International Journal of Innovative Research and Scientific Studies, 8(3) 2025, pages: 2498-2511

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

From Nobel-winning antiparasitic to antiviral pandemic candidate: A bibliometric analysis of ivermectin's decades of veterinary and human protection

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Abstract

Ivermectin, a Nobel Prize-winning antiparasitic agent, has gained renewed scientific attention due to its potential antiviral properties, particularly during the COVID-19 pandemic. This study aims to systematically map the global research landscape of ivermectin through a comprehensive bibliometric analysis. A total of 3,723 articles indexed in Scopus from 1980 to April 2025 were analyzed using bibliometric tools including VOSviewer and Bibliometrix. The study evaluated research productivity, citation patterns, geographic distribution, collaboration networks, and thematic evolution. Keyword co-occurrence and overlay visualization were applied to map classical and emerging trends. The annual publication rate increased at an average of 4.89%, with a sharp rise between 2020 and 2022 during the COVID-19 pandemic. Articles had an average of 25.06 citations and involved 5.71 co-authors per document. The United States led in publication output, followed by Brazil and China, with Mahidol University being the most productive institution. Six thematic clusters were identified: veterinary parasitology and resistance; neglected tropical diseases; toxicity and resistance mechanisms; antiviral repurposing (COVID-19); dermatological applications; and scabies treatment. Emerging areas of focus include nanodelivery systems and SARS-CoV-2-related studies. Ivermectin's research trajectory reflects its evolving role beyond antiparasitic use, especially during global health crises. The pandemic significantly accelerated its repositioning as a potential antiviral agent, although this trend varies across regions and institutions. This study highlights ivermectin's expanding therapeutic landscape and underscores the need for balanced global collaboration. Future research should focus on the development of novel delivery technologies and robust clinical trials to substantiate its antiviral efficacy as well as testing its potential broad-spectrum antiviral activity.

Keywords: Bibliometrics, Human protection, Ivermectin's decades, Nobel-winning antiparasitic, Pandemic candidate.

DOI: 10.53894/ijirss.v8i3.7031
Funding: The authors extend their appreciation to the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia (Grant Number: KFU251689).
History: Received: 1 April 2025 / **Revised:** 7 May 2025 / **Accepted:** 9 May 2025 / **Published:** 14 May 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

The antiparasitic drug ivermectin represents one of the most significant pharmaceutical discoveries of the late 20th century, transforming both veterinary practice and human health interventions worldwide [1]. Since its introduction in the early 1980s, ivermectin has evolved from a primarily veterinary antiparasitic agent to a multifaceted therapeutic compound with applications spanning human medicine, particularly in the treatment of neglected tropical diseases [2, 3]. Most notably, the drug's effectiveness against onchocerciasis (river blindness) as well as its broad-spectrum antiparasitic actions granted its discoverers, William C. Campbell and Satoshi Ōmura, the 2015 Nobel Prize in Physiology or Medicine, underscoring its transformative impact on global health [4].

The research landscape surrounding ivermectin has undergone a remarkable evolution over the past four decades. Initial investigations focused predominantly on its efficacy against parasitic nematodes in livestock, but the scope rapidly expanded to include human applications, particularly following the establishment of the Mectizan Donation Program in 1987, which revolutionized access to treatment in endemic regions [5, 6]. More recently, investigations into potential antiviral properties have generated renewed interest in the compound, particularly during the COVID-19 pandemic, where ivermectin emerged as a candidate for drug repurposing strategies [7, 8].

Although ivermectin has had a major scientific and public health impact, comprehensive bibliometric analyses of its research landscape remain limited. Understanding its historical development, global distribution, and thematic evolution can highlight scientific progress and future opportunities.

This study aims to systematically analyze global ivermectin research from 1980 to early 2025 using bibliometric indicators to assess publication trends, citation impact, geographic distribution, and thematic areas. Our findings will help researchers, funding agencies, and policymakers by identifying key contributors, collaboration networks, and emerging fields, especially following the COVID-19-driven surge in publications.

2. Methods

2.1. Study Design

This research utilized a bibliometric analysis to evaluate scientific production related to Ivermectin from 1980 to early 2025. We systematically examined publication trends, citation impacts, geographic distribution, and thematic evolution within the field as previously described [9, 10].

2.2. Data Collection

We retrieved publication records from the Scopus database using the primary keyword "ivermectin" and searched article titles using the following search query: (TITLE(ivermectin) AND (LIMIT-TO (DOCTYPE,"ar")) AND (EXCLUDE(PREFNAMEAUID,"Undefined")) AND (EXCLUDE(AFFILCOUNTRY,"Undefined")) AND (LIMIT-TO(LANGUAGE,"English"))). Our search covered data from January 1980 through April 2025 (Figure 1). For each publication, we extracted metadata including publication date, author information, institutional affiliations, country of origin, journal details, citation metrics, and keywords.

2.3. Inclusion Criteria

Articles were included if they: 1) focused primarily on Ivermectin as a central research topic; 2) were published in peer-reviewed Scopus-indexed journals; and 3) provided complete bibliographic information; 4) Articles should be in the English language only; 5) articles are only included. Other publications were excluded. The exclusion includes any type of publication other than research articles, articles in languages other than English, and articles missing authorship, affiliation, or country details.

2.4. Data Analysis

We calculated productivity metrics including annual publication counts, author contributions, institutional outputs, and country distributions. Citation analysis included total citations, mean citations per publication, and normalized citation rates adjusted for publication age. For author impact, we computed the number of publications and h-index. We analyzed collaboration patterns through co-authorship networks, particularly examining single-country publications (SCP) versus

multi-country publications (MCP). Additionally, we identified core journals publishing Ivermectin research and analyzed their relative contributions to the field.

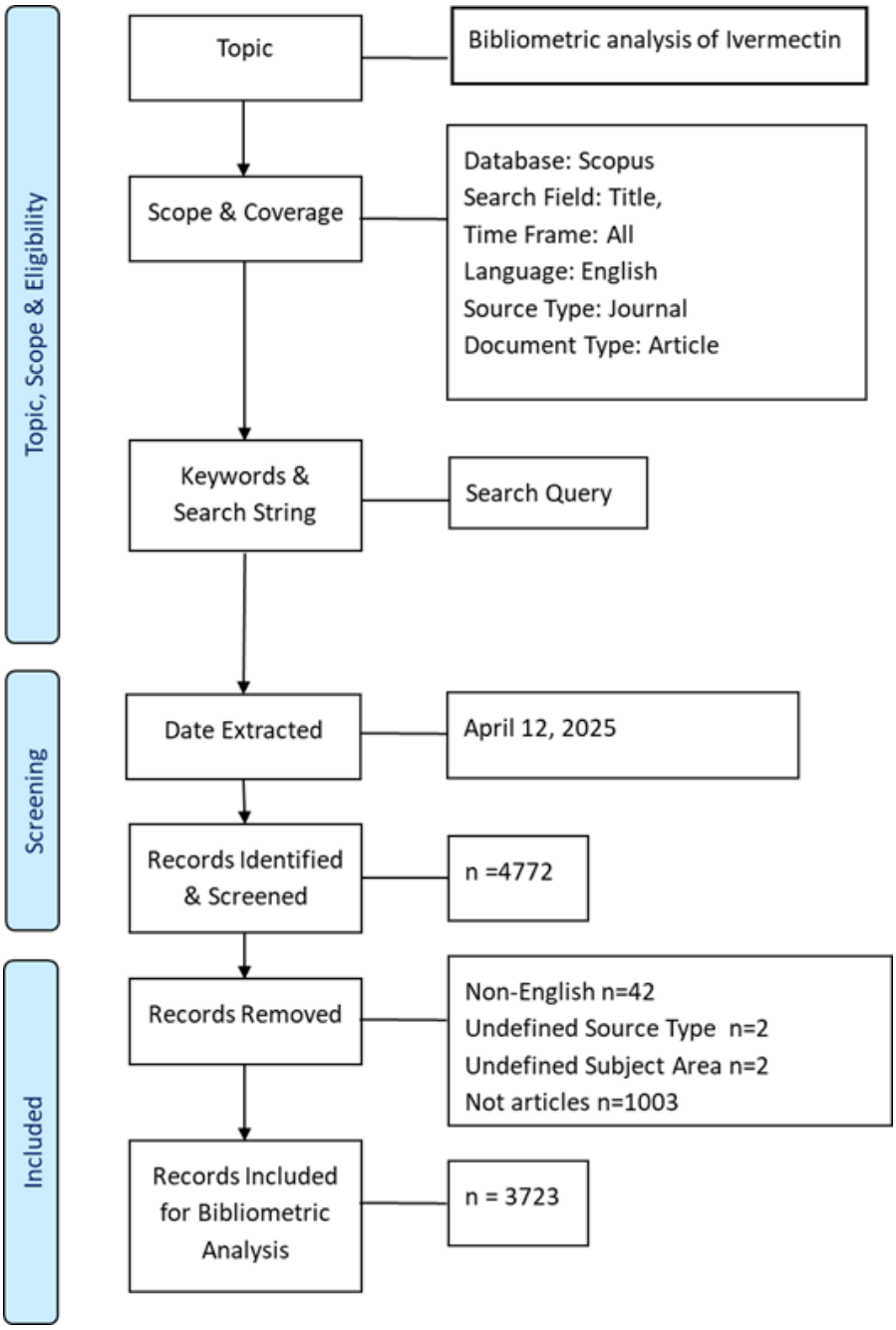

Figure 1.
Flowchart of the systematic literature search and screening process for bibliometric analysis.

2.5. Visualization of Data

Temporal trends were represented through time-series graphs, while geographic distributions utilized choropleth maps with collaboration network overlays. The thematic analysis employed keyword co-occurrence networks where node size represented term frequency and edge thickness indicated co-occurrence strength.

2.6. Software and Tools

Several software tools supported the analysis process: Microsoft Excel was used for organizing the data and conducting initial analyses; VOSviewer helped visualize bibliometric networks like author collaborations and keyword co-occurrences [11]; and Bibliometrix, an R package, provided a more in-depth bibliometric analysis, covering citation metrics and journal impact evaluations [12].

3. Results

Spanning from 1980 to 2025, our results captured insights from 3,723 documents across 1,027 sources, illustrating a steady annual growth rate of 4.89%. Although the documents are relatively mature with an average age of 16.6 years, they

continue to demonstrate influence, averaging 25.06 citations each. Collaborative efforts are notable, with an average of 5.71 co-authors per paper and 28.2% involving international partnerships. The breadth of topics is reflected in over 13,000 Keywords Plus entries and nearly 5,000 author keywords. Further details are shown in Table 1.

Table 1.
Main information of the search results.

Description	Results
Main Information About Data	
Timespan	1980:2025
Sources	1027
Documents	3723
Annual Growth Rate %	4.89
Document Average Age	16.6
Average citations per doc	25.06
References	87294
Document Contents	
Keywords Plus (ID)	13368
Author's Keywords (DE)	4811
AUTHORS	
Authors	13565
Authors of single-authored docs	119
Authors Collaboration	
Co-Authors per Doc	5.71
International co-authorships %	28.2
Document Types	
Article	3723

3.1. Annual Scientific Production

The annual production of articles related to ivermectin demonstrates a generally upward course from a modest seven publications in 1980 to a peak of 225 publications in 2022. The initial decade (1980-1990) shows steady but relatively limited output, with production remaining below 70 articles annually. The 1990s witnessed more substantial growth, with outputs consistently exceeding 70 publications per year. The period from 2010 to 2019 demonstrated sustained productivity, typically ranging between 80-120 articles annually. Most notably, a significant acceleration occurred from 2020 onward, with article production increasing dramatically to 141 (2020), 179 (2021), 225 (2022), and 190 (2023). The 2024 data shows continued increases in output with 214 articles, while the partial data for 2025 (60 articles) suggests ongoing research activity (Figure 2).

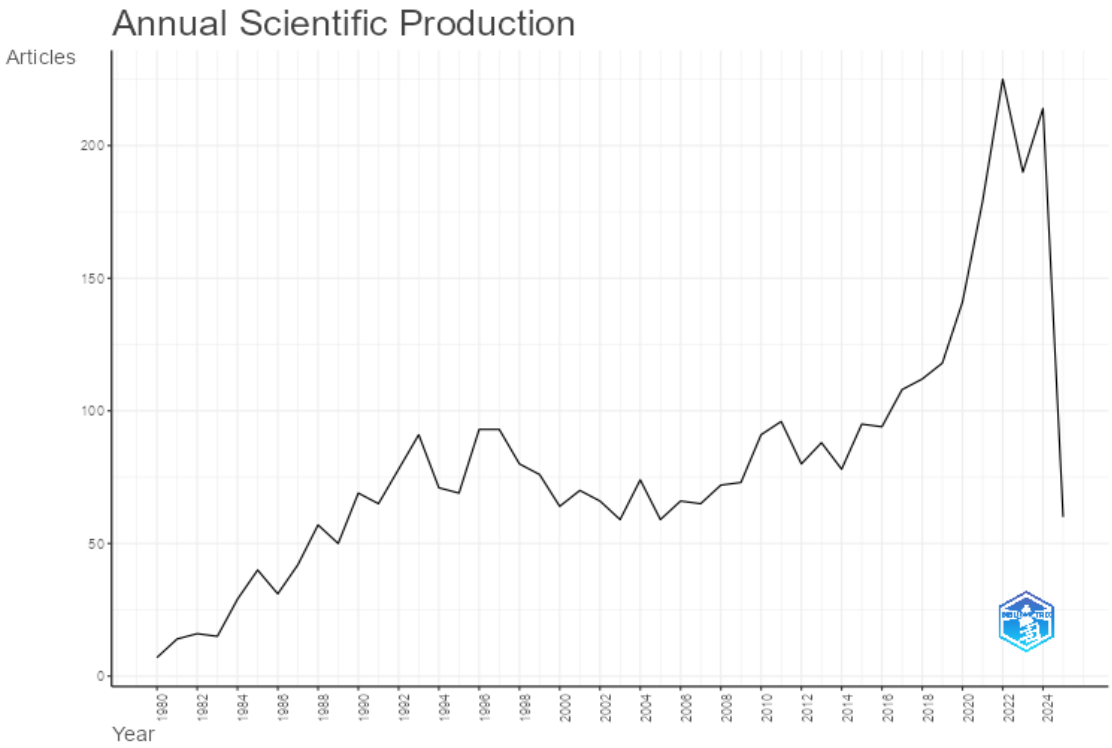

Figure 2.
Annual scientific production.

3.2. Citation Impact

Early publications, particularly from 1980 and 1983, achieved relatively high mean citation rates (65.43 and 66.2 citations per article, respectively), despite the comparatively lower volume of publications during those years. As scientific output increased during the 1990s and 2000s, citation rates largely stabilized between 30-40 citations per article, indicating consistent scholarly engagement. A notable citation surge appeared in 2020, with a mean citation per article value of 31.79, corresponding with the COVID-19 pandemic and emerging interest in Ivermectin's potential applications. The recency effect is demonstrated in the declining citation metrics for 2022-2025 publications, which have had less time to accumulate citations. Regarding citable years, publications from 2020 demonstrate the highest annual citation rate (5.30), followed by 2021 (4.04), representing exceptional scholarly attention to Ivermectin research during this period (Figure 3).

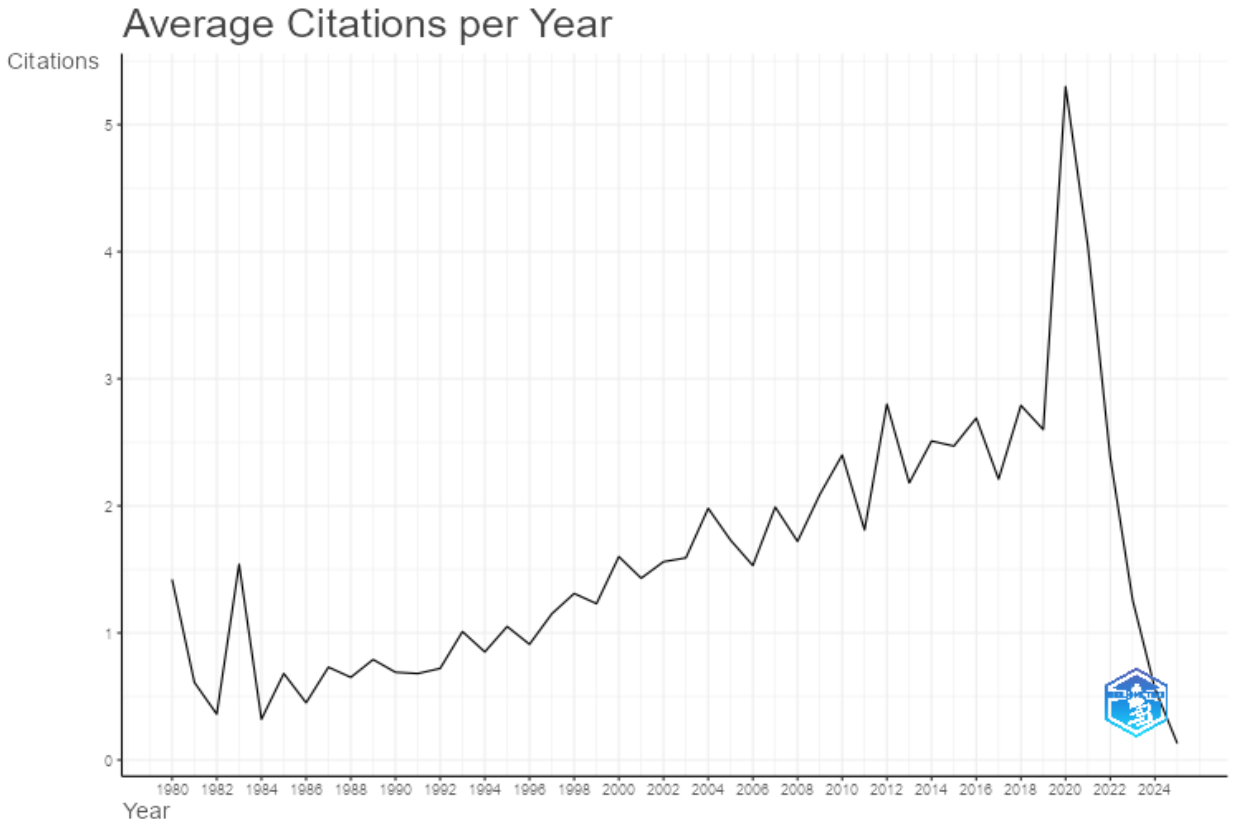

Figure 3.
Annual Citation per Year.

3.3. Publication Sources and Journal Impact

Veterinary Parasitology emerges as the dominant publication journal with 266 articles, substantially exceeding other sources. This aligns with Ivermectin's historical significance as an antiparasitic agent in veterinary medicine. The second tier of influential journals includes Veterinary Record (99 articles), PLOS Neglected Tropical Diseases (98 articles), Transactions of the Royal Society of Tropical Medicine and Hygiene (89 articles), and American Journal of Tropical Medicine and Hygiene (88 articles). This distribution underscores the multidisciplinary nature of Ivermectin research, spanning veterinary medicine, parasitology, tropical medicine, and pharmacology. Collectively, the ten most relevant sources account for approximately 22.5% of the total publication output, demonstrating both concentration in core journals and diversification across multiple disciplines, consistent with Ivermectin's expanding applications beyond its original antiparasitic indications (Figure 4).

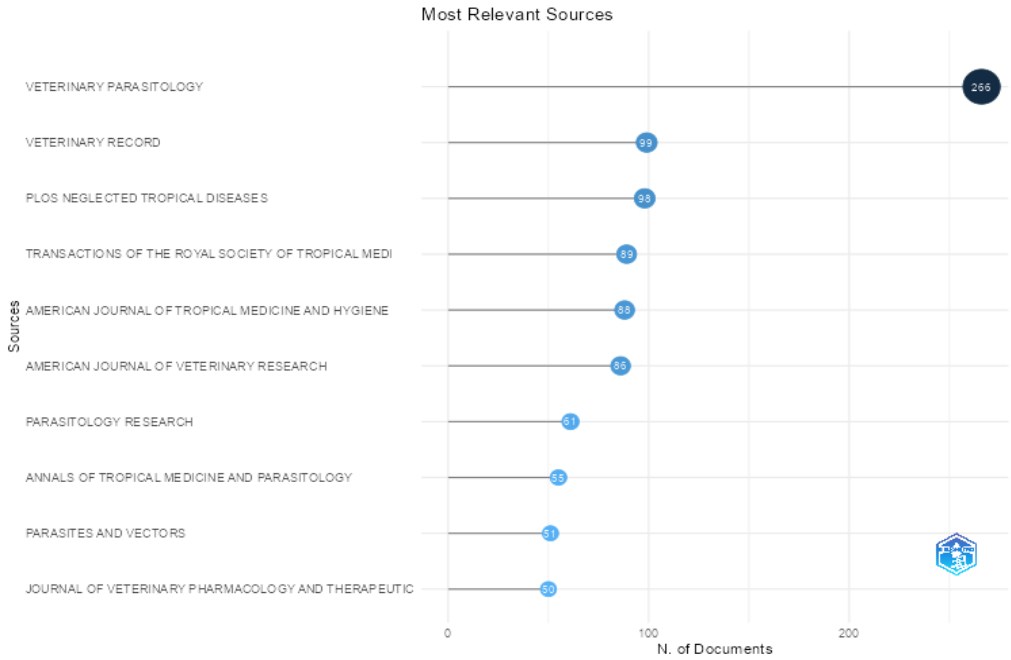

Figure 4.
Most Relevant Sources (journals).

3.4. Author Impact and Research Leadership

Alvinerie M. and Prichard R.K. demonstrate the highest h-indices (both 30), indicating substantial influence and scientific impact. However, their citation patterns differ notably, with Prichard accumulating 2,987 total citations compared to Alvinerie's 2,340, despite publishing fewer papers (44 versus 47). Boussinesq M. maintains a similarly high impact position with an h-index of 26 and 2,294 citations across 52 publications. Lanusse C. and Lifschitz A. present identical h-indices (25) with comparable publication counts (55 and 54, respectively), suggesting potential research collaboration or complementary research trajectories. When examining productivity relative to career duration (m-index), Lanusse and Lifschitz demonstrate the highest values (both 0.86), indicating more rapid scholarly impact accumulation compared to longer-established researchers. The most recent entrants to the field among top authors began publishing in 1997, while the earliest contributors initiated their Ivermectin research in 1985 (Figure 5).

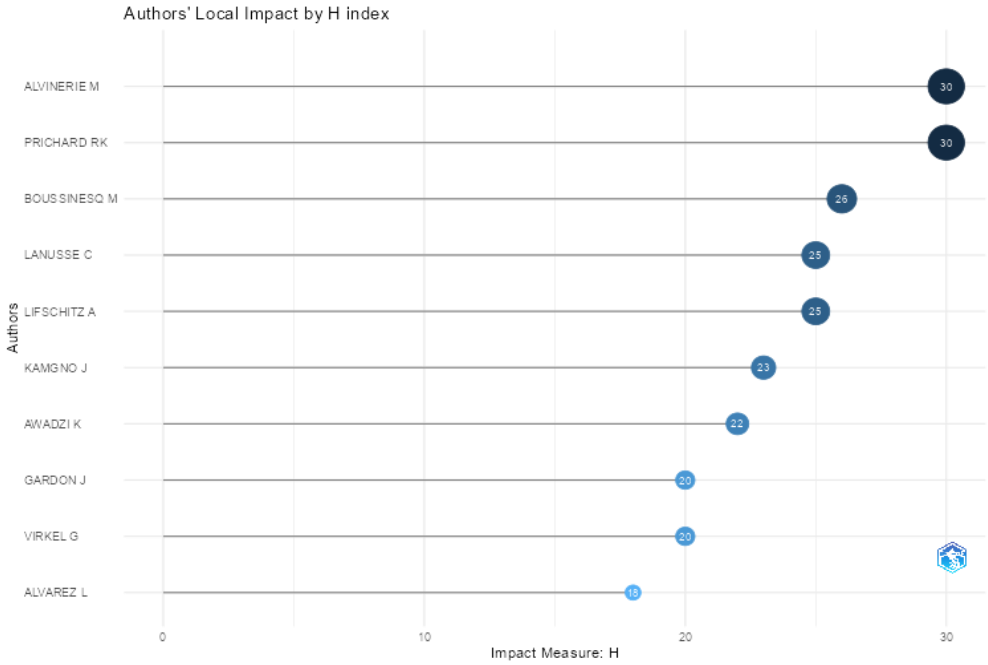

Figure 5.
Authors' Local Impact.

3.5. Institutional and Geographic Distribution of Research

Mahidol University emerges as the most productive institution with 173 articles, followed by the University of Basel (121) and the University of Buea (116). This institutional leadership pattern highlights the significant research contributions from academic centers in Thailand, Switzerland, and Cameroon, respectively (Figure 6).

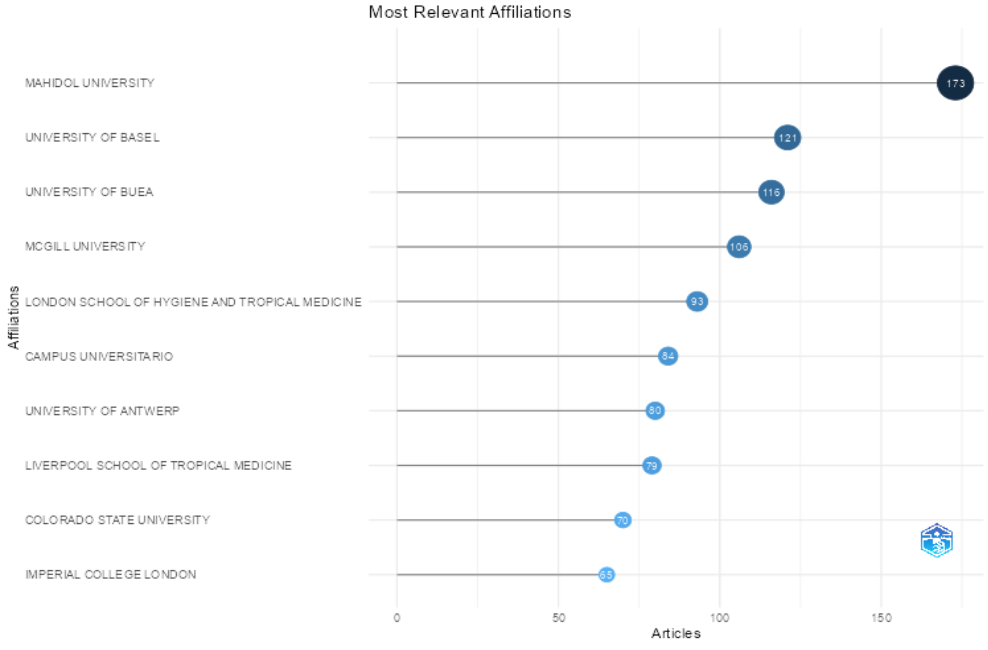

Figure 6.
Most Relevant Affiliations.

When examining the corresponding authors' countries, the United States dominates with 297 articles (approximately 8% of total output), followed by Brazil (145 articles) and China (140 articles). The distribution demonstrates substantial research activity across both high-income nations and endemic regions where parasitic diseases represent significant public health challenges. The collaboration patterns reveal notable differences in international engagement; while high-income countries like Switzerland (80%), Germany (64.5%), and the United Kingdom (56.6%) demonstrate robust international collaboration percentages (MCP%), emerging research nations such as India (7.0%) and Egypt (18.46%) display stronger tendencies toward single-country publications (Figure 7).

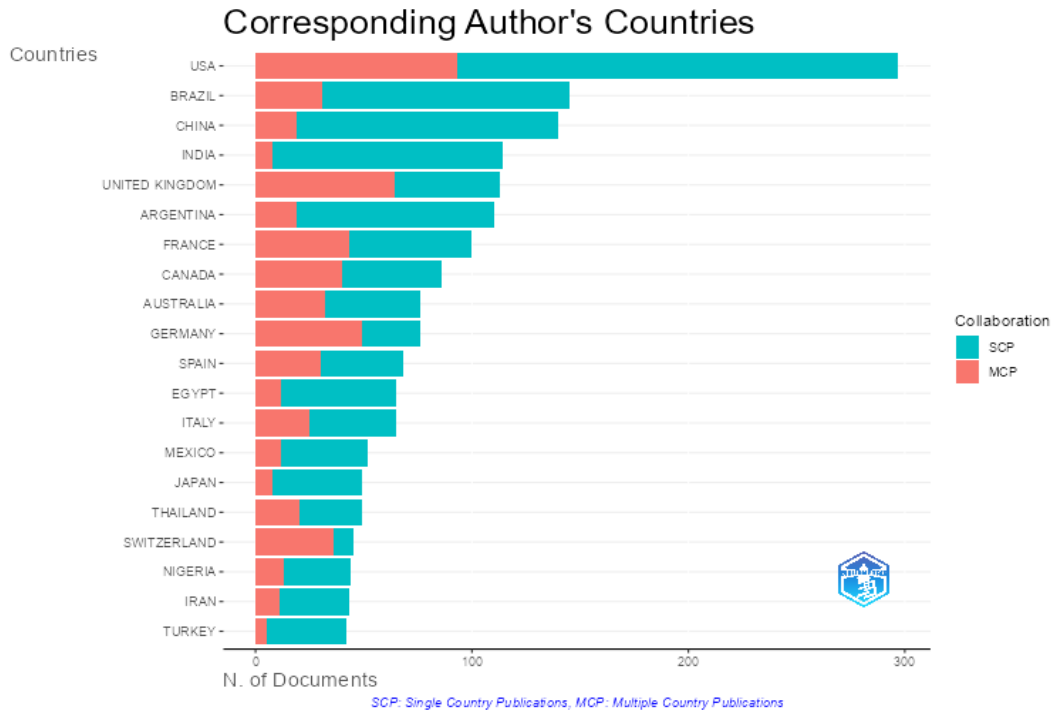

Figure 7.
Corresponding Authors Countries.

The regional distribution of scientific production further emphasizes the United States' dominance (3,407 articles), followed by the United Kingdom (1,309) and Brazil (1,187). Notably, several endemic regions demonstrate substantial research contributions, including Cameroon (511), Nigeria (432), Thailand (386), and Ghana (272) (Figure 8).

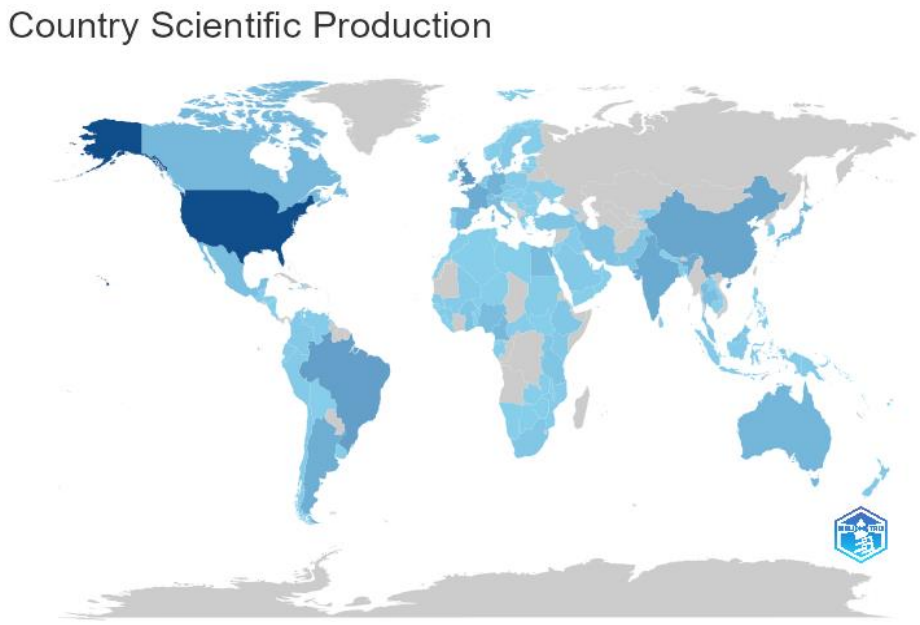

Figure 8.
Country Scientific Production.

3.6. Citation Impact and Research Trends

The analysis of citation metrics reveals significant research milestones and evolving thematic priorities in Ivermectin research. As presented in Table 2, the most cited publication is Caly et al. [13] in Antiviral Research, accumulating 1,559 citations with an extraordinary citation rate of 259.8 per year, reflecting intense scholarly interest in Ivermectin's potential antiviral applications during the COVID-19 pandemic [14]. The second most cited work, Campbell [15] with 702 citations, represents foundational research in the field [16]. Further details are shown in Table 2.

Table 2.
Most Global Cited studies. TC: total citations, DOI: Digital Object Identifier.

Paper	DOI	Total Citations	TC per Year	Normalized TC
Caly, et al. [13]	10.1016/j.antiviral.2020.104787	1559	259.8333333	49.04484605
Campbell [15]	10.1126/science.6308762	702	16.3255814	10.60422961
Wagstaff, et al. [17]	10.1042/BJ20120150	554	39.57142857	14.15522197
Geurden, et al. [18]	10.1016/S0140-6736(96)11094-1	498	17.17241379	14.87283237
Mealey, et al. [19]	10.1097/00008571-200111000-00012	395	15.8	11.05115907
Dent, et al. [20]	10.1073/pnas.97.6.2674	353	13.57692308	8.47411853
Meinking, et al. [21]	10.1056/NEJM199507063330105	345	11.12903226	10.60356347
Liu and Li [22]	10.1016/j.biomaterials.2004.02.013	335	15.95238095	9.231667445
Mastrangelo, et al. [23]	10.1093/jac/dks147	328	23.42857143	8.380709039
Osei-Atweneboana, et al. [24]	10.1016/S0140-6736(07)60942-8	308	16.21052632	8.131600325
Guzzo, et al. [25]	10.1177/009127002401382731	303	12.625	8.116071429

Analysis of keyword frequency confirms "ivermectin" as the predominant term (1,588 occurrences), followed by "onchocerciasis" (145) and "COVID-19" (114), highlighting the drug's historical antiparasitic applications and recent exploration in viral contexts (Figure 9).

The bibliometric keyword co-occurrence analysis of ivermectin research reveals a diverse and structured scientific output, with clearly defined thematic clusters. At the center, ivermectin is the dominant and most connected keyword, linking several specialized research areas. The red cluster "Anthelmintic Treatment, Resistance and Veterinary Parasitology" includes keywords like *Haemonchus contortus*, resistance, horse, levamisole, and closantel, reflecting studies on drug resistance in livestock. The green cluster "Neglected Tropical Diseases and Public Health" focuses on onchocerciasis, *Onchocerca volvulus*, *Wuchereria bancrofti*, elimination strategies, and countries like Cameroon, highlighting ivermectin's critical role in disease control programs. The blue cluster "Toxicity and Drug Resistance Mechanisms," covers p-glycoprotein, ABC transporters, ecotoxicology, rats, dogs, and milk, showing concern over ivermectin's biological effects and resistance mechanisms.

The olive cluster "Ivermectin Repurposing for COVID-19 and Antiviral Research" includes COVID-19, antiviral therapy, and chloroquine, representing the pandemic-driven interest in ivermectin's broader applications. The orange cluster "Dermatological Uses" gathers keywords such as demodex, rosacea, and doxycycline, indicating its role in skin conditions. Lastly, the brown cluster "Scabies and Topical Applications" connects ivermectin to scabies, permethrin, and oral ivermectin. Node size correlates with the frequency of keyword use, while thicker edges represent stronger co-occurrences.

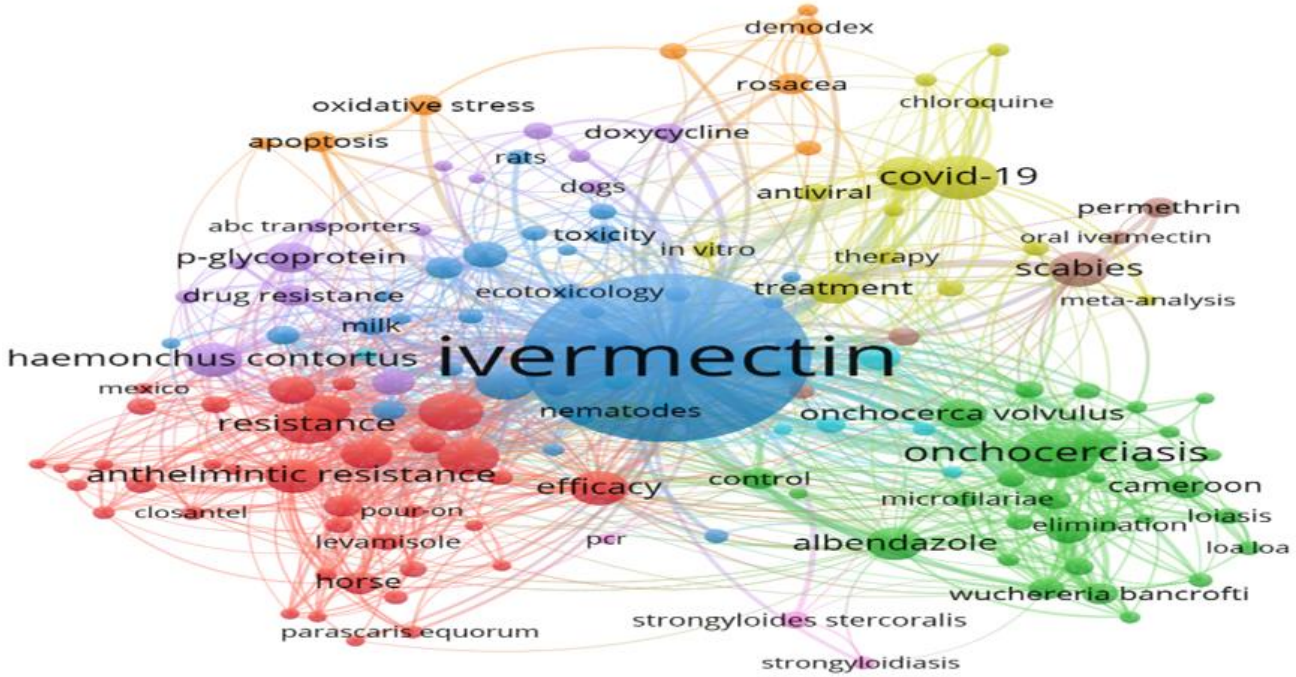

Figure 9.
Most Frequent Words.

The trend topic analysis reveals the chronological evolution of research priorities, from early focus on arthropod and nematode control methods (median years 1995-1996) to emerging interest in COVID-19 and SARS-CoV-2 (median year 2022), and most recently, advanced delivery systems such as nanoparticles (median year 2024). This temporal progression demonstrates how Ivermectin research has expanded from its original antiparasitic applications to encompass diverse therapeutic domains, including potential antiviral mechanisms, autoimmune conditions (rosacea, median year 2021), and vector-borne diseases (malaria, median year 2021) (Figure 10).

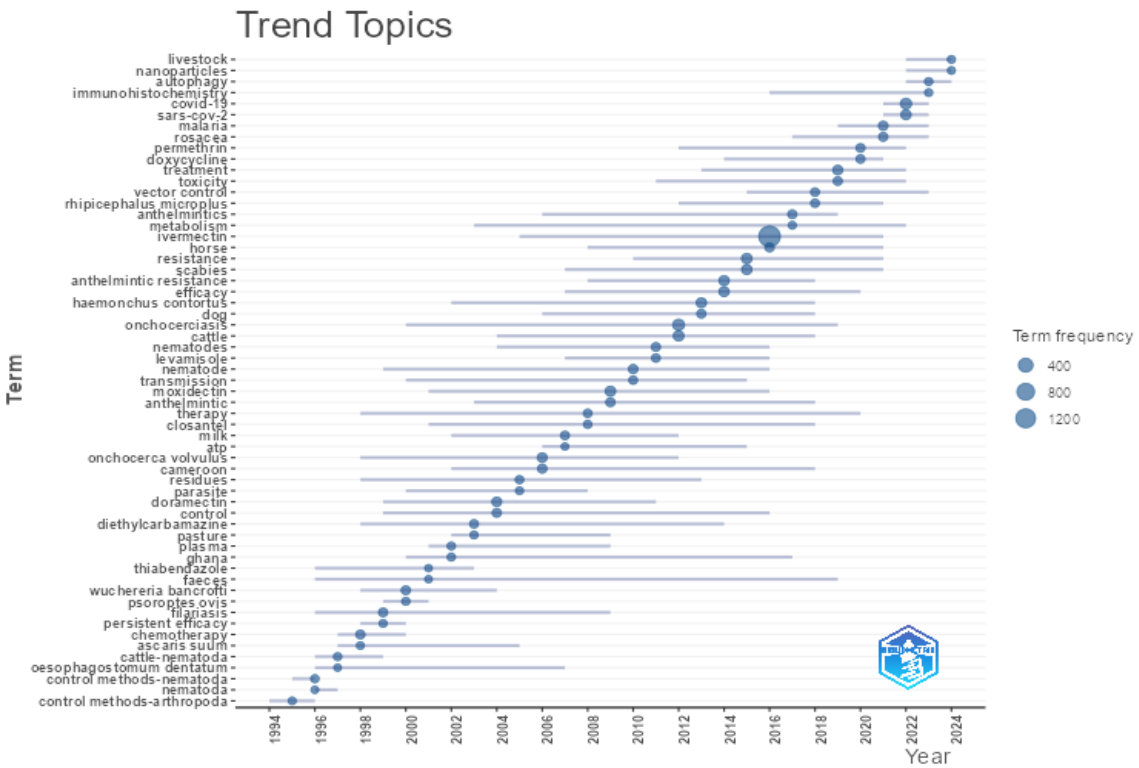

Figure 10.
Trend Topics over the years.

3.7. Thematic Analysis

Our data illustrated a complex relationship among countries, universities, medical topics, and research themes related to ivermectin use. Notably, institutions like Mahidol University, the University of Buea, and Liverpool School of Tropical Medicine appear as significant contributors to research, particularly around topics such as ivermectin and onchocerciasis (Figure 11).

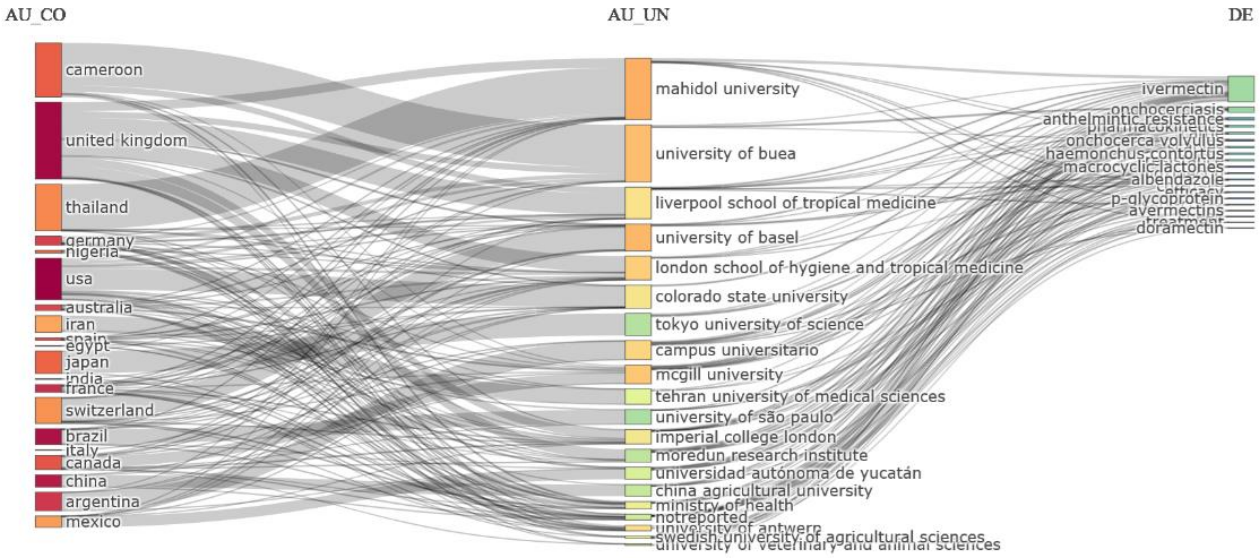

Figure 11.
The relationship between country (AU-CO), university (AU-UN), and keywords (DE).

The dynamic visualization categorizes these themes into four quadrants: motor themes, niche themes, emerging or declining themes, and basic themes. Here, prominent subjects like "ivermectin", "COVID-19" and "scabies" manifest in the basic themes quadrant, emphasizing their relevance in ongoing research. Meanwhile, topics like "efficacy" and "pharmacokinetics" are central, indicating vital areas of ongoing exploration within the field (Figure 12**).**

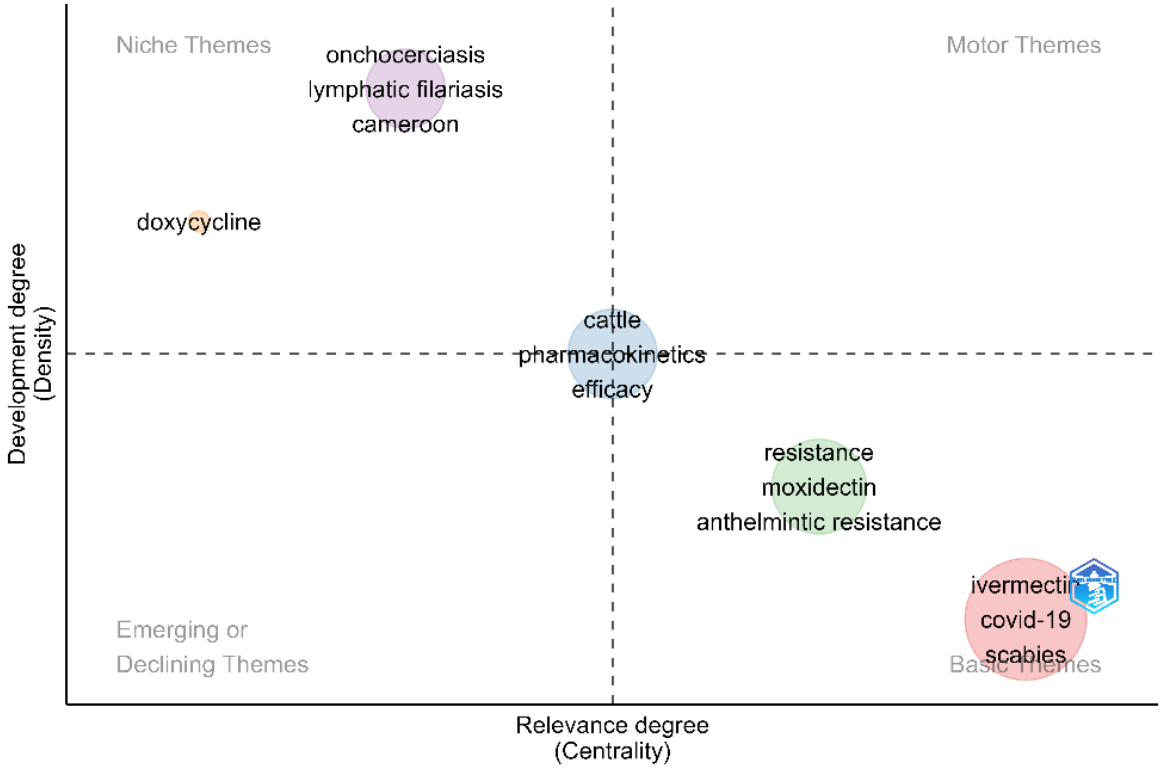

Figure 12.
Thematic Map.

3.8. Emerging Topics

Figure 13 illustrates the keyword overlay visualization related to ivermectin research, with colors representing the time evolution of publications. Blue and purple shades indicate older research areas (from around 2005–2010), while green, light green, and yellow shades signify more recent topics (approaching 2020 and beyond). Earlier studies, shown in blue, concentrated on ivermectin's role in veterinary parasitology, featuring keywords like *Haemonchus contortus*, *anthelmintic resistance*, and *p-glycoprotein*. In contrast, the yellow nodes represent emerging research areas, including the use of ivermectin in *COVID-19*, *scabies*, and *antiviral therapy*. This shift from blue to yellow highlights how ivermectin research has expanded from traditional antiparasitic applications toward broader clinical and antiviral uses in recent years.

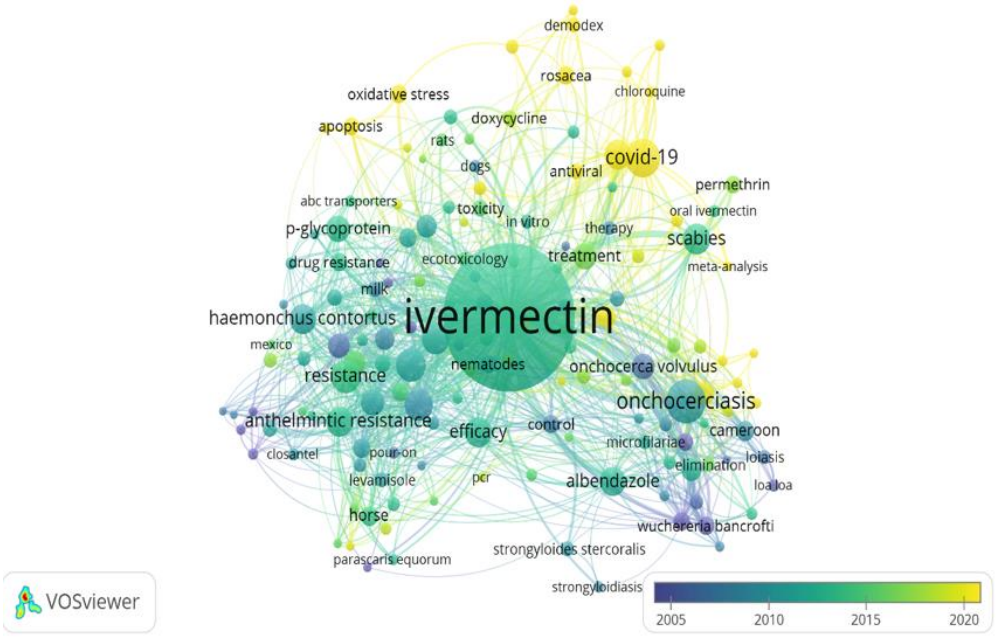

Figure 13.
Overlay Visualization of Keyword Co-occurrence in Ivermectin Research.

4. Discussion

Bibliometric analysis is a standard strategy to investigate the scholarly output in specific topics, giving insights into the trending topics and evolutions in the scientific [26, 27] discipline. Our comprehensive bibliometric analysis reveals several significant patterns in the evolution of ivermectin research over the past four decades. The steady growth in annual scientific production from only 7 publications in 1980 to peaks exceeding 200 articles annually in recent years reflects ivermectin's expanding role in both veterinary and human medicine. The substantial publication surge observed between 2020-2022, concurrent with the COVID-19 pandemic, demonstrates the scientific community's remarkable adaptability in exploring potential drug repurposing applications during global health emergencies [28].

The citation analysis provides valuable insights into the field's intellectual structure. Early publications from the 1980s maintained exceptionally high citation rates (exceeding 65 citations per article), underscoring the foundational importance of these works in establishing ivermectin's therapeutic potential. The most cited paper by Caly et al. (2020), with 1,559 citations and an extraordinary citation rate of 259.8 citations per year, highlights the unprecedented scholarly attention directed toward ivermectin's potential antiviral properties during the pandemic [14].

The literature landscape surrounding ivermectin reveals distinct phases of scientific interest and application development. Comparing our findings with Crump and Ōmura's [3] historical review of ivermectin's discovery and development, we observe that publication trends closely mirror key milestones in the drug's application journey [3]. Their documentation of ivermectin's expansion from veterinary use to human health applications in the late 1980s corresponds with our observed increase in publications during this period.

The institutional and geographic distribution of research reveals both concentration and diversification patterns. While established research powers like the United States dominate overall production (8% of corresponding authorship), the prominence of institutions from endemic regions such as Mahidol University (Thailand), University of Buea (Cameroon), and significant contributions from Brazil reflects ivermectin's global health relevance. The varying international collaboration rates between high-income countries (Switzerland: 80%, Germany: 64.5%) and emerging research nations (India: 7.0%, China: 13.6%) suggest differing research priorities and capacities.

The thematic evolution of ivermectin research demonstrates remarkable versatility. The progression from early veterinary applications to human antiparasitic uses, and most recently to COVID-19 investigations and advanced delivery systems, illustrates how a single pharmaceutical compound can transcend disciplinary boundaries. The emergence of COVID-19 and SARS-CoV-2 as prominent keywords (median year 2022) [29-31] represents one of the most dramatic thematic shifts in the field's history.

The bibliometric analysis of ivermectin research identifies several key thematic clusters, each reflecting distinct phases of scientific inquiry. The earliest and most established cluster focuses on veterinary parasitology and anthelmintic resistance, highlighting ivermectin's foundational role in livestock health [32, 33]. A second cluster centers on neglected tropical diseases, such as onchocerciasis and lymphatic filariasis, underscoring the drug's transformative impact on global public health [34, 35]. More recent clusters reveal ivermectin's expanding applications, including dermatological uses for rosacea and scabies [36, 37]. As well as investigations into its antiviral potential during the COVID-19 pandemic. The analysis also highlights emerging trends, such as advanced drug delivery systems and renewed interest in ivermectin's antiviral properties [38, 39].

Our study has several strengths, including its comprehensive temporal coverage (1980-2025), comprehensive analytical methodology, and multidimensional examination of productivity, impact, and thematic evolution. The visualization techniques employed particularly the thematic map categorizing research into motor themes, niche themes, emerging themes, and basic themes provide valuable strategic intelligence for researchers and funding agencies to identify promising research directions.

Nevertheless, limitations warrant acknowledgment. Our reliance on Scopus as the sole database may have excluded some relevant publications indexed elsewhere. Additionally, citation analysis inherently favors older publications, potentially underrepresenting the impact of recent contributions, particularly those from 2023-2025.

5. Conclusions

This bibliometric analysis documents ivermectin's remarkable journey from a primarily veterinary antiparasitic to a multifaceted therapeutic compound with applications spanning tropical medicine, dermatology, and potential antiviral interventions. The significant research surge during the COVID-19 pandemic underscores the scientific community's capacity for rapid mobilization around promising therapeutic candidates during global health emergencies. Future research would benefit from increased international collaboration, particularly involving researchers from endemic regions, and continued exploration of novel delivery systems and mechanisms of action. Regular bibliometric monitoring may help identify emerging trends and research gaps, ensuring optimal allocation of resources in this dynamic and expanding field.

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