Journal of Ethnopharmacology 142 (2012) 503–515

Contents lists available at SciVerse ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jep

Observations on the therapeutic practices of riverine communities of the Unini River, AM, Brazil

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ARTICLE INFO

Article history:
Received 21 February 2012
Received in revised form
17 April 2012
Accepted 15 May 2012
Available online 30 May 2012

Keywords:
Ethnopharmacology
Ethnobotany
Medicinal plants
Medicinal animals
Exudates

ABSTRACT

Ethnopharmacological relevance: Parts and products of animals and plants, like exudates, have been used for medicinal and/or toxic purposes by various human groups throughout history. However, few ethnopharmacological studies have engaged their rescue.

Aim of the study: To perform a broad ethnopharmacological survey of the local medicine practiced by traditional healing experts living in relative isolation at seven communities within the Amazon rainforest, in order to provide the basis for further pharmacological studies of the most promising findings.

Materials and methods: The field work was conducted using an ethnographic approach with the assistance of a doctor. Plants and animals, as well as their products and derivatives, reported by the practitioners as being involved in healing practices were collected, identified and deposited in scientific collections.

Results: A total of 33 traditional healing experts were selected and interviewed; they described themselves as: *healer*, *midwife*, *knowledgeable of natural drugs* or '*desmintidor*' (an expert in massage techniques for the treatment of muscle contractures and joint sprains). In this therapeutic practice, 122 plant species, belonging to 60 botanical families, were indicated and collected; the most frequently mentioned families were: Fabaceae s.l. (10%), Arecaceae (6%), Zingiberaceae (5%) and Lamiaceae (5%). Plant exudates from 14 of those plant species were also indicated and collected, with those from the Burseraceae family being the most common. Furthermore, 57 animals belonging to 35 taxonomic families were indicated. They most frequently belonged to 2 families of bony fishes: Cichlidae (14%) and Characidae (9%). Plants and animals were indicated for 67 therapeutic uses and grouped into 21 usage categories; the psychoactive category was associated with the greatest number of used resources (17%), followed by the cultural syndromes category (16.7%).

Conclusions: The geographic isolation and limited access to medical care in these communities resulted in unique, rich and consistent therapeutic system. There was a high degree of agreement among interviewees regarding the use of the same resources especially in the categories: psychoactive, cultural syndromes, pregnancy and childbirth, and inflammatory processes, suggesting a high degree of repetition and intercommunication. Further pharmacological and phytochemical investigations may search for new bioactive compounds among the described resources.

1. Introduction

Brazil possesses the greatest vegetal biodiversity in the world, estimated at approximately 20% of the total number of plant species on the planet. It is believed that this country houses approximately 55,000–60,000 angiosperms, 5–10 gymnosperms, 3100 bryophytes and 1200–1300 pteridophytes (Giulietti et al., 2005). This vast genetic heritage, already scarce in developed countries, has an inestimable economic-strategic value in various activities, especially within the field of new drug development (Calixto, 2003). The reasoning behind this statement is easily proven when considering the number of medicines obtained directly or indirectly from natural products (Harvey, 2000).

For being among the seventeen megadiverse countries and for housing a vast cultural array, Brazil should be the primary focus of pharmacological research for the discovery of new drugs and of

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0378-8741
http://dx.doi.org/10.1016/j.jep.2012.05.027

research to recover traditional knowledge in relation to genetic resources (Rodrigues, 2006). However, the recurrent changes in Brazil's landscape, marked by environment deterioration, wildlife threats and cultural information loss, weaken this great potential. Therefore, the social understanding of biodiversity is critical for the fields of conservation biology, public health policy, environmental sustainability and bioprospecting (Alves and Rosa, 2007).

The Amazon rainforest is one of the five major biomes of Brazil. It encompasses an area of approximately 7 million km^2, occupying 40.2% of South America, including part of the territory from 8 countries and approximately 56% of tropical forests (Picasso-Botto, 1999). Among the diverse population inhabiting the Amazon forest, the 'caboclos' or riverine communities stand out (Parker, 1985).

According to Alves and Rosa (2005), in addition to the use of plants and microorganisms as medicinal sources, the use of animal products and derivatives as key ingredients in preventive, protective and healing medicine has increased in many cultures around the world.

The aim of this study was to perform a survey of the local medicine practiced by traditional healing experts living in relative isolation, at seven communities within the Amazon rainforest, in order to provide the basis for further pharmacological studies of the most promising findings.

2. Materials and methods

2.1. Study area

Along the Unini River (1°40'S and 63°48'W), located in the municipality of Barcelos, Amazonas, Brazil, there are 10 communities distributed among three Conservation Units (CUs) (Unini River Extractive Reserve, Jau National Park and Amana Sustainable Development Reserve). Out of the 10 communities, seven participated in this study (*Vista Alegre*, *Floresta*, *Terra Nova*, *Tapiira*, *Pataua*, *Manapana* and *Lago das Pombas*), as shown in Fig. 1.

The communities are provided with school, social center, diesel-powered generator and clinic, which is responsible for the diagnosis and care of malaria patients. The rivers are the only means of transportation for the riverine communities. The largest and most important is the Negro River, which permits access to the municipalities of Barcelos and Novo Airao (270 and 250 km away, respectively). It is important to highlight the enormous geographic isolation of these communities in relation to the standard medical care.

2.2. Field work

Eight field trips were undertaken, mostly by one of the authors (Santos, JFL), between 2008 and 2012, totaling 11 months of research. Prior to the field trips, all necessary permits for the study were obtained, including access permits to the CUs, for sample collection, for the transport of biological material and for access to associated traditional knowledge, including the prior informed consent of the informants (SISBIO no. 16805-2, CGEN/MMA no. 47/2009 and CEP-UNIFESP/EPM, no. 1354/08).[1]

For the selection of local healing experts, a snowball sampling, as described by Bernard (1988), was performed in consultation with the local inhabitants of the riverine communities. Ethnographic techniques and methods were applied, including participant observation, field diaries and informal and unstructured interviews (Bernard, 1988; Foote-Whyte, 1990). During the interviews, the following data sheets were administered: Interviewee Personal Information (sex, age, ancestry), Ethnopharmacological Survey (ingredients, uses, parts used, mode of preparation, and contraindications of plants and animals used for therapeutic purposes), Plant Collection (popular name, habit, time of flowering/fruiting, organoleptic and morphological aspects) and Animal Collection (popular name, size, color). The latter two forms were accompanied by pictures to illustrate the resource and facilitate their taxonomic identification.

The plants were collected and stored using the wet method (Mori et al., 1985). The specimens were identified by Mr. Jose Ramos, a plant taxonomy technician, at the National Institute for Amazonian Research (INPA) and incorporated into the herbarium of this institute.

Most of the animals cited were collected and identified by INPA researchers and deposited in the institute's collections; they are listed in Table 1 and indicated with an asterisk (*). The birds and mammals listed in Table 1 were not collected in this study, because INPA zoologists had already collected them in conjunction with area residents for other research projects. Thus, it was possible to establish a correlation between the popular and scientific names for these animals.

The medical doctor, who is a co-author is this study (Pagani, E.), visited the communities in order to better understand their local medical terms, which are described throughout the manuscript in italics. Dr. Pagani performed diagnostic and clinical examinations to establish comparisons between the local terms and standard medical terms. Therefore, the therapeutic uses translated by the doctor were grouped into usage categories, according to their effects, as described in Table 1. The uses italicized in Table 1 belong to the "cultural syndromes" category. These did not have any equivalents in the standard medical terminology; many of the symptoms associated with these diseases will be described in detail in the section "Main Usage Categories".

2.3. Data analysis

As suggested by Heinrich et al. (1998), the first step employed in the data analysis is calculating the informant consensus factor (ICF). ICF values will be low (near 0) if plants/animals are chosen randomly, or if expert healers do not exchange information about their use. Values will be high (near 1) if there is a well-defined selection criterion in the community and/or if information is exchanged between expert healers.

The ICF is calculated as follows: number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one: $FCI = nur - nt/nur - 1$.

3. Results and discussion

3.1. Profile of interviewees

Out of the 33 interviewees, 17 were female, and 16 were male. All were born in the Middle Negro River region. Most are

[1] The biological resources and traditional knowledge associated with biodiversity (TK) referred to in this article are protected under the terms of the United Nations Convention on Biological Diversity, in force internationally since December 1993. Any individual or public or private entity who wishes to carry out scientific or technological investigations on the biological resources and TK referred shall observe the requirements set forth by Articles 8 (j) and 15 of the CBD, as well as, in the case of Brazilian biological resources and TK, the requirements set forth by the Provisional Measure no. 2.186-16/2001, which regulates access to genetic resources, protection and access to TK and the sharing of benefits arising from the use of Brazilian TK and biological resources. The unauthorized use of these resources is an act of misappropriation, and subjects violators to administrative, civil and criminal penalties in Brazil.

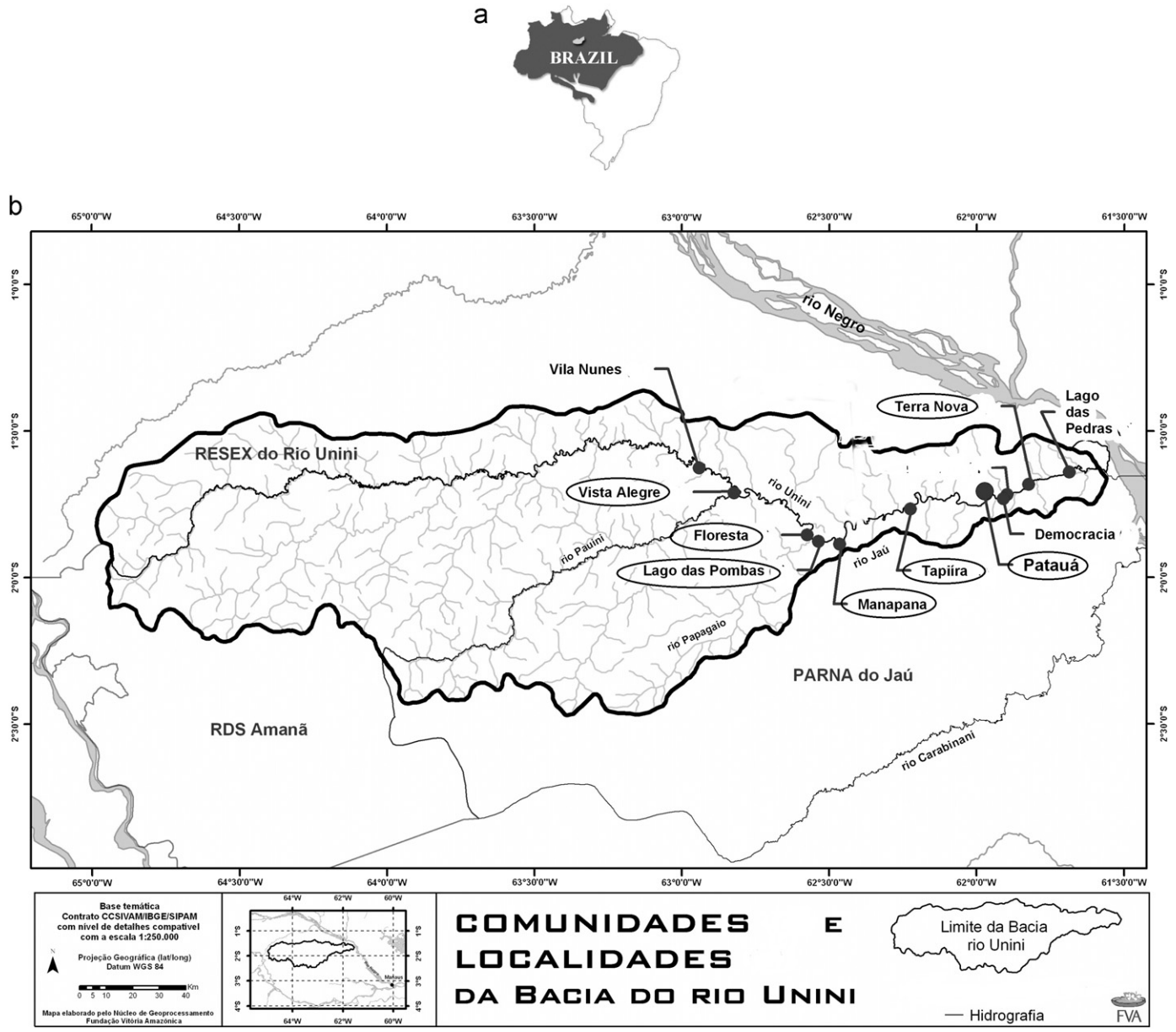

Fig. 1. (a) Unini River location ( ) in the Amazon forest biome (Brazil) ( ) and (b) distribution of ten Unini River communities and the seven studied ( ) during the field work.
Source: Vitoria Amazônica Foundation, 2005.

descended of inhabitants from Amazon and Ceara States, as the region hosted large rubber tree plantations, which favored migration to the region during the 19th century. The specialty and number of individuals, indicated in brackets, were distributed as follows: *knowledgeable of natural drugs* (23), *healer* (9), *midwife* (7) and '*desmintidor*' (an expert in massage techniques for the treatment of bone dislocation and muscle strain) (4). Some respondents may have more than one healing speciality. The subjects reported learning the healing techniques from parents, relatives, friends and neighbors and often as a result of self-interest, as in the case of *midwives* and '*desmintidores*'. Only two reported receiving spiritual guidance when delivering a cure and/or prayer. Despite the large amount of plants and animals that comprise the recipes used in the therapeutic treatments, all interviewees reported that faith is the main factor in the healing process and treatment of any disease. The Catholic religion is evident, primarily, in the prayers and narratives that accompany the healing and childbirth processes. This phenomenon was also observed by Parra (1993) with midwives in Mexico, Santos (2009) with healers from northeastern Brazil and Fleischer (2008) with midwives from northern Brazil.

3.2. Main usage categories

Interviewees perceived no distinction between plants and animals when used as a therapeutic resource; furthermore, several organisms (animal or vegetal) were associated within the same recipe. Therefore, to simplify their classification, the 67 mentioned therapeutic uses for the 179 natural resources (122 plant species and 57 animals, described in the section "Natural Resources") were grouped into 21 usage categories in Table 1.

Table 1
Number of plants (122) and animals (57) indicated for the 67 therapeutic uses grouped into 21 categories of use.

Categories of use (number of resources) and therapeutic uses	Family	Species (voucher)	Popular name	Part used
1. Psychoactive (31) nootropic, orexigenic, hallucinogen, stimulant, sexual stimulant and anxiolytic				
Animals	Alligatoridae	*Caiman crocodilus*—Santos 015	Jacaré-tinga*	Meat
	Alligatoridae	*Paleosuchus trigonatus*—Santos 016	Jacaré-açú*	Meat
	Cebidae	*Cebus apella*	Macaco-prego	Penis
	Characidae	*Serrasalmus gouldingi*—Santos 013	Piranha*	Meat
	Characidae	*Serrasalmus rhombeus*—Santos 010	Piranha-fulá*	Meat
	Didelphidae	*Didelphis* sp.	Mucura	Bone
	Emberizidae	*Cacicus cela*	Japiim/tuchauá	Brain
	Erythrinidae	*Hoplias curupira*—Santos 01	Traíra-preta*	Fat
	Formicidae	*Atta* sp.—Santos 01	Formiga-saúva*	Whole body
	Formicidae	*Paraponera* spp.	Tucandeira	Whole body
	Phasianidae	*Gallus gallus domesticus*	Galinha	Meat
	Picidae	*Campephilus melanoleucos*	Pica-pau-da-cabeça-vermelha	Bone
	Procyonidae	*Nasua nasua*	Quati	Penis
Plants	Apocynaceae	*Aspidosperma excelsum* Benth.—Santos 451	Pacanaúba/ carapanaúba	Bark
	Apocynaceae	*Aspidosperma marcgravianum* Wood.—Santos 401	Pacanaúba/ carapanaúba	Bark
	Aristolochiaceae	*Aristolochia fimbriata* Cham. & Schltdl.—Santos 504	Uecá	Stalk
	Bignoniaceae	*Mansoa alliaceae* (Lam.) A.H.Gentry—Santos 388/ 476	Cipó-alho	Leaf
	Bignoniaceae	*Thynnanthus* sp.—Santos 418	Cipó-cravo	Stalk
	Euphorbiaceae	*Jatropha curcas* L.—Santos 363	Pião-branco	Seed/leaf
	Euphorbiaceae	*Jatropha gossypiifolia* L.—Santos 351	Pião-preto	Leaf/fruit
	Fabaceae s.l.	*Deguelia rariflora* (Mart. ex Benth.) A.M.G. Azeve—Santos 456	Timbó	Stalk
	Fabaceae s.l.	*Hymenaea courbaril* L.—Santos 384/ 467/424	Jatobá-do-mato	Bark
	Lamiaceae	*Leucas martinicensis* (Jacq.) R. Br.—Santos 355	Catinga-de-mulata	Leaf
	Lamiaceae	*Mentha viridis* L.—Santos 362	Hortelãzinho	Leaf
	Malvaceae	*Hibiscus rosa-sinensis* L.—Santos 507	Pampola	Leaf
	Monimiaceae	*Siparuna guianensis* Aubl.—Santos 350	Capitiú	Leaf
	Passifloraceae	*Passiflora coccinea* Aubl.—Santos 486	Maracujá-do-mato	Leaf
	Passifloraceae	*Passiflora foetida* L.—Santos 374	Maracujá-do-mato	Leaf
	Phytolaccaceae	*Petiveria alliacea* L.—Santos 380/500	Mucura-caá	Leaf
	Poaceae	*Cymbopogon citratus* (DC.) Stapf—Santos 445	Capim-santo	Leaf
	Verbenaceae	*Lippia grandis* Schum.—Santos 442-444	Sálvia-do-marajó	Leaf
2. Cultural syndromes (30) *derrame, quebrante, espante, vento-caído, panema, doença- do-ar and mãe-do-corpo*				
Animals	Ampullariidae	*Pomacea* sp.—Santos 025	Uruá*	Shell
	Boidae	*Boa constrictor*	Jibóia	Skin
	Emberizidae	*Cacicus cela*	Japiim/tuchauá	Feather
	Felidae	*Leopardus* spp.	Gato-maracajá	Skin
	Felidae	*Puma concolor*	Onça-vermelha	Skin
	Hydrochoridae	*Hydrochoerus* sp.	Capivara	Bone
	Hylidae	*Trachycephalus resinifictrix*	Sapo-canuaru	Exudate (spit/ excrement)
	Psophiidae	*Psophia crepitans*	Jacamim	Feather
	Tayassuidae	*Tayassu pecari*	Porco-queixada	Skin
	Tayassuidae	*Tayassu tajacu*	Caititu	Skin
	Tinamidae	*Crypturus* spp.	Nambu	Feather
	Tinamidae	*Not identified*	Quandu	Feather
	Tropiduridae	*Uranoscodon superciliosus*—Santos 018	Lagarto-tamanquaré*	Nest
Plants	Annonaceae	*Annona montana* Macfad.—Santos 381	Araticón	Leaf
	Asteraceae	*Sphagneticola trilobata* (L.) Pruski—Santos 398	Tira-panema	Leaf
	Burseraceae	*Protium amazonicum* (Cuatrec.) Daly—Santos 413	Breu-branco	Exudate
	Burseraceae	*Protium* cf. *aracouchini* (Aubl.) Marchand—404, 405, 406, 407, 408 e 409	Breu-preto	Exudate
	Burseraceae	*Protium* cf. *heptaphyllum* (Aubl.) Marchand—Santos, 458 e 485	Breu-preto	Exudate
	Cucurbitaceae	*Citrullus lanatus* (Thunb.) Matsum. & Nakai—Santos 483	Melancia	Leaf
	Dilleniaceae	*Doliocarpum* sp.—Santos 423	Cipó-água	Exudate
	Euphorbiaceae	*Jatropha curcas* L.—Santos 363	Pião-branco	Seed/leaf
	Euphorbiaceae	*Jatropha gossypiifolia* L.—Santos 351	Pião-preto	Leaf/fruit
	Lamiaceae	*Leucas martinicensis* (Jacq.) R. Br.—Santos 355	Catinga-de-mulata	Leaf
	Monimiaceae	*Siparuna guianensis* Aubl.—Santos 350	Capitiú	Leaf
	Phytolaccaceae	*Petiveria alliacea* L.—Santos 380/500	Mucura-caá	Leaf
	Pteridaceae	*Pteris* sp.—Santos 482	Vence-tudo	Leaf
	Selaginellaceae	*Selaginella conduplicata* Spring.—Santos 373	Samambainha	Leaf

Table 1 (*continued*)

Categories of use (number of resources) and therapeutic uses	Family	Species (voucher)	Popular name	Part used
	Verbenaceae	*Verbena* sp.—Santos 369	Mutuquinha	Leaf
	Zingiberaceae	*Alpinia nutans* (L.) Roscoe—Santos 436	Vindi-caá	Leaf
	Zingiberaceae	*Renealmia floribunda* K. Schum.—Santos 352	Manúfa	Leaf
3. Inflammatory processes (28) boils, conjunctivitis, acute sinusitis, general inflammation, acute tonsillitis, cataracts and rheumatism				
Animals	Apidae	*Melipona seminigra*—Santos 024	Jandaíra*	*Sabura***
	Atelidae	*Alouatta seniculus*	Macaco-guariba	Trachea
	Boidae	*Eunectes* sp.	Sucurijú	Fat
	Cervidae	*Mazama gouazoupira*	Veado-vermelho/ capoeira	Skin
	Teiidae	*Ameiva ameiva* —Santos 017	Lagarto-azul*	Fat
Plants	Anacardiaceae	*Mangifera* cf. *ferrea* L. (Mart.)—Santos 479	Manguita	Bark
	Apocynaceae	*Aspidosperma excelsum* Benth.—Santos 451	Pacanaúba/ carapanaúba	Bark
	Apocynaceae	*Aspidosperma marcgravianum* Wood.—Santos 401	Pacanaúba/ carapanaúba	Bark
	Araceae	*Philodendron billietiae* Croat—Santos 425	Cipó-ambé	Exudate
	Araceae	*Xanthosoma* sp.—Santos 393	Mão-aberta	Leaf
	Asteraceae	*Spilanthus oleracea* L.—Santos 441	Jambu	Leaf
	Bixaceae	*Bixa orellana* L.—Santos 430	Urucum	Seed
	Boraginaceae	*Heliotropium indicum* L.—Santos 511	Fedegoso	Leaf
	Burseraceae	*Protium decandrum* (Aubl.) Marchand—Santos 421	Chico-da-silva	Exudate
	Crassulaceae	*Bryophyllum calycinum* Salisb.—Santos 443	Corama	Leaf
	Dioscoraceae	*Dioscorea* cf. *amaranthoides* C. Presl—Santos 389	Mangaratáia	Root
	Euphorbiaceae	*Dipteryx odorata* (Aubl.) Willd.—Santos 481	Cumaru	Seed
	Fabaceae s.l.	*Copaifera multijuga* Hayne—Santos 403	Copaíba	Bark
	Fabaceae s.l.	*Hymenae courbaril* L.—Santos 384/ 467/424	Jatobá-do-mato	Bark/exudate
	Lecythidaceae	*Lecythis* sp.—Santos 416	Tamanquaré	Exudate
	Meliaceae	*Carapa guianensis* Aubl.—Santos 367	Andiroba	Exudate
	Myrtaceae	*Zyzygium jambolanum* DC.—Santos 372	Jambolão	Bark
	Piperaceae	*Piper peltatum* L.—Santos 461	Caapeba	Leaf
	Rubiaceae	*Geophila cordifolia* Miq.—Santos 463/464/465/ 466	Pimenta-de-jabuti	Whole plant
	Rutaceae	*Citrus limon* (L.) Burm. f.—Santos 383	Limãozinho-verde	Leaf
	Zingiberaceae	*Costus arabicus* L.—Santos 470	Cana-fita	Leaf
	Zingiberaceae	*Costus scaber* Ruiz & Pav.—Santos 387	Pobre-velho	Leaf
	Zingiberaceae	*Zingiber officinale* Roscoe—Santos 391	Mangarataiá	Root
4. Pregnancy and childbirth (25) oxitotoxic, contraceptive and galactogenic				
Animals	Agoutidae	*Agouti paca*	Paca	Bone/skin
	Potamotrygonidae	*Potamotrygon* sp.—Santos 05	Arraiá*	Fat
	Tapiridae	*Tapirus terrestris*	Anta	Fat
Plants	Apiaceae	*Eryngium foetidum* L.—Santos 495	Chicória-do-norte	Root
	Apocynaceae	*Aspidosperma excelsum* Benth.—Santos 451	Pacanaúba/ carapanaúba	Bark
	Apocynaceae	*Aspidosperma marcgravianum* Wood.—Santos 401	Pacanaúba/ carapanaúba	Bark
	Asteraceae	*Eupatorium triplinerve* Vahl—Santos 439	Pimenta-malagueta	Leaf
	Cactaceae	*Cereus* sp.—Santos 440	Manacaru	Stalk
	Dioscoraceae	*Dioscorea* cf. *amaranthoides* C. Presl—Santos 389	Mangaratáia	Root
	Euphorbiaceae	*Hevea spruceana* (Benth.) Mull. Arg—Santos 401	Seringa-barriguda	Exudate
	Euphorbiaceae	*Jatropha gossypiifolia* L.—Santos 351	Pião-preto	Leaf/fruit
	Fabaceae s.l.	*Copaifera multijuga* Hayne—Santos 403	Copaíba	Bark
	Heliconiaceae	*Heliconia* sp.—Santos 435	Banana-sororoca	Exudate
	Humiriaceae	*Endopleura uchi* (Huber) Cuatrec—Santos 402	Uxi-liso	Bark
	Humiriaceae	*Schistostemon macrophyllum* (Benth.) Cuatrec.—Santos 474	Uruá-mari	Bark
	Lamiaceae	*Mentha viridis* L.—Santos 362	Hortelãzinho	Leaf
	Lamiaceae	*Mezilaurus* sp.—Santos 394	Itaúba	Leaf
	Malvaceae	*Gossypium barbadense* L.—Santos 431	Algodão-roxo	Leaf
	Menispermaceae	*Abuta grandifolia* (Mart.) Sandwith—Santos 399	Abuta/ buta	Leaf
	Musaceae	*Musa* sp.—Santos 494	Banana-maça	Inflorescence
	Myrtaceae	*Psidium guajava* L.—Santos 478	Goiaba	Fruit
	Orchidaceae	*Cattleya* sp.—santos 489	Parasita	Root
	Poaceae	*Cymbopogon citratus* (DC.) Stapf—Santos 445	Capim-santo	Leaf
	Rutaceae	*Citrus limon* (L.) Burm. f.—Santos 383	Limãozinho-verde	Leaf
	Zingiberaceae	*Zingiber officinale* Roscoe—Santos 391	Mangaratáia	Root
5. Gastrointestinal system (23) stomach pain, hemorrhoids, liver disease, infectious diarrhea, constipation and intestinal worms				
Animal	Chelidae	*Chelus fimbriatus*	Matá-matá	Hoof
Plants	Amaranthaceae		Erva	Leaf

Table 1 (*continued*)

Categories of use (number of resources) and therapeutic uses	Family	Species (voucher)	Popular name	Part used
		Alternanthera brasiliana var. *villosa* (L.) Kuntze—Santos 361		
	Aristolochiaceae	*Aristolochia triloba* L.—Santos 390	Urubu-caá	Leaf
	Asteraceae	*Spilanthus oleracea* L.—Santos 441	Jambu	Leaf
	Asteraceae	*Vernonia condensata* Backer—Santos 498	Boldo	Leaf
	Cecropiaceae	*Cecropia* cf. *concolor* Willd.—Santos 460	Embaúba-branca	Leaf
	Convolvulaceae	*Bonamia ferruginea* (Choisy) Hallier f.—Santos 473	Cipó-tuíra	Leaf
	Euphorbiaceae	*Croton sacaquinha* Croizat—Santos 510	Sacaca-fêmea	Leaf
	Euphorbiaceae	*Jatropha gossypiifolia* L.—Santos 351	Pião-preto	Leaf/fruit
	Fabaceae s.l.	*Bauhinia* cf. *macrostachya* Benth.—Santos 455	Escada-de-jabuti	Stalk
	Fabaceae s.l.	*Cassia lucens* Vogel—Santos 493	Paracaxí	Leaf
	Fabaceae s.l.	*Copaifera multijuga* Hayne—Santos 403	Copaíba	Bark
	Fabaceae s.l.	*Parkia discolor* Spruce ex Benth.—Santos 450/ 397	Piradabi/ tapacu/ guaribinha-do-igapó	Bark
	Lamiaceae	*Coleus neochilus* (Schltr.) Codd—Santos 446	Boldo	Leaf
	Lecythidaceae	*Bertholletia excelsa* Bonpl.—Santos 462	Castanheira	Bark
	Myrtaceae	*Psidium guajava* L.—Santos 478	Goiaba	Fruit
	Myrtaceae	*Zyzygium jambolanum* DC.—Santos 372	Jambolão	Leaf
	Piperaceae	*Piper cavalcantei* Yunk—Santos 428	Lelétrico	Leaf
	Rhamnaceae	*Ampelozizyphus amazonicus* Ducke—Santos 417	Saracura-mirá	Leaf
	Sapotaceae	*Pouteria caimito* (Ruiz & Pav.) Radlk.—Santos 487	Abiu	Leaf
	Sapotaceae	*Pouteria* sp.—Santos 471	Pau-doce	Bark
	Sterculiaceae	*Theobroma grandiflorum* (Willd. ex Spreng.) K.Schum.—Santos 488	Cupuaçu	Bark
	Verbenaceae	*Lippia grandis* Schum.—Santos 442	Sálvia-do-marajó	Leaf
6. Dermatologic problems (17) scabies, dermatophytes, pityriasis versicolor, itching and skin lesion				
Animals	Apidae	*Melipona seminigra*—Santos 024	Jandaíra*	*Sabura***
	Podocnemididae	*Podocnemis unifilis*—Santos 012	Tracajá*	Fat
	Ramphastidae	*Ramphastos* spp.	Tucano-pacovão	Beak
	Sphecidae	*Sceliphrons* sp.—Santos 021	Caba-leão*	Nest
	Tropiduridae	*Uranoscodon superciliosus*—Santos 018	Lagarto-tamanquaré*	Nest
Plants	Araceae	*Xanthosoma* sp.—Santos 393	Mão-aberta	Leaf
	Bixaceae	*Bixa orellana* L.—Santos 430	Urucum	Seed
	Clusiaceae	*Calophyllum brasiliense* Cambess.—Santos 513	Jacareúba	Exudate
	Clusiaceae	*Vismia guianensis* (Aubl.) Pers.—Santos 359	Lacre	Exudate
	Fabaceae s.l.	*Cassia leiandra* Benth.—Santos 490	Ingá-mari	Leaf
	Fabaceae s.l.	*Vatairea guianensis* Aubl.—Santos 371	Faveira/ fava	Fruit
	Gentianaceae	*Chelonanthus grandiflorus* (Aubl.) Chodat & Hassl.—Santos 469	Tabaco-de-lagarto	Leaf
	Malpighiaceae	*Lophanthera longifolia* (Kunth) Griseb.—Santos 368/ 395	Cuiarana	Leaf
	Meliaceae	*Carapa guianensis* Aubl.—Santos 367	Andiroba	Exudate
	Portulacaceae	*Portulaca pilosa* L.—Santos 392	Amor-crescido	Leaf
	Scrophulariaceae	*Scoparia dulcis* L.—Santos 357	Vassourinha	Whole plant
	Solanaceae	*Capsicum chinense* Jacq.—Santos 438	Pimenta-malaguetona	Leaf
7. Genitourinary system (17) dysmenorrhea, calculosis of the kidney, ureter and kidney disorders, and metrorrhagia				
Animals	Erythrinidae	*Hoplias malabaricus*—Santos 02	Traía-branca*	Otoliths
	Sciaenidae	*Plagioscion auratus* —Santos 03	Pescada-branca*	Otoliths
Plants	Arecaceae	*Iriartella setigera* (Mart.) H. Wendl.—Santos 459	Jarina	Seed
	Bignoniaceae	*Arrabidaea chica* (Humb. & Bompl.) Verl.—Santos 354	Crajirú	Leaf
	Commelinaceae	*Commelina benghalensis* L.—Santos 375	Maria-mole	Whole plant
	Fabaceae s.l.	*Ormosia* sp.—Santos 508	Tento	Seeds
	Humiriaceae	*Endopleura uchi* (Huber) Cuatrec—Santos 402	Uxi-liso	Bark
	Malvaceae	*Gossypium barbadense* L.—Santos 431	Algodão-roxo	Leaf
	Passifloraceae	*Passiflora coccinea* Aubl.—Santos 486	Maracujá-do-mato	Leaf
	Passifloraceae	*Passiflora foetida* L.—Santos 374	Maracujá-do-mato	Leaf
	Phytolaccaceae	*Petiveria alliacea* L.—Santos 380/500	Mucura-caá	Leaf
	Poaceae	*Pariana radiciflora* Sagot ex Doll—Santos 396	Pariri	Leaf
	Portulacaceae	*Portulaca pilosa* L.—Santos 392	Amor-crescido	Leaf
	Verbenaceae	*Verbena* sp.—Santos 369	Mutuquinha	Leaf
	Viscaceae	*Phoradendron bacthyorictum* Eichler—Santos 427	Erva-de-passarinho	Whole plant
	Zingiberaceae	*Alpinia* sp.—Santos 452	Vindi-caá	Leaf
	Zingiberaceae	*Renealmia floribunda* K. Schum.—Santos 352	Manúfa	Leaf
8. Fever (16) Fever				
Animal	Hylidae	*Trachycephalus resinifictrix*	Sapo-canuaru	Spit/excrement
Plants	Anacardiaceae	*Mangifera ferrea* L. (Mart.)—Santos 479	Manguita	Bark
	Asteraceae	*Eupatorium triplinerve* Vahl—Santos 439	Pimenta-malagueta	Leaf

Table 1 (*continued*)

Categories of use (number of resources) and therapeutic uses	Family	Species (voucher)	Popular name	Part used
	Cecropiaceae	*Cecropia* cf. *concolor* Willd.—Santos 460	Embaúba-branca	Leaf
	Convolvulaceae	*Bonamia ferruginea* (Choisy) Hallier f.—Santos 473	Cipó-tuíra	Leaf
	Euphorbiaceae	*Croton cajucara* Benth.– Santos 484	Sacaca	Leaf
	Lamiaceae	*Mentha viridis* L.—Santos 362	Hortelãzinho	Leaf
	Meliaceae	*Carapa guianensis* Aubl.—Santos 367	Andiroba	Exudate
	Passifloraceae	*Passiflora coccinea* Aubl.—Santos 486	Maracujá-do-mato	Leaf
	Passifloraceae	*Passiflora foetida* L.—Santos 374	Maracujá-do-mato	Leaf
	Rhamnaceae	*Ampelozizyphus amazonicus* Ducke—Santos 417	Saracura-mirá	Leaf
	Rutaceae	*Citrus limon* (L.) Burm. f.—Santos 383	Limãozinho-verde	Leaf
	Solanaceae	*Physalis angulata* L.—Santos 468	Camapu	Leaf
	Verbenaceae	*Lippia grandis* Schum.—Santos 442-444	Sálvia-do-marajó	Leaf
	Zingiberaceae	*Costus arabicus* L.—Santos 470	Cana-fita	Leaf
	Zingiberaceae	*Costus scaber* Ruiz & Pav.—Santos 387	Pobre-velho	Leaf
9. Analgesic (13) headache and otitis				
Animal	Hydrochaeridae	*Hydrochoerus hydrochoeris*	Capivara	Bone
Plants	Asteraceae	*Tagetes patula* L.—Santos 472	Cravo-de-defunto	Leaf
	Bignoniaceae	*Mansoa alliaceae* (Lam.) A.H.Gentry—Santos 388/ 476	Cipó-alho	Leaf
	Burseraceae	*Protium amazonicum* (Cuatrec.) Daly—Santos 413	Breu-branco	Exudate
	Burseraceae	*Protium* cf. *aracouchini* (Aubl.) Marchand—Santos 404, 405, 406, 407, 408 e 409	Breu-preto	Exudate
	Burseraceae	*Protium* cf. *heptaphyllum* (Aubl.) Marchand—Santos 454, 458 e 485	Breu-preto	Exudate
	Dioscoraceae	*Dioscorea* cf. *amaranthoides* C. Presl—Santos 389	Mangaratáia	Root
	Euphorbiaceae	*Jatropha gossypiifolia* L.—Santos 351	Pião-preto	Leaf/ fruit
	Lamiaceae	*Leucas martinicensis* (Jacq.) R. Br.—Santos 355	Catinga-de-mulata	Leaf
	Lamiaceae	*Scutellaria purpurascens* Sweet—Santos 370	Crevo-roxo	Leaf
	Monimiaceae	*Siparuna guianensis* Aubl.—Santos 350	Capitiú	Leaf
	Rutaceae	*Citrus limon* (L.) Burm. f.—Santos 477	Limãozinho-verde	Leaf
	Zingiberaceae	*Zingiber officinale* Roscoe—Santos 391	Mangaratáia	Root
10. Respiratory System (13) pneumonia, tuberculosis, asthma, nasal constipation, cough and whooping cough				
Animals	Characidae	*Serrasalmus rhombeus*—Santos 010	Piranha-fulá*	Meat
	Cichlidae	*Acaronia nassa*—Santos 12	Cará-doido*	Body
	Cichlidae	*Crenicichla cincta*—Santos 06	Jacundá*	Body
	Cichlidae	*Mesonauta insignis*—Santos 07	Bouarí*	Body
	Cichlidae	*Satanoperca jurupari*—Santos 11	Cará-doido*	Body
	Felidae	*Puma concolor*	Onça	Fat
	Pimelodidae	*Phractocephalus* sp.	Pirara	Fat
	Tayassuidae	*Tayassu pecari*	Porco-queixada	Tooth
Plants	Bixaceae	*Bixa orellana* L.—Santos 430	Urucum	Seed
	Euphorbiaceae	*Dipteryx odorata* (Aubl.) Willd.—Santos 481	Cumaru	Seed
	Euphorbiaceae	*Jatropha curcas* L.—Santos 363	Pião-branco	Fruit
	Malpighiaceae	*Lophanthera longifolia* (Kunth) Griseb.—Santos 368/ 395	Cuiarana	Leaf
	Moraceae	*Brosimum parinarioides* ssp. Parinnarioides Ducke—Santos 414	Leite-do-amapá	Exudate
11. Taboos/food restrictions (12) discharge, heavy menstrual flow and difficult childbirth				
Animals	Characidae	*Serrasalmus* cf. *gouldingi*—Santos 04	Piranha-branca*	Meat
	Characidae	*Serrasalmus rhombeus*—Santos 010	Piranha-fulá*	Meat
	Cichlidae	*Cichla temensis*—Santos 08	Tucunaré*	Meat
	Pimelodidae	*Phractocephalus* sp.	Pirara	Fat
	Testudinidae	*Geochelone* sp.—Santos 019	Jabuti*	Meat
Plants	Arecaceae	*Bactris* sp.—Santos 496	Pupunha	Fruit
	Arecaceae	*Euterpe* cf. *catinga* Wallace—Santos 437	Açaí	Fruit
	Arecaceae	*Euterpe precatoria* Mart.—Santos 497	Açaí	Fruit
	Arecaceae	*Mauritia* sp.—Santos 432	Buriti	Fruit
	Arecaceae	*Oenocarpus mapora* H. Karst.—Santos 512	Bacaba	Fruit
	Arecaceae	*Syagrus inajai* (Spruce) Becc.—Santos 457	Paxiubinha	Fruit
	Malvaceae	*Gossypium barbadense* L.—Santos 431	Algodão-roxo	Leaf
12. Immunologic system (10) Flu				
Plants	Anacardiaceae	*Mangifera ferrea* L. (Mart.)—Santos 479	Manguita	Bark
	Apiaceae	*Eryngium foetidum* L.—Santos 495	Chicória-do-norte	Root
	Bignoniaceae	*Mansoa alliaceae* (Lam.) A.H.Gentry—Santos 388/ 476	Cipó-alho	Leaf
	Cactaceae	*Cereus* sp.—Santos 440	Manacaru	Stalk
	Fabaceae s.l.	*Copaifera multijuga* Hayne—Santos 403	Copaíba	Exudate

Table 1 (*continued*)

Categories of use (number of resources) and therapeutic uses	Family	Species (voucher)	Popular name	Part used
	Lamiaceae	*Lamium album* L.—Santos 505/506	Malvarisco-verde/ malavarisco-branco	Leaf
	Lamiaceae	*Leucas martinicensis* (Jacq.) R. Br.—Santos 355	Catinga-de-mulata	Leaf
	Malpighiaceae	*Lophanthera longifolia* (Kunth) Griseb.—Santos 368/ 395	Cuiarana	Leaf
	Meliaceae	*Carapa guianensis* Aubl.—Santos 367	Andiroba	Exudate
	Rutaceae	*Citrus limon* (L.) Burm. f.—Santos 383	Limãozinho-verde	Leaf
13. Tropical diseases (7) dengue and malaria				
Plants	Apocynaceae	*Aspidosperma excelsum* Benth.—Santos 451	Pacanaúba/ carapanaúba	Bark
	Apocynaceae	*Aspidosperma marcgravianum* Wood.—Santos 401	Pacanaúba/ carapanaúba	Bark
	Cactaceae	*Cereus* sp.—Santos 440	Manacaru	Stalk
	Fabaceae s.l.	*Hymenae courbaril* L.—Santos 384/ 467/424	Jatobá-do-mato	Bark
	Myrtaceae	*Zyzygium jambolanum* DC.—Santos 372	Jambolão	Bark
	Rhamnaceae	*Ampelozizyphus amazonicus* Ducke—Santos 417	Saracura-mirá	Leaf
	Solanaceae	*Physalis angulata* L.—Santos 468	Camapu	Leaf
14. Musculoskeletal system (7) sprain and muscle strain				
Animals	Alligatoridae	*Caiman crocodilus*—Santos 015	jacaré-tinga*	Meat
	Alligatoridae	*Paleosuchus trigonatus*—Santos 016	Jacaré-açú*	Meat
	Cebidae	*Cebus apella*	Macaco-prego	Fat
	Gryllotalpidae	*Scapteriscus* sp.—Santos 22	Paquinha*	Whole body
	Phasianidae	*Gallus gallus domesticus*	Galinha	Meat
Plants	Dioscoraceae	*Dioscorea* cf. *stegelmanniana* Knuth—Santos 509	Batata-puçanga	Root
	Solanaceae	*Capsicum frutescens* L.—Santos 447	Cipó-apuí	Stalk
15. Magic and oracles (6) For good luck, to attract the loved one and predict the sex of the fetus				
Animals	Ciconiidae	*Not identified*	Manguarí	Heart
	Cracidae	*Penelope jacquacu*	Jacu	Heart
	Psophiidae	*Psophia crepitans*	Jacamiim	Heart
	Trochilidae	*Amazilia* sp.	Beija-flor	Nest
Plants	Cucurbitaceae	*Citrullus lanatus* (Thunb.) Matsum. & Nakai—Santos 483	Melancia	Leaf
	Pteridaceae	*Pteris* sp.—Santos 482	Vence-tudo	Leaf
16. Accidents with animals (4) anti-venom				
Animal	Teiidae	*Tupinambis teguixin*—Santos 14	Lagarto-jacurarú*	Viscera
Plants	Amaranthaceae	*Pfaffia* cf. *glomerata* (Spreng.) Pedersen—Santos 448/499	Contra-veneno-de-cobra	Leaf
	Lecythidaceae	*Lecythis* cf. *rurida* Berg Krieger—Santos 491	Matá-matá	Stalk
	Menispermaceae	*Odontocarya tamoides* (D.C) Miers—Santos 433	Erva-dos-índios	Whole plant
17. Cardiovascular system (4) Depurative and anti-hemorrhagic				
Plants	Bixaceae	*Bixa orellana* L.—Santos 430	Urucum	Root
	Fabaceae s.l.	*Ormosia* sp.—Santos 508	Tento	Seed
	Musaceae	*Musa* sp.—Santos 503	Banana-prata	Exudate
	Viscaceae	*Phoradendron bacthyorictum* Eichler—Santos 427	Erva-de-passarinho	Whole plant
18. Infectious diseases (2) Measles and mumps				
Animal	Sphecidae	*Sceliphrons* sp.—Santos 021	Caba-leão*	Nest
Plant	Caprifoliaceae	*Sambucus australis* Cham. & Schltdl.—Santos 360	Sabugueira	Leaf
19. Anti-aging (1) adaptogen/resistogen				
Plant	Myrtaceae	*Myrcia fallax* (Rich.) DC.—Santos 492	Araçá	Bark
20. Epilepsy (1) Anticonvulsant				
Plant	Oxalidaceae	*Averrhoa carambola* L.—Santos 480	Carambola	Leaf
21. Control of animal pests (1) Repellent				
Plant	Clusiaceae	*Calophyllum brasiliense* Cambess.—Santos 513	Jacareúba	Exudate

* Species collected, identified and incorporated into collections at the INPA; each may be present in more than one usage category.
** Flower pollen collected by bees and stored in the hive.

The category with the largest number of indicated plants and animals was the psychoactives (17%), which comprised the following therapeutic uses: nootropic, orexigenic, hallucinogen, stimulant, sexual stimulant and anxiolytic. The cultural syndromes category was the second most frequent (16.7%), containing seven therapeutic uses: *derrame*, *quebrante*, *espante*, *vento-caído*, *panema*, *doença-do-ar* and *mãe-do-corpo* (Table 1).

In standard health care, cultural syndromes are not recognized by professional medical doctors as they do not have a scientifically ascribable cause (Pinto et al., 2006). However, they are reported

among different groups of people in Latin America and according to local beliefs; can cause various symptoms and serious health consequences. Usually, the treatment is accomplished through rituals and the sensory perceptions of the local healing specialists (Leonti et al., 2001). However, as suggested by Bourbonnais-Spear et al. (2007), a more rigorous examination of the processes and treatments used by these traditional practitioners can provide important information on the etiology of these syndromes.

In the Unini River communities, the most common cultural syndromes are *quebrante*, *espante* and *vento-caído*, which are recognized by the interviewees as children's diseases. According to the experts, these syndromes are similar in terms of their general symptoms, which include shrunken eyes, vomiting, diarrhea, loss of appetite and drowsiness. In some cases, these clinical manifestations could be medically recognized as a dehydration following a gastroenterocolitis. In the case of *espante*, the following manifestations may also occur for a certain period of time: screaming, dizziness and agitation. For *quebrante*, we observed the same denomination and symptoms in Spain (Rubel, 1964). With such nonspecific manifestations is difficult and risky to propose any translation to a medical diagnosis.

The causal relationship of these cultural syndromes suggests that the afflicted individual is spiritually imbalanced and affected by lowering defences, which favors the 'entrance' of the disease into the person's body; these syndromes can also be transmitted by a spirit or by an evil eye. According to Hollweg (1997), this statement suggests that syndromes of this category are social, cultural, spiritual and cosmological products of other factors related to the worldview of these populations, which plays a key role in the subjectivity of the individual.

A few studies, such as that by Bourbonnais-Spear et al. (2007), establish a correlation between these syndromes and anxiety. These observations match our own, as the Unini River interviewees reported that the main treatments for these syndromes use plants that fight anxiety. Thus, baths with leaves of mucura-caa (*Petiveria alliacea* L.) are prescribed for relaxation. From a pharmacological standpoint, the leaves of this plant were found to have potentially depressant and anticonvulsant effects (Gomes et al., 2008), and its roots were characterized as potentially antinociceptive (De Lima et al., 1991, Gomes et al., 2005). Another soothing bath often used in these cases is prepared with the leaves of the garlic-vine (*Mansoa alliacea* A.H.Gentry), capitiu (*Siparuna guianensis* Aubl.) and catinga-de-mulata (*Leucas martinicensis* R.Br). They all are macerated and boiled together; it is recommended to bathe in the morning. Similar uses have been observed for capitiu among many indigenous and non-indigenous groups in Brazil, such as the Yanomami (Milliken and Albert, 1996) and Amazon populations (Prance, 1972; Rodrigues, 2006).

Another anxiolytic plant used to treat these syndromes is *Renealmia floribunda* K. Schum.; it is popularly known in the Unini River communities as manufa and is widely used in healing practices, especially in the form of body and head baths, along with other native plant species. The local inhabitants consider this plant to be a promoter of well-being that is soothing, analgesic and a preventive of *derrame* and respiratory disease. The mixture of herbs, specifically in this particular case, is made at dusk with fresh plants, which are macerated by hand and mixed in a bowl with water. This preparation must remain submerged in water all night in order to promote the extraction of the active ingredients. In the morning, before sunrise, the patient bathes in this mixture. No research was found regarding the pharmacological and chemical effects of this plant. Given the complexity of this category, the uses of these plants in treating these syndromes will need to be detailed in a future manuscript.

In addition to the cultural syndromes category, two other categories mentioned in this study deserve emphasis and detail. One is 'magic and prophecies,' which were described as having supernatural effects: *to bring good luck and to attract the loved one*. Similar uses were registered by Amorozo and Gély (1988), who found plants that *brought happiness* to rural populations of the state of Pará. In addition to the plants, three birds that had one of their organs used for prophecy were also included in this category. In the case of the Jacu bird (*Penelope jacquacu*), it is customary to cut out the heart and boil it with food in order to predict the sex of a fetus. If after boiling, the animal's heart remains closed, the child will be a male, and if it opens, the child will be a female. Among the Azande, in Africa, the use of animal parts to reveal what is hidden or predict the future is very common (Evans-Pritchard, 2005).

The other category that deserves mention is 'taboos/food restrictions'; although the plants and animals indicated for therapeutic uses in this category have a prophylactic rather than a remedial character, they were still included as part of the communities' therapeutic practices. This inclusion is because during some periods of life, such as during pregnancy, as explained by the interviewees, the consumption of certain foods items, such as fruits and fish, are restricted. If these taboos are not respected, several conditions, including discharge, heavy menstrual flow and difficulty in childbirth, may occur; however, if there is simultaneous use of these plants and animals, these conditions will be prevented. According to Bynum (1997), food taboos may be permanent or temporary, i.e., restricted to certain periods of life such as pregnancy, menstruation, postpartum and puberty; these taboos may be associated with social and religious customs.

When analyzing the contributions of animal and plants separately, we found that animals were more represented in the psychoactive and cultural syndromes categories, with 13 animals listed for each, followed by the respiratory system category (8 animals), as observed in Fig. 2. This latter category is the most represented in surveys conducted with animal medicine in Brazil (Costa-Neto, 1999; Silva, 2008; Alves et al., 2010, Garcia et al., 2010); therefore, the data in this study do not match those observed by other authors. This difference could be explained by our categorization of therapeutic uses, including the psychoactive category, which is not always included in other studies. In the

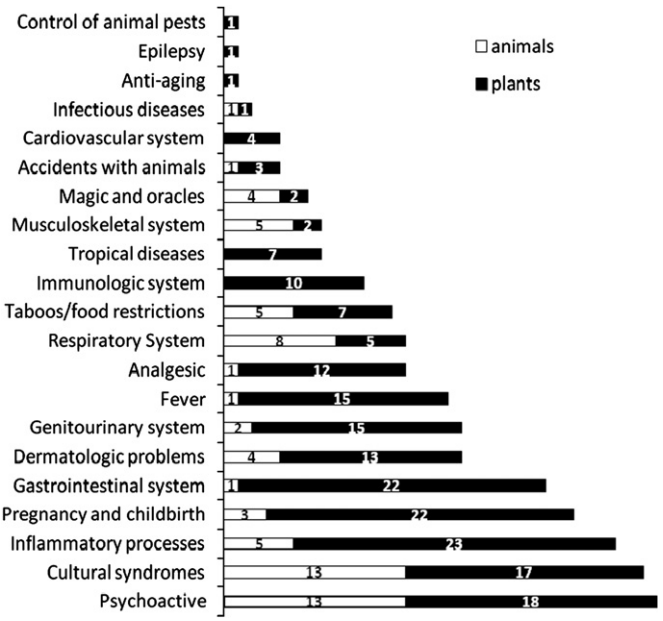

Fig. 2. Number of plants and animals listed for each of the 21 usage categories; each item could be present in more than one category.

case of cultural syndromes, it is known that they are recurrent among communities living in social and medical isolation; previous studies, however, were usually conducted in urban environments or in open-air markets and shops in large Brazilian cities.

As for plants, they were more frequently mentioned for the following categories: inflammatory processes (23 species), followed by pregnancy and childbirth, and the gastrointestinal system (22 species each). These results corroborate the findings from a study of a nearby region (Rodrigues, 2006). In addition, gastrointestinal disorders and reproductive problems were also recorded as main usage categories, respectively, by Silva et al. (2007) and Branch and Silva (1983) in ethnopharmacological surveys conducted in the Amazon region.

3.3. Natural resources

3.3.1. Plants

One hundred twenty-two plant species belonging to 60 taxonomic families, including Fabaceae s.l. (12 species), Arecaceae (7 species), Lamiaceae (6 species), Zingiberaceae (6 species), Asteraceae (5 species), Euphorbiaceae (5 species) and Burseraceae (4 species), were collected. These plants were identified and incorporated into the herbarium of the National Institute of Amazonian Research (INPA) with the following registration numbers: 237179–237199 and 237344–237380 (Table 1).

Approximately 65% of the 122 species listed were native to the Amazon rainforest. The main route of administration was oral; half of the reported uses indicated that they were used fresh or in the form of teas (infusions and decoction) or syrups. Topical administration (35%), mainly in the form of baths, was the second most common form of administration. Compresses and gargles appeared less frequently. Virtually all plant parts and products were involved in the recipes; however, the most frequently indicated parts were the leaves (40%), followed by exudates (18%). Few ethnopharmacological studies mention the use of exudates; the use of resin has been noted among the ethnic groups of Kapoor (Balée and Daly, 1990; Balée, 1994), Paumari (Prance et al., 1987) and Waimiri Atroari (Milliken et al., 1992).

The 122 plants were indicated for 58 therapeutic uses and grouped into 21 usage categories (Fig. 2 and Table 1). The breu-branco (*Protium heptaphyllum* (Aubl.) Marchand) was one of the most cited by the interviewees; its exudate was mainly used for the treatment of *derrame* and respiratory disease. Among other cultures, it is used to treat headaches and swelling, and it is applied as an anti-inflammatory substance, an expectorant and an insect repellent (Branch and Silva, 1983; Marques et al., 2010; Dr. Duke, 2011). A mixture of α- and β-amyrin was isolated from *P. heptaphyllum* (Susunaga et al., 2001); biological tests carried out by Oliveira et al. (2004) highlighted the important anti-inflammatory and analgesic properties of this species.

Exudates of this species, as well as of other species of the same genus, *P. aracouchini* (Aubl.) and *P. amazonicum* (Cuatrec.) Daly and Marchand, can be used as analgesics in the form of cigarettes for headache relief. No research was found on the pharmacological potential of these species. Other toasted and crushed plant seeds may be added for the purpose of promoting an even more satisfying effect, such as the seeds from the mucura-caa (*Petiveria alliacea* L.), piao-roxo (*Jatropha curcas* L.) and piao-branco (*Jatropha gossypiifolia* L.). The ingredients should be placed in a clean cloth that has been formed into a pouch, and the patient must inhale the released smoke. All interviewees emphasized the restricted use of embryos from the latter two seeds as they are considered toxic and can cause hallucinations. Similar findings related to toxicity (Mariz et al., 2006, 2008) or hallucinogenic powers (Schmeda-Hirschmann, 1993) have been reported for this genus.

Another versatile species was copaiba (*Copaifera multijuga* Hayne); whose oil was used in the treatment of sore throat, fever and flu. In severe cases of tonsillitis, the administration of a few drops on the affected site was recommended. To treat stomach pain, its seeds were grated, mixed with water and ingested. Its bark, together with those of other native trees, such as paracanauba (*Aspidosperma marcgravianum* Wood. or *Aspidosperma excelsum* Benth.) and uxi-liso (*Endopleura uchi* (Huber) Cuatrec), were used in the preparation of a reported powerful contraceptive among the women of the Unini River. Similar uses were described for copaiba in surveys conducted in the Amazon region by Branch and Silva (1983), Amorozo and Gély (1988), Balée (1994), Pinto and Maduro (2003), Shanley and Rosa (2005) and Rodrigues (2006). Some studies have evaluated the anti-inflammatory effects of its essential oil (Kobayashi et al., 2011), the antifungal effect of its essential oil and resin (Deus et al., 2009) and the anti-inflammatory and antinociceptive activity of the oleoresin (Gomes et al., 2010). The use of the bark from the paracanauba and uxi-liso plants for the treatment of genitourinary problems was described in ethnopharmacological studies performed in the Amazon region by Branch and Silva (1983) and by us, Rodrigues (2006), while studies on the pharmacological action and contraceptive properties of these two species were not found in the literature.

Another commonly used species was faveira (*Vatairea guianensis* Aubl.); its fruit pulp was topically applied for the treatment of *Pityriasis versicolor*, a yeast infection that often afflicts Amazon communities. The efficacy in the use of this species was described throughout the Unini River communities, and one of the procedures to increase its absorption involved scraping the affected area with a fingernail or wood stick. Similar uses were reported by Amorozo and Gély (1988) in rural populations in the state of Pará. Ottobelli et al. (2011) isolated and identified two anthraquinones, chrysophanol and fisciona, from the fruits of *V. guianensis*. The literature suggests that chrysophanol and fisciona have antifungal activities (Zhou et al., 2006; Coopoosamy and Magwa, 2006; Garcia-Rosa et al., 2006).

3.3.2. Animals

A total of 57 animals, belonging to 35 taxonomic families were indicated; bony fish from the Cichlidae (14%) and Characidae (9%) were the most common. Mammals, insects, amphibians, reptiles, birds and shellfish were also indicated. Out of the 57 animals, 25 were collected, identified and incorporated into the collections of the INPA; these are indicated with an asterisk in Table 1.

The animals were indicated for 19 therapeutic uses and grouped into 15 usage categories (psychoactive, cultural syndromes, respiratory system, inflammatory processes, taboos/food restrictions, musculoskeletal system, skin problems, magic and oracles, pregnancy and childbirth, genitourinary system, gastrointestinal system, fever, analgesic, animal accidents and infectious diseases), as shown in Fig. 2 and Table 1.

Several animal parts (skin, hoof, nail, feather, penis, bone and meat) and various products (lard, wax and bee geopropolis), as well as their derivatives (nests and cocoons), were mentioned in the preparation of home medicines. Fat was the most commonly used animal product (25%), followed by meat (15%); bone, nest, feather and skin, among others, are also mentioned (Table 1).

As in the case of plants, the animal parts, products and derivatives were included in more than one usage category; for example, fat from the diving lizard (*Uranoscodon superciliosus*) was used both for dermatological purposes and for treating the respiratory diseases. The nest of the lizards was used for treating a type of cultural syndrome. The indication of multiple therapeutic uses for the same animal was common, as observed in other

studies. Alves et al. (2010) found seven therapeutic indications for the same animal.

An interesting recipe entailed the ingestion of the raw brain of the bird (*Cacicus cela*) for nootropic purposes; this use was included in the psychoactive category. The main characteristic of this species was the ability to imitate the songs of other birds, suggesting that this ability to 'memorize' the songs could be passed along by consuming the brain, therefore improving the consumer's cognitive skills. Tea made from leaf-cutter ant (*Atta* sp.) that is used as a stimulant was also included in this category. A similar use was found for this animal by us in a previous study Rodrigues (2006), we noted the intake of ant tea among communities of the Jau River (near the study area) to remedy laziness; thus, from a pharmacological standpoint, this tea could be considered a stimulant. In the same study, another recipe called for the consumption of monkey brains to increase intelligence, which led us to believe that this practice was thought to be able to influence the consumer's cognition. The examples mentioned here are explained by the Doctrine of Signatures principle proposed by Paracelsus (1493–1541), which claims that it is possible to recognize the peculiarities and virtues of every plant and animal from its external appearance or 'signature' (figure, shape, color, typical feature). Ants, for example, are known for their intense labor activities; therefore, according to the interviewees, they could be used to cure laziness.

3.3.3. Plants associated with animals

In many recipes, animals are combined with plants. An example was the smoke treatment recipe prepared to cure *derrame* and respiratory disease. Animal parts were mixed with plant components (tinamous feather, porcupine thorn, plant resins) and placed in a clay pot containing embers of burning vegetable charcoal; the pot was then moved near the patient's body, and a specific prayer was performed. The main purpose of this treatment was to allow the illness to leave the body through sweating. In some instances, the patient's skin was smeared with alligator's fat (e.g., *Paleosuchus trigonatus* or *Caiman crocodilus*), which, according to the experts, enhanced smoke absorption.

The use of certain plants and animals as sexual stimulants was very common among the interviewees. The broth prepared from two species of piranha, *Serrasalmus gouldingi* and *Serrasalmus rhombeus*, was commonly used among Unini communities before sexual intercourse. The use of broths from other animals is widespread in different regions of Brazil, including broths from clams (*L. pectinata*), snails (*Turbinella laevigata*, *Strombus pugilis*, *Pugilina morio*) and oysters (*Crassostrea* sp.) (Costa-Neto, 1999; Costa-Neto, 2011).

Aside from these broths, beverages prepared with penises and pieces of skull from certain animals, which had been dried, pounded and mixed in hot water, were used in the promotion of sexual stimulation; some of these ingredients included skull bones from the red-headed woodpecker (*Campephilus melanoleucos*) and penises from the capuchin monkey (*Cebus apella*) and coati (*Nasua nasua*). The interviewees recommended such beverages two hours before intercourse. In contrast, interviewees mentioned that the constant use of a tea prepared with the bark of the clove vine (*Thynnanthus* sp.), known as a relaxant, could cause inhibition and loss of libido among men and women.

There are few animal pharmacology studies that have been conducted in Brazil, most of them are those conducted with marine animals (Berlink et al., 2004, Gray et al. 2006; Kossuga et al., 2009). The lack of pharmacological investigations of many species recorded in this study indicates the importance of ethnopharmacological records for discovering bioactive potential.

Table 2
Informant Consensus Factor presented by category of use based on the answers of 33 interviewees regarding 179 natural resources (122 plants and 57 animals).

Category of use	Species (animals and plants) nt	Use citations nur	ICF
(1) Psychoactive	31	342	0.91
(2) Cultural syndromes	30	328	0.91
(3) Inflammatory processes	28	153	0.82
(4) Pregnancy and childbirth	25	143	0.83
(5) Gastrointestinal system	23	113	0.80
(6) Dermatologic problems	17	53	0.69
(7) Genitourinary system	17	64	0.75
(8) Fever	16	52	0.70
(9) Analgesic	13	53	0.77
(10) Respiratory system	13	42	0.71
(11) Taboos/food restrictions	12	44	0.74
(12) Immunologic system	10	28	0.67
(13) Tropical diseases	7	13	0.50
(14) Musculoskeletal system	7	13	0.50
(15) Magic and oracles	6	18	0.70
(16) Accidents with animals	4	7	0.50
(17) Cardiovascular system	4	8	0.57
(18) Infectious diseases	2	3	0.50
(19) Anti-aging	1	1	0
(20) Epilepsy	1	1	0
(21) Control of animal pests	1	1	0

3.3.4. Consensus factor among expert healers

Considering the 179 natural resources utilized (122 plants and 57 animals) in the local medicine, it was observed a greater consensus factor (IFC=0.91) among the expert healers regarding the categories: psychoactive and cultural syndromes (Table 2). Other relevant IFC values were also observed: pregnancy and childbirth (IFC=0.83), inflammatory processes (IFC=0.82), gastrointestinal system (IFC=0.80), analgesic (0.77), genitourinary system (0.75) and 'taboos/food restrictions' (0.74). Only seven out of 21 categories of use presented IFC $\leq$ 0.50 (Table 2).

4. Conclusion

Traditional healing experts living in relative isolation at communities within the Amazon rainforest, accumulated a considerable amount of knowledge regarding the use of the regional natural resources for therapeutic purposes. A combination of factors such as: the geographical isolation, the immediate health needs unmet by the official medicine, the exuberant wealth of natural resources and the convergence of immigrants from various origins with diverse cultural backgrounds contributed to the creation of a healing practice that is both rich and consistent.

This study shows that not only hundreds of plants but also several plant exudates and animal products have an important role in their practices. Results displayed in Table 2 showed a high degree of agreement among interviewees especially in the categories: psychoactive, cultural syndromes, pregnancy and childbirth and inflammatory processes. It means that these practices are being regularly repeated and transmitted by the community's traditional healing experts. This increases the probability of finding measurable biological effects on natural resources used

for these categories including the cultural syndromes that held a high psychological content and could be benefited by the use of natural anxiolytics.

This paper provided a broad description of the healing practices and resources used by some communities from the Amazon rainforest. Further pharmacological and phytochemical investigations may use this information in the search for new compounds with potential bioactivity.

Acknowledgments

The authors would like to thank the inhabitants of the Unini River for their contributions to this work. We thank CAPES and CNPq for granting the doctoral fellowships and FAPESP/Biota 09/53382-2 for making the field work possible. We also thank the Vitoria Amazônica Foundation, the Unini River Extractive Reserve and Jau National Park for providing the initial contacts with the community and the logistical support. We would like to acknowledge the experts at the INPA Zoological Collections for assistance with the taxonomy and methods: Jansen Zuanon, Michel Jegu, Vinicius T. Carvalho, Jose C. Malta, Gislene Carvalho-Zilse, Augusto L. Henriques, Jorge L.P. Souza, Priscila Dias, Luciano Martins, Jose Ramos, Jose Guedes, Marcia Oliveira and Nory D. Erazo. Finally, we would like to thank the zoologist, Marcus V. Domingues, for his help in preparing the animal collection form. We also thank two anonymous referees for their helpful suggestions in improving this paper.

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