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Original Paper

Analysis of historical botanical reports of species of Fabaceae in *Historia Naturalis Brasiliae* (1648)

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Abstract

Historia Naturalis Brasiliae, a reference work for Brazilian natural sciences, contains information on species observed by 17th century naturalists. Among the reports, the botanical family Fabaceae deserves to be highlighted among the taxa that make up the Brazilian flora due to its richness of species and economic interest. In this sense, the objective of the present study was to retrieve information regarding Fabaceae cited in *Historia Naturalis Brasiliae* by naturalists Piso & Marggraf (1648), with the aim of identifying potential resources of Brazilian flora in conjunction with local knowledge about potential species today and how historical changes have influenced the use of these plant resources. Documentary data were analyzed in the original source and in Pickel's 2008 review work (*Flora do Nordeste do Brasil*). The information was organized in a database and analyzed qualitatively and quantitatively. The analysis recovered 49 species belonging to the botanical family Fabaceae in the work. Of this total, 33 species and two genera had their use mentioned in the work, the reports of which were subdivided into four categories, with the highest percentage being for the category of medicinal use (69.23%). Of the plants reported for medicinal use, 18 species and one genus had no records in contemporary works. The analyses presented here contribute to expanding the knowledge of Fabaceae, the recovery of knowledge of plants from past centuries, and the discussion of the influence of factors that cause historical changes in use patterns, thus enriching studies in the field of botany, particularly historical ethnobotany.

Key words: Brazilian flora, documentary analysis, Fabaceae, historical ethnobotany, useful plants.

Resumo

Historia Naturalis Brasiliae, obra de referência para as Ciências Naturais do Brasil, contém informações de espécies observadas por naturalistas do século XVII. Dentre os relatos a família botânica Fabaceae merece destaque entre os táxons que compõem a flora brasileira, devido à sua riqueza de espécies e interesse econômico. Nesse sentido, o objetivo do presente estudo, foi resgatar informações da Fabaceae citadas no registro *Historia Naturalis Brasiliae* dos naturalistas Piso & Marggraf (1648), identificando potenciais recursos da flora brasileria em conjunto com conhecimentos locais sobre as espécies potenciais na atualidade e como os processos de mudanças históricas influenciaram no uso desses recursos vegetais. Os dados documentais foram analisados na fonte original e no trabalho de revisão de Pickel de 2008 (*Flora do Nordeste do Brasil*). As informações foram organizadas em banco de dados e realizou-se uma análise qualiquantitativa dos itens. Após as análises, foram resgatadas na obra 49 espécies pertencentes à família botânica Fabaceae. Desse total, 33 espécies e dois gêneros tiveram seu uso citado na obra, os relatos dessas espécies foram subdivido em quatro categorias, tendo o maior percentual a categoria de uso medicinal (69,23%). Das plantas relatadas para uso medicinal, 18 espécies e um gênero não possuíam registros em trabalhos contemporâneos. As análises aqui

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apresentadas contribuem para expandir o conhecimento de Fabaceae, recuperar o conhecimento de plantas dos séculos passados e discutir a influência de fatores que acarretam mudanças históricas nos padrões de uso, enriquecendo estudos na área da botânica, principalmente a etnobotânica histórica.
Palavras-chave: flora brasileira, análise documental, Fabaceae, etnobotânica histórica, plantas úteis.

Introduction

Brazil is considered a megadiverse country and its riches have aroused interest since the time of sailing. In the 17th century, during the so-called Dutch Brazil, an important reference work for Brazilian natural history, particularly about the Northeast region, was produced - *Historia Naturalis Brasiliae* - originating from the hands of naturalists Piso and Marggraf (Kury & Sá 2009). Dutch Brazil was a period marked by scientific activities developed by naturalists who were brought by the Count of Nassau through the Dutch expedition organized by the West India Company in Brazil (Gesteira 2004). During this period, the Dutch physician Piso and the German naturalist Marggraf made observations about local people, produced astronomical and meteorological notes, and collected information and specimens of elements of nature (Nogueira 2000; Pickel 2008; Françoso 2009).

Although the central objective of works related to the discovery of Brazilian biodiversity was the description of its natural resources with economic potential, the documents produced throughout history constitute an invaluable collection of the most varied aspects of the relationships established in the past between human societies and nature, especially plants (Medeiros 2009, 2020). In this sense, the delineation of past and present time, in order to situate material production in history, is essential. This establishment is given by the date of production of the main source under analysis (Medeiros 2020).

Current study of historical documentation developed from the perspective of historical ethnobotany has revealed, for example, evidence about past use of medicinal plants (Bussmann & Sharon 2006; Medeiros *et al*. 2010; Giorgetti *et al*. 2011; Brandão *et al*. 2012; Medeiros & Albuquerque 2012; Breitbach *et al.* 2013; Mugge *et al.* 2016; Ricardo *et al.* 2017) and plants used in human nutrition (Nunes *at al.* 2012; Medeiros & Albuquerque 2014), and also this historical evidence has served as a source of information for technological prospecting (Silva *et al.* 2019). Such research demonstrates the relevance of investigating knowledge held by past societies about flora, which has been perpetuated or lost over time due to conditions such as the transmission of knowledge and social, economic and cultural aspects that certainly conditioned and condition the use/disuse of elements of nature. Thus, especially in the context of historical ethnobotany, the importance of the analysis of past and current uses is that it allows emerging issues, such as usage patterns, that arise to be related, deepened and discussed in the light of the relationships between humans and species of flora throughout history.

The family Fabaceae, or Leguminosae, is considered one of the most important families of angiosperms (Eudicotyledoneae), being the third largest of this group with 727 genera and about 19,325 species distributed among six subfamilies, namely: Faboideae, Duparquetioideae, Caesalpinioideae, Cercidoideae, Detarioideae and Dialioideae (LPWG *et al*. 2017). Fabaceae comprises one of the most diverse groups of the world's flora and has a cosmopolitan distribution with native species on all continents except Antarctica (Lewis *et al*. 2005). The family possesses 222 genera and 2,837 species in Brazil, including 1,535 endemics (Lima *et al*. 2015). Among Brazilian natural ecosystems, Fabaceae occurs in the Amazon, Cerrado, Pampa, Pantanal, Atlantic Forest and Caatinga, and is among the families with the greatest diversity and richness in the floristic composition of these phytophysiognomies (Lima *et al.* 2015).

Given the above, and in attempt to generate information that will expand knowledge of species of Fabaceae, especially in the Northeast region, this research was based on information reported in the 17th century in Northeast Brazil through the analysis of the work *Historia Naturalis Brasiliae*. This effort was intended to answer the following questions: which species of Fabaceae were observed in the 17th century by the Dutch entourage of naturists in Northeast Brazil? What information did the naturalists record about Fabaceae? Is the cast of species cited in the past still useful to humans in Northeast Brazil and other regions?

Thus, the objective of the present study was to retrieve information about species of the family Fabaceae present in *Historia Naturalis Brasiliae* of the naturalists Piso & Marggraf (1648), to identify potential resources of Brazilian flora along with local knowledge about potential species today. This study also discusses how the processes of historical change have influenced patterns of use of some of these plant resources.

Material and Methods

Reading and interpretation of primary and secondary records

The survey of historical information about species of Fabaceae that occur in the Northeast region of Brazil was performed by reading and interpreting records contained in *Historia Naturalis Brasiliae* (Piso & Marggraf 1648). The Northeast region was where the observations of these scholars were concentrated because it was the area that they explored the most. The region where Piso and Marggraf explored is currently represented by the interior of the current states of Pernambuco, Paraíba and Rio Grande do Norte (Nogueira 2000). Two sources derived from the aforementioned original register were chosen for the development of the present study: the version of the cited work translated into Portuguese, published in two volumes by Companhia Editora Nacional, the first for the writing of Marggraf, published 1942, and the second for Piso, published in 1948; and the review work of Pickel (2008).

To contextualize the data obtained via systematization of the information contained in the work, bibliographic material referring to Fabaceae and the species mentioned in the primary source were consulted. The consultations were made in the collections of the libraries of Centro de Educação e Saúde of Universidade Federal de Campina Grande and Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. Additionally, the following databases were consulted: Herbário Virtual A. de Saint-Hilaire (<http://hvsh.cria.org.br/>), Flora Brasiliensis (<http://florabrasiliensis.cria.org.br>), Tropicos.org Missouri Botanical Garden (<http://tropicos.org/>), Lista da Flora do Brasil (<http://floradobrasil.jbrj.gov.br/>), PubMed® (<https://pubmed.ncbi.nlm.nih.gov/>), SciELO (<https://scielo.org/>), Scopus® (<http://www.scopus.com/>) and Google Scholar. The articles were selected using the following keywords: “Fabaceae”, “geographic distribution”, “habitat”, “occurrence”, “use”, “utility”, “medicinal use”, and “knowledge”. Species mentioned in the primary source were also included as keywords. The conjugation between keywords was done by the connector “AND”. The selection criteria adopted excluded unindexed published works.

Organization of information

The information gathered from reading the set that includes the primary source of the present work was integrated into a database and organized using the program Microsoft Excel®. The database included data on species, popular names, place of occurrence, botanical characteristics, indications of utility and other observations made by naturalists. Species cited as medicinal were categorized according to the International Statistical Classification of Diseases and Related Health Problems - ICD 10, and a parallel with the Internacional classification of diseases for mortality and morbidity statistics - ICD-11 (WHO 1996, 2022).

The scientific names mentioned were checked by querying the databases of Tropicos.org Missouri Botanical Garden (2019), International Plant Names Index - IPNI (2019), Lista da Flora do Brasil do Jardim Botânico do Rio de Janeiro (2020) and specialized literature.

Results and Discussion

The documentary analysis of the work *Historia Naturalis Brasiliae* (1648) pointed to a total number of 51 resources belonging to Fabaceae, 49 of which were identified at a specific level and two identified at a generic level, making up a total of 39 genera. Among these, the genera *Cassia* and *Inga* stood out with the largest number of representative species (four each).

There were 35 plant resources with reports of past use among the species of Fabaceae cited in the work. The uses mentioned by the naturalists were categorized into four use categories, with the medicinal category concentrating the largest number of reports (69.23% of all use citations) (Fig. 1). Regarding the species whose past uses were categorized, four were used for more than one use category, namely *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis (medicinal and timber categories), *Canavalia ensiformis* (L.) DC., *Dolichos lablab* L. and *Hymenaea martiana* Hayne (medicinal and food categories).

Considering the medicinal category, the total number of therapeutic indications cited in the work for species of Fabaceae were 58 symptoms

and diseases, with the use of these plant resources for "wounds" concentrating the largest number of mentions (12.1% of the citations for medicinal use), followed by their use in cases of "pain" (10.3%) (Fig. 2).

The research carried out after Piso & Marggraf (1648) indicated a cast of eight species, and a taxon identified at the generic level that had current medicinal use (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.19658688.v1>). In additon to these, at about 18 species were found to have had no contemporary records of therapeutic indications.

Recent times have seen a loss in biodiversity and traditional and local knowledge, which has placed local resilience in the face of such losses at risk. Adaptive mechanisms for different environments have influenced the survival of plant species throughout the process of evolution, as well as human evolution itself, and advances in pharmaceutical sciences corroborate the loss of some uses (Aswani *et al.* 2018).

Therefore, it is possible to highlight several external factors that have triggered social and lifestyle changes, including globalization, urbanization, increased use of technologies, modern agricultural practices and even deforestation, all of which have a direct influence on the transmission of knowledge from older to younger generations (Sujarwo *et al.* 2014). Thus, studies that rescue the use of species have potential value, not only because of the historical recovery, but because they can also present new possibilities for using plants for different purposes.

Some differences in indications of therapeutic use were observed for some species with past and contemporary use records. A cast of seven species were indicated as medicinal today but had indications differing form those cited in the original work.

Arachis hypogaea L. is one of these species, for which the naturalists stated in the original work that it was used for wounds caused by snake bites and to mitigate pain, while in later works this species is cited for use for weakness, impotence, frigidity, scorpion bit, cyst and bilharzia (Matos 1999; Doka & Yagi 2009; Jiofack *et al.* 2010; Issa *et al.* 2018). Regarding *Myroxylon balsamum* (L.) Harms, the naturalists stated that this species is useful in cases of asthma, indigestion and certain chronic intestinal diseases. Fenner *et al*. (2006), however, reported that the plant had antiseptic properties for the treatment of urinary tract infections. In addition, *M. balsamum* has also been used in the treatment of bruises, rheumatism, washing of wounds and ear pain (Leonti *et al*. 2002; Macía *et al.* 2005).

Another such species is *Tamarindus indica* L., for which the naturalists reported its use as a white pungent for liver disease. In later work, this species is reported to be effective for treating blocked intestines, general fever, malaria, wounds, stomach pain, jaundice, flu and colds (Matos 1999; Sharma & Kumar 2011; Musa *et al.* 2011; Traore *et al.* 2013; Suleiman 2015). Piso & Marggraf (1648) further stated that *Bowdichia virgilioides* Kunth was widely used in the treatment of diseases caused by cold and swollen feet and belly. In the works of Matos (1999), Cordeiro & Félix (2014) and Penido *et al.* (2016), the use of this species is linked to cases of rheumatism, inflammation and fever, respectively.

Another species mentioned is *Hymenaea martiana* Hayne, for which the original work

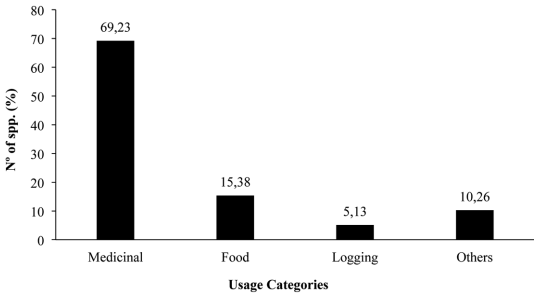

Figure 1 – Percentage representation of categories of use for species of the family Fabaceae mentioned in *Historia Naturalis Brasiliae* (Piso & Margrave 1648).

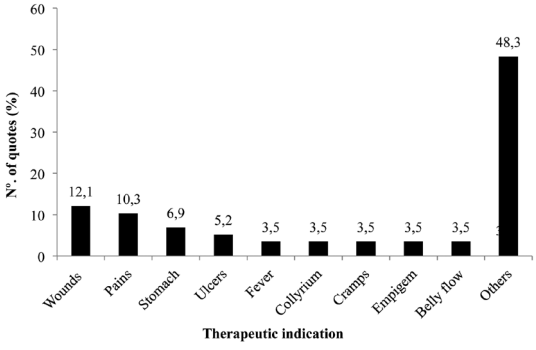

Figure 2 – Percentage of the number of citations by therapeutic indication of the medicinal species of Fabaceae cited in *Historia Naturalis Brasiliae* (Piso & Marcgrave 1648).

stated it was used for fumigations and combating headaches called "chabequos" (migraines), and against body aches caused by colds. Piso reports that he used the resin of this plant on muscular regions of his body by applying it in the form of poultice or ointment. Kurita *et al*. (2007) affirmed this species to be a widely studied plant, especially by the Japanese, who have patented various products for use against hair loss, skin lightening, autoimmune diseases and prostate hypertrophy. This is an example of a Brazilian plant that has been undergoing intense actions of biopiracy.

Another species that showed divergence in use was *Cajanus cajan* (L.) Huth, for which the naturalists cited use as a laxative, while works after Piso & Marggraf (1648) cited the use of this species for uterine infection, scabies, jaundice, diabetes, cancer, measles, fever, wounds, inflammation and energy and as a stimulant (Pilla *et al*. 2006; Saikia *et al.* 2006; Anisuzzaman *et al.* 2007; Rahmatullah *et al*. 2009; Ashidi *et al.* 2010; Oladunmoye & Kehinde 2011; Sen *et al.* 2011; Islam *et al.* 2014).

Convergence in terms of indication and the plant part used was observed for a plant identified at the generic level and one at the specific level. According to the naturalists, leaves of *Cassia grandis* L. f. were used in the treatment of slow-healing wounds and pustules, while Macedo & Ferreira (2004) also cited the use of its leaves for skin problems. *Copaifera* sp. was indicated in the original work for wound healing, fortifying the stomach, stopping cramps, calming nerves and healing, for which the plant part used was not indicated. Contemporary works also cited species of this genus for wound healing (Maciel *et al*. 2002; Francisco 2005); however, Alonso (2011) indicated species of this genus for cases of malaria and influenza; none of these studies indicated the plant part used.

For *Cassia occidentalis* L., there were citations for both different uses and convergences for some indications. Piso & Margrave (1648) indicated the use of the leaves of this species as a remedy against inflammation and to mitigate pain in the kidneys and bladder, while Hoehne (1939) cites the use of seeds in the treatment of intermittent fever and malaria, and the roots as an anthelmintic. Di Stasi & Hiruma-Lima (2002) adds that the plant can be used to treat anemia and against diseases of the liver and spleen and is used in itchy places and to cure mycoses, as well as against malaria. These authors also reported that in the region of the Atlantic Forest, root infusion is used against stomach pain, flu, fever, general infections, stomach and liver disorders and as a diuretic, while root maceration in sugarcane brandy is used as a diuretic and against general infections. Simões (1986) state that in the state of Rio Grande do Sul, it is also used against diseases of the liver, stomach, kidneys and bladder.

Two species that also merit comment are *Zollernia ilicifolia* Vog. and *Apuleia leiocarpa* (Vogel) J.F.Macbr., because they were not indicated as medicinal in the work of the naturalists Piso & Marggraf (1648), however, in contemporary works their therapeutic use is indicated. With respect to *Zollernia ilicifolia* Vog., Di Stasi & Hiruma-Lima (2002) reported that in the Vale do Ribeira region (state of São Paulo), the infusion of leaves of this species is used internally against ulcers and stomach problems, including pain. For *Apuleia leiocarpa* (Vogel) J.F.Macbr., Araújo *et al*. (2015) reported the use of the bark in the form of tea for anemia and injury, and as an anti-inflammatory, with proven activity for cough, bronchitis and whooping cough, and as an immunostimulant.

Categorizing the species that were cited as used for therapeutic purposes in the original work of Piso & Marggraf (1648) according to ICD-10 and ICD-11 (WHO 1996, 2022) resulted in six distinct classifications. Diseases of the skin and subcutaneous tissue (DSST) accounted for 45.5% of the diseases mentioned in the reference work, followed by diseases of the digestive system (DDS), which accounted for 27.3% (Fig. 3).

Analysis of the number of species per disease category also revealed DSST and DDT as the categories that concentrated the largest number of species that have citations of diseases related to these conditions, with 46.67% and 33.33% of each category, respectively (Fig. 4). Comparing these percentages with those presented for the same disease categories in the analysis of disease citation by category shows that there was a change in data. This variation was because the same species could indicate more than one disease, as is the case for *Cassia hoffmannseggii* Mart. *ex* Benth., for example, which was cited for use in the treatment of wounds and ulcers, and also because there are distinct species that may indicate the same diseases, such as *Canavalia ensiformis* (L.) DC. and *Copaifera* sp., for example, which were mentioned for use in situations of colic.

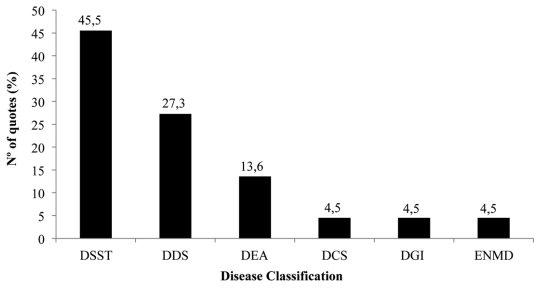

Figure 3 – Percentage of diseases cited as being treated by medicinal plants referenced in *Historia Naturalis Brasiliae* (Piso & Marggraf 1648) by disease category of the ICD-10 and ICD-11 (WHO 1996, 2022). Legend: DSST = diseases of the skin and subcutaneous tissue - now deseases of the skin; DDS = disease of the digestive system; DEA = diseases of the eye and attachments - now diseases of the visual system; DCS = diseases of the circulatory system; DGI = diarrhea and gastroenteritis of presumed infectious origin - now certain infectious or parasitic diseases; ENMD = endocrine, nutritional or metabolic diseases.

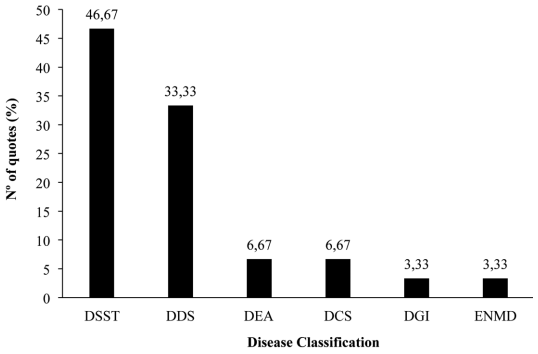

Figure 4 – Percentage of medicinal plant species referenced in *Historia Naturalis Brasiliae* (Piso & Marggraf 1648) by disease category of the ICD-10 and ICD-11 (WHO 1996, 2022). Legend: DSST = diseases of the skin and subcutaneous tissue - now deseases of the skin; DDS = disease of the digestive system; DEA = diseases of the eye and attachments - now diseases of the visual system; DCS = diseases of the circulatory system; DGI = diarrhea and gastroenteritis of presumed infectious origin - now certain infectious or parasitic diseases; ENMD = endocrine, nutritional or metabolic diseases.

Among the cast of 49 plants of Fabaceae identified at the species level and the two at the level of genus cited in the work, the naturalists mentioned the place of occurrence for 30 of specific taxa and one of the generic taxa. Clarity of the data was provided for 16 species and one genus such that their location could be delimited, with an emphasis in the region of the state of Pernambuco, with 14 species in total (Fig. 5).

More detailed observations of the place of occurrence were made for two species in particular, namely *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis and *Senna obtusifolia* (L.) H.S. Irwin & Barneby (Tab. 1).

The naturalist's observation for *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis and *Senna obtusifolia* (L.) H.S. Irwin & Barneby was that they were species with frequent occurrence, in the 17th century, although they also left a record that there was a population reduction in the coastal region of the former. The scenario observed for *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis, an endemic species of Brazil, is in line with their present-day consideration as endangered, with current occurrences in the Northeast (states of Alagoas, Bahia, Paraíba, Pernambuco and Rio Grande do Norte) and Southeast (states of Espírito Santo and Rio de Janeiro) (Lima *et al.* 2015).

The results obtained by the present work reveal that a richness of species of Fabaceae is mentioned in *Historia Naturalis Brasiliae*, most as medicinal plants. The reports of Piso & Marggraf (1648) presented the popular name, use data and the occurrence of Fabaceae. Present-past comparative analysis revealed convergences and divergences in terms of indication of use of these species, which may characterize a change over time in knowledge or use associated with floristic diversity.

The analyses presented here also contribute to the expansion of knowledge about Fabaceae, as well as to the recovery of knowledge about medicinal plants of past centuries. This, in turn, will facilitate investigating, revealing and demonstrating some results previously reported in *Historia Naturalis Brasiliae*, which will enrich studies in the field of botany and historical ethnobotany.

The preponderant factor for the occurrence of species of Fabaceae mentioned in the work in the state of Pernambuco is the fact that the observations of the naturalists are more concentrated in this region due to the influence of the Dutchman Mauricio de Nassau, who had taken over the province of Pernambuco, bringing with an entourage in which the authors were present.

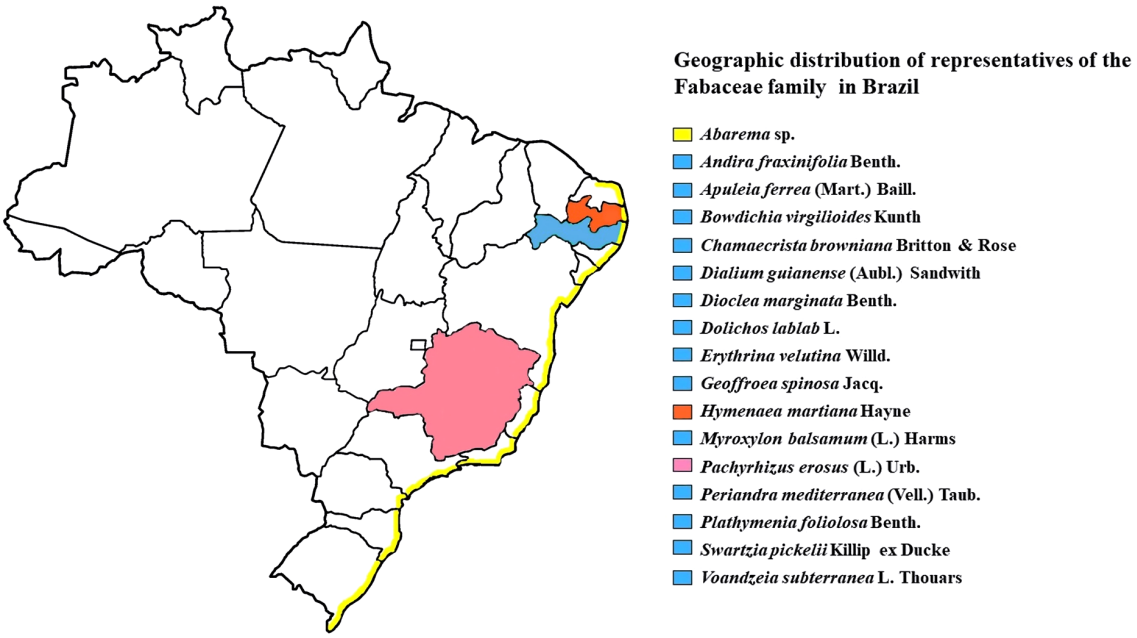

Figure 5 – Species of Fabaceae cited in *Historia Naturalis Brasiliae* (Piso & Marggraf 1648) that had indication of geographical occurrence.

Table 1 – Species of Fabaceae that had indication of more detailed geographical occurrence in *Historia Naturalis Brasiliae* (Piso & Marggraf 1648).

Species	Geographical Indication
Paubrasilia echinata (Lam.) Gagnon, H.C. Lima & G.P. Lewis	It is frequent in certain regions of the forest zone, lacking in the coast and in the wetter regions of the state
Senna obtusifolia (L.) H.S. Irwin & Barneby	This plant is very common on the coast and in the Northeast forest zone

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