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Mini-Review

*Dimorphandra gardneria*na Tul. (Fabaceae): Medicinal and Industrial Potential of a Brazilian Plant with Pharmacological and Bioactive Properties

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Abstract

The traditional use of medicinal plants, particularly in the Middle East and Asia, highlights the historical and contemporary importance of these herbs in the treatment of various diseases and infections. Among these plants, the Fabaceae family stands out for its incredible diversity and significant therapeutic potential, including the genus *Dimorphandra*, which has demonstrated remarkable efficacy in several studies. Known as fava d'anta, *Dimorphandra gardneriana* is a plant native to Brazil with significant pharmacological properties, due to the presence of rutin, a flavonoid with anti-inflammatory and antioxidant effects. This study aims to consolidate data on *Dimorphandra gardneriana*, reviewing its chemical constituents, biological activities, and pharmacological properties to provide a comprehensive overview of its medicinal potential. The review was conducted based on published material and new data collected through databases such as MEDLINE, PUBMED, and SCOPUS. The process included defining the topic, inclusion/exclusion criteria, extraction and classification of studies, evaluation, and interpretation of the results. The analysis revealed that *Dimorphandra gardneriana* contains several bioactive compounds, such as rutin, galactomannans, and quercetin. These compounds have demonstrated antioxidant, anti-inflammatory, and antimicrobial properties. Combined with their use in advanced controlled release technologies and the application of silver nanoparticles, these properties highlight their value not only in natural medicine but also in industry. These promising characteristics indicate potential future biological activities in various fields of scientific and technological research, with the potential to significantly contribute to the development of new treatments and innovative products in diverse areas of well-being and other sectors, in addition to presenting significant financial value.

***Keywords:** Phytotherapy, Health, Bioactivity, Pharmacognosy, Economic potential.*

Introduction

The use of medicinal plants is an ancient and currently widespread practice around the world. Medicinal plants have been used to treat a variety of diseases, prevent the development of epidemics, and combat infections caused by fungi and microbes [1].

Nowadays, most medicines are derived from components of these plants, based on their therapeutic properties [2]. Plants have been identified and classified for medicinal purposes, belonging to different families and botanical genera. Among these families, Fabaceae stands out for containing the largest number of species with therapeutic potential [3].

The Fabaceae family contains over 19,000 species, organized into around 695 genera. It presents an extensive variety of vegetative forms, including vines (or climbers), trees, shrubs, and herbs [4]. In addition to its significant role in food production, plants from the Fabaceae family also have great relevance in medicine and the economy [5].

Dimorphandra, from the Caesalpinioideae subfamily of the Fabaceae family, is found in the Cerrado and Semi-Arid regions of Brazil's Midwest and Northeast. Among its most studied species are *Dimorphandra mollis* Benth, *Dimorphandra gardneriana* Tulasne, and *Dimorphandra wilsonii* Rizz [6]. Known as “fava d’anta” or “faveiro,” it is a medicinal plant whose fruits and seeds are used in medications [7]. Its shoots contain rutin, a flavonoid with anti-inflammatory, antioxidant, and cardiovascular benefits [8].

Thus, the literature highlights the need for a comprehensive review of the medicinal properties of *Dimorphandra gardneriana* (Figure 01), providing a detailed account of its pharmacological characteristics and chemical compounds. This article aims to consolidate research data reported in the literature, offering an overview of its chemical constituents, highlighting its biological activities, and discussing relevant aspects of its pharmacological properties.

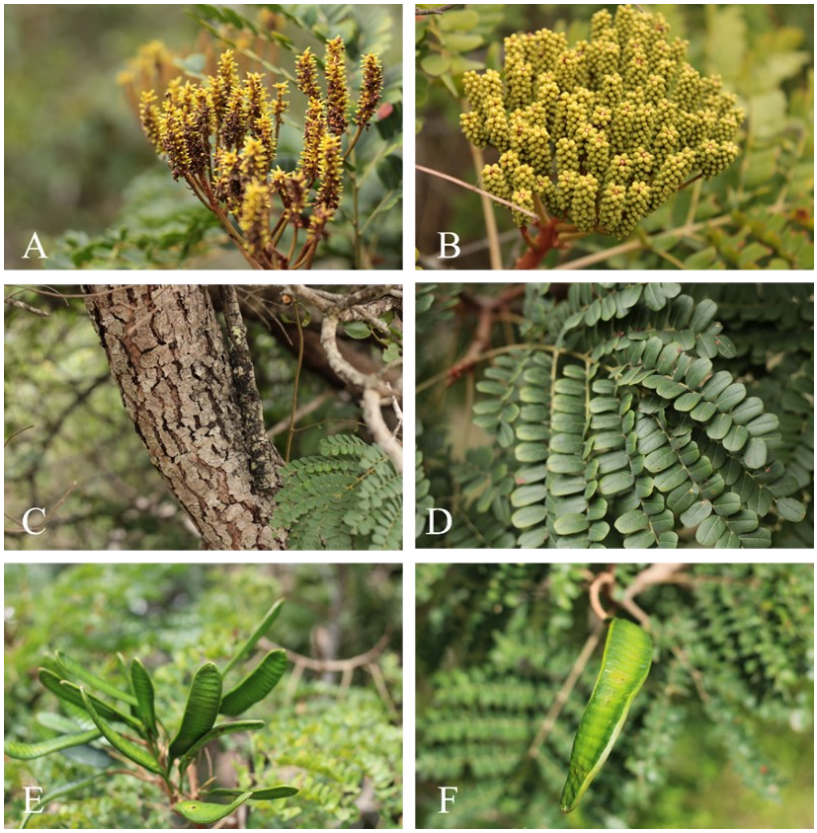

Figure 1. *Dimorphandra gardneriana Tul. A and B: Inflorescences; C: Woody stem; D: Compound leaflets; E and F: Fruit/pod.*

Methodology

Research is the critical analysis of already published material or new data to deepen a topic. The objective is to collect, integrate, and evaluate data from various sources to produce new viewpoints or generalizations. This is achieved through the synthesis of relevant studies on the issue or the investigation of new data that expands understanding in the field.

The following actions were carried out throughout the investigation:

1. Definition of the topic and formulation of questions;

2. Establishment of inclusion and exclusion criteria;

3. Extraction of information and classification of the studies;

4. Evaluation of the included studies;

5. Interpretation of the results; and

6. Review and presentation of the results.

This approach was developed based on previous studies.

The central question of this review was: "What are the scientific evidences regarding the phytochemistry, biological activity, and pharmacological properties of *Dimorphandra gardneriana*?" To answer this question, the following databases were searched: Medical Literature Analysis and Retrieval System Online (MEDLINE), National Library of Medicine (PUBMED), SCOPUS, Web of Science, Scientific Electronic Library Online (SCIELO), and Science Direct. The search strategy involved combining terms and their variations to ensure that all possible relevant references were identified.

To conduct a comprehensive and accurate search on *Dimorphandra gardneriana* Tul., strategic keywords were used to cover various relevant aspects of the research. The keywords were carefully selected to encompass the phytochemistry, biological activity, and pharmacological properties of the species. The keywords employed included: *Dimorphandra gardneriana*, Fava de Anta, Medicinal Properties, Phytotherapy, Bioactive Compounds, and Pharmacological Effects.

Results and Discussion

The analyzed studies demonstrate the efficacy of encapsulating mangiferin using Fava d'anta seeds and natural polymers. FT-IR analysis confirmed that mangiferin, a bioactive polyphenol, was efficiently encapsulated, preserving its properties and enhancing its potential application in both food and medicine [12]. Furthermore, the galactomannans extracted from the seeds showed antiviral activity against the DENV-2 virus and significant antioxidant properties, suggesting that these compounds have promising potential as herbal medicines for the treatment of dengue [14].

However, the seeds of the *Dimorphandra gardneriana* also show beneficial properties in treating intestinal inflammation induced by 5-fluorouracil, a drug widely used in cancer treatment. Rutin, a flavonoid present in this plant, is crucial in combating free radical damage and reducing inflammation [13]. Additionally, rutin demonstrated significant antileishmanial activity, with an EC_{50} of 30.3 μg/mL against *Leishmania infantum chagasi*, while quercetin proved even more effective, with an EC_{50} of 26.0 μg/mL. This efficacy of rutin and quercetin highlights the therapeutic potential of *Dimorphandra gardneriana* not only in controlling intestinal inflammation but also in fighting leishmanial infections [16].

Furthermore, three flavonoids—rutin, quercetin, and isoquercitrin—were identified and quantified, extracted from the methanolic extract of the inner bark of the fruits. The selection of these flavonoids was supported by previous studies that identified them in other species of *Dimorphandra* [10]. These flavonoids, such as rutin and quercetin, are effective in protecting against lipid peroxidation and oxidative stress, with an IC_{50} of 4.91 μg/mL, making them valuable for inclusion in cosmetics and pharmaceuticals aimed at preventing cellular damage and combating skin aging [11].

During the analyses, rutin was extracted from the fruits by heating in methanol, an effective solvent for polar compounds. In vitro tests demonstrated that both quercetin and rutin have a significant correlation with antioxidant potential, justifying the need for future *in vivo* studies to evaluate their efficacy in broader contexts [15]. It was observed that fruits from cultivated areas yielded better results, with higher yields and concentrations of bioactive compounds such as rutin, isoquercitrin, quercetin, and caffeic acid, which is of great interest to the pharmaceutical industry [9].

Researchers also isolated and characterized galactomannan from mature seeds of *Dimorphandra gardneriana* Tul., manually extracted from the endosperm. The results suggest that this galactomannan may be a promising alternative to guar gum, a relevant finding for the biopolymer industry [8]. Although the results are promising, it is important to consider that the efficacy of bioactive compounds may vary depending on the extraction method and the origin of the samples. Additional studies are necessary to validate these findings in clinical and large-scale models, ensuring the viability of the proposed applications.

Table 1. Phytochemistry and parts used of *Dimorphandra gardneriana*.

Parts	Analytical Methods	Constituents	References
Fruits	HPLC	caffeic acid, rutin, isoquercetin, quercetin	[9]
Bark	HPLC	rutin, isoquercitrin and quercetin	[10]
Seeds	HPLC	rutin and quercetin	[11]
Seeds	FT-IR	mangiferin	[12]
Seeds	FT-IR, DSC, NMR, HPLC	rutin	[13]
Seeds	FT-IR	galactomannans,	[14]
Fruits	HPLC	rutin, quercetin	[15]
Seeds	RMN	galactomannans	[8]

Table 2. Bioactivity of *Dimorphandra gardneriana*.

Biological Activity	Organisms Tested	Results	Compounds	References
Antioxidant		IC_{50} 7.56 ± 0.04 µg/mL	Galactomannans	[14]
Antiviral	Dengue virus (DENV-2)	96% inhibition at 25 µg/mL	Galactomannans	[14]
Antileishmanial	*Leishmania infantum chagasi*	EC_{50} of 26.0 µg/mL	Quercetin	[16]
Antileishmanial	*Leishmania infantum chagasi*	EC_{50} of 30.3 µg/mL	Rutin	[16]
Antioxidant		IC_{50} 4.91 µg/mL	Rutin and quercetin	[11]

Conclusion

The results indicate that *Dimorphandra gardneriana* seeds are widely used due to their high content of galactomannans, which have remarkable antioxidant and antiviral properties. In addition, rutin and quercetin, compounds present in the plant, are recognized for their anti-inflammatory and antileishmanial properties. However, research on *Dimorphandra gardneriana* still faces significant limitations due to the scarcity of available resources. Therefore, it is essential that research on this plant be continued to deepen knowledge and fully exploit its therapeutic potential in the future.

Conflict of Interest

The authors declare no conflict of interest.

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