

Notes on Economic Plants

Dangerous Confusion—“Cola de Caballo”—Horsetail, in the Markets of La Paz, Bolivia¹

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Introduction

Species of *Equisetum* (Equisetaceae) are sold around the globe under their most common vernacular names “Horsetail,” “Schachtelhalm,” and “Cola de Caballo.” *Equisetum* spp. are used so commonly that the crude drug of *Equisetum arvense* L. is listed in Germany as “Equiseti herba—Schachtelhalmkraut” in the official monographs of the Phytotherapy Commission (Liste der Monografien der Kommission E (Phyto-Therapie) and, as such, is one of the few officially recognized and sold medicinal species in Germany (Bundesanzeiger 1986). The monograph explicitly highlights the external use of *Equisetum* extracts in supportive wound care, the oral application for inflammation of the urinary system, and states that no secondary effects are known. It is, however, important to note that the monograph refers only to *Equisetum arvense* L., and no comparative information exists for other species of the genus.

In Latin America, especially in Andean countries, *Equisetum* is widely known as “Cola de Caballo” (horsetail) (e.g., Bolivia: Vandebroek and Evert 2003; Ecuador: Bussmann and Sharon 2006a; Peru: Bussmann and Sharon 2006b). Our own work in the region confirmed the use of *Equisetum bogotense* Kunth for kidney problems and the washing of wounds in Ecuador (Bussmann and Sharon 2006a, six informants), and both *Equisetum bogotense* and *Equisetum giganteum* L. are widely sold in local markets in northern Peru and are used for exactly the same purpose, as well as for prostate problems, inflammation of the reproductive tract in women, and arthritis (Bussmann and Sharon 2006b, >100 permanent and non-

permanent market venders). Gonzalez de la Cruz et al. (2014) and Huamantupa et al. (2011) report *Equisetum bogotense* as “Cola de Caballo” from central and southern Peru, and indicate the same uses.

Equisetum giganteum turned out to be one of the most frequently sold plants in northern Peru (Revene et al. 2008, >100 permanent and non-permanent market venders). The aqueous extracts (= tea) produced by immersing whole plants in boiling water, which is the traditional treatment, showed no toxicity (Bussmann et al. 2011).

In this study we compare plant use in the markets of La Paz, Bolivia, to the results we found in the markets of Trujillo and Chiclayo in northern Peru. Because Cola de Caballo is so widely used, and *Equisetum* spp. is very easily recognizable, we assumed that only *Equisetum bogotense* and *Equisetum giganteum* would be sold as “Cola de Caballo” and that they would be used for kidney and urinary tract problems as we found in Peru. We also believed, given the common use of the plant, that there would be consistency in the dosage, and that venders would sell the species without mentioning any side effects of the species.

Materials and Methods

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) were conducted with 25 plant venders between October 2013 and August 2014 in the

Mercado Rodriguez and Mercado Calle Santa Cruz “Mercado de brujas” in order to elucidate more details on plant usage and provenance. Mercado Rodriguez 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 produce. Fresh herbs are sold in a dedicated area by about a dozen venders in non-permanent posts. Mercado Calle Santa Cruz is the main “Witch market” of La Paz, where plants are sold in about three dozen permanent stalls and in a handful of specialized herbal stores. All venders in the studied markets were asked if they wanted to participate in the study. The 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. The 25 interviewed venders represent about 60% of all venders who agreed to participate in the study and gave their oral prior informed consent. All venders were female and all were members of cooperatives regulating the sale of plants for medicine as specified by the semi-governmental SOBOMETRA (Sociedad de Medicina Tradicional Boliviana). Age and ethnicity of the venders were not disclosed. In the sales process, the venders acted very much as healers, i.e., indicating to buyers which plants should be used for which ailment. The structure of the market stands in La Paz, as well as sourcing plant material and the function of the venders as “advisors” consulted for health problems of the public, were comparable to the markets in northern Peru (Bussmann and Sharon 2006b).

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.

Results

Most plants that are sold for medicinal purposes in the markets we studied are sold fresh and whole, allowing for easy botanical identification. Few species are sold as bark (e.g., Uña de Gato [Cat's claw]—*Uncaria* sp., Chuchuhuasi—*Maytenus* sp.) or as a root (e.g., some *Geranium* sp. and *Polypodium* sp.). Plant extracts in various forms can be

found in the specialized shops described above. However, in the case of *Equisetum* sp. and *Ephedra* sp., only fresh and complete plant material is sold in small bundles; no commercial extracts are available for purchase.

In the present study, we found that “Cola de Caballo” and related species in the inventory of 21 of the 25 interviewed market sellers (i.e., “horse-tail”) in some form or another occurred in the inventory of over 80% of all venders. In 14 cases, the plant *Ephedra americana* (Fig. 1A, ALM382) was sold as “Cola de Caballo.” One vender carried *Ephedra americana* var. *rupestris* (Fig. 1B, ALM317), which she sold as “Sanu Sanu del Altiplano.” The vender indicated, however, that this variety was not in high demand. Five more sellers carried *Ephedra americana* (“Cola de Caballo”) and *Equisetum giganteum* (Fig. 1C, ALM370), which were sold as both “Cola de Caballo” and “Cola de Caballo de las Yungas.” Only one vender carried *Equisetum bogotense* (Fig. 1D, ALM363), and sold it as “Sanu Sanu.” This reflects on the general problem of vernacular names and their spelling which, not unexpectedly, vary from vender to vender, with *Equisetum giganteum* called Cola de Caballo and Cola de Caballo de las Yungas; *Equisetum bogotense* called Sanu Sanu; *Ephedra americana* called Cola de Caballo; and *Ephedra americana* var. *rupestris* called Cola de Caballo and Sanu Sanu del Altiplano (note that Macía et al. 2005 found “Samu Samu” being used instead of “Sanu Sanu,” while Cardenas 1989 reports also “Sanu Sanu”).

Ephedra americana and *Equisetum giganteum*, as well as *Ephedra americana* var. *rupestris* were sold for kidney and liver problems. In contrast, *Equisetum bogotense* was interestingly sold for stomach pain, pain of the feet, cramps and tiredness, but never for kidney problems. All venders agreed that *Equisetum giganteum* worked “better,” and subsequently sold *Equisetum* at 1–2 Bolivian Pesos (Bs.) per bundle of about 50g), vs. *Ephedra* at 0.5–1 Bs. for the same quantity. All sellers of *Ephedra* indicated that the plant was a common shrub growing in rocky places in the Altiplano towards Oruro, around Lake Titicaca, and in the alpine zones towards Illimani, at altitudes between 3,900 and 4,500 m, sometimes as a large shrub (= Cola de Caballo del Altiplano), sometimes as a small shrub (= Sanu Sanu). The *Equisetum* venders indicated that both *E. bogotense* and *E. giganteum* came from wet places in the Macapaca valley, at the shores of Rio Irpavi (South

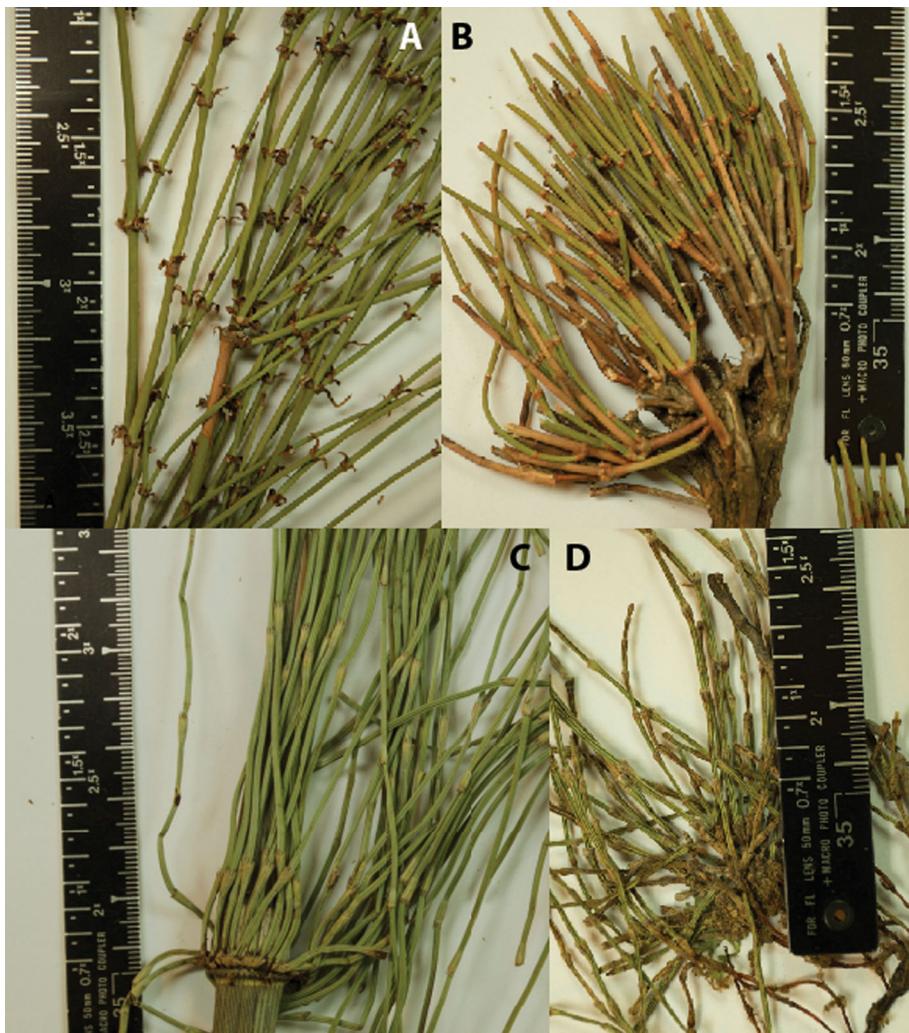


Fig. 1. A. *Ephedra americana* Humb. & Bonpl. ex Willd.; B. *Ephedra americana* var. *rupestris* (Benth.) Stapf.; C. *Equisetum giganteum* L.; D. *Equisetum bogotense* Kunth.

of La Paz), but that both species were rare and hard to collect. *Equisetum giganteum* was also obtained from the Yungas (the cloud forest zone east of La Paz), and again the venders indicated that the plant was rare and transport costly because of the distance involved. Most venders collected the material themselves and indicated that they much preferred to collect *Ephedra* because it was more common and close to their homes (all venders came from El Alto, the city just above La Paz). All venders recommended the same dosage (about 10 g of plant material prepared as tea (= immersed in 1 liter of

boiling water, without removing the material), to be drunk in three parts during the day—before breakfast, during lunch, and before going to bed, until the patient was cured). None of the venders knew of any side effects of either species sold, but a few recommended not drinking alcohol or carbonated soft drinks during treatment. However, the same venders gave these recommendations for all plants they sold, and as such they cannot be directly linked to possible side effects of Cola de Caballo use. Our field research confirmed our second and third hypothesis that there was no inconsistency in the

dosage, nor a relationship between dosage and species marketed under “Cola de Caballo” or “Sanu Sanu” as vernacular names, and that none of the venders mentioned side effects in the use of either species.

Discussion

Macía et al. (2005) published a short inventory of the same markets of La Paz. In their report, “Cola de Caballo macho” refers to *Equisetum giganteum*, used for urinary problems and kidney swellings. However, the same authors indicate that *Ephedra americana* Humb. & Bonpl. ex Willd. was sold as “Cola de Caballo hembra” for exactly the same indication. *Ephedra rupestris* Benth. was sold under the vernacular name “Samu Samu,” as a diuretic, but more commonly for abortions and menstrual retardation. While taxonomically the separation of the two *Ephedra* species does not hold up, and the latter species has long been classified as *Ephedra americana* var. *rupestris* (Benth.) Stapf., differentiated from *E. americana* by its much smaller size and prostrate growth (Macbride 1936), the findings of Macía et al. (2005) do however indicate a change in usage and vernacular name of *Ephedra* from the reports of Cardenas (1986) and Vandebroek et al. (2003), where the species is still listed as “Sanu Sanu” and is not reported for urinary system problems.

The decrease of *Equisetum* in the surroundings of La Paz and El Alto might be due to urban sprawl. Over the last decade, La Paz has greatly expanded southwards, destroying most of the wetlands in the Macapaca valley. The population of El Alto has also doubled over the last decade, and is currently expanding at over 6% annually, sprawling to occupy much of the former wetlands of the high plateau, destroying habitat that would formerly have harbored *Equisetum*. This could explain a shift to *Ephedra*, which grows on rocky slopes and is thus not directly affected by urban extension.

In contrast to Bolivia, we never found this confusion for the two species in northern Peru. *Ephedra americana* is sold in the markets as “Diego Lopez,” and a concoction is drunk for bruises, but with a maximum use time of two weeks. Gonzalez de la Cruz et al. (2014) report the same use for central Peru, but do not quote any local name. In addition, they found *Ephedra* being used as a bath for colds. Huamantupa et al. (2011) do, however, report *Ephedra americana* var. *rupestris* under the vernacular name “Pinco–Pinco” used as remedy to clean the

prostate. In addition, crude plant material is applied with fat to mend broken bones. For the latter application the vernacular name of the plant changes to “Suelda con Suelda.” Interestingly, the same vernacular name is also used for various Loranthaceae (Bussmann and Sharon 2006b). The latter fact is interesting, however, because it shows that a vernacular name might be linked to a use rather than a species: “Soldar” in Spanish signifies “mend”; i.e., “Suelda con Suelda” mends broken bones, for which reason the name is applied to various species used for that purpose. In the case of Cola de Caballo, the name refers to the appearance of the plant. As such, with a change in supply from *Equisetum* to *Ephedra*, a change of the latter species vernacular name to “Cola de Caballo” suggests a replacement of the species originally used.

The findings of the current study are problematic because “Cola de Caballo” is widely regarded as a safe and simple long-term remedy for urinary problems and kidney inflammation, and is thus frequently sold as a remedy. Consumers normally rely on the venders’ identification when they buy plants in the markets, and will not try to botanically identify material themselves. Moreover, although the genera belong to completely different plant groups (*Equisetum* to Pteridophyta, *Ephedra* to Gymnospermae), a quick identification of the plants at a glance, especially when bundled and without untying the material, is challenging even for a botanist. For the regular consumer, the identification in the market without an illustrated guide is almost impossible.

Given that traditionally *Ephedra* (as Sanu Sanu) was used as an abortive in Bolivia (Macía et al. 2005), the potentially serious effects of the plant must have been known. None of the venders selling the plant as “Cola de Caballo” mentioned any side effects or potential risks, however, and consumers simply rely on the vender’s identification as a harmless plant under a well-known vernacular. Apart from potentially causing abortions, other side effects include insomnia, irritation, nausea, tachycardia, headaches, and most seriously, development of addiction. These were clearly indicated in the monographs of the German medicinal plant commission (Bundesanzeiger 1991) when it approved the use of *Ephedra sinica* Stapf. for bronchial spasms, based on longtime use of the plant in Chinese traditional medicine (Abourashed et al. 2003). Because of potential side effects, the U.S. Federal Drug Administration banned supplements containing *Ephedra* in 2004 (FDA 2004). The German medicinal plant

commission also warns that *Ephedra* should not be used in cases where patients suffer from prostate adenoma and urine retention. Because such problems are exactly the sorts of indications treated with “Cola de Caballo” in Bolivia, this could potentially create serious complications.

Similar to the results of our previous study in the markets of Lima, where we found that Gentianaceae and Geraniaceae used to treat diabetes posed a potential health risk (Bussmann et al. 2013), we find again that even plants with a well-established vernacular name, and that are easily recognizable botanically, can be replaced by other species that can pose a serious health risk. More vendor education, and a much more stringent identification of the material sold in public markets and entering the global supply chain via Internet sales, is clearly needed.

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