant species originating from the Amazon region but that was not the case. Jorgenson et al. (1999) reported a comparison of species compositions in the four regions which revealed that Andes and Amazon have low levels of similar plant species. Out of 11 Amazonian plants, only *Aristolochia lagesiana* Ule (Saragosa) has strict Amazonian origin whereas *Piper aduncum* L. (Anisillo), *Equisetum gigantum* L. (Caballo), *Epidendrum sp.* (Flor de Christo) and *Cymbopogon citratos* DC. Stapf. (Hierba Luisa) are shared both by the Andes and the Amazon. This implies that the Amazonian plants though not in significant numbers, are still used as cleansing plants which reflects the intracultural exchange of plant knowledge among people from both regions.

Ranking of the most and least used cleansing plants

Five highly represented families of cleansing plants in this study are similar to rankings in studies done in Ecuador (Table 6). In the studies by Bailey (1997), Joyal (1989) and Rios (1991), Asteraceae and Fabaceae are ranked the first and second most used plant family, respectively, while no species of Piperaceae was recorded. Piperaceae family was not available for comparison from the Joyal's (1989) study, while in Bailey's (1997) study, Piperaceae was not ranked among the top 10 plants. This is likely due to the difference in the focus of this study (ceremonial cleansing plants) while the compared

studies focused on medicinal plants in general. This difference also reflects the preference of Piperaceae in cleansing rituals.

Table 6. Ranking of 5 most used plant families in Ecuador in the present study in comparision to four previous studies done in Ecuador based on number of plants used.

Family	Lamiaceae	Asteraceae	Solanaceae	Fabaceae	Piperaceae	**Total family**
Study	**Rank**					
Shrestha and Evans (2007)	1	2	3	5	4	45
Bailey and Evans (1997)	3	1	5	2	--	53
Joyal (1989)	4	1	3	2	--	94
Rios (1991)	3	1	2	--	2	46

In the present study, Lamiaceae and Asteraceae are ranked the first and second respectively, and Piperaceae is ranked fourth (Figure 8). This is not surprising since bioactive compounds of particular families of plants (Shultes and Raffauf 1990) have similar pharmacological action and are often represented in the pharmacopeias of various cultures. In this case, perhaps the pharmacological actions of the families make it so popular among the people of different locations in the Andes. Differences in family ranking reflect the focus of this study on cleansing plants as opposed to medicinal plants investigated by other studies. Five families with the highest number of plant species (Figure 8 and Appendix F) are described below:

Five most used plant families

Lamiaceae: Lamiaceae, the mint family, is ranked first in this study. Worldwide, Lamiaceae includes approximately 3,500 species and are known to contain essential oils, tannins, bitter diterpenoids and iridoid glycosides that have antimicrobial, antimycotic,

antiviral, anti-inflammatory and cholrectic properties (Leonti et al. 2003). Of the 15 Lamiaceae species collected, 12 are introduced**,** which reflects the inclusion of species non-native to the Andes or Ecuador used in the cleansing ceremony.

Asteraceae: Asteraceae, the sunflower family, is the second most frequently used family for cleansing. Worldwide, Asteraceae is the second largest plant family besides Orchidaceae and includes about 20,000 species worldwide (Schultes & Raffauf 1990). Asteraceae is phytochemically diverse with at least 7000 natural compounds such as sesquiterpene, lactones, diterpenes, phenols and polyenes (Leonti et al. 2003). These chemical constituents have been recorded to have a multitude of pharmacological activities including anti-inflammatory, cytotoxicitiy, bactericidal, fungicidal, and apetite-inducing properties (Leonti et al. 2003).

Solanaceae: Solanaceae, the nightshade family, is the third most frequently used family for cleansing. Solanaceae consists of genera rich in alkaloids rich in solanine and nicotine, both of which have physiological effects on humans.

Piperaceae: Use of five species of Piperaceae (Pepper family) makes it the fourth most used plant family along with Fabaceae. The Piperaceae are rich in monoteropenes, sesquiterpenes, phenylpropanes and amides with a variety of significant pharmacological effects recorded (Leonti et al. 2003). It is the tropical or subtropical family mainly composed of genera Piper and Peperomia. Parmar et al. (1997) reported that the alkaloids- piperine and kavapyrones of Piper show potent activity against nervous system (Bourbonnais et al. 2005). According to the studies done by Kretzschmar and Meyer (1969); Lee Shin and Woo (1984); Meyer (1962), Piper exhibits sedative, anticonvulsant activity and relaxing effects (Bourbonnais et al. 2005). It is possible that species of Piperaceae recorded in this study contributes similar effects.

Fabaceae: Fabaceae (bean family) includes approximately 13,000 species worldwide and is the second most economically important plant family besides Poaceae as food to

humans and live stocks (Schultes and Raffuaf 1990). Fabaceae species often contain polyphenoles (tannins and flavanoids) and triterpene saponins (Leonti et al. 2003).

The medical properties of the Asteraceae, Lamiaceae, Piperaceae, Solanaceae plants reflect the high reliance on therapeutic healing among the Qechuan Indians. According to Leonti et al. (2003), Asteraceae, Fabaceae and Lamiaceae are most frequently used because of the high diversity of secondary compounds, the taste and smell properties and distinctive plant morphology separate them organoleptically from the lesser used families such as Poaceae. Among the lesser used families such as the Orchidaceae exemplify problems in gathering epiphytic plant material and makes them unlikely candidates for medicinal plants.

Orchidaceae (Orchid family) and Rubiaceae (Coffee family) were two least selected plants in the present study. The Ecuadorian Andes supports 2,322 orchid species, the greatest number of any plant families but it is the least used family for cleansing purposes. *Epidendrum sp*. is the only orchid used in cleansing. This is probably because orchids are often rare, have relatively low scattered distributions and often inaccessible populations, which complicates the acquisition of plant material (Leonti et al. 2003). Although Rubiaceae is second least used species in this study (Appendix F), it is ranked as second most used species in the study done by Amiguet et al. (2006). However, it is underused (ranked 172 out of 174 species) in the study done by Leonti et al. (2003).

Although, Poaceae is ranked among the least used plants in previous studies, it ranked twenty fifth and was positively selected in this study (Appendix F). Only two species of Poaceae (grass family) are used for cleansing. *Cymbopogan citratus* (Heirba Luisa) is reported to be used for *limpia* and *grama* (Grass sp.) is used along with other plants for internal cleansing. *Cymbopogan citratus* is probably included because of its characteristic fragrance. *Cymbopogan* species are rich in essential oils such as citronellal and geraniol and are mostly used for gastrointestinal problems (Leonti et al. 2003). Although Poaceae is abundant (348 species) in Andean Ecuador, only one species (*grama*) is used. Poaceae are unlikely candidates to be selected because they have inconspicuous flowers or inflorescences and lack of aromatic compounds (Leonti et al. 2003).

Intercultural Comparison

Literature research show that use of ceremonial plants is not a phenomenon limited to Ecuador. Like the Qechuans, Chinese Shuhi indigenous people's concept of health and disease is related to various kinds of spirits, which are thought to be responsible for human illness (Weckerle et al. 2006). Plants like *Mahonia bracteolate*, *Rhamnus gilgiana* and *Sageretia pynophylla* were being used to drive ghosts out of the house and body (Weckerle et al. 2006).

Similarly, healers (*curanderos*) of the Nothern Peruvian Andes use *Burgmansia arborea* (Guanto) along with other *Burgmangia spp.* for *limpias* (De Feo, 2004). CUL, also related to spirit inflicted illnesses are treated using ritual healing plants among Mapuche people of northwestern Patagonia (Lozada et al. 2006) and Tzetal Maya of Mexico and Q'eqchi Mayans of Belize (Bourbonnais et al. 2006). Akli et al. (1999) found that Yucatec Mayans believe illness may be caused by "wind" (by bad air which enters a weak person's body). People were treated using ritual plants and, when necessary, the healer included a ritual cleansing ceremony known as *santigua* or *limpia* (Akli et al. 1999). Weckerle et al. (2003) recorded 20 ritual plants used by Shui. Q'eqchi Mayans were found to use 18 plant species (Amiguet et al. 2005) and the indigenous of Veracruz, Mexico used 127 plant species (Leonti et al. 2003). Qechuans seem to use by far the highest number of plant species (102) against culture bound syndromes (CUL).

CHAPTER IV

SUMMARY

1. Two types of ritual cleansing (*limpia*) methods were recorded: internal and external cleansing. Both methods employed dulce (sweet) and *amargos* (bitter) plants bundled in a pack. Qechuan Indians use cleansing plants for two purposes: i) to cleanse the house and ii) to cleanse the body so that affliction caused by culture bound syndromes (CUL) can be cured. *Mal aire* (bad air), *mal energia* (bad energy) and *susto* were prominent culture bound ailments treated.

The most basic way to cleanse was to strike the bare skin of the person repeatedly with the pack of plants. It is likely that the cleansing ritual is not simply a placebo effect but could be pharmacologically significant in actual treatment of ailments. It is possible that the plants when rubbed produced liquid (exposing more chemicals) which is absorbed through skin and thus, become effective in healing.

Inspite of significant cultural changes, Qechuans still maintain their old tradition of *limpia* (cleansing) and use numerous plants for that purpose. The knowledge of cleansing is prevalent throughout the study area with minor variations in species of plants employed.

2. One- hundred and one species from 50 plant families were reportedly used for cleansing. Among the collected specimens, 95 plants (93%) were identified to genus level. Eighty-five percent of plants were identified to both genus and species, remaining 15% were sent to Missouri Botanical Garden Herbarium for further identification.

3. Fifty- two (52%) species were native, 27 (26.7%) species were introduced and five (4.9%) were endemic to Ecuador. The Andean region provided the highest number of native plants. This is not surprising since, out of 273 plant families, Andes consist of 254 (93%) families that are native to Ecuador. Fifteen species are both introduced and cultivated while eight species are native to Ecuador and are cultivated. None of the endemic species are cultivated so they are most likely collected from the wild. Cultivation of the plants used in cleansing suggests the importance of these plants in the Andean pharmacopeia and the everyday use.

The greatest numbers of plants were woody (shrubs and trees) rather than herbs. Four species collected were epiphytes and five species were vines. *Cuscuta foetida* Kunth (Ayamadeja) is the only parasitic plant mentioned by several vendors as a cleansing plant. The high use of herbs and shrubs is likely because they are more accessible and are easier to reach.

Eight species of cleansing plants are from the Andean-Amazonian region. Out of 11 Amazonian plants, only *Aristolochia lagesiana* Ule (Saragosa) has strict Amazonian origin. This implies that the Amazonian plants though not in significant numbers are still used as cleansing plants which reflects the intracultural exchange of plant knowledge among people from both regions.

The most frequently used families are Lamiaceae (15), Asteraceae (12), Solanaceae (6), Fabaceae (5), Piperaceae (5) and Rosaceae and Malvaceae 3 species each. The high use of plant families such as Lamiaceae, Asteraceae, and Fabaceae is not surprising given the fact that these families are common in the temperate regions worldwide. Over 53 % of the recorded cleansing plants were reported more than three times by the vendors. The most frequently mentioned plant species was *Matricaria recutita* L. (Manzanilla) which was reported in 13 of 13 markets. Plant species: Aristequietia *glutinosa* (Lam.) R.M. King & H. Rob (Matico), Aloysia *triphylla* (L'He'r.) Britton (Cedron) and *Melissa officinalis* L. (Tronjil) were also mentioned more than 10 times by the vendors.

4. According to residual of RA, Lamiaceae (14.4757), was the most selected and Orchidaceae (- 4.9433) was the least selected family. With the regression residual, change in ranking was expected but the top five families stayed in top except Piperaceae. In this study, 192 families displayed a negative residual value above standard deviation (Standard error = 0.1) indicating that they were underselected for cleansing. The reason for under selection of Orchidaceae is likely because of its inaccessibility due to its rare and epiphytic nature.

5. There were no definite pattern among the markets in the north and south in terms of availability of plant species. Cluster analysis demonstrated that markets of Pujilli and Otovalo were the most floristically related while Cuenca was the least related of the 13. Pujilli and Otovallo paired together since both have the lowest number of plant

species and families represented and therefore they contribute very little to the variation of marketplace flora. The pairing of Saquisali-Latachunga and Santa Clara - Inya Quito, Ambato, Riobamba and Guamote can be partially explained by similarity in geographic location. Further, limited markets having the fewest species shared a similar flora despite being widely separated.

Previously reported markets having high number of plant species no longer exist or have greatly diminished. The few plant stalls and vendors in Otovalo and absence of stalls in Banos are suggestive of the vanishing plant trade and usage among the indigenous Qechuans. Thus, there is a greater need for additional market studies of the herbs and the herbalists now more than ever.

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APPENDIX

Appendix A: List of plants used for cleansing by the Qechuan Indians of Andean Ecuador, alphabetically by scientific name.

Collection #	Genus species and Authority	Family Name	Ethnic Name
614, 647	*Adiantum concinnum* Humb & Bonpl ex. Willd	Pteridiaceae	Culantro de pozo
650	*Alnus acuminata* Kunth	Betulaceae	Aliso
531, 566	*Aloysia triphylla* (L'He'r.) Britton	Verbenaceae	Cedron
604	*Alternanthera porrigens* (Jacq. Kuntz var. *porrigens*	Amaranthaceae	Moradilla
600	*Amaranthus caudatus* L.	Amaranthaceae	Ataco
504, 526	*Ambrosia arborescens* Mill	Asteraceae	Marco
652	*Anethum graveolens* L.	Apiaceae	Eneldo
508, 564	*Aristequietia glutinosa* (Lam.) R.M. King & H. Rob	Asteraceae	Matico
631	*Aristolochia lagesiana* Ule Liana	Aristolochiaceae	Saragosa
606, 617	*Arracacia elata* H. Wolff	Apiaceae	Noria Blanca/ Oja de Zanahoria
569	*Artemisia absinthium L.*	Asteraceae	Ajenco
505, 512, 524	*Baccharis latifolia* Kunth	Asteraceae	Chilca
642	*Banisteriopsis caapi* (Spruce ex. Griseb) C.V. Mortan	Malpighiaceae	Ayahuasca
613	*Bidens andicola* Kunth	Asteraceae	Nachag
603	*Borago officinalis* L.	Boraginaceae	Borraja
537, 589	*Brachyotum ledifolium* (Desr.) Triana	Melastomataceae	Colca/Pucachuglla
570, 586	*Brugmansia arborea* (L.) Lagerh	Solanaceae	Floripindio
525	*Brugmansia sanguinea* (Ruiz & Pav.) D. Don	Solanaceae	Guanto
619	*Campyloneurum amphostenon (Kunze ex Klotzsch) Fee*	Polypodiaceae	Calawala
539, 549 550	*Cestrum auriculatum* L'He'r	Solanaceae	Sauco negra
654	*Cestrum Peruvianum* Willd. Ex Roem & Schult	Solanaceae	Sauco
534, 584	*Chenopodium ambrosiodes* L.	Chenopodiaceae	Paico
523	*Citrus maxima* (Rumph. & Burm.) Merr.	Rutaceae	Oja de Naranja
649	*Clinopodium brownei* (Sw.) Kuntze	Lamiaceae	Huarmi polea
643	*Coriaria ruscifolia* L.	Coriariaceae	Shanshi
625	*Croton menthodorus* Benth	Euphorbiaceae	Mosquera
516	*Cupressus sp.*	Cupressaceae	Cipres
555	*Cuscuta foetida* Kunth	Cuscutaceae	Aya madeja

571, 585	*Cymbopogon citratos* (DC. Stapf.	Poaceae	Herba Luisa
510	*Dalea coerulea* (L.f) Schinz & Thell	Fabaceae	Iso
609. 641	*Desmodium molliculum* (Kumth) D.C	Fabaceae	Hierba del infante
514, 556	*Dianthus caryophyllus* L.	Caryophyllaceae	Claveles
648	*Epidendrum sp.* (*Epidendrum anceps*?)	Orchidaceae	Flor de Christo
605	*Equisetum gigantum* L.	Equisetaceae	Caballo
511, 532	*Eucalyptus globulus* Labill.	Myrtaceae	Eucalipto
644	*Eupatorium sp.*	Asteraceae	Unknown
621	*Ficus carica* L.	Moraceae	Oja de Higo
575	*Juglans Neotropica* Diels	Juglandaceae	Nogal
622	*Lamourouxia virgata* Kunth	Scrophulariaceae	Sojo yuyu/ Soldilla
624	*Lepechinia paniculata* (Kunth) Epling	Lamiaceae	Matico
591	*Liabum igniarum (Kunth) Less.*	Asteraceae	Santa Maria de Monte
634	*Lupinus pubescens* Benth	Fabaceae	Alverjilla/ Aya Chocho
658	*Malva sp.*	Malvaceae	Malva
521, 544	*Malva sylvestris* L.	Malvaceae	Malva
527, 618	*Mathiola incana* (L.) R.Br.	Brassicaceae	Aleli
509	*Matricaria recutita* L.	Asteraceae	Manzanilla
632	*Maytenus Krukovii* A.C. Smith	Celastraceae	Chugchuguaso/ Chuchuhuashu
542, 580	*Melissa officinalis* L.	Lamiaceae	Tronjil
611, 628	*Mentha spicata* L.	Lamiaceae	Heirba Buena
629	*Menthochytis sp*.	Lamiaceae	Unknown
594, 639	*Miconia crocea* (Desr.) Naudin	Melastomataceae	Colca
612, 640	*Minthostachys mollis* (Kunth Griseb	Lamiaceae	Tipo
536	*Monnina obtusifolia* Kunth	Polygalaceae	Bilin
576	*Morgyricarpus pinnatus* (Lam. Kuntze	Rosaceae	Piqui yuyu
633	*Muehlenbekia tamnifolia* (Kunth	Polygonaceae	Moilang
582	*Myrica parvifolia* Benth.	Myricaceae	Laurel
538, 592, 610	*Myrica pubescens* Humb & Bonpl ex. Willd	Myricaceae	Laurel de Monte
515, 518	*Myricanthus halli* (O. Berg)	Myrtaceae	Arrayan

	Mc Vaugh		
513	*Ocimum basilicum L.*	Lamiaceae	Albahaca
627	*Oenothera lacinata* Kunth	Onagraceae	Platanillo/Shullo
565	*Oreganum vulgare* L.	Lamiaceae	Oregano
574	*Oreopanax ecuadoensis* Seem.	Araliaceae	Puma maqui
579	*Origanum majorana x vulgare* Comb.	Lamiaceae	Mejorana
520, 651	*Otholobium mexicanum* (L.f.) J.W. Grimes	Fabaceae	Trinitarea/ Huashua
620	*Papaver rhoes* L.	Papaveraceae	Amapola
558	*Peperomia galiodes* Kunth	Piperaceae	Tigrecillo
559	*Peperomia inaequalifolia* Ruiz and Pav.	Piperaceae	Congona
540	*Peperomia peltigera* C. DC.	Piperaceae	Patacun yuyu
657	*Phusia hybrida* hort. Ex. Siebert	Onagraceae	Phusia
646	*Piper aduncum* L.	Piperaceae	Anisillo
530, 590	*Piper barbatum* Kunth.	Piperaceae	Luto
546	*Plantago major* L.	Plantaginaceae	Llanten
638	*Podocarpus oleifolius* D. Don ex Lamb	Podocarpaceae	Olivo/ Romerillo
568	*Rosa sp.*	Rosaceae	Rosa
533, 563	*Rosmarinus officinalis* L.	Lamiaceae	Romero
500, 522, 567	*Ruta graveolens* L.	Rutaceae	Ruda
656	*Salvia corrugata* Vahl.	Lamiaceae	Unknown
517	*Salvia leucantha*	Lamiaceae	Lavanda
581	*Salvia sagittata Ruiz & Pav.*	Lamiaceae	Salvia real
655	*Salvia sp.*	Lamiaceae	Unknown
626	*Sanguisorba minor* Scop.	Rosaceae	Pimpinella
529	*Senna multiglandulosa* (Jacq.) H.S. Irwin & Barneby	Caesalpiniaceae	Chin Chin
593	*Sida sp. (Sida poeppigiana?)*	Malvaceae	Escubilla/ Escoba
519, 562	*Solanum caripense* Dunal	Solanaceae	Chimbalo
545	*Solanum nigrum* L.	Solanaceae	Hierba mora
615	*Sonchus asper* (L.) Hill	Asteraceae	Casha Cerraja
597	*Spartium junceum* L.	Fabaceae	Retama
557, 578	*Stellaria media*	Caryophyllaceae	Huarmimasi
507, 535, 561	*Tagetes zipaquirensis* Bonpl	Asteraceae	Roja de muerto/ Soroyuyu

501	*Tanacetum parthenium* (L.) Sch. Bip	Asteraceae	Santa Maria
601	*Taraxacum officinale* Weber	Asteraceae	Taraxaco
623	*Tropalium tubersom Ruiz & Pav.*	Tropaeloceae	Mashua
551, 553	Unknown sp.	Iridaceae/ Amaryllidaceae	Bara de muestilla
572, 577	Unknown sp.	Lamaiceae	Menta
548	Unknown sp.	Unknown	Miling
552	Unknown sp.	Unknown	Querendona
547	Unknown sp.	Unknown	Rosita de castilla
543, 554	Unknown sp.	Unknown	Medio yuyu
607	Unknown sp	Poaceae	Grama
503, 506, 528, 596	*Urtica Urens* L.	Urticaceae	Ortiga
541, 645	*Valerina microphylla* Kunth	Valerianaceae	Valerina

Appendix B. Methods for banos (bath) and plants used for mother and new born infant

Banos and internal cleansing does not seem to require special ceremonies. However, vendors still classify *banos* and internal cleansing as "*limpia*".

***Banos* (bath)**

Quechan Indians were observed to use *Banos* (bath) either to treat culture bound syndromes (CUL) or physical ailments that can be either the symptoms of CUL or just purely physical ailments. The concept of *Banos* is similar to phototherapy or even hydrotherapy. Baths are taken either solely using sweet plants or bitter plants or in combination with both types of plants. Most often, sweet plants are used to take sweet bath and to cure symptoms that could be but not always related to CUL.

Sweet and bitter plants for bath

Matricaria recutita L. (Manzanilla), *Melissa officinalis* L. (Tronjil), *Aloysia triphylla* (L'He'r.) Britton (Cedron), *Oreganum vulgare* L. (Oregano), *Citrus maxima* (Rumph. & Burm.) Merr. (Oja de naranja) (Bertha Yolanda; Estes, personal interview) and, *Eucalyptus globulus* Labill. (Eucalipto), *Cymbopogon citratos* DC. Stapf. (Hierba luisa) (Luis Valesco, personal interview) is used for respiration problems or to treat cough, cold and flu along with CUL. Bath with sweet plants is believed to bring good luck (Vilma Theresa Chilinguinga). Similarly, bitter plants like *Solanum nigrum* L. (Hierba mora), *Cestrum auriculatum* L'He'r and *Cestrum Peruvianum* Willd. Ex Roem & Schult (Sauco), and *Aristequietia glutinosa* (Lam.) R.M. King & H. Rob (Matico) is used to treat sore muscles (Laura Dennis, Unknown vendor, personal interview), and nervousness (Laura Dennis, personal interview).

At least one informant (Bertha Yolunda) mentioned plants used in bath by elderly to get rid of physical pain such as muscle spasms and bone pains (most likely rheumatism). Following are brief discussion on cleansing methods.

Method: The most frequently cited modes of preparation for *banos* was decoctions (boiling of plant parts) or simply placing plant parts into the warm water and taking a bath. For detail use of each plant and methods of preparation see Appendix. So, for both

bath and cleansing, method of administration was very similar with only slight variations discussed earlier.

Plants for mothers and new born infant

Plants like *Oreopanax ecuadoensis* Seem. (Puma maqui), *Brachyotum ledifolium* (Desr.) Triana (Colca), *Peperomia peltigera* C. DC. (Patacun yuyu), *Ocimum basilicum L.* (Albahaca), *Peperomia galiodes* Kunth (Tigrecillo) are used for a bath by a women following childbirth (Bertha Yolanda, personal interview). *Ruta graveolens* L (Ruda), *Peperomia inaequalifolia* Ruiz and Pav. (Congona) (Marisol, personal interview), *Juglans Neotropica* Diels (Nogal), *Rosmarinus officinalis* L. (Romero) (Blanca Ubidea, Luis Valesco), Unknown sp. (Medio yuyo), *Cuscuta foetida* Kunth (Ayamadeja) (Bertha Yolunda, personal interview) are used for bathing new born child so that mal aire or espanto will not effect him or her (Blanca Ubidea, personal interview). Detail studies must be done to record plants used specifically for women and her newborn since time limitation did not allow me to pursue this topic. However, it must be noted that plants used for both mother and babies are normally used in regular cleansing pack as well.

Appendix C: Descriptions of culture-bound syndromes used in this study.

Susto: *Susto* comes from Spanish word “fright”. It is believed to be caused by sudden frightening events (Treyvaud et al. 2005; Bourbonnais et al. 2006). Susto patients are believed to have his or her soul separated from the body (Bourbonnais et al. 2006). According to the Diagnostic and Statistical Manuel of Mental disorders (DSM-IV-TR), certain forms of posttraumatic disorders and acute stress disorders are related to symptoms of susto patients which includes depression, inactiveness, detachment from others and insomnia. Other symptoms include nervousness, anorexia, insomnia, headache and diarrhea, involuntary muscle tics (DSM-IV-TR; wilkipedia). Children and infants are supposed to be afflicted by susto more than the adults (Treyvaud et al. 2005; Bourbonnais et al. 2006). However, in our study we found adult susto patients were cleansed as well.

Espanto: In Spanish, *espanto* means terror or intense fright. *Espanto* is believed to be the severe form of susto (wilkipedia). The fright in infants and children that causes *espanto* is believed to be brought about by noises, shouts, and thunders. Symptoms include fever, diarrhea, and appetite loss (Ramon et al. 1988). Terms *espanto* and *susto* are used interchangeably (Coral et al 1992; personal interview with vendors)

Mal aire: In Spanish *mal aire* literally means “bad air”. According to the vendors and informants, *mal aire* could bring bad luck to the house and could make people sick and tired. *Mal aire* has similar characteristics as *mal energia* and *susto*.

Mal energia: In Spanish mal energia means “bad energy”. Bad energy or negative energy has similar characteristics as *mal aire* and *susto*.

Appendix D: Life form, origin and the regions the cleansing plants are found in Ecuador, alphabetically by scientific name.

Genus species and Authority	**Life form**	**Origin**	**Region**
Adiantum concinnum Humb & Bonpl ex. Willd	Epiphytic herb	Native	Galapagos/ Coastal/ Andean
Alnus acuminata Kunth	Woody	Native	Andean
Aloysia triphylla (L'He'r.) Britton	Woody	Cultivated	Andean
Alternanthera porrigens (Jacq. Kuntz var. *porrigens*	Woody	Native	Andean
Amaranthus caudatus L.	Herb	Native/cultivated	Andean
Ambrosia arborescens Mill	Woody	Native	Andean
Anethum graveolens L.	Herb	Introduced/cultivated	Andean
Aristequietia glutinosa (Lam.) R.M. King & H. Rob	Woody	Endemic	Andean
Aristolochia lagesiana Ule Liana	Woody vine	Native	Amazonian
Arracacia elata H. Wolff	Herb	Native	Andean
Artemisia absinthium L.	Woody	Introduced	Andean
Baccharis latifolia Kunth	Woody	Native	Andean
Banisteriopsis caapi (Spruce ex. Griseb) C.V. Mortan	Woody Vine	Native/Cultivated	Coastal/ Amazonian
Bara de muestillia	Herb	Unknown	Unknown
Bidens andicola Kunth	Herb	Native	Andean
Borago officinalis L.	Herb	Introduced/cultivated	Andean
Brachyotum ledifolium (Desr.) Triana	Woody	Native	Andean
Brugmansia arborea (L.) Lagerh	Woody	Native	Andean
Brugmansia sanguinea (Ruiz & Pav.) D. Don	Woody	Native/cultivated	Andean/Amazonian
Campyloneurum amphostenon (Kunze ex Klotzsch) Fee	Epiphyte	Native	Galapagos/Andean
Cestrum auriculatum L'He'r	Woody	Native	Coastal/Andean
Cestrum Peruvianum Willd. Ex Roem & Schult	Woody	Native	Andean

Genus species and Authority	**Life form**	**Origin**	**Region**
Chenopodium ambrosiodes L.	Herb	Introduced/cultivated	Galapagos/ Andean/ Amazonian
Citrus maxima (Rumph. & Burm.) Merr.	Woody	Introduced/cultivated	Galapagos/ Andean/ Amazonian/ Coastal
Clinopodium brownei (Sw.) Kuntze	Herb	Native	Andean
Coriaria ruscifolia L.	Woody	Native	Andean
Croton menthodorus Benth	Woody	Endemic	Andean
Cupressus sp.	Woody	Unknown	Unknown
Cuscuta foetida Kunth	Herb Parasitic vine	Native	Coastal/Andean
Cymbopogon citratos (DC. Stapf.	Herb	Introduced/cultivated	Galapagos/ Andean/ Coastal Amazonian
Dalea coerulea (L.f) Schinz & Thell	Woody	Native	Andean
Desmodium molliculum (Kumth) D.C	Herb Vine	Native	Andean
Dianthus caryophyllus L.	Herb	Cultivated	Coastal/Andean
Epidendrum sp. (*Epidendrum anceps*?)	Epiphytic	Native	Coastal/ Andean/ Amazonian
Equisetum gigantum L.	Herb	Native	Coastal/ Andean/ Amazonian
Eucalyptus globulus Labill.	Woody	Introduced/cultivated	Coastal/Andean
Eupatorium sp.	Woody	Unknown	Unknown
Ficus carica L.	Woody	Introduced/cultivated	Galapagos/ Coastal/ Andean
Grama	Herb	Unknow	Unknown
Juglans Neotropica Diels	Woody	Native/cultivated	Galapagos/Andean
Lamourouxia virgata Kunth	Herb	Introduced	Andean
Lepechinia paniculata (Kunth) Epling	Woody	Endemic	Andean
Liabum igniarum (Kunth) Less.	Woody	Native	Andean
Lupinus pubescens Benth	Woody	Native	Andean

Genus species and Authority	Life form	Origin	Region
Malva sp.	Woody	Unknown	Unknown
Malva sylvestris L.	Herb	Introduced/cultivated	Andean
Mathiola incana (L.) R.Br.	Herb	Introduced/cultivated	Andean
Matricaria recutita L.	Herb	Introduced/cultivated	Andean
Maytenus Krukovii A.C. Smith	Woody	Native	Unknown
Medio yuyu	Herb	Unknown	Unknown
Melissa officinalis L.	Herb	Cultivated	Andean
Mentha	Herb	Unknown	Unknown
Mentha spicata L.	Herb	Introduced	Unknown
Menthochytis sp.	Woody	Unknown	Unknown
Miconia crocea (Desr.) Naudin	Woody	Native	Andean
Miling	Unknown	Unknown	Unknown
Minthostachys mollis (Kunth Griseb	Herb	Native	Andean
Monnina obtusifolia Kunth	Woody	Native	Andean
Morgyricarpus pinnatus (Lam. Kuntze	Woody	Native	Andean
Muehlenbekia tamnifolia (Kunth	Woody	Native	Andean
Myrica parvifolia Benth.	Woody	Native	Andean
Myrica pubescens Humb & Bonpl ex. Willd	Woody	Native	Andean
Myricanthus halli (O. Berg) Mc Vaugh	Woody	Native/cultivated	Andean
Ocimum basilicum L.	Herb	Introduced/cultivated	Coastal
Oenothera lacinata Kunth	Herb	Native	Andean
Oreopanax ecuadoensis Seem.	Woody	Endemic	Andean
Origanum majorana x vulgare Comb.	Herb	Introduced/Cultivated	Andean
Origanum vulgare L.	Herb	Introduced/Cultivated	Andean
Otholobium mexicanum (L.f.) J.W. Grimes	Woody	Native	Andean
Papaver rhoes L.	Herb	Introduced	Andean
Peperomia galiodes Kunth	Herb	Native	Galapagos/Andean

Genus species and Authority	**Life form**	**Origin**	**Region**
Peperomia inaequalifolia Ruiz and Pav.	Herb	Native/cultivated	Andean
Peperomia peltigera C. DC.	Epiphytic herb	Native/cultivated	Andean
Phusia hybrida hort. Ex. Siebert	Woody	Introduced/cultivated	Andean
Piper aduncum L.	Woody	Native/cultivated	Galapagos/ Andean/ Coastal Amazonian
Piper barbatum Kunth.	Woody	Native	Andean
Plantago major L.	Herb	Introduced	Galapagos/Andean/ Amazonian
Podocarpus oleifolius D. Don ex Lamb	Woody	Native	Andean
Querendona	Herb	Unknown	Unknown
Rosa sp.	Woody	Unknown	Unknown
Rosita de castilla	woody	Unknown	Unknown
Rosmarinus officinalis L.	Woody	Introduced/ Cultivated	Andean
Ruta graveolens L.	Woody	Introduced	Andean
Salvia corrugata Vahl.	Woody	Native	Andean
Salvia leucantha	Woody	Introduced	Unknown
Salvia sagittata Ruiz & Pav.	Herb	Native	Andean
Salvia sp.	Woody	Unknown	Unknown
Sanguisorba minor Scop.	Woody	Native	Andean
Senna multiglandulosa (Jacq.) H.S. Irwin & Barneby	Woody	Native	Andean
Sida sp. (Sida poeppigiana?)	Woody	Unknown	Unknown
Solanum caripense Dunal	Herb/Vine	Native	Andean
Solanum nigrum L.	Herb	Endemic	Andean
Sonchus asper (L.) Hill	Herb	Introduced	Andean
Spartium junceum L.	Woody	Introduced	Andean
Stellaria media	Herb	Native	Galapagos/Andean
Tagetes zipaquirensis Bonpl	Herb	Native	Andean
Tanacetum parthenium (L.) Sch. Bip	Herb	Introduced	Andean

Genus species and Authority	**Life form**	**Origin**	**Region**
Taraxacum officinale Weber	Herb	Introduced	Andean
Tropalium tubersom Ruiz & Pav.	Herb/vine	Native	Andean
Urtica Urens L.	Herb	Introduced	Andean
Valerina microphylla Kunth	Woody	Native	Andean

Appendix E: Input data used in cluster analysis along with the frequency

Input data: Cleansing plant species represented by 13 marketplaces and the frequency of individual plants

Vernacular Name	1	2	3	4	5	6	7	8	9	10	11	12	13	Frequency
Ajenco	1	0	1	0	1	0	0	1	0	0	1	1	1	7
Albahaca	1	1	0	0	1	0	1	0	0	0	1	1	0	6
Aleli	1	0	0	0	0	0	1	1	0	0	0	1	1	5
Aliso	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Alverjilla	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Amapola	0	0	0	0	0	0	0	1	0	1	0	0	1	3
Anisillo	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Arrayan	1	1	1	0	1	0	1	0	1	1	1	1	0	9
Ataco	1	1	0	0	0	1	1	0	1	1	1	1	1	9
Ayahuasca	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ayamadeja	0	0	1	0	0	0	0	0	0	0	0	1	0	2
Bara de muestilla	0	0	1	0	0	0	0	0	0	0	0	0	1	2
Bilin	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Borraja	0	1	0	0	0	1	0	0	0	1	0	0	0	3
caballo	0	0	0	0	0	1	0	1	0	0	0	1	0	3
Calaguala	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Casha serraja	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Cedron	1	1	1	1	1	1	0	1	1	1	1	1	0	11
Chilca	1	1	0	0	0	0	1	0	0	1	1	1	0	6
Chimbalo	1	1	1	1	1	0	1	0	0	0	1	0	0	7
Chin Chin	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Chugchuguaso	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Cipres	1	0	0	0	1	1	1	0	0	1	1	1	0	7
Claveles	1	1	1	0	0	0	1	0	0	0	1	1	1	7
Colca	1	1	1	0	1	0	0	0	0	0	0	0	0	4
Colca/Pucachuglla	1	1	0	0	0	1	0	0	0	0	1	1	1	6
Congona	1	0	1	1	0	1	1	0	1	1	1	1	1	10
Culantro de pozo	0	0	0	0	0	0	0	1	0	0	0	0	1	2
Eneldo	0	0	0	0	0	1	0	1	0	1	0	1	1	5
Escubilla	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Eucalipto	1	1	1	1	1	1	1	0	0	1	1	0	1	10
Eupatorium sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Flor de christo	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Floripindio	1	1	1	1	1	0	0	0	0	0	1	1	0	7
Grama	0	0	0	0	0	1	0	1	0	0	0	0	0	2

Vernacular Name	1	2	3	4	5	6	7	8	9	10	11	12	13	Frequency
Guanto	1	1	0	0	0	0	1	0	0	0	1	1	1	6
Heirba Buena	1	1	0	0	0	0	1	0	0	1	1	1	0	6
Herba Luisa	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Hierba del infante	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Hierba mora	1	0	1	0	0	0	0	1	0	0	1	1	0	5
Huarmi poleo	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Huarmimasi	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Iso	1	1	0	0	0	0	0	0	0	1	0	1	0	4
Laurel	1	1	1	0	1	0	1	0	0	0	1	1	0	7
Laurel de Monte	1	1	1	0	0	1	0	0	1	0	1	0	0	6
Lavanda	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepchinia paniculata	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Llanten	1	1	1	0	0	1	1	1	1	1	0	1	0	9
Luto	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Malva	1	1	1	0	1	1	1	1	0	1	1	1	0	10
Malva sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Manzanilla	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Marco	1	1	0	1	1	0	1	1	1	1	1	1	1	11
Masuwa	1	0	0	0	0	1	0	1	0	1	0	0	1	5
Matico	1	1	1	1	0	0	1	1	1	1	1	1	1	11
Medioyuyu	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Mejorana	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Menta	1	0	0	1	1	0	0	0	0	1	0	0	0	4
Menthocytis sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Miling	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moilang	0	0	0	0	0	0	0	0	0	0	1	1	0	2
Moradilla	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Mosquera	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Nagchag	0	0	0	0	0	0	1	0	0	1	0	0	1	3
Naranja	1	1	1	0	0	1	0	0	0	0	0	0	0	4
Nogal	1	0	1	0	1	1	1	1	1	1	0	1	1	10
Noria blanca	0	0	0	0	0	1	0	1	0	0	0	0	0	2
Oja de Higo	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Olivo	1	0	0	0	0	0	1	0	0	0	0	1	0	3
Oregano	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Ortiga	1	1	0	0	0	1	1	1	1	1	1	0	0	8
Paico	1	1	0	0	1	0	0	0	0	0	0	1	0	4
Patacun yuyu	0	0	1	0	1	0	0	0	0	0	1	1	1	5

Vernacular Name	1	2	3	4	5	6	7	8	9	10	11	12	13	Frequency
Phusia	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pimpinella	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Piqui yuyu	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Platanillo	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Pumamaqui	0	0	0	0	1	1	0	0	0	0	0	1	0	3
Querendona	0	0	1	0	0	0	0	0	0	0	0	1	0	2
Retama	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Roja de muerto	1	1	1	1	0	0	1	1	0	0	1	1	0	8
Romero	1	1	1	1	1	0	0	1	1	1	1	1	1	11
Rosa	1	1	1	0	0	0	1	0	0	0	1	1	0	6
Rosita de castilla	0	0	1	0	0	0	0	0	0	0	0	1	0	2
Ruda	1	1	1	0	1	0	1	1	1	1	1	1	1	11
Salvia corrugata	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Salvia leucantha	1	1	0	0	0	0	0	0	0	0	0	0	0	2
salvia real	1	1	1	0	0	0	0	0	0	0	0	0	0	3
Salvia sp?	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Santa Maria	0	1	1	1	1	1	1	1	0	1	1	1	0	10
Santa Maria de Monte	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Saragosa	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Sauco	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Sauco negra	1	1	1	0	0	0	1	1	0	0	1	1	1	8
Shanshi	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sojo Yuyu	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Taraxaco	0	0	0	0	0	1	0	1	0	1	0	0	0	3
Tigrecillo	1	0	1	1	1	1	1	0	1	1	1	1	0	10
Tipo	0	0	0	0	0	0	1	0	0	0	1	0	0	2
Trinitarea	1	1	0	0	1	0	0	0	0	0	0	0	1	4
Tronjil	1	1	1	1	1	0	1	1	1	1	1	1	1	12
Valerina	1	0	1	1	0	0	0	1	0	1	1	1	1	8
Total sp. / market	46	38	36	16	28	31	31	31	17	36	40	44	36	

1= Santa Clara 2= Inya Quito 3= Latachunga 4= Pujilli
5= Saquisalli 6= Sangolquí 7= Ambato 8= Puyo
9= Otovalo 10= Ibarra 11= Guamote 12= Riobamba
13= Cuenca

0 = species absent
1 = species present

Appendix F: Ranked list of residuals per family including the total number of species of the flora of Ecuador and cleansing plants documented.

Rank	Plant Families	Total species	Cleansing species	Residuals
1	Lamiaceae	135	15	14.4757
2	Asteraceae	918	12	10.0111
3	Solanaceae	351	6	5.0717
4	Fabaceae	404	6	4.9725
5	Piperaceae	441	5	3.9033
6	Rosaceae	80	3	2.5786
7	Malvaceae	113	3	2.5168
8	Myricaceae	2	2	1.7245
9	Rutaceae	39	2	1.6553
10	Polygonaceae	42	2	1.6497
11	Onagraceae	60	2	1.6160
12	Apiaceae	64	2	1.6085
13	Amaranthaceae	74	2	1.5898
14	Myrtaceae	90	2	1.5599
15	Betulaceae	1	1	0.7263
16	Coriariaceae	1	1	0.7263
17	Juglandaceae	1	1	0.7263
18	Papaveraceae	6	1	0.7170
19	Chenopodiaceae	10	1	0.7095
20	Cuscutaceae	11	1	0.7076
21	Plantaginaceae	11	1	0.7076
22	Celastraceae	18	1	0.6945
23	Melastomataceae	553	2	0.6938
24	Aristolochiaceae	22	1	0.6871
25	Poaceae	557	2	0.6863
26	Tropaeolaceae	26	1	0.6796
27	Valerianaceae	35	1	0.6627
28	Caryophyllaceae	51	1	0.6328
29	Araliaceae	55	1	0.6253
30	Polygalaceae	56	1	0.6235
31	Brassicaceae	63	1	0.6104
32	Urticaceae	87	1	0.5655
33	Boraginaceae	91	1	0.5580
34	Malpighiaceae	92	1	0.5561
35	Moraceae	126	1	0.4925
36	Verbenaceae	141	1	0.4645
37	Scrophulariaceae	153	1	0.4420
38	Euphorbiaceae	243	1	0.2737
39	Aceraceae	1	0	-0.2737
40	Asteliaceae	1	0	-0.2737
41	Bataceae	1	0	-0.2737
42	Casuarinaceae	1	0	-0.2737
43	Cyrillaceae	1	0	-0.2737

44	Droseraceae	1	0	-0.2737
45	Haemodoraceae	1	0	-0.2737
46	Hippocastanaceae	1	0	-0.2737
47	Krameriaceae	1	0	-0.2737
48	Menyanthaceae	1	0	-0.2737
49	Nolanaceae	1	0	-0.2737
50	Pedaliaceae	1	0	-0.2737
51	Pellicieraceae	1	0	-0.2737
52	Phormiaceae	1	0	-0.2737
53	Platanaceae	1	0	-0.2737
54	Podostemataceae	1	0	-0.2737
55	Punicaceae	1	0	-0.2737
56	Rafflesiaceae	1	0	-0.2737
57	Resedaceae	1	0	-0.2737
58	Sphenocleaceae	1	0	-0.2737
59	Sterlitziaceae	1	0	-0.2737
60	Tovariaceae	1	0	-0.2737
61	Winteraceae	1	0	-0.2737
62	Zannichelliaceae	1	0	-0.2737
63	Achatocarpaceae	2	0	-0.2755
64	Asparagaceae	2	0	-0.2755
65	Asphodelaceae	2	0	-0.2755
66	Cabombaceae	2	0	-0.2755
67	Callitrichaceae	2	0	-0.2755
68	Ceratophyllaceae	2	0	-0.2755
69	Elatinaceae	2	0	-0.2755
70	Eremolepidaceae	2	0	-0.2755
71	Haloragaceae	2	0	-0.2755
72	Hugoniaceae	2	0	-0.2755
73	Hypoxidaceae	4	0	-0.2755
74	Mayacaceae	2	0	-0.2755
75	Melanthiaceae	2	0	-0.2755
76	Opiliaceae	2	0	-0.2755
77	Pittosporaceae	2	0	-0.2755
78	Typhaceae	2	0	-0.2755
79	Balsaminaceae	3	0	-0.2774
80	Columelliaceae	3	0	-0.2774
81	Dipsaceae	3	0	-0.2774
82	Dracaenaceae	3	0	-0.2774
83	Fumariaceae	3	0	-0.2774
84	Juncaginaceae	3	0	-0.2774
85	Musaceae	3	0	-0.2774
86	Plumbaginaceae	3	0	-0.2774
87	Rapateaceae	3	0	-0.2774
88	Rhizophoraceae	3	0	-0.2774

Rank	Plant Families	Total species	Cleansing species	Residuals
89	Santalaceae	3	0	-0.2774
90	Saxifragaceae	3	0	-0.2774
91	Staphyleaceae	3	0	-0.2774
92	Triuridaceae	3	0	-0.2774
93	Alliaceae	4	0	-0.2793
94	Buxaceae	4	0	-0.2793
95	Hernandiaceae	4	0	-0.2793
96	Hydroharitaceae	2	0	-0.2793
97	Limnochataceae	4	0	-0.2793
98	Najadaceae	4	0	-0.2793
99	Salicaceae	4	0	-0.2793
100	Anthericaceae	106	0	-0.2811
101	Humiriceae	5	0	-0.2811
102	Lacistemataceae	5	0	-0.2811
103	Linaceae	5	0	-0.2811
104	Oleaceae	5	0	-0.2811
105	Turneraceae	5	0	-0.2811
106	Agavaceae	6	0	-0.2830
107	Bixaceae	6	0	-0.2830
108	Cannaceae	6	0	-0.2830
109	Caryocaraceae	6	0	-0.2830
110	Crassulaceae	6	0	-0.2830
111	Ebenaceae	6	0	-0.2830
112	Hydrangeaceae	6	0	-0.2830
113	magnoliaceae	6	0	-0.2830
114	Nymphaeceae	6	0	-0.2830
115	Primulaceae	6	0	-0.2830
116	Xyridaceae	6	0	-0.2830
117	Zygophyllaceae	6	0	-0.2830
118	Gunneraceae	7	0	-0.2849
119	Molluginaceae	7	0	-0.2849
120	Balanophorbiaceae	8	0	-0.2868
121	Potamogetonaceae	13	0	-0.2868
122	Styracaceae	8	0	-0.2868
123	Aizoaceae	9	0	-0.2886
124	Connaraceae	9	0	-0.2886
125	Icacinaceae	9	0	-0.2886
126	Polemoniaceae	9	0	-0.2886
127	Vochysiaceae	9	0	-0.2886
128	Basellaceae	10	0	-0.2905
129	Clethraceae	10	0	-0.2905
130	Grossulariaceae	10	0	-0.2905
131	Smilaceae	10	0	-0.2905

132	Thymelaeaceae	10	0	-0.2905
133	Ulmaceae	10	0	-0.2905
134	Lentibulariaceae	12	0	-0.2924
135	Mendonciaceae	11	0	-0.2924
136	Ochnaceae	11	0	-0.2924
137	Pontederiaceae	11	0	-0.2924
138	Burmanniaceae	12	0	-0.2942
139	Cyperidaceae	12	0	-0.2942
140	Eriocaulaceae	12	0	-0.2942
141	Lemnaceae	11	0	-0.2942
142	Quinaceae	12	0	-0.2942
143	Brunelliaceae	13	0	-0.2961
144	Olacaceae	13	0	-0.2961
145	Potulacaceae	8	0	-0.2961
146	Theophrastaceae	13	0	-0.2961
147	Alismataceae	14	0	-0.2980
148	Erythroxylaceae	14	0	-0.2980
149	Caricaceae	15	0	-0.2998
150	Buddlejaceae	16	0	-0.3017
151	Chloranthaceae	16	0	-0.3017
152	Dichapetalaceae	16	0	-0.3017
153	Dilleniceae	16	0	-0.3017
154	Phytolaccaceae	17	0	-0.3036
155	Rhamnaceae	17	0	-0.3036
156	Simaroubaceae	17	0	-0.3036
157	Theaceae	17	0	-0.3036
158	Cornaceae	18	0	-0.3055
159	Costaceae	18	0	-0.3055
160	Sabiaceae	18	0	-0.3055
161	Anacardiaceae	19	0	-0.3073
162	Proteaceae	19	0	-0.3073
163	Elaeocarpaceae	20	0	-0.3092
164	Actinidiaceae	22	0	-0.3129
165	Caprifoliaceae	22	0	-0.3129
166	Juncaceae	22	0	-0.3129
167	Vitaceae	22	0	-0.3129
168	Ranunculaceae	24	0	-0.3167
169	Tiliaceae	24	0	-0.3167
170	Combretaceae	26	0	-0.3204
171	Cunoniaceae	26	0	-0.3204
172	Loganiaceae	26	0	-0.3204
173	Marcgraviaceae	26	0	-0.3204
174	Loasaceae	27	0	-0.3223
175	Lythraceae	27	0	-0.3223
176	Symplocaceae	27	0	-0.3223

Rank	Plant Families	Total species	Cleansing species	Residuals
177	Berberidaceae	30	0	-0.3279
178	Hippocrateaceae	30	0	-0.3279
179	Nyctaginaceae	30	0	-0.3279
180	Zinziberaceae	31	0	-0.3298
181	Aquifoliaceae	32	0	-0.3316
182	Geraniaceae	32	0	-0.3316
183	Commelinaceae	33	0	-0.3335
184	Loranthaceae	33	0	-0.3335
185	Dioscoreaceae	34	0	-0.3354
186	Capparaceae	36	0	-0.3391
187	Alstroemeriaceae	37	0	-0.3410
188	Lecythidaceae	39	0	-0.3447
189	Burseraceae	40	0	-0.3466
190	Violoaceae	43	0	-0.3522
191	Menispermaceae	45	0	-0.3560
192	Bombacaceae	47	0	-0.3597
193	Myristaceae	69	0	-0.3597
194	Sapotaceae	49	0	-0.3634
195	Liliaceae	50	0	-0.3653
196	Sterculiaceae	50	0	-0.3653
197	Viscaceae	50	0	-0.3653
198	Cactaceae	51	0	-0.3672
199	Oxalidaceae	53	0	-0.3709
200	Chrysobalanaceae	56	0	-0.3765
201	Cecropiaceae	57	0	-0.3784
202	Flacourtiaceae	57	0	-0.3784
203	Heliconiaceae	57	0	-0.3784
204	Begoniaceae	59	0	-0.3821
205	Cyclanthaceae	61	0	-0.3859
206	Melliaceae	61	0	-0.3859
207	Gentiaceae	66	0	-0.3952
208	Myrisinaceae	47	0	-0.4009
209	Cucrbitaceae	82	0	-0.4252
210	Asclepiadaceae	85	0	-0.4308
211	Apocyanaceae	95	0	-0.4495
212	Passifloraceae	95	0	-0.4495
213	Convoluaceae	96	0	-0.4514
214	Marantaceae	96	0	-0.4514
215	Annonaceae	5	0	-0.4701
216	Bignoniaceae	106	0	-0.4701
217	Arecaceae	127	0	-0.5093
218	Clusiaceae	128	0	-0.5112
219	Sapindaceae	130	0	-0.5150

220	Acanthaceae	151	0	-0.5542
221	Campanulaceae	164	0	-0.5786
222	Lauraceae	167	0	-0.5842
223	Mimosaceae	187	0	-0.6216
224	Cyperaceae	217	0	-0.6777
225	Ericaceae	225	0	-0.6927
226	Gesneriaceae	240	0	-0.7207
227	Monimiaceae	390	0	-1.0013
228	Araceae	404	0	-1.0275
229	Bromeliaceae	440	0	-1.0948
230	Rubiaceae	499	0	-1.2052
231	Orchidaceae	3032	1	-4.9433