



Bibliometric Analysis of *Eugenia uniflora* L. from Brazil: Study Based on Scopus Data from 2020-2025

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ABSTRACT

Eugenia uniflora L. is a tropical plant that contains a variety of bioactive compounds, including anthraquinones, steroids, triterpenes, and other phenolic compounds, which have potential antioxidant, antimicrobial, and anticancer properties. This study aims to identify the main research patterns, leading researchers, commonly used terminology, and collaboration networks between authors and countries from 2020 to 2025, using a bibliometric approach on *E. uniflora* L. The data were obtained from Scopus through a combination of relevant English keywords and all open-access sources. Of the 920 articles retrieved, 146 met the inclusion criteria and were analyzed using VOSviewer software version 1.6.20 for co-authorship, co-occurrence, and bibliographic coupling. Brazil emerged as the top contributor, with the highest number of publications, institutional affiliations, and collaborative efforts among researchers. The year 2022 recorded the highest scholarly output, with 32 publications. Keyword analysis shows that the primary research focus is on antioxidant activity, bioactive compounds, and the therapeutic potential of this plant. Overlay visualizations indicated an increasing emphasis on in vivo testing of pharmacological effects, especially concerning anti-inflammatory and cytotoxicity studies. These findings highlight opportunities for further research in previously underexplored areas, such as antimicrobial and anticancer applications, and support the strategic cultivation of *E. uniflora* L. as a pharmacologically valuable plant. This research provides a solid foundation for future studies on *E. uniflora* L.

Keywords: *Eugenia uniflora* L., pitanga, Suriname Cherry, Brazilian Cherry, Bibliometric Analysis.

Introduction

Suriname cherry (*E. uniflora* L.) is a member of the *Myrtaceae* family, which has various potential uses in the field of pharmacology.¹ This plant can be found in different regions of South America and Southeast Asia. This plant is also cultivated in Latin America under the name Pitanga² and is known as dewandaru in Indonesia.³ *E. uniflora* L. is a rounded, branching plant that reaches a height of 10 meters. This plant possesses a deep root system and long-lasting foliage.² The stalks of this plant's leaves are approximately 2 mm long, turning dark green when mature and brownish green when immature. *E. uniflora* L. typically resembles a berry in appearance and features skin with 8-10 longitudinal lines or grooves. The leaves of *E. uniflora* L. have been found to contain a variety of compounds, including anthraquinones, steroids, triterpenes, flavonoids, saponins, and tannins.⁴ The fruit also contains several bioactive compounds, including carotenoids, proanthocyanidins, flavonols, and catechins.⁵ Interest in *E. uniflora* L. is increasing with the ongoing progression of phytopharmaceutical research and the development of natural medicine. Studies have shown that this plant has potential uses as an anticancer agent, a hepatoprotective substance, an antimicrobial agent, an anti-inflammatory agent, and an antioxidant.^{1,6} Its therapeutic potential makes it a significant focus in research related to pharmacy, biotechnology, toxicology, and the development of plant-based

pharmaceuticals. Previous studies have employed a similar approach to examine the quantitative and visual distribution of scientific literature on this subject in relation to medicinal plants. For instance, a research study titled "*Amazonian Plants: A Global Bibliometric Approach to *Petiveria alliacea* L. Pharmacological and Toxicological Properties*"⁷ presents a global bibliometric analysis of *Petiveria alliacea*, a medicinal plant with analgesic, immunomodulatory, anti-inflammatory, and antioxidant properties. The study reveals the constraints of collaboration between researchers and underscores the need to strengthen research networks to accelerate the scientific progress of this plant. Furthermore, a study titled "*Bibliometric analysis of antibacterial activity of *Centella asiatica*: A study based on Scopus database*"⁸ examines bibliometric research by assessing research trends, scientific partnerships, and principal subjects in studies on the antibacterial properties of *C. asiatica*. To date, no bibliometric research has focused on *E. uniflora* L. Consequently, a bibliometric analysis is necessary to provide a thorough overview of the research trends that have emerged, thereby serving as a basis for formulating more strategic directions for future research on *E. uniflora* L. Bibliometric analysis employs bibliographic data to methodically evaluate publication patterns, research collaborations, and the knowledge framework within a specific field of study. Extensive scientific datasets can be analyzed more efficiently with the aid of bibliometric software, such as VOSviewer, in conjunction with scientific databases like Scopus.⁹ VOSviewer enables visualization of connections between authors, countries, institutions, and frequently cited keywords in scientific research.¹⁰ Additionally, a bibliometric analysis can reveal changing research trends over time and identify the most influential studies within a specific subject area.¹¹ This study aims to provide an overview of the development of publications explored within the Scopus database related to *E. uniflora* L. Despite current limitations in bibliometric research in this area, the number of publications on *E. uniflora* L. continues to increase. More comprehensive bibliometric analyses are needed to fully explore global research patterns, collaborations among authors, and underlying trends

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related to this plant. Although research exists, the key therapeutic properties of *E. uniflora* L., such as its antimicrobial and anticancer activities, have not been thoroughly examined. This underscores the need for a systematic bibliometric study to clarify current research developments and guide future research goals. Therefore, this study also aims to analyze articles about *E. uniflora* L. cataloged in the Scopus database. Additionally, it seeks to provide evidence-based recommendations for future research, especially in developing therapeutic agents from *E. uniflora* L. and identifying medications based on natural products.

Materials and Methods

Research design

This analysis employs bibliometric techniques to examine scientific publications indexed in the Scopus database. Scopus is widely recognized as a leading online resource for bibliometric research, comprising the largest global database of abstracts and citations.^{12,13} It surpasses the Web of Science in terms of its overall scope and effectiveness for conducting keyword searches and citation analyses, providing more comprehensive coverage of scholarly literature across a broad range of academic subjects. Unlike Scopus and Web of Science, Google Scholar lacks stringent quality control, indexing materials from academic websites without quality evaluation, which results in a mix of

high and low-quality content, such as blogs and articles.^{8,14} The period used in this study is 2020-2025. This study focuses on the literature regarding *E. uniflora* L., with inclusion criteria that include open-access articles and reviews from English-language journals. The six years were chosen to ensure the recency of the data to be analyzed.

Search strategy

The search for scientific articles was performed in the Scopus database using the search types "Article title," "Abstract," and "Keywords." The keywords used were "eugenia AND uniflora" OR "pitanga" OR "surinam AND cherry" OR "brazilian AND cherry." The search filters applied in this study included open-access articles and reviews. The study focused on journals as the source type, English as the language, and publications from the past six years. An initial pool of 920 articles was narrowed down to a final dataset of 146 articles that met the inclusion criteria.

Data analysis

The analysis was limited to published papers that met the specified inclusion criteria. The criteria included original research articles, review articles, and English-language publications, with the additional stipulation that studies had to focus exclusively on *E. uniflora* L. The data collection and study screening procedure is illustrated in Figure 1.

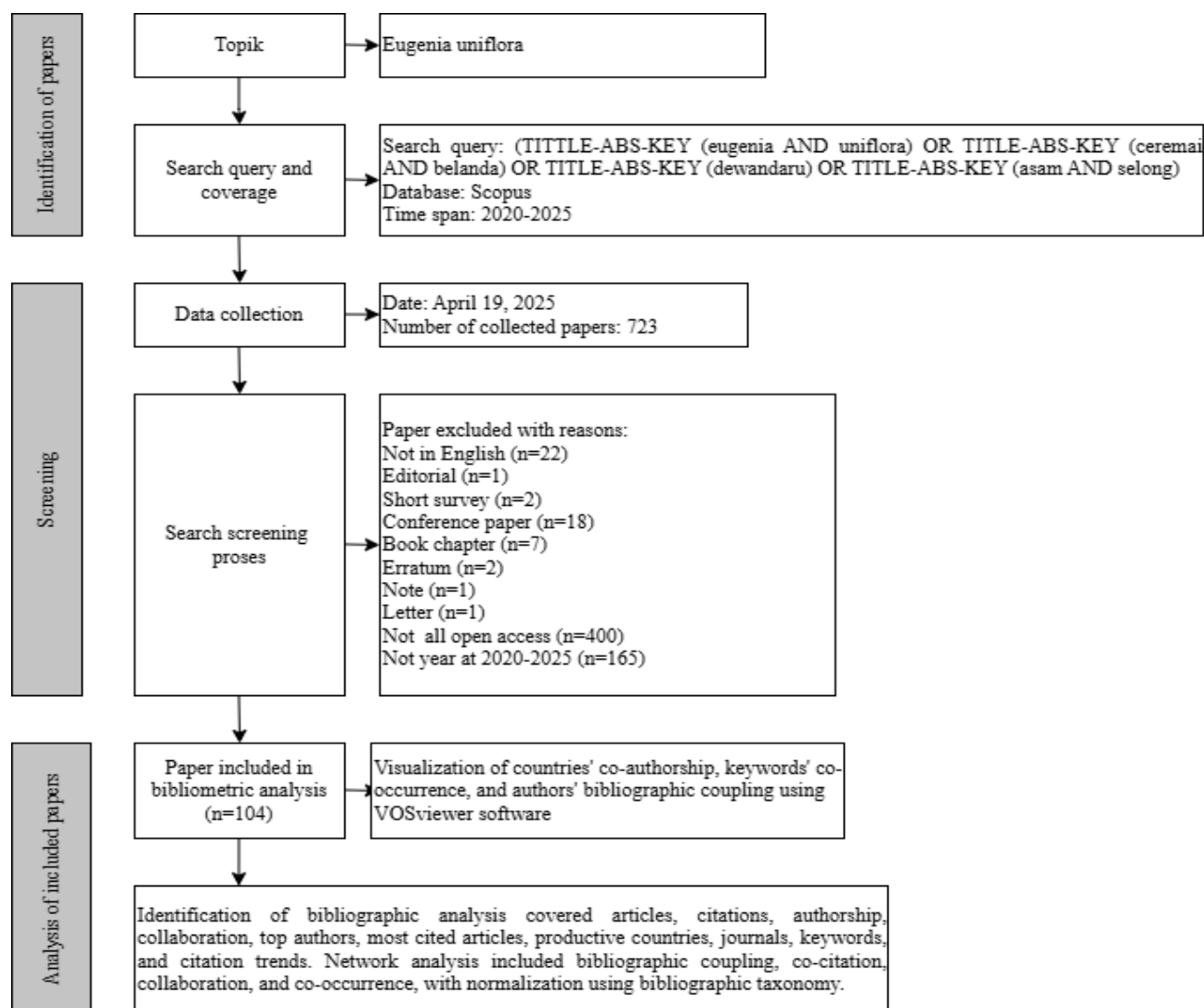


Figure 1: Flowchart of research methods.^{10, 15, 18}

The final selection of papers was then converted into CSV format and exported to VOSviewer software, version 1.6.20, for additional

analysis.¹⁵ The analysis includes three key components: international co-authorship, keyword co-occurrence, and bibliographic links between

authors, each displayed as a separate network graph. Items such as countries, keywords, and authors are depicted as nodes within these maps. Each node is sized in proportion to the relative weight or importance of the item it represents.^{10,16,17} The color signifies cluster affiliation, with connecting lines denoting specific relationships, such as collaboration, co-occurrence, or bibliographic connection.¹⁸

Results and Discussion

Publication trends

From an initial collection of 920 publications concerning *E. uniflora* L., a total of 146 satisfied the specified inclusion criteria. These works were published across 107 journals and featured a total of 160 authors. The first study to be included, from a 2020 issue of *Pharmaceuticals*, was titled "A Polyphenol-Rich Fraction from *Eugenia uniflora* Exhibits Antioxidant and Hepatoprotective Activities In Vivo".¹⁹ The most recent study, published in the *Journal of Antibiotics* in 2025, is entitled "*Chemical* Characterization and Antimicrobial Activity of Essential Oils and Nanoemulsions of *Eugenia uniflora* and *Psidium Guajava*,"²⁰

which characterises the essential oils of these plants and assesses their antimicrobial activity.

Figure 2 depicts the publication output of *E. uniflora* L. between the years 2020 and 2025, which exhibits a fluctuating pattern. In 2022, a notable increase was observed, with 32 research papers published. In contrast, the number dropped significantly to a total of nine publications by 2025. The significant drop may be due to either insufficient data collection for that year or a decreasing interest in researching *E. uniflora* L.

Contribution of countries and their collaboration

Figure 3 shows the number of publications about *E. uniflora* L. across different countries. According to the data, Brazil tops the list with a total of 108 publications, providing the most significant contribution to the field. The figure is notably higher than that of other countries, highlighting Brazil's substantial publication activity related to *E. uniflora* L.

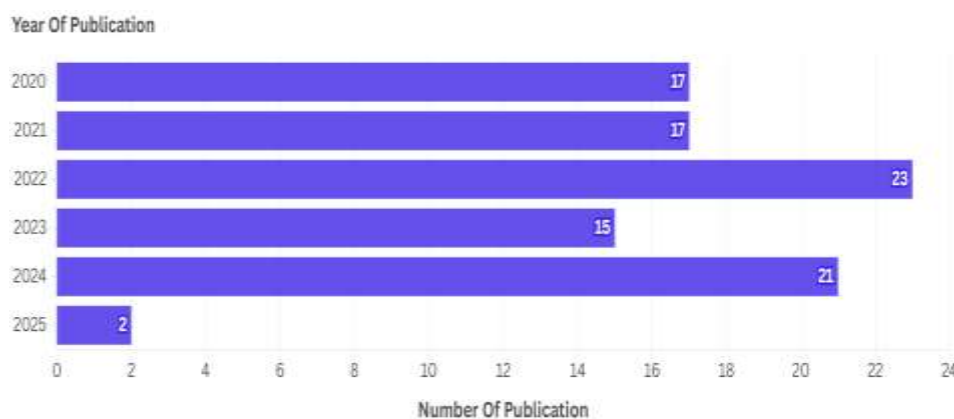


Figure 2: Publication trends on the topic *E. uniflora* L.

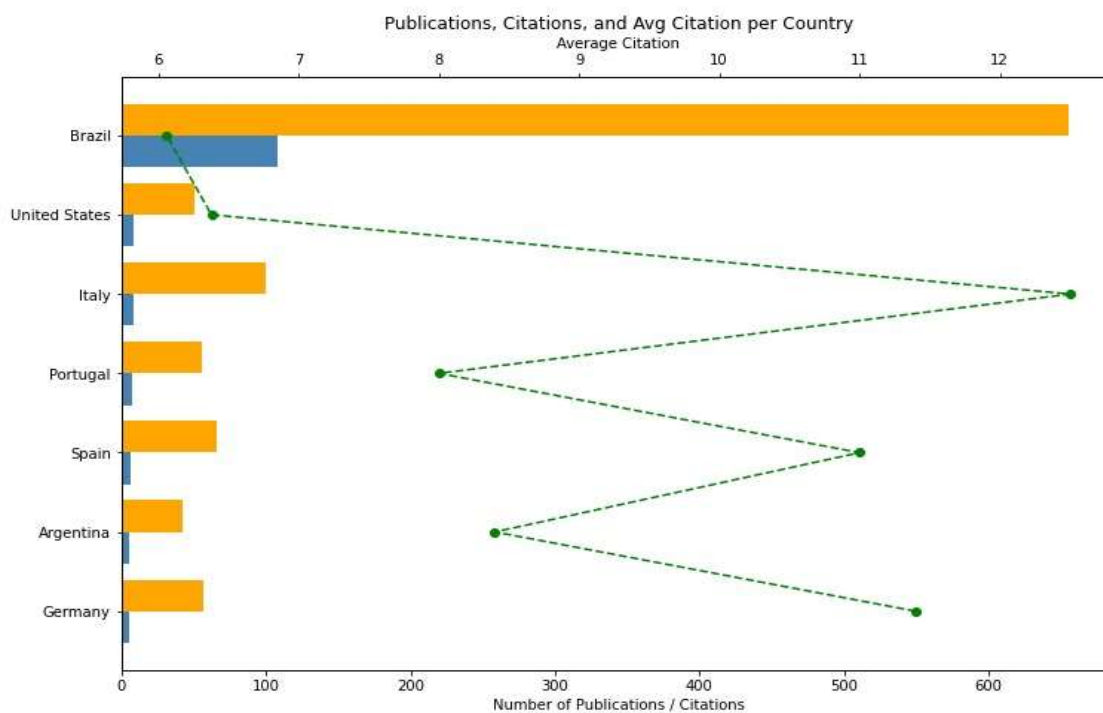


Figure 3: The most productive countries in the topic of *E. uniflora* L.

* Blue bars = number of publications; orange bars = total citations; green dashed line = average citation per publication

Brazil tops the list with 108 publications, trailed closely by Italy and the United States, which both have a respectable number of contributions. Portugal occupies the fourth position with seven publications, while

both Indonesia and Spain boast six publications each, indicating a moderate level of research activity. Both Argentina and Germany have five publications each. India and Australia exhibit the lowest levels of

engagement, with 3 and 2 publications, respectively, indicating a relatively minor level of participation compared to other nations. Brazil records the highest total number of citations (655), followed by Italy (100) and Spain (66). However, in terms of average citations per paper, Italy ranks first with 12.50, ahead of Germany (11.40) and Spain (11.00). This rank may indicate that the latter three nations produce research of significant impact or quality.

Co-authorship analysis at the country level was conducted using VOSviewer to visualize collaborations between countries. Countries

included in the study had to meet a minimum threshold of publishing at least one work and having zero citations. The network of international collaboration on *E. uniflora* L. research is illustrated in Figure 4. The seven largest connected countries among the 40 are Brazil, Portugal, Germany, Italy, Spain, the United States, and Argentina. Brazil exhibits the highest level of international collaboration, with a total of six links through its connections with Portugal, Germany, Italy, Spain, the United States, and Argentina.

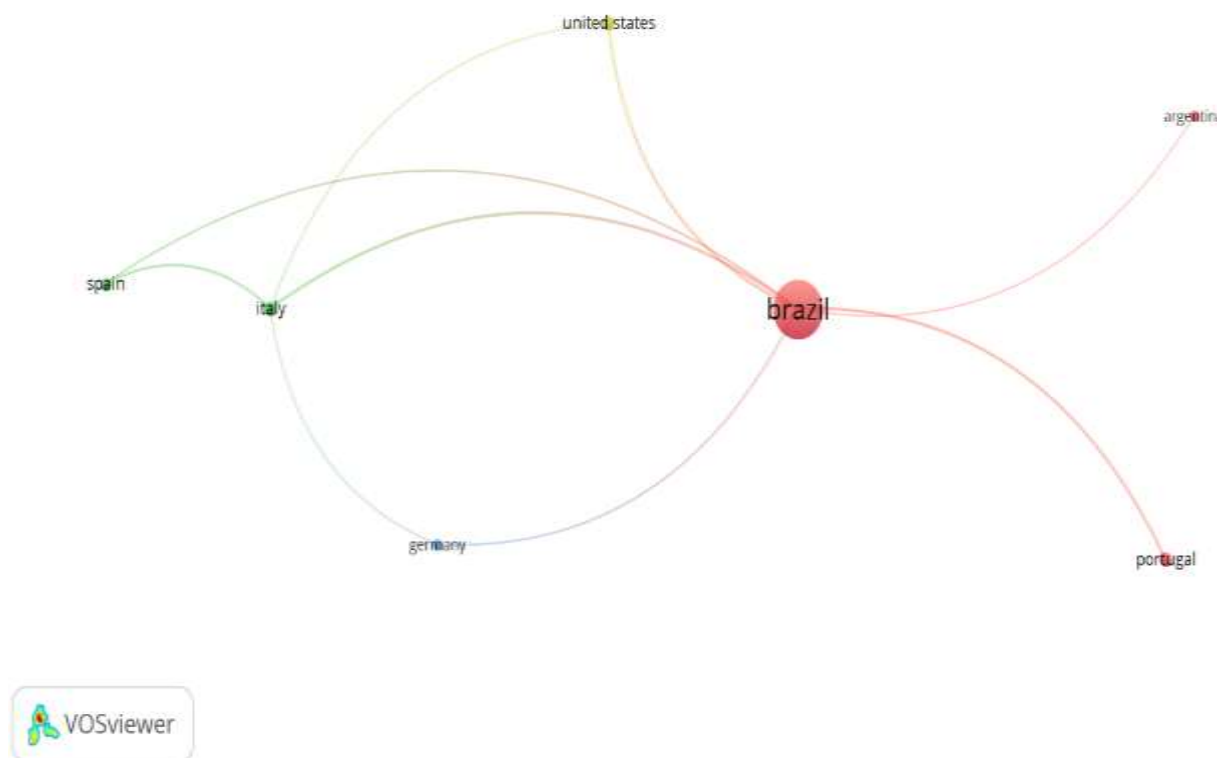


Figure 4: Visualization of the co-authorship network among countries researching *E. uniflora* L.

Contributions based on affiliation

The analysis of 146 selected articles indicates that 160 institutions have contributed to the research on *E. uniflora* L. Table 1 highlights the ten most productive institutions, all of which are in Brazil. The Universidade de São Paulo and the Universidade Tecnológica Federal do Paraná are the leading contributors; each having published 10 articles. The Universidade de São Paulo has a higher citation count of 79. Other notable contributors include the Universidade Federal do Pampa, which has published eight articles with 49 citations, and five institutions with seven publications each, including the Universidade Federal do Pará, which has 138 citations, and the Universidade Estadual de Campinas, which has 88 citations. Among the most productive institutions, the Universidade Federal do Pará recorded the highest average citation rate of 19.71, signifying that its publications in this area have a significant impact.

The dominance of *E. uniflora* L. research in Brazil is attributed to the plant's importance in the health and pharmaceutical sectors, which has garnered significant academic attention. While multiple institutions have published a comparable number of studies, the citation counts indicate a notable disparity, suggesting differences in the scientific impact of their research. Brazilian institutions are key drivers of research advancements on this species, showcasing leadership in both the quantity of output and the extent of scholarly influence.

Contributions by journals

A total of 146 selected papers on *E. uniflora* L. were published across 107 different journals. The top five journals with the highest publication output on this subject are listed in Table 2. Most notably, the *Molecules* journal was the most productive, publishing six articles with 39 citations, which signifies a significant level of influence among researchers. The *Australian Journal of Crop Science* came in second, with four articles and 18 citations. *Ciencia Rural* and *Foods* journals published a total of four articles, with *Foods* receiving significantly more citations, amounting to 36, compared to the 27 citations received by *Ciencia Rural*. Notably, the number of citations does not necessarily reflect the level of influence each article has, as this can be influenced by factors such as quality and relevance. *Acta Botanica Brasilica*, with three publications and ten citations, further illustrates this point. The comparison implies that the productivity of a journal is not always directly correlated with the number of citations it receives, as the quality and relevance of the topic also influence an article's citation rate.

Analysis of authors and their bibliographic relationship networks

Figure 5 illustrates a network map of author collaboration in *E. uniflora* L. research, generated through bibliographic coupling analysis using VOSviewer. Each node symbolizes an author, with the size of the node reflecting the strength of their connections, and lines between nodes display bibliographic links.

Table 1: The most productive affiliate on the topic *E. uniflora* L.

No	Affiliation	Country	Number of publications	Citation	Average citation
1.	University of São Paulo	Brazil	10	79	7.90
2.	Universidade Tecnológica Federal do Paraná	Brazil	10	68	6.80
3.	Universidade Federal do Pampa	Brazil	8	49	6.13
4.	Universidade Federal do Pará	Brazil	7	138	19.71
5.	Universidade Estadual Paulista Júlio de Mesquita Filho	Brazil	7	17	2.43
6.	Universidade Federal de Pelotas	Brazil	7	32	4.57
7.	Universidade Estadual de Campinas	Brazil	7	88	12.57
8.	Universidade Federal de Pernambuco	Brazil	7	11	1.57
9.	Universidade Federal de Campina Grande	Brazil	6	26	4.33
10.	Universidade Federal de Santa Catarina	Brazil	6	32	5.33

Table 2: The most productive journal on the topic of *E. uniflora* L.

No	Journal	Number of documents	Citation	Average citation
1.	Molecules	6	39	6.50
2.	Australian Journal of Crop Science	4	18	4.50
3.	Ciencia Rural	4	27	6.75
4.	Foods	4	36	9.00
5.	Acta Botanica Brasilica	3	10	3.33

Three main clusters of authors are identified by color - red, blue, and green - which indicate the frequency and intensity of their collaborative relationships; the red cluster, led by "Pinton, Simone", is defined by a central figure with many connections within the group. Centered on the individual "Cipriano, Roger Raupp," the blue cluster acts as a connection between the red and green clusters. The green cluster comprises authors such as "Lima, Antônio Gilson Barbosa D." and "Amadeu, Lumara Tatiely Santos," who demonstrate significant collaborations within their own group and with other clusters. The map overall displays a closely connected network with several key researchers facilitating collaboration in this field.

Keyword co-occurrence network

Figure 6 shows a bibliometric network visualization of the results from a keyword co-occurrence analysis, created using VOSviewer software. The visualization illustrates the relationship between keywords that frequently co-occur in scientific papers on *E. uniflora* L., a plant renowned for its diverse pharmacological properties. In this visualization, each node represents a keyword, and its size indicates the frequency with which the word appears. Colorful clusters of keywords are closely connected. At the center is "*Eugenia uniflora*," which serves as the main focal point of the study. This keyword links to several key aspects of the research, including chemical compounds, biological effects, and geographical and taxonomic factors.

One of the most notable groups is the red cluster, which focuses primarily on antioxidants. Keywords such as "antioxidant", "plant extract", "flavonoids", and "bioactive compounds" are prominent nodes in this cluster, indicating a substantial research focus on the antioxidant properties of phenolic compounds found in *E. uniflora* L.²¹⁻²⁴

The exploration of bioactive compounds in various plant parts, such as leaves, fruits, and essential oils, is a key area of focus, as indicated by the grouping of keywords like "chemical analysis", "essential oil", "plant leaves", and "fruits" in the red cluster.²⁵⁻²⁷ The inclusion of the keyword "Brazil" in this cluster suggests that the plant in question

originates from Brazil and has been the subject of the most research studies.

The blue cluster focuses on the phytochemical properties and unique substances of plants. The core terms of this cluster are "polyphenols", "quercetin", "gallic acid", and "phytochemistry". This cluster presents a deeper investigation into the characterization of active compounds using methods such as the DPPH assay^{28,29} and high-performance liquid chromatography (HPLC).³⁰ This cluster is closely related to the red cluster, as it also focuses on antioxidant activity, but with a stronger emphasis on identifying individual compounds.

The green cluster is primarily focused on biological studies and the pharmacological effects of *E. uniflora* L. Key terms in this field include "nonhuman", "rat", "animal experiment", "oxidative stress", and "apoptosis". Some studies have been conducted on animals to examine the biological effects of compounds found in this plant.³¹ Research has also examined immunomodulatory and cellular protective effects,³² in addition to antioxidant effects, as indicated by the keywords "anti-inflammatory activity" and "controlled study".

A discussion cluster focused on yellow identifies the issues of toxicity and safety, encompassing terms such as "cytotoxicity", "animals", and "genetics". The emergence of this cluster suggests that the protection of *E. uniflora* L.²⁴ is becoming a priority area of concern. Despite this, their significance is still overshadowed by the emphasis on antioxidant activity. Studies in this area have helped develop formulas that are safe for humans to use.³¹

The relationships between clusters are very close, as shown by the numerous lines connecting nodes of different colors. Research on themes such as antioxidant activity appears to be closely interconnected with studies on biological effects, toxicity, and phytochemicals. According to the overlay visualization results in Figure 7, a new trend, marked in yellow, has become visible, indicating topics such as "animal experiment," "anti-inflammatory activity," "oxidative stress," and "animal model." Current research on *E. uniflora* L. plants mainly involves testing their biological activity in living organisms, especially in animal models.

 VOSviewer

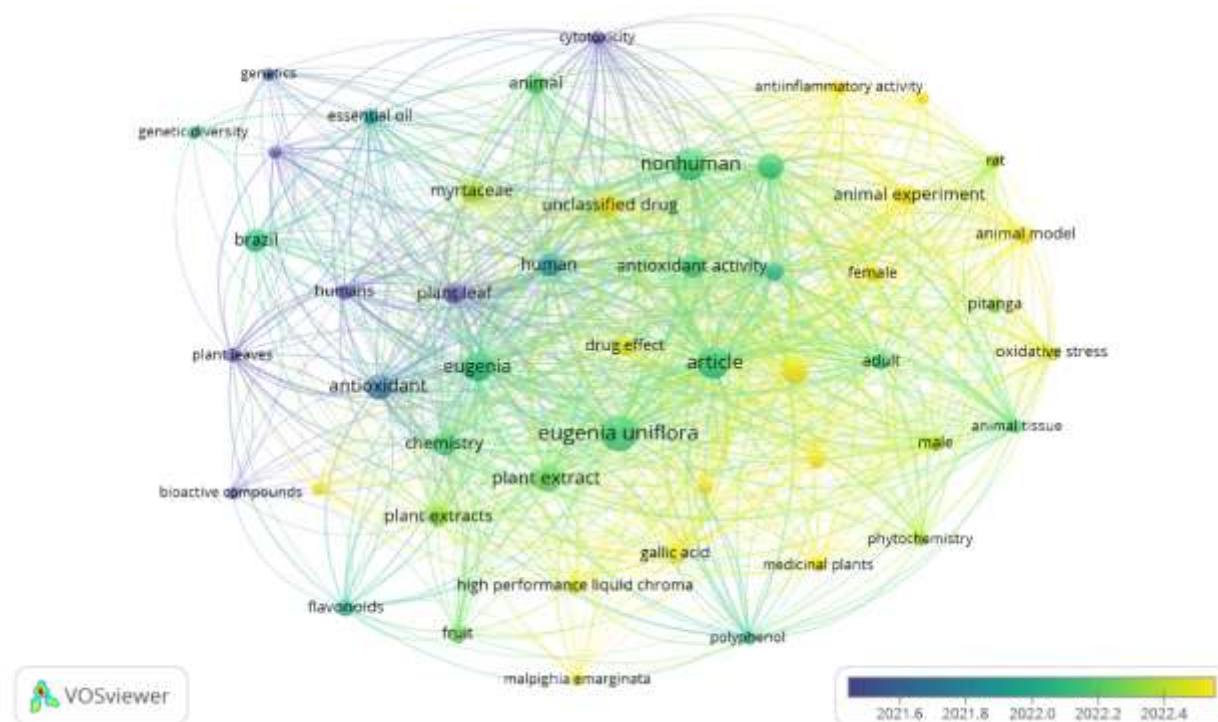


Figure 7: The mapping of VOSviewer overlay visualization on the topic of *E. uniflora* L.

The network visualization supports this by highlighting a green cluster with keywords like "nonhuman," "animal tissue," "drug effect," and "rat." Experimental and preclinical approaches are becoming increasingly prominent, suggesting that studying the mechanisms of action of active compounds, assessing toxicity, and developing phytopharmaceuticals will be highly promising in the future. The combined results of overlay and cluster visualizations show that *E. uniflora* L. has significant research potential. Predictions indicate that future research will focus more on detailed studies of pharmacological activity, including the isolation and identification of compounds with therapeutic potential, as well as preclinical testing, to progress toward clinical trials.

Conclusion

Recent research has demonstrated a rising academic emphasis on *E. uniflora* L. between 2020 and 2025, with a particularly pronounced surge in publications in 2022, indicating heightened interest in its pharmacological properties. Brazil emerged as the leading contributor in terms of publications, institutions, and researchers, thereby solidifying its position as a central hub for *E. uniflora* L. research. VOSviewer analysis revealed significant collaborations among authors and recurring research topics, particularly in the examination of plant bioactive compounds, including flavonoids and polyphenols, as well as toxicological and preclinical research. The keyword mapping revealed that antioxidant activity and bioactive compounds continue to be dominant topics, alongside an emerging interest in in vivo pharmacological testing, which includes anti-inflammatory and cytotoxicity studies. Despite the focus on other aspects, there has been relatively little research into the antimicrobial and anticancer potential of this area, suggesting a promising direction for future studies. The overlay map indicates a shift towards conducting preclinical and experimental research using animal models, which underscores the need for a more in-depth examination of mechanisms of action, safety assessment, and potential opportunities for advancing to the clinical stage. Maximizing the potential of *E. uniflora* as a pharmacologically relevant natural product will depend on strengthening global collaborations and broadening the scope of research topics, particularly beyond antioxidant studies.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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