Rev Bras Farmacogn 24(2014): 225-247

Revista Brasileira de Farmacognosia
BRAZILIAN JOURNAL OF PHARMACOGNOSY
www.journais.elsevier.com/revista-brasileira-de-farmacognosia/

Original article

Medicinal plants traded in the open-air markets in the State of Rio de Janeiro, Brazil: an overview on their botanical diversity and toxicological potential

Fernanda Leitão[a,*], *Suzana Guimarães Leitão*[a], *Viviane Stern da Fonseca-Kruel*[b], *Ines Machline Silva*[c], *Karine Martins*[a]

[a]*Faculdade de Farmácia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brazil*
[b]*Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro, RJ, Brazil*
[c]*Universidade Federal Rural do Rio de Janeiro, UFRRJ, Seropédica, RJ, Brazil*

ARTICLE INFO

Article history:
Received 25 February 2014
Accepted 16 April 2014

Keywords:
Brazil
Medicinal plants
Open-air markets
Rio de Janeiro
Toxic plants
Urban Ethnobotany

A B S T R A C T

Medicinal plants have been used for many years and are the source of new active substances and new drugs of pharmaceutical interest. The popular knowledge contained in the open-air markets is studied through urban ethnobotany, and is a good source of information for ethnobotanical research. In this context, we surveyed the literature on works concerning open-air markets in the State of Rio de Janeiro to gather knowledge of the commercialized plants therein. A literature search resulted in ten studies with 376 listed species, distributed in 94 families and 273 genera. Asteraceae family had the greater representation, followed by Lamiaceae and Fabaceae. *Solanum* was the most frequent genus. Two hundred and twenty four species could be considered potentially toxic or potentially interact with other drugs/medicines. Eighteen species are referred as "not for use during pregnancy", and 3 "not for use while nursing". These results are a source of concern since in Brazil, as it is worldwide, there is the notion that plants can never be harmful. The results for the Sørensen Coefficient showed greater similarity between works performed in very close study areas. Other studies presented low similarity, mainly because of the difficulty in plant identification or a very specific focus in methodology.

Introduction

Medicinal plants have been used for many years, and currently are used as the source of new active substances and new drugs of pharmaceutical interests. Ethnobotany and ethnopharmacology have been the primary scientific approaches to select these medicinal plants (Albuquerque and Hanazaki, 2006; Leitão et al., 2013). The scenario of urban populations is different from that of traditional communities regarding the use of the, often limited, resources. The city, as an ecosystem, possesses its own ecological dynamics and its residents build their knowledge around it (Almada,

* *Corresponding author.*
E-mail: fernandals@ufrj.br (F. Leitão).
0102-695X/$ - see front matter © 2014 Sociedade Brasileira de Farmacognosia. Published by Elsevier Editora Ltda. All rights reserved.
http://dx.doi.org/10.1016/j.bjp.2014.04.005

2010). The popular knowledge kept in the open-air markets is studied by urban ethnobotany, which observes the human-plant relationship. Hence these studies are a good source of information for ethnobotanical research, which have opened many doors to knowledge that has rarely been catalogued (Bye and Linares 1983; Balick and Lee 2001; Ceuterick et al., 2008; 2011; Philander 2011). Open-air markets are often the link between the urban population and natural products. These markets concentrate and diffuse empirical knowledge about plant and animal resources, including the use of medicinal and ornamental plants, foods and other products that have regional value (Martin, 2000; Albuquerque et al., 2007; Monteiro et al., 2010).

In Brazil, these studies are of great importance since it is the most biologically diverse country of the world (MS, 2006). Despite its relevance, only a few studies have been performed (Berg, 1984; Almeida and Albuquerque, 2002; Nunes et al., 2003; Pinto and Maduro, 2003; Albuquerque et al., 2007; Alves and Rosa, 2007; Lima et al., 2011; Freitas et al., 2012). Almada (2010) mentions these articles to point out possibilities of research in ethnoecology. Monteiro et al. (2010) conducted a revision of studies in markets and open-air markets in many parts of the world, fifteen from Brazil, of which only three were carried out in Rio de Janeiro (Azevedo and Silva, 2006; Maioli-Azevedo and Fonseca-Kruel, 2007; Leitão et al., 2009). Despite the work from Monteiro et al. (2010) regarding open-air markets in Brazil, there is still a lack of information about the diversity and potential toxicity of the species sold in markets in the state of Rio de Janeiro.

The state of Rio de Janeiro has a total area of 43,780.172 km², and a population of 15,989,929 inhabitants (365.23 inhabitants/km²) distributed in 92 municipalities (IBGE, 2013) (Fig. 1). This state is located within the Atlantic Forest biome, recognized by UNESCO as one of the most vital biomes for global biodiversity conservation. Less than 8% remain from its original territory (Rambaldi et al., 2003) and it is one of the 35 global biodiversity hotspots (Martinelli and Moraes, 2013). This is worrying because, in order to supply the plant quota requested by the markets some of the species come directly from forest areas (Silva, 2008). An important issue generally unattended, refers to the possibility of the population being at risk of ingesting toxic plants sold in popular markets, due to misidentifications, as it is the case of *espinheira-santa* (*Maytenus aquifolia* or *M. ilicifolia*). At the majority of Rio de Janeiro State markets, the species termed *espinheira-santa* is oftenly *Sorocea blomplandii* (Coulaud-Cunha et al. 2004; Leitão et al., 2009; Parente and Rosa, 2001) or *S. guilleminiana* Gaudich, Moraceae (Maioli-Azevedo and Fonseca-Kruel, 2007; Azevedo and Silva, 2006). Although a report on the acute toxicity of *S. bomplandii* exists (Gonzalez et al., 2001), the safety of this species has not been fully determined.

In this context, we searched the literature for works concerning open-air markets in the state of Rio de Janeiro, in order to answer the following questions: which plants are sold at open-air markets in the state of Rio de Janeiro? Is there a variation of species richness within the studied open-air markets? Which species are considered native to Brazil and show some degree of endangerment? Are species with toxic potential being sold in these markets?

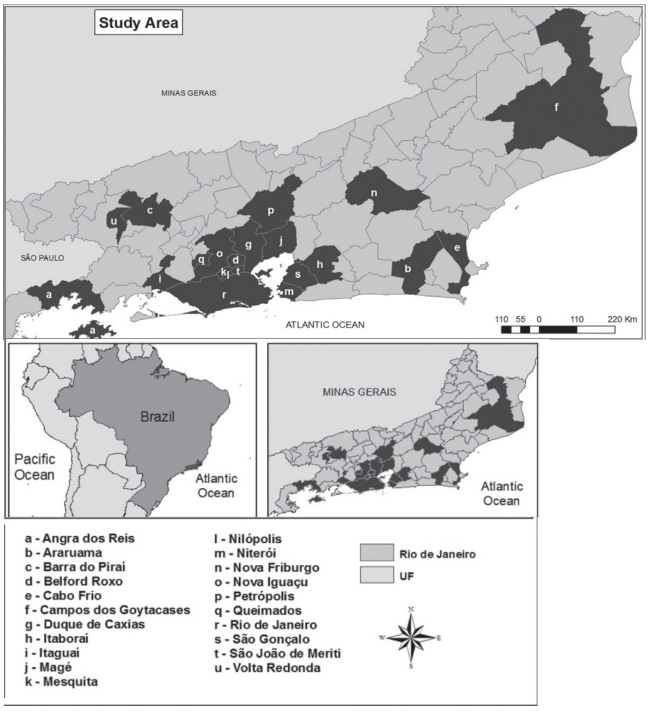

Figure 1 - Map of the State of Rio de Janeiro, Brazil, showing the municipalities from which open-air market studies were found.

Materials and methods

Data collection of open-air markets studies

This study was carried out using five scientific databases: Science Direct, JSTOR, Scopus, Web of Science, and SciELO; as well as Capes Journals Portal (www.periodicoscapes.gov.br). The literature search retrieved: 10,998 articles in Science Direct; 6270 in JSTOR: 77 in Scopus; 41 publications in the Web of Science; and 52 in SciELO. The following keyword combinations were used: "*feiras livres* Rio de Janeiro"; "free fair Rio de Janeiro", "public market Rio de Janeiro"; "Urban Market Rio de Janeiro"; "Open air Market Rio de Janeiro". In addition, the references in each article were used as source for further searches. When a study was not found on the web, we would ask authors and researchers to send them. Ten national publications concerning free-trade of medicinal plants in Rio de Janeiro were found, between 2000 and 2013.

Systematization of plant names and data on their origin

The species listed on the selected studies were compiled and their scientific names were updated in accordance to the List of Species of the Brazilian Flora (Lista de Espécies da Flora do Brasil, 2014), The International Plant Names Index (2013), Tropicos (2013) and The Plant List (2013), in that order. The native species were labeled (*) in Table 1 according to the List of Species of the Brazilian Flora (Lista de Espécies da Flora do Brasil, 2014), which is the current reference for Brazil.

Table 1
List of the plants commercialized in the markets and open-air markets in the state of Rio de Janeiro with botanical information and toxicological potential.

Family/Scientific name	popular name	Growth habit	Toxicity/Interaction with drugs	Reference
ACANTHACEAE				
Justicia gendarussa Burm. F.	vence-tudo	herb		9
Justicia pectoralis Jacq.*	anador	herb	f (5)	2
Pachystachys lutea Nees*	camarão	herb		3
ADOXACEAE				
Sambucus australis Cham. and Schltdl.*	sabugueiro	shrub	c	2, 10
Sambucus nigra L.	sabugueiro		b, c, d, f (64)	3, 6, 7, 9
ALISMATACEAE				
Echinodorus grandiflorus (Cham. and Schltr.) Micheli*	chapéu-de-couro	herb/aquatic		1, 2, 3, 5, 6, 9
Echinodorus macrophyllus (Kunth) Micheli*	chapéu-de-couro	herb/aquatic	f (1)	10
AMARANTHACEAE				
Alternanthera brasiliana (L.) Kuntze*	penicilina, anador	herb	f (1)	7, 9
Amaranthus viridis L.	caruru-sem-espinho, caruru-preto	herb	f (21)	9
Celosia argentea L.	crista-de-galo, suspiro	herb	f (3)	9, 10
Chenopodium ambrosioides L.*	mastruço, mastruz, mentruz, santa-maria	herb	d, f (51)	2, 3, 4, 6, 7, 9, 10
Pfaffia glomerata (Spreng.) Pedersen*	novalgina, penicilina	herb/subshrub	f (1)	3
AMARYLLIDACEAE				
Allium cepa L.	cebola	herb	c, e, f (131)	2, 9
Allium sativum L.	alho, casca-de-alho	herb	a3, b, c, e, f (162)	7, 9
ANACARDIACEAE				
Anacardium occidentale L.*	cajueiro	tree	c, f (131)	9
Mangifera indica L.	mangueira	tree	c, e, f (93)	2, 6, 9, 10
Schinus terebinthifolius Raddi*	aroeira	tree	c, e, f (37)	1, 2, 3, 6, 9, 10
Shinus molle L.*	aroeira	tree		5
ANNONACEAE				
Annona acutiflora Mart.*	guiné-preto	tree		9
Annona muricata L.	graviola	tree	f (18)	2, 6
APIACEAE				
Foeniculum vulgare Mill.	erva-doce, funcho	herb	e, f (34)	2, 3, 6, 7, 9, 10
APOCYNACEAE				
Asclepias curassavica L.*	oficial-de-sala	herb	f (53)	2, 6, 7, 9, 10
Geissospermum laeve (Vell.) Miers*	pau-pereira	tree	f (1)	2, 3, 9, 10
Himatanthus lancifolius (Müll.Arg.) Woodson*	agoniada	tree	f (1)	10
Tabernaemontana laeta Mart.	esperta	shrub	f (1)	10
Thevetia peruviana (Pers.) K. Schum.	chapéu-de-napoleão	tree	c, e, f (136)	9

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
ARACEAE				
Dieffenbachia seguine (Jacq.) Schott*	comigo-ninguém-pode, comigo-ninguém-pode-macho, comigo-ninguém-pode-fêmea	herb	c, f (35)	9, 10
Epipremnum aureum (Linden and André) G.S. Bunting (= Scindapsus aureus Engl.)	cipó-imbé, jiboia	herb	c	7, 9
Pistia stratiotes L.*	erva-de-santa-luzia, erva-de-santa-luzia-d'água	herb	f (2)	2, 3, 7, 9, 10
Xanthosoma appendiculatum Schott*	patioba	herb		9
Zantedeschia aethiopica (L.) Spreng	copo-de-leite	herb	c, f (42)	3
ARALIACEAE				
Hydrocotyle umbellata L.	abebê, vintém, abebê-de-oxum	herb	f (1)	9
ARECACEAE				
Elaeis guineensis Jacq.	dendezeiro, dendê	tree	f (2)	2, 9
ARISTOLOCHIACEAE				
Aristolochia cymbifera Mart. and Zucc.*	cipó-mil-homens	voluble		5
Aristolochia triangularis Cham. and Schltdl.*	mil-homem, cipó mil-homem, bem-com-deus, papo-de-peru	voluble		9
ASPARAGACEAE				
Agave americana L.	pita	herb	e, f (54)	2
Cordyline fruticosa (L.) A. Chev.	pelegum-roxo, pelegum-de-oxum-roxo	shrub	f (7)	9
Dracaena fragrans (L.) Ker Gawl.	pelegum, pelegum-amarelo, pau-d'água, pelegum-verde	shrub	f (1)	9, 10
Furcraea foetida (L.) Haw	pita	herb	f (3)	9
Herreria glaziovii Lecomte*	salsaparrilha	voluble		9
Herreria salsaparrilha Mart.*	salsaparrilha	voluble		2, 7
Sansevieria cylindrica Bojer ex Hook	lança-de-insã, espada-de-iansã	herb	f (2)	9
Sansevieria trifasciata Hort. ex Prain	espada-de-santa-bárbara, espada-de-são-jorge	herb	f (8)	1, 2, 7, 9, 10
ASPLENIACEAE				
Asplenium serratum L.*	pena-de-xangô	herb		9
ASTERACEAE				
Acanthospermum australe (Loef.) Kuntz.*	fel-da-terra	herb		10
Achillea millefolium L.	camomila, mil-em-rama, macelinha	herb	a2, b, f (63)	3, 9
Achyrocline satureioides (Lam.) DC.*	macelinha, macela, marcela	herb		1, 2, 6, 9, 10
Acmella brachyglossa Cass.*	jambu	herb		6
Acmella uliginosa (Sw.) Cass.*	oripepê, jambú, agrião-do-pará	herb		9
Ageratum conyzoides L.*	erva-de-são-joão, mentrasto	herb	f (10)	1, 2, 3, 6, 9, 10
Artemisia absinthium L.	losna	herb	a1, a2, c, d, f (2)	2, 6, 7

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Artemisia annua L.	marcelão	herb	f (29)	3
Artemisia verlotorum Lamotte	losna	herb	f (3)	9
Baccharis crispa Spreng.* (= *Baccharis trimera* (Less.) DC.; *Baccharis myriocephala* DC.)	carqueja, carquejo	subshrub		2, 3, 5, 6, 7, 9, 10
Baccharis dracunculifolia DC.*	alecrim-do-campo, alecrim	shrub		2, 3, 6, 9, 10
Baccharis junciformis DC.* (= *Baccharis usterii* Heering)	carqueja-doce	subshrub		3
Baccharis montana DC.* (= *Baccharis elaeagnoides* Steud. ex Baker)	alecrim-do-mato	shrub/tree		3
Bidens pilosa L.	picão, picão-do-mato, picão-branco	herb	f (9)	2, 3, 4, 6, 7, 9, 10
Centratherum punctatum Cass.*	balainho de-velho, balauê	herb		6, 9
Chromolaena maximilianii (Schrad. ex DC.) R.M. King and H. Rob.* (= *Eupatorium maximiliani* Schrad.)	arnica-do-mato, arnica-do-campo	shrub		10
Chromolaena odorata (L.) R.M. King and H. Rob.*	arnica-do-mato, arinca-do-campo	shrub	a1, f (3)	9
Conyza bonariensis (L.) Cronquist* (= *Erigeron bonariensis* L.)	mata-pasto	subshrub	f (2)	7
Coreopsis grandiflora Nutt. ex Chapm.	camomila, camomila nacional	herb	f (12)	2, 6, 9
Cyanthillium cinereum (L.) H. Rob. (= *Vernonia cinerea* (L.) Less.)	vassourinha-preta	herb	f (4)	9
Cynara cardunculus L. (= *Cynara scolymus* L.)	alcachofra	herb	b, e	3, 5, 7, 9
Cyrtocymura scorpioides (Lam.) H. Rob.* (= *Vernonia scorpioides* (Lam.) Pers.)	erva-de-coelho	herb/subshrub	f (2)	7
Elephantopus mollis Kunth* (= *Elephantopus scaber* L.)	língua-de-vaca, erva-grossa, gervão	herb	f (2)	2, 4, 7, 10
Emilia fosbergii Nicolson* (= *Emilia coccinea* (Sims) Sweet.)	dente-de-leão	herb	f (2)	6, 10
Emilia sonchifolia (L.) DC. ex Wight*	serralha, dente-de-leão	herb	f (2)	2, 9, 10
Erechtites hieracifolius (L.) Raf. ex DC.*	serralha	herb	f (1)	10
Erechtites valerianifolius (Wolf) DC.*	capichoba, capiçova	herb	f (2)	3, 7
Gochnatia polymorpha (Less.) Cabrera*	baleeira-branca	tree		10
Gymnanthemum amygdalinum (Delile) Sch. Bip. ex Walp.* (= *Vernonia condensata* Baker.)	boldo, boldo-do-chile, alumã	tree		6, 7, 10
Helianthus annuus L.	girassol	herb	e, f (31)	6, 9
Helipterum manglesii (Lindl.) Benth.	rondante			3
Heterocondylus alatus (Vell.) R.M. King and H. Rob.*	assa-peixe			4
Hypochaeris chillensis (*Kunth*) Britton (= *Hypochaeris brasiliensis* (Less.) Benth. and Hook. F. ex Griseb.)	cardo-santo			3, 4
Matricaria chamomilla L. (= *Matricaria recutita* L.)	camomila	herb	a1, b, f (55)	2, 5
Melampodium divaricatum (Rich. Ex Pers) DC.*	botão-de-ouro	herb	f (1)	9
Mikania glomerata Spreng.*	guaco, guapo	voluble	f (2)	2, 6, 9, 10

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Mikania hirsutissima DC.*	cipó-cabeludo	voluble	f (1)	2, 3, 9
Mikania laevigata Sch. Bip. ex Baker*	guapo, guaco, guacro	voluble	f (2)	3, 4
Orthopappus angustifolius (Sw.) Gleason* (= *Elephantopus angustifolius* Sw.)	língua-de-vaca	herb	f (1)	10
Pluchea sagittalis (Lam.) Cabrera*	quitoco	herb		2, 9
Porophyllum ruderale (Jacq.) Cass.*	covinha-do-mato	herb		7
Pterocaulon alopecuroides (Lam.) DC.*	quitoco, barbaço, erva-da-lua, neve-branca	herb		3, 6, 7, 9
Smallanthus sonchifolius (Poepp.) H. Rob	batata-yacon			9
Solidago chilensis Meyen	arnica, arnica-do-campo	herb	a1, f (2)	1, 2, 3, 4, 6, 7, 9, 10
Sonchus oleraceus L.*	serralha	herb	f (4)	9
Sphagneticola trilobata (L.) Pruski*	doripepe, margarida-do-telhado	herb	f (2)	10
Stevia rebaudiana (Bertoni) Bertoni*	estévia	herb		2
Stifftia chrysantha J. C. Mikan*	ifa, esponjinha	shrub/tree		3
Tagetes erecta L.	cravo	herb	f (13)	6
Tithonia rotundifolia (Mill.) S. F. Blake (= *Tithonia speciosa* Hook.)	mão-de-deus, girassol-miúdo	herb		10
Vernonanthura beyrichii (Less.) H. Rob.* (= *Vernonia beyrichii* Less.)	assa-peixe	shrub	f (2)	9, 10
Vernonanthura brasiliana (L.) H. Rob. (= *Vernonia scabra* Pers)	assa-peixe	shrub	f (1)	6
Vernonanthura paludosa (Gardner) H. Rob.* (= *Vernonia paludosa* Gardner)	assa-peixe			9
Vernonanthura phaeoneura (Toledo) H. Rob.* (= *Vernonia phaeoneura* Toledo)	assa-peixe	tree		4
Vernonanthura phosphorica (Vell.) H. Rob.* (= *Vernonia polyanthes* Less.)	cambará assa-peixe, assa-peixe	shrub		1, 2, 3, 4, 5
Vernonanthura westiniana (Less.) H. Rob.* (= *Vernonia westiniana* Less.)	assa-peixe	shrub		4
Vernonia serrata Less.*	assa-peixe		f (3)	3
BALSAMINACEAE				
Impatiens balsamina L.	beijo-branco	shrub	f (6)	9
Impatiens sultanii Hook. F.	maravilha	shrub		9
BIGNONIACEAE				
Anemopaegma arvense (Vell.) Stellfeld ex de Souza*	pau-de-resposta			5
Crescentia cujete L.	coité, cuitê	tree	f (6)	7, 9
Cybistax antisyphilitica (Mart.) Mart.*	cinco-em-folhas, ipê	tree		2, 10
Jacaranda macrantha Cham.*	carobinha-roxa	tree		3
Jacaranda puberula Cham.*	carobinha, caroba, caraúba	tree		2, 3, 7, 9, 10
Newbouldia laevis Seem.	akokô, erva-da-felicidade	tree		9

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Sparattosperma leucanthum (Vell.) K. Schum* (= *Sparattosperma vernicosum* (Cham.) Bureau and K. Schum.)	cinco-folhas, cinco-chagas-de-cristo, caroba-branca	tree		9, 10
Tynanthus labiatus (Cham.) Miers*	cipó-cravo	voluble		2, 9
BIXACEAE				
Bixa orellana L.*	urucum	tree	f (3)	1, 2, 6, 9, 10
BORAGINACEAE				
Cordia ecalyculata Vell. (= *Cordia salicifolia* Cham.)	porangaba	tree		5
Symphytum officinale L.	confrei	herb	a2, a3, c, d	7, 9, 10
Varronia curassavica Jacq.* (= *Cordia curassavica* (Jacq.) Roem. and Schult.)	erva-baleeira	shrub	f (3)	9
Varronia polycephala Lam.* (= *Cordia monosperma* Roem and Schult.)	baleeira-preta, balieera-preta	shrub	f (1)	6, 10
Coronopus didymus (L.) Sm.* (= *Senebiera pinnatifida* DC.)	mascruz, mastruço, mastruz	herb		10
Lepidium pseudodidymum Thell. ex Druce	mastruz	herb		9
Lepidium virginicum L.	vassourinha-de-relógio	herb	f (10)	10
Nasturtium officinale W.T. Aiton	agrião	herb	a2, d, f (27)	4
Aechmea fasciata (Lindl.) Baker*	bromélia	herb	f (2)	3
Tillandsia usneoides (L.) L.*	barba-de-velho	herb		2, 9, 10
Vriesea psittacina (Hook.) Lindl.*	gravatá, espadinha	herb		3
CACTACEAE				
Cereus fernambucensis Lem.*	mandacaru	shrub		9
Epiphyllum phyllanthus (L.) Haw.*	dama-da-noite	herb		2, 9
Nopalea cochenillifera (L.) Salm-Dyck	palmatória	shrub	f (1)	9
CANNABACEAE				
Trema micrantha (L.) Blume*	mutamba, curindiba	shrub/tree	f (7)	9
CAPPARACEAE				
Crateva tapia L.*	pau-d'alho	tree	f (4)	6
CARICACEAE				
Carica papaya L.	mamão	tree	a1, f (46)	10
CELASTRACEAE				
Maytenus ilicifolia Mart. ex Reissek*	espinheira-santa	shrub/tree		5
CHLORANTHACEAE				
Hedyosmum brasiliense Mart. ex Miq.*	macota	shrub/tree		9
CHRYSOBALANACEAE				
Chrysobalanus icaco L.*	abajiru, abajuru, bajuru	shrub	f (1)	6, 9
COMMELINACEAE				
Commelina virginica L.	trapoeraba-azul	herb	f (3)	10
Tradescantia zebrina Heynh. ex Bosse	trapoeraba	herb	c	9

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
CONVOLVULACEAE				
Cuscuta racemosa Mart.*	cipó-chumbinho, cipó-chumbo, cuscuta	herb/parasite		3, 9, 10
Ipomoea batatas (L.) Lam.	batata-doce	herb	f (54)	9
COSTACEAE				
Costus spiralis (Jacq) Roscoe*	cana-do-brejo	herb		2, 6, 9, 10
CRASSULACEAE				
Kalanchoe crenata (Andrews) Haw. (= *Kalanchoe brasiliensis* Cambess.)	saião, folha-da-fortuna	herb		2, 3, 4, 6, 9, 10
Kalanchoe pinnata (Lam.) Pers.	fortuna, saião	herb	f (17)	6, 9, 10
CUCURBITACEAE				
Apodanthera smilacifolia Cogn.	cipó-azogue	voluble		3
Cayaponia tayuya Cogn.*	abóbora-d'anta	voluble	f (1)	9
Luffa cylindrica M.Roem.*	bucha	voluble	f (2)	9, 10
Luffa operculata (L.) Cogn*	buchinha-do-norte, buchinha	voluble	f (3)	1, 2, 5, 9
Momordica charantia L.	melão-de-são-caetano	voluble	c, f (51)	1, 2, 3, 5, 6, 7, 9, 10
CYPERACEAE				
Cyperus odoratus L.* (= *Cyperus acicularis* Steud.)	dandá-da-costa	herb		9
Cyperus rotundus L.*	batata-de-tiririca, dandá-da-costa	herb	f (4)	9, 10
Scleria melaleuca Rchb. Es Schltdl.and Cham.* (= *Scleria pterota* C. Presl.)	navalha-de-macaco	herb		2
DENNSTAEDTIACEAE				
Pteridium arachnoideum (Kaulf.) Maxon (= *Pteridium aquilinum* (L.) Kuhn)	samambaia-de-reumatismo, samambaia	herb	c, f (621)	8, 10
DILLENIACEAE				
Davilla rugosa Poir.*	cipó-cabloco	voluble	f (4)	2, 9, 10
DIOSCOREACEAE				
Dioscorea alata L.	cará	voluble	f (21)	9
EQUISETACEAE				
Equisetum giganteum L.*	cavalinha; rabo-de-cavalo			8
Equisetum hyemale L.	cavalinha	herb	f (20)	3, 6, 9
EUPHORBIACEAE				
Acalypha communis Müll. Arg.*	parietária	herb	f (11)	9
Acalypha poiretii Spreng.*	parietária	herb	f (1)	2, 6, 10
Cnidoscolus urens (L.) Arthur*	cansanção	shrub	f (12)	9
Codiaeum variegatum (L.) Rumph. ex A. Juss.	folha-da-independência	shrub	c, e, f (30)	9
Euphorbia hirta L.*	erva-de-santa-luzia-da-terra	herb	f (33)	10
Euphorbia prostrata Aiton* (= *Chamaesyce prostrata* (Aiton) Small)	quebra-pedra-rasteira, quebra-pedra-miúda/roxa, quebra-pedra	herb	f (24)	1, 3, 9, 10

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Euphorbia tirucalli L.	velame	shrub	c, f (64)	9
Jatropha gossypiifolia L.*	pinhão-roxo, pinhão, pinhão-branco, pião-roxo	shrub	f (27)	2, 6, 7, 9, 10
Joannesia princeps Vell.*	cutieira, boleira	tree	f (4)	2, 9
Manihot esculenta Crantz*	mandioca	shrub	f (238)	9
Ricinus communis L.	mamona	shrub	a1, a2, c, d, e, f (729)	2, 10
FABACEAE				
Amburana cearensis (Allemão) A.C. Sm*	amburana-de-cheiro	tree		9
Bauhinia blakeana Dunn	pata-de-vaca	tree	f (1)	10
Bauhinia forficata Link*	pata-de-vaca, unha-de-vaca	tree		2, 3, 6, 7
Bauhinia variegata L.	pata-de-vaca	tree	f (5)	2, 3, 6
Bowdichia virgilioides Kunth*	sucupira	tree		5
Cajanus cajan (L.) Huth	feijão-guandu, guando, guandu	tree	f (19)	2, 9, 10
Desmodium adscendens (Sw.) DC.	amor-do-campo, carrapichinho	herb/subshrub		3, 6, 9, 10
Erythrina speciosa Andrews*	mulungú	tree	f (8)	9
Hymenaea courbaril L.*	jatobá	tree	f (3)	5, 9
Libidibia ferrea (Mart. ex Tul.) L.P. Queiroz* (= *Caesalpinia ferrea* Mart. ex Tul.)	jucá, fava-de-jucá, fruto-de-jucá, pau-ferro	tree	f (1)	2, 5, 9
Mimosa pudica L.*	dormideira	herb/subshrub	f (18)	6, 10
Phanera microstachya (Raddi) * (= *Bauhinia microstachya* (Raddi) J.F. Macbr.)	pata-de-vaca	voluble		2, 3, 6, 9
Phanera radiata (Vell.) Vaz* (= *Bauhinia radiata* Vell.)	pata-de-vaca, pata-de-vaca-rasteira	voluble	f (1)	6, 9
Senna alexandrina Mill.* (= *Cassia angustifolia* Vahl.)	sene, sene-indiano		a1, f (32)	5, 9
Senna macranthera (DC. ex Collad.) H.S. Irwin and Barneby*	acácia	shrub/tree	a1	3
Senna occidentalis (L.) Link*	fedegoso	shrub/subshrub	a1, f (97)	2, 9, 10
Stryphnodendron adstringens (Mart.) Coville* (= *Stryphnodendron barbatimam* (Vell.) Mart.)	baratimão	shurb/tree		5
GINKGOACEAE				
Ginkgo biloba L.	ginkgo, ginkgo biloba	tree	a1, b, c, f (109)	5, 9
HELICONIACEAE				
Heliconia psittacorum L.F.*	lírio	herb		6
Heliconia rostrata Ruiz and Pav.*	colar-de-princesa, bico-de-papagaio	herb		3, 9
LAMIACEAE				
Aeollanthus suaveolens Mart. ex Spreng.	macaça, macassá, catinga-de-mulata	herb		6, 9, 10
Hyptis suaveolens Poit.*	vento-virado-de-bucho	herb/shrub	f (1)	7
Leonotis nepetifolia (L.) R. Br.	cordão-de-frade	herb/shrub	f (4)	2, 3, 6, 9, 10
Leonurus sibiricus L.	erva-macaé, isopi	herb/shrub	f (3)	2, 3, 6, 7, 9, 10

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Mentha × *piperita* L.	alevante, elevante, hortelã	herb	b, f (29)	2, 3, 4, 6, 9, 10
Mentha pulegium L.	poejo, poejo-branco	herb	a2, b, c, f (64)	2, 3, 4, 5, 6, 7, 9, 10
Mentha spicata L.	hortelã-da-horta, hortelã-miúdo, menta	herb	f (20)	9
Mentha x gentilis L.	alevante	herb		6
Ocimum americanum L.	manjericão, manjericão roxo	herb	f (2)	2, 7, 9
Ocimum basilicum L.	manjericão, manjericão roxo	herb	a2, a3, f (7)	3, 5, 6, 9, 10
Ocimum campechianum Mill.*	alfavaca, alfavaca-da-horta, alfavaquinha	herb	f (1)	4, 9, 10
Ocimum carnosum (Spreng.) Link and Otto ex Benth.* (= *Ocimum selloi* Benth.)	anis, alfavaca-anis, elixir-paregórico	herb		1, 2, 3, 9
Ocimum gratissimum L. (= *Ocimum urticifolium* Benth.)	alfavacão, alfavaca, alfavaca-do-mato	herb	f (3)	1, 2, 3, 4, 6, 7, 9, 10
Ocimum minimum L.	manjericão-da-folha-miúda	herb	f (1)	10
Origanum vulgare L.	manjerona, orégano	herb	f (18)	9
Plectranthus amboinicus (Lour.) Spreng.	hortelã-pimenta, hortelã-doce	herb	f (2)	9, 10
Plectranthus barbatus Andr.	boldo, malva	herb	c, e	2, 6, 7, 9, 10
Plectranthus neochilus Schltr.	boldo-japonês	herb		9
Plectranthus verticillatus (L. F.) Druce (= *Plectranthus nummularius* Briq.)	dólar	herb		9
Pogostemon cablin (Blanco) Benth.	patchouli	herb		9
Rosmarinus officinalis L.	alecrim, alecrim-de-horta	herb/shrub	a2, f (21)	1, 2, 3, 5, 6, 7, 9, 10
Salvia officinalis L.	sálvia, salva	herb	a2, b, c, e, f (47)	3, 6, 7, 9, 10
Tetradenia riparia (Hochst.) Codd	alfazema-fêmea, sândalo	herb		3, 9
Thymus vulgaris L.	tomilho, amor-agarradinho	herb	b, e, f (21)	9
Vitex agnus-castus L.	erva-da-jurema	shrub	a1, a2, b, f (10)	9
Cinnamomum camphora (L.) J. Presl	vick-do-mato	tree	a2, f (45)	9
Cinnamomum verum J. Presl (= *Cinnamomum zeylanicum* Breyne)	canela	tree	e	6, 9
Laurus nobilis L.	louro	tree	c, e, f (27)	2, 3, 5, 6, 9
Ocotea elegans Mez.*	canela-de-sassafrás	tree	f (1)	7
Ocotea glaziovii Mez.*	canela-preta	tree		2
Ocotea odorifera (Vell.) Rohwer*	canela-sassafrás	tree	f (3)	2
Persea americana Mill.	abacate	tree	c, f (58)	2, 9, 10
LECYTHIDACEAE				
Lecythis pisonis Cambess.*	sapucaia	tree		9
LINDERNIACEAE				
Torenia fournieri Linden ex Fourn.	amor-perfeito	herb		9
LORANTHACEAE				
Struthanthus concinnus (Mart.) Mart.*	erva-de-passarinho	herb/parasite		3, 4, 6, 10
Struthanthus marginatus (Desr.) Blume*	erva-de-passarinho	herb/parasite		1, 4, 9

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
LYGODIACEAE				
Lygodium venustrum Sw.*	abre-caminho, samambaia de caboclo			8
Lygodium volubile Sw.*	abre-porta, abre-caminho, samambaia-de-cabloco	herb/voluble		1, 2, 3, 6, 7, 8, 9, 10
LYTHRACEAE				
Cuphea carthagenensis (Jacq.) J. Macbr.*	sete-sangrias	herb	f (2)	1, 2, 3, 6, 7, 9, 10
Punica granatum L.	romã	shrub	d, f (22)	2, 6, 9, 10
MALPIGHIACEAE				
Byrsonima sericea DC.*	akossí, murici	tree		9
Heteropterys tomentosa A. Juss. (= *Heteropterys aphrodisiaca* Machado)	nó-de-cachorro	shrub		5
MALVACEAE				
Abutilon striatum Dicks. ex Lindl.*	brinco-de-princesa	shrub		9
Ceiba speciosa (A. St.-Hil) Ravenna*	algodão	tree	f (1)	3
Cola acuminata (P. Beauv.) Schott and Endl.	obi	tree	a2, b, f (17)	9
Gossypium barbadense L.	algodão	shrub	f (13)	6, 10
Gossypium herbaceum L.	algodão	shrub	a2, f (15)	3, 9
Hibiscus rosa-sinensis L.	papoula-vermelha, brinco-de-princesa	shrub	f (9)	9
Hibiscus sabdariffa L.	vinagreira	shrub	f (1)	9
Luehea conwentsii K. Schum.*	açoita-cavalo	tree		9
Malva parviflora L.	malva-branca, malva		f (26)	3, 9
Malva sylvestris L.	malva-de-banho		f (8)	3
Sida panicaulis Cav.* (= *Sida carpinifolia* L.)	vassourinha, vassoura-preta	herb	f (2)	3, 6, 10
Wissadula hernandioides (L. Hér.) Garcke)* (= *Wissadula subpeltata* (Kuntze) R.E. Fr.)	capixinguim			7
MARSILEACEAE				
*Marsilea polycarp*a Hook. and Grev.*	trevo-de-quatro-folhas			9
MELASTOMATACEAE				
Clidemia biserrata DC.*	abranda-fogo			9
Miconia albicans (Sw.) Triana*	canela-de-velho, branda-fogo, vence-demanda, café-do-mato	shrub/tree		2, 6, 9, 10
Miconia calvescens DC.*	abranda-fogo, erva-de-xangô	shrub/tree		2, 9
Miconia chartacea Triana*	branda-fogo	shrub/tree		3
Miconia mirabilis (Aubl.) L.O. Williams*	capa-de-xangô	shrub/tree		10
Tibouchina granulosa (Desr.) Cogn.*	quaresma, erva-de-naná	tree		10
MELIACEAE				
Guarea guidonia (L.) Sleumer*	berreiro	tree		9
Melia azedarach L.	para-raio, berreiro, carrapeta, erva-de-xangô	tree	f (128)	2, 6, 7, 9, 10

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
MENISPERMACEAE				
Chondrodendron platiphyllum (A. St.- Hil.) Miers*	buta			9
MONIMIACEAE				
Mollinedia schottiana (Spreng.) Perkins*	quebra-mironga	tree		2
MORACEAE				
Artocarpus altilis (Parkinson ex F.A. Zorn) Fosberg (= *Artocarpus incisus* (*Thunb*.) L.F.)	fruta-pão	tree	f (6)	2, 9
Dorstenia arifolia Lam.*	carapiá	herb		7
Morus nigra L.	amora	shrub/tree	f (9)	6
Sorocea bonplandii (Baill.) W.C. Burger et al.*	espinheira-santa	tree		7, 9
Sorocea guilleminiana Gaudich*	espinheira-santa	tree		1, 2, 6
MUSACEAE				
Musa x *paradisiaca* L.	bananeira, coração-de-bananeira			2, 9
MYRTACEAE				
Campomanesia guaviroba (DC.) Kiaersk*	guariroba	tree		9
Corymbia torelliana (F. Muell.) K.D. Hill and L.A.S. Johnson (= *Eucalyptus torelliana* F. Muell.)	eucalipto			9
Eucalyptus cinerea F. Muell ex Benth.	eucalipto	tree	f (5)	7
Eucalyptus globulus Labill.	eucalipto	tree	c, f (19)	3
Eugenia astringens Cambess* (= *Eugenia rotundifolia* Casar.)	abajiru, bajuru, abajuru, bajiru	tree		9
Eugenia uniflora L.*	pitanga	shrub	f (3)	2, 4, 6, 10
Myrcia guianensis (Aubl.) DC. *	pedra-ume-caá	tree		9
Pimenta dioica (L.) Merr.	cravo-da-índia		f (11)	9
Psidium guajava L.	goiabeira	tree	f (6)	10
Syzygium aromaticum (L.) Merr. and L.M. Perry	cravo-da-índia	tree	c, f (22)	9
Syzygium cumini (L.) Skeels (= *Eugenia jambolana* Lam.)	jamelão, jambolão	tree	f (3)	2, 3, 6, 10
Syzygium malaccense (L.) Merr. and L.M. Perry	jambolão, jamelão	tree	f (1)	9
NYCTAGINACEAE				
Boerhavia diffusa L.	erva-tostão, pega-pinto, para-tudo	herb	f (3)	9, 10
Mirabilis jalapa L.	maravilha, folha-de-maravilha	herb	f (29)	3, 7, 10
ORCHIDACEAE				
Cyrtopodium gigas (Vell.) Hoehne*	sumaré	herb		9
Dendrobium nobile Lindl.	pendoba	herb	f (2)	3
Oeceoclades maculata (Lindl.) Lindl.	cantaria	herb		9
OXALIDACEAE				
Averrhoa carambola L.	carambola	tree	f (8)	2, 10

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
PASSIFLORACEAE				
Passiflora alata Curtis*	maracujá-açu, folha-de-maracujá	voluble	f (1)	9, 10
Passiflora edulis Sims*	maracujá, folha-de-maracujá	voluble	f (15)	2, 10
PHYLLANTHACEAE				
Phyllanthus niruri L.*	quebra-pedra	herb	f (6)	2
Phyllanthus tenellus Roxb.*	quebra-pedra, erva-pombinha	herb		3, 9
Gallesia integrifolia (Spreng.) Harms*	pau-d'alho	tree		2, 9
Petiveria alliacea L.	guiné, guiné (piu-piu)	herb	f (7)	1, 2, 3, 6, 7, 9, 10
PIPERACEAE				
Peperomia pellucida (L.) Kunth.	oriri, oripepê, parietária e lingua-de-sapo, oriri-da-oxum	herb	f (3)	6, 9, 10
Piper amalago(Jacq.) Yunck	tira-teima, bete-cheirosa, corta-mandinga, corta-mironga			9
Piper anisum (Spreng.) Angely (= *Ottonia anisum* Mart. ex Miq.)	desata-nó, jaborandi, joão-barandi	herb		2, 7, 9
Piper arboreum Aubl	vence-demanda, quebra-canga, joão-barandi, desata-nó, abranda-fogo	shrub	f (5)	2, 7, 9, 10
Piper hoffmannseggianum Roem. and Schult.	jaborandi, desata-nó	herb		6, 9
Piper mollicomum Kunth	aperta-ruã, aperta-ruão	herb	f (1)	9, 10
Piper umbellatum L.* (= *Potomorphe umbellata* (L.) Miquel)	capeba	herb/shurb	f (8)	2, 7, 9, 10
PLANTAGINACEAE				
Plantago australis Lam.*	tanchagem	herb	a1, f (8)	3, 7
Plantago lanceolata L.	tanchagem	herb		5
Plantago major L.	trançagem	herb	a1, f (20)	1, 2, 3, 6, 9, 10
Scoparia dulcis L.*	vassourinha-de-nossa-senhora	herb/shurb	f (7)	6, 9, 10
POACEAE				
Andropogon bicornis L.*	cavalinha	herb		10
Cenchrus ciliaris L.	capim-angola	herb	f (11)	6
Coix lacryma-jobi L.	lágrima-de-nossa-senhora	shrub	f (1)	2, 3, 6, 7, 9, 10
Cymbopogon citratus (DC.) Stapf	capim-limão	herb	a2, f (8)	1, 2, 3, 4, 6, 7, 9, 10
Cymbopogon densiflorus (Steud.) Stapf	saco-saco, capim-de-angola, capim-são-josé	herb	f (1)	9
Eleusine indica (L.) Gaertn.	capim-pé-de-galinha	herb	f (15)	2
Melinis minutiflora P. Beauv.	capim-gordura	herb	f (2)	7, 9, 10
Saccharum officinarum L.	cana-de-açúcar	herb	f (16)	9
Zea mays L.	cabelo-de-milho	herb	f (117)	6, 10
POLYGALACEAE				
Polygala paniculata L.	gelol, vick			1, 7
Antigonon leptopus Hook and Arn.	amor-agarradinho		f (1)	6

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
Persicaria hydropiper (L.) Delarbre (= *Polygonum hidropiper* Neck.)	erva-de-bicho			5
Polygonum ferrugineum Wedd.* (= *Polygonum spectabile* Mart.)	erva-de-bicho	herb	f (6)	6
Polygonum hydropiperoides Michx.*	erva-de-bicho	herb	f (3)	2
Polygonum persicaria L.*	erva-de-bicho	herb	f (48)	1, 3
Polygonum punctatum Elliott* (= *Polygonum acre* Kunth)	erva-de-bicho, erva-de-bicho-roxa	herb	f (2)	7
Microgramma vacciniifolia (Langsd. and Fisch.) Copel.*	erva-silvina, erva-servina, erva-de-mamãe-oxum			8
Portulaca oleracea L.*	beldroega, erva-de-obaluaiê	herb	f (37)	7, 9
Talinum patens (Jacq). Willd.	bredo	herb	f (1)	6
Talinum racemosum (Jacq). Willd.	bredo-de-santo-antônio	herb		9
Talinum triangulare (Jacq). Willd.*	preta	herb		10
PROTEACEAE				
Roupala sculpta Sleumer*	jurema-preta			10
PTERIDACEAE				
Adiantum raddianum C.Presl.*	avenca	herb		3, 7, 9
ROSACEAE				
Eriobotrya japonica (Thunb.) Lindl.	ameixa	tree	f (18)	9
Rubus rosifolius Sm.*	moranguinho-do-mato	subshrub		3
RUBIACEAE				
Borreria verticillata (L.) G.Mey.* (= *Spermacoce verticillata* L.)	peito-de-moça	subshrub	f (1)	6
Coffea arabica L.	café	shrub	a1, a2, b, c, f (75)	2, 6, 9
Genipa americana L.*	genipapo, jenipapo	shrub/tree	f (2)	2, 9
Pentodon pentandrus (Schumach. and Thonn.) Vatke	trapoeraba-branca	herb		9
Simira glaziovii (K. Schum.) Steyerm*	quina-rosa	tree		9
Spermacoce laevis Lam.	corredeira	herb	f (1)	9
Uncaria tomentosa (Willd. ex Roem. and Schult) DC.*	unha-de-gato	voluble	b, f (3)	5, 6
RUTACEAE				
Citrus x aurantium L.	laranja-da-terra		b, e, f (19)	2, 4, 9, 10
Hortia brasiliana Vand. ex DC.* (= *Hortia arborea* Engl.)	cáscara-sagrada, casca-d'anta, pau-para-tudo	tree	a1	9
Murraya paniculata (L.) Jack.	dama-da-noite	tree	f (2)	10
Ruta graveolens L.	arruda		a2, c, d, f (59)	1, 2, 3, 5, 6, 9, 10
Zanthoxylum caribaeum Lam.*	espinho-cheiroso, erva-de-oxóssi	tree	f (2)	9
Zanthoxylum rhoifolium Lam.*	espinho-cheiroso	tree		2
SALICACEAE				
Casearia commersoniana Cambess.*	chá-de-bugre, porangaba	tree		9
Casearia sylvestris Sw.*	são-gonçalinho	tree	f (4)	2, 6, 9

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
SAPINDACEAE				
Cupania oblongifolia Mart.*	camboatá	tree	f (1)	7
Serjania cuspidata Cambess.*	cipó-cabeludo, uva-do-mato		f (1)	9
Serjania eucardia Raldk.*	cipó-cabeludo			10
SAPOTACEAE				
Chrysophyllum oliviforme L.	abiu	tree		9
SCHIZAEACEAE				
Anemia phyllitidis (L.) Sw.*	abre-caminho	herb		7
SELAGINELLACEAE				
Selaginella convoluta (Arn.) Spring*	inverninho, mão-de-sapo			8
SIMAROUBACEAE				
Quassia amara L.*	pau-tenente	shrub/tree		5
SIPARUNACEAE				
Siparuna guianensis Aubl.*	negramina	shrub/tree	f (3)	2, 6, 7, 9, 10
SOLANACEAE				
Brugmansia suaveolens (Willd.) Bercht. and J. Presl.	trombeta	shrub	c, f (7)	9
Capsicum annuum L.*	pimenta-caiana, pimenta-rabo-de-macaco, pimenta dedo-de-moça, pimenta-cambuci, pimenta-reino, pimenta-de-cheiro	herb	a1, b, f (64)	9
Capsicum frutescens L.	pimenta-malagueta	herb	b, d, f (42)	9
Cestrum axillare Vell. * (= *Cestrum laevigatum* Schltdl.)	quairama	tree	f (18)	6, 9, 10
Lycopersicum esculentum Mill.	tomate (folha-de-tomate)	herb	f (16)	10
Nicotiana tabacum L.	fumo		f (247)	9, 10
Solanum aculeatissimum Jacq.*	arrebenta-cavalo	subarbusto	c, f (18)	2
Solanum alternatopinnatum Steud.*	jiquiti	herb/voluble		9
Solanum americanum Mill.*	erva-moura	herb	f (32)	1, 2, 3, 6, 9, 10
Solanum argenteum Dunal*	erva-prata	shrub/tree		2, 6, 9, 10
Solanum capsicoides All.*	arrebenta-cavalo	herb		9
Solanum cernuum Vell.*	panaceia	herb/shrub		1, 2, 3, 7, 9, 10
Solanum lycocarpum A.St.-Hil.*	fruta-de-lobo	shrub	f (1)	3
Solanum pachimatium Dunal*	panaceia, milho-de-cobra	herb/shrub		9
Solanum paniculatum L.*	jurubeba	shrub	f (12)	2, 6, 7
Solanum torvum Sw.*	jurubeba	herb/shrub	f (13)	9, 10
THELYPTERIDACEAE				
Macrothelypteris torresiana (Gaudich.) Ching	samambaia-de-pedra			8
Thelypteris dentata (Forssk.) E.P. St. John	samambaia-do-mato			8
TRAPAEOLACEAE				
Tropaeolum majus L.	chaga-de-são-sebastião, capuchinho	herb	d, f (18)	3

(Cont.)

Table 1 *cont.*

Family/Scientific name	Popular name	Growth habit	Toxicity/Interaction with drugs	Reference
URTICACEAE				
Cecropia glaziovi Snethl.*	embaúba	tree		2
Cecropia hololeuca Miq.*	embaúba-branca	tree		6
Cecropia pachystachya Trécul* (= *Cecropia catarinensis* Cuatrec.)	embaúba, folha-da-preguiça, imbaúba	tree		9, 10
Phenax sonneratii (Poir.) Wedd.*	parientária	shrub		1, 3
Pilea microphylla (L.) Liebm	brilhantina-do-campo	herb		10
Pilea nummularifolia (Sw.) Wedd.*	dinheiro-em-penca	herb	f (2)	3, 9, 10
Urera baccifera (L.) Gaudich. ex Wedd.*	urtiga-do-mato	shrub/tree	f (9)	7
Urera caracasana (Jacq.) Gaudich. ex Griseb. (= *Urera mitis* Miq.)	urtiga-branca	shrub	f (1)	6
VERBENACEAE				
Aloysia gratissima (Gillies and Hook. ex Hook.) Tronc.	alfazema			3, 7, 9, 10
Lantana camara L.*	cambará	herb/shrub	c, f (241)	3, 6, 9, 10
Lantana fucata Lindl.* (= *Lantana lilacina* Desf.)	cambará-roxo	herb/shrub		2
Lippia alba (Mill.) N.E. Br*	erva-cidreira	herb/shrub	f (2)	1, 2, 3, 6, 9, 10
Stachytarpheta cayennensis (Rich.) Vahl*	gervão-roxo	herb/shrub		1, 2, 3, 6, 9, 10
VIOLACEAE				
Anchietea pyrifolia (Mart.) G. Don*	suma-roxa	voluble		2, 9
VITACEAE				
Cissus verticillata (L.) Nicolson and C.E. Jarvis (= *Vitis cissoides* (Blume) Backer)	insulina-vegetal, insulina	voluble		2, 3, 6, 9, 10
XANTHORRHOEACEAE				
Aloe arborescens Mill.	babosa	herb	a1, a2, c, f (11)	4, 6
Aloe vera (L.) Burm. f.	babosa	herb	a1, a2, c, d, e, f (33)	1, 2, 3, 9, 10
ZINGIBERACEAE				
Alpinia zerumbet (Pers.) B.L. Burtt. and R.M. Sm.	colônia	herb		1, 2, 3, 6, 9, 10
Hedychium coronarium J.Koenig	lirio-do-brejo	herb	f (1)	9, 10
Zingiber officinale Roscoe	gengibre	herb	b, e, f (27)	2, 3, 6, 9

* Native species (Lista de Espécies da Flora do Brasil, 2014).
Legend to References: (1) Abreu, 2011; (2) Azevedo and Silva, 2006; (3) Leitão et al., 2009; (4) Leitão et al., 2013; (5) Lima et al., 2009; (6) Maioli-Azevedo and Fonseca-Kruel, 2007; (7) Parente and Rosa, 2001; (8) Santos and Silvestre, 2000; (9) Silva 2008; (10) Stalcup, 2000.
Interactions: letters refer to report on toxicological information in the following references: a refers to Gruenwald et al. (2000), being a1 – when there is a report for drug/herb interactions; a2 – when there is a report that the plant is not for use during pregnancy, and a3 when there is a report that the plant is not for use during nursing; b refers to Williamson et al. (2012); c refers to Bruneton (1999); d refers to Vanaclocha (1999); e refers to Lovell (1993); and f refers to U.S. Food and Drug Administration database (FDA, 2013).

Floristic similarity analysis

For the analysis of the floristic similarity between the mentioned species on the selected studies, multivariate analysis by grouping were used (Valentin, 1995; Peroni, 2002). Initially, we assessed the total number of medicinal plants mentioned by the vendors presented in each publication. From that pattern, the analysis by grouping

was done taking into consideration every named species and commercialized species as variables, and the selected studies as the minimum unities of described analysis. We used the Sørensen-Dice Coefficient similarity index to compare commercialized plants and indicated plants in the selected ethnobotanical studies. This index has been applied to highlight the simultaneous occurrence of a given species in two or more compared species (Araújo and Ferraz, 2008). The chosen grouping method was UPGMA and, for the multivariate analysis, MVSP (Multivariate Statistical Package) 3.1 version was used (Kovach, 2007).

Toxicological data

The data listed from this search were confronted with specialized literature regarding the toxicity of plants and possible drug interactions. A thorough search in five books and in one database was done: *Interações Medicamentosas de Stockley* (Williamson et al., 2012), *Plants and the Skin* (Lovell, 1993), *PDR for Herbal Medicine* (Gruenwald et al., 2000), *Toxic Plants* (Bruneton, 1999), *Vademecum de Prescripción: Plantas Medicinales* (Vanaclocha, 1999) and the U.S. Food and Drug Administration database (FDA, 2013). A table containing information about plant family names, mentioned species, growth habit, popular name, origin, and toxicity was built.

Results and discussion

Data collection

Literature search using the selected keywords combinations yielded a total of ten studies for the state of Rio de Janeiro (Santos and Silvestre, 2000; Stalcup, 2000; Parente and Rosa, 2001; Azevedo and Silva, 2006; Maioli-Azevedo and Fonseca-Kruel, 2007; Silva 2008; Leitão et al., 2009; Lima et al. 2009; Abreu, 2011; Leitão et al., 2013). The state has 92 municipalities, however in only 21 any kind of ethnobotanical research in open-air markets and markets were carried out (Table 2, Fig. 1).

The number of interviewees varied from one to 54. This discrepancy is related to the research dynamics and/or to the structure of the study place such as, for instance, the existence of open-air markets with only one herbs stalls. The number of informants is not related to the number of species, as observed works with few informants and many species (Stalcup, 2000; Parente and Rosa, 2001; Leitão et al., 2009). The qualitative methodologies used in the above-mentioned studies were similar, comprising direct and participative observation, semi-structured interviews and free listings. On the quantitative analysis, different calculation methodologies were encountered such as: relative importance (Bennett and Prance, 2000), collector's curve analysis (Schilling and Batista, 2008), informants consensus (Trotter and Logan, 1986),

Table 2
List of reported studies conducted in markets and open-air markets in the state of Rio de Janeiro, Brazil.

Reference	Municipalities	N° open-air markets	N° informants	N° species	N° families	Most common family	Most important plant part
Abreu, 2011	Angra dos Reis	1	1	43	26	Lamiaceae	whole plants
Azevedo and Silva, 2006	Rio de Janeiro	8		127	58	Asteraceae	
Leitão et al. 2009	Petrópolis and Nova Friburgo	3	4	115	49	Asteraceae	branches
Leitão et al. 2013	Angra dos Reis, Araruama, Belford Roxo, Cabo Frio, Campos dos Goytacazes, Duque de Caxias, Itaboraí, Itaguaí, Magé, Mesquita, Nilópolis, Niterói, Nova Friburgo, Nova Iguaçu, Petrópolis, Queimados, Rio de Janeiro, São Gonçalo, São João de Meriti and Volta Redonda.	20	30	36	12	Asteraceae	
Lima et al. 2009	Duque de Caxias	1	2	29	20	Asteraceae	leafs
Maioli-Azevedo and Fonseca-Kruel, 2007	Rio de Janeiro	33	54	106	49	Asteraceae	leafs
Parente and Rosa, 2001	Barra do Piraí	1	2	101	42	Asteraceae	whole plants
Santos and Silvestre, 2000	Rio de Janeiro and Niterói		10	8	6	Schizaeaceae and Thelypteridaceae	
Silva 2008	Rio de Janeiro	2	22	265	85	Asteraceae	aerial parts
Stalcup, 2000	Rio de Janeiro	1	4	151	59	Asteraceae	leafs

Sørensen's index (Mueller-Dombois and Ellenberg, 1974) and salience analysis (Quinlan, 2005).

Regarding plant identification, eight works reported to deposit voucher specimens of the collected plants in herbariums located in the city of Rio de Janeiro: Universidade Federal Rural do Rio de Janeiro's Herbarium (RBR); Jardim Botânico do Rio de Janeiro's Herbarium (RB); Museu Nacional's Herbarium (R); Universidade Federal do Rio de Janeiro's Herbarium (RFA); and Universidade Universidade Santa Úrsula's Herbarium (RBR). In one of the works, the voucher specimens were deposited in a public institution (Cederj) in the city of Angra dos Reis/RJ, a botanical collection made for didactical purposes. Only one of the works did not report voucher specimen deposit in an institutional herbarium (Lima et al., 2009). This result demonstrates the preoccupation of the authors for species identification, even with the difficulties of collecting material in open-air markets.

Commercialized plants

Three hundred and seventy-six species were compiled, distributed in 94 botanical families and 273 genera. However, the number of species varied between studies, ranging from eight (Santos and Silvestre, 2000) to 265 species (Silva, 2008) (Tables 1 and 2).

Asteraceae family was the most represented in terms of abundance of species (57), followed by Lamiaceae (25), Fabaceae (17), Solanaceae (16), Malvaceae and Myrtaceae (12), Euphorbiaceae (11), and Poaceae (9) (Table 1).

The great number of Asteraceae species is due to the nature of the studied articles; this family was the most common one in eight of the ten articles evaluated. Only in the work at Angra dos Reis (Abreu, 2011) the most greatly represented family was Lamiaceae, followed by Asteraceae. Furthermore, the work done by Santos and Silvestre (2000) included the pteridophytes commercialized at the open-air markets in Rio de Janeiro and Niterói, which explains why the most representative families were Schizaeaceae and Thelypteridaceae (Table 2).

Asteraceae is the most frequently encountered plant family in studies of urban ethnobotany around the world (Macía et al., 2005; Lee et al., 2008; Monteiro et al., 2010). The popularity of Asteraceae is believed to be due to the large diversity of bioactive components within its family members (Tabuti et al., 2010), and to their herbaceous habit (Monteiro et al., 2010). Many species of Asteraceae exhibit significant antibacterial, antifungal, anti-inflammatory, antimalarial and antimicrobial activities(Monteiro et al., 2010), among others. Asteraceae is the biggest family of vascular plants, with 23,000 species (Judd et al., 2009), and a great number are cosmopolitan, known worldwide as medicinal plants (Di Stasi et al., 2002). In Brazil this botanical family is well represented with approximately 2000 species present (Souza and Lorenzi, 2008).

Concerning the genera, the most frequent one was *Solanum*, which presented ten species, followed by *Ocimum, Piper* and *Vernonathura* (six species each), and also by *Baccharis, Mentha*, *Miconia, Plectranthus* and *Polygonum* (four species each) (Table 1). The genus *Solanum* is common popular markets (Albuquerque et al., 2007). The genus represents approximately half of the species diversity of the family Solanaceae (3,000-4,000 species) (Knapp et al., 2014). *Solanum* is present in tropical and subtropical regions, being South America the center of diversity and distribution (Silva and Carvalho, 2003). Generally speaking, the species of this genus are herbs/subshrubs common along roadsides (Knapp et al., 2014).

The abundance of the genus *Ocimum* is due to the fact that its species are generally cultivated since multiple uses are attributed to them (medicinal, ritualistic and for seasoning) which causes to their wide commercialization. On the other hand, the ones representing *Piper* are herbaceous and shrubby, native of the underbrush and common in trails of woods considered as secondary (Lista de Espécies da Flora do Brasil, 2014). These are used for rituals, which could explain their availability on stalls. The *Vernonanthura* species represent the "*assapeixes*", used in Brazil in the composition of syrups for the treatment of flus and colds. They are found as bushes or small trees and, most of the time, they are commonly found in the woods surrounding the cities, thereby facillitating their collection.

None of the species was mentioned in all of the articles, but some stood out for being mentioned in eight of them: *Cymbopogon citratus* (DC.) Stapf; *Lygodium volubile* Sw.; *Mentha pulegium* L.; *Momordica charantia* L.; *Ocimum gratissimum* L. (= *Ocimum urticifolius* Benth.); *Rosmarinus officinalis* L.; and *Solidago chilensis* Meyen. Other plants are mentioned on seven of the ten works: *Baccharis crispa* Spreng. (= *Baccharis trimera* (Less.) (DC.; *Baccharis myriocephala* DC.); *Bidens pilosa* L.; *Chenopodium ambrosioides* L.; *Cuphea carthagenensis* (Jacq.) J.F. Macbr; *Lygodium volubile* Sw.; *Petiveria alliacea* L.; and *Ruta graveolens* L. (Table 1). As stated by Bye and Linares (1983), the presence of certain species in a market for long periods of time suggests that these plants elicit the effects that are expected by consumers; thus, they are continually tested, validated, and sought because of their recognized properties.

Among the species mentioned on five or more articles (45 species), some of them have only one popular name. For instance, *Cymbopogon citratus* ("*capim-limão*"); *Momordica charantia* ("*melão-de-são-caetano*"); *Alpinia zerumbet* ("*colônia*"); *Coix lacryma-jobi* ("*lágrima-de-nossa-senhora*") and *Echinodorus grandiflorus* ("*chapéu-de-couro*"). According to Mácia et al. (2005), this uniformity of vernacular names used by all medicinal plant sellers is probably an indication that these species are generally well known as medicinal. They show, as well, variations that adjectivize their names, as it happens with *Rosmarinus officinalis* ("*alecrim/alecrim-da-horta*"). Still, the name "alecrim" is also used for another species (*Baccharis dracunculifolia*), which is native to Brazil (Lista de Espécies da Flora do Brasil, 2014) and is also known by the name "*alecrim-do-campo*", probably used to mark the difference between it and "*alecrim-da-horta*", which is cultivated. There are also linguistic variations connected to social, cultural and/or geographic matters of the interviewees ("*carqueja/carquejo*"; "*salvia/salvo*"; "*caroba/caraúba*"; "*tanchagem/transagem*"; "*alevante/elevante*"). The names attributed to species with medicinal/ritualistic uses can be different, even though it is related to only one species. A good example is the Piperaceae family, with *Peperomia pelucida* (known as "*oriri*", "*oripepê*", "*parietária*" and "*língua-de-sapo*"); *Piper amalago* ("*tira-teima*", "*bete-cheirosa*", "*corta-mandinga*",

"*corta-mironga*") and *Piper arboreum* ("*vence-demanda*", "*quebra-canga*", "*joão barandi*", "*desata-nó*", "*abranda fogo*").

From the analyzed works, seven of them mention the leaves as the most commercialized plant parts, followed by branches, aerial parts and the whole plant. None of the works cited roots and barks as the most consumed. However, Silva (2008) registered the commerce of barks, underground organs, fruits, seeds and aerial stems (vines), by means of extractivism practices, in two big markets. Moreira and collaborators (2002) and Freitas and collaborators (2012) have noticed the importance of the leaves in popular medicine. It is noticeable that the reccomended plant part used varies according to the region in Brazil (Albuquerque et al., 2007) as in Northeast Brazil where the barks are the most used part; for instance, in Campina Grande, PB (Alves and Rosa, 2007) and in Caruaru, PE (Almeida and Albuquerque, 2002). It's worth mentioning that barks are always available in the Caatinga, unlike the leaves, which are found occasionally since their production depends on ephemeral rains (Monteiro et al., 2006).

The preparation method was described on five of the analysed works and in all of them, infusion was the main application method. This result is a consequence of the priority use of leaves and branches, which is in agreement with other ethnobotanic works that show the importance of the tea in the preparation of "home remedies" in Brazil (Moreira et al., 2002; Alves and Rosa, 2007; Veiga Junior, 2008) and in other countries. The same was noticed on markets of La Paz and El Alto, Bolivia, where the majority of remedies were prepared from fresh material in the form of decoction and infusion (Macía et al., 2005). Nevertheless, the oral use of tea may be harmful due to the toxicity of some species.

Toxicity of commercialized species

The toxicity of the plants listed in the ten articles above-mentioned was assessed using selected bibliography, consisting of five books and one database considered as important sources of plant toxicity information. However, this literature is not exhaustive. A complete bibliographic search for each species was not performed due to the vast amount of information that would be generated. Toxicity information retrieved from Vanaclocha (1999) was recorded only in terms of absence or presence, since the criteria used by the authors (one sign ◊ when the plant exhibits certain toxicity, two ◊ when the plant is toxic, and three ◊ when the plant is very toxic, with a narrow therapeutic range) and they could not be same as in the other consulted works. The same procedure was adopted for the book of Bruneton (1999). The references Williamson et al. (2012) and the PDR for Herbal Medicine (Gruenwald et al., 2000) were consulted for information regarding toxicity and possible herb-drug interactions. The latter further categorizes such information into three different possibilities: herb-drug interactions; herbs not for use during pregnancy; and herbs not for use while nursing. This information was taken into consideration for the construction of Table 1. Finally, the work of Lovell (1993) reports plants that can exert potential photoxic reactions and contact dermatitis. The only database consulted was the U.S. Food and Drug Administration database (FDA, 2013) from where it was possible to find articles about to the toxicity associated to the studied plant name (searched by botanical name). In Table 1, the numbers in parenthesis aside the reference for this database refers to the numer of articles found of a given plant species. However, we understand that the bigger the number of articles related to a given plant's toxicity does not necessarily means higher toxicity.

According to Table 1, based on the methodology applied, among the 376 valid species listed in this work, 224 (59,57%) species can be considered potentially toxic (or present some kind of toxicity), or can present potential interactions with other drugs/medicines. Considering the information in Table 1, one can find that eighteen plants of the list are reported as "not for use during pregnancy" and three "not for use while nursing". These results are a source of concern since in Brazil, as it is worldwide, there is the notion that plants can never be harmful.

It is worthy to note that several highly toxic species are sold in some of these markets according to the list in Table 1: *Asclepias curassavica*, from the Apocynaceae family contains cardenolides (Li et al., 2009) that may lead to fatal intoxication; and *Diffenbachia seguine*, which all special books agree on the danger of chewing of its leaves, since these species induce oropharyngeal inflammation (Bruneton, 1999) that could lead to asphyxiation. Also notable for their toxic potential are: *Chenopodium ambrosioides* L., due to the toxicity of the monoterpene ascaridol present in the essential oil and the antihelmintic active principle of this plant (Castellanos, 2008); *Aristolochia* species, known for the nephrotoxicity of the aristolochic acid (Bruneton, 1999); *Symphitum officinale* (comfrey) known for the toxicity of its pyrrolizidine alkaloids, and in France and Germany it is specified that the drug can be only used externally (Bruneton, 1999), as well as in Brazil (MS, 1992). In North America, comfrey-based products are not approved for medical use (Bruneton, 1999).

It is noteworthy, that medicinal species sold as horsetail ("*cavalinha*") have no correspondence between the collected voucher samples, to the species which uses and safety are supported by literature: the two listed species in Table 1 (*E. hyemale and E. giganteum*) are species different from the true horsetail (*E. arvense* L.) (Wagner, 1984).

Endangered plants

In order to identify the origin of the plants, we used the Lista de Espécies da Flora do Brasil (2014) where information was available for 278 (73.94%) of the species, of which 209 (75.18%) are native.

Three species on the Livro Vermelho da Flora do Brasil (Martinelli and Moraes, 2013) are at risk of extinction: *Anemopaegma arvense* (Vell.) Stell. ex de Souza, *Ocotea odorifera* (Vell.) Rohwer, and *Roupala sculpta* Sleumer; the first two classified as "endangered" and the latter as "vulnerable". Furthermore, the book offers a list of non-endangered species, which posit higher interest for research and conservation: *Jacaranda macrantha* Cham.; *Jacaranda puberula* Cham.; *Amburana cearensis* (Allemão) A.C.Sm; *Bowdichia virgilioides* Kunth; *Chondrodendron platiphyllum* (A. St.- Hil.) Miers and *Hortia brasiliana* Vand. ex DC (=*Hortia arborea* Engl.). These nine species are found in the Mata Atlântica whereas *Chondrodendron*

platiphyllum and Jacaranda puberula are endemic to this biome and all can be found in the state of Rio de Janeiro, with the exception of *Bowdichia virgilioides* (distributed in Espírito Santo, Minas Gerais and São Paulo) (Martinelli and Moraes, 2013; Lista de Espécies da Flora do Brasil, 2014).

The "*carobinhas*" (*Jacaranda* spp.) are cited by six of the analyzed works (Stalcup, 2000; Parente and Rosa, 2001; Azevedo and Silva, 2006; Silva, 2008; Leitão et al., 2009) which indicates their availability on open-air market stalls and markets in Rio de Janeiro. This finding corroborates the concern on the Livro Vermelho da Flora do Brasil about *J. macrantha* and *J. puberula,* flagged as species "with a verified and projected decline". It is worth mentioning that the chemical and biological activities of *Jacaranda puberula* have been studied (Passero et al., 2007; Martins et al., 2008, De-Almeida et al., 2013).

Martinelli and Moraes (2013) point that, among the species considered as endangered on the Livro Vermelho da Flora do Brasil, only 5,2% (244) of them have particular information about their use shown on the literature and that their most common use is related to their ornamental value, followed by the bioactive properties and timber value. The authors add that: "a great part of the traditional knowledge about natural resources isn't documented appropriately".

Similarity of species traded in open-air markets

The results of the Sørensen-Dice Coefficient showed greater similarities between the works of Maioli-Azevedo and Fonseca-Kruel (2007) and Stalcup (2000) (0.54), and between these two and Azevedo and Silva (2006) (0.53). The greater similarity might be explained by the geographical proximity of sample areas in both studies. Maioli-Azevedo and Fonseca-Kruel (2007) classified the species sold in open-air markets in the southtern and northern zones of Rio de Janeiro; Stalcup (2000) surveyed species in open-air markets in northern part Rio de Janeiro; whereas Azevedo and Silva (2006) focused on species sold in open-air markets in the western zone of the city.

A larger similarity group is formed by the work of Azevedo and Silva (2006), Maioli-Azevedo and Fonseca-Kruel (2007), Stalcup (2000), Silva (2008), Parente and Rosa (2001), Leitão et al. (2009) and Abreu (2011) (Fig. 2). Sampling in these papers happened in very close areas, and four out of seven sample areas were within the municipality of Rio de Janeiro.

The greater number of species (228) was described by Silva (2008), who also obtained the highest number of exclusive species (90), in the markets Mercadão de Madureira and CEASA. Stalcup (2000) listed 134 species, 26 of them exclusively found in an open-air market in the neighborhood of Tijuca. Azevedo and Silva (2006) reported 113 species in four open-air markets and four markets (in the neighborhoods of Campo Grande, Realengo, Taquara, Irajá and Madureira), 22 of them exclusively listed in his work. Forty-seven species were common to all four papers (Table 1).

Studies that had a different sampling area, different parts of the state of Rio de Janeiro such as Região Serrana (Petrópolis and Nova Friburgo), Médio Paraíba (Barra do Piraí) and Costa Verde (Angra dos Reis) were the studies from Leitão et al. (2009), Parente and Rosa (2001), and Abreu (2011). They described, 93, 64 and 31 species respectively, and were slightly more distant from other studies of this first group (Fig. 2).

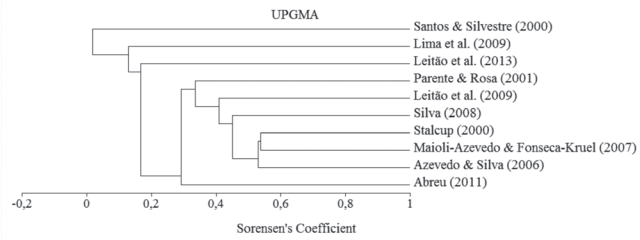

Figure 2 - Cluster analysis based on the Sørensen-Dice Coefficient for the species listed on studies in the state of Rio de Janeiro, Brazil. (Stalcup, 2000 - Rio de Janeiro, Santos and Silvestre, 2000 - Niterói and Rio de Janeiro; Parente and Rosa, 2001 - Barra do Piraí, Leitão et al., 2013 - several municipalities in the Rio de Janeiro; Azevedo and Silva, 2006 – Rio de Janeiro; Maioli-Azevedo and Fonseca-Kruel, 2007 - Rio de Janeiro; Silva, 2008 - Rio de Janeiro; Leitão et al., 2009 - Petrópolis and Nova Friburgo; Lima et al., 2009 - Duque de Caxias; Abreu, 2011 - Angra dos Reis).

The study conducted in the city Duque de Caxias (Lima et al., 2009) described 29 plant species. This showed low similarity to other studies. The author reported great difficulty for the identification of species because only some parts of the plant were sold, making it impossible for botanical identification. This fact may have lead to the report of botanical names based only in literature consultation and not by confrontation with voucher specimens.

The study by Leitão et al. (2013) did not present great similarity with other groups, possibly because it had a specific aim, seeking to identify species indicated exclusively for the treatment of tuberculosis (22 species) (Fig. 2). Four species were exclusively described in this study (Table 1). Another group was formed by the study of Santos and Silvestre (2000) (Fig. 2). These authors inventoried only one plant group, the Pteridophytes, sold in open-air markets in Rio de Janeiro and Niterói. The researchers identified eight species, of which six were exclusively described in this study. The specificity in these studies probably caused the low similarity. In other papers, a more comprehensive approach to medicinal plants was chosen, leading to higher species similarity.

Conclusions

The aim of the present work was to search the literature regarding studies of open-air markets in the state of Rio de Janeiro, in order to gather knowledge on the plants commercialized, their botanical diversity and toxicological potential. This research revealed that a significant number of native species are being commercialized in these open-air markets, but only nine classified as endangered by Martinelli and Moraes (2013), which are good news. However, this may also reveal that there is scarce information available about the real amount of plants extracted directly from nature and commercializaed without any control. Also worthy of note is the presence of some toxic plants being sold in these markets, which may represent a risk to the population of the state of Rio de Janeiro.

Authors' contributions

FL conceived the idea for this publication and wrote the first draft, KM performed bibliographic revision. All authors contributed in analysis and discussion of the data and wrote the manuscript. All the authors have read the final manuscript and approved the submission.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

Authors are greatful to CNPq, FAPERJ and CAPES for funding; and to Gustavo Simão, Thamires Dore, Danila Souza, Vanessa Dias and Bruna Peres Leitão for their help in the compilation of "Toxicity/Interaction with drugs" information reported in Table 1.

REFERENCES

Abreu, L.P.G., 2011. Plantas comercializadas como medicinais na feira livre da praca zumbi dos palmares, municipio de Angra dos Reis, RJ. Rio de Janeiro, 59 p. il: 160. Monografia, Universidade Federal do Rio de Janeiro.

Albuquerque, U.P., Hanazaki, N., 2006. As pesquisas etnodirigidas na descoberta de novos fármacos de interesse médico e farmacêutico: fragilidades e pespectivas. Rev. Bras. Farmacogn. 16 (Supl.), 678-689.

Albuquerque, U.P., Monteiro, J.M., Ramos, M.A., Amorim, E.L., 2007. Medicinal and magic plants from a public market in northeastern Brazil. J. Ethnopharmacol. 110, 76-91.

Alves, R.R.N., Rosa, I.L., 2007. Zootherapy goes to town: The use of animal-based remedies in urban areas of NE and N Brazil. J. Ethnopharmacol. 113, 541-555.

Almada, E.D., 2010. Sociobiodiversidade Urbana: por uma etnoecologia das cidades. In: Silva, V.A., Almeida, A.L.S., Albuquerque, U.P., 2010. *Etnobiologia e Etnoecologia*. Pessoas and Natureza na América Latina, 1.ed., Recife: NUPEEA, p. 39-63.

Almeida, C.F.C.B.R., Albuquerque, U.P., 2002. Uso e conservação de plantas e animais medicinais no estado de Pernambuco (Nordeste do Brasil): um estudo de caso. Interciencia 27, 276-285.

Araújo, E.L., Ferraz, E.M.N., 2008. Análise da vegetação: amostragem, índices de diversidade e aplicações na etnobotânica. In: Albuquerque, U.P., Lucena, R.F.P., Cunha, L.V.F.C. (Orgs.). *Métodos e técnicas na pesquisa etnobotânica*. Recife, Comunigraf.

Azevedo, S.K.S., Silva, I.M., 2006. Plantas medicinais e de uso religioso comercializadas em mercados e feiras livres do Rio de Janeiro, RJ, Brasil. Acta Bot. Bras. 20, 185-194.

Balick, M.J., Lee, R., 2001. Looking within: urban ethnomedicine and ethnobotany. Altern. Ther. 7, 114-115.

Bennett, B.C., Prance, G., 2000. Introduced plants in the indigenous pharmacopoeia of Northern South America. Econ. Bot. 54, 90-102.

Berg, M.E.V.D., 1984. Ver-o-peso: The ethnobotany of an Amazonian market. In: Prance, G.T., Kallunki *Advances in Economic Botany*. vol. 1. The New York Botanical Garden, New York.

Bruneton, J., 1999. *Toxic Plants*. Paris: Lavoisier. 1. ed. Paris: Lavoisier. 545 p.

Bye, R., Linares, E., 1983. The role of plants found in the Mexican markets and their importance in ethnobotanical studies. J. Ethnobiol. 3, 1-13.

Castellanos, J.R.G., 2008. Epazote (*Chenopodium ambrosioides*). A revision to its morphological characteristics, pharmacological activity, and the biogenesis of its principal active ingredient, ascaridole. Bol. Latinoam. Caribe 7, 3-9.

Ceuterick, M., Vandebroek, I., Torry, B., Pieroni, A., 2008. Cross-cultural adaptation in urban ethnobotany: The Colombian folk pharmacopoeia in London. J. Ethnopharmacol. 120, 342-359.

Ceuterick, M., Vandebroek, I., Pieroni, A., 2011. Resilience of Andean urban ethnobotanies: A comparison of medicinal plant use among Bolivian and Peruvian migrants in the United Kingdom and in their countries of origin. J. Ethnopharmacol. 136, 27-54.

De-Almeida, M.R., Ramos-Leal, I.C., Ruela, H.S., Justo-Araujo, Md., Martins, T.M., Pinto-Coelho, M.G., Kuster, R.M., Carvalho-Sabino, K.C., 2013. Anti-tumor potential and acute toxicity of *Jacaranda puberula* Cham. (Bignoniaceae). Pak. J. Pharm. Sci. 26, 881-892.

Di Stasi L.C., Oliveira, G.P., Carvalhaes, M.A., Queiroz-Junior, M., Tien, O.S., Kakinami, S.H., Reis, M.S., 2002. Medicinal plants popularly used in the Brazilian Tropical Atlantic Forest. Fitoterapia 73, 69-91.

FDA, 2013 U.S. Food and Drug Administration. www.accessdata.fda.gov/scripts/plantox/textResults.cfm.

Freitas, A.V.L., Coelho, M.F.B., Azevedo, R.A.B., Maia, S.S.S., 2012. Os raizeiros e a comercialização de plantas medicinais em São Miguel, Rio Grande do Norte, Brasil. Rev. Bras. Bioci. 10, 147-156.

Gonzalez, F.G., Portela, T.Y., Stipp, E.J., Di Stasi, L.C., 2001. Antiulcerogenic and analgesic effects of aytenus aquifolium, Sorocea bomplandii and Zolernia ilicifolia. J. Ethnopharmacol. 77,41-47.

Gruenwald, J., Brendler, T., Jaenicke, C., 2000. PDR for Herbal Medicine. Montvale: Thomson.

IBGE, 2013. Estados. www.ibge.gov.br/estadosat.

Judd, W.S., Campbell, C.S., Kellog, E.A., Stevens, P.F., Donoghue, M.J., 2009. *Sistemática Vegetal - Um enfoque filogenético*. 3rd ed. Editora Artmed.

Knapp, S., Bohs, L., Nee, M., Spooner, D.M., 2004. Solanaceae - a model for linking genomics with biodiversity. Comp. Funct. Genomics 5, 285-291.

Kovach, W.L., 2007. MVSP – A Multi Variate Statistical Package for Windows, ver. 3.1. Kovach Computing Services, Pentraeth, Wales, U.K.

Lee, S., Xiao, C., Pei, S., 2008. Ethnobotanical survey of medicinal plants at periodic markets of Honghe Prefecture in Yunnan Province, SW China. J. Ethnopharmacol. 117, 362-377.

Leitão, F.S., Fonseca-Kruel, V.S., Silva, I.M., Reinert, F., 2009. Urban ethnobotany in Petrópolis and Nova Friburgo (Rio de Janeiro, Brazil). Rev. Bras. Farmacogn. 19, 333-342.

Leitão, F., Leitão, S.G., Almeida, M.Z., Cantos, J., Coelho, T., Silva, P.E., 2013. Medicinal plants from open-air markets in the State of Rio de Janeiro, Brazil as a potential source of new antimycobacterial agents. J. Ethnopharmacol. 149, 513-521.

Li, Jun-Zh., Qing, C., Chen, Chang-Xiang, Hao, Xiao-Jiang, Liu, Hai-Yang., 2009. Cytotoxicity of cardenolides and cardenolide glycosides from Asclepias curassavica. Bioorg. Med. Chem. Lett. 19, 1956-1959.

Lima, E.P.R., Maia, M.S., Matos, W.R., 2009. Levantamento das plantas medicinais comercializadas na feira livre do município de Duque de Caxias, Rio de Janeiro, Brasil. Saúde Ambiente Rev. 4, 34-39.

Lima, P.G.C., Coelho-Ferreira, M., Oliveira, R., 2011. Plantas medicinais em feiras e mercados públicos do Distrito Florestal Sustentável da BR-163, estado do Pará, Brasil. Acta Bot. Bras. 25, 422-434.

Lista de Espécies da Flora do Brasil, 2014. Jardim Botânico do Rio de Janeiro. www.floradobrasil.jbrj.gov.br.

Lovell, C.R., 1993. Plants and the Skin. Oxford: Blackwell Scientific Publications. 272 p.

Macía, M.J., García, E., Vidaurre, P.J., 2005. An ethnobotanical survey of medicinal plants commercialized in the markets of La Paz and El Alto, Bolivia. J. Ethnopharmacol. 97, 337-350.

Maioli-Azevedo, V., Fonseca-Kruel, V., 2007. Plantas medicinais e ritualísticas vendidas em feiras livres no município do Rio de Janeiro, RJ, Brasil: estudo de caso nas zonas Norte e Sul. Acta Bot. Bras. 21, 263-275.

Martin, G.J., 2000. Etnobotánica - Manual de métodos: manuales de conservación. Série Pueblos y Plantas 1, WWF. Uruguay: Ed. Nordan-Comunidad.

Martinelli, G., Moraes, M.A., 2013. Livro Vermelho da Flora do Brasil. 1. ed. - Rio de Janeiro: Andrea Jakobsson: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, 1100 p.

Martins, M.B.G., Castro, A.A., Cavalheiro, A.J., 2008. Caracterização anatômica e química de folhas de *Jacaranda puberula* (Bignoniaceae) presente na Mata Atlântica. Rev. Bras. Farmacogn. 18, 600-607.

Monteiro, J..M., Almeida, C.F.C.B.R., Albuquerque, U.P., Lucena, R.F.P., Florentino, A.T.N., Oliveira, R.L.C., 2006. Use and traditional management of *Anadenanthera colubrina* (Vell.) Brenan in the semi-arid region of northeastern Brazil. J. Ethnobiol. Ethnomed. 2, 1-18.

Monteiro, J.M., Araújo, E.L., Amorim, E.L.C., Albuquerque, U.P., 2010. Local markets and medicinal plant commerce: a review with emphasis on Brazil. Econ. Bot. 64, 352-366.

Moreira, R.C.T., Costa, L.C.B., Costa, R.C.S., Rocha, E.A., 2002. Abordagem etnobotânica a cerca do uso de plantas medicinais na Vila Cachoeira, Ilhéus, Bahia, Brasil. Acta Farm. Bonaerense 21, 205-211.

MS, 1992. Portaria SNVS n. 19 from 30.01.92. Diário Oficial da União, 03. Feb. (Forbid the use of *Symphytum officinale* L. for internal use).

MS, 2006. Política Nacional de Plantas Medicinais e Fitoterápicos / Ministério da Saúde, Secretaria de Ciência, Tecnologia e Insumos Estratégicos, Departamento de Assistência Farmacêutica. – Brasília: Ministério da Saúde, 2006. Série B. Textos Básicos de Saúde. http://bvsms.saude.gov.br/bvs/publicacoes/politica_nacional_fitoterapicos.pdf Acessed March 2014.

Mueller-Dombois, D., Ellenberg, H., 1974. *Aims and methods of vegetation ecology*. Ed. John Willey and Sons, New York, 574 p.

Nunes, G.P., Silva, M.F., Resende, U.M., Siqueira, J.M., 2003. Plantas medicinais comercializadas por raizeiros no Centro de Campo Grande, Mato Grosso do Sul. Rev. Bras. Farmacogn. 13, 83-92.

Parente, C.E.T., Rosa, M.M.T., 2001. Plantas comercializadas como medicinais no Município de Barra do Piraí, RJ. Rodriguésia 52, 47-59

Passero, L.F., Castro, A.A., Tomokane, T.Y., Kato, M.J., Paulinetti, T.F., Corbett, C.E., Laurenti, M.D., 2007. Anti-leishmania activity of semi-purified fraction of *Jacaranda puberula* leaves. Parasitol. Res. 101, 677-680.

Peroni, N., 2002. Coleta e análise de dados quantitativos em etnobiologia: introdução ao uso de métodos multivariados, p. 155-180. *In*: Amorozo, M.C.M., Ming, L.C., Silva, S.P. (eds.). *Métodos de coleta e análise de dados em etnobiologia, etnoecologia e disciplinas correlatas*. Rio Claro, Divisa Gráfica Editora.

Philander, L.A., 2011. An ethnobotany of Western Cape Rasta bush medicine. J. Ethnopharmacol. 138, 578-594.

Pinto, A.A.C., Maduro, C.B., 2003. Produtos e subprodutos da medicina popular comercializados na cidade de Boa Vista, Roraima. Acta Amazônica 33, 281-290.

Quinlan, M., 2005. Considerations for collecting freelists in the field: examples from ethobotany. Field Method. 17, 1-16.

Rambaldi, D.M., Magnani, A., Ilha, A., Lardosa, E., Figueiredo, P., Oliveira, R.F., 2003. *A reserva da biosfera da Mata Atlântica no Estado do Rio de Janeiro*. Caderno 22. Caderno da Reserva da Biosfera da Mata Atlântica - Programa MAB. Cetesb, São Paulo.

Santos, M.G., Silvestre, L.S., 2000. Pteridófitas comercializadas por erveiros de Niterói e do Rio de Janeiro, RJ, Brasil: Uma abordagem etnobotânica. Leandra 15, 79-90.

Schilling, A.C. Batista, J.L.F., 2008. Curva de acumulação de espécies e suficiência amostral em florestas tropicais. Rev. Bras. Bot. 31,179-187.

Silva, I.M.A., 2008. Etnobotânica e a medicina popular em mercados na cidade do Rio de Janeiro. Rio de Janeiro, 184 f. Tese (Doutorado em Botânica), Instituto de Pesquisas Jardim Botânico do Rio de Janeiro/Escola Nacional de Botânica Tropical.

Silva, T.M.S., Carvalho, M.G., 2003. Ocorrência de flavonas, flavonóis e seus glicosídeos em espécies do gênero *Solanum* (Solanaceae). Quim. Nova 26, 517-522.

Souza, V.C., Lorenzi, H., 2008. *Botânica Sistemática. Guia Ilustrado para identificação das famílias de Fanerógamas nativas e exóticas do Brasil, baseado em APGII*. 2ª Edição, Nova Odessa, SP. Instituto Plantarum.

Stalcup, M.M., 2000. Plantas de uso medicinal ou ritual numa feira livre no Rio de Janeiro, Brasil. Rio de Janeiro, 212 p. Dissertação de Mestrado em Ciências Biológicas, Universidade Federal do Rio de Janeiro.

Tabuti, J.R.S., Kukunda, C.B., Waako, P.J., 2010. Medicinal plants used by traditional medicine practitioners in the treatment of tuberculosis and related ailments in Uganda. J. Ethnopharmacol. 127, 130-136.

The International Plant Names Index (IPNI), 2013. www.ipni.org.

The Plant List 2013. www.theplantlist.org

Tropicos, 2013. www.tropicos.org.

Trotter, R.T., Logan, M.N., 1986. Informant consensus: a new approach for identifying potentially effectice medicinal plants. In: Etkin, N.L. (Ed.). *Indigenous Medicine and Diet: biohevioral approaches*. Redgrave Bedford Hills, New York, p. 91-112.

Valentin, J.L., 1995. Agrupamento e ordenação. In: Peres Neto, P.R., Valentin, J.L., Fernadez, F.A.S. (eds.). *Oecologia Brasiliensis*. Volume II: Tópicos em tratamento de dados biológicos. Rio de Janeiro, Universidade Federal do Rio de Janeiro.

Vanaclocha, B.V., 1998. *Fitoterapia, vademecum de prescripción: plantas medicinales*. 3. ed. Barcelona: Manson, S.A. 1148 p.

Veiga-Junior, V.F., 2008. Estudo do consumo de plantas medicinais na Região Centro-Norte do Estado do Rio de Janeiro: aceitação pelos profissionais de saúde e modo de uso pela população. Rev. Bras. Farmacogn. 18, 308-313.

Wagner H., Bladt, H., Zgainski, E.M., 1984. *Plant Drug Analysis*. A Thin Layer Chromatography Atlas. Germany: Springer-Verlag.

Williamson, E., Driver, S., Baxter, K., 2012. *Interações Medicamentosas de Stockley*. Plantas Medicinais e Medicamentos Fitoterápicos. Artmed.