Ethnobotanical study of the medicinal plants from Tlanchinol, Hidalgo, México

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A B S T R A C T

The people in Mexico still depend upon the use of medicinal plants to treat simple health problems, including those who live in regions like Tlanchinol Hidalgo, where it is still possible to find people who speak the pre-Hispanic Nahua language. This area is surrounded by rain forest, which is more or less well conserved, so ethnopharmacological field studies are quite relevant. The cultural knowledge about the use of medicinal plants converge with the richness in the surrounding flora making this region ideal for the selection of traditionally used medicinal plants. 

Aim of the study: To present the results of an ethnopharmacological field survey conducted in the municipality of Tlanchinol Hidalgo, Mexico analyzed with two different quantitative tools, with the aim of selecting the most important species used in traditional medicine.

Materials and methods: Direct interviews with the people were performed in several short visits to the municipality of Tlanchinol Hidalgo. The plants were collected, and the species were determined. The interviews were analyzed with two quantitative tools. First, the factor informant consensus highlighted the agreement in the use of plants and the fidelity level defined as: the ratio between the number of informants who independently suggested the use of a species for the same major purpose and the total number of informants who mentioned the plant for any use. Furthermore, we analyzed the use-mentions for the plants.

Results: The results of the factor informant consensus showed that the gastrointestinal category had the greatest agreement, followed by the respiratory and dermatological categories. The most important species according to their fidelity are: Coleus blumei, Plantago australis and Lippia dulcis for the gastrointestinal category; Borago officinalis, Foeniculum vulgare, and Eucalyptus globulus for the respiratory category; and Agaratum houstonianum and Solanum nigrescens for the dermatological category.

Conclusion: As a result of the present study, we recommend the plants listed in Table 2 for further ethnopharmacological studies, especially Lippia dulcis var Mexicana.

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1. Introduction

The use of medicinal plants has occurred in Mexico since pre-Hispanic times. With the presence of nearly 10,000,000 indigenous people speaking nearly 85 different languages (MNM, 2008), who still depend upon plants for primary therapy from the diverse flora (almost 5,000 medicinal plants), Mexico is a good area to perform ethnopharmacological field studies. Studying the biological diversity of plants related to their traditional use as medicines can lead us to understand how they act and to assure the rational exploitation of the resources and their further development as phytomedicines. Because medicinal plants continue to be culturally suitable as treatments for several illnesses, it is important to document their uses and perform studies about their pharmacological activities to assure their efficacy and safety.

Despite the vast literature that exists in Mexico (in Spanish) about ethnobotanical studies, only a few efforts to publish these data at an international level have been done. However, Heinrich and his group published more than 18 works (i.e. Weimann and Heinrich, 1997; Heinrich et al., 1998; Ankli et al., 1999) with a combination of adequate field work and appropriate interpretation of the data.

The aim of this work is to present the results of an ethnopharmacological field survey conducted between 2000 and 2004 in the municipality of Tlanchinol Hidalgo, Mexico, which was analyzed with two different quantitative tools in order to select the important species used in traditional medicine.

1.1. Background

The municipality Tlanchinol was populated by two ethnic groups “Nahuas” and “Huastecs” until the arrival of the Spaniard
monks in the XVI century, who started the evangelization and colo-
nization of the zone. The name “Tlanchinol” came from the “Nahua”
voice “Tlanchinoli,” which means ‘Burn House,’ and “icpac,” which
means “Over,” thus meaning “over the burn house” (EMM, 2008).
The area is 380 km² and is located at 21° 10' N, 98° 53' S latitude and
98° 32' E, 98° 46' W longitude, at 1590 m above sea level (INEGI,
2008). The weather is humid with an annual mean temperature of
18.9 °C and having an annual mean rain precipitation of 2601 mm.
The population is composed mainly of “Nahuas” in the poorest
zones and half-caste people in the richest areas. Although the main
town is Tlanchinol, the actual municipality consists of 20 towns.
The Mexican government reported a population of near 32,000
people in 2000, of whom 54% speak Nahua. In 2003, according to
official data from the total population, only 9% received an official
health service free of charge and 67% received an official health
service, but had to pay a small amount of money for the service
(INEGI, 2008). Therefore, only 76% of the population accessed health
services at least one time during that year, and the other 24% did not.
The Nahua, who live in the poorest areas depend upon medicinal
plants and traditional healers for primary health care.
The vegetation that surrounds the area is cloud forest “Bosque
mesolfo de montaña,” according to Luna-Vega et al. (1994). The
flora is composed of 306 species, 247 genera and 107 families.

2. Materials and methods

2.1. Data collection

Direct interviews with the people were performed in sev-
eral short visits between 2000 and 2004 using a semistructured
questionnaire, prior to the interviews the Informed Consent was
obtained. We visited “Apantlazol,” “Olotla,” “Tierra Colorada,”
“Cuatlatán,” and “Tlanchinol” and interviewed the general popula-
tion house by house. We asked questions about the plants they use
against diseases, which parts of the plants are used, the method of
preparation, details of administration and the dosage. These towns
have the presence of “Nahuas” and the same kind of vegetation, thus
providing us with a rich cultural region to perform this study. With
the help of the informants, the botanical material was collected,
properly identified with the help from Biol. Ramiro Cruz Duran and
MS Othon Alcantara Ayala, the plant names were revised, in the
approved, international data bases. The voucher specimens were
deposited at the Laboratory of Ethnopharmacology, “Facultad de
Ciencias, UNAM”.

2.2. Quantitative ethnobotany

The results of the direct interviews were analyzed using two
quantitative tools. For the analysis of the general use of plants, we used the factor informant consensus (\(F_{IC}\)) (Heinrich et al., 1998). The factor was originally used to highlight plants of particular intercultural rel-
reance and the agreement in the use of plants. In order to use
this tool, it was necessary to classify the illnesses into broad dis-

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<th>Name</th>
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<th>Preparation</th>
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<td>Tlanchichinole</td>
<td>He</td>
<td>Lv</td>
<td>Diarrhoea</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>25.0</td>
<td>7</td>
</tr>
<tr>
<td>Sambucus mexicana C. Presl ex DC.</td>
<td>ETLA-80</td>
<td>Caprifoliaceae</td>
<td>Sauco</td>
<td>TR</td>
<td>Lv</td>
<td>Diarrhoea</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>25.0</td>
<td>1</td>
</tr>
<tr>
<td>Sechium edule (Jacq.) Sw.</td>
<td>ETLA-81</td>
<td>Cucurbitaceae</td>
<td>Chayote</td>
<td>He</td>
<td>Fr</td>
<td>Kidney problems</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>50.0</td>
<td>7</td>
</tr>
<tr>
<td>Sedum L.</td>
<td>ETLA-82</td>
<td>Crassulaceae</td>
<td>Yahualchit</td>
<td>Sh</td>
<td>St</td>
<td>Inflammation</td>
<td>1</td>
<td>Macerated</td>
<td>Oral</td>
<td>25.0</td>
<td>5</td>
</tr>
<tr>
<td>Smallanthus muculatus (Cav.) H. Rob.</td>
<td>ETLA-83</td>
<td>Asteraceae</td>
<td>Flor de margarita</td>
<td>He</td>
<td>Fl</td>
<td>Vaginal infections</td>
<td>2</td>
<td>Macerated</td>
<td>Oral</td>
<td>50.0</td>
<td>9</td>
</tr>
<tr>
<td>Solanum esculentum Dunal</td>
<td>ETLA-84</td>
<td>Solanaceae</td>
<td>Jitomate</td>
<td>He</td>
<td>Fr</td>
<td>Headache</td>
<td>1</td>
<td>Macerated</td>
<td>Topical</td>
<td>25.0</td>
<td>2</td>
</tr>
<tr>
<td>Solanum nigriscens M. Martens &amp; Galeotti</td>
<td>ETLA-85</td>
<td>Solanaceae</td>
<td>Tomatillo</td>
<td>He</td>
<td>Fr</td>
<td>Sore throat</td>
<td>2</td>
<td>Macerated</td>
<td>Topical</td>
<td>50.0</td>
<td>2</td>
</tr>
<tr>
<td>Sphaerolea angustifolia (Cav.) G. Don</td>
<td>ETLA-86</td>
<td>Malvaceae</td>
<td>Hierba del negro</td>
<td>He</td>
<td>Ap,Lv</td>
<td>Rheumatism</td>
<td>1</td>
<td>Macerated in Alcohol</td>
<td>Topical</td>
<td>50.0</td>
<td>5</td>
</tr>
<tr>
<td>Tagetes erecta L.</td>
<td>ETLA-87</td>
<td>Asteraceae</td>
<td>Cempasúchitl</td>
<td>He</td>
<td>Lv</td>
<td>Wounds</td>
<td>1</td>
<td>Decoction</td>
<td>Oral</td>
<td>50.0</td>
<td>12</td>
</tr>
<tr>
<td>Tagetes micrantha Cav.</td>
<td>ETLA-88</td>
<td>Asteraceae</td>
<td>Anis</td>
<td>He</td>
<td>Ap</td>
<td>Bronchitis</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>25.0</td>
<td>2</td>
</tr>
<tr>
<td>Tannerioc parthenium (L.) Sch. Bip.</td>
<td>ETLA-89</td>
<td>Asteraceae</td>
<td>Santamaría</td>
<td>He</td>
<td>Ap,Lv</td>
<td>Erysipelas</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>25.0</td>
<td>4</td>
</tr>
<tr>
<td>Taraxacum officinale Weber ex F.H. Wigg.</td>
<td>ETLA-90</td>
<td>Asteraceae</td>
<td>Diente de león</td>
<td>He</td>
<td>Ap</td>
<td>Stomach pain</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>4.0</td>
<td>9</td>
</tr>
<tr>
<td>Tectaria heraclea (Wild.) Underw.</td>
<td>ETLA-91</td>
<td>Dryopteridaceae</td>
<td>Hierba del monte</td>
<td>He</td>
<td>Ap</td>
<td>Inflammation</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>20.0</td>
<td>5</td>
</tr>
<tr>
<td>Tithonia mexicana Schtldl.</td>
<td>ETLA-92</td>
<td>Tiliaceae</td>
<td>Tila</td>
<td>Tr</td>
<td>Fl, Lv</td>
<td>Hypertension</td>
<td>2</td>
<td>Infusion</td>
<td>Oral</td>
<td>33.3</td>
<td>6</td>
</tr>
<tr>
<td>Urena caracasana (Jacq.) Gaudich. ex Griseb.</td>
<td>ETLA-93</td>
<td>Urticaceae</td>
<td>Ortiga real</td>
<td>Sh</td>
<td>Lv</td>
<td>Muscular pain</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>50.0</td>
<td>2</td>
</tr>
<tr>
<td>Zaluzania triloba (Ort.) Pers.</td>
<td>ETLA-94</td>
<td>Asteraceae</td>
<td>Hierba amarga</td>
<td>He</td>
<td>Ap,Lv</td>
<td>Abortifacient</td>
<td>1</td>
<td>Infusion</td>
<td>Oral</td>
<td>33.3</td>
<td>9</td>
</tr>
</tbody>
</table>
3.3. Factor informant consensus

The results of the FIC showed that the gastrointestinal category had the greatest agreement with a FIC of 0.79, followed by respiratory (0.66), dermatological (0.64), cardiovascular (0.57), diabetes (0.57), and urological (0.56). The least agreement between the informants was observed in the musculoskeletal category with an FIC of 0.35, followed by reproductive (0.42), oncologic (0.43) and pain/fiber (0.43), see Table 3. Within the gastrointestinal category, the main reported ailments were stomach pain (32 reports) and diarrhoea (21), in the respiratory category, there were 29 reports of the main reported ailments were stomach pain (32 reports) and diarrhoea (21), in the respiratory category, there were 29 reports of cough and 9 reports of skin problems. Within the dermatological category, there were 22 wound reports and 7 reports of skin problems (Tables 1 and 3).

3.4. Fidelity level

We analyzed the categories with the major agreements to highlight the most important plants in each category. For this analysis, the plants only mentioned once were not considered. For the gastrointestinal category, we found that the most important species, according to their fidelity, were Coleus blumen (Fl = 100), Plantago auriculata (Fl = 100), and Lippia dulcis (Fl = 92). They were Borago officinalis (Fl = 100), Foeniculum vulgare (Fl = 100) and Eucalyptus globulus (Fl = 90) for the respiratory category. They were Ageratum houstonianum (Fl = 100), Solanum nigrescens (Fl = 100) and Liquidambar macrophylla (Fl = 60) for the dermatological category. The most important plants in the cardiovascular category were Campanula edulis (Fl = 60) and Phlebodium aureum (Fl = 50). For the diabetes category, Cercropia obtusifolia (Fl = 68) and Eryngium longifolium (Fl = 50), were the most important. In the urological category, we found Zea mays (Fl = 100) and Costus pulverulentus (Fl = 86) as the most important (see Table 2, B).

3.5. Correlation between use-mentions and fidelity level

The species with the major fidelity levels were determined by an analysis of the data through the Fl. For the main gastrointestinal category, we found that the plants with the highest fidelity level were not the ones with the major number of mentions (Um). Bascially, the plants with an Fl of 100 had only a couple of mentions, which is in contrast with plants with a high number of mentions (19 and 15), but had only Fl of 80 and 10, respectively. To avoid this problem, we correlated all categories of the plants with more use-mentions (for one purpose) with their fidelity level, for these analysis we take 10% of the sample. The plants with the most Um for all categories were Artemisia ludoviciana with 19 mentions for stomach pain (Fl = 80), Matricaria recutita with 15 mentions for stomach pain (Fl = 48), Artemisia vulgaris with 12 mentions for stomach pain (Fl = 75), Lippia dulcis var mexicana with 12 mentions for diarrhoea (Fl = 93), Psidium guajava with 10 mentions for diarrhoea (Fl = 77), and Hamelia patens with 10 mentions for gastritis (Fl = 48). Eucalyptus globulus had 12 mentions for cough (Fl = 90), Agastache mexicana had 9 mentions against Take fright (Fl = 64), Bougainvillea glabra had 9 mentions for cough (Fl = 75) and Salvia cocinea had 9 mentions for stomach pain (Fl = 56) (see Table 2, C).

The plants with a high fidelity level (Fl = 100) and a Um for one ailment were Borago officinalis for cough (100, 6), Ageratum houstonianum for skin infections (100, 5), Achillea millefolium for ear pain (100, 3), Zea mays used as a diuretic (100, 3), Coleus blumei for diarrhoea (100, 2), Foeniculum vulgare for cough (100, 2), Plantago auriculata for diarrhoea (100, 2) and Solanum nigrescens to treat wounds (100, 2). Plants with Fl between 80 and 99 were Lippia dulcis var mexicana for diarrhoea (92, 12) Eucalyptus globulus for cough (90, 9), Cercropia obtusifolia for diabetes (86, 4), and Coleus blumei (85, 6) and Matricaria recutita for stomach pain (83, 15) (see Table 2, D).

4. Discussion

One of the goals of an ethnopharmacological field study is to provide the main plants in a region used to perform further phytochemical and pharmacological studies. In this work, we used two quantitative tools to perform the selection. With the FIC, we detected the main categories of used plants, and with the Fl and the Um, we selected the most important species from these categories.

In the present work, we found that the gastrointestinal, respiratory and dermatological categories used the most plants, which was in agreement with the categories in the work of Heinrich et al. (1998). Because none of the areas studied by Heinrich (Zapotec, Maya or Nahua) are close to the studied region herein, we can assume that the main problems treated by traditional medicine in Mexico fall into these categories.

If we considered the plants with the highest number of mentions for a single use (Table 2, C), meaning that we placed more value on the number of reports than on Fl, we saw that seven of these plants were used for gastrointestinal disorders and two for respiratory problems. If we considered the plants with the highest Fl together with the use-mentions (Table 2, D), meaning that we placed more value to the Fl, we saw that four plants were used for gastrointestinal, three for respiratory, and two for dermatological ailments. In both cases, the most species were in the gastrointestinal category, which was followed by the respiratory category. If we analyzed the data through the FIC, the Fl or the use-mentions, we got the same categories as being the most prominent. The Fl and the use-mentions support the FIC. Therefore, based on this observation, we can say that the FIC is a good analytical tool to select categories of illness when analyzing the data as they are presented here.

After selecting the categories, we analyzed the important plants with three further criteria: the plants with the highest Fl for each category (Table 2, B), the plants with the greatest number of mentions for all categories (Table 2, C), and the plants with the highest Fl (Table 2, D). If we perform a cross-link analysis between the plants in Table 2, C and D, which means that we considered both the Fl and the use-mentions as final factors, we observed the following plants on both lists: Lippia dulcis var mexicana used to treat diarrhoea,
Table 2
Analysis of the main used plants.

(A) Plants with high total use-mentions.
- Rhus choleppensis (25)
- Aloe vera (24)
- Artemisia ludoviciana (24)
- Heterotricha insuloides (23)
- Habanilla patens (21)
- Matricaria recutita (18)
- Justicia spicigera (18)
- Agave atrorubens (17)
- Artemisia vulgaris (16)
- Oenothera rosea (16).

(B) Plants with high fidelity level by category.
- Gastrointestinal
  - Coleus blumei (Fl = 100)
- Plantago australis (Fl, 100)
- Foeniculum vulgare (Fl, 100)
- Solanum nigrescens (Fl = 100)
- Matricaria recutita (Fl = 83)
- Cecropia obtusifolia (Fl, 86)
- Eucalyptus globulus (Fl = 90)
- Lippia dulcis var mexicana (Fl, 100)

(C) Plants with high use-mentions for all categories.
- Artemisia ludoviciana (Fl = 100)
- Plantago australis (Fl = 100)
- Lippia dulcis (Fl = 92)

(D) Plants with high fidelity level and their use-mentions for one ailment.
- Respiratory
  - Artemisia ludoviciana (Fl = 100)
  - Plantago australis (Fl, 100)
- Eucalyptus globulus (Fl = 90)
  - Matricaria recutita (Fl = 83)

Table 3
Factor informant consensus.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Taxons</th>
<th>Uses</th>
<th>FIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal</td>
<td>45</td>
<td>211</td>
<td>0.79</td>
</tr>
<tr>
<td>Respiratory</td>
<td>33</td>
<td>95</td>
<td>0.66</td>
</tr>
<tr>
<td>Dermatological</td>
<td>28</td>
<td>75</td>
<td>0.64</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>10</td>
<td>22</td>
<td>0.57</td>
</tr>
<tr>
<td>Diabetes</td>
<td>14</td>
<td>31</td>
<td>0.57</td>
</tr>
<tr>
<td>Urological</td>
<td>15</td>
<td>33</td>
<td>0.56</td>
</tr>
<tr>
<td>Cultural filiations</td>
<td>14</td>
<td>25</td>
<td>0.52</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>11</td>
<td>0.50</td>
</tr>
<tr>
<td>Pain/fiber</td>
<td>26</td>
<td>45</td>
<td>0.43</td>
</tr>
<tr>
<td>Oncologic</td>
<td>5</td>
<td>8</td>
<td>0.43</td>
</tr>
<tr>
<td>Reproductive</td>
<td>8</td>
<td>13</td>
<td>0.42</td>
</tr>
<tr>
<td>Muscular/skeletal</td>
<td>12</td>
<td>18</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Total | 216 | 590 |

Eucalyptus globulus used to treat cough, and Matricaria recutita used to treat stomach pain. Because the last two plants are widely used and there are a lot of studies about their pharmacological activities, we will select the first one for further studies. The data showed that the main problems treated by traditional medicine in Tlanchinol, Hidalgo are stomach pain, cough, wounds and diarrhea, and there is also a consensus about the plants to treat these ailments. A possible explanation may be due to a couple of observations: (A) traditional medicine is used to treat “daily” health problems, and (B) traditional medicine better treats simple health problems. It must be considered that this work was based on interviews with the general population. A different kind of analysis could be done if we focused on specific diseases or interviewed people with these diseases, instead of the general population (see Andrade-Cetto et al., 2006).

As a result of the present study, we can recommend the plants listed in Table 2 for further ethnopharmacological studies, especially Lippia dulcis var Mexicana.

Acknowledgments
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References