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A Bibliometric Analysis of Investigations on Black Pepper Published from 1978 to 2023

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Abstract

Spices have played a crucial role in human history, shaping cultures, trade routes, and culinary traditions for millennia. The diverse and fascinating world of spices, examining their origins, cultural significance, economic impact, and the multifaceted roles they play in both traditional and modern societies. Black pepper (Piper nigrum) stands as one of the most globally recognized and widely used spices, with a history rooted in ancient trade routes and culinary traditions. The multifaceted aspects of black pepper, encompasses its botanical characteristics, historical significance, culinary applications, medicinal properties, and its current standing in the global spice market. Therefore, this study aims to map investigations on black pepper using the bibliometric method. A bibliometric investigation was adopted through metadata planning with the keywords "Investigation AND black AND pepper" from Scopus Database (1978-2023). Metadata is stored in CSV and BibTex types. Furthermore, CSV format of Scopus metadata for analysis using the counting method on VOS viewer. Mapping results showed that the number of publications related to the black pepper experienced a minimum investigation, most occurring from 2007 to 2023. Most articles relating to Black pepper were published in the Food and Chemical Toxicology. The most prolific studies were conducted by Elangovan Kannan, Gunasekaran Vetrichelvi, Niranjali Devaraj is the most cited. Studies on black pepper need to be explored and most of the keywords with a fairly high density included phenols, hplc, antivenom. Meanwhile, the rarely investigated themes include piperaceae.

Keywords: Bibliographic, Citations, Black pepper, Vos viewer

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1. Introduction

Spices are plant-based ingredients used to flavour, colour, or preserve food. They are usually extracted from the seeds, bark, roots, fruits, or other parts of plants [1]. For millennia, they have been an essential component of human culinary customs and conventional medical procedures [2]. In addition to adding flavour and perfume to food, spices play an important role in the cultural and historical identities of many different cuisines worldwide [3]. Professionals in the food business can also benefit from using spices as a beneficial reference [4-5]. One of the most extensively used and traded spices in the world is black pepper (Piper nigrum) [6]. It is well known for both its strong flavour and adaptability in cooking [7]. Black pepper is said to have come from India's Malabar Coast and has long been a highly valued item in the spice trade [8]. Black pepper has been acknowledged for possible health advantages in addition to its culinary usage [9]. Because black pepper (Piper nigrum) has such cultural, gastronomic, and maybe health-related significance, it has been the focus of several scientific studies. Scholars have investigated several facets of black pepper, encompassing its chemical constitution, growing methods, medical attributes, and its uses in multiple sectors. Scholars have carried out investigations to examine the molecular makeup of black pepper, pinpointing essential constituents accountable for its taste and fragrance. Gas chromatography-mass spectrometry (GC-MS) is one technology that is frequently used in these investigations to give extensive insights into the volatile chemicals present [10]. Black pepper production techniques have been optimised via research on soil needs, irrigation techniques, and insect management. The goal of these studies is to

improve the production of black pepper in terms of yield, quality, and sustainability [11]. Black pepper's potential health advantages, including as its antibacterial, anti-inflammatory, and antioxidant qualities, have been the subject of several research. Studies have been conducted to learn more about the potential health benefits of black pepper extracts and how they may be used in conventional medicine [12]. Studies have been done on the possible industrial uses of black pepper, such as in the food and cosmetics sectors. Research investigates its function as an organic preservative, enhancer of flavour, and constituent of fragrance [13]. The goal of research on black pepper's genetic diversity is to boost breeding initiatives for improved qualities, yields, and resistance to disease. Genetic variability is frequently evaluated through the use of molecular methods [14]. Research and academia both heavily rely on bibliometric investigations. To learn more about the traits and significance of academic work, these studies employ quantitative analysis of publications, citations, and other bibliographic data [15]. By offering quantifiable metrics for analysing the productivity and calibre of researchers, institutions, or even whole research fields, it aids in determining the effect and influence of research output. It enables academics to spot new developments, hot subjects, and potential growth prospects in a certain field [16]. To properly distribute resources, decision-makers in academia, funding agencies, and industry can benefit from this knowledge. It continues to be useful in mapping patterns of collaboration between scholars, institutions, and nations. Fostering collaborations, multidisciplinary research, and international information sharing all depend on an understanding of collaborative networks. One popular bibliometric technique for assessing the influence of academic publications is citation analysis [17]. Citations show a publication's impact on the academic community by showing how frequently it is cited by other scholars. Bibliometric studies can also be useful to policymakers in developing research and innovation strategies. A comprehensive understanding of the scientific production and impact landscape facilitates well-informed decision-making aimed at promoting and advancing research excellence [18]. Academic quality assurance procedures benefit from the use of bibliometrics, which analyses publication trends and citation patterns. It facilitates comprehension of the dissemination and communication of scientific knowledge within the research community [19–20]. This data is useful for enhancing communication tactics and maximising the influence of study results. In the discipline of bibliometrics, VOS viewer is a useful tool that gives academics an effective way to examine and display bibliographic data. In bibliometric analysis, VOS viewer is a flexible tool that gives scholars a quantitative and visual knowledge of the links, dynamics, and structure of academic literature. Its uses in academia and research organisations are numerous and include collaborative analysis, strategic planning, and research assessment. It makes it easier to analyse journal co-citation networks, identify research clusters related to authors or keywords, researchers, and thematic groups within a larger dataset. It also enables the analysis of co-authorship networks within a particular field or discipline, keyword co-occurrence patterns in academic literature, and visualisation of citation patterns. Researchers can organise publications, authors, or keywords based on common interests and use this to analyse bibliometric data over time. Therefore, the goal of the current work is to use bibliometric analysis to map research on black pepper.

2. Materials and Methods

This study's methodology is bibliometrica research using metadata planning using the keywords "black AND pepper" and "investigation" from the Scopus Database (1978–2023). Data saved in BibTex and CSV formats. Tables No. 1 and No. 2 mentioned the input metrics. The complete counting approach is used to the CSV format of Scopus information for examination in VOS Viewer. It explains the relationships between several articles from different points of view, and you may get more specific article associations by using the text analysis tool, scrolling, and mapping. The analysis types that were carried out are listed in Table No. 1. Microscoft Excel is utilised for data visualization, and the maps were made utilising the clusters that were acquired from the CSV file that VOS Viewer produced.

3. Results and Discussion

Figure 1 depicts the varying pattern in the number of published scientific works connected to the research on black pepper from 1978 to 2023. There was a notable high in 2012 and a considerable dip in 2014–2021. A scopus index search of 169 publications published between 1978 and 2023 produced 215 items pertaining to studies on black pepper. In practical terms, abstract readability is equally important. The length of the article, the amount of keywords, and the title are all insignificant or have little real-world impact. Nonetheless, there is a strong correlation between longer abstracts and more citations. Furthermore, citations were linked to the journal, document, and cooperation attributes shown in Table 3 and Figure 2. The outcome offered fresh, compelling statistical proof that research works ought to be published in high-impact journals, include several authors, include all relevant references, and produce extensive abstracts. Examining the data using a graphical representation from the CSV file that was produced with the aid of VOS Viewer, it was discovered that only seven nations—Brazil, France, India, Mexico, Poland, Spain, and Sweden—had papers with at least one reference. These countries have 6, 4, 82, 1, 6, 2, and 5 citations, respectively. India is the top-ranked country among the seven, with around 82 publications that have received 1638 citations. In contrast, Brazil and Poland only have six texts with 100 and 44 citations, respectively. Despite only having four documents, France has a significant number of article citations, ranking second out of all countries with around 206. India was at first and France is standing as second position having 82 & 4 documents at citation level which was the most productive publications on the investigations of Black pepper. Co-authorship relationships showed that 23 items out of 1000 were related. 808 is the lowest number of times an author's keywords appear in the data shown in Figures 4 and 5. 808 of them satisfy the requirement. Of the 169 sources cited, just three—food and chemical toxicology, molecules, and mutation research/genetic toxicology—were considered strong sources.

Table 1. Bibliometric Analysis Performed

S. No.	Type of Analysis	Unit of Analysis
1.	Co-authorship	Authors
2.	Co-occurance	Author Keywords
3.	Citation	Countries
4.	Citation	Sources
5.	Co-Citation	Cite Authors

Table 2. Information for VOS Viewer Analysis

Description	Results
Information about Data	
Timespan	1978:2023
Sources(Journals, Books etc.,)	169
Research Documents	215
Document Type	
Article	215
Reviews	23
Book Chapters	6
Conference Paper	2
Conference Review	2
Note	1
Documents Contents	
Keywords Plus	0
Author's Keywords (DE)	2392

Table 3. No. of Citations attained to respective Countries

S. No.	Countries	Weight of Documents	Weight of Citations
1.	Brazil	6	100
2.	France	4	206
3.	India	82	1638
4.	Mexico	1	10
5.	Poland	6	44
6.	Spain	2	21
7.	Sweden	5	59

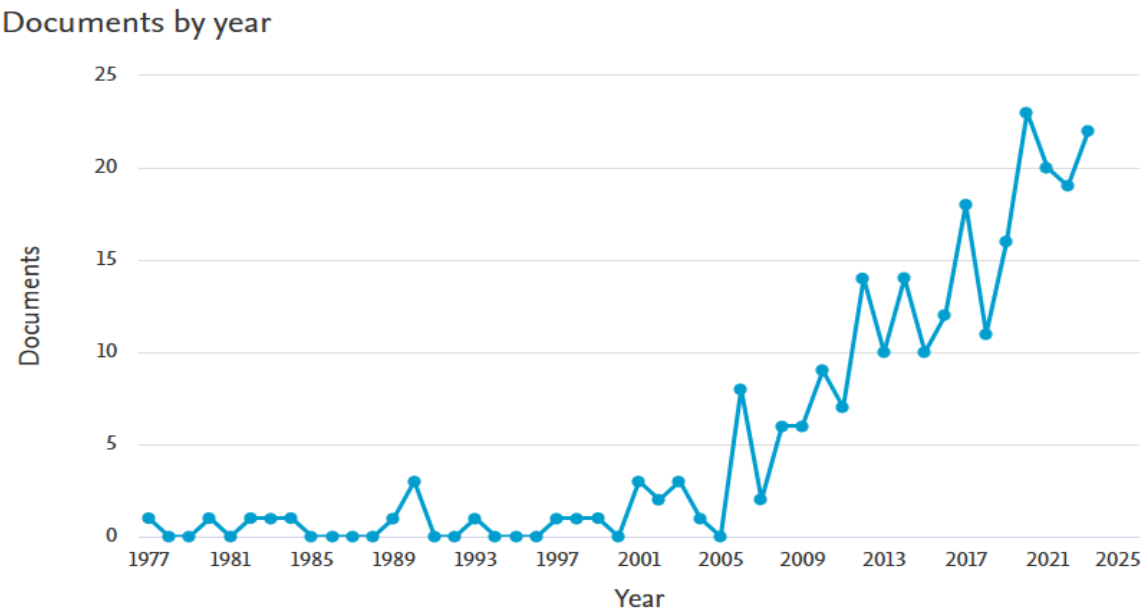

Figure 1. Graphical Representation of Documents published per Year

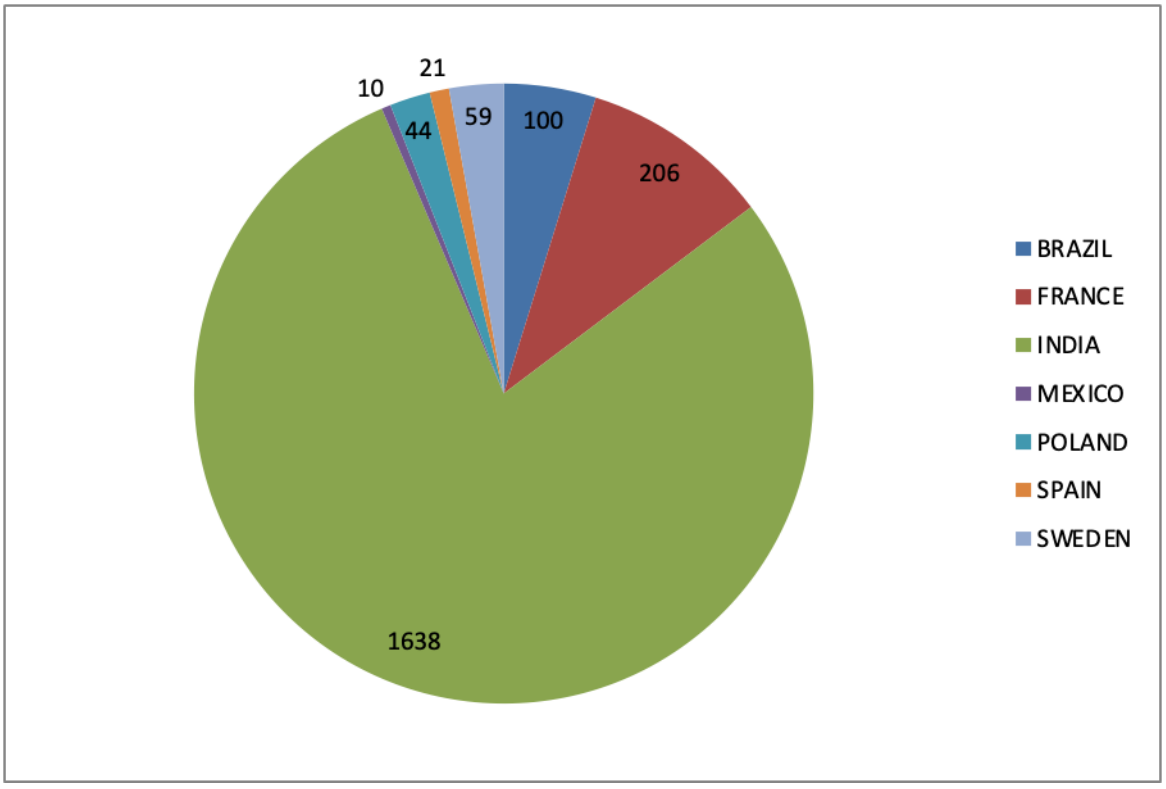

Figure 2. Graphical representation mentioning Citations among Countries

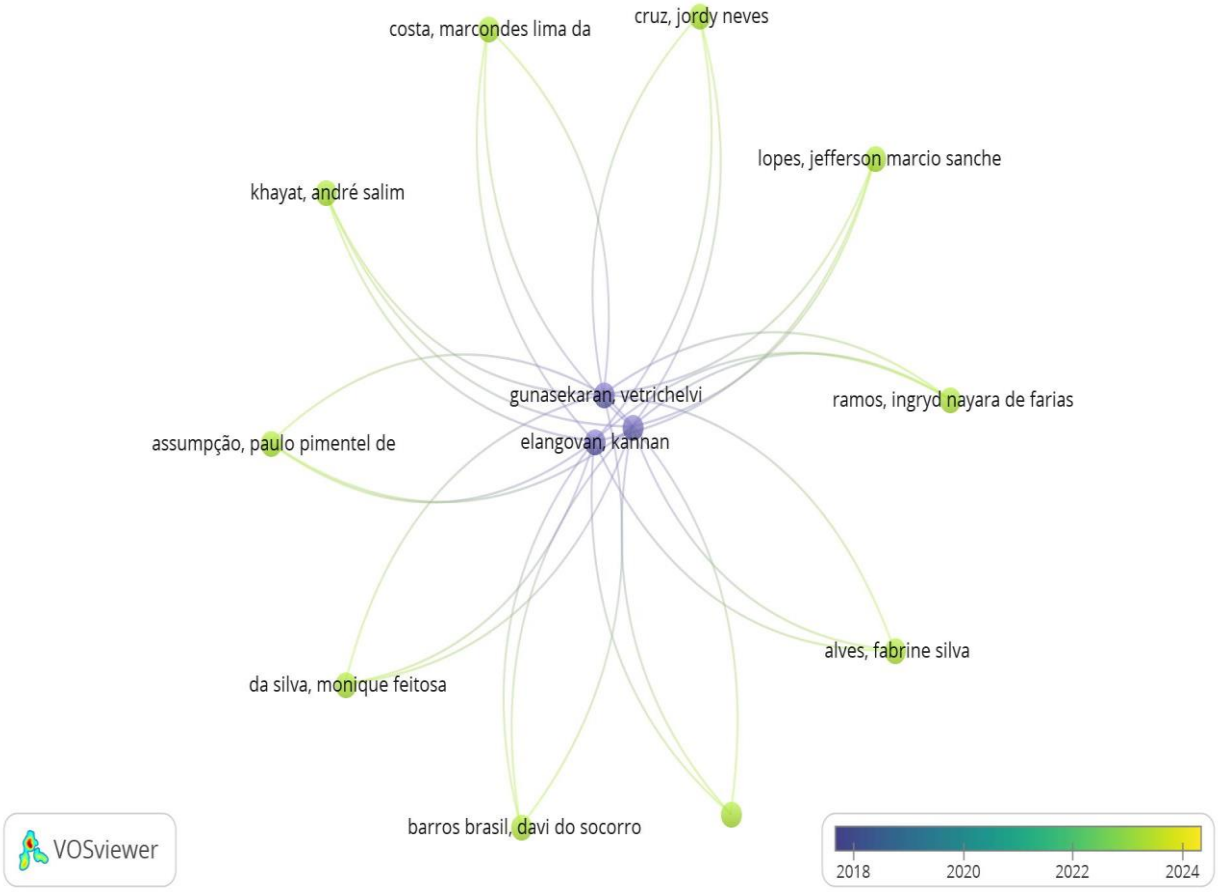

Figure 3. Unit of Analysis mentioning Citations and Authors

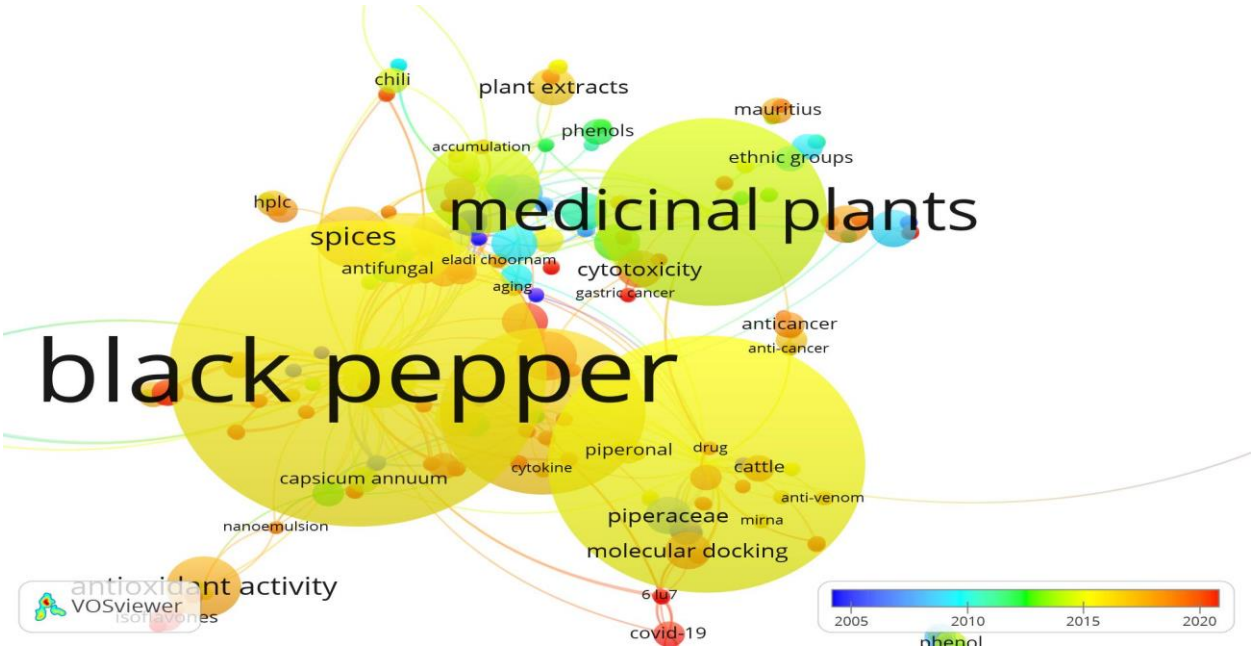

Figure 4. Overlay Vizualization mentioning Unit of Analysis of Co-occurance and Authors Keywords

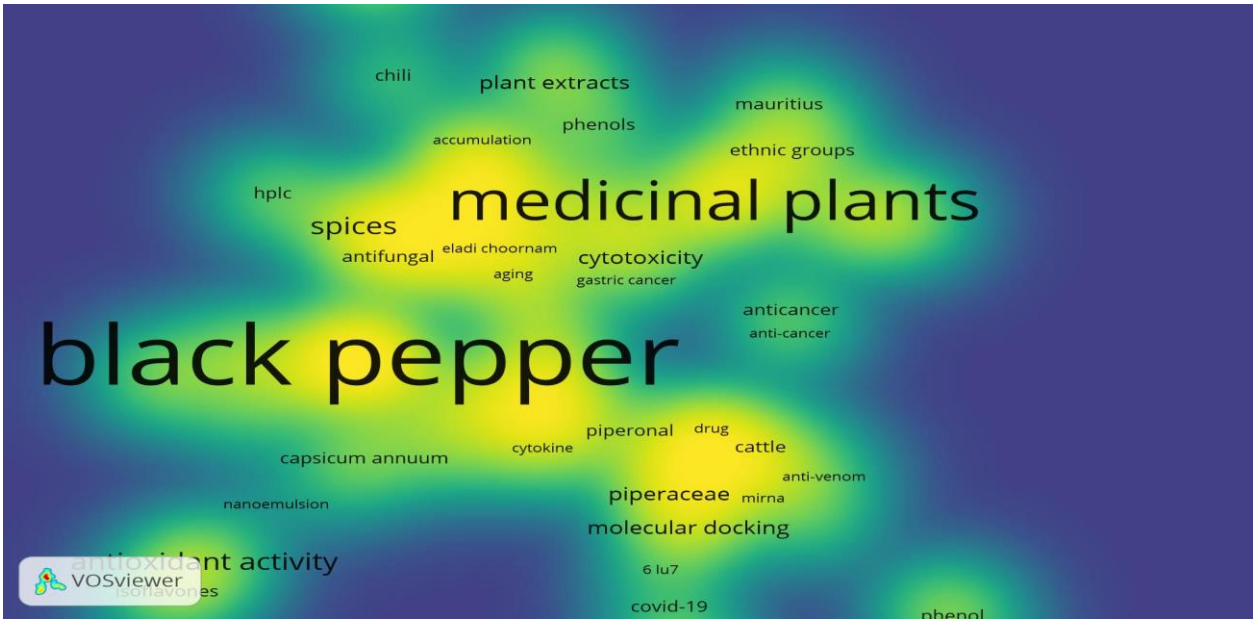

Figure 5. Density Vizualization mentioning Unit of Analysis of Co-occurrence and Authors Keywords

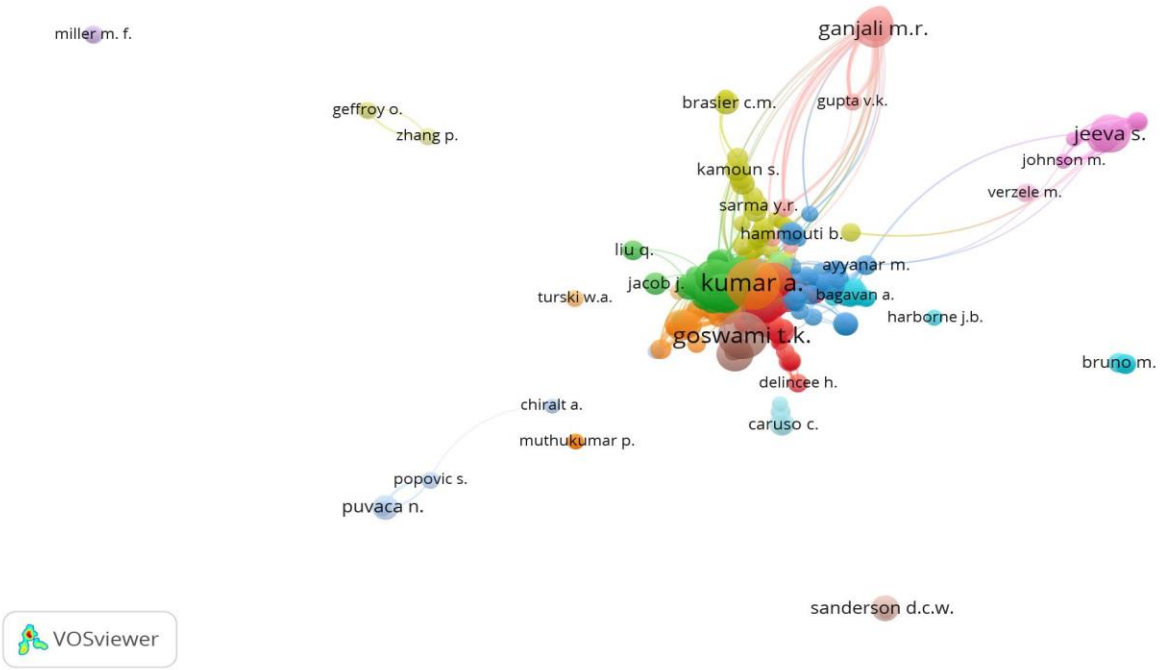

Figure 6. Overlay Visualization mentioning Unit of Analysis of Co-citation and Cited Authors

Elangovan Kannan, Gunasekaran Vetrichelvi, and Niranjali Devaraj are the most prolific authors of studies on black pepper, as evidenced by Figure 3 (Targeting hepatocellular carcinoma with piperine by radical-mediated mitochondrial pathway of apoptosis: An in vitro and in vivo study, which has been cited 40 times). Out of 463 writers, only 23 reached the required number of co-citations and cited authors. Out of the 23 writers, the citation number for each author was 4.

Studies that are written and published are more valuable when they have a greater citation count [21]. These findings suggest that there is no clear relationship between the quantity of research and the amount of citations. For every participant, a co-authorship network was generated using the VOS viewer programme. An author must have a minimum of one document and a minimum of one reference in relation to data selection and thresholds. Out of the 23445 writers in the co-authorship network shown in Figures 6 and 7, only 463 authors satisfied the requirements with at least 5 citations and 22 linkages. The relationships between the authors are shown by the lines connecting each node.

The strength of the link is shown in the distance between two nodes; closer nodes signify a stronger relationship. Moreover, more publications and citations are indicated by bigger nodes. Additionally, a correlation between 463 authors who fulfilled the criterion in many scientific journal articles is displayed using the Author Network Visualisation mode. Among the 450 items with linkages totaling 18506, or a link strength of 71246, 18 Clusters were identified. 23 writers are linked in Cluster 1, 103 authors are linked in Cluster 2, and 23 authors are linked in Cluster 3. The number of co-authored studies is indicated by the strength value of each connection [22]. A quantitative statistic that characterises the relationship between two objects is the total link, which is the total of this node's link strengths across all others [23].

The most significant writers in a field and the degree of contact between them are revealed by country co-authorship analysis, which makes it valuable [24]. A visualisation map of the country co-authorship network overlay is displayed in Figure 4b. For data selection and criteria, a nation must have a minimum of one study and one citation. Of the 57 nations, 57 meet the standards. India ranked top out of 57 nations with 6 connections totaling 82 documents. In addition, the overlay representation is coloured according to the average publishing year, with yellow representing the best score and red representing the lowest. The nations with the highest number of publications include Mexico, France, Brazil, Sweden, Poland, Spain, India, and France (Figure 4b). In this field, the research centres with the strongest overall links are Brazil, France, and India. Furthermore, the size of a node on this map corresponds to the quantity of research it includes. They can communicate and work together with nations and regions all around the world since they have the best overall link strength. According to this finding, teamwork and cooperation in this sector are enhanced by proximity [25-34].

4. Conclusion

There has been a shifting tendency in the number of publications pertaining to restricted investigations on black pepper; the majority of these articles happened between 2020 and 2023. Food and Chemical Toxicology published the majority of the studies on this subject. Moreover, Elangovan Kannan, Gunasekaran Vetrichelvi, and Niranjali Devaraj conducted the three most often referenced studies. Low-density studies were conducted on antivenom, phenols, and HPLC. In the meantime, the piperaceae family is one of the understudied issues at the moment.

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