academicJournals

Vol. 10(21), pp. 286-297, 3 June, 2016
DOI: 10.5897/JMPR2016.6106
Article Number: 3D2656B58779
ISSN 1996-0875

http://www.academicjournals.org/JMPR

Journal of Medicinal Plants Research

Full Length Research Paper

Eleutherine bulbous (Mill.) Urb.: A review study

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Received 21 March, 2016; Accepted 11 May, 2016

***Eleutherine bulbous* (Mill.) Urb, Iridaceae, is a native plant and quite common in several regions of America, commonly known as "coquinho" being widely used in the folk medicine for the treatment of giardiasis, amoebiasis and diarrhea. This paper presents a literature review of studies about *Eleutherine bulbous* including aspects of taxonomy, synonymies, geographical distribution, ethnopharmacology, chemistry and pharmacology studies from several databases (Biological Abstracts, Chemical Abstracts, Medline, Lilacs, Web of Science, Science Direct, PubMed, Food and Drugs Administration) and data bank of patents. The research was also carried on some thesis, dissertations, books and also in some whole articles covering the period from 1950 to 2015, using as key works *Eleutherine*, *Eleutherine bulbous* and its botanical synonymies. The studies indicated several works in the field of ethnopharmacology, prevailing employment in gastrointestinal disorders, especially diarrhea and giardiasis, proving the potential of the species for investments in research and development of new therapies.**

Key words: *Eleutherine bulbous* (Mill.) Urb., coquinho, review, diarrhea, giardiasis.

INTRODUCTION

Natural products with therapeutic properties are important sources of new biologically active compounds and have been used in many parts of the world for decades, attracting the interest of many researchers (Araújo, 2011). Numerous studies show that some natural products are the main source of chemical diversity while new discoveries in the pharmaceutical field are emerging (Mishra and Tiwari, 2011). The plant selection to

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pharmacological study is a very important step. The choice can be done by one of several ways, such as the traditional, by the chemical components, random selection or combination of more than one criterion (Albuquerque and Hanazaki, 2006). The evaluation of isolated substances, fractions or extracts obtained from the vegetable drug can occur through the characterization of their biological activity, research of the mechanisms assigned to constituents and parts of the plant, determination of their active concentration and their toxic potential (Toledo et al., 2003).

For any approach chosen, the search of new plant-derived active products must be begun with a bibliographical and documentary research (Camargo, 2003). Data obtained from literature reviews, making a list of the plant species, extracts, semi-purified fractions and chemically defined molecules with biological activity as research target, have provided important subsidies, which contribute effectively to the definition of criteria inclusion and or exclusion of plant species selected for development of the validation studies (Barbosa-Filho et al., 2006; Amaral et al., 2006).

The contribution of the review works has been found not only by the increase in publications on this subject, but also by increasing its citations in national and international journals. Thus, various approaches for selection of plant species have been presented, among which are the three most investigated: (a) Random approach, where the choice is done based on the availability of the plant; (b) Chemotaxonomic or phylogenetic approach, in which the selection is done by the interest in a given class of substances in a genus or family; (c) Ethnopharmacological approach, in which the plant is selected according to the therapeutic use evidenced by a particular ethnic group (Albuquerque and Hanazaki, 2006). In these segments, these studies contribute effectively in the selection of vegetable material to be investigated, at the collection place, experimental delineating and analysis of results among others.

Eleutherine bulbous (Mill.) Urb. an important medicinal plant belonging to Iridaceae family and distributed in Amazon region. This plant species has been included in the list of medicinal plants of interest in National Health System at Brazil (RENISUS) (Brazil, 2009). This work presents a literature review of studies showing the potential of *E. bulbous* to advance the stages of the production chain and to include it in herbal medicine to generate the products of interest for better health care.

MATERIALS AND METHODS

Surveys were done to collect information in database (Biological Abstracts, Chemical Abstracts, Medline, Lilacs, Web of Science, Science Direct, PubMed, Food and Drugs Administration) and bases of patents, employing also research to theses, dissertations and books; covering a period from 1950 to 2015; using as descriptors, Iridaceae *E. bulbous* and its botanical synonyms. The references obtained were consulted for details of the studies on the botany, ethnopharmacology, plant geography, chemistry, biology and pharmacology area.

RESULTS AND DISCUSSION

In the analysis of the works that make up this review has been shown that, in several studies, the authors employ various scientific names to designate the *E. bulbous* species (Mill.) Urb., mainly *Eleutherine american* (Aubl.) Merr. ex K.Heyne and *Eleutherine plicata* Herb. ex Klatt. The first is considered in Plant List (2015) of the Royal Botanical Garden (Kew) and the second is cited as a synonym in the two bases of the main botanical institutes (Plant List, 2015; Tropic, 2015). Thus, to keep the nomenclatures adopted by the authors in this study we chose to use the scientific names originally employed in the work referred in this review, presented in the sections and tables that make up this study. Thus, the initial citation of the accepted nomenclature was standardized, that is, bulbous Eleutherine, and in the sequence jobs with the two most commonly used synonyms.

Taxonomic

E. bulbous has the following taxonomic according to Angiosperm Phylogeny Group III system (2009) (Tropics, 2015).
Kingdom: Plantae
Class: Equisetopsida
Subclass: Magnoliidae
Suborder: lilianae
Order: Asparagales
Family: Iridaceae
Genus: *Eleutherine*
Species: *Eleutherine bulbous*

Scientific and vernacular synonyms

E. bulbous (Mill.) Urb has as botanical synonyms: *Bermudiana bulbous* (Mill.) Molina; *Bermudiana congesta* (Klatt) Kuntze; *Cipura plicata* (Sw.) Griseb.; *Eleutherine american* (Aubl.) Merr. ex K. Heyne; *Eleutherine anomala* Herb.; *Eleutherine longifolia* Gagnep.; *Eleutherine plicata* (Sw.) Herb.; *Eleutherine plicata* Herb. ex Klatt; *Eleutherine subaphylla* Gagnep.; *Ferraria parviflora* Salisb.; *Galatea american* (Aubl.) Kuntze; *Galatea bulbous* (Mill.) Britton; *Galatea plicata* (Sw.) Baker; *Ixia american* Aubl.; *Sisyrinchium altissimum* Ten.; *Sisyrinchium americanum* (Aubl.) Lemée; *Sisyrinchium bulbosum* Mill.; *Sisyrinchium capitatum* Pers.; *Sisyrinchium congestum* Klatt; *Sisyrinchium elatum Seub. ex Klatt; Sisyrinchium intihuatanense (Vargas) Ravenna; Sisyrinchium latifolium Sw.; Sisyrinchium palmifolium var. Intihuatanense Vargas;*

Sisyrinchium plicatum (Sw.) Spreng.; Sisyrinchium racemosum Pers. (Kew, 2015).

E. bulbous is the currently accepted scientific name for this species, according to databases of Kew (Plant List, 2015) and the Missouri Botanic Garden (Tropicos, 2015). The vernacular names are marupari, marupazinho (Schultes and Raffaulf, 1990; Project..., 2015), marupapiranga (Schultes and Raffaulf, 1990), coquinho, lily-leaf-of-palm, marupá, marupaí, marupá-piranga, Palmeirinha (Project ..., 2015) and Rhubarb-of-field (Brasileiro et al.; 2006). In other countries it is known as Jasin huaste, pacahuasten, Pacha huaste, pachahuasten, piri-piri, yagua Piripiri, Yahuar piri piri and WA-ro (Project ..., 2015).

For synonym *Eleutherine plicata*, have been assigned the following vernacular names: marupazinho (Baraúna and Rock, 2006; Oliveira Neto et al., 2007; Lorenzi and Matos, 2008; Menezes et al., 2009; Nascimento et al., 2012), coquinho (Sousa et al., 2005; Oliveira Neto et al., 2007), marupari (Oliveira Neto et al., 2007; Nascimento et al., 2012), marupá-piranga, Palmeirinha, Marupa-ú and nambu marrow (Oliveira Neto et al., 2007).

Geographical distribution

The *E. bulbous* species is native of Americas, frequent in this area (Saralamp et al., 1996; Afanas'ev et al., 1999; Johnson, 1999; Lorenzi and Matos, 2002; Paramapojn et al., 2008; Nascimento et al., 2012). In Brazil, it occurs in the Amazon region, mainly in the state of Roraima (Revilla, 2001; 2002a).

For the *E. american* synonym, the studies indicate your origin in the tropical America, being found in plantations around the world mainly in South Africa, China, Indonesia and Thailandia (Chen et al., 1986; Hara et al., 1997).

Already by the synonymy *E. plicata* several studies indicate this species as widely found in the Amazon region (Baraúna and Rock, 2006; Oliveira Neto et al., 2007; Lorenzi and Matos, 2008).

Morphological description

The species of Eleutherine genus are herbaceous, perennial, rhizomatous and bulbous, predominantly red bulbs or wine color with scales similar to the onion, medium with 20 to 30 cm (Revilla, 2001; Lorenzi and Matos, 2002; Revilla, 2002b; Baraúna and Rocha, 2006).

Goldblatt and Le Thomas (1992) showed that the Eleutherine genus has monossulcado pollen grain with heterogeneous exine in different parts of the grain, almost perforated proximal surfaces.

Jobs reported that *E. bulbous* presents features simple leaves, whole, along pleated, with 25 cm average length; the flowers are white or pink, arranged in a large panicle at the apex of a long hard scape above the foliage, with 5 to 6 petals soldered on the base (Revilla, 2001, 2002b; Lorenzi and Matos, 2002).

Studies developed by Lorenzi and Matos (2002) and Baraúna and Rocha (2006) with *E. plicata* also identified the presence of whole leaves, pleated, simple, verticillate, linear-lanceolate, with longitudinal ribs; the inflorescence is in panicles of white flowers or roses, at the height of an escapement.

Kuntorini and Nugroho (2010) described the changes of the anatomical characteristics that occur in the leaves and the bulb of the *E. american* species during the plant growth cycle, showing that the specie leaf has homogenous mesophyll suffering change in thickness during growth of the plant. Prismatic crystals of calcium oxalate were observed in the mesophyll of this leaf. There is the presence of stomata on both sides of the leaf epidermis, with difference in number according to the development stage, however, on the average, the lower surface has a higher concentration of these. The thickness of the lower and upper epidermis layers also varied in the growth stage of the plant, and in general, the upper epidermis consists of smaller cells than the cells of the upper face. On the bulb, an increse in diameter and length with the growth of the plant was demonstrated. Anatomically, the bulb has difference in the size and number of parenchymal cells in which was observed the presence of calcium oxalate crystals of different shapes, with predominance of styloid. In the bulb was also verified increase in the vascular bundles structures.

These authors also evaluated the concentration of naphthoquinones during the growth sategs of the plant. In the bulb, there was an increase in the amount of this active ingredient, with the growth of the parenchyma; however the leaves, the concentration of naphtho-quinones remained constant evaluated in phases, despite the increase in thickness of the mesophyll (Kuntorini and Nugroho, 2010).

Use of the specie

Some studies have shown the predominance of the popular employment of leaves and *E. bulbous* bulbs for medical purposes, for gastrointestinal disorders (Table 1); being also employee as contraceptives, equimóticos healing by healers of Peru and abortive by the population of Haiti (Project ..., 2015; Weninger et al., 1982) and in indigenous communities of Guyana (Lorenzi and Matos, 2002) and Brazil (Ribeiro, 2008). Kainer and Duryea (1992) refer to representation of *E. bulbous* in extractive activities of women reservation communities in the state of Acre, Northern Brazil.

Study developed by Nascimento et al. (2012) refers potential *E. plicata* as therapeutic option in primary health care in the Amazon region.

Employment in Asian cuisine (Zhengxiong et al., 1984), in the treatment of cellulite (Revilla, 2002b) and as an

Table 1. Indications of popular therapeutic use of *E. bulbous* (Mill.) Urb. and its botanical synonyms.

Nomenclature of plant species	Use indication	References
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Stroke	Ieyama et al., 2011
	Anti-inflammatory	Saptowalyono, 2007
	Antiplatelet	Saptowalyono, 2007
	Anti-Tumor	Saptowalyono, 2007
	Increase the production of milk	Ieyama et al., 2011
	Breast cancer	Saptowalyono, 2007
	Nasal congestion	Saralamp et al., 1996
	Sexual disorders	Ieyama et al., 2011
	Diuretic	Afanas'ev et al., 1999; Johnson, 1999
	Heart disease	Afanas'ev et al., 1999; Saptowalyono, 2007
	Cold diseases **	Saralamp et al., 1996
	Hypertension	Ieyama et al., 2011
	Laxative	Afanas'ev et al., 1999
	Hypoglycemic	Ieyama et al., 2011
	Intestinal disorders	Duke and Vasquez, 1994; Revilla, 2001
	Amebiasis	Duke and Vasquez, 1994; Project..., 2015
	Amenorrhea and menopause	Duke and Vasquez, 1994
	Anti carcinogenic	Brasileiro et al., 2006
	Antiparasitic	Schultes and Raffauf 1990; Revilla, 2001; Lorenzi & Matos, 2002
	Healing	Revilla, 2001; Lorenzi & Matos, 2002
	Colic;	Hodge and Taylor 1956; Revilla, 2001
	Conjunctivitis	Revilla, 2001
	Contraceptive	Weniger et al. 1982; Lorenzi and Matos, 2002
	Contractions In muscle fibers	Duke and Vasquez, 1994; Delgado et al. 1997
	Diarrhea	Schultes and Raffauf 1990; Duke and Vasquez, 1994; Delgado and Sifuentes, 1995; Revilla, 2001, Project..., 2015, Lorenzi and Matos, 2002
	Dysentery	Revilla, 2001, Project..., 2015
	Stomachache	Duke and Vasquez, 1994
	Epilepsy	Duke and Vasquez, 1994
	Spasm	Delgado and Sifuentes, 1995; Revilla, 2001
	Gastralgia	Schultes and Raffauf 1990; Lorenzi & Matos, 2002
	Bleeding	Revilla, 2001; Revilla, 2002[a]
	Irregular periods	Hodge and Taylor 1956
	Purgative	Brasileiro et al., 2006
	Treating cough	Revilla, 2001; Revilla, 2002a
	Treatment Of Cellulite	Revilla, 2002b

Table 1. Cont'd

	Treatment Of Strokes And Displacements	Revilla, 2001
	Gastric Ulcer	Revilla, 2001
Eleutherine plicata (Sw.) Herb.*	Amebiasis	Oliveira Neto et al., 2007; Baraúna and Rocha, 2006
	Antiparasitic	Sousa et al., 2005
	Dysentery	Oliveira Neto et al., 2007
	Intestinal Disorders	Sousa et al., 2005
	Diarrhea	Oliveira Neto et al., 2007; Baraúna and Rocha, 2006
	Hemorrhoids	Oliveira Neto et al., 2007
	Irregular Menstruation	Sousa et al., 2005

*Nomenclature adopted by the authors representing botanical synonyms of the species *E.bulbosa* (Mill.) Urb., official name currently defined in the databases and botanical institutes.** terminology used by the authors.

ornamental (Revilla, 2001) represent the only indications of non-medicinal popular use for the species of the genus Eleutherine.

Chemical constituents

In chemical studies of *E. bulbous* predominates analysis with bulbs, indicating the presence of secondary metabolites, proving the presence of naphthoquinones and anthraquinones, especially the eleuterina (Table 2). Chemical constituents of the aerial parts were studied by Paramapojna et al. (2008); and the underground parts were identified metabolites in study of Xijing et al. (2009).

Phytochemical screening revealed the presence of alkaloids, steroids free, hydroxybenzoic, quinones, anthraquinones, fixed coumarins, flavonoids and chalcones auronas in *E. bulbous* (Delgado et al., 1997). Studies held with *E. american* bulbs indicated the presence of anthraquinones (Komura et al., 1983).

Phytochemical screening with hydroalcoholic extracts of *E. plicata* indicated the presence of alkaloids, catechins, flavanones and coumarins in leaves and stem; Fixed acids, flavanonois, steroids and condensed tannins in the leaves and triterpenoid (Sousa et al., 2005). The presence of alkaloids was confirmed by Baraúna and Rocha (2006). Phenolic compounds, coumarin derivatives, and Depsides depsidonas, reducing sugars and organic acids were cited by Baraúna and Rocha (2006).

Pharmacological studies

Naphthoquinones (eleuterinona) isolated of dichloromethane extract *E. bulbous* bulbs demonstrated strong activity against the fungus Cladosporium sphaerospermum (Xu et al, 2006).

Antimicrobial properties and coronary dilating action, potentially useful in treating heart disease have been attributed to species rhizomes extract (Lorenzi and Matos, 2002). Zhengxiong et al. (1984) indicate that eleuterol and eleuterina isoeleuterina isolated of rhizomes extracts of the specie have antifungal activity and enhances the flow of the bloodstream, including coronary artery.

Eleuterina, isoeleuterina, elecanacina and isolated isoeleuterol bulbs of bulbous Eleutherine showed inhibitory activity against HIV replication (Hara et al., 1997).

Voravuthikunchai et al. (2007) showed anti-bacterial activity of *E. bulbous* on Streptococcus pyogenes. Ifesan and Voravuthikunchai (2009) demonstrate that the extract ethanolic species bulbs can be used as an additive in the pork meat; indicating mild anti-bacterial effect and significant antioxidant activity.

In vitro assays performed with Eleutherine leaf extracts bulbous giardicidal showing activity against Giardia lamblia (Amaral, 2007) and amebicide against Entamoeba histolytica / Entamoeba dispar (Nascimento et al., 2012) represent the only biological studies to validate the ethno-pharmacological use.

Oliveira Neto et al. (2007) in biomonitored study indicate a steroidal sapogenin with peripheral analgesic properties and anti-dematogênica, as active ingredient in *E. plicata* bulbs extract.

E. plicata crude lyophilized extract has shown anti-edema and peripheral analgesic activity, but not central (Baraúna and Rock, 2006); and

Table 2. Chemical constituents isolated from *Eleutherine bulbous* (Mill.) Urb. And its botanical synonyms.

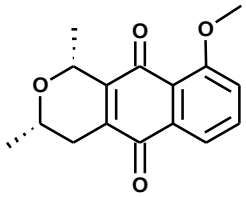
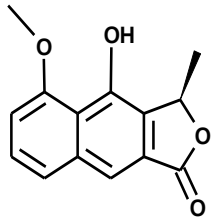
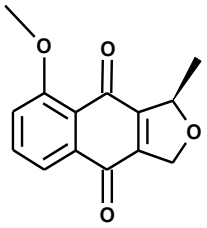
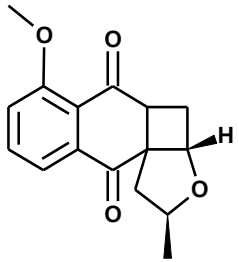
Nomenclature of plant species	Chemical compound	Chemical nomenclature**	Structure **	Reference(s)
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Eleuterina	1*H*-Naphtho[2,3-*c*]pyran-5,10-dione,3,4 dihydro-9-methoxy-1,3-dimethyl-,(1*R*,3*S*)- 1H-Naphtho[2,3-c]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1R-cis)-; 1HNaphtho[2,3-c]pyran-5,10-dione,3,4-dihydro-9-methoxy-1β,3β-dimethyl- (8CI)	 1	Hara et al., 1997; Paramapojna et al., 2008; Xijing et al., 2009; Phoem & Voravuthikunchai, 2012
	Eleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 4-hydroxy-5-methoxy-3-methyl-, (3*R*)- Naphtho[2,3-c]furan-1(3H)-one,4-hydroxy-5-methoxy-3-methyl- (8CI); Naphtho[2,3-c]furan-1(3H)-one, 4-hydroxy-5-methoxy-3-methyl-, (R)-	 2	Weniger et al., 1982; Hara et al., 1997; Jinzhong et al., 2006; Paramapojna et al., 2008; Cavalcante et al., 2009
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Eleuterinona	Naphtho[2,3-*c*]furan-4,9-dione, 1,3-dihydro-8-methoxy-1-methyl-, (1*S*)- (+)-	 3	Xijing et al., 2009
	Elecanacina	10*H*Naphtho[2',3':2,3]cyclobuta[1,2-*b*]furan-5,10(3a*H*)-dione, 1,2,4,4a-tetrahydro-6-methoxy-2-methyl-, (2*S*,3a*S*,4a*S*,10a*S*)-(+)	 4	Hara et al., 1997

Table 2. Cont'd.

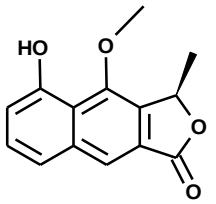
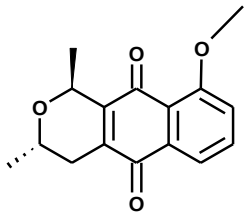
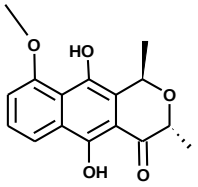
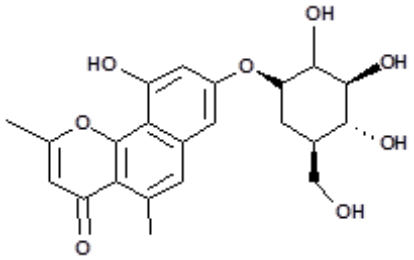
	Isoeleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 5-hydroxy-4-methoxy-3-methyl-, (3*R*)-Naphtho[2,3-c]furan-1(3H)-one,5-hydroxy-4-methoxy-3-methyl-, (R)-	 5	Hara et al., 1997 ; Jinzhong et al., 2006; Xijing et al., 2009
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Isoeleuterina	1*H*-Naphtho[2,3-*c*]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1*R*,3*R*)-1H-Naphtho[2,3-c]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1R-trans)-; 1H-Naphtho[2,3-c]pyran-5,10-dione,3,4-dihydro-9-methoxy-1β,3α-dimethyl- (8CI)	 6	Hara et al., 1997 ; Paramapojna et al 2008 ; Xijing et al., 2009 ; Nascimento et al., 2012 ; Phoem & Voravuthikunchai, 2012
	Hongconina	1*H*-Naphtho[2,3-*c*]pyran-4(3*H*)-one, 5,10-dihydroxy-9-methoxy-1,3-dimethyl-,(1*R*,3*R*)-1H-Naphtho[2,3-c]pyran-4(3H)-one, 5,10-dihydroxy-9-methoxy-1,3-dimethyl-,(1R-trans)-	 7	Zhengxiong et al., 1981; Xijing et al 2009
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Isoeleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 5-hydroxy-4-methoxy-3-methyl-, (3*R*)-Naphtho[2,3-c]furan-1(3H)-one,5-hydroxy-4-methoxy-3-methyl-, (R)-	5	Hara et al., 1997 ; Jinzhong et al., 2006; Xijing et al., 2009
	Eleutherinoside A	4H-Naphtho[1,2-b]pyran-4-one, 8-(β-D-glucopyranosyloxy)-10-hydroxy-2,5-dimethyl-	 8	Ganzera et al., 2009

Table 2. Cont'd.

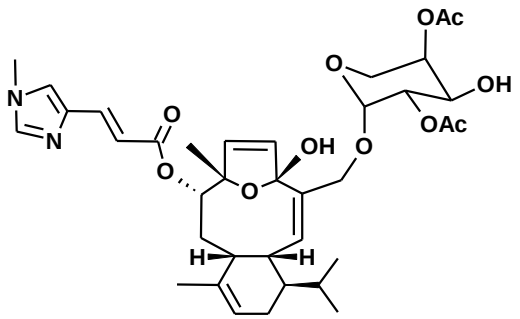
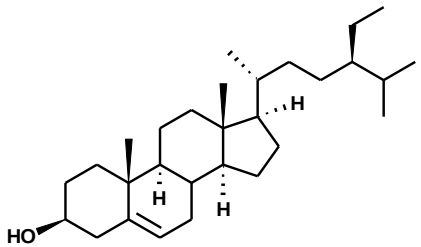
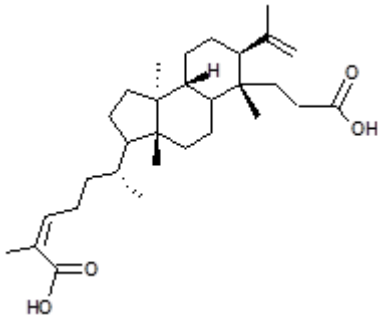
	Eleuthoside B	Naphtho[2,3-*c*]furan-1(3*H*)-one, 4-[(6-*O*-β-D-glucopyranosyl-β-D-glucopyranosyl)oxy]-5-methoxy-3-methyl-, (3*R*)-	 9	Ganzera et al., 2009
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Beta-Sitosterol	Nimbosterol (6CI); Stigmast-5-en-3β-ol (8CI); (-)-β-Sitosterol;(24R)-Ethylcholest-5-en-3β-ol; (24R)-Stigmast-5-en-3β-ol; 22,23-Dihydrostigmasterol; 24α-Ethylcholestero	 10	Xijing et al., 2009
	Ni	8-hydroxy-3, 4-Dimethoxy-1-methyl-anthra-9, l0-quinone-2-carboxylic acid methyl ester	NI	Xijing et al., 2009
	Ni	4,8-Dihydroxy-3-Methoxy-1-methyl-anthra-9,10-quinone-2-carboxylic acid methyl ester	NI	Xijing et al., 2009
	Kadsuric Acid	1H-Benz[e]indene-6-propanoic acid, 3-[(1R,4Z)-5-carboxy-1-methyl-4-hexenyl]-2,3,3a,4,6,7,8,9,9a,9b-decahydro-3a,6,9b-trimethyl-7-(1-methylethenyl)-,(3R,3aR, 6S,7S, 9aR,9bS)-(9CI);3,4-Secolanosta-4(28),9(11),24-triene-3,26-dioic acid, (24Z)-;1H-Benz[e]indene-6-propanoic acid, 3-(5-carboxy-1-methyl-4-hexenyl)-2,3,3a,4,6,7, 8,9,9a,9b-decahydro-3a,6,9b-trimethyl-7-(1methyle thenyl)-,[3R-[3α(1R*,4Z), 3aα,6β,7α,9aα,9bβ]]-	 11	Xijing et al., 2009

Table 2. Cont'd.

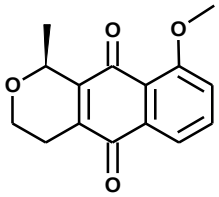
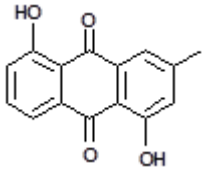
Eleutherine american (Aubl.) Merr. ex K.Heyne *	Ni	(_)-3-[2-(acetyloxy)propyl]-2-hydroxy-8-methoxy-1,4-naphthoquinone	NI	Malheiros, 2008
	Ni	2,5-Dimethyl-10-hydroxynaphtho pyrone 8-*O*-_-d-glucopyranoside	NI	Paramapojna et al., 2008
	Ni	3-methoxy-1-methylan-thraquinone-2-carboxylic acid methyl ester	NI	Phoem and Voravuthikunchai, 2012
	Ni	methyl ethers of 3,4,8-trihydroxy-1-methyl-anthra-9,10-quinone-2-carboxylic acid methyl ester 4-6	NI	Komura et al., 1983
Eleutherine bulbous (Mill.) Urb.	Ni	anthracene-9,10-dione-1,5-diol-4-methoxy-3-methyl-2-carboxylic acid methyl ester	NI	Weniger et al.,1982
	Eleutheriona	Naphtho[2,3-*c*]furan-4,9-dione, 1,3-dihydro-8-methoxy-1-methyl-, (1*S*)-(+)	 12	Xijing et al., 2009
Eleutherine bulbous (Mill.) Urb.	Eleuterina	1*H*-Naphtho[2,3-*c*]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1*R*,3*S*)-1H-Naphtho[2,3-c]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1R-cis)-; 1H-Naphtho[2,3-c]pyran-5,10-dione,3,4-dihydro-9-methoxy-1β,3β-dimethyl- (8CI)	1	Hara et al., 1997; Paramapojna et al., 2008; Xijing et al., 2009; Phoem & Voravuthikunchai, 2012
	Isoeleuterina	1*H*-Naphtho[2,3-*c*]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1*R*,3*R*)-1H-Naphtho[2,3-c]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-, (1R trans)-; 1H-Naphtho[2,3-c]pyran-5,10-dione,3,4-dihydro-9-methoxy-1β,3α-dimethyl- (8CI)	6	Hara et al., 1997 ; Paramapojna et al 2008 ; Xijing et al., 2009 ; Nascimento et al., 2012 ; Phoem & Voravuthikunchai, 2012
	Eleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 4-hydroxy-5-methoxy-3-methyl-, (3*R*)-Naphtho[2,3-c]furan-1(3H)-one,4-hydroxy-5-methoxy-3-methyl- (8CI); Naphtho[2,3-c]furan-1(3H)-one, 4-hydroxy-5-methoxy-3-methyl-, (R)-	2	Weniger et al., 1982; Hara et al., 1997; Jinzhong et al., 2006; Paramapojna et al., 2008; Cavalcante et al., 2009

Table 2. Cont'd.

Eleutherine bulbous (Mill.) Urb.	Isoeleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 5-hydroxy-4-methoxy-3-methyl-, (3*R*)-Naphtho[2,3-c]furan-1(3H)-one,5-hydroxy-4-methoxy-3-methyl-, (R)-	5	Hara et al., 1997 ; Jinzhong et al., 2006; Xijing et al., 2009
	Elecanacina	10*H*Naphtho[2',3':2,3]cyclobuta[1,2-*b*]furan-5,10(3a*H*)-dione, 1,2,4,4a-tetrahydro-6-methoxy-2-methyl-, (2*S*,3a*S*,4a*S*,10a*S*)-(+)	4	Hara et al., 1997; Nielsen e Wege 2006
	Hongconina	1*H*-Naphtho[2,3-*c*]pyran-4(3*H*)-one, 5,10-dihydroxy-9-methoxy-1,3-dimethyl-, (1*R*,3*R*)-1H-Naphtho[2,3-c]pyran-4(3H)-one, 5,10-dihydroxy-9-methoxy-1,3-dimethyl- (1R-trans)-	7	Zhengxiong et al., 1981; Chen, et al., 1986; Xijing et al 2009
	Crisofanol	9,10-Anthracenedione,1,8-dihydroxy-3-methyl-Anthraquinone, 1,8-dihydroxy-3-methyl- (8CI); 1,8-Dihydroxy-3-methyl-9,10-anthracenedione; 1,8-Dihydroxy-3-methyl-9,10-anthraquinone; 1,8-Dihydroxy-3 methylanthraquinone; 2-Methyl-4,5dihydroxyanthraquinone; 3-Methyl-1,8-dihydroxyanthraquinone; 3-Methylchrysazin; 4,5-Dihydroxy-2-methylanthraquinon	 13	Weniger et al., 1982; Lorenzi & Matos, 2002
Eleutherine plicata (Sw.) Herb. * *Eleutherine plicata* Herb. ex Klatt *	Eleuterol	Naphtho[2,3-*c*]furan-1(3*H*)-one, 4-hydroxy-5-methoxy-3-methyl-, (3*R*)-Naphtho[2,3-c]furan-1(3H)-one,4-hydroxy-5-methoxy-3-methyl- (8CI); Naphtho[2,3-c]furan-1(3H)-one, 4-hydroxy-5-methoxy-3-methyl-, (R)-	2	Weniger et al., 1982; Hara et al., 1997 ; Jinzhong et al., 2006; Paramapojna et al., 2008; Cavalcante et al., 2009
	Isoeleuterina	1*H*-Naphtho[2,3-*c*]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-,(1*R*,3*R*)-1H- Naphtho[2,3-c]pyran-5,10-dione, 3,4-dihydro-9-methoxy-1,3-dimethyl-,(1Rtrans)- ; 1H-Naphtho[2,3-c]pyran-5,10-dione,3,4-dihydro-9-methoxy-1β,3α-dimethyl- (8CI)	6	Hara et al., 1997 ; Paramapojna et al 2008 ; Xijing et al., 2009 ; Nascimento et al., 2012 ; Phoem & Voravuthikunchai, 2012

*Nomenclature adopted by the authors representing botanical synonyms of the species *E. bulbous* (Mill.) Urb, official name currently defined in the databases and botanical institutes; ** Chemical nomenclature and structure of the Chemical Abstract; NI: no information.

moderate anti-fungal activity (Menezes et al., 2009). Study of hydroalcoholic extract of your bulbs has shown anticholinesterase action (Cavalcante et al., 2009).

Crude extract *E. american* bulbs inhibit protease and lipase enzymes and may be used in the food industry as an additive, aiming to combat the growth of *Staphylococcus aureus* (Ifesan and Voravuthikunchai, 2009).

Study Mahabusarakam et al. (2010) with *E. american* bulbs has shown antibacterial activity against *S. aureus* (ATCC25923 and ATCC27664). Study of ethanol extract of kind of bulbs has shown antibacterial activity against *Campylobacter spp* (Sirirak and Voravuthikunchai, 2011).

In a study of bioprospecting, Brazilian et al. (2006) showed that the ethanol extracts of the aerial parts of *E. bulbous* have toxicity to larvae of Artemia salina (LD50 <1000 ppm) without evidence of antimicrobial activity assay with *Escherichia coli,* but showing activity against *S. aureus*, which is the only evaluation job of toxicity developed with the species under study.

Patents

In databases it was found patent deposit, predominating registration based in the *E. plicata* terminology, where the evaluated patent corresponds to the process for obtaining of an extract and a vegetable fraction, pharmaceutical compositions and their use for the treatment of malaria (WO 2013166576 A1); use of *E. plicata* to decreased levels of blood cholesterol triglicerideose (CN103127319-A); use of *E. bulbous* for the treatment of neuro-degenerative disease, heart disease and diabetes (VN31660-A); use of *E. plicata* for cure of diseases rheumatoid arthritis, arthralgia and myalgia (CN1813986-A), use of leaves of *E. bulbous* (Mill.) Urb. giardicidal for therapeutic use as (BR 1020150161930).

Conclusion

E. bulbous (Mill.) Urb., which is native and of high occurrence in various regions of the Americas, is a vegetable specie with potential for investments in research and development of herbal products, given the broad therapeutic use in popular practice. The analysis of botanical institutions databases have demonstrated a high number of scientific synonyms for this species and, further, various publications employing scientific names *E. plicata* and us Eleutherine, which do not represent the official name for the species currently accepted. In this review we noted that the ethnopharmacological studies indicate broad popular job *E. bulbous* in the gastro-intestinal disorders, but there are few validation studies of popular use; noting the need for more study of plant anatomy, for the determination of authenticity parameters. Thus, research in these areas, as well as evaluation of toxicity, should be encouraged aiming at setting security parameters.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLEDGMENTS

The authors thank the National Council for Scientific and Technological Development (CNPq) for financial support and scholarships and the Maranhão Foundation for the Protection of Research and Scientific and Technological Development (FAPEMA) for financial support.

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