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Why ritual plant use has ethnopharmacological relevance

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ABSTRACT

Ethnopharmacological relevance: Although ritual plant use is now recognised both for its socio-cultural importance and for its contribution to nature conservation, its potential pharmacological effects remain overlooked.

Aim of the study: Our objective was to see whether ritual plant use could have ethnopharmacological relevance through practices that involve direct physical contact with the human body. We hypothesise that ritual practices reflect traditional knowledge on biological activities of plant species, even if plants are used in a symbolic way.

Materials and methods: Data were collected in collaboration with traditional healers and ritual plant vendors and harvesters in Benin (West Africa) and Gabon (Central Africa). Both ritual and medicinal uses of plants were recorded. Voucher specimens were collected and identified. We documented different administration routes of ritual plants and selected those whose uses involved direct contact with the human body. Based on our quantitative market surveys and field inventories, we identified 24 commercially or otherwise culturally important species and compared their ritual uses with proven biological activity from the literature.

Results: We recorded 573 plant species with 667 ritual uses, of which ca. 75% (442 species and 499 uses) implied direct contact with the human body. The most common route of administration for ritual treatments was baths, followed by oral ingestion and skin rubbing. One third (186 species) of all ritual plants doubled as medicine for physical ailments. In contrast to previous research that explained the effectiveness of ritual plant use to be a matter of belief, our results hint at the potential medicinal properties of these plants. Ritual treatment of madness caused by evil spirits by the consumption of *Rauvolfia vomitoria* roots, for example, may be based on the species' proven anticonvulsant properties.

Discussion and conclusion: We discuss some of the possible implications of ritual plant use for public health and conclude by suggesting that ritual plant uses that do not involve contact with the human body may also be vehicles for the transmission of traditional medicinal knowledge.

1. Introduction

According to the International Council for Science (ICSU, 2000), traditional knowledge is defined as the body of knowledge and practices developed and maintained by people to manage their environment. It includes beliefs in supernatural agents such as spirits, ancestors and gods, and how these relate to society (Reyes-García, 2010). Over the past two decades, traditional knowledge has received increasing recognition for its importance in nature conservation (Berkes et al., 2000), and for the advancement of biomedical science (Young, 1983). In the case of Africa, anthropologists have thoroughly studied traditions that involve the enactment of agency by supernatural entities (henceforth religious traditions Quiroz, 2015) and rituals (i.e. the practical matrix of religious traditions (Rappaport, 1999)) (Herskovits, 1938; Fernandez, 1982; Blier, 1995), but the plants associated with these practices have barely been documented (Verger, 1995; Raponda-Walker and Sillans, 1961; Vergiat, 1970; Akendengue, 1992; De Souza, 2006). With the exception of psychoactive plants that are central to some religious traditions (notably, *Tabernanthe iboga* (Sheppard, 1994; Alper et al., 2008)) and toxic species used in poison ordeals (e.g. *Erythrophleum suaveolens* (Abbiw, 1996; Ngounou et al., 2005)), African ritual plants use has received little attention in ethnopharmacology. This is probably due to the tendency of researchers in this discipline to base their studies almost exclusively on a combination of chemical, biological, and pharmacological sciences (Reyes-García, 2010). Moreover, from

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bioprospecting during the colonial era, the notion emerged that African ritual plant use is too much typified by witchcraft and sorcery to be of any medicinal benefit (Voeks, 2004). Not surprisingly, ritual plant use has been described as "superstitious" (Irvine, 1961), characteristic of "under-developed peoples" (Oliver-Bever, 1986), a demonstration of "the gullibility of the credulous" (Burkill, 1995), or has simply been omitted from the otherwise extensive inventories of useful plants (Abbiw, 1996).

This attitude of neglect is indisputably changing, as demonstrated by the number of publications that acknowledge ritual plant use as an integral part of traditional healing systems (Van Andel and Ruysschaert, 2011; Iwu, 2014). In practice, however, we now face the consequences of the historical disdain for ritual plants. For example, the Plant Resources of Tropical Africa (PROTA) series composed of eight volumes and a web database with over 1850 articles on useful plant species (PROTA, 2014) is probably the most valuable resource on useful plants for Africa to date. Although ritual, religious, or magic uses of plants are sometimes mentioned in the separate sections on medicinal uses given for each of the species treated, these appear to be proportionally underrepresented. This is an unfortunate situation, given that PROTA's mission is to make scientific information about useful plants accessible in Africa, yet an important aspect of societal life in the continent remains scantly covered.

Nowadays, with modern health facilities becoming more accessible to Africans, ethnomedical practitioners are likely to increasingly limit their services to illnesses that have medico-religious aetiologies (Anyinam, 1987). Today, hundreds of plant species are used for ritual practices in West and Central Africa (Quiroz and van Andel, 2015), and many of these are sold in large quantities on the medicinal plant markets in the region (Van Andel et al., 2012; Quiroz et al., 2014; Towns et al., 2014). The few detailed studies on ritual plant use in Africa reveal a variety of practices with potential pharmacological effects on the patients receiving the treatment (Bouquet, 1969). Earlier studies on ritual plants worldwide already indicated that these plants often have additional healing properties (Voeks, 1990; Van Andel and Ruysschaert, 2011), which could be the reason why they are considered sacred in the first place (Van Andel et al., 2013).

We documented ritual plants in Benin (West Africa) and Gabon (Central Africa) and assessed their possible pharmacological relevance. We hypothesise that ritual practices reflect traditional knowledge concerning biological activities of the specific plant species, even if plants are used in a symbolic way. Therefore, we posed the following research questions: (1) Which plant species are used for ritual purposes in Benin and Gabon? (2) How many of these plants have known medicinal uses? (3) What proportion of ritual implies direct contact with the human body? (4) Which species and applications suggest biological effects? (5) Do symbolic uses suggest biological activity?

2. Methods

2.1. Study areas

Located in the Dahomey Gap (Salzmann and Hoelzmann, 2005), Benin's vegetation is a mosaic composed by some 2800 forest-savannah species occurring intermittently among fallows, fields, and semi-evergreen, deciduous, and swamp forest islands (Adomou, 2005). Gabon is situated in the Lower Guinea rain forest block (White, 1979), and its vegetation consists of at least 4700 species (Sosef et al., 2006). In Benin, traditional faiths are considered official religions, whereas in Gabon these are tolerated by most of the population (US Department of the State, 2013). Vodoun or Orisha, the most prevalent traditional faith in the country, is based on the belief of supernatural gods that help the creator govern the natural world (Herskovits, 1938). In Gabon, "Bwiti" is a social and religious institution comprised by secret societies, each with its own passage rites and ceremonies (Świderiski, 1965). In both countries, ritual plants are the most predominant type of plants sold at the herbal medicine markets (Quiroz et al., 2014; Towns et al., 2014).

2.2. Data collection

Fieldwork in Benin was undertaken between March and October 2011 in the departments of Kouffo, Zou, Plateau, Ouémè, Atlantique, Littoral, and Mono. There, we worked in the regions predominantly inhabited by people of Fon and Yoruba descent. In Gabon, we worked with members of Bantu-speaking ethnic groups in the provinces of Estuaire, Haut-Ogooué, Ngounié, Moyen-Ogooué, Ogooué-Ivindo, and Nyanga from June until December 2012. The informant pool consisted of 50 individuals in Benin. In Gabon we worked with 52 informants.

We started at the medicinal plant markets of both countries. We conducted informal interviews with market vendors in order to identify ritual plants (i.e. plants used in contexts involving the presence of supernatural entities such as ancestors, spirits, and gods) and salient ailments attributed a supernatural origin. We complemented our data on (commercial) ritual plant use gathered at the markets with ethnobotanical questionnaires administered to traditional healers by the main author. Traditional healers were reached by means of snowball sampling. In total, our sample consisted of 57 informants (35 traditional healers and 22 market vendors) in Benin and 46 informants (38 traditional healers and 8 market vendors) in Gabon. Special attention was paid to recording detailed information on plants' vernacular names, local terms for the conditions treated with these plants, preparation methods, dosage, and route of administration. Additionally, informants were asked to explain, whenever possible at length, the symptoms, causes, and effects of the health conditions in question. Participant observation techniques were also utilised to better understand the different contexts in which ritual plant were used. This implied that we participated not only in plant collection, but also in ritual ceremonies, food and medicine preparation, farming, and other daily activities of the communities where we worked that involved contact with supernatural entities.

Questionnaires were completed by the collection of voucher material from all plant species cited during the interviews. We purchased the plants mentioned by vendors directly at their market stalls. We accompanied traditional healers to the sites where they collected the plants they used during their ritual treatments. These sites included communal forests and grasslands, sacred forests, home gardens, and shrines. All plants were collected following standard botanical methods (Forman and Bridson, 1989). For each specimen, two vouchers were made: one was deposited at the national herbarium of the country where the plant was collected (BEN in Benin and LBV in Gabon) and the other one deposited at Naturalis Biodiversity Center (L). Plants were identified using the Flora of Benin (Akoegninou et al., 2006) and the Flora and Checklist of Gabon (Various editors, 1960–2008; Sosef et al., 2006, 2009). Current scientific names were updated using The Plant List (www.theplantlist.org).

2.3. Data analysis

We constructed a database of all ritual plant uses documented in Benin and Gabon and applied exclusion criteria to narrow down the list (Supplementary file 1). These criteria were set in order to only include plants that had been identified to the species level and to exclude: (1) plants that had been identified to family or