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Plants of restricted use indicated by three cultures in Brazil (Caboclo-river dweller, Indian and Quilombola)

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Abstract

A detailed record of plants cited during ethnopharmacological surveys, suspected of being toxic or of triggering adverse reactions, may be an auxiliary means to pharmacovigilance of phytomedicines, in that it provides greater knowledge of a "bad side" to plant resources in the Brazilian flora. This study describes 57 plant species of restricted use (abortive, contraceptive, contraindicated for pregnancy, prescribed in lesser doses for children and the elderly, to easy delivery, in addition to poisons to humans and animals) as indicated during ethnopharmacological surveys carried out among three cultures in Brazil (Caboclos-river dwellers, inhabitants of the Amazon forest; the Quilombolas, from the pantanal wetlands; the Krahô Indians, living in the cerrado savannahs). These groups of humans possess notions, to a remarkable extent, of the toxicity, contraindications, and interaction among plants. A bibliographical survey in the Pubmed, Web of Science and Dr. Duke's Phytochemical and Ethnobotanical Databases has shown that 5 out of the 57 species have some toxic properties described up to the present time, they are: *Anacardium occidentale* L. (Anacardiaceae), *Brosimum gaudichaudii* Trécul (Moraceae), *Senna alata* (L.) Roxb. (Fabaceae), *Senna occidentalis* (L.) Link (Fabaceae), *Strychnos pseudoquina* A. St.-Hil. (Loganiaceae) and *Vernonia brasiliana* (L.) Druce (Asteraceae).

Keywords: Ethnopharmacology; Pharmacovigilance; Contraindications; Adverse reactions; Toxic plants

1. Introduction

Whether medicinal or poisonous, the plants have undergone experimentation, not always with laboratory animals. In communities that live in the forests, humans have, for a long time been, and still are, a substitute for laboratory animals, above all, where there is a dearth of conventional medical services and where local therapeutics must meet the demands of day-to-day diseases and those as yet unknown.

In the same way as in academic sciences, this experimentation is carried out by specific individuals in those communities and follows some criteria for the selection of new plants/animals to be tested as prospective therapeutic agents.

During the investigation for new drugs, academic science utilizes four main criteria for a selection of the plants to be studied, namely random collecting (at random), collecting oriented by chemotaxonomy, biorational collecting (guided by chemical ecology), and collecting based on traditional knowledge, the latter being the focus of ethnopharmacology (Kate and Laird, 1999).

The criteria used by forest-dwellers, who possess the said traditional knowledge, are based on four kinds of thoughts: (a) similar to random collecting, they use trial and error as one strategy in the search for new drugs: latter we will understand that this strategy is not at all random, for it would seem to follow "sensory clues"; (b) in the same way as biorational collecting, the forest-dwellers endeavor to observe the behavior of certain animals after consumption of one specific plant, to see whether the animals become more agitated or drowsy, for instance, these observations serve as clues to be followed when they decide to experiment a particular plant. The other two criteria differ from those utilized in academic science: (c) sensory stimuli (obtained as yet in infancy, while they play in the forest with flowers, leaves, and animals—dissecting, smelling, and crushing the plants in an endeavor to understand how they work) added to the innate curiosity of these same people, are a start to an elaboration of a correlation between particularities (morphological and organoleptic) of a plant/animal, and its potential use. When

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Table 1
Ethnopharmacological surveys developed by the author, whose data were utilized in the elaboration of the present text

Period	Culture	Bioma (local)	Area (ha) and number of habitants	Number of interviewees	Number of collected species
1995 (May–November)	Caboclos-river dwellers	Amazon forest (Jaú National Park—JNP, Amazonas State)	2,272,000 and about 1000	7 Prayer-makes 3 Midwives 2 Healers 1 Masseur 1 Medium[a] 12 Specialists in household remedies	120
1998–2001	Quilombolas	A transition area of cerrado savannahs and pantanal wetlands (Sesmaria Mata-Cavalos, Mato Grosso State)	13,620 and about 300	2 Mediuns 2 Specialists in household remedies	82
1999–2001	Krahô Indians	Cerrado savannahs (Kraholândia, Tocantins State)	302,533 and about 1590	7 *wajacás* (shamans)	164

[a] Healer that possess the power to communicate himself with the spirits aiming therapeutic purposes.

they find need for a new remedy, it is as if they consult their "sensory memory bank" to correlate the need for one specific particularity from one plant (Strauss, 1989). Innate curiosity and observation added to the availability of a rich source of plants and animals, permit new prescriptions to be tested at the time they prove necessary: in testing a plant "at random", the forest dwellers utilize this "sensorial information". This reasoning is universal (Johns, 1990) and follows the principle of the Doctrine of Signatures advocated by Paracelsus (1493–1541) which specifies it is possible to recognize the peculiarities and virtues of each herb by its "signature" (shape, form, color); (d) finally, intuition is of extreme importance in selecting new resources to be tested: these individuals are part of an environment consisting of beings interconnected biologically.

All of this process is complex and dynamic and in continuous transformation and therefore, does not consist only of the knowledge of their forebearers.

Within these dynamics, when a specific plant is suspected or defined as exerting an effect that may put the lives of the inhabitants of any particular site at risk, because of its poisonous/toxic effect, this knowledge is disseminated among all of the individuals in the community. For this reason, knowledge about plants as abortive, contraceptive, as poisonous to animals, as poisonous to humans, as contraindicated in pregnancy, toxic to children or to the aged, is not restricted to medicine men (shamans, healers, faith healers and midwives).

We might draw a parallel between this practice and the objective of pharmacovigilance, whether in collecting, analyzing, and informing on an adverse reaction to medication, outlining an encounter between the latter and ethnopharmacology, as suggested by Barnes (2003a,b,c), a researcher devoted to the pharmacovigilance of herbal medicines. In this way, a record of information on plants with restrictions in use cited during ethnopharmacological surveys should merit special attention and supply the database auxiliary to pharmacovigilance of phytomedicines.

The need to extend pharmacovigilance to include products of plant origin also, has been under discussion for almost 10 years now, in that these may pose a potential health risk (Marques, 1996); however, this practice is as yet incipient in Brazil. In spite of this, there are a great many cases of toxic effects and of adverse reactions triggered by medicinal plants and phytomedicines (Veiga Junior et al., 2005).

The present article describes the plants of restricted use cited during ethnopharmacological surveys carried out with three cultures in Brazil: Caboclos-river dwellers (Amazon forest bioma, Amazonas State), the Krahô Indians (cerrado brushlands, Tocantins State) and the Quilombolas (area of transition between the cerrado brushlands and the pantanal wetlands in Poconé, Mato Grosso State).

2. Methodology

The three ethnopharmacological surveys were carried out at different times as shown in Table 1. The first was developed among the Caboclos of the Jaú National Park (JNP), Amazonas (Rodrigues, 1997, 1998, 2006). The second among the Quilombolas of the Mata-Cavalos Sesmaria, Mato Grosso (Rodrigues and Carlini, 2003a, 2004, 2006), and the third among the Krahô Indians, Tocantins (Rodrigues, 2001; Rodrigues and Carlini, 2003b, 2005). Methods of anthropology and botany employed in these surveys were described in the articles cited above.

Written permissions were obtained from the Ethics Committee of the Federal University of São Paulo and from the Quilombolas and Indians (those who took part in the study) to access their knowledge and botanical material (UNIFESP's

Research Ethics Committee no 056/00). In the case of the Quilombolas, Mrs. Cezário, the main interviewed, deceased in 2004, explained that his knowledge should be used for the well being of humanity.

The information necessary for ethnopharmacological data was gathered as from semi-structured interviews that afforded a record under the vernacular name of the plant, with therapeutic indication, the part utilized, mode of preparation, route of administration, and contraindication.

The samples of plant species collected were deposited in herbaria in the INPA—National Institute for Research of the Amazon Region and the Botanical Institute of Sao Paulo State (IB). Several taxonomists from both herbaria identified the plants.

Only those species with some type of restricted use that belonged to each of the six categories below, were selected as from the universe of data obtained in these three surveys:

1. with contraindication during pregnancy;
2. prescribed in lesser doses for the elderly and for children (or even unprescribed in some cases);
3. abortive;
4. contraceptive;
5. to ease delivery;
6. poisonous to humans and/or animals.

At a second stage, a bibliographical survey was carried out on the Pubmed (2006), Web of Science (2006) and Dr. Dukeís Phytochemical and Ethnobotanical Databases (October 2006) to verify the existence of previous work that might describe some type of toxicity or cases of adverse reactions to the species of plants selected.

3. Results and discussion

Three hundred sixty-six (366) plant species were collected in the course of 3 ethnopharmacological surveys, with 82 plants (from the Quilombolas), 164 (the Krahô Indians), and 120 plants (from the Caboclo population) [Table 1] of which 57 or, 15.6%, presented at least 1 of the 6 restrictions for use: abortive plants, contraceptives, plants contraindicated during pregnancy, prescribed in lesser doses for children and the elderly, to easy delivery, as poisonous to animals and/or humans (Table 2).).

As can be seen in Table 2, most of these species were utilized as decoctions, and the parts most utilized were leaves, roots and barks. It was possible to inform the doses of few species, expressed as number of leaves and seeds. Sometimes, the doses were mentioned as "fingers" in order to specify the amount of barks or roots, or even as "a handful", according to the interviewed. On the other hand, doses are lacking to some species, since these informations were not properly obtained during the ethnopharmacological surveys. Concerning the plants indicated as poisonous to animals and/or humans, their doses were not provided because the interviewees explained that any dose should be avoided.

As can be observed in Fig. 1, 37 of the 57 plants are contraindicated for pregnant women, including all of the abortives (13 plants), the contraceptives (10), those to easy delivery (6) in addition to 8 other plants.The six categories of restricted use are described below:

3.1. Abortive (13 species)

Most of the knowledge about plants with abortive properties was obtained from the women of the three cultures studied, although some men, when broached by the researcher, showed knowledge of plants and prescriptions for this purpose. In the majority of cases, the plants are utilized individually in the form of teas (decoction) or maceration and taken empty stomach, immediately the women suspect they are pregnant. The Krahô Indians associate two of the plants in a single prescription, "aprytytti" (quina), *Acosmium dasycarpum* (Vogel) Yakovlev and "ahkryt" (cajú), *Anacardium occidentale* (Anacardiaceae); the bark is boiled and the beverage ingested in the early hours, at dawn—an extremely bitter beverage, rich in tannin and, therefore, extremely astringent. The Indians explain that in a very few days the embryo is expelled. This procedure is to be carried out only when the pregnancy is recent (at most, in the first two months). Also the Quilombolas utilize a decoction from the leaves of "hortelã-da-várzea" (*Hyptis cana* L.—Lamiaceae) for the same purpose.

3.2. Contraceptives (10 species)

This category of plants was included in this text, because, according to those interviewed, a potion can make women that consume it chronically infertile, reversibly (temporary contraceptive) or irreversibly (permanent contraceptive) depending on the plant utilized. The Krahô Indians explain that, when they wish to be some time (years) without becoming pregnant, they imbibe a tea prepared with one of the plants from Table 2 every day of the menstrual cycle (for three or four cycles). They explain that ingestion of this tea in a chronic form "dries up the menstruation", and seems to reduce the blood flow. When these women wish to become pregnant, they explain they must use another plant, "pincraioketré—*Ayenia angustifolia* A St.-Hil. and Naudin (Sterculiaceae) to antagonize the effect of the first, so that the normal flow of menstruation will return and render them fertile once more.

One of the plants regarded as a permanent contraceptive is the "apênkumkrore-ti", *Sclerolobium aureum* (Tul.) Baill. (Fabaceae) which, according to those interviewed, acts in a way similar to temporary contraceptive plants: however, no other plant antagonizes its effect, and the women may, therefore, never become pregnant again. This plant is used by elderly women who already have a good number of children.

Some women in the JNP imbibe a red, extremely bitter beverage, prepared with the bark of the "carapanaúba", *Aspidosperma excelsium* (Apocynaceae) in water (crushed) during all day, if they have had sexual intercourse the previous night and are in a fertile period. In this case, in particular, the plant may act during the period for pre-implantation of the embryos in the uterus. Other more careful women, however, say they ingest this crushed plant, also empty stomach, in the morning, during the fertile

Table 2
Categories of plants of restricted use indicated by three Brazilian cultures (●) river dwellers Caboclos from JNP; (▲) Quilombolas from Sesmaria Mata-Cavalos and (■) Krahô Indians

Species (family) voucher	Vernacular name	Abortive	Contraceptive	Prescribed in lower doses for children and elderly or even unprescribed	Contraindicated for pregnant	To ease delivery	Animal and/or human poison	Scientific studies
(1) *Acosmium dasycarpum* (Vogel) Yakovlev (Fabaceae) E. Rodrigues 868	Aprytytti (or Quina) (■)	Bark, 3 fingers (decoction)			Bark, 3 fingers (decoction)			
(2) *Aeschynomene mollicula* Kunth (Fabaceae) E. Rodrigues 999	Pojarkwahô (■)			Root (decoction)				
(3) *Anacardium occidentale* L. (Anacardiaceae) E. Rodrigues 750	Ahkryt (or caju) (■)	Bark, 3 fingers (decoction)	Bark, 3 fingers (decoction)		Bark, 3 fingers (decoction)			Alergy—cashew nut (Ippen, 1983; Menezes et al., 2002; Rance et al., 2003; Inomata et al., 2006)
(4) *Annona coriacea* Mart. (Annonaceae) E. Rodrigues 763	Wagatenré (Bruto-rasteiro) (■)				Root (maceration)			
(5) *Annona crassiflora* Mart. (Annonaceae) E. Rodrigues 630	Wahcate (Bruto) (■)						Bark (juice)	
(6) *Aspidosperma excelsum* Benth. (Apocynaceae) E. Rodrigues 11	Carapanaúba (●)	Bark, 1 finger (maceration)	Bark, 1 finger (maceration)		Bark, 1 finger (maceration)			
(7) *Bauhinia pulchella* Benth. (Fabaceae) E. Rodrigues 782	Tepjacotréhô (■)			4 Leaves (juice)				
(8) *Brosimum gaudichaudii* Trécul (Moraceae) E. Rodrigues 614	Algodãozinho (▲)				Leaf/root (decoction)			Mutagenic activity—root bark (Varanda et al., 2002)
(9) *Byrsonima oblongifolia* A. Juss. (Malpighiaceae) E. Rodrigues 644	Pintuncrare (■)			5 Leaves (decoction)				
(10) *Cissampelos ovalifolia* DC. (Menispermaceae) E. Rodrigues 711	Ropjapachô (■)						Tubercle (juice)	
(11) *Clitoria simplicifolia* (Kunth) Benth. (Fabaceae) E. Rodrigues 702	Harejaré (■)						Tubercle	
(13) *Copaifera guyanensis* Desf. (Fabaceae) E. Rodrigues 78	Copaíba (●)	4 Seeds (decoction)			4 Seeds (decoction)			
(13) *Cordia insignis* Cham. (Boraginaceae) E. Rodrigues 506	Iodo-do-campo (▲)				Root (decoction)			
(14) *Crescentia cujete* L. (Bignoniaceae) E. Rodrigues 29	Cuia (●)						1 Flower	
(15) *Crotalaria maypurensis* Kunth (Fabaceae) E. Rodrigues 1011	Cagajaxy (■)				Seed/leaf (juice)			
(16) *Cymbopogon citratus* (DC.) Stapf (Poaceae) E. Rodrigues 1035	Capim-cidreira (●)				1 Root (decoction)	1 Root (decoction)		
(17) *Dorstenia asaroides* Hook. (Moraceae) E. Rodrigues 745	Tonturé (■)				Tubercle (decoction)			
(18) *Emmotum nitens* (Benth.) Miers (Icacinaceae) E. Rodrigues 767	Hôjiproré (■)			Young leaves (juice)				
(19) *Duckesia verrucosa* (Ducke) Cuatrec. (Humiriaceae) E. Rodrigues 23	Uchi-corôa (●)		1 Seed (decoction)		1 Seed (decoction)			
(20) *Endopleura uchi* (Huber) Cuatrec. (Humiriaceae) E. Rodrigues 24	Uchi-liso (●)	Bark, 1 finger (maceration/decoction)			Bark, 1 finger (maceration/decoction)			
(21) *Eriosema crinitum* (Kunth) G. Don (Fabaceae) E. Rodrigues 752	Mecaprotu (■)	Root (decoction)	Root (decoction)		Root (decoction)			
(22) *Eryngium foetidum* L. (Umbeliferae) E. Rodrigues 115	Chicória (●)				Whole plant (decoction)	Whole plant (decoction)		
(23) Guazuma ulmifolia *Lam.* (Sterculiaceae) E. Rodrigues 535	Chico-magro (▲)				Bark (decoction)			
(24) *Helicteres muscosa* Mart. (Sterculiaceae) E. Rodrigues 688	Caxatré (■)						Tubercle (juice)	
(25) *Hymenaea stigonocarpa* Mart. ex Hayne (Fabaceae) E. Rodrigues 678	Pojkôré (■)		Bark (decoction)		Bark (decoction)			
(26) *Hyptis cana* Pohl ex Benth. (Lamiaceae) E. Rodrigues 530	Hortelã-da-várzea (▲)	Leaves-a handful (decoction)			Leaves-a handful (decoction)			
(27) *Jacaranda copaia* (Aublet.) D. Don. (Bignoniaceae) E. Rodrigues 116	Murupá (●)		Tubercle (juice)					
(28) *Julocroton humilis* Müll. Arg. (Euphorbiaceae) E. Rodrigues 955	Ihôncôcôré (■)				Root/leaf (decoction)			
(29) *Lafoensia pacari* A. St.-Hil. (Lythraceae) E. Rodrigues 532	Mangava-brava (▲)				Bark (decoction)			

(30) *Martiodendron mediterraneum* (Mart. ex Benth.) R. Koeppen (Fabaceae) E. Rodrigues 685	Pihtyre (■)				Whole plant (decoction)			
(31) *Mouriri pusa* Gardner (Melastomataceae) E. Rodrigues 787	Krohtot (■)		Bark/leaf (decoction)		bark/leaf (decoction)			
(32) *Ouratea castaneifolia* (DC.) Engl. (Ochnaceae) E. Rodrigues 831	Tuiohy (■)			Leaf/root (decoction)				
(33) *Oxalis physocalyx* Zucc. ex Progel (Oxalidaceae) E. Rodrigues 884	Azedinha (▲)	Whole plant (juice)			Whole plant (juice)			
(34) *Palicourea* Aubl. (Rubiaceae) E. Rodrigues 839	Par (■)						Root (juice)	
(35) *Palicourea nicotianifolia* Cham. and Schltdl. (Rubiaceae) E. Rodrigues 120	Erva-de-rato (●)						Leaf (juice)	
(36) *Pectis elongata* H.B.K. (Asteraceae) E. Rodrigues 71	Cominho (●)				3 Roots (decoction)	3 Roots (decoction)		
(37) *Piper tuberculatum* Jacq. (Piperaceae) E. Rodrigues 781	Cukoi-johparhyre (■)			Leaf (juice)				
(38) *Plathymenia reticulata* Benth. (Fabaceae) E. Rodrigues 769	Acààre (Candeia) (■)				Bark (decoction)			
(39) *Polygala longicaulis* Kunth (Polygalaceae) E. Rodrigues 710	Harêrá (■)			Leaf (decoction)				
(40) *Psittacanthus robustus* (Mart.) Mart. (Lorantaceae) E. Rodrigues 922	Hôtucti (■)	Leaf (decoction)			Leaf (decoction)			
(41) *Qualea parviflora* Mart. (Vochysiaceae) E. Rodrigues 814	Krác (■)						Fruit	
(42) *Rhynchospora cephalotes* (L.) Vahl (Cyperaceae) E. Rodrigues 909	Caparé (■)		Root (decoction)					
(43) *Rourea induta* Planch. (Connaraceae) E. Rodrigues 648	Hohocré (■)	4 Leaves/1 root, 1 finger (decoction)			4 Leaves/1 root-1 finger (decoction)			
(44) *Salvertia convallariodora* A St.-Hil. (Vochysiaceae) E. Rodrigues 731	Parhô (■)						Whole plant	
(45) *Sclerolobium aureum* (Tul.) Baill. (Fabaceae) E. Rodrigues 712	Apênkumkrore-ti (or Tatarema) (■)		Bark (decoction)		Bark (decoction)			
(46) *Senna alata* (L.) Roxb. (Fabaceae) E. Rodrigues 114	Sene (●)				Leaf (decoction)	Leaf (decoction)		Hepatorenal toxicity—leaves (Yagi et al., 1998)
(47) *Senna occidentalis* (L.) Link (Fabaceae) E. Rodrigues 515	Fedegoso (▲)				Seeds (decoction)			Mitochondrial myopathies—seeds (Calore et al., 2002); toxicity—seeds (O'Hara and Pierce, 1974; Haraguchi et al., 1998, 2003; Barbosa-Ferreira et al., 2005)
(48) *Simaba suffruticosa* Engl. (Simaroubaceae) E. Rodrigues 899	Tuhôhoré (■)	Root (maceration)			Root (maceration)			
(49) *Siparuna guianensis* Aubl. (Monimiaceae)	Capitiú (●)				Leaf (decoction)	Leaf (decoction)		
(50) *Strychnos pseudoquina* A. St.-Hil. (Loganiaceae) E. Rodrigues 522	Quina (▲)	Leaf/bark (decoction)			Leaf/bark (decoction)			Mutagenic activity—leaves (Santos et al., 2006)
(51) *Syagrus* Mart. (Arecaceae) E. Rodrigues 679	Hôtréjô (■)				Leaf (juice)			
(52) *Syagrus petraea* (Mart.) Becc. (Arecaceae) E. Rodrigues 705	Açaí-bravo (▲)		Fruit (*in natura*)		Fruit (*in natura*)			
(53) *Tabebuia aurea* (Silva Manso) Benth. and Hook. f. ex S. Moore (Bignoniaceae) E. Rodrigues 826	Tocti (or Caraíba) (■)				Bark (decoction)			
(54) *Vernonia brasiliana* (L.) Druce (Asteraceae) E. Rodrigues 511	Assa-peixe (▲)			Leaf/root (decoction)			Leaf/root (decoction)	
(55) *Vernonia herbacea* (Vell.) Rusby (Asteraceae) E. Rodrigues 693	Ampohôrerecre (■)			Leaf/root (decoction)				
(56) *Virola subsessilis* (Benth.) Warb. (Myristicaceae) E. Rodrigues 629	Rojoxô (■)	4 Leaves (decoction)/3 drops of the latex		4 Leaves (decoction)/3 drops of the latex	4 Leaves (decoction)/3 drops of the latex			
(57) *Zingiber officinalis* L. (Zingiberaceae) E. Rodrigues 90	Managarataia (●)				1 Root, 3 fingers (decoction)	1 Root (decoction)		

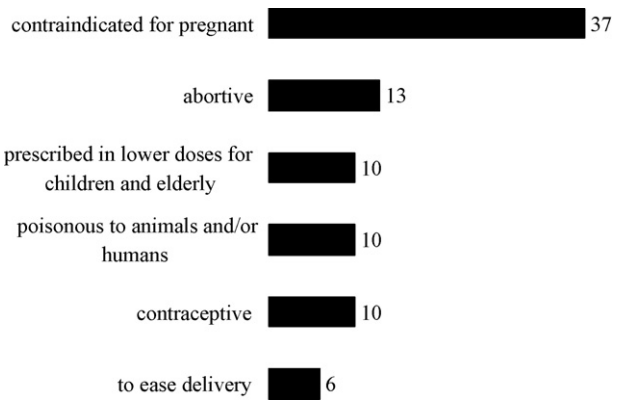

Fig. 1. Number of plants cited for each category of restricted use indicated by the three Brazilian cultures (Quilombolas, Indians and Caboclos).

period of the month, if they desire to have sexual intercourse without risk of getting pregnant.

A medicinal plant does not only have effects related to its acute ingestion, but also, effects manifest after a long period of time, even subsequent to interrupted use; for instance, chronic use of "cáscara-sagrada" (*Rhamnus purshiana* DC—Rhamnaceae), may lead to electrolytic disorders, and intestinal and cardiac trouble (Wong and de Castro, 2003). In the same way, the ingestion of these contraceptives, almost always chronic, should be investigated for possible unwanted effects on the long term; rarely is a relationship established between this type of effect and the consumption of any one specific plant.

3.3. Contraindication for pregnant women (37 species)

According to those interviewed, almost all "bitter" tasting plants should be avoided by women in pregnancy, in addition to those that trigger abortion or are utilized as contraceptive methods.

In fact, one particular article shows that the majority of the 30 plants with a toxic, teratogenic and abortive effect present "bitter" organoleptic properties, namely "alcachofra" (*Cynara scolymus* L.), "arnica" (*Arnica montana* L.), "sene" (*Cassia senna* L.), "erva-de-Santa-Maria" (*Chenopodium ambrosioides* L.), "losna" (*Artemisia absinthium* L.), among others (Soares et al., 2003).

Another study identifies 108 plant species with contraindications in lactation and pregnancy, with over 16 reactions cited for these species, among these: emmenagogue, abortive, mutagenic, cathartic, occitoxic/stimulant of the uterus, teratogenic and producer of colic in breast-fed babies (Comissão Técnica da Anfarmag, 2002). Most of them are bitter.

The bitter astringent flavor of these plants is related to their chemical composition, rich in tannin. It is a known fact that plants with this chemical constituent particularity may hinder the absorption of proteins and alkaloids (Williamson, 2001), possibly impeding the passage of proteins and other substances by the placenta (Sawada et al., 1989).

3.4. To easy delivery (6 species)

This use is considered restricted since the ingestion of these plants may provoke uterine contractions, thus should be avoided by pregnant. Some of these prescriptions may include several ingredients, for example, a mix of alcohol, *Piper nigrum* L.—Piperaceae (seeds) and also *Cymbopogon citratus* (DC.). Stapf–Poaceae (root) is utilized by the midwives from JNP. This prescription is associated with prayers that the midwives should say in the hour of the birth. Another prescription is a decoction prepared with: *Eryngium foetidum* L.—Umbeliferae (whole plant), *Pectis elongata* H.B.K.—Asteraceae (root), *Zingiber officinalis* L.—Zingiberaceae (root) and drops of animal fats, such as: *Agouti paca* (Agoutidae) "paca" and *Potamotrygon* spp. (Potamotrygonidae) "ray".

3.5. Prescribed in lesser doses to children and the elderly (10 species)

The "care" of the medicine men in prescribing differentiated doses to children and to the elderly, in relation to young people and adults, was observed only among the Quilombolas and the Krahô Indians (Table 2) who indicated 10 plants in this category (Fig. 1). The interviewees explain that, although the plants may be used by all, some of them are very "strong" and must, therefore, be consumed by children and the elderly in lesser doses, or even not prescribed for them; otherwise, the patients may become extremely ill, or even die. Among these, the species *Virola subsessilis* (Benth.) Warb (Myristicaceae), whose toxic potential, evident in the chemical composition of this genera, rich in neolignanes and tryptamines, has been described (Schultes, 1984).

3.6. Poisonous to humans and animals (10 species)

To understand how a group of humans classifies plants as either "poisonous to people" or intended "to make someone ill", is no easy task: the approach to this type of use is not always seen in a good light by the person interviewed. In the JNP, for instance, two species were cited: "assa-peixe", *Vernonia brasiliana* (L.) Druce (Asteraceae) and "pé-de-boi" *Bauhinia platyphylla* Zipp ex Spanoghe (Fabaceae), indicated "to make someone ill". The intended victim must consume a preparation with high concentrations of one of these plants that, according to the interviewee will make him/her debilitated, tired, and dispirited.

"Poisons to people and to animals" are probably plants of high toxicity, as in the case of some species of the genus *Palicourea* (Rubiaceae), with high concentrations of alkaloids (Schultes and Raffauf, 1990). It is to be supposed that knowledge of the pharmacological properties of these plants by these groups of humans, was acquired as a result of fatalities concerning random experimentation by forebearers of the group or even by the observation of the animal behaviour after consuming them.

3.7. Specificity versus non-specificity in the use of plants

Use of a great number of plants in a single prescription was observed among the Quilombolas – as many as 10, in some

cases – whereas the Krahô utilize, most of the times, only 1 single plant per prescription (Rodrigues and Carlini, 2006). The Caboclos utilize up to five plants/animals per prescription: a combination of animal added to plants was observed only in this group of humans.

It is important to consider that these plant–plant or plant–animal associations in a single prescription may produce interaction, synergism, and antagonism, potentializing or reducing the pharmacological or toxic effects of each chemical component (Williamson, 2001; Spinella, 2002; Wong and de Castro, 2003; Gilbert and Alves, 2003).

When a *wajacá* (Krahô shaman), prescribes one specific plant to a patient with no improvement to the clinical picture, he will wait until the next day to administer a new plant to the patient, since he almost never mix two plants in a same prescription. In other words, the *wajacás* avoid mixing plants because they are not familiar with the possible interaction between them, although they may have perceived such interaction.

As to the specificity and non-specificity in the use of plants, one specific plant species may be utilized for up to seven different disturbances in the therapeutics of the Quilombolas, for 10 in that of the Caboclos: while among the Krahô Indians, in most cases, only one plant is indicated for a single disease. These therapeutic particularities show specificity of the Krahô Indians and of other Brazilian indigenous ethnic groups (Rodrigues and Carlini, 2006) in the uses of plants, which to a certain extent is closer to the academic science's logic, from a pharmacological standpoint.

The use of common plants among the three cultures was not observed. This may be explained because these cultures inhabit different biomes: the Amazon forest, the pantanal wetlands and the cerrado savannahs and most of the plants utilized are native to Brazil, having their geographical distribution limited to these areas.

3.8. Data from literature

A deep survey in the Databases showed that there are no studies focusing on the toxicity or cases of adverse reactions for the species cited in this text, with the exception of the following: *Anacardium occidentale* L. (Anacardiaceae) "cajú", *Brosimum gaudichaudii* Trécul (Moraceae) "algodãozinho", *Senna alata* (L.) Roxb. (Fabaceae) "sene", *Senna occidentalis* (L.) Link (Fabaceae) "fedegoso", and *Strychnos pseudoquina* A. St.-Hil. (Loganiaceae) "quina" (Table 2).

Studies describe the toxicity of the "fedegoso" seeds in rats, birds, and rabbits (O'Hara and Pierce, 1974; Haraguchi et al., 1998, 2003; Barbosa-Ferreira et al., 2005), as well as the mitochondrial myopathies (Calore et al., 2002).

A study conducted with "sene" described the hepatorenal toxicity present in its leaves (Yagi et al., 1998). The fruit of "cajú" has been well studied and the findings points to its allergic property (Ippen, 1983; Menezes et al., 2002; Rance et al., 2003; Inomata et al., 2006).

The remaining two plants, "quina" and "algodãozinho" present mutagenic activity in their leaves (Santos et al., 2006) and root bark (Varanda et al., 2002), respectively.

4. Conclusion

Data from these three ethnopharmacological surveys show that the knowledge of cultures concerning plants utilized in treatments transcend their medicinal nature. Knowledge extends to notions of toxicity, contraindications, differentiated doses, and interaction between plants. Knowledge of these properties is as important as, or more important than recognizing curative properties.

The suspicion that certain plant species may be toxic or produce adverse reactions, based on a detailed record of their use in ethnopharmacological surveys, may be an auxiliary tool to pharmacovigilance of phytomedicines, with broader knowledge of the "bad side" of plant resources in the world flora.

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