SVOA Microbiology

e-ISSN 2634-534X

ScienceVolks Open Access

Systematic Review

Phytochemical Potential and Pharmacological Activities of *Hancornia speciosa* Gomes (Apocynaceae): A Systematic Review

Fábio Caboclo Moreira[1], José Thyálisson da Costa Silva[2], Viviane Bezerra da Silva[2], Adrielle Rodrigues Costa[2], Dieferson Leandro de Souza[2], Janês Inês de Brito[2], Anna Lídia Nunes Varela[2], Daniela Jomara Caruço de Oliveira[3], Lucas dos Santos Sa[2], Leandro Marques Correia[4], Antonio César Vieira da Silva[2], Rafael de Carvalho Mendes[5], Hayane Mateus Silva Gomes[2], Maria Elizete Machado Generino[2], Yedda Maria Lobo Soares de Matos[2], Cícera Natalia Figueirêdo Leite Gondim[2], Lucas Yure Santos da Silva[2], José Weverton Almeida Bezerra[2]*

[1]Regional of University of Blumenau, Blumenau – SC, Brazil.

[2]Regional University of Cariri, Crato – CE, Brazil.

[3]Federal University of Paraná, Curitiba – PR, Brazil.

[4]Federal University of Cariri, Juazeiro do Norte – CE, Brazil.

[5]Paraíso Medical Faculty, Araripina - PE, Brazil.

***Corresponding Author:** Prof. Dr. Jose Weverton Almeida-Bezerra, Department of Biological Chemistry, Regional University of Cariri, 63105-000, Crato, CE, Brazil.

https://doi.org/10.58624/SVOAMB.2026.07.005

Received: February 10, 2026

Published: April 08, 2026

Citation: Moreira FC, Silva JTC, Silva VB, Costa AR, Souza DL, Brito JI, Varela ALN, Oliveira DJC, Sa LS, Correia LM, Silva ACV, Mendes RC, Gomes HMS, Generino MEM, Matos YMLS, Gondim CNFL, Silva LYS, Almeida-Bezerra JW. Phytochemical Potential and Pharmacological Activities of Hancornia speciosa Gomes (Apocynaceae): A Systematic Review. *SVOA Microbiology* 2026, 7:2, 46-54. doi: 10.58624/SVOAMB.2026.07.005

Abstract

The relevance of *Hancornia speciosa* Gomes, popularly known as mangabeira, a native Brazilian species with traditional medicinal use, therefore, the main objective of this work was to carry out a critical and comprehensive evaluation of the information published about the "mangabeira", focusing on its chemical constituents, pharmacological properties and biological effects. The methodology consisted of a systematic review of the scientific literature, with a search in databases such as SCOPUS, using descriptors faithful to the phytochemistry and biological activities of the species. The results revealed a remarkable phytochemical complexity, with the predominance of phenolic compounds (such as rutin and chlorogenic acid) and cyclitols (such as bornesitol) in its various parts of the plant (leaves, bark and latex), substantiating its multiple biological activities, including antidiabetic effects, acting by inhibiting α-glucosidase, cardiovascular (antihypertensive and vasorelaxant), anti-inflammatory and leishmanicidal effects. We conclude that the integration of chemical and pharmacological data confirms the significant therapeutic potential of *H. speciosa*, although it highlights the need for future investigations to fully explore its value as a promising resource for phytotherapy.

Keywords: *Disease Treatments, Medicinal Plant, Health, Phytotherapies, Chemistry.*

Introduction

Given the increasing prevalence of chronic and complex diseases and the limitations of many conventional pharmacological treatments, the search for strategies that promote health and quality of life has become a priority in the modern world [1]. The use of medicinal plants for therapeutic purposes has been known since antiquity, being used both in traditional medicine and in contemporary approaches in various cultures. These plants are relevant resources for health promotion, and, with the advancement of scientific research, their efficacy has been progressively recognized, favoring the incorporation of phytotherapy into evidence-based medicine [2,3].

According to the World Health Organization (WHO), about 80% of the population of developing countries uses traditional practices in basic health care, and approximately 85% resort to the use of medicinal plants or their derivatives [4]. In this context, natural products of plant origin play a prominent role in the prospection of new drugs, since their wide structural diversity and multiple biological activities make them fundamental for the development of innovative therapies [5,6].

Following this panorama, Brazil has the greatest plant diversity on the planet, with about 60 thousand species of higher plants already cataloged. however, less than 10% of these species have been investigated for the potential to obtain bioactive compounds, and only about 20% have undergone systematic evaluations of their medicinal properties [4]. This limitation highlights a significant gap in scientific knowledge, since only a small portion of the known species have been studied from a chemical point of view, and an even more restricted contingent has undergone pharmacological evaluations. Such a scenario highlights the need to expand the characterization and validation of these plants to take full advantage of their bioprospective potential [7,8].

In this scenario, several botanical families have shown to be promising, as a highlight, the Apocynaceae family is one of the largest among the angiosperms, has a wide distribution in tropical regions, also occurring in temperate zones, bringing together more than 300 genera and about 5,000 species [9]. In addition to its taxonomic diversity, the family is distinguished by its complex floral morphology, especially by the presence of gynostegio, and by an intricate evolutionary history, marked by multiple transitions between herbaceous and woody habits, as indicated by recent phylogenetic [10].

Within this family, the species *Hancornia speciosa* Gomes (Figure 01), popularly known as "mangabeira", is a fruit tree native to Brazil, with great socioeconomic and medicinal relevance [11]. Various parts of the plant, including leaves, fruits, bark, latex, and seeds, are explored in folk medicine for the treatment of conditions such as inflammation, diarrhea, and hypertension [11]. The species *H. speciosa* has a small to medium tree size, with a height ranging from 2 to 15 meters and a generally irregular crown [12].

Figure 1. Ripe fruit of *Hancornia speciosa* Gomes (Apocynaceae) in Chapada do Araripe, Jardim - CE, Brazil.

Therefore, the search proposal and highlight the importance of a detailed analysis of the species *H. speciosa*, allows us to recognize the therapeutic potential of the plant and better understand its possible applications in the health area, so this study aims to carry out a critical and comprehensive evaluation of the information published on *H. speciosa*, with emphasis on its chemical constituents, pharmacological properties and associated biological effects.

Methodology

This methodological strategy was based on models previously established in the scientific literature. The main objective of this review was to answer the following question: "What is the available scientific evidence about the phytochemical composition, biological activities and therapeutic properties of *H. speciosa*?". To this end, a search for studies was carried out in the SCOPUS databases (Figure 2).

In order to ensure a comprehensive and targeted search for *H. speciosa*, strategic descriptors were selected that contemplated the main axes of the study. The keywords used covered aspects related to the phytochemistry, biological activities and pharmacological properties of the species, including: *Hancornia speciosa*, Mangabeira and Mangaba.

Original studies published in English, Portuguese, available in full and indexed in recognized scientific databases, which directly addressed the chemical and biological characteristics of *H. speciosa* were considered eligible, the period was used 2019 to 2025.

On the other hand, abstracts from conferences, book chapters, literature reviews, monographs, books/ebooks, paid articles and other documents that were not configured as original articles, as well as studies that did not specifically deal with the biological and biochemical activities of the species, were excluded.

Based on the search strategy adopted, using exclusively the Scopus database and considering articles on *H. speciosa*, 36 articles were initially identified. After applying the previously established inclusion and exclusion criteria, 25 studies were excluded. Thus, 11 articles met the defined criteria and were selected to compose the final analysis of the study Figure 2.

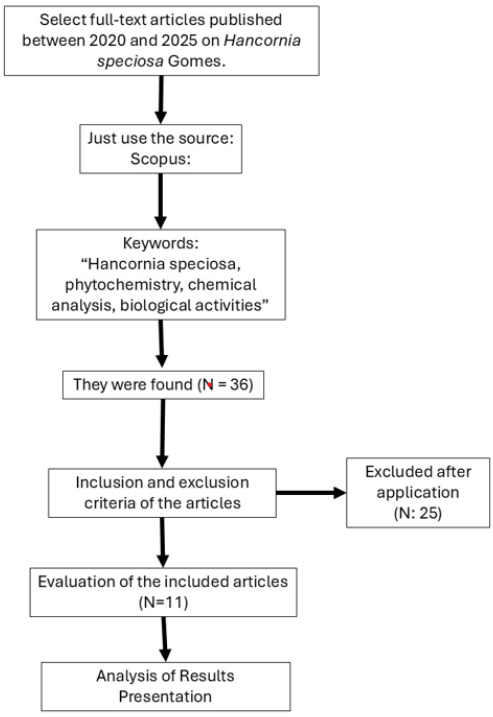

Figure 2. Flowchart: Steps used in searching for articles.

Results

From the review of the scientific studies consulted, the extracted data were gathered and organized in Table 1. It summarizes the findings related to the phytochemical composition of *H. speciosa*, including the plant portion evaluated in each study, the techniques used for the analysis, the compounds identified and the corresponding bibliographic sources.

Table 1. Phytochemistry and parts of *Hancornia speciosa* Gomes (Apocynaceae).

Parts	Type of extract	Analytical techniques	Constituents	References
Leaves	Ethanol Extract obtained by percolation with ethanol 96 °GL	UPLC-DAD-ESI-MS/MS e RMN	3-O-β-(3′-R-hidroxi)-hexadecanoil-lupeol	Pereira *et al.,* 2022
Fruit	Hydroalcoholic extract (70% methanol)	HPLC-DAD/UV-Vis	Gallic acid, caffeic acid, catechin and rutin.	Zitha et al., 2022
Latex	Aqueous extract	HTPLC, NMR e FT-IR	1-O-methyl-myo-inositol (bornesitol) Cornoside Dihydrocornoside	Tomazi et al., 2021
Fruit	Aqueous extract	HPLC-DAD	Rutin, chlorogenic acid	Bitencourt et al., 2024
Bark	Sulfuric Ethereal Extract	(GC-MS) (MIC)	[...]	Silva et al., 2024a
	Extrato Methanolic			
Stem bark	Extrato methanolic and Extrato ethereal sulfuric	UPLC-MS-ESI-QTOF	Gluconic acid, cinconain Ib, cinconain IIb, cinconain Ib isomer and lariciresinol hexoside isomer	Silva et al., 2024b
Leaves	Aqueous extract	HPLC/DAD	Rutin, chlorogenic acid	Ribeiro et al., 2023
Fruits	Hydroalcoholic Extract	HPLC	Routine Chlorogenic acid Ferulic acid	Santos et al., 2021
Fruit	Fruit juice	HPLC-DAD-MS/MS	L-bornesitol, quinic acid, chlorogenic acid and rutin	Yamashita et al., 2020
Pulp + Peel	Dichloromethane extract	GC-MS	Lupeol acetate, α-amirine and α-amirine acetate.	Leite *et al.,* 2025
Latex	Raw Latex Aquoso	HPLC	Phenolics and carbohydrates	Castro et al., 2024

HPLC – High Performance Liquid Chromatography, DAD – Diode Array Detector, UV-Vis – Ultraviolet-Visible Absorption Spectrometry, MS/MS – Tandem Mass Spectrometry, ESI – Electrospray Ionization, GC-MS – Gas Chromatography coupled to Mass Spectrometry, MIC- Minimum Inhibitory Concentration, HTPLC – High Performance Thin Layer Chromatography, NMR/NMR – Nuclear Magnetic Resonance, FT-IR – Fourier Transform Infrared Spectroscopy.

Based on the data from the 11 articles reviewed, it reveals a clear preference for the fruit of the plant, which represents most of the investigations, totaling approximately 36.4% of the cases. The leaves, latex, and bark (including the stem bark) were studied in similar proportions, each contributing about 18.2% of the total, demonstrating a distributed interest in these parts. As for the extraction methods, there is a predominance of high polarity solvents. The aqueous extract (including fruit juice) is the most frequent, corresponding to 45.5% of the studies, closely followed by alcoholic and hydroalcoholic extracts (methanolic and ethanolic), which add up to 36.4%. Extracts with organic solvents of lower polarity, such as sulfuric ether and dichloromethane, are less common, accounting for the remaining 18.2% of extraction techniques.

Regarding the analytical techniques used in the characterization of the constituents, the predominance of High-Performance Liquid Chromatography (HPLC) and its variants (UPLC, DAD, MS/MS) is highlighted, used in about 72.7% of the studies, evidencing their relevance in the separation and identification of polar and thermolabile compounds, such as rutin, chlorogenic acid, phenolics and carbohydrates. Gas chromatography coupled to mass spectrometry (GC-MS), aimed at the analysis of volatile or semi-volatile compounds, such as lupeol acetate and α-amyrin, was used in 18.2% of the studies. Complementary techniques, such as NMR and FT-IR, aimed at structural elucidation, were less frequent (9.1%), generally associated with liquid chromatography.

The data extracted from the selected studies were systematized in Table 2, offering an overview of the biological activities attributed to *H. speciosa*. This table summarizes the experimental models adopted, the methodological approaches applied, the effects observed, the bioactive substances detected, and the sources of the corresponding studies.

Table 2. Biological activities of *Hancornia speciosa* Gomes (Apocynaceae).

Biological activity	Biological model evaluated	Type of in vivo vitro tests	Results	Constituents	References
Antibacterial	*Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 25853 e *Staphylococcus aureus* ATCC 22923	*In vitro*	No intrinsic antibacterial activity (MIC > 512 µg/mL); modulating effect with antibiotic potentiation, especially against *E. coli* and *S. aureus*	-	Silva et al., 2024a
Antifungal	*Candida albicans* INCQS 40006	*In vitro*	The MEHS extract showed relevant antifungal activity (CI_{50} = 80.61 µg/mL) and the EEHS was able to completely inhibit the formation of hyphae.	Gluconic acid, cinconain Ib, cinconain IIb, cinconain Ib isomer, and lariciresinol isomer hexoside.	Silva et al., 2024b
	Candida krusei INCQS 40095	*In vitro*	Reduction in the amount and size of filamentous structures, especially with the EEHS extract.		
	Candida tropicalis INCQS 40042	*In vitro*	The EEHS and MEHS extracts potentiated the effect of fluconazole in all strains evaluated at subinhibitory concentration (MC/8).		

Table 2 continued....

Anti-inflammatory	Human neutrophils	*Ex vivo*	Significant reduction in ROS production in PMA-stimulated neutrophils, indicating anti-inflammatory potential.	Lupeol acetate, α-amirine and α-amirine acetate.	Leite *et al.,* 2025
Antihyperglycemic	*Danio rerio*	*In vivo*	The aqueous extract of latex, at doses of 500, 1000 and 1500 mg/kg, significantly reduced alloxan-induced hyperglycemia in adult zebrafish.	1-O-methyl-myo-inositol (bornesitol), cornoside and dihydrocornoside.	Tomazi *et al.*, 2021
Leishmanicidal	*Leishmania amazonensis*	*In vitro*	Reduction of edema, leukocyte migration and induced muscle damage.	Rutin and chlorogenic acid	Bitencourt et al., 2024
Antioxidant effect	*Human hepatocellular carcinoma cells (HepG2) (ATCC: HB8065)*	*In vitro*	All extracts significantly reduced the levels of Reactive Oxygen Species (ROS) induced by paracetamol.	Chlorogenic acid, rutin	Ribeiro *et al.*, 2023

The quantitative analysis of the 9 biological studies reported reveals a significant predominance of studies focused on antifungal activity, which corresponds to 33.3% of the total, followed by anti-inflammatory properties (22.2%), while antibacterial, antihyperglycemic, leishmanicidal and antioxidant activities each represent 11.1% of the evaluations. As for the methodology, there is a strong concentration in in vitro tests (66.7%), carried out mostly on microorganisms and cell lines, while in vivo tests on animal models such as *Danio rerio* and *Mus musculus* add up to 22.2%, and ex vivo tests with human neutrophils complete the remaining 11.1% of the sample.

In terms of chemical composition and efficacy, the studies highlight the recurrent presence of phenolic compounds, such as rutin and chlorogenic acid, as well as terpenes such as α-amyrin, which are directly associated with the positive results observed, such as the reduction of reactive oxygen species (ROS) and the modulation of antibiotic effects. The results demonstrate that, although many extracts do not have high intrinsic activity against bacteria, they have a crucial role in the potentiation of existing drugs, while in fungal and leishmania models, the extracts exhibited direct reductions in viability and inhibition of filamentous structures, consolidating the diversified pharmacological potential of the materials studied.

Discussion

3-O-β-(3′-R-hydroxy)-hexadecanoyl-lupeol is a triterpene identified in *H. speciosa*, associated with antidiabetic activity through inhibition of the enzyme α-glucosidase. As this is the first report of this compound in the species, it stands out as a potential chemical marker for the quality control of its extracts [13]. Their identification reinforces the presence of triterpene metabolites, a class often related to antidiabetic and anti-inflammatory activities in plant species [14]. Previous evidence indicates that lupeol esters contribute significantly to the pharmacological profile of different plants, especially for their anti-inflammatory and antioxidant effects [15].

Accordingly, *ex vivo analyses* in human neutrophils demonstrated a significant reduction in the production of reactive oxygen species (ROS) after PMA stimulation, suggesting anti-inflammatory potential of the sample, possibly associated with the presence of triterpenes such as lupeol acetate, α-amyrin, and α-amyrin acetate [16].

In addition to the effects attributed to triterpenes, phenolic metabolites, such as rutin and chlorogenic acid, are widely recognized for their role in modulating inflammatory and oxidative processes [17]. These compounds showed anti-inflammatory and anti-edematogenic activity in experimental in vivo models with mice (*Mus musculus*), promoting a significant reduction in edema, leukocyte migration, and induced muscle damage [18]. In addition, rutin has been shown to be effective in decreasing transaminase levels and improving hepatic histological architecture; in HepG2 cells, its association with chlorogenic acid resulted in a significant reduction in reactive oxygen species induced by paracetamol, reinforcing the antioxidant potential of these metabolites and providing subsidies to interpret the effects observed in this study [19].

H. speciosa extracts did not show intrinsic antibacterial activity against *E. coli*, *P. aeruginosa* and *S. aureus* (MIC > 512 µg/mL); however, they exhibited a relevant modulatory effect when associated with antibiotics, especially against *E. coli* and *S. aureus* [20]. In contrast, promising antifungal effects were observed, with the methanol extract active against *Candida albicans* and more effective than fluconazole against *C. krusei*, while the ethanolic extract inhibited the formation of hyphae in *C. albicans*. Additionally, both extracts potentiated the action of fluconazole against *C. tropicalis* at subinhibitory concentrations, an effect that may be related to the presence of phenolic compounds, such as gluconic acid, cinchonain Ib and IIb and lariciresinol derivatives, which are described as modulators of microbial resistance [20].

Latex showed multifunctional pharmacological potential, with a significant reduction in the viability of *L. amazonensis* and morphological changes suggestive of structural and metabolic interference, possibly associated with the joint action of carbohydrates and phenolic compounds [21]. The higher activity of the crude extract compared to the isolated fractions indicates the occurrence of a synergistic effect between the metabolites present. In a convergent way, the significant reduction of hyperglycemia in *Danio rerio* reinforces the systemic biological action of latex. The presence of 1-O-methyl-myo-inositol (bornesitol), carnoside, and dihydrocornoside may be associated with modulation of glucose metabolism, as previously described for compounds with similar structure and activity [22].

Conclusion

In a convergent way, *H. speciosa* stands out for its remarkable phytochemical complexity, characterized by a wide diversity of bioactive compounds such as phenols, flavonoids and cyclitols distributed among its leaves, bark and fruits. This rich chemical profile translates directly into a diverse biological spectrum, which includes antifungal, anti-inflammatory, antioxidant, antihyperglycemic, and leishmanicidal activities.

The association between biological efficacy and the presence of phenolic and triterpene compounds highlights the potential of the species as a source of bioactive metabolites, with direct or drug-modulating action. The growing interest in *H. speciosa* reinforces the need for further research. These advances can drive the development of innovative and sustainable solutions, strengthening future scientific research.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgement

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES). The authors also acknowledge the National Council for Scientific and Technological Development (CNPq) for the financial support.

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