



Changing markets – Medicinal plants in the markets of La Paz and El Alto, Bolivia



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ABSTRACT

Ethnopharmacological relevance: Given the importance of local markets as a source of medicinal plants for both healers and the population, literature on market flows and the value of the plant material traded is rather scarce. This stands in contrast to wealth of available information for other components of Bolivian ethnobotany. The present study attempts to remedy this situation by providing a detailed inventory of medicinal plant markets in the La Paz–El Alto metropolitan area, hypothesizing that both species composition, and medicinal applications, have changed considerably over time.

Materials and methods: From October 2013–October 2015 semi-structured interviews were conducted with 39 plant vendors between October 2013 and October 2015 in the Mercado Rodríguez, Mercado Calle Santa Cruz, Mercado Cohoni, Mercado Cota Cota, and Mercado Seguencoma and Mercado El Alto in order to elucidate more details on plant usage and provenance. The results of the present study were then compared to previous inventories of medicinal plants in La Paz and El Alto studies to elucidate changes over time and impact of interview techniques.

Results: In this study we encountered 163 plant species belonging to 127 genera and 58 families. In addition, 17 species could not be identified. This species richness is considerably higher than that reported in previous studies (2005, 129 species of 55 families; 2015, 94 identified species). While the overall distribution of illness categories is in line with older reports the number of species used per application, as well as the applications per species, were much higher in the present study. Overall, informant consensus was relatively low, which might be explained by the large number of new species that have entered the local pharmacopoeia in the last decade, although some species might simply have been missed by previous studies. In course of the present study it became apparent that even well known species might often be replaced by other apparently similar but botanically unrelated species due to environmental and market forces

Conclusions: The present study indicated that, while the floristic composition of markets in the La Paz metropolitan area remained relatively constant over the last decade, with this inventory adding about 20% of species to previous studies, the number of indications for which certain species were used increased tremendously, and that profound differences exist even between markets in close proximity. The dramatic increase in previously not used species used per indication might pose serious risks for consumers. We found serious problems due to species replacements. Even plants that have a well established vernacular name, and are easily recognizable botanically, can be replaced by other species that can pose a serious health risk. Vendor education and stringent identification of the material sold in public markets are clearly needed.

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1. Introduction

General ethnobotanical studies in Peru and Bolivia have focused mostly on Quechua herbalism of the Cusco area (e.g. De Ferreyra, 1978, 1981; Franquemont et al., 1990). Other comprehensive studies have centered on the border region of Peru and Bolivia around Lake Titicaca (Roersch, 1994), with many treating

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the Kallawayas, famous itinerant traditional healers (Andel-Malek et al., 1996; Bastien, 1982, 1983, 1987, 1992; Girault 1987). Other broad studies from Bolivia include the pioneering work of Cárdenas (1943, 1989), De Luca and Zalles (1992), Oblitas (1992), Zalles and De Luca (1996), and Beck et al. (1999). In addition, studies in Bolivia exist in for individual ethnic groups, e.g. Mosestén-Tsimané (Aguirre, 2006), Jampiris (Alba and Tarifa, 1993), Ese Eja (Alexiades, 1999), Yuracaré (Hinojosa et al., 2001; Vargas, 1997), Tacana (Paniagua-Zambrana, 2001), and Chácobo (Boom, 1987; Bussmann and Paniagua-Zambrana 2014; Paniagua-Zambrana et al., 2014), as well as for individual regions, e.g. Cochabamba (Arrázola et al., 2002; De Luca, 2004), Chiquitanía (Birk, 1995; Toledo 1996), Potosí (Fernandez, 1999; Fernandez et al., 2003; Fisel, 1989), and Chaco (Bourdy, 2002; Bourdy et al., 2000, 2004; Quiroga et al., 2009, 2012; Quiroga, 2012). During the last years, the contemporary use of plants by local healers (*curanderos*) in the wider region has been well documented (Bussmann, 2013; Bussmann and Sharon, 2006a, 2006b, 2009, 2015a, 2015b; Bussmann et al., 2007a, 2007b, 2008a, 2008b, 2010a, 2010b; Monigatti et al., 2013; Revene et al., 2008).

Both healers and laypeople often buy their medicinal plants in local markets. Information on the composition of the market flora, the origin of the plant material, and the quantities of plant material sold exists to some extent (Bussmann et al., 2007b, 2008a, 2009, 2010a; Bussmann and Sharon, 2009; Revene et al., 2008), and some studies focus on the interface between traditional and allopathic medicine (Bussmann et al., 2007a, 2009). Previous studies indicate that patients regularly receive their diagnosis from allopathic doctors, and then go to the markets to buy traditional remedies to treat this illness previously diagnosed by a biomedical health provide (Bussmann et al., 2007a, 2009). Vendors also followed the allopathic concept. Initial bioassays indicate that at least for antibacterial applications the efficacy of parts of the medicinal flora can be proven (Bussmann et al., 2008b, 2010b; Hammond et al., 1998), and preliminary data on plant toxicity exist (Bussmann et al., 2011). However, there is very little comparative information available about which plants are sold under which vernacular name at any given time, for which indication, and which dosage information, and what kind of information about side effects vendors provide to their clients.

Given the importance of local markets as a source of medicinal plants for both healers and the population in general literature on local markets, market flows and the value of the plant material traded is rather scarce. This stands in contrast to wealth of available information for other components of Bolivian ethnobotany. Although the value of the international market for medicinal receives high interest (e.g. Breevort, 1998), and ecosystem services as well as non-timber forest products do receive some attention (Constanza et al., 1997; Godoy et al., 2000; Grimes et al., 1994), studies on the trade volumes of local medicinal markets hardly exist, and mostly focus on the export market (Olsen, 1998, 2005; Olsen and Helles 1997).

Latin America is still *terra incognita* with regards to its medicinal plant markets, and detailed studies are of high importance as even local health care authorities begin to promote complementary alternative medicine. Macía et al. (2005) provided the first study of a high Andean market, focusing on La Paz, Bolivia. This was followed by a short study by Justo Chipana and Moraes (2015) in the same region. In addition, studies exist especially for the very large medicinal plant markets of Northern Peru (Bussmann et al., 2007b), and a recent review of Lima et al. (1996) focused on Amazonian markets. However, information on the composition of the overall market flora of the La Paz metropolitan area, and possible changes over the last decade is still lacking. The present study attempts to remedy this situation by providing a detailed inventory of medicinal plant markets in the La Paz-El Alto

metropolitan area, hypothesizing, based on long term experience in the area, that both species composition, and medicinal applications, have changed considerably over time.

2. Materials and methods

2.1. Ethnobotanical inventory

Since October 2013 we have been conducting an ongoing collection of medicinal plant species and associated plant use knowledge in the main plant markets of La Paz, Bolivia. Semi-structured interviews following Bussmann and Sharon (2006b), under consideration of the collection standards established by Cook (1995) were conducted with 39 plant vendors between October 2013 and October 2015 in the Mercados Rodríguez, Calle Santa Cruz, Cohoni, Cota Cota, Seguencoma and El Alto in order to elucidate more details on plant usage and provenance. Mercado Rodríguez is the main daily market that supplies much of the center of La Paz (covering a population of about 500,000 inhabitants) with fresh vegetables, flowers, and other products. Fresh herbs are sold in a dedicated area by about a dozen vendors in non-permanent posts. Mercado Calle Santa Cruz is the so called “witch market” of La Paz, where plants are sold in about three dozen permanent stalls and in a handful of specialized herbal stores. Mercado Cohoni, Mercado Cota Cota, and Mercado Seguencoma are small markets in the more “modern” southern part of the city. Mercado El Alto is the main plant market in the independent city El Alto above La Paz proper. Vendor participants were self-selected: every vendor in the studied markets was asked if they wanted to participate in the study. Specialized herbal shops were excluded from the study because they sold mostly plant material that was, according to the owners, obtained from Peru, for “mesas”—offerings that are blessed and burned, and artifacts for healing ceremonies, but few medicinal plants. Interviews were conducted only after explaining the study to all participants and obtaining their oral prior informed consent. All vendors were female and all were members of cooperatives regulating the sale of plants for medicine as specified by the semi-governmental SOBOMETRA (Sociedad Boliviana de Medicina Tradicional). Age and ethnicity of the vendors were not disclosed. The structure of the market stands in La Paz, as well as sourcing plant material and the function of the vendors as “advisors” consulted for health problems of the public, were comparable to the markets in northern Peru (Bussmann and Sharon, 2006b). Initial contact and prior informed consent were made and obtained by all authors together. Given that only female participants were encountered the detailed interviews were conducted in Aymara and Spanish by the female authors to avoid gender influence, because in initial surveys the authors found that female vendors did not talk to men about specific female conditions, e.g. menstruation, childbirth etc.

Vouchers of all species were collected, and all plant material was identified and deposited in the National Herbarium of Bolivia (LPB). No material whatsoever was exported from Bolivia. The nomenclature of all species follows www.tropicos.org, under AP-GIII (Angiosperm Phylogeny Group, 2009).

The results of the present study were then compared to previous inventories of medicinal plants in La Paz and El Alto studies (Macía et al., 2005; Justo Chipana and Moraes, 2015) to elucidate changes over time and impact of interview techniques.

2.2. Statistical analysis

Among markets and among studies, we compared plants species reported as being used (unique Latin binomials eg. “*Aloe vera*”), plant-uses (unique combinations of a species used for an ailment

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