Bibliometric Analysis of Propolis Research Based on ITGInsight

yifan wang
17869806026@163.com
Dali University https://orcid.org/0009-0006-5414-7448
Xi Liu
Dali daxue: Dali University
Yanqing Yang
Kunming Medical University Second Hospital: Kunming Medical University Second Affliated Hospital
Jianfang Yang
Dali University
Hongchi Ding
Dali University
Canwei Li
Dali University
Zizhong Yang
Dali University
Hairong Zhao
Dali University
Yu Zhao
Dali University
Chenggui Zhang
Dali University
Weihong Liu
Dali University
Pengfei Gao
Dali University https://orcid.org/0000-0001-6909-4701

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Abstract

Propolis garnered considerable attention due to its multifaceted pharmacological properties. A bibliometric analysis of 4,215 propolis research papers published between 2014 and 2024 was conducted in this study. The Web of Science Core Collection database served as the data source, and ITGInsight software was utilized for analytical processing. The study delineated propolis research through multi-dimensional assessments, including national contributions, institutional affiliations, author influence, journal prominence, and thematic evolution. It revealed that Brazil, China and Turkey were the leading contributors, while the most productive institutions went to the University of São Paulo (Brazil), the State University of Maringá (Brazil), and King Saud University (Saudi Arabia). Scholars such as Jairo Kenupp Bastos and Vassya Bankova were identified as prominent figures, while the journals *Molecules*and the *Journal of Apicultural Research* stood out as the predominant publication platforms. Thematic analysis indicated sustained interest in the chemical composition and its medicinal properties of propolis. Burst detection analysis identified “nanotechnology”, “functional foods”, and “immune regulation” as emerging research frontiers in recent years. Generally, thisstudy summarized the landscape and trends of propolis research and offered valuable guidance for future explorations.

1. Introduction

Propolis is a kind of natural substance produced by honeybees from plant resins, salivary secretions and wax(Li, Li et al. 2021, Tanuğur Samanci, Bayar Muluk et al. 2024). It contains a heterogeneous composition of bioactive phytochemicals, including flavonoids, phenolic acids and terpenoids(Tanuğur Samanci, Bayar Muluk et al. 2024), which endow propolis with multifaceted pharmacological properties, such as potent antioxidant, anti-inflammatory, antimicrobial and antiviral activities(Wallis and Galarneau 2020, Bouzahouane, Ayari et al. 2021). The therapeutic application of this resinous substance can be traced back to antiquity, and the earliest documented reference was found in Aristotle’s Historia Animalium (384 – 322 BCE), in which the Greek philosopher described its origin and medicinal use as a pungent “black wax” for treating skin ailments, cuts and infected wounds(Ghisalberti 1979).

Modern scientific research continued to affirm propolis’ therapeutic and other potential. For example, Phonrachom *et al.*(Phonrachom, Charoensuk et al. 2023) developed quaternized chitosan/pectin hydrogel films loaded with it to improve wound closure. Xu *et al.*(Xu, Lu et al. 2022) observed flavonoids isolated from it possessing the potential to treat diseases relating to oxidative stress, while Vivek P. Chavda *et al.*(Chavda, Vuppu et al. 2024) revealed that it could reduce the risk of atherosclerosis. Wang *et al.*(Wang, Cai et al. 2023) identified that caffeic acid phenethyl ester (CAPE) isolated from it could modulate inflammatory cascades, and Martinotti *et al.*(Ranzato 2025) reviewed its anti-cancer properties. In addition, Pu *et al.*(Pu, Jiang et al. 2023) pioneered its application as bioactive food coatings. It was noteworthy that research by Campos *et al.*(de Almeida Campos, Renzi et al. 2025) found that the antibacterial activity of propolis was closely related to its complex and diverse phytochemical components..

Bibliometrics encompasses theoretical frameworks, analytical techniques and practical applications(Lyu, Liu et al. 2023), enabling systematic evaluation of publication trends, citation networks and research impact(Donthu, Kumar et al. 2021). Its utility is well-established in medical research. For instance, a bibliometric analysis of honey spanning the years 2001 to 2022 was conducted to examine its antioxidant and antimicrobial properties by Christos Stefanis *et al*(Stefanis, Stavropoulou et al. 2023).

Regarding analytical software selection, contemporary bibliometric analysis requires a specialized tool to perform sophisticated data mining and visualization tasks, such as VOSviewer (for scientific knowledge mapping), CiteSpace (for literature evolution analysis), Bibliometrix (an R-based bibliometric package) and ITGinsight (an intelligent literature visualization platform). Developed by Engineer Liu Yuqin of Beijing Zhengyi Technology Co., ITGInsight enables comprehensive text mining and visual representation and offers robust capabilities for bibliometric analysis(Wang, Zhang et al. 2021). Its robust data processing and dynamic visualization features were implemented in diverse contexts from Yali Qiao's photovoltaic patent analysis to Wang *et al.*'s medical research mapping(Wang, Zhang et al. 2021, Qiao, Porter et al. 2025). Following a thorough comparison of existing bibliometric tools in terms of functionality and practical suitability, ITGInsight (Intelligence Insight) was adopted as the central analytical platform in the research.

Although extensive literature was accumulated in propolis research, a systematic analysis remained missing. To address it, this study introduced bibliometric analysis to analyze propolis publications from 2014 to 2024. As the first systematic quantitative research of propolis, the work filled a critical methodological gap and offered fresh insights for follow-up studies.

2. Materials and Methods

2.1 Data Sources and Search Strategy

The Web of Science (WoS) database, as the primary data source due to its inclusion of high-impact journals worldwide, allows users to retrieve both current and historical literature(Sevinc 2004, Mongeon, Philippe et al. 2016). Its broad coverage and detailed metadata, including titles, abstracts and keywords, is recognized as a solid foundation for bibliometric research and data visualization.

The search was conducted in the WoS Core Collection on December 9, 2024, encompassing publications from January 1, 2014, to December 1, 2024. The query TS (propolis OR “bee gelatine” OR “bee glue”) was employed, where TS denoted title, abstract and keyword fields. All retrieved records were exported from the Web of Science (WoS) database and imported into ITGinsight for bibliometric analysis. Initial screening filtered documents by type (articles and reviews) and language (English). The discrepancies were identified and corrected through a screening process. Study documents were included based on specific criteria that required clear focus on propolis or its components such as bee gelatine and bee glue. Exclusion criteria eliminated studies unrelated, those having duplicated content, incomplete data, or non-research publications such as brief communications and opinion pieces. This approach ensured that only relevant, high-quality research was incorporated into the analysis. Finally, the refined dataset was analyzed through ITGInsight software.

2.2 Statistical Analysis

Annual publication output was recorded through ITGInsight 2.5.0, with key parameters setting as follows: term length (2–4 words), standard stopword lists, and the filter-wos1-author-use-fullname-doi-as-id preset. The study applied Top N (N = 30) ranking criteria to the 2014–2024.

3. Results

3.1 General Data

As illustrated in Fig. 1, the flow diagram presented the numerical distribution of publications at each sequential stage. Initially, the query yielded 5,724 records, which underwent a rigorous screening process. Specifically, during the data screening process, an initial selection was made based on document type and language. Only English articles and review publications were retained to ensure the analysis to focus on research outputs with substantial academic merit. Subsequently, manual screening was conducted to eliminate irrelevant publications. 4,215 publications were obtained for analytical procedures finally.

3.2 Publication Analysis

3.2.1 Publication Distribution

The distribution of publications is considered as a key indicator reflecting the development trends of the research(Zupic and Ater 2014). A total of 4,215 propolis-related publications were identified through systematic retrieval from the WoS Core Collection in the study. The resultant dataset comprised distinct publication categories: 3,820 research articles, 395 review papers, 3 book chapters, 2 editorial materials, 58 early access documents, 1 data paper and 20 conference papers, which represented the full spectrum of scholarly discourse on propolis research.

3.2.2 Journal Analysis of Publication Sources

As presented in Table 1 and Fig. 2, the top five journals ranked by publication volume included *Molecules* (161 articles, 4,245 citations), J*ournal of Apicultural Research* (90 articles, 1,163 citations), *Evidence-Based Complementary and Alternative Medicine* (69 articles, 2,037 citations), *Scientific Reports* (56 articles, 1,646 citations), and *PLOS One* (52 articles, 1,689 citations). *Molecules* emerged as the most prominent journal, which likely attributed to its open-access policy and interdisciplinary scope spanning chemistry, biology, and materials science.

The temporal evolution of journal distribution revealed distinct phases. From 2014 to 2018, research output was concentrated in *Evidence-Based Complementary and Alternative Medicine*. Between 2019 and 2024, *Molecules* became the dominant platform, driven by its broader disciplinary coverage.

Table 1
Top 5 journals by number of publications

Source	Documents	Citations
Molecules	161	4245
Journal Of Apicultural Research	90	1163
Evidence-Based Complementary And Alternative Medicine	69	2037
Scientific Reports	56	1646
Plos One	52	1689

3.3 Analysis of Annual Publication Output

The study of propolis between 2014 and 2024 revealed a marked escalation in scholar activity, as indicated by the publication numbers. The annual research output of propolis was detailed in Table 2. A total of 4,215 publications were published with an average of 383 articles in each year, equivalent to more than 31 core publications per month. A linear regression analysis of publication volume (y) against time (x) showed a significant positive correlation (r = 0.86), with the best-fit linear equation expressed as $\hat{y} = 33.45x + 234.36$.

As represented in Fig. 3, the sustained upward trend of output from 2014 to 2024 signified intensifying research engagement with propolis. Two distinct peaks were observed in 2019 (409 publications) and 2021 (521 publications), suggesting the emergence of breakthrough studies or the influence of major research initiatives. After 2019, publication numbers stabilized at consistently high levels, which demonstrated sustained research activity in propolis field. Furthermore, distinct evolutionary phases were observed across the studied decade: the initial phase (2014–2018) witnessed gradual expansion from 234 to 289 annual publications, reflecting fragmented research directions during this exploratory period. In contrast, the subsequent phase (2019–2024) showed significant acceleration and reached a peak of 543 publications in 2023, which may be attributed to converging research priorities and increased funding support.

Table 2
Annual distribution of propolis research output

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number	234	229	248	280	289	409	423	521	526	543	513

3.4 Author Analysis

Author productivity analysis (Table 3) revealed Jairo Kenupp Bastos from the University of São Paulo, Brazil, was the most prolific author with 55 publications (542 citations). Followed by Vassya Bankova of the Bulgarian Academy of Sciences(45 publications, 1396 citations), while Milena Popova (Canterbury

Christ Church University, UK; 39 publications, 1270 citations) and Boryana Trusheva (Bulgarian Academy of Sciences; 30 publications, 912 citations) secured the third and fourth positions respectively. José Mauricio Sforcin from São Paulo State University (28 publications, 604 citations) and Badiaa Lyoussi from Sidi Mohamed Ben Abdellah University (28 publications, 661 citations) ranked fifth and sixth. Especially, although Chinese scholar Kai Wang (Chinese Academy of Agricultural Sciences) ranked seventh with 27 publications, whose papers' citations reached highly to 1495. From the citation angle, Kai Wang was ranked first in co-citations (average citation rate of 55.37 per article). His research focused on the quality and function assessment of bee products, along with bee biology. In addition, his high citations reflected the vibrant scholarly culture of traditional Chinese medicine (TCM) in China.

The author collaboration network (Fig. 4a) exhibited three distinct regional clusters. Bastos formed the Brazilian core, maintaining strong ties with University of São Paulo colleagues like Victor Pena Ribeiro (18 co-authored publications). Bankova and Popova constituted the dominant Bulgarian cluster (39 co-authored works). Kai Wang represented the Chinese cluster, primarily collaborating with domestic scholars such as Hu Fuliang (12 co-authored publications). Crucially, limited international cooperation was observed among these clusters. Cross-national collaborations accounted for less than 7% of total publications (e.g., 6.8% for Chinese scholars), and the network density remained low at 0.15, revealing a pronounced core-periphery structure.

Activity trend evolution (Fig. 4b) further indicated that Bankova's team displayed peak activity during 2015–2018 (dark nodes), whereas scholars like Bastos (Brazil) and Kai Wang (China) gained prominence (gradual node coloration), and became key contributors in Post-2019. In addition, emerging researchers such as Turkey's Sevgi Kolayli demonstrated notable activities recently. Summarily, it reflected there was dynamic research activities in propolis research.

Table 3
Top10 authors in terms of publications

Rank	Author	Documents	Institution	Citations
1	Bastos, Jairo Kenupp	55	University of São Paulo	542
2	Bankova, Vassya	45	Bulgarian Academy of Sciences	1396
3	Popova, Milena	39	Canterbury Christ Church University	1270
4	Trusheva, Boryana	30	Bulgarian Academy of Sciences	912
5	Sforcin, Jose Mauricio	28	São Paulo State University	604
6	Lyoussi, Badiaa	28	Sidi Mohamed Ben Abdellah University	661
7	Wang, Kai	27	Chinese Academy of Agricultural Sciences	1495
8	Kolayli, Sevgi	27	Karadeniz Technical University	442
9	Bruschi, Marcos Luciano	26	Pharmacist from the State University of Maringa	391
10	Fearnley, James	23	Apiceutical Research Centre	625

3.5 National Analysis

Global propolis research demonstrated significant geographic concentration. It revealed Brazil was positioned No.1 with 822 publications (19.50% of total) and 15,191 citations. Though Brazil produced a high number of papers, its average citation rank stood relatively low (7th, Table 1 in Supplementary Materials). This was possibly linked to the condition that its research mainly focused on resource classification and surveys, and papers from Brazilian institutions were mostly published in local journals. China (387 publications, 9.18%, 8,748 citations) and Turkey (355 publications, 8.42%, 5,712 citations) followed as the second and third contributors respectively. Iran (293 publications, 6.95%, 4,861 citations) and Egypt (281 publications, 6.67%, 5,022 citations) were ranked fourth and fifth (Table 4).

The country distribution map (Fig. 5a) visually depicted the above geographic focus. Variations in color intensity clearly emphasized the high research density in Brazil, China, and Turkey as core hotspots, alongside notable contributions compared with nations like Iran and Egypt.

Table 4
The top 5 countries/regions in propolis research.

No.	Country/Region	Continent	Documents	Citations
1	Brazil	South America	822	15191
2	China	Europe	387	8748
3	Turkey	Asia	355	5712
4	Iran	Asia	293	4861
5	Egypt	Africa	281	5022

3.6 Article Analysis

3.6.1 Top Cited Articles

Through co-citation analysis, the core literature network in propolis research could be identified. The top 10 most co-cited articles were presented in Table 5. There were three review articles and seven research publications in the top 10 cited references. Among the three review papers above, "Recent Advances in the Chemical Composition of Propolis" received 486 citations, followed by "Honey, Propolis, and Royal Jelly: a comprehensive review of its biological actions and health benefits" with 439 citations, and "Composition and functional properties of propolis (bee glue): A review" with 352 citations. These publications were recognized for its summaries of propolis' chemical constituents, biological activities, and functional characteristics.

Meanwhile, the seven research articles in Top 10 cited references focus on three key areas: (1) the validation of antibacterial properties ("Antibacterial Properties of Propolis," 322 citations); (2) the development of analytical methods ("FTIR analysis and quantification of phenols and flavonoids of five commercially available plants extracts used in wound healing," 320 citations); (3) food applications ("Improving functional properties of chitosan films as active food packaging by incorporating with propolis," 318 citations). Together, these studies indicated the current interesting research field in propolis.

Table 5
Top 10 most cited articles by total

Name	Citations
Recent Advances in the Chemical Composition of Propolis	486
Honey, Propolis, and Royal Jelly: A Comprehensive Review of Their Biological Actions and Health Benefits	439
Composition and functional properties of propolis (bee glue): A review	352
Antibacterial Properties of Propolis	322
FTIR analysis and quantification of phenols and flavonoids of five commercially available plants extracts used in wound healing	320
Improving functional properties of chitosan films as active food packaging by incorporating with propolis	318
Biological Properties and Therapeutic Applications of Propolis	307
Chrysin: Sources, beneficial pharmacological activities, and molecular mechanism of action	286
Therapeutic Properties of Bioactive Compounds from Different Honeybee Products	281
Antioxidant Activity of Quercetin and Its Glucosides from Propolis: A Theoretical Study	256

3.7.1 Keyword Analysis

The research focus could be identified through journal and keyword analysis, which enables deeper understanding of the core research themes.

The five most frequently occurring keywords were presented in Table 6. The data revealed that “propolis” (n = 1,948), “antioxidant” (n = 199), and “antioxidant activity” (n = 183) were the three most prominent terms, indicating a strong research focus and its antioxidant properties.

The keyword heatmap of propolis (Fig. 6a) displayed high-frequency terms in its research, including “antioxidant”, “antibacterial”, “anti-inflammatory”, “chemical composition”, and “bioactivity”. These results demonstrated that its research on pharmaceutical purposes became increasingly prominent.

The keyword burst graph (Fig. 6b) identified emerging terms in propolis research. Notable terms such as “nanotechnology”, “functional foods”, and “immunomodulation” were detected in recent years, suggesting that its research expanded into the material science, food and immunology field. Furthermore, the persistent and pronounced bursts of antioxidant and antibacterial themes provided additional validation of its continued predominance in medicine.

Table 6
Top 5 most keywords

Keywords	Documents
Propolis	1948
Antioxidant	199
Antioxidant Activity	183
Flavonoids	161
Oxidative Stress	147

3.8 Institutional Analysis

A significant concentration was observed in the global distribution of institutions in propolis research. The top 10 institutions of research output between 2014 and 2024 were presented in Table 7. The University of São Paulo (Brazil) was ranked first globally with a dominant output of 227 publications and 4,192 citations. Followed by the State University of Maringá (Brazil)(67 publications), King Saud University (Saudi Arabia, 64 publications), and Islamic Azad University (Iran, 59 publications). The University of São Paulo publication counts substantially exceeded that of the the above three institutions, demonstrating its central role in global propolis research. The Bulgarian Academy of Sciences (53 publications) ranked fifth, identified as the European representative. It was noted that although China held the second-highest national publication total (387 publications), no Chinese institution appeared among the global top 10 (e.g., Zhejiang University produced 37 publications), which contrasted with the strong concentration around the University of São Paulo and its affiliated network in Brazil.

The institutional collaboration network (Fig. 7a) visually revealed patterns of cooperation among global propolis research institutions. The University of São Paulo occupied the absolute center of the network, represented by the largest node size, while it formed the strongest connections with ohter institutions, particularly with Brazil institutions. Significant collaborative clusters within Brazil were established, specifically with the State University of Campinas (25 collaborative publications) and São Paulo State University (16 collaborative publications). However, direct collaborative links between Brazilian cluster and other major regional hubs, such as King Saud University, the Bulgarian Academy of Sciences, and Islamic Azad University, were found to be sparse or absent, pointing to insufficient international institutional cooperation. In addition, some regional collaboration existed in the Middle East/North Africa region, exemplified by links between Cairo University and the National Research Centre (9 collaborations) and among Egyptian institutions like Cairo University and Alexandria University.

The institutional burst graph (Fig. 7b) illustrated the evolution of institutional research activity in propolis over distinct periods. Institutions like the University of São Paulo and the Bulgarian Academy of Sciences exhibited sustained high activity in the early period (e.g., 2015–2018, darker nodes). Subsequently, Middle Eastern institutions, including King Saud University and Islamic Azad University (nodes showing gradual color change), experienced a marked increase in research activity around 2019. Throughout the studied decade, the number of institutions engaged in propolis research grew consistently (from 388 in 2014 to 1,076 in 2024). Later stages in Fig. 7b (e.g., 2021–2024) showed the appearance of more nodes representing emerging or increasingly active institutions (lighter nodes), which reflected an expansion in the research community. Nevertheless, the University of São Paulo and core Brazilian institutions maintained its central and active leadership position throughout the entire ten years.

Table 7
The top 10 institutions in propolis research.

No.	Organization	Country	Documents	Citations
1	Univ Sao Paulo	Brazil	227	4192
2	Univ Estadual Maringa	Brazil	67	1132
3	King Saud Univ	Saudi Arabia	64	1441
4	Islamic Azad Univ	Iran	59	798
5	Bulgarian Acad Sci	Bulgaria	53	1202
6	Univ Estadual Campinas	Brazil	52	1608
7	Karadeniz Tech Univ	Turkey	49	755
8	Cairo Univ	Egypt	48	865
9	Sao Paulo State Univ Unesp	Brazil	45	532
10	Natl Res Ctr	Egypt	44	723

5. Discussion

5.1 General Information

Bibliometric analysis with ITGInsight software was employed to systematically analyze 4,215 publications of propolis between 2014 and 2024 in this study.

Propolis research exhibited distinct developmental phases. Annual publication trends were revealed to exhibit two distinct phases as followed. A period of stable expansion was observed from 2014 to 2018, characterized by a 5.8% average yearly growth rate and primary emphasis on fundamental investigations. Subsequently, accelerated development occurred between 2019 and 2024, featuring a 13.4% average annual increase that culminated in peak annual output (543 publications) during 2023. This expansion pattern appeared linking to multiple factors, such as wider accessibility afforded by open-access journals, heightened attention toward natural agents' medical potential triggered by the COVID-19 pandemic, *etc*.

5.2 Journals Distribution

It revealed that *Molecules* (161 publications) ranked first in this field, with 4,245 citations. Its coverage spanned chemistry, biology, materials science and related disciplines. However, concerns about its article quality were raised in recent years due to its extensive output and broad subject scope. Followed by *Journal of Apicultural Research* (90 publications), *Evidence-Based Complementary and Alternative Medicine* (69 publications), *Scientific Reports* (56 publications) and *PLOS One* (52 publications), ranked second to fifth respectively.

5.3 Cooperation Networks

The author collaboration network was found to be dominated by three major research clusters centered in Brazil, Bulgaria, and China. In the Brazilian cluster, Jairo Kenupp Bastos from the University of São Paulo (55 publications) served as the central figure, primarily collaborating with domestic scholars, especially Victor Pena Ribeiro (18 co-authored publications) and colleagues within the same university network. The Bulgarian cluster was tightly formed around Vassya Bankova (45 publications), Milena Popova (39 publications), and Boryana Trusheva (30 publications) from the Bulgarian Academy of Sciences, specially Vassya Bankova co-authoring 39 papers with Popova and 29 publications with Trusheva. In China, Kai Wang (27 publications) from the Chinese Academy of Agricultural Sciences mainly worked with domestic researchers, particularly with Hu Fuliang (12 co-authored publications). However, direct collaborative links between these major national clusters were rare or absent. The overall network density remained low (0.15, it indicates low density), suggesting weak connectivity within the global propolis research community.

The institution collaboration network demonstrated that the University of São Paulo occupied the centre position with 227 publications, maintaining strong domestic ties with the State University of Campinas (25 collaborative studies) and São Paulo State University (16 joint projects). Meanwhile, international partnerships were established with institutions including Universidade de Franca (35 collaborations) and Universidade Federal da Bahia (4 joint efforts). Co-authored papers from the University of São Paulo received an average of 28.5 citations, substantially higher than the 12.7 citations for independent studies. However, the overall network density remained low at 0.15, which suggested that enhanced international cooperation was recommended to foster innovation in propolis research.

Notably, although China ranked second globally in total publications (387), no Chinese institution was listed among the world's top ten most productive institutions (Table 7). By contrast, Brazil's top three institutions produced 354 publications collectively, accounting for 43.1% of its national total (822 publications).

5.4 Research Hotspots

A hotspot refers to a scientific issue or topic keyword in a specific period(Katsurai 2017). The analysis of high-frequency keywords can help identify hot spots in a certain research field.

In this study, “antioxidant” and “antioxidant activity” were identified as the most frequent keywords in propolis research, demonstrating that antioxidant activity received widespread attention. For instance, Boufadi(Boufadi, Van Antwerpen et al. 2018) *et al*. observed that propolis extract restored homeostasis and organ damage caused by oxidative stress. It was closely associated with propolis’ abundant components of flavonoids and phenolic acids. Notably, “flavonoids” ranked as the second most frequent keyword. Its multifunctional properties, including antioxidant, anti-inflammatory and immunomodulatory effects, were broadly applied in functional foods and pharmaceutical development, underscoring the value of propolis’ bioactive constituents.

Keyword bursts serve as a valuable analytical tool, capturing dynamic shifts in research interests and revealing emerging trends(Katsurai 2017). From the perspective of keyword emergence timing, “Nanocomposite” was identified as the most recently emerged term, representingthe convergence of material science and propolis research. The integration of nanotechnology achieved significant improvement in the stability and bioavailability of propolis’ active components, which promoted its application in drug delivery systems and functional materials.

5.5 Implications of Bibliometric Analysis for Policy and Decision-Making

It provides critical evidence for policy and decision-making in healthcare, agriculture, and industrial sectors in propolis field based on the systematic bibliometric analysis. For instance, exploration of propolis' therapeutic properties, including its antimicrobial, anti-inflammatory, immunomodulatory and wound healing effects, fosters more policies and funding to support propolis research and application.

5.6Theoretical and practical implications of bibliometric analysis

Bibliometric analysis was systematically applied to examine thematic evolution, uncover under-explored areas, and monitor emerging patterns. Based on this framework, the theoretical foundation of propolis research was significantly deepened, and a transferable analytical framework was established for similar research. Additionally, the specialized tool ITGinsight enabled multi-dimensional visualization and in-depth interpretation of literature data, providing empirical validation for bibliometrics’ methodological efficacy in complex natural product studies. Crucially, this study fundamentally expanded the application scope and research frontiers of bibliometrics, thereby enhancing its practical value in interdisciplinary contexts.

6. Strengths and Limitations

This study had two important strengths. Firstly, it provided the first systematic bibliometric analysis of propolis research, offering researchers a valuable reference resource of the current landscape and future research directions. Secondly, the research findings were derived through the application of ITGInsight. It enabled sophisticated text mining, multidimensional data visualization and dynamic trend detection, which were crucial for comprehensively mapping the complex evolution of propolis research over the decade. Nevertheless, certain limitations must be acknowledged. Primarily, only the Web of Science

(WoS) database was consulted, whereas other major medical databases such as Scopus and Embase were excluded. Additionally, publications related to propolis from 2025 were excluded from analysis due to incomplete data during the database search (conducted on December 9, 2024), this omission may cause incompleteness in the dataset.

7. Conclusion

This study highlights the dynamic growth and research shift from basic science to practical application in propolis research through bibliometric analysis. These findings provide valuable insights for researchers, policy and decision-makers, guiding future efforts in its practices.

Declarations

Ethics approval（not applicable）

Competing interests

1. The authors have no relevant financial or non-financial interests to disclose.

2. The authors have no competing interests to declare that are relevant to the content of this article.

3. All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

4. The authors have no financial or proprietary interests in any material discussed in this article.

Authors' contributions All authors contributed to the study conception and design. Y.W, X.L, Y.Y: conceptualization, methodology, investigation, software, formal analysis, writing – original draft; J.Y, H.D, C.L: investigation, formal analysis; Z.Y, H.Z, Y.Z: validation; C.Z: funding acquisition, formal analysis; W.L: supervision, funding acquisition;

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Availability of data and material This study is a bibliometric analysis based on publicly accessible literature data from ITGInsight, and no additional datasets or materials were generated. Thus, the availability of data and material statement is not applicable.

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Figures

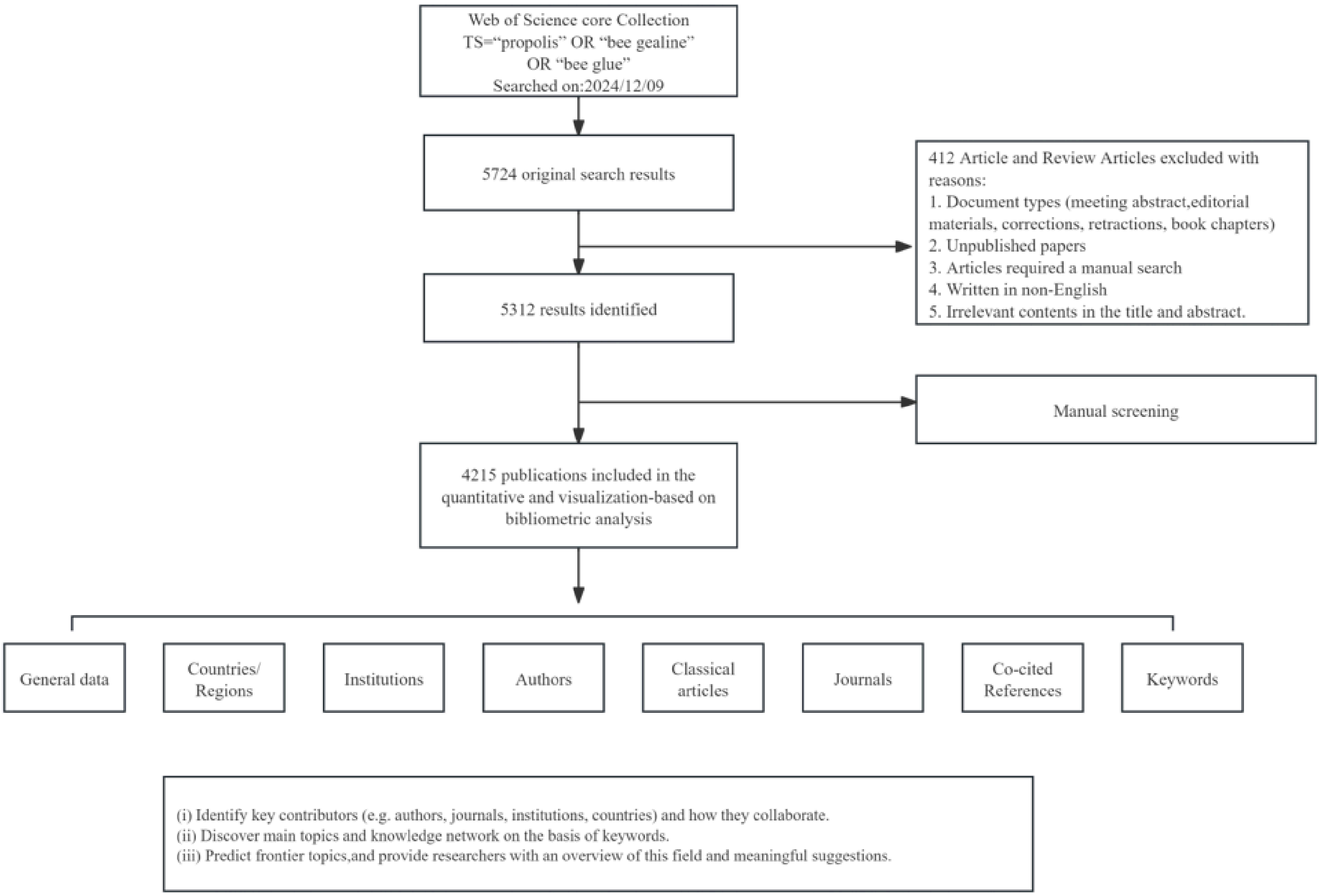


Figure 1

Flowchart of data screening and bibliometric analysis.

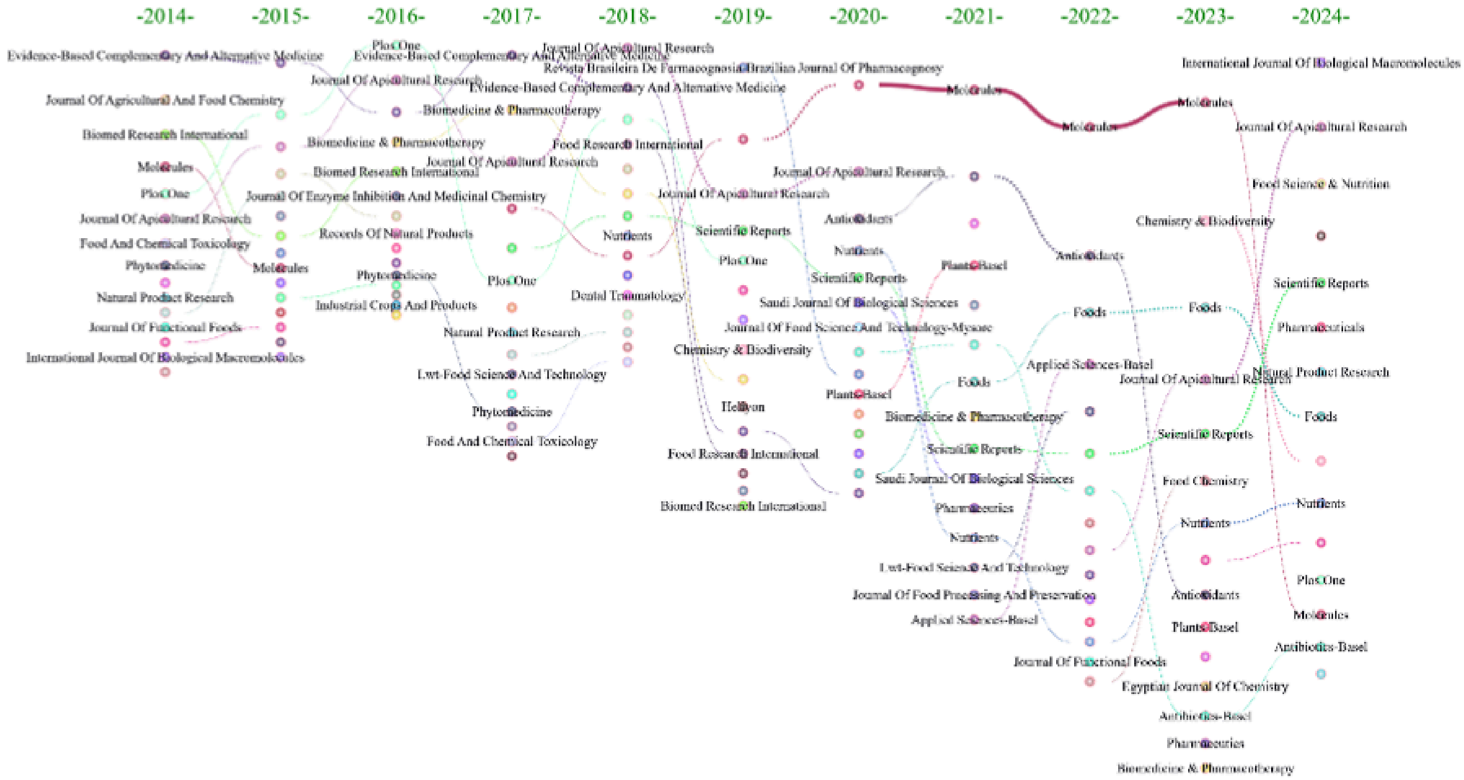


Figure 2

Evolution Publication graph

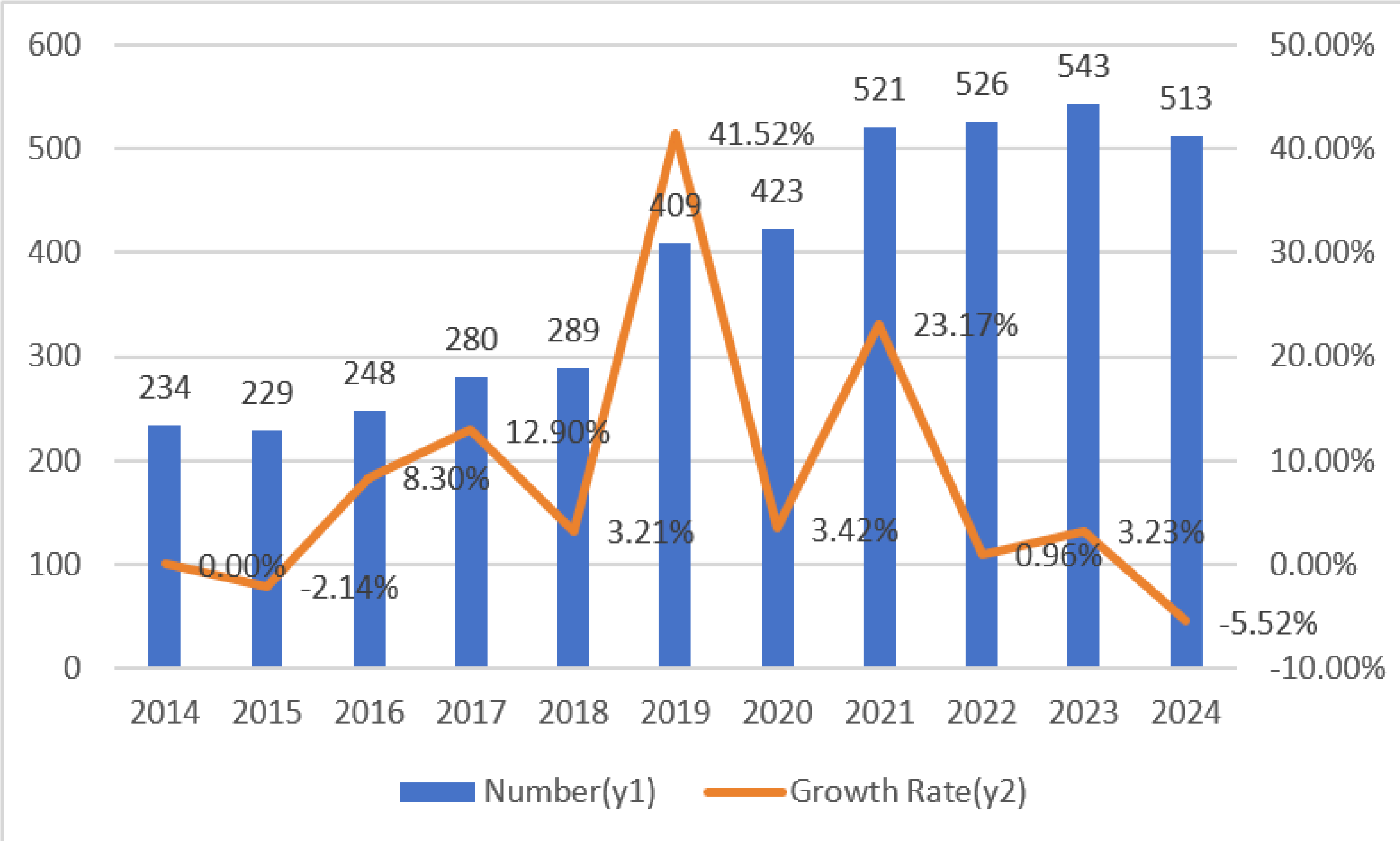


Figure 3

Annual research outputs

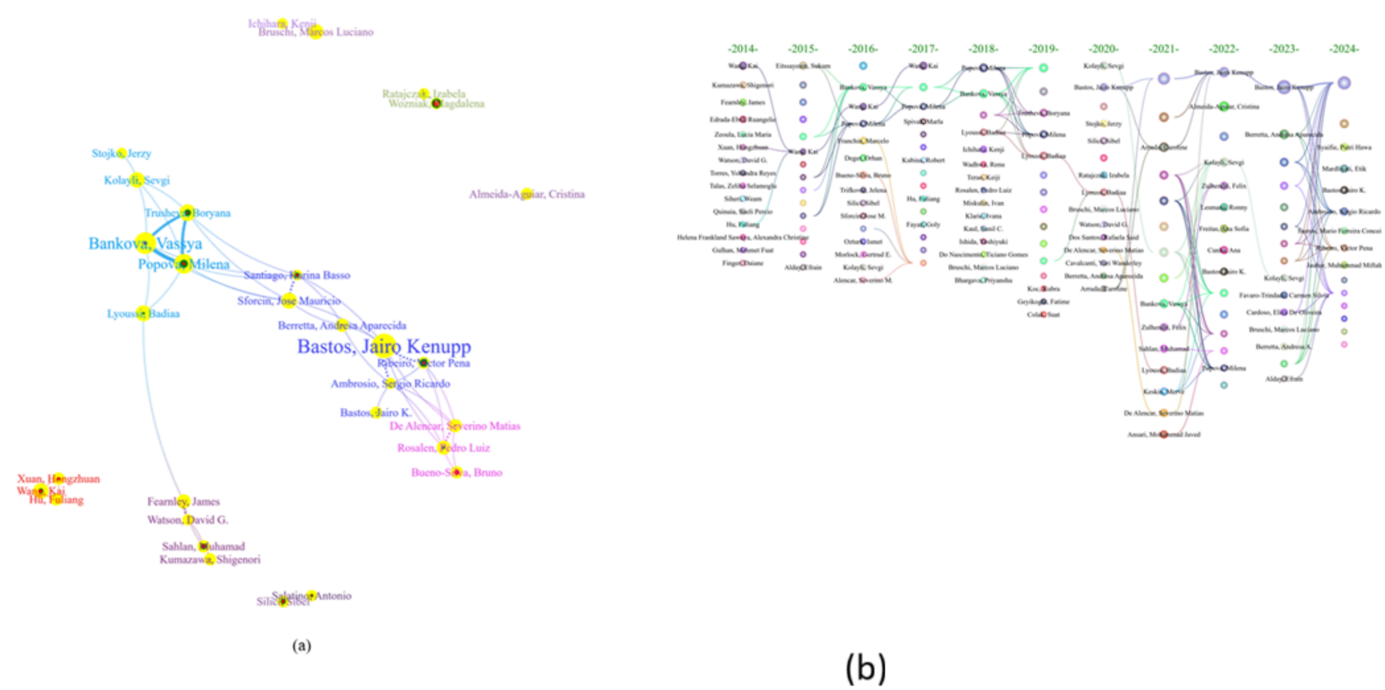


Figure 4

Visualization of Publication. (a) Co-author graph

(b) Evolution Author graph

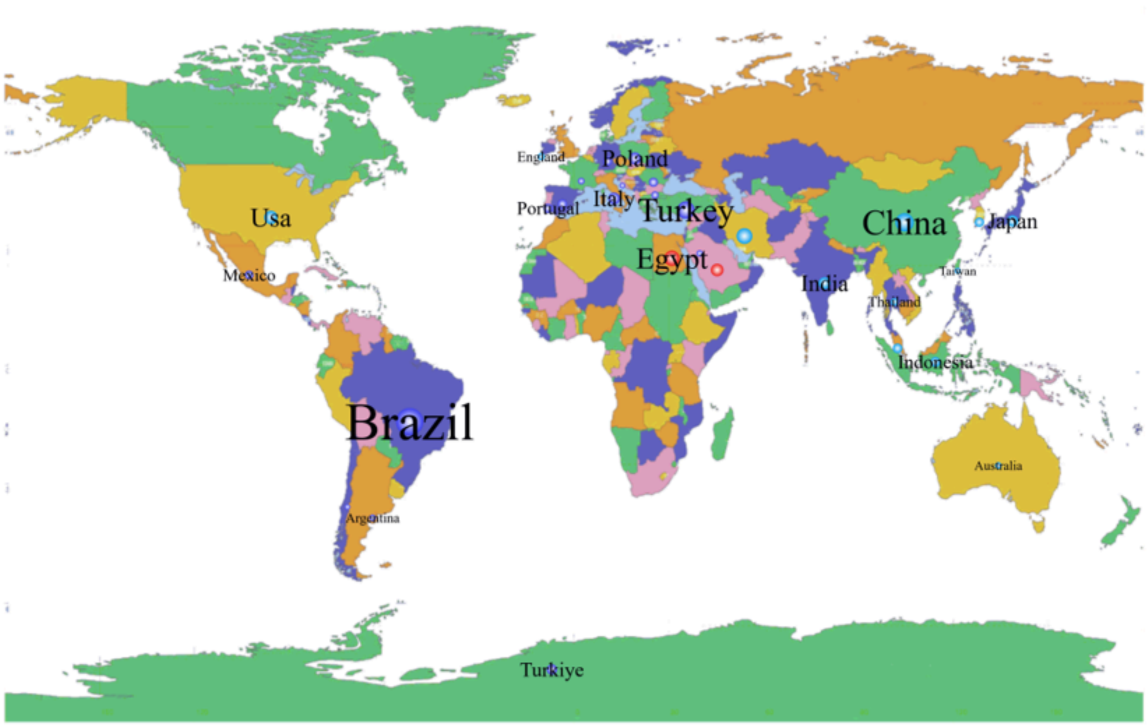
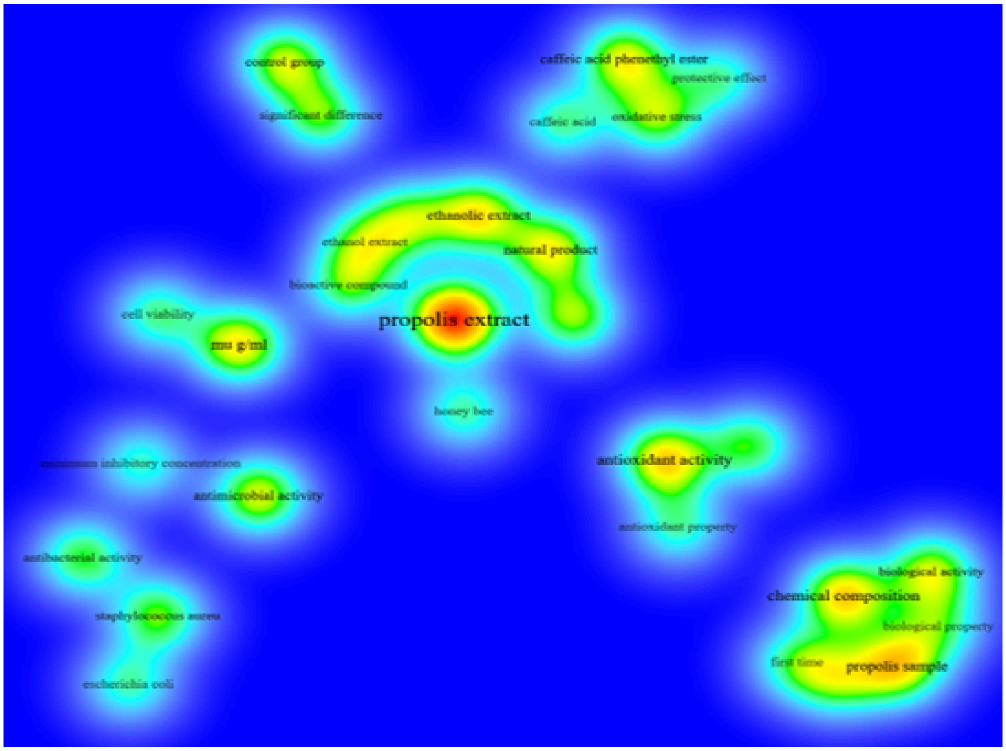


Figure 5

a Country distribution map

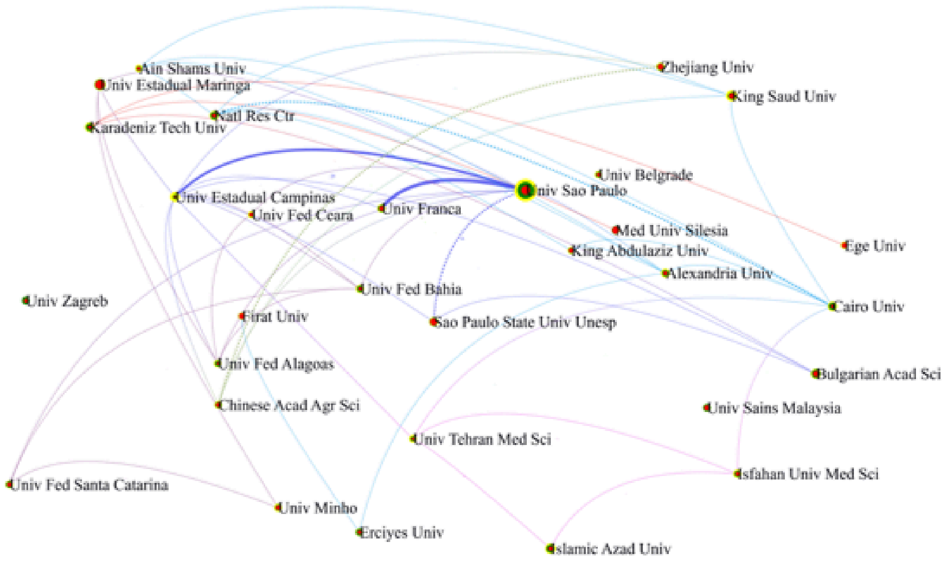


(a)

(b)

Figure 6

Visualization of keywords. (a) Keyword heat-map (b) Keyword burst graph



(a)

(b)

Figure 7

Visualization of institutions. (a) Coaffiliation graph

(b) Break Affiliation graph

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