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Original article

Ethnopharmacological study of *Stryphnodendron rotundifolium* in two communities in the semi-arid region of northeastern Brazil

Dayanne Rakelly de Oliveira[a], *Washington Soares Ferreira Júnior*[b], *Vanessa de Carvalho Nilo Bitu*[c], *Patricia Gonçalves Pinheiro*[a], *Cicero Diego Almino Menezes*[a], *Francisco Elizaudo de Brito Junior*[a], *Ulysses Paulino de Albuquerque*[b], *Marta Regina Kerntopf*[a], *Henrique Douglas Melo Coutinho*[d,*], *Roselei Fachinetto*[e], *Irwin Rose Alencar Menezes*[a]

[a]*Laboratório de Farmacologia e Química Molecular, Departamento de Química Biológica, Universidade Regional do Cariri, Crato, CE, Brazil*
[b]*Laboratório de Etnobotânica Aplicada, Departamento de Biologia, Universidade Federal Rural de Pernambuco, Recife, PE, Brazil*
[c]*Faculdade Leão Sampaio Juazeiro do Norte, CE, Brazil*
[d]*Laboratório de Microbiologia e Biologia Molecular, Departamento de Química Biológica, Universidade Regional do Cariri, Crato, CE, Brazil*
[e]*Universidade Federal de Santa Maria, Santa Maria, RS, Brazil*

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ABSTRACT

This work describes the local knowledge of the medicinal use of *Stryphnodendron rotundifolium* Mart., Fabaceae, according to informants in two areas of the Araripe bioregion, in the Northeast Region of Brazil. We used interviews to investigate the ethnomedicinal use of the local species to determine the mode of use, frequency of administration, duration of treatment and restrictions of use. In traditional medicine, the use of *S. rotundifolium* is associated with the treatment of inflammatory and infectious diseases. The part of the plant most used was the stem bark (86.11%), the predominant mode of preparation was immersion in water (52.83%), and oral administration was the most cited (48.43%). For inflammatory and infectious diseases, the treatment lasted 3-10 days and the frequency of administration was 2-3 times/day. For gastroprotective effects, treatment lasted up to 30 days, and the herb was administered 1-3 times/day. For pain complaints, the therapy varied from 2-3 days to continuous administration. The informants (46.87%) did not mention restrictions of use, except for pregnant women, with a rate of 25%. A comparison of these results with the ethnopharmacological information from other studies showed that some of the traditional indications are scientifically supported by the literature or clinical studies. Nevertheless, the results showed that pharmacologists have not fully investigated all the possible bioactivities that healers credit to this plant.

* *Corresponding author.*
E-mail: hdmcoutinho@urca.br (H.D.M. Coutinho).
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Introduction

A historical perspective on the use of medicinal plants for the treatment and cure of disease shows that this practice (known as folk medicine) has been associated with humanity since ancient times (Halberstein, 2005). Added to this fact, a significant proportion of the world's population uses plants for medicinal purposes as the only therapeutic resource (WHO, 2001). Traditional knowledge about plants and their medicinal uses results from the accumulated experience of hundreds of years, and is crucial for the sustainability of species (Calixto 2005; Signorini et al., 2009).

Traditional practices exert a direct influence on the country's development and rational use of biodiversity with valuable cultural importance. Natural products and research in the field of medicinal plants have helped in the discovery of various bioactive compounds and elucidation of their mechanisms of action. In this respect, ethnopharmacology is the branch of scientific knowledge that seeks to support the use of natural resources for the development of studies regarding their biological properties, hence providing a database of relevant plants. Thus, by using traditional knowledge, much information can be obtained concerning the use and application of natural resources and their properties given by the respondents (Canales et al., 2005).

Regional biodiversity provides several widely used plant species with medicinal potential to local people for health care. One of such plants is *Stryphnodendron rotundifolium* Mart., Fabaceae, known by local people living in the Chapada do Araripe (NE Brazil). This species has been used by traditional communities for their antimicrobial (Oliveira et al., 2011), anti-ulcer and anti-inflammatory properties, among others (Rodrigues et al., 2008). The genus *Stryphnodendron*, a member of the family Fabaceae, presently includes 21 species and one subspecies, with characteristic geographical distribution in North (PA, AM, TO), Northwest (MA, PI, CE, BA), Central-West (MT, GO, MS), Southeast (MG, SP), South (PR) and *caatinga* environments in Brazil (Forzza, 2010). The species *S. rotundifolium* is popularly known as *barbatimão*. Local populations in northeastern Brazil traditionally treat various types of inflammation (Albuquerque et al., 2007) using the stem bark. This study is important to assess the importance of this species for disease treatment by people in local communities, and to provide strategies for the local management of the species.

The purpose of the present work was to survey members of local communities in the Araripe region regarding the knowledge of the medicinal use of *S. rotundifolium* and the importance of this species to healers.

Materials and methods

Description of the study area

Two different rural zones, around the cities of Crato (7° 14' 03'' N, 39° 40' 34'' W) and Santana do Cariri (7° 11' 18'' N, 39° 73' 13'' W) in the state of Ceará were studied. Crato is located around the Araripe plateau and has a population of 121,428 inhabitants; 20,512 reside in rural areas, with a demographic density of 104.87 and 65.94 in rural zones (inhab/km²). The city of Santana do Cariri is located on the plateau and has a population of 17,170 inhabitants; the rural resident population is 8,348 with a demographic density of 20.07 and 26.76 in rural zones (inhab/km²). All communities studied were situated around the Araripe plateau area (Fig. 1). The geographic location of the Araripe plateau coordinates are 39º00'-40º50' W and 7°15'-7°50' S. The weather on the Araripe plateau is classified as tropical with an average yearly temperature of 23-39°C, an estimated mean of 24ºC, and rainfall of 1000-2000 mm/year and a means over 1000 mm/year (summer/fall); it falls into the 4bTh and 4cTh bioclimatic category of Gaussen (Nimer, 1972; Andrade, 1977). Both biogeographical zones are characterized by a biome of diverse geological and geomorphological characteristics, soil, climate, hydrographic and hydrological features and vegetation. This region has various habitats, abundant water, rich floristic diversity and typical tropical rainforest. A standardized data collection sheet was used for the habitat description, which includes all necessary information about the physical attributes of the local environment (Fundetec, 1998). Vegetation of this plateau is made up of seasonal semi-deciduous forests below 700 m, and tropical rainforests (montane semi-perennial rainforest) at an altitude of 750-850 m, both on the hillside; while at the top sits a savanna ("*cerradão*"), an isolated tree savanna

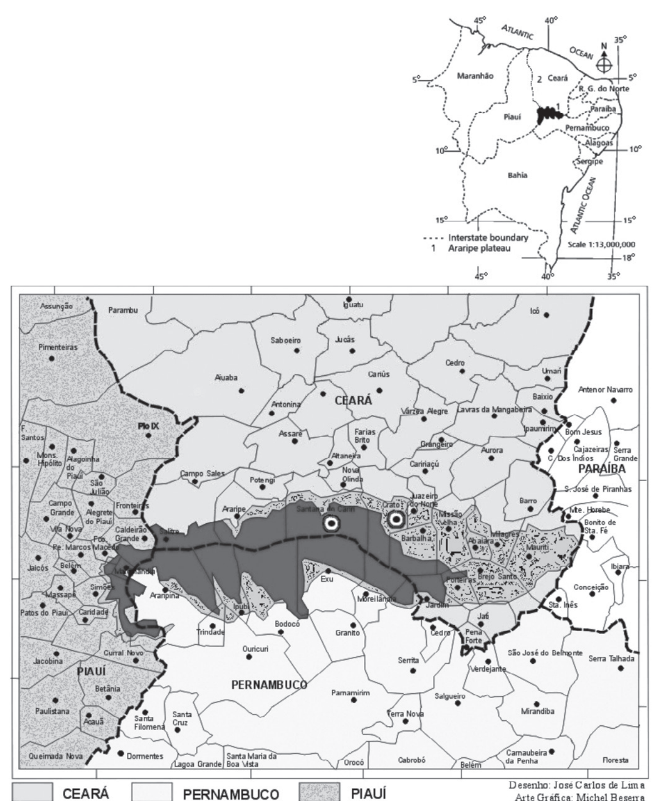

Figure 1 - Localization of the communities in Crato (latitude - 07° 14' 03'' N, longitude - 39° 40' 34'' W) and Santana do Cariri cities (latitudes - 07° 11' 18'' N, longitudes - 39° 73' 13'' W).

("*campo cerrado*") and a mountain deciduous shrubby vegetation ("*carrasco*") (Lima-Verde and Freitas, 2002).

The two cities were chosen because one is on the Araripe plateau and the other is located around the plateau at the National Forest of Araripe. People from the Guritiba and Lirio communities (Santana do Cariri) and Matinha, Mata Velha, Barreiro Grande and Baixa da Garganta communites (Crato) were selected for this study.

Data collection

Semi-structured questionnaires were given to the members of the different districts after informing them about the objectives of the investigation. They assisted and cooperated with the survey team. Interviews and conversations were used to administer the questionnaires to preserve the spontaneity of the information. The ethnopharmacological survey was carried out in June and July 2009, and included all traditional healers such as herbal practitioners, fetish priests and divine healers. The selection of healers was based on the recommendation from elders and local authorities. The data were obtained from informal and semi-structured interviews. Information regarding personal data (name, sex, age, marital status, place of birth, main occupatio, n and level of schooling), as well as data of the studied species (use, part used, route of administration, contraindications, doses, restrictions of use) were obtained from the interviews. We applied a snowball sampling approach (Albuquerque et al., 2010), we asked each informant to suggest other people experienced in traditional plant use. A total of 33 healers (seventeen men and sixteen women) between the ages of 23 and 80 (mean of 48 years) were selected for this study.

The research followed the recommendations for studies involving humans in accordance with Resolution 196/96 of the National Council of Health, and the informants signed an informed consent form. The study was reviewed and approved by the Committee of Ethics in Research of the Faculty of Medicine of Juazeiro do Norte (Process No. 2009_0433).

The study species, *Stryphnodendron rotundifolium* Mart., Fabaceae, was collected, samples were identified by Dr. Maria Arlene Pessoa and a voucher specimen (number 4661) was deposited in the Herbarium Caririense Dárdano de Andrade Lima at the Regional University of Cariri.

Data analysis

Three different measurements of knowledge were used (Chart 1). These parameters indicated how *S. rotundifolium* was potentially used and how knowledge about its uses was distributed among the informants. Statistical tests were applied to evaluate differences in the number of uses indicated between females and males and between two age categories, 18-39 and ≥ 40 years of age (chi-square test at the 5% level significance), using the software BioEstat V.5.0 (Ayres et al., 2007). All informants were grouped into age and gender categories. To calculate the use-diversity value (UD), therapeutic uses were classified according to the following injuries/disorders: gastrointestinal, dermatological (skin and subcutaneous tissues), urinary, infectious and inflammatory, general health and metabolic, respiratory, gynecological and reproductive, and parasitic diseases and cytostatic purposes (Chart 1). A descriptive statistical method and percentages were used to analyze the ethnobotanical data on the reported medicinal plants.

Results and discussion

The characteristics of the informants are listed in Table 1, which shows geographical equivalence, where nineteen (57.58%) were interviewed for the municipality of Santana do Cariri and fourteen people (42.43%) in the rural city of Crato. Age classes were taken into consideration: eight (24.24%) were younger than 40 year of age, 18 (54.55%) were 40 to 58 years old and 7 (21.21%) aging more than or 60 years old. In this study, 21.9% were male participants and 34.4% were females in Santana do Cariri, CE; and there were 28.1% males and 15.6% females in the Crato rural area. Regarding occupation, 25 (75.76%) engaged in agricultural activities and eight (24.24%) reported not doing any agricultural work. Most of the informants had minimal schooling, while only one (3%) of them had a university degree; the majority (28.85%) only

Chart 1
Knowledge measurements calculated for *Stryphnodendron rotundifolium* in Santana do Cariri and Crato cities, Ceará, Brazil.

Index	Calculation	Description
Consensus value for plant part (CPP) $CPP = \frac{P_x}{P_t}$	CPP represents the number of times a given plant part was cited (Px), divided by the total number of citations of all parts (Pt).	This index measures the degree of agreement between informants concerning the plant part used.
Use-diversity value (UD) $UD = \frac{U_{cx}}{U_{ct}}$	The use-diversity value is calculated as the number of citations for a use category (U_{cx}) divided by the number of citations considering all use categories (U_{ct}).	Use-diversity value (UD) is the index that measures the importance of use categories and how they contribute to the total value of uses.
Fidelity level (FL) $FL\ (\%) = \left(\frac{N_p}{N}\right) \times 100$	This index was calculated dividing N_p, the number of use-reports cited for a given species for a particular ailment, by N_p, the total number of use-reports cited for any given species.	The fidelity level determines the informant consensus about each therapeutic indication mentioned for the species studied.

Table 1
Socio-cultural data of respondents, including number of interviewees in Crato and Santana do Cariri municipalities.

	Number of interviewees	%
Place		
Crato – CE	14	42.43
Santana do Cariri – CE	19	57.58
Age		
39 or under	8	24.24
40-58	18	54.55
60 or above	7	21.21
Sex		
Men	17	51.52
Women	16	48.48
Occupation		
Agriculture	25	75.76
Other	8	24.24
Level of Education		
No education	1	3.03
Primary	26	78.79
Middle	2	6.06
High school	4	12.12
University	1	3.03

had primary education (elementary school), while a small proportion (4.12%) had a high school education. Except for primary level education, male healers had a higher education than did female healers.

We considered different medicinal use categories based on the body system treated (Chart 2). A total of 43 medicinal uses were attributed to *Stryphnodendron rotundifolium*, of which 23 were indicated by women and 20 by men. This showed that men and women indicated a similar number of uses for the study species, as demonstrated by the chi-square test (χ^2 = 0.093; p = 0.7604). The average number of uses reported by informants was 4.71, but variation between young (2.67) and older (6.25) individuals was observed. Older informants mentioned more different clinical uses than did younger ones, where older informants indicated 25 uses in comparison to 15 uses indicated by younger informants. Nanyingi et al. (2008) reported that informants between 58 and 77 years old mentioned more species than did younger informants. This fact can be explained by the greater experience of older individuals in using knowledge about medicinal plants obtained by the transfer of experience and knowledge.

Reliability level, use-diversity value and part used of the S. rotundifolium

Reliability level (RL), which estimates the agreement between the traditional healers about a reported use, was calculated for the most reported health problems. The RL values identified for *S. rotundifolium* about the medicinal use indicated by the informants in the two places investigated (Crato and Santana do Cariri) are presented in Table 2. The most reported use in injuries/diseases was wound healing. The RL for this use in both regions were 61.5 and 52.6% for Crato and Santana do Cariri, respectively. The use with the second highest RL was inflammation, which was, respectively, 46.1 and 42.1%. The use of the plant to cure infections was as high as 38.5% in Crato (third highest RL in this area) and 21% in Santana do Cariri.

The RL for the reported diseases was high in general, showing a high degree of agreement between the traditional healers on the uses of *S. rotundifolium*. It was therefore observed that the highest RL were for wounds, followed by use to treat inflammation, in general, and with regard to gastritis and pains. In addition, the use-diversity value showed that the use category of infection and inflammation was the category most cited among the informants (0.65 in Santana do Cariri and 0.65 in Crato) (Table 3). Some ethnobotanical studies in Northeast region of Brazil show the importance of anti-inflammatory and wound healing uses of medicinal plants in the Brazilian semiarid region (Albuquerque et al., 2007; Araújo et al., 2008). It has been suggested that the same use of a medicinal plant by different people from different areas is often considered to be a good and reliable indicator of potential therapeutic properties .

The plant part most commonly indicated for medicinal purposes was the stem bark, with an informant consensus for that plant part of 0.68 in Santana do Cariri and 0.80 in Crato (Table 4). There was prevalent use of the bark of *S. rotundifolium* by the residents of both places. The data in the literature confirm the popular use of the stem bark of species of the genus *Stryphnodendron* to treat several disorders affecting human health, specially infections (Souza et al., 2009), inflammatory processes (Lima et al., 1998) and leukorrhea and other gynecological problems (Oliveira et al., 2012), and for antibacterial (Oliveira et al., 2011), anti-ulcer (Rodrigues et al., 2008), antifungal (Ishida et al., 2006) and wound-healing (Lopes et al., 2005) purposes. In addition, this information indicated a higher use pressure in the study species, since the stem bark is the main part of the plant used.

Method of preparation and route of administration

The methods of use and preparation of *S. rotundifolium* for medicinal use were also investigated. The majority of informants indicated preparation using an aqueous medium by immersion (58.49% of the citations) or decoction (32.80%), which represented the most commonly, used methods of preparation. Nevertheless, other useful solvents were reported, including oil, butter and cow's milk. According to the informants, the harder parts of the plant must be decocted and the softer prepared as an infusion, however the differences between methods of preparation were very small. Some of the indications (9.43%) involved the use of preparations from mashed material, and other kinds of preparations were used for few indications.

In the literature, species of the genus *Stryphnodendron* are used in decoctiosn or infusion of the stem bark to treat various infections, as well as diarrhea and inflammatory reactions (Rebecca et al., 2002). In traditional medicine, the decoction of the bark of *Stryphnodendron adstringens* is widely used for

Chart 2
Categories of medicinal uses of *Stryphnodendron rotundifolium* (barbatimão) in Santana do Cariri and Crato cities in Ceará, Brazil.

Illness category	Biomedical terms	
Gastrointestinal	Antispasmodic	Gastroprokinetic
	Stomachic	Resolutive
	Anti-dysenteric	Emetic
	Gastroprotective	Antiemetic
	Carminative	Biliary lithiasis treatment
	Cholagogue	Hepatic protector
	Laxative	
Dermatology	Emollient; dermatologic protector	
	Alopecia	Vulnerary
	Complexion	Astringent
	Keratolytic	Anti-cellulite
	Anti-allergic	
Urinary	Diuretic and urinary tract diseases	Lithiasis treatment (renal)
Infectious and inflammatory	Anti-inflammatory	Antifungal
	Antipyretic	Anti-influenza
	Anti-rheumatic	Analgesic
	Anti-neuralgic	Anti-podagric
	Anti-arthritic	Anti-edema
	Antiseptic	
General health and metabolic	Anxiolytic	Hypocholesterolemic
	Diaphoretic	Phlebotonic
	Sedative	Hypoalbuminemic
	Anti-migraine	Anti-anemic
	Antidepressant	Anti-asthenia
	Anesthetic	Anti-diabetic
	Anti-tobacco	Anti-alitosis
	Anti-vertiginous	Anti-aging
	Otologic drugs	Ophthalmologic drug
	Anti-hemorrhoidal	Oral antiseptic
	Hypotensive	
Respiratory	Bronchodilator	Mucolytic
	Anti-asthmatic	Cough suppressant
	Anti-catarrhal	
Gynecologic and reproductive	Emmenagogue	Anti-galactogogue
	Sexual stimulant	Abortive
	Menopause	Galactogogue
	Infertility treatment	Childbirth induction
	Anti-emmenagogue	
Parasitosis	Anti-malaria	Vermifuge
	External anti-parasitic	
Cytostatic	Anti-neoplastic	

Table 2
Comparison of fidelity level (FL) regarding the medicinal indications of the *Stryphnodendron rotundifolium* (barbatimão) in two different areas, Santana do Cariri and Crato cities in Ceará, Brazil.The reported uses that did not show more than 5% agreement were not included.

Crato-CE		Santana do Cariri-CE	
Medical indications	**FL**	**Medical indications**	**FL**
Wounds	61.5	Wounds	52.6
Inflammation	46.1	Inflammation	42.1
Gastritis	38.5	Vaginal inflammation	21.0
Vaginal inflammation	38.5	Gastritis/ulcer	21.0
Pain	30.8	Infection	10.5
Infection	23.0	Abortive effect	5.3
Bone pain	15.4	Neoplastic	5.3
Diseases of the prostate	15.4	Sexually transmitted disease	5.3
Rheumatism	7.7	Hypertension	5.3
Dermatitis	7.7	Burns	5.3
Menopause	7.7	Postpartum healing	5.3
Renal calculi	7.7	Influenza	5.3
Lung diseases	7.7		

Table 3
Use-diversity value (UD) for categories of therapeutic indication for *Stryphnodendron rotundifolium* (barbatimão) in two different cities in the semiarid region of northeastern Brazil.

Category	Santana do Cariri	Crato
Infectious and inflammatory	0.65	0.65
Gynecologic and reproductive	0.22	0.16
Gastrointestinal/ulcer	0.13	0.12
General health and metabolic	0.03	0.05
Cytostatic	0.03	0.05
Respiratory	0.03	0.02
Dermatology	-	0.02
Urinary	-	0.07
Parasitosis	-	-

Table 4
Informant consensus for plant part (CPP) of *Stryphnodendron rotundifolium* (barbatimão) in two different cities in the semiarid region of northeastern Brazil.

Plant part	Santana do Cariri	Crato
Bark	0.68	0.80
Root	0.18	-
Inner bark	0.09	0.30
Leaf	0.05	-

the treatment of vaginal inflammations and cleansing of wounds (Macedo and Ferreira, 2004); cutaneous wound healing (Coelho et al., 2010); and as anti-nociceptive (Melo et al., 2007) and antimicrobial (Soares et al., 2008, Fiori et al., 2013) remedies.

The most prevalent types of preparation, as shown by the above-mentioned data, were immersion and decoction of the bark of the plant, used by the communities around the Araripe Plateau in both municipalities investigated.

The methods of administration described by the communities are listed in Table 5. The more common types of administration of the plant were oral ingestion, topical application and as a bath, with rates of 48.43, 25 and 14.06%, respectively. Oral use was predominant, likely due to the low toxicity of the plant; a gastroprotective and acute toxicity study reported that the LD_{50} of an ethanolic extract of *S. rotundifolium* in mice was greater than 2000 mg/kg (Rodrigues et al., 2008).

Duration of the treatment, dose and counter-indications

The informants' responses indicated that there were variations in the dose of the remedies, and duration and time of treatment. These data are given in Table 6. The results show that for the most mentioned diseases, there was variation in the duration of the therapeutic treatment as well as the frequency of administration. The maximum duration of treatment was 30 days, or continuous in the cases of rheumatic pains and respiratory diseases. Ethnopharmacological studies in the literature do not demonstrate a standardization of the dose used, and therefore, several aspects such as age and physical appearance of the patient, sociocultural factors, and experience of individual herbalist may influence the choice of dose and treatment duration (Teklehaymanot and Giday, 2007).

Most of the informants mentioned that the species did not show restrictions for its use (46.87%), but the interviewees did note that depending on the treatment, oral use was contraindicated during pregnancy (25%) and in children (21.87%) (Table 7). An evaluation of *S. adstringens* in mice demonstrated low toxicity with no deaths after oral treatment with a dose of 2699 mg/kg and LD50 of 3015 mg/kg (Rebecca et al., 2002).

Table 5
Method of medicinal administration of the species *Stryphnodendron rotundifolium* Mart. *(*barbatimãwo*)* in Santana do Cariri and Crato, Ceará, Brazil.

Methods of medicinal administration of *Stryphnodendron rotundifolium*	Number of citations	%
Oral	31	48.43
Topical	16	25.00
Hygienesummons	7	10.94
Bath	9	14.06
Cleaning of wounds and lesions	1	1.57

Literature information about pharmacological activity of Stryphnodendron

The literature reports that species of the genus *Stryphnodendron* have several popular indications for medicinal purposes, many of this still lacking scientific investigation. The most studied species is *S. adstringens*, for which anti-inflammatory and analgesic activities, and protective effects on the gastric mucous membrane have been reported (Rebecca et al., 2002). Moreover, the antioxidant and antimicrobial effects of the stem bark extracts have been attributed to the presence of tannins (Souza et al., 2013). The bark extracts of this species has also demonstrated antifungal action against *Candida* spp. (Ishida et al., 2006) and *Cryptococcus neoformans* (Ishida et al., 2009); as well as antimicrobial effect against *Pseudomonas aeruginosa* and *Staphylococcus aureus* (Coelho et al., 2010). A study by Vilar et al. (2010) evaluated the cytotoxic, mutagenic, and genotoxic effects of the stem bark of *S. adstringens* using the Ames test.

Data in the literature confirm the use of stem bark from species of the genus *Stryphnodendron* for various infections. Accordingly, investigations evaluating the effect of stem bark extracts, have demonstrated wound-healing activity by increasing epithelial tissue in wounds made in mice.

Table 6
Therapeutic indication, duration of the treatment and frequency of administration in the medicinal use of *Stryphnodendron rotundifolium (*barbatimão*)* in Santana do Cariri and Crato cities in Ceará, Brazil.

Indication	Duration of treatment	Frequency of administration
Gastritis/ulcer	10-30 days	1-3 times / day
Infection/inflammation and healing	3-10 days	2-3 times / day
Vaginal infection	7 days	3 times / day by vaginal bath
Pain	2-3 days	2 times / day
Rheumatic pains	Indefinite	3 times / day
Abortive	3 days	2-3 times / day
Lung diseases	Indefinite	2 times / day

A study of the antimicrobial activity of *Stryphnodendron barbatiman* against *Citrobacter freundii* was recently reported (Souza et al., 2013). Fractions of the extracts were also used to prove antibacterial activity against *Staphylococcus aureus* and gram-negative bacteria, also demonstrating growth-inhibitory and anti-free radical properties (Zocoler et al., 2009). This species has been shown to contain 12-19% tannins in the stem bark (Lopes et al., 2003). There are also reports of the evaluation of biological activities attributed to the seeds of the species *Stryphnodendron obovatum* Benth, whose medicinal relevance relies on its antifungal activity (Sanches et al., 2005), skin wounds healing (Lopes et al., 2005) and cytotoxic effects (Vasconcelos et al., 2004). Similarly, the extract of *S. obovatum* has demonstrated antioxidant action, attributed to the presence of flavonoids and tannins (Zocoler et al., 2009).

A pioneer study of *S. rotundifolium* carried out in the state of Ceará, investigated the antimicrobial and anti-ulcerogenic properties of the bark ethanol extract, demonstrated a gastroprotective effect against damage to the mucous membrane induced by ethanol, as well as bacterial growth-inhibition properties (Rodrigues et al., 2008). The authors attributed these properties to the tannins and flavonoids in the extract.

Data in the literature indicate that phenolic compounds, including tannins and flavonoids, have therapeutic effects, including anti-inflammatory, antifungal and antioxidant, and healing properties as well (Zuanazzi and Montanha, 2004). Tannins play an important role as anti-inflammatory agents and in the treatment of wounds. Flavonoids participate in the activation of enzymes in anti-inflammatory processes (Middleton et al., 2000; Okuda, 2005).

Tannins promote wound healing through an antioxidant action, acting as oxygen radical scavengers, promoting fibroplasia, reorganization of the capillary bed, keratinocyte proliferation and cell differentiation (Fernández et al., 2002; Deters et al., 2001). An ethnopharmacological study involving medicinal plants containing tannins and flavonoids in the state of Pernambuco, Brazil, identified therapeutic uses for gastritis, wounds, skin diseases, inflammation and vaginal inflammation, among others (Araújo et al., 2008).

Table 7
Restrictions in the medicinal use of *Stryphnodendron rotundifolium (*barbatimão*)* in Santana do Cariri and Crato, Ceará, Brazil.

Restriction	Number of informants	%
Stryphnodendron rotundifolium Mart.	n (32)	
Pregnancy	8	25.00
Children	7	21.87
Cardiopathies	1	3.12
Hypotension	1	3.12
None	15	46.87
Lung diseases	Indefinite	2 times / day

Final considerations

The data compiled in this study contribute to the development of larger and interdisciplinary studies on the medicinal uses of *S. rotundifolium* to improve its efficacy, to establish appropriate doses and to identify related toxicological effects. The results obtained in the present work indicate that further ethnopharmacological studies of this species are worthwhile. In this case, further studies of *S. rotundifolium* would be required for *in vitro* and *in vivo* evaluation of the wound-healing and anti-inflammatory properties of the stem bark, which may help for bioprospection of this plant; this is the search for new plant substances effective in treating inflammation. Moreover, given the information the importance of its use in the region of Chapada do Araripe, and considering that the stem bark is the main part of the plant used, future studies should investigate the population structure of this species in order to obtain information about the conservation status of these populations in the region.

Authors contributions

DRO, WSFJ, VCNB, PGP, CDAM, FEBJ, and FEBJ collected the ethnopharmacological information from the informants during the whole research and analysis, interpretation and writing of the paper. UPA, MRK, HDMC, RF and IRAM participated in the analysis, interpretation, coordination and preparation of the manuscript. All of the authors read and approved the manuscript.

Conflicts of interest

The authors declare no conflicts interest.

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