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REVISED Suggestions for resin research under the COST Action EU-PoTaRCh

[version 2; peer review: 1 approved, 3 approved with reservations]

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v2 **First published:** 20 Dec 2024, **4**:272
https://doi.org/10.12688/openreseurope.18988.1
Latest published: 04 Aug 2025, **4**:272
https://doi.org/10.12688/openreseurope.18988.2

Abstract

Forest management and planning are often challenging, specifically because of the irregular income flow available to landowners. In timber production, for example, producers must wait several years before receiving returns on their investments in forested land. As a result, such economic uncertainty can make forest activities less attractive to investors and discourage effective management strategies. The forest by-products appear as an opportunity to increase the profitability of the forest lands and motivate the landowners for more effective planning. This is crucial, namely in countries where, for example, forest fires are real problems for economic activity, populations and the environment. In this context, this study, developed within the scope of the COST Action EU-PoTaRCh, intends to bring more insights and suggestions for the scientific research about resin. To give suggestions, a search was performed in the Scopus database (article title, abstracts and keywords), on 02 November 2024, for the following topics: “natural resin” or “plant resin”. In the search, 4127 documents were obtained and assessed through bibliometric analysis. The results obtained show that scientific research has focused mainly on biological and chemical aspects, while social, economic, cultural, and policy dimensions remain unexplored. The study suggests promoting transdisciplinary and international collaboration, principally in countries with limited research on resin, to support more comprehensive and inclusive policies and strategies on forest by-product.

Keywords

Bibliometric analysis, Bibliometrix software, Gaps and Trends.

Open Peer Review

Approval Status ? ? ✓ ?

	1	2	3	4
version 2 (revision) 04 Aug 2025	? view			
version 1 20 Dec 2024	✗ view	? view	✓ view	? view

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Any reports and responses or comments on the article can be found at the end of the article.

This article is included in the COST Actions gateway.

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Author roles: Martinho VJPD: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Brózdowski J**: Conceptualization, Funding Acquisition, Investigation, Project Administration, Resources, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No CA22155 (COST Action CA22155 Network for forest by-products charcoal, resin, tar, potash (EU-PoTaRCh), as supported by the COST Association (European Cooperation in Science and Technology). This work was also funded by National Funds through the FCT - Foundation for Science and Technology, I.P., within the scope of the project Ref[a] UIDB/00681/2020
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: Martinho VJPD and Brózdowski J. **Suggestions for resin research under the COST Action EU-PoTaRCh [version 2; peer review: 1 approved, 3 approved with reservations]** Open Research Europe 2025, **4**:272 https://doi.org/10.12688/openreseurope.18988.2

First published: 20 Dec 2024, **4**:272 https://doi.org/10.12688/openreseurope.18988.1

REVISED **Amendments from Version 1**

Changes in this new revised version are in response to the constructive feedback of the reviewer. Most changes were made as clarifications of the descriptions of the estimation methods and the mathematical assumptions in the introduction and section 2 of the manuscript. We clarified the definition of confounders, the need for our parametric model assumptions as well as the DiD assumptions. This also included added further citations for the reader. Additionally, we corrected equation (6) and included the missing outer expectation. More substantial changes were made to section 2.5 and section 3 and section 5 in which we introduce, exemplify and apply the dissimilarity statistic to detect dissimilarities between estimates from different methods. We have made great effort to acknowledge the helpful comments from the reviewers and improve upon our interpretation of this test statistic. We therefore added some in depth explanation on how to interpret this test statistic in section 2.5 and clarified the interpretation of the test results in section 3 and 5. In order to emphasize that the propose test statistic aims to test dissimilarities rather than similarities, we have also changed the name if the test statistic.

A list of abbreviations was added, and terms were opened (E-TEAM, ISES, INTEGRANO, ECETOC-TRA). Text was clarified without changing the context. The quantitative exposure model paragraph was moved. Fransman *et al*. (2022) were referenced only in the Underlying Data section 1, which was also added to the main text. For mechanistic models, accuracy and uncertainty were added as references Fryer *et al*. (2006) and a reference for ISES Europe strategy Slüther *et al*. (2022).

Any further responses from the reviewers can be found at the end of the article

Introduction

Resin is a plant secretion of unquestionable importance for sustainable development, considering its chemical, biological, environmental, socioeconomic, and cultural dimensions. Resin has a significant economic aspect[1] and, from this perspective, can contribute significantly to landowners' income[2]. Resin is also important for bee ecology[3], mutualism between bees and plants[4], rural development[5] and defence against insects[6]. On the other hand, the size of the resin ducts is fundamental to resin production[7]. These insights highlight the importance of resin-related topics for the scientific community, policymakers and landowners. The key question is what has already done and what can be improved in the future. The idea is to assess the information available in the scientific literature, namely through bibliometric analysis, and from there present suggestion that can be considered by stakeholders and, specifically, by the EU-PoTaRCh COST Action.

The literature survey shows that, despite some efforts to apply bibliometric analysis in the fields associated with natural/plant resin[8,9], there is still space to explore even more of the several dimensions related to this, often called, forest by-product (in a more reductive approach). Natural resin and gums are relevant complements of timber production in forest areas[10].

Bibliometric assessment is an approach that may produce relevant insights as support for the researchers, policymakers and other stakeholders in the diverse science fields, including in the forest domains, allowing gaps and trends identification in the literature[11]. This is particularly important when, in some topics, we need to deal with a great number of documents to survey and understand what was already done and what we still need to do[12].

The literature also reveal also that some fields have been poorly addressed in the topics considered in this research, namely those associated with the following areas[13]: social sciences; economics econometrics and finance; business, management and accounting; and decision sciences.

On the other hand, the areas related to "agricultural and biological sciences" have received relevant attention from researchers. Some of these studies give relevance to the resin synthesis by the trees[14] and others on the resin produced by bees (propolis)[15]. The propolis is a resinous combination[16] that is obtained from plant resin[17] and used by the honeybees for their needs in beehives[18]. This bee glue has several benefits for human health and has been used as an antioxidant or anti-inflammatory product, for example[19]. In some cases, propolis has been considered as a substitute for antibiotics[20], including in the poultry industry[21]. Nonetheless, pests and pathogens, for example, create difficulties for the honeybee's activities, where the role of the propolis still needs deeper analysis[22,23].

Other research associated with natural/plant resin focuses on: extraction techniques, related economic dimensions and environmental impacts[24]; tree response to wounding and fungi infections[25]; Dragon's Blood reddish resin oil[26]; resin tapping[27]; and the benefits of Chios mastic gum for human health[28]. In addition to areas related to "agricultural and biological sciences", topics associated with "medicine", "biochemistry, genetics and molecular biology", "chemistry", and "pharmacology, toxicology and pharmaceutics" have also received special attention from the scientific community.

Considering these perspectives, the aim of this study is to bring more insights into the diverse dimensions (chemical, biological, environmental, socioeconomic, and cultural) of natural/plant resin. This work contributes directly to the objectives of COST Action CA22155 (EU-PoTaRCh), particularly in supporting interdisciplinary collaboration, addressing research gaps, and promoting the sustainable use of non-wood forest products[29]. More specifically, this research has the following two research questions: 1) What insights does the scientific literature offer on natural/plant resin?; What are the key recommendations for stakeholders, particularly in guiding future research priorities under the EU-PoTaRCh COST Action?

Methods

This COST Action focuses, as its name suggests, on the "Network for forest by-products charcoal, resin, tar, potash" and aims to analyse, over time, the productions that may be obtained in the forest lands, beyond the timber, highlighting chemical, biological, environmental, socioeconomic and cultural dimensions. EU-PoTaRCh is organised into five working groups

focused on fields related to heritage, analytical approaches, archaeology, history and future scenarios[29]. To achieve the objectives proposed in this research, 4127 documents were obtained from the Scopus database[13], in a search carried out on 02 November 2024 (for the topics: "natural resin" or "plant resin"), and were assessed through bibliometric analysis, following the procedures proposed by the Bibliometrix software[30–34].

Suggestions, gaps and trends from bibliometric analysis

For this study, the period 1915–2024 was considered, for a total of 1742 sources, 4127 documents, 4.74% of annual growth rate, 20.59 average citations per document, 12538 authors, 3.96 co-authors per document and 12.41% of international co-authorships (Table 1). Molecules, Contact Dermatitis, Phytochemistry, International Journal of Biological Macromolecules, Journal of Chromatography A, Fitoterapia, Food Chemistry and Journal of Agricultural and Food Chemistry are between the top 30 most important sources about the topics of natural resin or plant resin (Table 2). Some of these sources are also among those with the highest impact within the sample considered (Table 3). The most productive authors and those with the highest impact within the sample taken into account are presented in Table 4 and Table 5, respectively. These findings confirm the relevance of topics related to specific areas, such as "agricultural and biological sciences", "medicine", "biochemistry, genetics and molecular biology", "chemistry", and "pharmacology, toxicology and pharmaceutics". These insights reveal that there is room for exploration in other dimensions associated with natural/plant resin, namely social, economic, cultural, and policy making.

Table 1. Main information related to natural resin or plant resin.

Description	Results
Main Information about Data	
Timespan	1915:2024
Sources (Journals, Books, etc)	1742
Documents	4127
Annual Growth Rate %	4.74
Document Average Age	25.7
Average citations per doc	20.59
References	95836
Document Contents	
Keywords Plus (ID)	21866
Author's Keywords (DE)	6881
Authors	
Authors	12538
Authors of single-authored docs	626
Authors Collaboration	
Single-authored docs	687
Co-Authors per Doc	3.96
International co-authorships %	12.41
Document Types	
article	3663
book	2
book chapter	46
conference paper	108
conference review	2
data paper	4
editorial	11
erratum	4
letter	46
note	29
retracted	1
review	201
short survey	10

The most important affiliations are the following (Table 6): Tokai University; Beijing University of Chinese Medicine; National and Kapodistrian University of Athens; Chinese Academy of Medical Sciences and Peking Union Medical College; University of Nizwa; Sojo University; Fukuoka University; and China Pharmaceutical University. China, USA, India, Brazil, Japan, Italy, Germany, UK, France, Iran, Greece and Spain are the most productive countries (Table 7) and are among the most cited nations (Table 8). Natural/plant resin is also of great importance in countries with less scientific production in these areas. Strategies to promote research in these countries on these themes should be designed and implemented.

Beyond the topics of search considered in this study (natural resin and plant resin), dragon's blood and mass spectrometry are examples of the most frequent words in the abstracts of the 4127 documents taken into account in this analysis (Figure 1). Other words appear with lower frequency, such as (Figure 2): amalgam restorations; fatty acids; traditional medicine; natural products; wound healing; mastic gum; antibacterial activity; resin ducts; biological activities; oxidative stress; and resin glycoside.

On the other hand, composite films, glycosidic acid, mechanical properties, chemical composition, mass spectrometry, resin acids, natural resin, dragon's blood, fatty acids and mastic gum

Table 2. Top 30 most relevant sources related to natural resin or plant resin.

Source	Articles
Molecules	97
Contact Dermatitis	65
Phytochemistry	45
International Journal of Biological Macromolecules	43
Journal of Chromatography A	42
Fitoterapia	40
Food Chemistry	40
Journal of Agricultural and Food Chemistry	37
Scientific Reports	34
Natural Product Research	33
Plos One	33
Journal of Natural Products	31
Journal of Ethnopharmacology	28
Meditsina Truda I Promyshlennaya Ekologiya	28
Gigiena i Sanitariia	26
Journal of Combinatorial Chemistry	26
Zhongguo Zhongyao Zazhi	25
Organic Letters	20
Journal of the American Chemical Society	19
Planta Medica	19
Journal of Natural Medicines	18
Analytical Biochemistry	17
International Journal of Molecular Sciences	17
Operative Dentistry	17
Analytical and Bioanalytical Chemistry	16
The Journal of Prosthetic Dentistry	16
Tree Physiology	16
Chemistry and Biodiversity	15
Biotechnic and Histochemistry	14
Journal of The American Dental Association	14

Table 3. Top 30 sources' local impact related to natural resin or plant resin.

Source	h_index
Molecules	26
Food Chemistry	23
Journal of Agricultural and Food Chemistry	23
Phytochemistry	21
Journal of Combinatorial Chemistry	19
Journal of Chromatography A	18
Fitoterapia	17
Journal of Natural Products	17
Contact Dermatitis	16
International Journal of Biological Macromolecules	16
Plos One	16
Journal of Ethnopharmacology	15
Tree Physiology	14
Organic Letters	13
Operative Dentistry	12
Phytomedicine	12
Planta Medica	12
Analytical and Bioanalytical Chemistry	11
Organic Geochemistry	11
Scientific Reports	11
Analytical Chemistry	10
Industrial Crops and Products	10
Journal of The American Chemical Society	10
Natural Product Research	10
Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy	10
The Journal of Prosthetic Dentistry	10
International Journal of Molecular Sciences	9
Journal of the American Dental Association	9
Analytical Biochemistry	8
Biomedicine and Pharmacotherapy	8

Table 4. Top 30 most relevant authors related to natural resin or plant resin.

Author	Articles
Li J	37
Wang X	25
Ono M	23
Zhang H	22
Chen Y	20

Author	Articles
Kinjo J	20
Liu Y	20
Okawa M	20
Yoshimitsu H	20
Yasuda S	19
Wang J	18
Zhang J	18
Cheng Y-X	17
Chen X	16
Li Y	16
Pereda-Miranda R	16
Wang L	16
Zhang Y	16
Anderson KB	15
Song Z	15
Wang H	15
Wang Y	15
Al-Harrasi A	14
Chen H	14
Leonhardt SD	14
Nohara T	14
Spivak M	14
Zhang L	14
JR	13
Miyashita H	13

Table 5. Top 30 authors' local impact related to natural resin or plant resin.

Author	h_index
Li J	16
Wang X	14
Chen Y	13
Zhang H	13
Liu Y	12
Pereda-Miranda R	12
Spivak M	12
Chen H	11
Anderson KB	10
Chen X	10
Edwards Hgm	10
Leonhardt SD	10
Li K	10
Li Y	10
Song J	10
Wang C	10
Wang J	10
Wang L	10
Zhang J	10
Al-Harrasi A	9
Colombini MP	9
Lu Y	9
Merrifield RB	9
Wang H	9
Zhang Y	9
Cheng Y-X	8
Kinjo J	8
Liu X	8
Nohara T	8
Okawa M	8

Table 6. Top 30 most relevant affiliations related to natural resin or plant resin.

Affiliation	Articles
Tokai University	111
Beijing University of Chinese Medicine	90
National and Kapodistrian University of Athens	62
Chinese Academy of Medical Sciences and Peking Union Medical College	59
University of Nizwa	59
Sojo University	55
Fukuoka University	54
China Pharmaceutical University	53

Affiliation	Articles
Nanjing University of Chinese Medicine	53
Northwest Aandf University	53
Shandong University	51
Nanjing Forestry University	50
Guangdong Pharmaceutical University	49
University of Alberta	48
Institute of Chemical Industry of Forest Products	46
Shenyang Pharmaceutical University	46
University of São Paulo	46
King Saud University	43
Peking Union Medical College	43
Universidad Nacional Autónoma de México	42
Jiangnan University	40
Guangxi University for Nationalities	39
Silpakorn University	39
Notreported	38
University of Messina	38
Mashhad University of Medical Sciences	35
University of Minnesota	34
Aristotle University of Thessaloniki	32
Nantong University	31
Shenzhen University Health Science Center	31

Table 7. Top 30 countries' scientific production related to natural resin or plant resin.

Country	Number of documents
China	2830
USA	1728
India	989
Brazil	885
Japan	674
Italy	595
Germany	555
UK	481
France	386
Iran	270
Greece	251
Spain	249
Canada	225
Egypt	224
Mexico	214
Poland	189
South Korea	178
Australia	168
Thailand	163
Turkey	161
Saudi Arabia	144
Finland	143
Romania	140
Switzerland	130
Belgium	118
Sweden	117
Austria	114
Chile	99
Indonesia	90
Pakistan	83

Table 8. Top 30 most cited countries related to natural resin or plant resin.

Country	Total Citations
China	7512
USA	6685
India	3645
Brazil	3555
Germany	2837
Italy	2465
Malaysia	1498
France	1492
United Kingdom	1277
Austria	1178

Country	Total Citations
Canada	1149
Japan	1112
Egypt	1055
Iran	1032
Greece	889
Australia	876
Switzerland	701
Thailand	671
Korea	661
Mexico	595
Spain	554
Turkey	531
Finland	483
Denmark	472
Poland	430
Chile	343
Singapore	302
Belgium	297
Oman	292
Israel	284

are trending terms (Figure 3). Figure 4 shows (considering information in abstracts and Walktrap clustering algorithm) that amalgam restorations, resin ducts, drug release and controlled release are emerging or declining themes. Resin glycosides is an important theme, but not yet well developed. Electron microscopy, mass spectrometry, chemical composition, traditional medicine and gum resin are important and well-developed themes. Figure 5 (taking into account information in abstracts, Walktrap as clustering algorithm and inclusion index weighted by word-occurrences as weight index) confirms that plant resin and natural resin are trending themes. Figure 6 and Table 9 (factorial analysis in abstracts and multiple correspondence analysis) highlight three clusters for the words present in the abstracts and show that the words considered in cluster 1 are central for the research of the topics here addressed, considering the documents surveyed.

These results reveal that topics related to political, social, economic, and cultural dimensions have received less attention from the scientific community. As highlighted by the literature survey, natural/plant resin plays a fundamental role in socio-economic sustainability, with the policy framework being crucial for this sustainable development.

More in-depth assessment of the most relevant documents

In this section, the 15 most relevant documents (with the highest total link strength metrics for bibliographic coupling links), presented in Table 10, will be analysed in greater depth in terms of their content, namely, to better understand how research on resins considered their different dimensions. These studies were identified following the procedures proposed by the VOSviewer software. Bibliographic coupling links appear

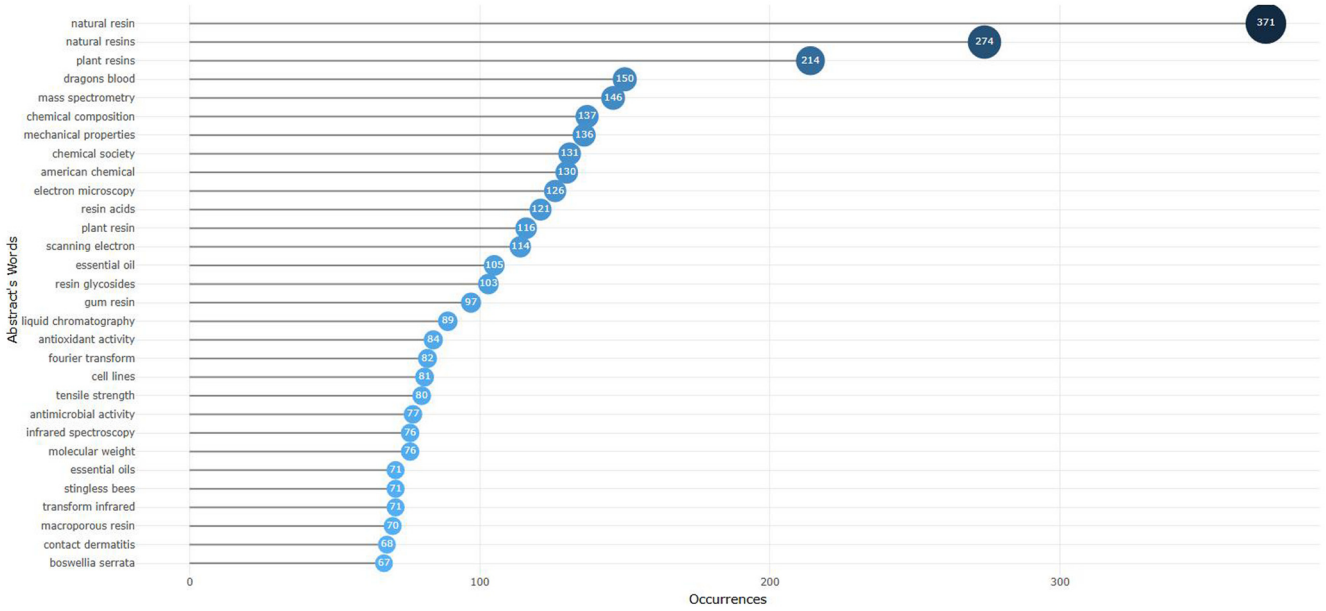

Figure 1. Most frequent words (in abstracts) related to natural resin or plant resin.



Figure 2. **TreeMap (in abstracts) related to natural resin or plant resin.**

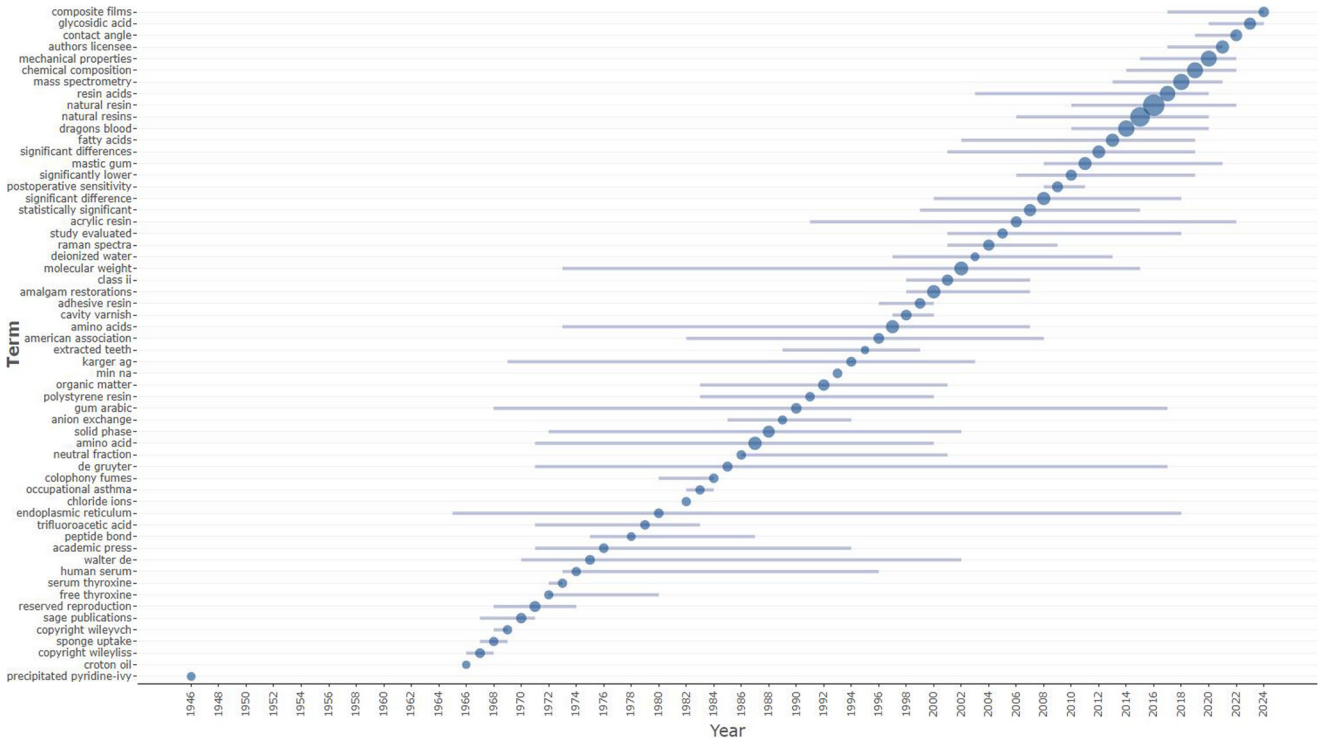

Figure 3. **Trend topics (in abstracts) related to natural resin or plant resin.**

when two documents share references, and the total link strength is associated with the number of references shared by one item with others in the network[35–37].

The documents presented in Table 10 reveal that a relevant number of documents analysed the chemical characteristics[38], applications (for example, medicine and food industry)[39],

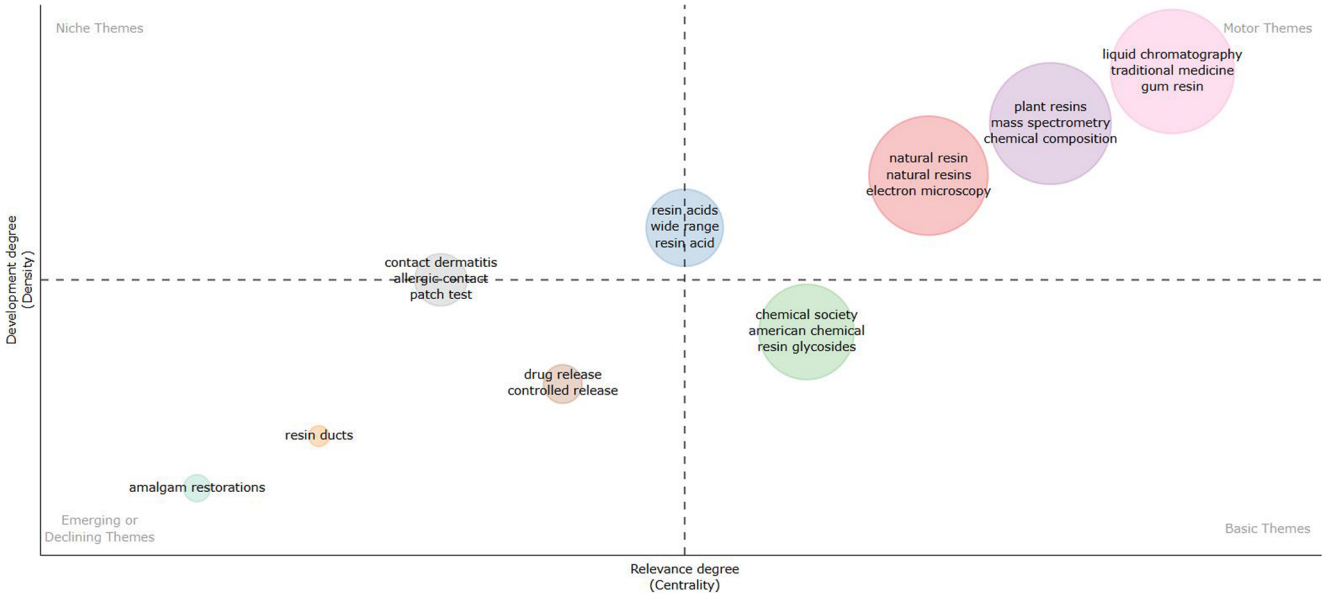

Figure 4. Thematic map related to natural resin or plant resin.

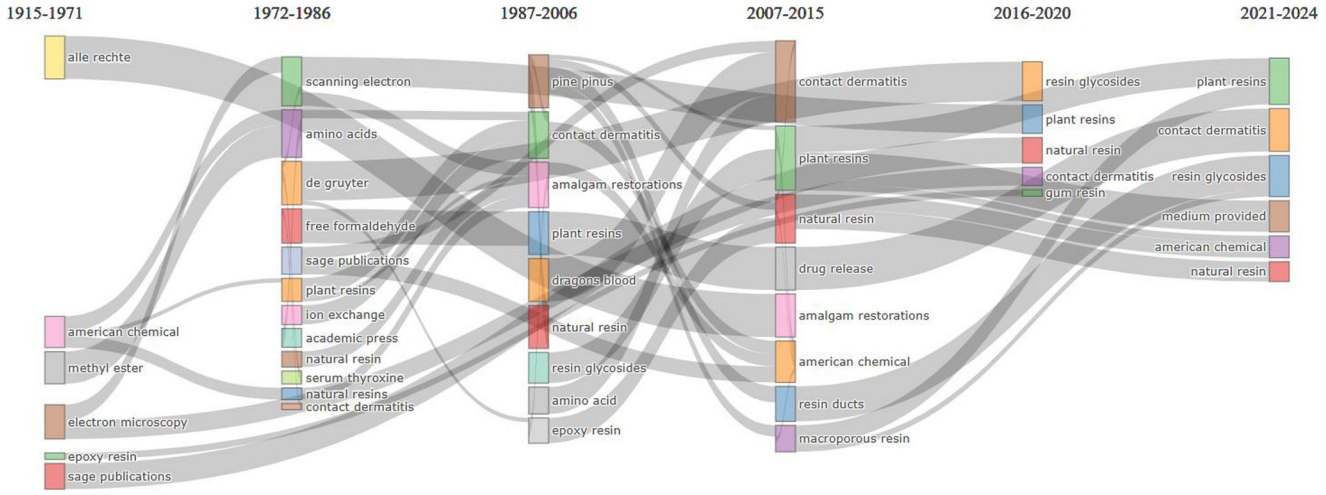

Figure 5. Thematic evolution related to natural resin or plant resin.

sources of plant resin[40] and potentialities of propolis. In some documents, propolis is described as a resinous compound[16], presented as having antimicrobial characteristics[23] and considered by honeybees as a defence strategy against infestations and associated viruses[41]. The biological properties of propolis depend on its chemical characteristics, plant sources and geographical origin[42], as well as the genetic variability of bees and the season of production[43]. Propolis is also referred to in the literature as a serious source of pesticide contamination[22]. In summary, propolis is considered by the literature not as a food, but as a building and defence material[18], with several potentialities and applications for bees and humans.

Other studies focus on the mechanism and factors associated with resin production by trees[14], the medicinal potential of natural resin[44] and the health benefits of Boswellia resin[45]. The pharmaceutical use of resin glycosides has also been assessed in scientific literature[46]. More recently, the literature highlights

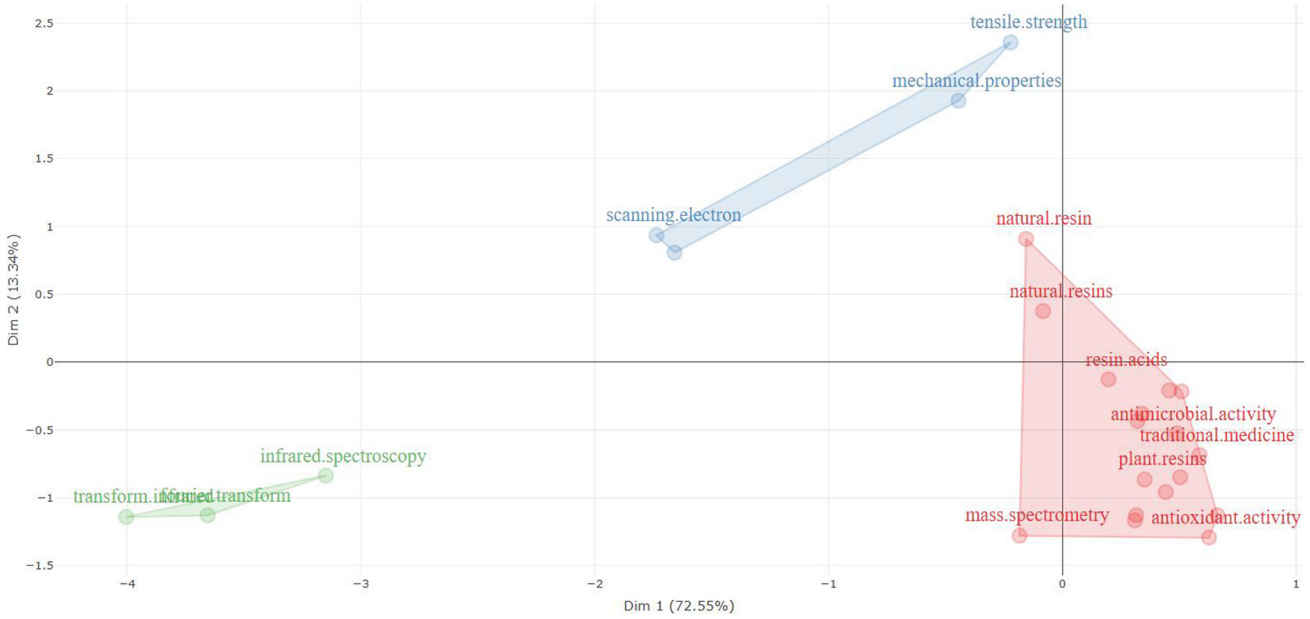

Figure 6. Factorial analysis related to natural resin or plant resin.

Table 9. Words by cluster related to natural resin or plant resin.

word	cluster
natural.resin	1
natural.resins	1
plant.resins	1
dragons.blood	1
mass.spectrometry	1
chemical.composition	1
resin.acids	1
plant.resin	1
essential.oil	1
resin.glycosides	1
gum.resin	1
liquid.chromatography	1
antioxidant.activity	1
cell.lines	1
antimicrobial.activity	1
traditional.medicine	1
biological.activities	1
mechanical.properties	2
electron.microscopy	2
scanning.electron	2
tensile.strength	2
fourier.transform	3
infrared.spectroscopy	3
transform.infrared	3

the structural and biological dynamics of natural products based on medicinal plant resin[47].

This in-depth review of the literature confirms that the literature has focused on topics related to a few specific areas, such as “agricultural and biological sciences”, “medicine”, “biochemistry, genetics and molecular biology”, “chemistry”, and “pharmacology, toxicology and pharmaceutics”, with further contributions needed on the social, economic, environmental and cultural dimensions.

In areas less considered by the literature, some documents addressed the economic dimension, focusing on the export destinations of natural resins[48], or cultural aspects, analysing the biomaterials used in past centuries[49], or even environmental issues, using natural resins to produce modified nanofiltration membranes[50].

Table 10. Top 15 documents with the highest total link strength for bibliographic coupling links and for the topics "natural resin" or "plant resin".

Authors	url	Total link strength	Citations	Normalised Citations	Publication Year
Popova (2022)[39]	https://doi.org/10.1007/978-3-030-91378-6_38	705	0	0	2022
Termentzi (2011)[44]	https://doi.org/10.2174/138161211795703807	667	54	1.7709	2011
Sura (2024)[47]	https://doi.org/10.1039/d4np00007b	610	2	1.5678	2024
Simone-Finstrom (2017)[22]	https://doi.org/10.3390/insects8020046	609	107	4.3984	2017
Fan (2022)[46]	https://doi.org/10.1002/med.21916	569	10	1.1988	2022
Simone-Finstrom (2010)[23]	https://doi.org/10.1051/apido/2010016	547	305	8.8818	2010
Sforcin (2016)[42]	https://doi.org/10.1002/ptr.5605	516	350	11.7743	2016
Huang (2014)[38]	https://doi.org/10.3390/molecules191219610	508	559	14.8407	2014
Al-Harrasi (2021)[14]	https://doi.org/10.1016/j.phytochem.2021.112660	504	16	1.2136	2021
Bankova (2018)[18]	https://doi.org/10.1016/j.phytochem.2018.07.007	493	82	3.0505	2018
Salatino (2011)[40]	https://doi.org/10.1039/c0np00072h	493	217	7.1162	2011
Toreti (2013)[43]	https://doi.org/10.1155/2013/697390	488	349	9.5648	2013
Dezmirean (2021)[16]	https://doi.org/10.3390/plants10010022	482	56	4.2475	2021
Drescher (2017)[41]	https://doi.org/10.3390/insects8010015	478	50	2.0553	2017
Rashan (2019)[45]	https://doi.org/10.4103/ijnpnd.ijnpnd_11_19	438	28	1.1708	2019

Discussion

The literature survey highlights the importance of the natural/plant resin for forest management, considering that this by-product may be an interesting complement of the forest owners' income[1,2]. The consideration of alternative and sustainable sources of revenues on forest land, beyond wood production, is crucial to motivate more adjusted forestry planning, namely in contexts where such adjustments are needed and urgent. This is particularly indispensable in frameworks where forest fire prevention requires innovative and effective approaches. Climate changes and the abandonment of agricultural land increased the risk of forest fires worldwide, requiring new approaches, mostly by providing more incentives for forest landowners[51], and the natural resin can play a key role here. The bibliometric analysis may bring important highlights in the literature survey on any topic[11,12], including in the fields related to the forest dimensions and natural/plant resin. On the specific topics covered here, the literature review reveals that the scientific areas associated with social sciences, economics and management may be further explored in future research In turn, the issues associated with the following areas have already been addressed by a relevant number of documents[13]: agricultural and biological sciences; medicine; biochemistry, genetics and molecular biology; chemistry; and pharmacology, toxicology and pharmaceutics. In these studies, a relevant part of documents considered the different dimensions of the propolis (resinous combination produced by bees from plant resin)[16]. Other studies analysed, for example, extraction techniques[24], tree response to external aggressions[25], dragon's blood resin[26] and resin tapping[27].

The bibliometric assessment highlights a modest international co-authorship of 12.41% and that the most important sources (number of documents and citations) are related, for example, to contact dermatitis, phytochemistry, biological macromolecules, chromatography and food chemistry. This shows that there is space to be explored in other sources with scopes more multidisciplinary and focused on other scientific areas, such as socioeconomic, environmental and cultural issues. The most productive countries, for the topics addressed here, are China, the USA, India and Brazil, revealing that some European countries, for example, where the natural/plant resin has a historical relevance may add important contributions to these fields. The bibliometric analysis also shows that natural resin,

plant resin, dragon's blood, mass spectrometry, chemical composition, resin acids, essential oils, resin glycosides, gum resin, antioxidant activity and traditional medicine are central topics for natural/plant resin research. Some of them are also trending topics, such as chemical composition, mass spectrometry, resin acids, natural resin and dragon's blood. Other important themes are missing here, particularly those associated with strategies, legislation and policies designed for natural/plant resin frameworks. The socioeconomic impacts of natural resin use deserve greater attention, specifically in rural areas, where sustainability issues face more serious threats in some circumstances. New technologies for data collection and assessment, particularly those associated with artificial intelligence, need to be better explored, as well as approaches related to life cycle sustainability assessment.

Conclusions

In terms of practical implications, this research highlights trending themes related to natural/plant resin topics, nonetheless, these issues are mainly associated with the fields of agricultural, medicine, biochemistry, chemistry, and pharmacology. On the other hand, some scientific areas, such as social, cultural, economics, management and environmental sciences, could be further explored in the literature. For policy recommendations, it is suggested to promote more transdisciplinary approaches in the analyses related to the different dimensions of resin production and collection, to better support the various stakeholders in managing and planning the natural/plant resin activities. Specifically for COST Action CA22155 (EU-PoTaRCh), it is suggested to scientifically and technically explore the socioeconomic dimensions of the natural/plant resin to provide guidelines that support stakeholders in better considering this forest by-product as an alternative way to bring more income for rural land management. It is also suggested to promote more research on natural/plant resin in countries with fewer scientific studies on these subjects. For future research, it would be important to increase international co-authorships, promote transdisciplinary co-authorships and consider other bibliometric methodologies. These suggestions for future research are something that can be promoted by COST Action CA22155 (EU-PoTaRCh).

In summary, the areas of agricultural, medicine, biochemistry, chemistry, and pharmacology have already been addressed by scientific literature, namely the several dimensions associated with propolis. We need, in future studies, to explore social, economic, environmental and cultural areas in greater depth and promote scientific research on natural/plant resin in countries where this by-product is important, but the number of studies is more limited.

Data availability statement

No data are associated with this article

Acknowledgements

Furthermore we would like to thank the CERNAS Research Centre and the Polytechnic Institute of Viseu for their support.

References

1. Cabrita P: **A model for resin flow.** *Ref Ser Phytochem.* 2019; 1–28.
Publisher Full Text

2. Dyrmose AMH, Turreira-García N, Theilade I, *et al.*: **Economic importance of oleoresin (*Dipterocarpus Alatus*) to forest-adjacent households in Cambodia.** *Nat Hist Bull Siam Soc.* 2017; **62**(1): 67–84.
Reference Source

3. Chui SX, Keller A, Leonhardt SD: **Functional resin use in solitary bees.** *Ecol Entomol.* 2022; **47**(2): 115–136.
Publisher Full Text

4. Leonhardt SD, Baumann AM, Wallace HM, *et al.*: **The chemistry of an unusual seed dispersal mutualism: bees use a complex set of olfactory cues to find their partner.** *Anim Behav.* 2014; **98**: 41–51.
Publisher Full Text

5. Perez SO, Robredo FG, Tellez EA, *et al.*: **Effects of the crisis in the resin sector on the demography of rural municipalities in Spain.** *For Sys.* 2013; **22**(1): 39–46.
Publisher Full Text

6. Wainhouse D, Staley JT, Jinks R, *et al.*: **Growth and defence in young pine and spruce and the expression of resistance to a stem-feeding weevil.** *Oecologia.* 2009; **158**(4): 641–650.
PubMed Abstract | Publisher Full Text

7. Yang H, Shi J, Chen L, *et al.*: **A study of the effects of stimulants on resin yield, resin duct and turpentine chemical composition in *Pinus Kesiya* var. langbianensis.** *Forests.* 2024; **15**(5): 748.
Publisher Full Text

8. Jiajia L, Bingjian Z: **Research status of binders in ancient painted cultural relics -based on data analysis of research papers from the web of science.** *Sciences of Conservation and Archaeology.* 2019; **31**: 119–129.

9. Rosa RS, Lannes SC, da S: **Hop extracts and their utilizations: perspectives based on the last 10 years of research.** *Braz J Pharm Sci.* 2024; **60**: e23905.
Publisher Full Text

10. Sharma SC, Prasad N, Pandey SK, *et al.*: **Mechanization in processing commercially significant natural resins and gums: a review.** *Ind Crops Prod.* 2024; Part 2 **222**: 119630.
Publisher Full Text

11. Mourao PR, Martinho VD: **Forest entrepreneurship: a bibliometric analysis and a discussion about the co-authorship networks of an emerging scientific field.** *J Clean Prod.* 2020; **256**: 120413.
Publisher Full Text

12. Martinho VD, Mourão PR: **Circular economy and economic development in the European Union: a review and bibliometric analysis.** *Sustainability.* 2020; **12**(18): 7767.
Publisher Full Text

13. **Scopus scopus database**.
Reference Source

14. Al-Harrasi A, Khan AL, Rehman NU, *et al.*: **Biosynthetic diversity in triterpene cyclization within the boswellia genus.** *Phytochemistry.* 2021; **184**: 112660.
PubMed Abstract | Publisher Full Text

15. Aliakbarian M, Jazinaki MS, Bahari H, *et al.*: **Effects of propolis consumption on liver enzymes and obesity indices in adults: a systematic review and dose-response meta-analysis.** *Curr Dev Nutr.* 2024; **8**(9): 104438.
PubMed Abstract | Publisher Full Text | Free Full Text

16. Dezmirean DS, Paşca C, Moise AR, *et al.*: **Plant sources responsible for the chemical composition and main bioactive properties of poplar-type propolis.** *Plants (Basel).* 2021; **10**(1): 22.
PubMed Abstract | Publisher Full Text | Free Full Text

17. Dequenne I, Philippart de Foy JM, Cani PD: **Developing strategies to help bee colony resilience in changing environments.** *Animals (Basel).* 2022; **12**(23): 3396.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

18. Bankova V, Popova M, Trusheva B: **The phytochemistry of the honeybee.** *Phytochemistry.* 2018; **155**: 1–11.
PubMed Abstract | **Publisher Full Text**

19. Bankova V, Trusheva B, Popova M: **Propolis extraction methods: a review.** *J Apic Res.* 2021; **60**(196): 734–743.
Publisher Full Text

20. Chuttong B, Lim K, Praphawilai P, *et al.*: **Exploring the functional properties of propolis, geopropolis, and cerumen, with a special emphasis on their antimicrobial effects.** *Foods.* 2023; **12**(21): 3909.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

21. Lukas LL, Latif N, Hassan MN, *et al.*: **A review of the potential applications of propolis in the Malaysian poultry industry.** *Malays Appl Biol.* 2023; **52**(6): 1–9.
Publisher Full Text

22. Simone-Finstrom M, Borba RS, Wilson M, *et al.*: **Propolis counteracts some threats to honey bee health.** *Insects.* 2017; **8**(2): 46.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

23. Simone-Finstrom M, Spivak M: **Propolis and bee health: the natural history and significance of resin use by honey bees.** *Apidologie.* 2010; **41**: 295–311.
Publisher Full Text

24. Dehghanizadeh M, Mendoza Moreno P, Sproul E, *et al.*: **Guayule (*parthenium argentatum*) resin: a review of chemistry, extraction techniques, and applications.** *Ind Crops Prod.* 2021; **165**: 113410.
Publisher Full Text

25. Gaylord ML, Hofstetter RW, Kolb TE, *et al.*: **Limited response of ponderosa pine bole defenses to wounding and fungi.** *Tree Physiol.* 2011; **31**(4): 428–437.
PubMed Abstract | **Publisher Full Text**

26. Peres ISA, Conceição KAO, Silva LAF, *et al.*: **Dragon's blood: antioxidant properties for nutraceuticals and pharmaceuticals.** *Rend Fis Acc Lincei.* 2023; **34**: 131–142.
Publisher Full Text

27. Sharma SC, Prasad N, Pandey SK, *et al.*: **Status of resin tapping and scope of improvement: a review.** *AMA Agric Mech Asia Afr Lat Am.* 2018; **49**(3): 16–26.
Reference Source

28. Soulaidopoulos S, Tsiogka A, Chrysohoou C, *et al.*: **Overview of chios mastic gum (*Pistacia lentiscus*) effects on human health.** *Nutrients.* 2022; **14**(3): 590.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

29. **COST project action CA22155 (EU-PoTaRCh)**. (accessed on 16 November 2024).
Reference Source

30. Aria M, Cuccurullo C: ***Bibliometrix*: an R-tool for comprehensive science mapping analysis.** *J Informetr.* 2017; **11**(4): 959–975.
Publisher Full Text

31. Cobo MJ, López-Herrera AG, Herrera-Viedma E, *et al.*: **An approach for detecting, quantifying, and visualizing the evolution of a research field: a practical application to the fuzzy sets theory field.** *J Informetr.* 2011; **5**(1): 146–166.
Publisher Full Text

32. Cuccurullo C, Aria M, Sarto F: **Foundations and trends in performance management. A twenty-five years bibliometric analysis in business and public administration domains.** *Scientometrics.* 2016; **108**: 595–611.
Publisher Full Text

33. R Software R: **The R project for statistical computing.** (accessed on 8 November 2024).
Reference Source

34. RStudio: **Rstudio desktop.** (accessed on 8 November 2024).
Reference Source

35. van Eck NJ, Waltman L: **Software survey: VOSviewer, a computer program for bibliometric mapping.** *Scientometrics.* 2010; **84**(2): 523–538.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

36. van Eck NJ, Waltman L: **Visualizing bibliometric networks.** In: *Measuring Scholarly Impact: Methods and Practice.* Ding, Y., Rousseau, R., Wolfram, D., Eds, Springer International Publishing: Cham, 2014; 285–320.
Publisher Full Text

37. van Eck NJ, Waltman L: **Manual for VOSviewer Version 1.6.20**. 2023.
Reference Source

38. Huang S, Zhang CP, Wang K, *et al.*: **Recent advances in the chemical composition of propolis.** *Molecules.* 2014; **19**(12): 19610–19632.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

39. Popova M, Trusheva B, Bankova V: **Chemistry and applications of propolis.** In: *Gums, Resins and Latexes of Plant Origin.* Springer, Cham, 2022; 657–688.
Publisher Full Text

40. Salatino A, Fernandes-Silva CC, Righi AA, *et al.*: **Propolis research and the chemistry of plant products.** *Nat Prod Rep.* 2011; **28**(5): 925–936.
PubMed Abstract | **Publisher Full Text**

41. Drescher N, Klein AM, Neumann P, *et al.*: **Inside honeybee hives: impact of natural propolis on the ectoparasitic mite *varroa destructor* and viruses.** *Insects.* 2017; **8**(1): 15.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

42. Sforcin JM: **Biological properties and therapeutic applications of propolis.** *Phytother Res.* 2016; **30**(6): 894–905.
PubMed Abstract | **Publisher Full Text**

43. Toreti VC, Sato HH, Pastore GM, *et al.*: **Recent progress of propolis for its biological and chemical compositions and its botanical origin.** *Evid Based Complement Alternat Med.* 2013; **2013**: 697390.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

44. Termentzi A, Fokialakis N, Skaltsounis AL: **Natural resins and bioactive natural products thereof as potential antimicrobial agents.** *Curr Pharm Des.* 2011; **17**(13): 1267–1290.
PubMed Abstract | **Publisher Full Text**

45. Rashan L, Hakkim FL, Idrees M, *et al.*: **Boswellia gum resin and essential oils: potential health benefits – an evidence based review.** *Int J Nutr Pharmacol Neurol Dis.* 2019; **9**(2): 53–71.
Reference Source

46. Fan BY, Jiang X, Li YX, *et al.*: **Chemistry and biological activity of resin glycosides from convolvulaceae species.** *Med Res Rev.* 2022; **42**(6): 2025–2066.
PubMed Abstract | **Publisher Full Text**

47. Sura MB, Cheng YX: **Medicinal plant resin natural products: structural diversity and biological activities.** *Nat Prod Rep.* 2024; **41**(10): 1471–1542.
PubMed Abstract | **Publisher Full Text**

48. Udaykumar MS, Roy A, Pandey SK, *et al.*: **Production and export dynamics of natural resins and gums in India.** *Indian J Econ Dev.* 2025; **21**(1): 105–112.
Publisher Full Text

49. Dighe BB, Singh MR: **Promoting conservation sustainability: analysing biomaterials in 6–8th century Aurangabad cave mud plasters.** *J Cult Herit.* 2025; **74**: 276–288.
Publisher Full Text

50. Eryildiz-Yesir B, Keskin B, Dehqan A, *et al.*: **Modification of polyamide Nanofiltration membranes with green Dragon's Blood natural Resin: improvement in permselectivity and antifouling properties.** *React Funct Polym.* 2025; **216**: 106398.
Publisher Full Text

51. Martinho VJPD: **Socioeconomic impacts of forest fires upon Portugal: an analysis for the agricultural and forestry sectors.** *Sustainability.* 2019; **11**(2): 374.
Publisher Full Text

Open Peer Review

Current Peer Review Status: ? ? ✓ ?

Version 2

Reviewer Report 18 August 2025

https://doi.org/10.21956/openreseurope.22834.r57453

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Marco Biagi
University of Parma, Parma, Italy

I'd want to thank authors for the revision which resulted in an overall improvement of the manuscript, with clearer presentation and better organization of the data.
However, as all reviewers consistently pointed out, a key structural weakness remained, not fully fixed: the connection between the stated aim, aligned with the broader objectives of COST Action CA22155 (EU-PoTaRCh), and the bibliometric analysis conducted is still not fully developed. The paper effectively describes the state of research and identifies significant gaps, but yet it does not translate these findings into operational perspectives or concrete strategies that could guide future action. In light of the Action mission, I recommend authors an additional effort to transform the bibliometric evidence into targeted, integrated perspectives, strengthening the paper as a decision-making tool rather than solely a mapping document.

As regards this point, I suggest to include a dedicated and extensive section on limitations and future perspectives, explicitly discussing methodological constraints, potential biases in data collection and outlining how future research could address the identified gaps. This section could also provide examples of actions, including how to foster cross-disciplinary collaborations in underrepresented fields or strategies for stimulating research, thereby increasing the paper practical value for stakeholders and policy makers.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmaceutical biology, pharmacognosy, phytochemistry, phytotherapy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Version 1

Reviewer Report 11 August 2025

https://doi.org/10.21956/openreseurope.20548.r56657

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İnci Caglayan
[1] Istanbul University-Cerrahpaşa, Sarıyer, Turkey
[2] Istanbul University-Cerrahpaşa, Sarıyer, Turkey

This study aims to provide a bibliometric analysis on natural and plant resins within the scope of the COST Action EU-PoTaRCh. While the topic is timely and relevant, the manuscript has several shortcomings regarding structure, originality, and interpretation. The paper relies heavily on basic bibliometric outputs and lacks sufficient analysis and discussion. Below are my specific comments:
1-Abstract: The abstract is not clear enough. It does not explain the aim, method, or key findings well. The contribution of the study is also not obvious. A clearer and more structured abstract is needed.
2-The authors present this study as a bibliometric analysis. However, it would benefit from clarifying whether the approach follows a thematic or chronological perspective. Currently, it reads more like a general listing of publication metrics rather than a structured review with clear categories or insights. Bibliometric analysis is a tool—not a review type.
3-The introduction does not clearly follow a logical structure. It should explain (1) why the topic is important, (2) what the research gap is, and (3) how this study addresses that gap. Currently, these points are not well developed.
4-The data presented in Tables 1 to 8 appear to be standard outputs from Scopus or Web of Science. These are descriptive and not supported by further interpretation or original evaluation. To enhance the value of the study, the authors should provide more critical insight or thematic classification based on these results.
5- Figure 2 is a standard tree map that can be directly generated by Scopus or Web of Science. It lacks added interpretation or connection to the research objectives. The authors should go beyond visual representation and provide analytical insights.
6- The manuscript reports bibliometric indicators (e.g., citation counts, co-authorships), but it does not explain what these mean in terms of research development or scientific progress in resin-related studies.
7-There is excessive focus on propolis and bee-related resins, which may not fully align with the scope of forest-based resin production unless justified more clearly.
I believe the manuscript has potential, but it requires **major revisions** before being considered for indexing.

Is the topic of the essay discussed accurately in the context of the current literature?
Partly

Is the work clearly and cogently presented?
Partly

Is the argument persuasive and supported by appropriate evidence?
Partly

Does the essay contribute to the cultural, historical, social understanding of the field?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: I specialize in forest planning and have conducted several taxonomic and thematic literature reviews, particularly on forest management, wildfires, and species distribution modeling. I also have experience with literature reviews and forest-based ecosystem services such as resin production. Based on this background, I was able to assess the article in terms of its structure, methodology, literature coverage, and contribution to research gaps. My review focuses specifically on the literature review approach and its implementation in the study.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 28 July 2025

https://doi.org/10.21956/openreseurope.20548.r56660

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Lilia Ortiz Rodríguez
[1] Tecnológico Nacional de México/ Instituto Tecnológico Superior de Perote, Veracruz, Mexico
[2] Tecnológico Nacional de México/ Instituto Tecnológico Superior de Perote, Veracruz, Mexico

The text discusses the topic of forest resin with notable precision. It presents a solid literature review that enables an understanding of the current state of knowledge in this field, clearly identifying both the areas that have received scholarly attention and those that still require further investigation. The information is presented in a clear and organized manner, which facilitates comprehension even when diverse topics are addressed. The thematic progression is well structured. Although technical concepts are used, the overall organization and language make the content accessible to academic and professional readers.
The text does not employ overtly persuasive language; however, it effectively convinces the reader of the importance of bibliometric analysis in this field. The identification of thematic gaps and the proposal of new research directions serve as strong arguments to justify the continuation of the study and the need for initiatives such as the COST Action PoTaRCh.
The text also provides elements that contribute indirectly to the cultural, historical, and social understanding of resin use. By referencing traditional practices such as resin harvesting and the use of propolis, it opens the door to analysis from other disciplinary perspectives. Furthermore, by highlighting the lack of research in social and economic areas, it encourages the integration of

these approaches to achieve a more comprehensive understanding of the topic.

Is the topic of the essay discussed accurately in the context of the current literature?
Yes

Is the work clearly and cogently presented?
Partly

Is the argument persuasive and supported by appropriate evidence?
Yes

Does the essay contribute to the cultural, historical, social understanding of the field?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My area of specialization lies in agronomic and forest sciences. Last year, I carried out a funded project focused on the application of forest resin as a biofilm in food products. Therefore, I consider this work to be highly impactful, as further interdisciplinary research is still needed to advance the study of resin as a forest by-product with the potential to be sustainable and to contribute to a circular economy model that benefits local communities.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 30 Jul 2025

Vítor João Pereira Domingues Martinho

Dear Reviewer Lilia Ortiz Rodríguez, Thank you very much for your comments, which have been duly taken into account to improve the paper. We appreciate the following encouraging words you said about our research: “The text discusses the topic of forest resin with notable precision. It presents a solid literature review that enables an understanding of the current state of knowledge in this field, clearly identifying both the areas that have received scholarly attention and those that still require further investigation. The information is presented in a clear and organized manner, which facilitates comprehension even when diverse topics are addressed. The thematic progression is well structured. Although technical concepts are used, the overall organization and language make the content accessible to academic and professional readers. The text does not employ overtly persuasive language; however, it effectively convinces the reader of the importance of bibliometric analysis in this field. The identification of thematic gaps and the proposal of new research directions serve as strong arguments to justify the continuation of the study and the need for initiatives such as the COST Action PoTaRCh. The text also provides elements that contribute indirectly to the cultural, historical, and social understanding of resin use. By referencing traditional practices such as resin harvesting and the use of propolis, it opens the door to analysis from other disciplinary perspectives. Furthermore, by highlighting the lack of research in social and economic areas, it encourages the integration

of these approaches to achieve a more comprehensive understanding of the topic."

Thank you very much for your contributions. Kind regards, The authors

Competing Interests: No competing interests were disclosed.

Reviewer Report 25 July 2025

https://doi.org/10.21956/openreseurope.20548.r56658

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M. V. Velasco-García
[1] CENID COMEF, National Institute of Forestry, Agriculture and Livestock Research (INIFAP), Ciudad de México, Coyoacán, Mexico
[2] CENID COMEF, National Institute of Forestry, Agriculture and Livestock Research (INIFAP), Ciudad de México, Coyoacán, Mexico

The bibliometric study *"Suggestions for Resin Research under the COST Action EUPoTaRCh"* aims to assess the scientific output related to natural resins. The objective of the research was to provide insight into the various dimensions of natural/plant-based resins and to offer suggestions for the CA22155 Work Plan under the COST Action (EU-PoTaRCh). The study generates valuable information on the most relevant sources on resins and their impact, as well as on the influence and affiliations of key authors, the countries with the highest scientific output and their citation rates, the most frequent keywords associated with natural resins, and the thematic evolution and clustering of the topic. All of this constitutes the main strengths of the study.
In contrast, the presentation of the study reveals several weaknesses:

- **The introduction is weak.** It lacks sufficient background and fails to highlight the relevance and importance of the topic, as well as a clear articulation of the research problem. Additionally, there is an absence of clearly defined research questions or hypotheses guiding the investigation.
- **The results section** requires improvement in its presentation. In several parts of the text, information is redundantly presented in both the narrative and the tables.
- **The discussion and conclusions are deficient.** Certain paragraphs—or parts of them—do not correspond to a critical analysis of the results. For example, the first paragraph focuses on the study's objective in the context of the EU-PoTaRCh COST Action work plan, which would be more appropriate in the introduction. The latter part of that paragraph seems more aligned with the methodology section. Much of the second paragraph follows the same pattern. The remainder of the discussion is too brief considering the extensive results presented; a deeper analysis is needed to explore the underlying causes and implications of the findings for the present and future of various dimensions of natural resin research. Moreover, this section should have included a detailed discussion of the content of the publications reviewed—specifically, how resin-related research has contributed to the

advancement of the field. A particularly notable omission is the absence of concrete "suggestions for the CA22155 Work Plan of the COST Action (EU-PoTaRCh)," as proposed in the second part of the research objective. Furthermore, this section fails to explicitly present the main conclusions of the study, which should be clearly articulated based on the research objectives, hypotheses or questions, and key findings.

In summary, the study offers robust and extensive findings regarding the multiple dimensions of natural resin research, and serves as a solid foundation for guiding future investigations. However, substantial revision is required across all sections, particularly in the discussion, where a more thorough interpretation of the results is needed to ensure alignment with the stated research objectives.

Is the topic of the essay discussed accurately in the context of the current literature?
Partly

Is the work clearly and cogently presented?
No

Is the argument persuasive and supported by appropriate evidence?
Partly

Does the essay contribute to the cultural, historical, social understanding of the field?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Selection and genetic improvement of resin species

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 30 Jul 2025

Vítor João Pereira Domingues Martinho

Dear Reviewer M. V. Velasco-García, Thank you very much for your comments, which have been duly taken into account to improve the paper. We appreciate the following encouraging words you said about our research: "The bibliometric study "Suggestions for Resin Research under the COST Action EUPoTaRCh" aims to assess the scientific output related to natural resins. The objective of the research was to provide insight into the various dimensions of natural/plant-based resins and to offer suggestions for the CA22155 Work Plan under the COST Action (EU-PoTaRCh). The study generates valuable information on the most relevant sources on resins and their impact, as well as on the influence and affiliations of key authors, the countries with the highest scientific output and their citation rates, the most frequent keywords associated with natural resins, and the thematic evolution and clustering of the topic. All of this constitutes the main strengths of the study." The changes made based on your suggestions for improvement are highlighted in the

document, but in any case, we provide a detailed description below.

Comment:
- "The introduction is weak. It lacks sufficient background and fails to highlight the relevance and importance of the topic, as well as a clear articulation of the research problem. Additionally, there is an absence of clearly defined research questions or hypotheses guiding the investigation."

Response:
- The introduction section was significantly improved to consider your valuable recommendations.

Comment:
- "The results section requires improvement in its presentation. In several parts of the text, information is redundantly presented in both the narrative and the tables."

Response:
- The results section was improved following your suggestions and a new section was created for "More in-depth assessment of the most relevant documents".

Comment:
- "The discussion and conclusions are deficient. Certain paragraphs—or parts of them—do not correspond to a critical analysis of the results. For example, the first paragraph focuses on the study's objective in the context of the EU-PoTaRCh COST Action work plan, which would be more appropriate in the introduction. The latter part of that paragraph seems more aligned with the methodology section. Much of the second paragraph follows the same pattern. The remainder of the discussion is too brief considering the extensive results presented; a deeper analysis is needed to explore the underlying causes and implications of the findings for the present and future of various dimensions of natural resin research. Moreover, this section should have included a detailed discussion of the content of the publications reviewed—specifically, how resin-related research has contributed to the advancement of the field. A particularly notable omission is the absence of concrete "suggestions for the CA22155 Work Plan of the COST Action (EU-PoTaRCh)," as proposed in the second part of the research objective. Furthermore, this section fails to explicitly present the main conclusions of the study, which should be clearly articulated based on the research objectives, hypotheses or questions, and key findings."

Response:
- The discussion section has been improved and a new section for conclusions has been created.

Thank you very much for your contributions. Kind regards, The authors

Competing Interests: No competing interests were disclosed.

Reviewer Report 23 January 2025

https://doi.org/10.21956/openreseurope.20548.r49526

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Marco Biagi
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The study titled "Suggestions for Resin Research under the COST Action EU-PoTaRCh" aims to provide with valuable insights into the various dimensions of natural resins through a bibliometric analysis. The goal to identify gaps and trends in resin-related research and provide suggestions for future studies is timely and relevant, given the increasing interest in sustainable forest by-products and their socioeconomic and environmental implications.

In my opinion, the study has strenghts and limitations, detailed below.

Strengths of the Study.
The authors effectively highlight the under-representation of specific research areas, particularly in social sciences, economics, and management.

The paper provides relevant suggestions on the need for transdisciplinary approaches for the study and exploitation of resins.

Despite these strengths, the study presents several limitations that need to be addressed to enhance its overall impact and clarity.

While the paper sets out to explore the multiple dimensions of resin (chemical, biological, environmental, socioeconomic, and cultural), the bibliometric methodology employed is not sufficiently linked to these objectives.

The focus is primarily on quantitative metrics such as publication count, citations, and authorship, which do not directly address the stated multidimensional aspects of resin. The study does not sufficiently analyze the content of the publications to explain how resin research has evolved across different disciplines. In other terms, the study lacks an in-depth thematic discussion that connects the identified items with different topics and applications.

The discussion does not adequately link findings to concrete policy recommendations that stakeholders could adopt.

Overall, the study provides a solid foundation for further research on resin; however, major revisions and improvements are needed in aligning the methodology with the objectives and enhancing the interpretation of the results.

Is the topic of the essay discussed accurately in the context of the current literature?
Partly

Is the work clearly and cogently presented?
No

Is the argument persuasive and supported by appropriate evidence?
No

Does the essay contribute to the cultural, historical, social understanding of the field?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmaceutical biology, pharmacognosy, phytochemistry, phytotherapy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 30 Jul 2025

Vítor João Pereira Domingues Martinho

Dear Reviewer Marco Biagi, Thank you very much for your comments, which have been duly taken into account to improve the paper. We appreciate the following encouraging words you said about our research: “The study titled ’Suggestions for Resin Research under the COST Action EU-PoTaRCh" aims to provide valuable insights into the various dimensions of natural resins through a bibliometric analysis. The goal to identify gaps and trends in resin-related research and provide suggestions for future studies is timely and relevant, given the increasing interest in sustainable forest by-products and their socioeconomic and environmental implications. In my opinion, the study has strengths and limitations, detailed below. Strengths of the Study. The authors effectively highlight the under-representation of specific research areas, particularly in social sciences, economics, and management. The paper provides relevant suggestions on the need for transdisciplinary approaches for the study and exploitation of resins." The changes made based on your suggestions for improvement are highlighted in the document, but in any case, we provide a detailed description below.

Comment:
- “While the paper sets out to explore the multiple dimensions of resin (chemical, biological, environmental, socioeconomic, and cultural), the bibliometric methodology employed is not sufficiently linked to these objectives.”

Response:
- To clarify this aspect, all sections have been improved, particularly the introduction, and a new section has been created for “More in-depth assessment of the most relevant documents”.

Comment:
- “The focus is primarily on quantitative metrics such as publication count, citations, and authorship, which do not directly address the stated multidimensional aspects of

resin. The study does not sufficiently analyze the content of the publications to explain how resin research has evolved across different disciplines. In other terms, the study lacks an in-depth thematic discussion that connects the identified items with different topics and applications."

Response:

- Following your suggestions a new section has been created for "More in-depth assessment of the most relevant documents".

Comment:

- "The discussion does not adequately link findings to concrete policy recommendations that stakeholders could adopt."

Response:

- The discussion section has been improved and a new section for conclusions has been created.

Thank you very much for your contributions. Kind regards, The authors

Competing Interests: No competing interests were disclosed.