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Pharmacognostic characterization of leaves of ajuru plant species chrysobalanus icaco (l.) And its phytochemical activity

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1 INTRODUCTION

The use of medicinal plants has been described in history since the dawn of humanity. Over time, to obtain a cure for diseases, our ancestors observed everything that nature offered, especially plants, to discover which species would serve to cure diseases, which would be suitable for food preparations, and which were poisonous. and hallucinogenic (GASPAR, 2009). The World Health Organization (WHO) estimates that 80% of the world's population uses some kind of plant to improve or treat signs and/or symptoms of pathological processes (ANVISA, 2002).

Among the possible species to be found in the Brazilian flora, several studies have shown the high potential for use/therapeutic purpose of a species linked to the Chrysobalanaceae family, the species Chysobalanus icaco L., popularly known in Brazil as guajuru, abageru, ajiru, among other names, and can be found in the states of Pará, Ceará, Maranhão, Pernambuco, Rio de Janeiro, and Rio Grande do Norte (PRESTA; PEREIRA, 1987; SILVA; PEIXOTO, 2009; AGUIAR, 2010), it is

classified as an angiosperm, belonging to the genus Chysobalanus. Initially, the Chysobalanaceae family, in which it is found, has a wide distribution in subtropical and tropical regions, and geographically it is present in European countries, Africa and Latin America, since its morphology, commonly of woody and shrubby species, is known in countries English-speaking ones like coco-plum, icaque-ponne, pork-fat-apple, and zicate; while in French-speaking countries it is known as Prunier de cacao (KRUEL; PEIXOTO, 2004).

Ajuru is a species that occurs in places with water deficit or flooding, such as swamps, varying

according to the seasons, developing in leached, sandy and shallow soils, it can be found in Restinga areas in the zones coastal and coastal areas and preferentially inhabits dunes (VARGAS, 1998; KRUEL; PEIXOTO, 2004; FREITAS; LOCATELLI, 2009). For being a kind

medium-sized wild, C. icaco has a height that varies between 1.5 and 3 meters (AGUIAR, 2010), with a trunk diameter that varies from 15 cm to 30 cm and hard, oval leaves, of a shiny dark green color on the upper part, which are up to 4 cm long and 3 to 6 cm wide (PRESTA; PEREIRA, 1987; MATOS, 1999; AGUIAR, 2010). Its fruit is rounded, with a width between 2 and 5 cm, with a diversified color that varies between creamy white and pink, with small variations for black, presenting the pulp in the color white with a spongy, sweet, or insipid characteristic that, when maturing, is quite astringent (AGUIAR, 2010; PERES, 2012).

As for medicinal use/application, the Chrysobalanaceae family comprises species with great therapeutic value for popular use, with a relative emphasis on the species considered in the present study, which is traditionally used in the northern region of Brazil for the treatment of diabetes (AGUIAR, 2010; PERES, 2012), in the treatment of leukorrhea, hemorrhages and chronic diarrhea (PRESTA; PEREIRA, 1987; GOMES, 2006), and is also known for its diuretic and hypoglycemic effect (FRANCIS, 2003). In Brazil, in coastal regions, it has its prominence in food, as for riverside people, but in American countries, Mexico and Cuba, it has economic importance, for the manufacture of sweets and preserves (AGUIAR, 2010). For medicinal purposes, seed oil is popularly used to prepare an antidiarrheal emulsion and for ointments. The roots, bark, and leaves are used against dysentery, leukorrhea, and kidney stones, due to their astringent characteristic. Its potential use as an antitumor agent and in the fight against diabetes mellitus is widely explored (TORRES et al., 2009; AGRA et al., 2008; KRUEL et al., 2006).

As for the biological activity, the authors Presta and Pereira (1987), Castilho et al. (2000), and Aguiar (2010) exposes that the leaves of C. icaco have analgesic, and anti-inflammatory characteristics, and properties with genotoxic effects. The extracts and fractions of the species have antibacterial activity against Staphylococcus aureus and Streptococcus pyogenes and hypoglycemic activity (CASTILHO et al., 2000). In their research, Gustafson et al. (1991) and Peres (2012), respectively, concluded that the diterpenes of Chrysobalanus icaco also have anti-HIV activity and that the hydroalcoholic extract of the leaves has been used in the treatment of mycoses and fungal infections of candidiasis. Concerning, popular medicine, the leaves of C. icaco have analgesic and anti-inflammatory, anesthetic, and hypoglycemic characteristics (BARBOSA et al., 2005: TORRES et al., 2009; CASTILHO et al., 2000; FRANCIS, 2003; AGUIAR, 2010).

Such studies denote, therefore, the need for more in-depth exploratory studies about the still unknown potential of the species, as well as pointing to the enormous possibility of discovering new herbal medicines, drugs, and/or pharmaceutical raw materials that legitimize its traditional use. Therefore, based

on the presented potential, it was proposed through the study to carry out the pharmacognostic characterization of the leaves of Ajurú collected in the urban area of the city of Macapá/AP, the objective of this research was to determine and identify, through the phytochemical study, the main classes of secondary metabolites found in the leaves of the plant species C. icaco.

2 METHODOLOGY

Based on the methodology of Barbosa et al. (2001), collections of plant material were carried out, the leaves of C. icaco, located in the city of Macapá – Amapá (0°5'57.772"; 51°2'46.701"), and specimens were produced for cataloging. At the Laboratory of Pharmacognosy and Phytochemistry of the Federal University of Amapá, the collected material was separated and dried in an oven at 45°C, shortly after grinding, the powder obtained was weighed, resulting in 400g of material. For the process of obtaining the crude extract, according to the basic methodology, the material was placed in alcoholic extraction, with Hydrated alcohol at 92.8° INPM for 72 hours at room temperature, it undergoes a rota evaporation process, obtaining, after 3 extractions and drying of the extract, 3.31g of crude extract was obtained.

The phytochemical analyses carried out were: cardiac glycosides, saponins, phenols and tannins, alkaloids, catechins, reducing sugars, steroids and triterpenoids, coumarin derivatives, organic acids, proteins and amino acids, purines, anthraquinones, flavonoids, carotenoids, sesquiterpene lactones, depsides, and depsidones, according to the methodology of Barbosa (2001).

3 CONCLUSION

According to the phytochemical analysis of the classes of secondary metabolites carried out in the crude extract of the leaves of C. icaco, it was possible to positively identify: foaming saponins, catechins, carotenoids, phenols, tannins, depsides and depsidones, steroids and triterpenes **(Table 1).**

Table 1- Phytochemical tests performed to identify classes of secondary metabolites

Secondary metabolite class	Results
Organic Acids	-
Reducing sugars	-
alkaloids	-
anthraquinones	-
Carotenoids	+
Catechin	+
Depsides and Depsidones	+
coumarin derivatives	-

Steroids and triterpenoids	+
Phenols and Tannins	+
flavonoids	-
cardiac glycosides	-
Proteins and Amino Acids	-
Purines	-
saponins	+
Sesquiterpecolactones and other lactones	-
Parameters: Negative (-); Positive (+)	

From the results of the phytochemical prospection, it was possible to observe the presence of foaming saponins, historically in the literature as anti-inflammatory, varying the mechanism, being able to act by inhibiting the degradation of corticoids, causing a direct interference in the mediators, resulting in this biological action. Hemolytic activity can be due to the possible ability to complex with steroids, proteins, and phospholipids, changing the permeability of cell membranes, thus being able to have cytotoxic, antitumor, and antiviral action (BESSA et al., 2013; CASTEJON, 2011; MACEDO et al., 2007). Saponins are steroid glycosides or polycyclic terpenes, have a high molecular mass, and generally have complex structures (BARBOSA et al., 2020).

Saponins can act as a cholesterol reducer due to their irritating activity, possibly due to the mechanism of intestinal cholesterol interaction, causing exfoliation with loss of function and reduction of the area of absorption, which may cause a consequent reduction in cardiac congestive failure by inhibiting cellular efflux of Na+, acts as an expectorant, entropic, molluscicidal and healing agent (CASTEJON, 2011; MACEDO et al., 2007). Concomitantly, the class of catechins also known as flavonoids subclass of flavonoids found in Ajuru, belong to the class of polyphenols and have characteristics of colorless, water-soluble compounds, which favor the bitterness and astringency of the vegetable (STRACK; SOUZA, 2012; LAMARÃO; FIALHO, 2009).

Its bioactivity may contribute to the reduction and incidence of some cancers, an effect induced by apoptosis, in the reduction of body fat, this is suggested as a modulator of norepinephrine in the sympathetic system, acting on thermogenesis and fat oxidation, as well as its possible role as a potent antioxidant, as a scavenger of free radicals, and in aiding the reduction of total cholesterol by a probable mechanism of action in the inhibition of oxidized LDL (low-density lipoprotein); this may come to act as a protective agent in the release of chemical mediators from the immune system, portraying also its effects in reducing platelet reactivity, anti-inflammatories, and insulin sensitivity, benefits correlated to the decrease of dyslipidemia and cardiovascular diseases with increased intake of food sources (PEREIRA; CARDOSO,

2012; STRACK; SOUZA, 2012; LAMARÃO; FIALHO, 2009).

The class of carotenoids is characterized by the presence of the polyene chain, with a structure of a long system of conjugated double bonds, this can be associated with the biological and therapeutic activity as its probable antioxidant action, it is associated that the chain for presenting groups cyclic terminals with substituents, in which, with oxygen, it provides a conjugated system in polyene electrons, helping in the absorption of singlet oxygen and the free radicals present, through the interruption of the chain reactions that they involve, in addition, these can be correlated the in vitro peroxidation inhibition of lipids at low oxygen pressures (McNULTY, et al., 2007; QUIRÓS; COSTA, 2006; SIKORA et al., 2008).

The class of phenols identified in the analysis may have biological activity associated with their composition and form of use, it is suggested that internally it may have anti-diarrheal activity, through the inhibition of some enzymes in the digestive process, and external antiseptic action, which may be associated with its astringency, waterproofing the most exposed layers of the skin and mucous membranes, a fact that also leads to toxic effects (high mortality of treated insects) related to condensed tannins by associating greater weight of the molecule and by the easy mechanism of complexing with metallic ions (ANDREO; JORGE, 2006).

However, some studies suggest the physiological properties with antiallergenic, anti-arteriogenic, anti-inflammatory, antithrombotic, antimicrobial, cardioprotective (reduction of LDL), and vasodilator effects, but the main effect is its action as a powerful antioxidant, through the capture of concentrated intercellular free radicals intercepting oxygen that can cause the formation of stable radicals, which can act in the prevention of degenerative diseases such as cancer and the delay of aging, in low molecular weight and adequate amounts for easy absorption (MONTEIRO et al., 2005; CARVALHO, 2007).

The tannins identified in the aqueous extract of abageru leaves, this class being commonly associated with medicinal activities against infections and dysentery when roots, fruit peels, flowers, and leaves are used (PRESTA; PEREIRA, 1987; KRUEL et al., 2006; AGRA, FREITAS, BARBOSA, 2007;

LORENZI; MATOS, 2002). In this way, it can be correlated with the vasoconstrictor action, preventing external aggressions and fluid decrease; it heals, being able to regenerate tissues in cases of wounds or burns; has biological action against certain microorganisms, such as carcinogenic agents and antitumor agents, and may supposedly be correlated with the fight against diabetes mellitus, but they are still widely explored (TORRES et al., 2009; AGRA et al., 2008; KRUEL et al., 2006).

The pharmacological actions of tannins derive from their ability to form complexes with proteins and polysaccharides, thus contributing to the healing of wounds and burns. Similarly, this affinity of polyphenols for proteins is of essential importance in the activity of inactivating enzymes, thus preventing the growth of some microorganisms (SIMÕES, 2010).

The use of C. icaco leaves associated with cytotoxic activity may be associated with the presence

of diterpenes and triterpenes (FERNANDES et al., 2003; GUSTAFSON; MUNRO, 1991), terpenoids, from C. icaco leaves, these may be associated with the in vitro inhibitory action on the Acquired Immunodeficiency Virus (HIV) (GUSTAFSON et al., 1991), supposedly composes the species, compounds such as pomolic acid and betulinic acid, homologous series of hydrocarbons of C27 and C33 (BARBOSA et al ., 2006; FERNANDES et al., 2003; MENDEZ et al., 1995; CASTILHO et al., 2000), and trienoic and tetraenoic acids and their derivatives from seed oils (GUNSTONE; SUBBARAO, 1967; VERMA; RAYCHAUDHURI, 1972).

Polycyclic steroids or terpenes, which in their structural form have a lipophilic part (triterpene or steroid) and a hydrophilic part (sugars), which may be correlated to antifungal activity (BORELLA et al., 2006), among the main classes are the polyenes, azoles, allylamines, 5-fluorocytosine, griseofulvin, among others. However, polyenes and azoles are related in the treatment of candidiasis, in the hexanic extract of C. icaco leaves, antifungal activity was revealed against the

Candida albicans (CPRobin) Berkhout (CASTILHO et al., 2000; FERNANDES et al., 2003).

The action of depsides and depsidones is still vaguely elucidated, however, they are associated with activities against gram-positive bacteria, mycobacteria, nematodes, and insects, in addition to having anti-inflammatory, anticancer, analgesic, antiviral, and antipyretic properties (ZHAO et al. ., 1997). It is known that depsides are an example of polyketides and are metabolites produced by lichens and endophytic microorganisms, which have as a chemical characteristic the presence of two or more aromatic rings that are linked by a carboxylic unit (SILVA et al. 2020).

Therefore, it was possible to associate these classes of metabolites identified in the crude extract of Ajuru leaves with antibacterial and anti-inflammatory activity correlated to C. icaco, which may have therapeutic potential, such as tannins, which are presented, according to the literature, effects against dysentery, thus associating the popular use. However, a microbiological study of the obtained extract is necessary to investigate the pharmacological potential of C. icaco leaves.

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