saúde EM DEBATE

REVIEW

Scientometric analysis of *Dipteryx alata* Vogel (Fabaceae): A socio-biodiversity resource applied to human health

Análise cienciométrica de Dipteryx alata Vogel (Fabaceae): um recurso de sociobiodiversidade aplicado à saúde humana

Elizabeth de Fátima Lopes da Rocha[1], Jaqueline Gleice Freitas[1], Liandra Bertoni Bento Rocha[1], Flávia Melo Rodrigues[1], Josana Castro Peixoto[1], Andreia Juliana Caldeira Rodrigues[1], Flávio Monteiro Ayres[1]

DOI: 10.1590/2358-28982026E210695I

ABSTRACT *Dipteryx alata* Vogel (*D. alata*) is a species typical of the Brazilian Cerrado and used in several studies and research, mainly in the Health sector. Popularly known as baru, this species has known antioxidant, anti-rheumatic, anti-tumor and anti-ophidic effects, as well as being used in diets to control cholesterol. In this sense, this study aimed to characterize the scientometric indicators of *D. alata* as a Cerrado plant and socio-biodiversity resource applied to human health. As it is a native species in Brazil, this country leads the ranking of countries that have published the most, but most of the studies are in English. The most prominent funding agencies were the Coordination for the Improvement of Higher Education Personnel, Goiás State Research Support Foundation and São Paulo State Research Support Foundation. Our results show that scientific production on the baru peaked in 2017 on topics related to the Cerrado biome, genetic conservation, population genetics and nutrition. While biodiversity has emerged as a consolidated theme, baru as a social resource applied to human health remains a thematic gap to be explored.

KEYWORDS Cerrado. Phytotherapy. Traditional medicine. Nutrition.

RESUMO *Dipteryx alata Vogel (D. alata) é uma espécie típica do Cerrado brasileiro e utilizada em diversos estudos e pesquisas, principalmente na área da saúde. Popularmente denominada como baru, essa espécie tem conhecida ação antioxidante, antirreumática, antitumoral, antiofídica além de também ser utilizada em dietas para o controle do colesterol. Nesse sentido, o presente estudo objetivou caracterizar os indicadores cienciométricos sobre D. alata enquanto planta do Cerrado e recurso de sociobiodiversidade aplicado à saúde humana. Por ser uma espécie nativa do Brasil, este país lidera o ranking de países que mais publicaram; entretanto, a maioria dos estudos está em inglês. As agências financiadoras com maior destaque foram a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, a Fundação de Amparo à Pesquisa do Estado de Goiás e a Fundação de Amparo à Pesquisa do Estado de São Paulo. Os resultados mostram que a produção científica sobre o baru teve um pico no ano de 2017, em temas relacionados ao bioma Cerrado, conservação genética, genética de populações e nutrição. Enquanto a biodiversidade se apresentou como uma temática consolidada, o baru, na qualidade de recurso social aplicado à saúde humana, permanece como uma lacuna temática a ser explorada.*

PALAVRAS-CHAVE *Cerrado. Fitoterapia. Medicina tradicional. Nutrição.*

[1]Universidade Estadual de Goiás (UEG) – Anápolis (GO), Brasil.
jgjgleice@gmail.com

Introduction

The Brazilian Cerrado harbors a rich biodiversity of plant species that may be – and in fact are – used in research aimed at developing medicines and products for nutritional purposes. Some native Cerrado species, such as *Dipteryx alata* Vogel (*D. alata*), also known as baru, have been studied for years because of their broad potential and multiple possible applications. Studies have shown that baru has antioxidant, antirheumatic, antitumor, and antivenom properties, and that it is also used in diets aimed at cholesterol control[1].

D. alata occurs in well-drained sandy-clay soils. It is native to Brazil mainly found in the states of Goiás, Mato Grosso, Mato Grosso do Sul, and Minas Gerais, although it can also be found in Tocantins, Pará, Rondônia, Maranhão, Bahia, Piauí, São Paulo, and in some areas of other countries, such as the Pantanal complex in Paraguay, Bolivia, and Peru[2].

The baru almond is consumed as food and has high nutritional value because it is rich in protein, total lipids, and several minerals. Its macronutrients – such as carbohydrates, proteins, and fats – are essential for body structure and function. Carbohydrates are broken down into glucose, the body's main energy source. Proteins, which are composed of amino acids, contribute to muscle building. Lipids are essential for the structure and function of cell membranes, help absorb fat-soluble vitamins, and are the body's main long-term energy source. *D. alata* oil also plays an important role in reducing liver lesions (such as hepatic steatosis) and vascular lesions (such as atherosclerosis) resulting from dyslipidemic disorders[2,3].

Although Brazil remains the priority area for baru cultivation, scientific publications addressing the use of this oilseed remain limited. Identifying patterns in the scientific production on *D. alata* in the country is therefore strategically important in order to support researchers, governments, and funding agencies in making more efficient decisions. Scientometric analyses can outline patterns of scientific output and support researchers, governments, and funding agencies in identifying underfunded areas and topics – such as baru – and thus in making more efficient decisions. This research method has been used increasingly often, including in Brazil, making it possible to recognize research efforts through the quantitative description of documents, scientific collaboration, and the characterization of scientific social networks related to a given topic[3].

In light of the above, the present study aimed to conduct a scientometric investigation in order to provide a comprehensive account of published studies on *D. alata*.

Material and methods

This was a qualitative approach characterized as descriptive in terms of its objectives. No time limit was established for the bibliographic survey, which was conducted using the Web of Science (ISI) database, since this platform contains more than 44,502 journals, books, proceedings, patents, and datasets and provides access to multidisciplinary and regional citation indexes, patent-family indexes, and scientific datasets. In addition, it includes 166 million journal articles, books, and conference proceedings; more than 87 million patents; and 8.9 million datasets. This database offers a comprehensive view of worldwide scientific production, is updated weekly, and includes in its core collection more than 22,000 high-quality, peer-reviewed academic journals published around the world, more than 305,000 conference proceedings, and more than 204,000 editorially selected books.

The search was conducted in April 2025 using the keyword "*Dipteryx alata*" both

individually and combined with Boolean operators and specific expressions, as follows: ["*Dipteryx alata*"], ["*Dipteryx alata*" OR baru AND barueiro], ["*Dipteryx alata*" OR baru AND "Cerrado plants"], ["*Dipteryx alata*" AND baru], and ["*Dipteryx alata*" OR baru]. From the results obtained, the selected publications were screened, and the following information was extracted from each work: document type; year of publication; funding or sponsoring agency; authors; country and region; language; research area; and journal Impact Factor (IF).

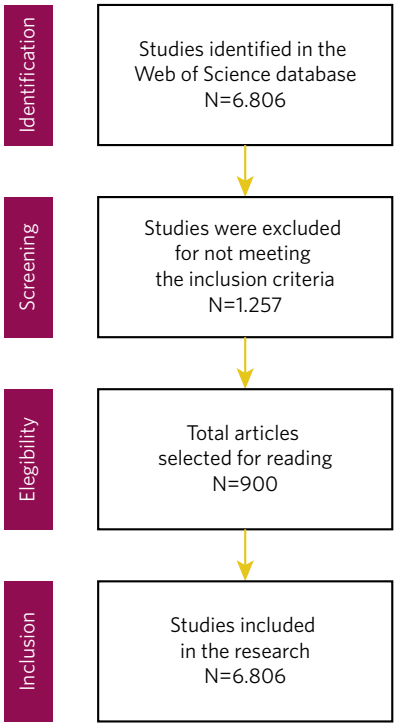
The data were extracted, organized, and tabulated in electronic spreadsheets for later representation by descriptive statistics. We performed the nonparametric Kruskal-Wallis analysis to determine the statistical significance of the year-by-year scientific production. We adopted the nonparametric Mann-Whitney test to compare the number of publications across countries and institutions. Data were analyzed using BioEstat 5.3 software. All selected files were exported from the Web of Science database to RStudio, where the Bibliometrix package was used[4].

Results and discussion

Characterization of the sample group

In the present study, the bibliographic survey and search criteria yielded 6,806 articles, of which 5,549 were freely available in full text and broadly matched the objective of the research. The largest number of articles found with the combination "*Dipteryx alata*" OR baru revealed that the term "baru", in other countries, refers to singular parameters in physics, mathematics, and robotics studies (over baru, under baru, baru), artists' and authors' surnames, a crocodile species, an atmospheric condition, coral reefs, the name of a lake, a volcano, an archipelago, and places (streets, sectors, cities, health centers), and that in Indonesian it means 'new'. For this reason, 5,192 articles were excluded, leaving 357 in the study (*figure 1*). The keywords and Boolean combinations yielded the following totals: "*Dipteryx alata*" = 266 articles; "*Dipteryx alata*" OR baru AND barueiro = 266 articles; "*Dipteryx alata*" OR baru AND "Cerrado plants" = 166 articles; "*Dipteryx alata*" AND baru = 177 articles; and "*Dipteryx alata*" OR baru = 6,806 articles.

Figure 1. Flowchart of the process of study identification, exclusion, and inclusion



Source: Prepared by the authors, adapted from PRISMA-ScR[5]

This bibliometric analysis spans more than four decades (1981–2025), gathering 357 documents published in 189 different sources. The mean of 17.03 citations per document indicates scientific production of moderate impact. Collaboration among authors is high, with an average of 6.6 authors per document and a collaboration index of 6.64, reinforcing the strong tendency toward partnerships in scientific publications on *D. alata*. Only three of the 2,355 authorships identified were single-authored studies. The high number of keywords suggests thematic diversity, with 1,380 keywords plus, which are terms extracted from the titles of cited articles, and 1,412 author's keywords, that is, terms selected or created by the authors themselves.

Characterization of the articles

When annual scientific production on baru from 1981 to 2025 is analyzed, a clear evolution in the scientific visibility of this species can be observed (*graph 1A*). Between 1981 and 2005, the annual number of publications was low or absent, indicating either an initial lack of interest or low scientific visibility of the species in the academic context. A progressive increase in the number of publications began in 2006, with clear peaks after 2010. This growth coincides with the rising appreciation of native Cerrado species, indicating a trend toward applied research in biodiversity, agroecology, and conservation[6]. Additionally, the growing scientific interest in baru may be related to recognition of its nutritional, economic, or ecological properties[7].

The highest publication peak occurred in 2017, with approximately 40 articles, possibly as a result of policy actions, research calls, or increased funding directed toward the Cerrado or native species. The keywords identified in the 2017 articles revealed several lines of research. In all, 58 words were counted, of which 7 were repeated: "baru", "*Dipteryx alata*", "food functional", "baru nuts", "conservation genetics",

"population genetics", and "Cerrado biome". Considering the most prominent terms, the content of the articles was found to be consistent with research on the genetic conservation of the species and on functional foods based on baru with beneficial applications for human health.

Still, regarding the 2017 peak, when the total number of articles was compared with the countries that published the most, Brazil ranked first, accounting for 97.872% of this production ($p < 0.0001$). This high percentage is due to the fact that the species is native to the country and of great interest to the pharmaceutical and food sectors because of the broad applicability of the plant's active compounds, as well as to ecological issues such as propagation, preservation, and genetic differentiation[8,9]. Countries such as Spain (0.532%), Colombia (0.532%), India (0.532%), and the United States of America (0.532%) also published articles on baru, emphasizing antivenom, nutritional, and conservation-related properties of the species[10,11]. The authors who published the most on baru during this period were Soares TN and Oshima Franco Y.

In institutional terms, the scientific production of the Federal University of Goiás (UFG) was considerably higher than that of the other universities and research institutes ($p = 0.04$). One possible explanation for this finding is the link between the authors and a germplasm bank devoted to the propagation, conservation, and study of the species. São Paulo State University ranked second, and we should recall that the state of São Paulo has plantings dedicated to baru conservation[9]. The other Brazilian institutions that contributed to the 2017 publication peak were the Federal University of Mato Grosso do Sul, the Brazilian Agricultural Research Corporation, the State University of Campinas, the Goiás Federal Institute, the University of São Paulo, the Federal University of Lavras, the University of Sorocaba, the Federal University of Tocantins, the State University of Goiás, the Pontifical Catholic University of Goiás, the University of Brasília, the University of Vale do Paraíba, and the Federal University of Grande Dourados.

Our results show that, after the peak in 2017, output fluctuated. This oscillation may be interpreted as reflecting maturation of the thematic field and, consequently, stabilization in the number of publications[8]. Up to that point, the main research domains concerning baru were forestry, agriculture, molecular biology, and biochemistry, as well as other approaches related to forest management, the nutritional composition of the almond, and applications in the pharmaceutical or food industries. In this sense, the sustained thematic interest in baru is confirmed by the scientific production, which remains high and is again increasing. The year 2025 appears with low output because the available data are still incomplete.

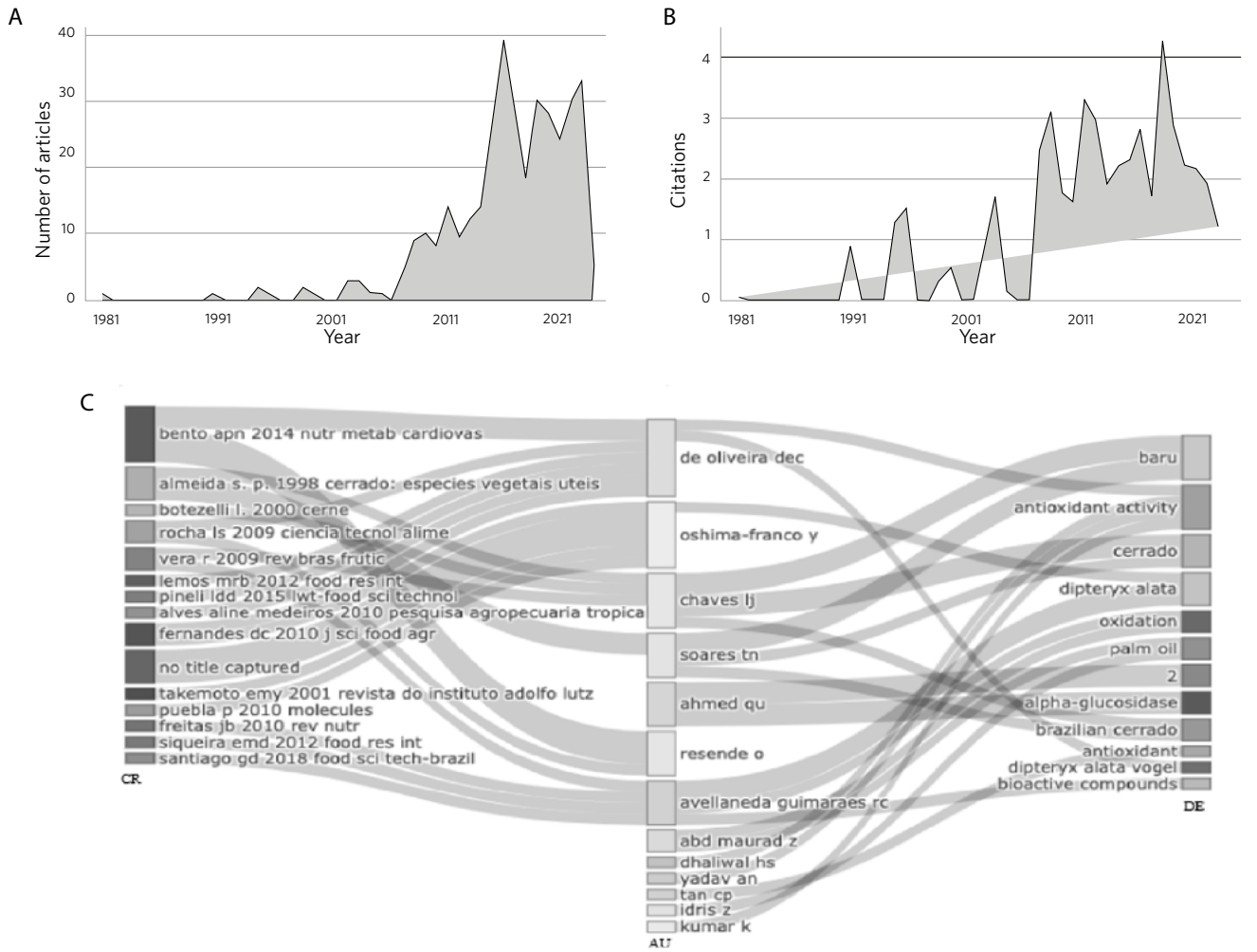
Articles published up to the early 2000s received few or no citations, which is consistent with the low visibility or small volume of scientific production up to that period. The progressive increase in citations between 2005 and 2015 reflects growing attention to the topic and its impact on the scientific community (*graph 1B*); that is, there was a qualitative increase in the publications and a perceived improvement in their quality.

Articles published in 2018 were, on average, the most cited, indicating strong repercussion. This peak may be related to thematic relevance or highly visible projects – for example, studies with socioeconomic impact, the sustainable use of the Cerrado, or the inclusion of baru in public policies and productive chains. The average number of citations per article decreased in subsequent years, possibly because more recent articles have not yet had enough time to accumulate a larger number of citations.

To identify scientific leadership and consolidated research lines in the field, the Sankey diagram (*graph 1C*) represents the connection between: (a) the main references cited in the articles (CR); (b) the authors of the analyzed articles (AU), and thus the most productive authors; and (c) the keywords (DE) that define the dominant themes related to baru.

Authors Oliveira DEC, Oshima-Franco Y, Chaves LJ, and Soares TN were the most strongly connected, indicating substantial scientific production and/or collaboration in research on baru. The most important keywords were "baru", "Cerrado", "*Dipteryx alata*", "antioxidant activity", "oxidation", and "bioactive compounds", pointing to a focus on baru's functional and nutritional properties. The references published by Bento et al., Almeida SP, and Botezelli L were the most influential, as they were most frequently cited by the highlighted authors.

Graph 1. Characterization of the articles on *D. alata* indexed in Web of Science over the years



Source: Prepared by the authors.

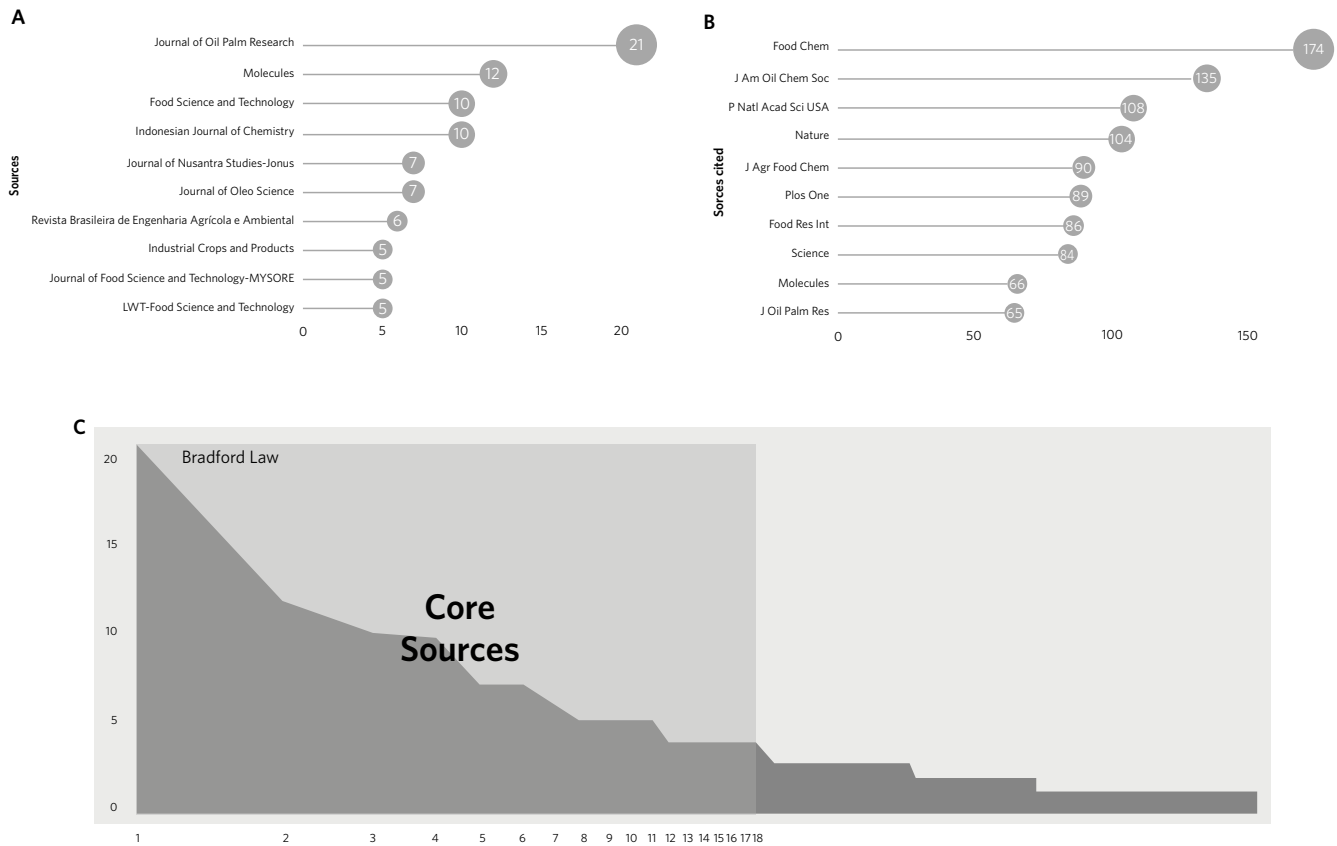
A) Annual number of published articles; B) Impact of published articles illustrated by the average number of citations per year; C) Sankey diagram showing the connection between the main references cited in the articles (CR), the authors of the analyzed articles (AU), and the keywords (DE).

The most prominent funding agencies were the Coordination for the Improvement of Higher Education Personnel (CAPES), the Goiás Research Support Foundation (FAPEG), and the São Paulo Research Support Foundation (FAPESP).

Characterization of the journals

Among the 189 journals identified, the 'Journal of Oil Palm Research' stands out for having the highest number (n = 21) of publications related to baru (*graph 2A*), and it was also the second journal with the highest number of citations (n = 135). 'Food Chem' had the greatest impact, with 174 citations (*graph 2B*). The journals that concentrate the largest share of relevant articles on the topic are 'Journal of Oil Palm Research', 'Molecules', 'Food Science and Technology', and 'Indonesian Journal of Chemistry' (*graph 2C*). According to Bradford's Law, a small number of journals publish many articles, whereas many journals publish only a few articles on a given topic. This information is a useful tool for identifying where to publish or search for core literature in the field of interest.

Graph 2. Characterization of the journals that published articles on D. alata between 1981 and 2025 and were indexed in Web of Science



Source: Prepared by the authors.

A) Most relevant journals; B) Most cited journals; C) Journals that concentrate the largest share of relevant articles on the topic.

.

Global representation of scientific production

Brazil is the leading country in scientific production on the topic of baru (*figure 2A*). Although countries such as India, the United States, China, Malaysia, and some European countries display publications related to the term baru, examination of the production shows that these refer to uses of the word baru outside the context of *D. alata*. Notably, there is low or no production in Africa and in countries of Central America and the Caribbean.

As a way of representing the construction of meaning and the connections among terms related to baru, a word-chain diagram was developed comparing the periods 1981–2018 and 2019–2025 (*figure 2B*). In both periods, the word baru appeared at the top of the representation, followed, in the 1981–2018 period, by the words, in this order: palm → properties → bacterium → effect → activity. In the second period (2019–2025), the ordering of the words following baru was: properties → growth → oil → basis → evaluation → analysis.

In addition to changes in ordering and the disappearance/emergence of words, the following contextual links stand out in the before-and-after comparison: (a) the word "baru" was associated with the word "property"; (b) the word "palm" was associated with the words "oil", "basis", and "analysis"; (c) the word "bacterium" was associated with the words "growth" and "basis"; (d) the word "effect" was associated with the words "property" and "evaluation"; and (e) the word "activity" was associated with the words "growth" and "evaluation".

A word cloud was prepared in order to visually represent the 100 keywords most frequently cited in articles on baru, in order of relevance (*figure 2C*). The result allows us to identify that the thematic pattern and trend regarding baru are concentrated mainly in the words: [baru] > [alata, oil palm] > [properties, characterization]. In the word cloud, the most frequently cited word is shown in a larger size and centered, while the shades of gray function as a neutral component that helps distinguish the words.

Figure 2. Global representation of scientific production on *D. alata* between 1981 and 2025 and indexed in Web of Science

Source: Prepared by the authors.

A) Scientific production by country, with the production gradient ranging from the main scientific producers (dark gray tones) to countries with no production (light gray tones); B) Chain of diverse themes across two periods; C) Word cloud representing the 100 most cited keywords in the articles.

Baru extractivism as a territorial strategy for health promotion

The results of this study show that community organization around baru extractivism constitutes a relevant social mechanism for producing health in Cerrado territories. The higher household income observed among organized participants should not be interpreted merely as an economic indicator, but as a structuring component of living conditions, with direct impacts on food, territorial mobility, and access to health services. This finding reinforces the understanding that health is socially produced and traversed by relations of work, income, and social protection[12].

At the qualitative level, participants' reports indicated strengthening of community social capital, greater circulation of information, and expanded local support networks. These processes express concrete forms of collective empowerment, especially among women and families in situations of vulnerability who have historically been excluded from formal production chains. This movement contributes to reducing power asymmetries in commercial relations, traditionally marked by the presence of middlemen and the devaluation of extractive labor[13].

Insertion into institutional markets, particularly through the National School Feeding Program (PNAE) and the Food Acquisition Program (PAA), proved strategic in ensuring greater predictability of income and productive stability. However, the data also revealed important limitations, such as bureaucratic obstacles, difficulties in meeting sanitary requirements, and fragile continuity of technical assistance. These obstacles reduce the potential of these policies as effective instruments for promoting equity in health and demand greater coordination among the health, agriculture, social assistance, and education sectors[14,15].

From the perspective of the solidarity economy, the organization of female baru collectors represents a concrete alternative to the hegemonic model of natural resource exploitation. By linking environmental sustainability, the generation of work, and the recognition of traditional knowledge, these initiatives contribute to building territories that are more resilient and more socially just. This aspect is central in the context of the Cerrado, a biome historically marked by territorial conflicts, the advance of agribusiness, and the weakening of traditional ways of life[12,13].

Finally, the findings suggest that strengthening community organizations cannot be treated solely as a productive strategy, but rather as a Public Health policy. The promotion of intersectoral actions, institutional support for cooperatives, investment in local infrastructure, and the expanded access to public procurement programs are structuring measures for addressing health inequities. Thus, baru extractivism, when supported by consistent public policies, proves to be a powerful territorial strategy for promoting health, food security, and sustainable development[13].

In addition, the development of Regional Phytotherapy Protocols is a fundamental strategy for incorporating scientometric findings into the clarification of practice-based gaps in primary care in the Cerrado territory. Systematized scientific evidence on native species, their therapeutic uses, levels of evidence, safety, and methods of preparation can support the construction of practical guides adapted to the local sociocultural reality, thereby strengthening the rational use of medicinal plants in the Brazilian Unified Health System (SUS)[16].

This approach fosters the establishment of a research agenda oriented toward evidence-based decision-making, enhances the problem-solving capacity of primary care, and reduces risks associated with unguided empirical use. In this way, the articulation of scientometric data, traditional knowledge, and institutional guidelines contributes to valuing the biodiversity of the Cerrado and to the effective implementation of the National Policy on Integrative and Complementary

Practices (PNPIC) and the National Policy on Medicinal Plants and Herbal Medicines, promoting comprehensive, intercultural, and territorialized care in Primary Health Care[17].

Considerations on the sociobiodiversity dimension of baru

The present study conducted a robust scientometric survey of publications on baru. The time span of studies on baru covers approximately four decades, which is relatively recent. In addition, current bibliometric indicators reflect a stage of maturation in this thematic field, as suggested by fluctuations in the number of publications. Nevertheless, the trend toward growth in scientific production on the topic was clearly evidenced, especially with regard to species preservation, genetic conservation, and population distribution, as well as the recovery of degraded areas and soil improvement.

Notably, Brazil is the country that produces the largest number of articles on topics related or correlated to baru, encompassing environmental, botanical, and biochemical studies with applicability, for example, in the food industry. In the territorial context of the Cerrado, UFG and researchers affiliated with it made a relevant contribution to the composition of this scientific body of knowledge through support from several funding agencies.

In conclusion, scientific production on the topic is broad and remains on an upward trajectory, corroborating a research agenda in which the applicability of baru to human health converges with themes of sustainable exploitation of the Cerrado.

Authorship contributions

Rocha EFL (0000-0002-0021-3714)* contributed to the conception, analysis, and interpretation of the manuscript data. Freitas JG (0000-0002-4517-347X)* and Rodrigues FM (0000-0002-2557-6570)* contributed to the analysis and interpretation of data, preparation of preliminary versions, critical review of the intellectual content, and final approval of the manuscript. Rocha LBB (0000-0001-6110-2439)* contributed to the analysis and interpretation of data and the preparation of preliminary versions of the manuscript. Peixoto JC (0000-0002-3496-1315)* contributed to the critical review of the intellectual content and final approval of the manuscript. Rodrigues AJC (0000-0002-7454-8824)* contributed to the analysis and interpretation of data and final approval of the manuscript. Ayres FM (0000-0003-1170-6933)* contributed to the analysis and interpretation of data, preparation of preliminary versions, critical review of the intellectual content, and final approval of the manuscript ■

References

1. Rocha EFL, Cabral IB, Ferreira LH, et al. Aplicabilidades do Baru (*Dipteryx alata* Vogel) na Saúde Humana: revisão de literatura. EVS. 2021;48:1-6. DOI: https://doi.org/10.18224/evs.v48i1.8306

2. Barbosa IP, Costa LB, Sanches FLZ. Conhecimento e perfil de consumo de frutos nativos do Cerrado e do Pantanal de Mato Grosso do Sul. Interações (Campo Grande). 2024;25(2):e2523824. DOI: https://doi.org/10.20435/inter.v25i2.3824

*Orcid (Open Researcher and Contributor ID).

3. Santos JM, Borgesa JAT, Santos SM, et al. Formagio. Baru (*Dipteryx alata*): a comprehensive review of its nutritional value, functional foods, chemical composition, ethnopharmacology, pharmacological activities and benefits for human health. Braz J Biol. 2024;84:e278932. DOI: https://doi.org/10.1590/1519-6984.278932

4. Aria M, Curccurullo C. Bibliometrix: An R-tool for comprehensive science mapping analysis. J Informetr. 2017;11(4):959-75. DOI: https://doi.org/10.1016/j.joi.2017.08.007

5. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021:372:n71. DOI: http://dx.doi.org/10.1136/bmj.n71

6. Leimu R, Koricheva J. Does scientific collaboration increase the impact of ecological articles. BioScience. 2005;55:438-443. DOI: http://dx.doi.org/10.1641/0006-3568(2005)055

7. Barizão EO, Boeing JS, Rottaem, et al. 2021. Phenolic composition of Dipteryx alata Vogel pulp + peel and its antioxidant and cytotoxic properties. J Braz Chem Soc. 2021;32(12):2206-14. DOI: https://doi.org/10.21577/0103-5053.20210112

8. Diniz-Filho JÁ, Rodrigues H, Telles MP, et al. Correlation between genetic diversity and environmental suitability: taking uncertainty from ecological niche models into account. Mol Ecol Resour. 2015;15(5):1059-66. DOI: https://doi.org/10.1111/1755-0998.12374

9. Sano SM, Brito MA, Ribeiro JF. *Dipteryx alata*: Baru. In: Ministério do Meio Ambiente (BR). Espécies nativas da flora brasileira de valor econômico atual ou potencial: plantas para o futuro. Brasília, DF: Ministério do Meio Ambiente, Secretaria de Biodiversidade; 2018. p. 203-15.

10. Ferraz MC, Yoshida EH, Tavares RVS, et al. An Isoflavone from Dipteryx alata Vogel is Active against the in Vitro Neuromuscular Paralysis of Bothrops jararacussu Snake Venom and Bothropstoxin I, and Prevents Venom-Induced Myonecrosis. Molecules. 2014;19:5790-5805. DOI: https://10.3390/molecules19055790

11. Souza RGM, Gomes AC, Castro IA, et al. A baru almond-enriched diet reduces abdominal adiposity and improves high-density lipoprotein concentrations: a randomized, placebo-controlled trial. Nutrition. 2018;55-56:154-60. DOI: https:/10.1016/j.nut.2018.06.001

12. Buss PM, Pellegrini Filho A. A saúde e seus determinantes sociais. Physis. 2007;17(1):77-93. DOI: https://doi.org/10.1590/S0103-73312007000100006

13. Organização Mundial da Saúde. A conceptual framework for action on the social determinants of health [Internet]. Geneva: WHO; 2010 [acesso em 2026 jan 20]. Disponível em: https://www.who.int/publications/i/item/9789241500852

14. Ministério da Cidadania (BR). Programa de Aquisição de Alimentos (PAA): marco legal e operacional. Brasília, DF: Ministério da Cidadania; 2020.

15. Fundo Nacional de Desenvolvimento da Educação. Programa Nacional de Alimentação Escolar (PNAE). Brasília, DF: FNDE; 2021.

16. Ministério da Saúde (BR). Política Nacional de Plantas Medicinais e Fitoterápicos. Brasília, DF: MS; 2015.

17. Organização Mundial da Saúde. Traditional medicine strategy: 2025–2034 [Internet]. Geneva: WHO; 2025 [acesso em 2026 jan 18]. Disponível em: https://www.who.int/publications/i/item/9789240113176

Received on 05/28/2025
Approved on 01/29/2026
Conflict de interest: Non-existent
Data availability: The research data is contained within the manuscript itself
Financial support: Non-existent

Editor in charge: Guilherme Fran-co Netto, Fundação Oswaldo Cruz (Fiocruz), Rio de Janeiro (Rio de Janeiro/RJ), Brasil. Lattes: http://lattes.cnpq.br/5162760718464160, Orcid: https://orcid.org/0000-0002-8861-8897, e-mail: guilherme.netto@fiocruz.br