

SURVEY ON THE ANTIOXIDANT, ANTI- INFLAMMATORY AND HEALING POTENTIAL OF THE GENUS *Jatropha* (L., 1753)

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Abstract: Ethnopharmacological relevance: The genus *Jatropha* (L., 1753), belonging to the Euphorbiaceae family, formed approximately by more than 170 varieties that are recognized in domestic medicine, as a plant with healing, antioxidant, hemostatic, anti-inflammatory and antimicrobial properties. **Purpose of the study:** The present study aimed to carry out a narrative review on the antioxidant, anti-inflammatory and healing properties of the genus JL, in order to correlate its therapeutic uses in folk medicine with scientific evidence. **Materials and Methods:** A search was carried out, without restriction of year or language of publication in the PubMed and SciELO databases in order to find studies that investigated the possible properties of the genus *Jatropha*. **Results:** Sixteen studies were found that identified antioxidant, anti-inflammatory and healing therapeutic properties in different species of the *Jatropha* genus. **Conclusions:** The genus *J. L.* demonstrates antioxidant, anti-inflammatory and healing properties, especially in the roots and leaves of *J. gossypifolia* L., *J. mollissima* (Pohl) Baill., *J. elliptica* (Pohl) Mull. Arg. and *J. curcas* L.

Keywords: *Jatropha* L. Antioxidant. Anti-inflammatory. Healing.

INTRODUCTION

The use of plants with medicinal properties, also called popular medicine, is an ancient practice of human beings as a therapeutic device for survival (SAAD *et al.*, 2016) and improvement of the quality of life (BRASIL, 2006). In Brazil, this ancient practice is composed of the integration of different ethnic groups that make up the national culture and propagate throughout history, the most diverse principles of local herbs and their functions (ANVISA, 2016).

In modern society, the use of natural and herbal products represents a lucrative market

in several industrialized and developing countries, moving billions of dollars in the pharmaceutical industry (BRASIL, 2019). Therefore, according to ANVISA (2016), in 2006, public policies were implemented in the country for the regulation and adequacy of actions and services related to the use of medicinal plants and herbal medicines, such as the National Policy on Medicinal and Herbal Plants (PNPMF) and the National Policy on Integrative and Complementary Practices in the Unified Health System (PNPIC), which aim to provide safe access and rational use to the entire population.

There are in Brazil more than 25 thousand species of plants cataloged with medicinal properties (AGÊNCIA BRASIL, 2020). However, there is a scarcity of official data regarding the trade of these samples, since there are only 196 herbal medicine formulations registered in the 2nd^{edition} of the Brazilian Pharmacopoeia Phytotherapy Form (ANVISA, 2021). Of these, 71 are part of the Ministry of Health's list of plants with active ingredients that are of interest to the SUS, and only 12 are registered in the National List of Essential Medicines (Rename) (CECHINEL; ZANCHETT, 2020). Among these unregistered plants is the genus *Jatropha* (*J.*) L., belonging to the Euphorbiaceae family, approximately formed by more than 170 varieties rich in pharmaceutical properties (WEBSTER, 1994; KRISHNAN; PARAMATHMA, 2009).

Popularly known in Brazil as Pinhão Purple, Pinhão de Purga, Pinhão Manso, Pinhão Bravo and Flor de Coral, the native specimens of *J.L.* are a source of phytochemicals that can be used both ornamentally and as hedgerows, as well as in industries nutritional, agricultural and pharmaceutical (DRUMOND *et al.*, 2008; HIROTA *et al.*, 2010). In domestic medicine, JL has healing, antioxidant, hemostatic, anti-inflammatory, antimicrobial properties, among others (DRUMOND *et al.*, 2008,

HIROTA *et al.*, 2010; MARIZ *et al.*, 2010) that are discussed in several studies scientists who seek to prove its effectiveness.

Therefore, this study aims to present a narrative review on the antioxidant, anti-inflammatory and healing properties of the genus *JL* in order to correlate its therapeutic uses in folk medicine with scientific evidence.

MATERIAL AND METHODS

The present work is a narrative review that aimed to identify the scientific knowledge available about the genus *Jatropha* (L., 1753) in current scientific literature.

Searches for articles were carried out in the electronic databases PubMed and SciELO, using the descriptors “*Jatropha* L”, “Antioxidant”, “Anti-inflammatory” and “Healing”. No limits were established regarding the year of publication of the articles or language of publication; however, the established exclusion criterion was the elimination of articles that did not present any aspect of the proposed theme.

Initially the articles were pre-selected after reading the titles and abstracts, in a second moment a complete reading was carried out and only those articles that fulfilled all the criteria established in the selection process were included in the present work.

The genus *Jatropha* is listed on the website <http://www.theplantlist.org>, and this information was verified on September 19, 2022. This genus is recognized by several names from different regions of Brazil, and the popular names verified in the consulted literature are: Pinhão violet, Pinhão de Purga, Pinhão Manso, Pinhão Bravo and Flor de Coral.

THEORY

The genus *Jatropha* (*J.*) L., belonging to the Euphorbiaceae family, comprises approximately 170 varieties rich in

pharmaceutical properties (WEBSTER, 1994; KRISHNAN; PARAMATHMA, 2009). Among the properties associated with this genus are the anti-inflammatory, healing and antioxidant capacity, popularly recognized in several varieties of *Jatropha* L.

In popular knowledge, it is common to believe that *J. gossypifolia* L. may have an important property in combating premature aging, by inhibiting free radicals (REIS; SILVA, 2015). This plant belongs to the Euphorbiaceae family, of the genus *J. L.* (MARIZ *et al.*, 2010) and is popularly known as purple “pinhão”. It is a typical plant from the Brazilian savannah and wetlands, which is part of the national list of medicinal plants of interest to the SUS (CECHINEL; ZANCHETT, 2020), and presents a variety of therapeutic recommendations such as anti-inflammatory, healing, being used for the treatment of rheumatic diseases, hypertension, diabetes and as a diuretic (MARIZ *et al.*, 2010; MARANGUELI; MINGUZZI, 2015).

J. elliptica (Pohl) Mull Arg is commonly known as medicinal Jalapão or snake root. It is a typical plant of the savannah and a traditional species of Brazilian folk medicine used in the treatment of ulcers, neoplasms, hypertension, diarrhea, inflammatory diseases and in accidents with snakes (PIMENTEL; FAGUNDES, 2015; RODRIGUES, 2020).

Jatropha curcas L. _ or “Pinhão manso” or “Pinheiro de purga” or “Pinhão-de-circa”, as it is commonly known, is common in the northeast, southeast and south of Brazil. It has several uses, from raw material for biofuels, paints and soap to medicinal plants used for the treatment of dermatological and rheumatological diseases such as arthritis and gout, in addition to jaundice, inflammation and injuries (OTHMAN *et al.*, 2015; VIRGENS *et al.*, 2017), and can be used as healing, hemostatic, diuretic and laxative (DRUMOND *et al.*, 2008).

Pinhão Bravo, as *J. mollissima* is known (Pohl) Baill. is a common species of the Brazilian caatinga. The milky sap produced by this shrub, latex, is widely used empirically in wounds as an antimicrobial, antiophidic, anti-inflammatory, hemostatic, antipyretic and healing agent (VASCONCELOS et al., 2014, GOMES, 2019 and QUEIROZ NETO et al., 2019)

One of the species of the genus *J. L.* used due to its anti-inflammatory power is the species *J. isabelli* (müell arg.), known in Brazil as mamoeira do campo and in Paraguay as “yagua rova”, is commonly used to treat back pain and various inflammatory diseases such as arthritis and gout (FRÖHLICH, 2012, PIANA, 2012 and SILVA et al., 2013). In northeastern Brazil, *Jatropha mollissima* (Pohl) Baill. is a natural species known for its possible anti-inflammatory properties (VASCONCELOS et al., 2014).

RESULTS AND DISCUSSION

Among all the articles found, 15 works were selected because they met the requirements listed for this research. The works were published between 2004 and 2019, 13 of which were in Portuguese and 2 in English. The general characteristics of the studies included in this review are shown in Table 1.

The anti-inflammatory effect of the root of *J. curcas* L. was studied in vivo by Mujumdar and Misa (2004) in albino mice. Topical application of a powdered paste from the root of *J. curcas* L. led to systemic anti-inflammatory activity, with a significant reduction in edema induced by carrageenan and formalin in the paws of rats. In 2015, the bioactive compounds with anti-inflammatory and cytotoxic properties of *J. curcas* L. were also studied by Othman et al. According to his in vitro test, the roots of these plants have the highest concentration of phenolic compounds among leaves, fruits, roots and

stems. Likewise, the extract of its roots has a 100% capacity to inhibit the production of pro-inflammatory products (nitric oxide). However, it has both anti-inflammatory and cytotoxic activities, preventing cell growth.

The raw extract of *J. isabelli* (müell arg.) was tested in pre-clinical tests with rats by Silva et al. (2013) who observed a large presence of alkaloids in this species, which provides it with an important property in combating inflammation, since its injection in rats with gout was able to prevent pain, edema and proliferation of neutrophils. Thus, concluding that the *J.* extract (müell arg.) has proven anti-inflammatory effects.

The *jatropha* species *mollissima* (Pohl) Baill. had its anti-inflammatory capacity tested by Gomes et al. (2016) who applied Jararaca bothrops venom to the paws of mice inducing the release of several pro-inflammatory mediators generating edema. In this study, the extract of *J. mollissima* (Pohl) Baill. showed an anti-inflammatory effect, with significant inhibition of edema, similar to that produced by dexamethasone, a glucocorticoid with potent anti-inflammatory activity. Thus, the extract of this species is characterized as a potent anti-inflammatory mediator.

The extract of the leaves of *J. gossypifolia* L. was tested and analyzed by Santos (2014) who identified the presence of flavonoids, phenols, tannins and other secondary metabolites with antioxidant characteristics. In their study, all the investigated extracts of this plant showed some antioxidant effect. In addition, it was proven that the greater the number of polyphenols in the extract, the greater its antioxidant activity. However, it is not possible to confirm that the inhibition of free radicals is performed exclusively by these compounds. Therefore, due to the large number of polyphenols in its leaves, *J. gossypifolia* L. may have significant natural antioxidant potential.

Study	Species	Parts of the plant used	How to prepare the extract	Model generated for inflammation	Expected anti-inflammatory effect	Proven potential and effectiveness
Mujumdar and Misa (2014)	<i>curcas jatropa</i>	roots	Extraction of solvents by ether and methanol	TPA-induced ear inflammation in albino mice.	Local and systemic anti-inflammatory activity	Proven local and systemic anti-inflammatory activity
Fagundes (2011)	<i>jatropha gossypifolia</i>	roots and leaves	Ethanol extracts	Not identified	Not identified	antioxidant
Silva et al. (2013)	<i>jatropha isabelli</i>	Stalk	Infusion or decoction	Application of intra-articular injection of monosodium urate crystals	Antinociceptive, anti-inflammatory and hypouricemic potential	Anti-inflammatory and antinociceptive
Saints (2014)	<i>jatropha gossypifolia</i>	Sheets	Extraction with solvents	Not identified	Not identified	Antimicrobial and antioxidant capacity
Marangueli and Minguzzi (2015)	<i>jatropha gossypifolia L</i>	Source	Alcoholic extract of the roots	Not identified	Not identified	Antioxidant, cytotoxic and inhibitory of tumor growth
othman et al. (2015)	<i>jatropha curca</i>	Leaves, root, stem and fruit	methanol extraction	The evaluation of anti-inflammatory bioactive compounds was performed in vitro	Investigate the anti-inflammatory activity of different parts of the <i>J. curcas plant</i> .	Hexadecanoic acid methyl ester, octadecanoic acid methyl ester, and octadecoric acid may be responsible for the anti-inflammatory activity
Pimentel and Fagundes (2015)	<i>jatropha gossypifolia (J.G) Jatropha elliptical (J.E.</i>	roots	Ethanol extracts	Not identified	Not identified	antioxidant
Kings and Silva (2015)	<i>jatropha gossypifolia L</i>	Sheets	Ethanol extract	Not identified	Not identified	antioxidant
Gomes et al. (2016)	<i>jatropha mollissima (Pohl)</i>	Sheets	Decoction	Venoms from freeze-dried snakes <i>B. eritrolástica</i> and <i>B. jararaca</i> . <i>B. erythromelas</i> were applied to mice	Evaluate the effectiveness of the plant on the local effects induced by Bothrops venoms	Bothrops and pit viper venoms
Saints (2018)	<i>jatropha gossypifolia</i>	Sheets	Decoction	induction of ear edema by single application of croton oil and carrageenan-induced paw edema and ear edema induced by multiple application of croton oil (chronic inflammation) in swiss albino mice	Evaluation of topical anti-inflammatory activity	Anti-inflammatory
Silva et al. (2018).	<i>jatropha gossypifolia L</i>	Leaves, branches and stalk	Maceration of the leaves with ethanol and rotary evaporation to concentration	<i>in vitro</i> research	Investigate the cytotoxic, antimicrobial and healing potential of extracts from leaves, twigs and stem of <i>J. gossypifolia L</i> .	Has healing potential

Gomes (2019)	<i>Jatropha mollissima</i> (Pohl) Baill	Sheets	Extracts: ethanolic and aqueous	Injection of venom into snakes of the genus Bothrops and scorpions of the genus Tityus in mice	Evaluate the effectiveness inhibitory effect of the aqueous extract of <i>J. mollissima</i> leaves against the systemic toxicities produced by snakes of the genus Bothrops and scorpions of the genus Tityus	Antioxidant, anti-inflammatory, anticoagulant
Queiroz Neto <i>et al.</i> (2019),	<i>Jatropha mollissima</i> (Pohl) Baill	Latex	latex ethanolic extract	Not identified	Not identified	Antioxidant and antibacterial action, without presenting acute toxicity.

Table 1: general characteristics of the studies

Source: own authorship

Reis and Silva (2015) evaluated *J. gossypifolia* L., researchers analyzed the extract of the leaves of this plant and proved its high potential for retaining oxidizing radicals. In addition, Marangueli and Minguzzi (2015) observed that this Euphorbiaceae species has important antioxidant characteristics in its root. Moreover, in 2011 Fagundes analyzed the flavonoids in the leaves and roots of *J. gossypifolia* L. and observed that these present chemical elements with favorable antioxidant potential with percentages above 90%.

J. mollissima (Pohl) Baill., popularly known as ``Pinhão Bravo``, showed good antioxidant activity in the work carried out by Queiroz Neto *et al.* (2019), the authors also describe that this antioxidant activity is closely related to the content of phenols present in its composition. Gomes (2019) also studied the same species, performing his research in vivo with the aqueous extract of *J. mollissima* (Pohl) Baill. leaves. The result found was that the species showed the ability to reduce renal and hepatic oxidative stress caused by *Bothrops* (B.) *jararaca*, with an important ability to scavenge free radicals, demonstrating a possible antioxidant capacity. This study also demonstrated that the aqueous extract of *J. mollissima* (Pohl) Baill. it has anti-inflammatory ability similar to the reference drug (dexamethasone) to inhibit the pro-inflammatory activity of cytokines, enzymes and proteins that disabled the formation of pulmonary edema caused by *B. jararaca* venom.

Santos (2018) proved in his study the effectiveness of gels with leaf extracts of *J. gossypifolia* L. and *Ipomoea pescaprae* L. in combating inflammation, with a decrease in edema induced by croton oil applied to the ears and carrageenan applied to the paws of mice. This plant exhibited significant anti-inflammatory power with a decrease in edema, nitric oxide production, myeloperoxidase

enzyme and oxidative stress, with an intensity similar to dexamethasone, and this plant may have the ability to inhibit the migration of neutrophils and pro-inflammatory mediators such as histamine, serotonin, bradykinin and prostaglandins.

Silva *et al.* (2018) proved that the methanolic extracts of the leaves of *J. gossypifolia* L. have healing power, with a 45% increase in fibroblasts in an in vitro test, which observed cell proliferation at zero, 12 and 24 hours and concluded that this species may be a wound healing herbal alternative, but further studies are needed.

CONCLUSIONS

Given the above, it is understood that the genre *J. L.* Used over the years as a natural medicine for various ailments, it has shown antioxidant, anti-inflammatory and healing properties.

There are strong indications that the root and leaves of *J. gossypifolia* L. widely used for this purpose, exhibits great antioxidant, anti-inflammatory and healing potential, and can be compared with renowned drugs in modern medicine such as dexamethasone, making this plant a relevant herbal medicine to be studied, as well as *J. mollissima* (Pohl) Baill. typical Brazilian species, used for the treatment of inflammatory diseases and wound healing, which has demonstrated healing capacity, inhibiting the formation of free radicals and inflammation in preclinical studies.

Other species native to Brazil such as *J. elliptica* (Pohl) mull arg., *J. curcas* L., also have similar antioxidant and anti-inflammatory capabilities, but are less known and less studied. Thus, it was observed that research has shown the anti-inflammatory and antioxidant actions of this genus, however, there are few studies on the healing potential of the species. Therefore, there is still a lack of discussions and works that prove the effectiveness of this

genus rich in medicinal properties for the development of herbal medicines based on these plants.

GLOSSARY

ANVISA – National Health Surveillance Agency

B. – *Bothrops*

J. – *Jatropha*

pics – Complementary Integrative Practices in Health

PNPIC – National Policy for Integrative and Complementary Practices

PNPMF - National Policy for Medicinal Plants and Herbal Medicines

Rename – National List of Essential Medicines

SUS – Unified Health System

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