Mapping ethnobotanical research in Morocco (1997-2025): Scientific production, scientometric insights and emerging trends

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Review

Abstract

Background: Ethnobotanical research is a keystone of experimental studies and plays a pivotal role in traditional practices of several civilizations worldwide. It is a multidisciplinary field which consists various traditional botanical knowledge of various ethnic groups.

Methods: To gather available data on Moroccan ethnobotanical studies, a bibliometric analysis was conducted using the Scopus database as the largest database. The extracted data was analyzed using VOSviewer software to determine the research outputs, trends, gaps and future directions of research in this area.

Results: The obtained results revealed the ethnobotany study in Morocco began in 1997 and has growing continuously during the last decade. The highest number of publications was registered in 2022 with 22 documents. Zidane L is the most influential author with 20 publications with considerable relationships and citation impact (1582 citations). Morocco holds the highest number of publications, with strong international collaborations, especially with Italy (Link strength :52) followed by Spain and Egypt. The high frequency of keywords, such as ''medicinal plants'', ''ethnobotany'', and ''traditional medicine'' during the last decades suggests their emergence as key themes in the evolving research field.

Conclusions: Ethnobotany research and applications have become a prominent publication in ethnobotanical surveys in Morocco, revealing considerable growth and remaining a key data source. Results from the current study provide prospects for documenting traditional knowledge and advancing sustainable development in Morocco, and they can guide future research avenues, multiple collaborations and direct policy decisions for preserving traditional heritage.

Keywords: Ethnobotanical research, Morocco, research trends, bibliometric analysis, scientometrics

Background

Traditional knowledge has been transmitted generation by generation and has played a very important role in the management of various threatens of human life. Plants have been used in the daily lives of both animal and human life because of their nutritional and medicinal benefits. Ethnobotanical knowledge of Moroccan population has been developed for long time throughout the permanent contact with surrounding flora. The indigenous botanical knowledge varies according multiple factors, including ethnic communities, geographical conditions, and surrounding flora. The current national population stands at 37 million peoples, which rises significantly food and medication demand, particularly in the most populated zones. Medicinal plants play an important role in the daily life of several populations. The utility of medicinal herbs is attributed to various reasons, including safety, undeniable efficacy against multiple human health critical conditions, and availability (Es-safi *et al.*, 2021). For this reasons, new therapeutic strategies are emerging in favor of natural resources, such as medicinal plants (Aumage *et al.*, 2020). Traditional knowledge of different Moroccan regions has been documented, including Oulmes (Radi *et al.*, 2025), Middle Atlas, Saiss Plain (Ed-dahmani *et al.*, 2024; Habchaou *et al.*, 2023; Jaouad *et al.*, 2025; Mahraz *et al.*, 2023), Deraa-Tafilalet (Elhasnaoui *et al.*, 2025), Haj Kaddour (Benamar *et al.*, 2025), Taza (Ghabbour *et al.*, 2024; Nicerine *et al.*, 2025), Marrakech(Azalmad *et al.*, 2024), Casablanca-Settat (Arraji *et al.*, 2024), Al-Hoceima (Jahjah *et al.*, 2024; Mir *et al.*, 2024), Sidi Kacem (El Khomsi *et al.*, 2025), Tata (Agour *et al.*, 2025; Asraoui *et al.*, 2025), Anti-Atlas (Barkaoui *et al.*, 2022; El-Ouazzani *et al.*, 2024), High Atlas (El-Ghazouani *et al.*, 2024), Khemisset (Radi *et al.*, 2024), Taounate (Anas *et al.*, 2024; Balafrej *et al.*, 2024; El Mekkaoui *et al.*, 2024; Mzali *et al.*, 2023), and so on. Ethnobotanical studies reported multiple uses of aromatic and medicinal plants, focusing mainly on medicinal, nutritional, and cosmetic properties. Within this framework, this bibliometric study provides preliminary research to predict the current state of ethnobotany research in Morocco, discovering frontier directions, and analyzing patterns through the prism of published manuscripts in indexed databases. Ethnobotanical research is a field characterized by its thematic richness and vastness, requires methodological attempts to map its conceptual structure and examine changing research trends.

Bibliometric analysis using mathematical tools offers a potential strategy to statistically examine the available data on different databases and conducting an in-depth analysis on the available scientific data. It is an excellent approach to find the articles that have been published in a specific field within a given time frame. Recently, this mathematical tool plays an important role for evaluating and comparing scientific data encompassing databases, performance evaluation, visualization tools, identifying future outlooks, research trends, and gaps in a particular field.

The present study was designed for the first time to address the scientific question of whether ethnobotanical research has advanced or declined in Morocco over the three successive decades. Furthermore, the study aimed to understand the changing trends regarding various parameters, including authorship, citations, collaborations. On the other hand, the study evaluated the most influential researchers, and institutions acquiring trending topics within a specific field area of ''ethnobotanical survey in Morocco'' and offer helpful references for future research.

Materials and Methods

The present study was undertaken using a quantitative research strategy exploiting the available data on the Scopus database and VOSviewer as mathematical tool to examine the scientific production and scientometrics in ethnobotanical study in Morocco from 1997 to 2025. Data collection was carried out by extracting the available original papers published in various journals listed in the Scopus database on 29 June 2025. The search strategy adopted to guarantee a comprehensive capture of ethnobotanical research output from Morocco, carefully planned keyword-based retrieval method was used in the Scopus database. It consists a combination of Boolean operators ''AND'' and two relevant keywords, ethnobotany research and Morocco. A total of 146 publications, including articles, reviews, book chapters, and conference papers were extracted from the Scopus database under CSV format. The extracted data was exported to VOSviewer software to generate network maps based on keywords, authorships, and co-authorship, bibliographic coupling and keyword occurrences were also used for the analysis and visualization of treated data.

Results

Scientific production and historical background

The treatment of data extracted from the Scopus database revealed that the ethnobotanical research field in Morocco during the period covered from 1997 to 2025 was mostly articles (87%), reviews (11.6%), and book chapters and conference papers with 0.7% of each. The total number of papers is 146 publications with high productivity picked up during the last decade (Figure 1). The first publication appeared in the Scopus database was published in 1997 entitled ''Wild medicinal plants used by local Bouhmed population (Morocco) (Merzouki *et al.*, 1997). There is a growing interest of the scientific community in this research area due to its paramount importance as the keystone of experimental investigations of the utility in medicinal and cosmetic uses of medicinal herbs. It is obviously seen that 91.78 % of documents were published during the last decade (134 documents). The progression of research in ethnobotanical research could be explained by the pharmacological properties of various medicinal plants scientifically proved as the main source of bioactive compounds selected as medication candidates.

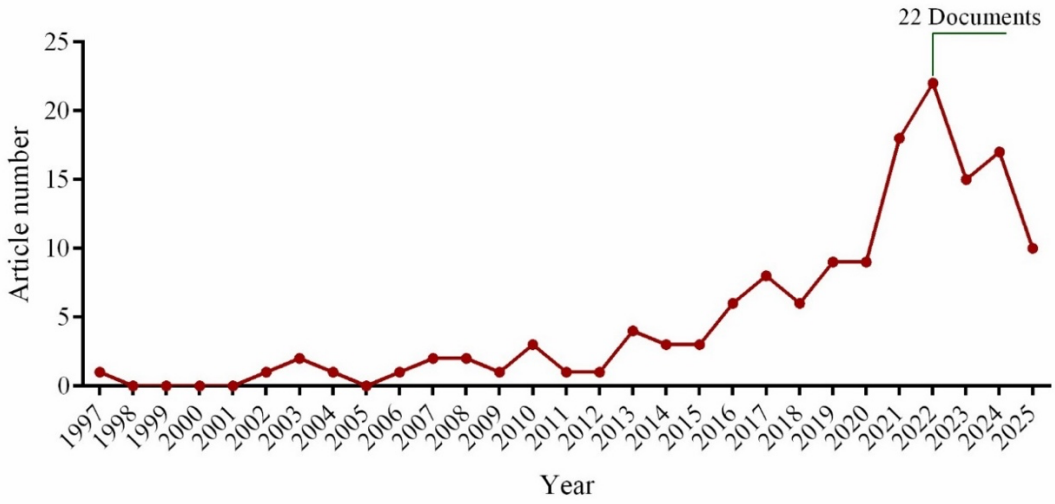

Figure 1. Ethnobotanical research trends on a Moroccan scale (1997-2025).

Authorship bibliometric analysis

Based on the extracted data on the most contributing Moroccan authors in the ethnobotanical research development, Zidane L, from Department of Botany and Plant Ecology, Scientific Institute, Mohammed v University in Rabat, Avenue Ibn Batouta, Agdal, Rabat, Morocco is the author with the most contribution with 20 documents published and a total of 1582 citations. His first publication date back 2010 entitled Floristic and ethnobotanical study of medicinal plants of kénitra (Maroc)'', which has been cited 174 times (Salhi *et al.*, 2010). This demonstrates the significant influence Zidane L.'s work has had on the scientific community and establishes him as a preeminent expert in ethnobotanical research. In the same way, Chaachouay N from the same research structure mentioned above, also contributed the most, with 10 documents available in the Scopus database. Other authors, including Merzouki A, Benkhnigue O, Bouyahya A, Elachouri M, Ibijbinjn J, and Nassiri L also contributed significantly with 8, 7 papers, respectively. The published papers of the most contributing authors have added depth to our understanding of various uses of medicinal and aromatic plants to treat and prevent various human diseases and their complications in different Moroccan regions. Figure 2 displays a visual map distribution of various contributing authors.

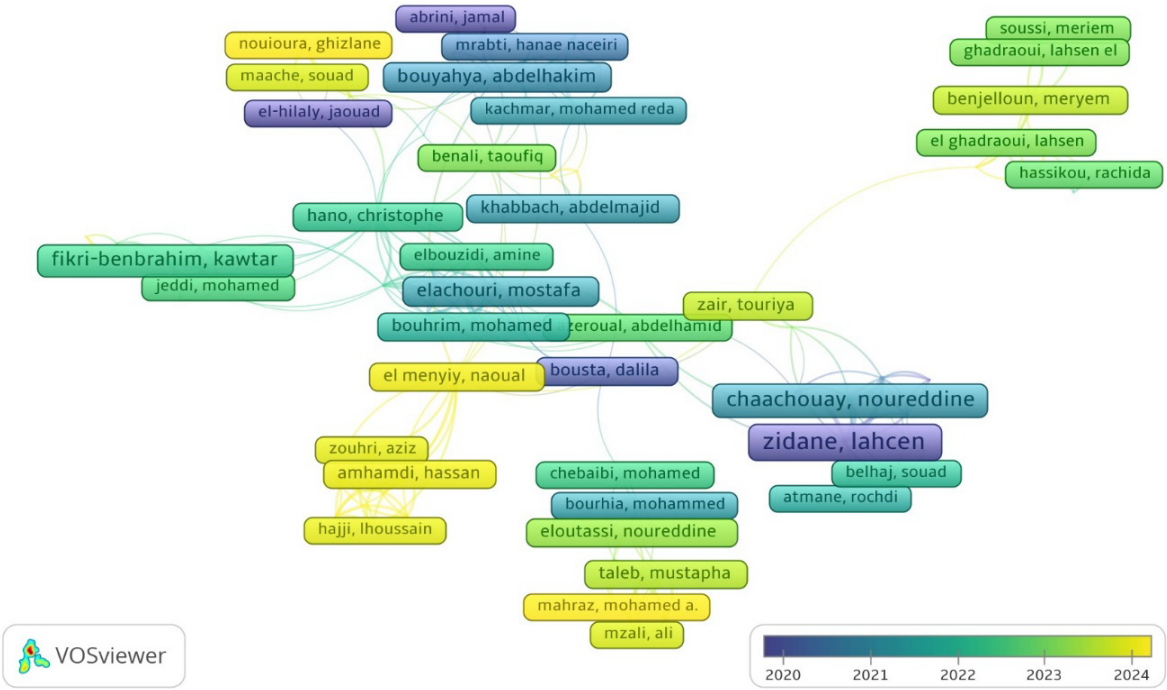

Figure 2. Authorship visualization network.

Keywords bibliometric analysis

Keyword analysis provide a thorough summary of the key findings from various available articles in the Scopus database. Furthermore, it elucidates the paper's primary ideas. Authors frequently use specific terminology, referred to as author keywords. The keyword with the highest frequency was represented by a large circle, indicating that the research issue was highly developed, however those represented by a small circles show that the research issue is still underdeveloped and needs more studies as potential field, such as toxic plants, clinical trials, pharmacology and ethnopharmacology (Figure 3). Shifting research priorities and trends could be clearly seen thanks to this historical perspective, which reflects the advancement of knowledge and scientific priorities.

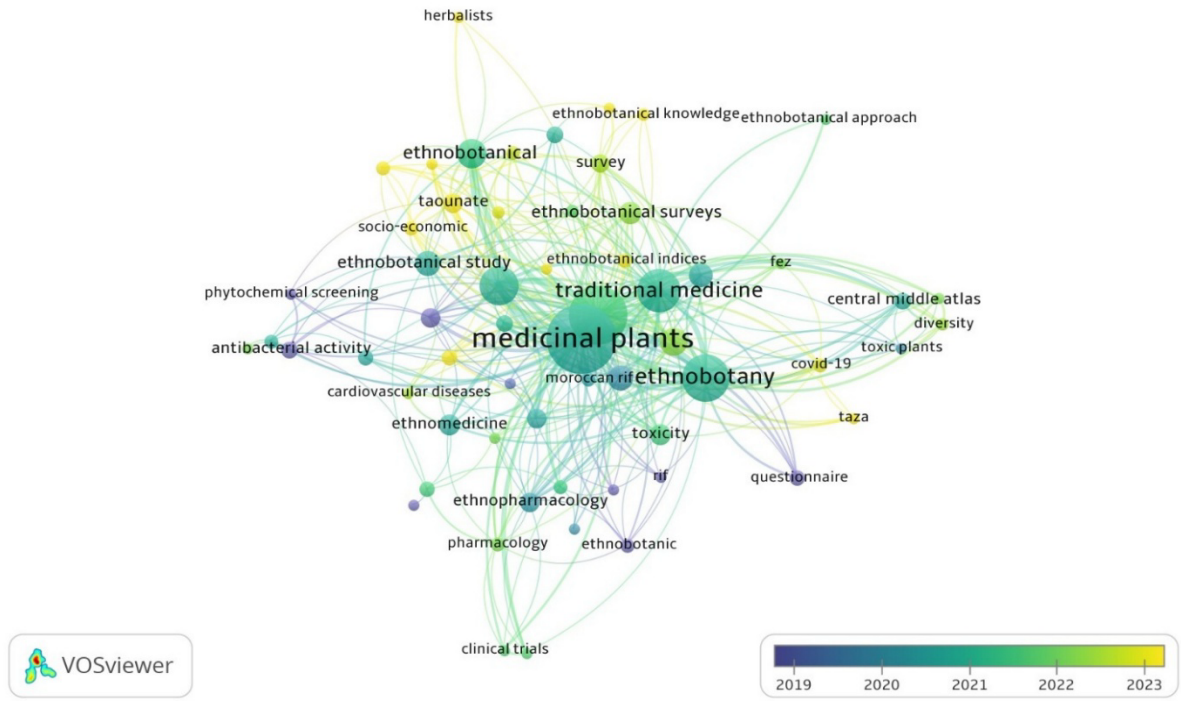

Figure 3. Keywords-wise mapping

Country contributions

A country-wise analysis showed that 132 documents were published in Morocco, followed by Spain with 12 articles, France with 9 documents, Italy with 7 documents, and Egypt, Germany and United Kingdom with 5 documents for each, respectively. Country-wise mapping revealed that 32 countries contributed to ethnobotany research in collaboration with Morocco (Figure 4). The distribution of research endeavors across countries demonstrates the worldwide scope and collaboration in this field. Both Spain and France are considerably implicated in ethnobotany research (21 documents). Out of 40 countries, 16 met the threshold, generating 6 clusters. In cluster 1 (Green), the Morocco is grouped with France, Italy, Spain, Saudi Arabia, Egypt, and Turkey. According to table 1, the total link strength between Morocco and Italy is 55, indicating that Morocco collaborated considerably with the Italy compared to other countries. Spain ranks in the second position with a total link strength of 22 followed by Egypt with a link strength of 19 (Table 1).

Author citation analysis

Figure 5 shows the author's citation network with a minimum number of documents of an author of 3 documents. Among of 692 authors, 239 meet the thresholds and were divided into 13 clusters. In term of the number of citations, the author, Zidane L, ranks the first author with 1066 citations over 25 documents available in the Scopus database, followed by Chaachouay, A, with 782 citations over 15 publications and Bouyahya A, with 462 citations over 10 publications.

Table 2 resumes the ranking of various authors implicated in the ethnobotany research development according to the number of citations. The treatment of the obtained results revealed that out of 239 authors meet the thresholds. Zidane L, has the highest link strength (674), followed by Chaachouay N (463) and Bouyahya A (310).

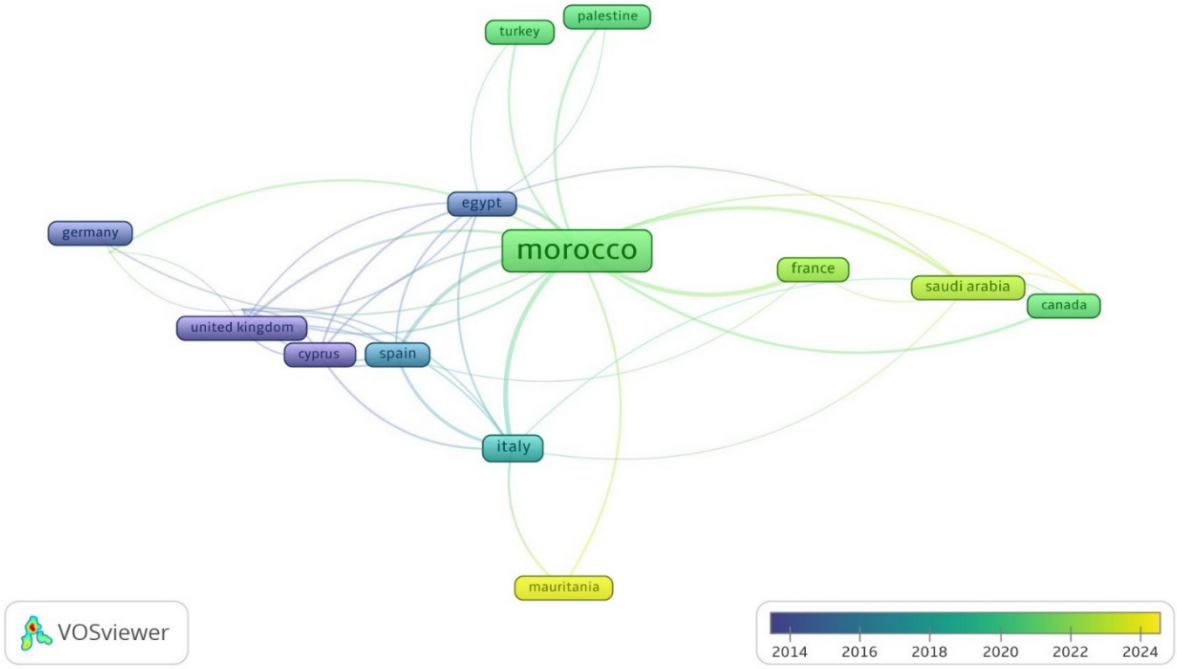

Figure 4. Countries collaborating with Morocco-network visualization

Table 1. Countries collaborating with Morocco

N°	Country	Total link strength
1	Italy	52
2	Spain	22
3	Egypt	19
4	France	12
5	Saudi Arabia	11
6	United Kingdom	11
7	Portugal	5
8	Germany	3

Table 2. Ranking of authors according to total link strength

N°	Author	Total link strength
1	Zidane Lahcen	674
2	Chaachouay Noureddine	463
3	Bouyahya Abelhakim	310
4	Douira Allal	293
5	Benkhnigue Ouafae	281
6	Fadli Mohamed	262
7	Merzouki Abderrahmane	246
8	El-hilaly Jaouad	235
9	Nassiri Laila	206
10	Ibijbijen Jamal	203

Organizations contributing

In Morocco, bibliometric analysis revealed that 6 institutions contributing to ethnobotany research, which were grouped into two clusters. The first one consists four items, such as, and the second cluster comprises two institutions, including Biology and health laboratory, department of biology, Faculty of Science, Abdelmalek Essaadi University Tetouane and Laboratory of human pathologies, Departemnt of Biology, Faculty of Sciences, Genomic center (Figure 6).

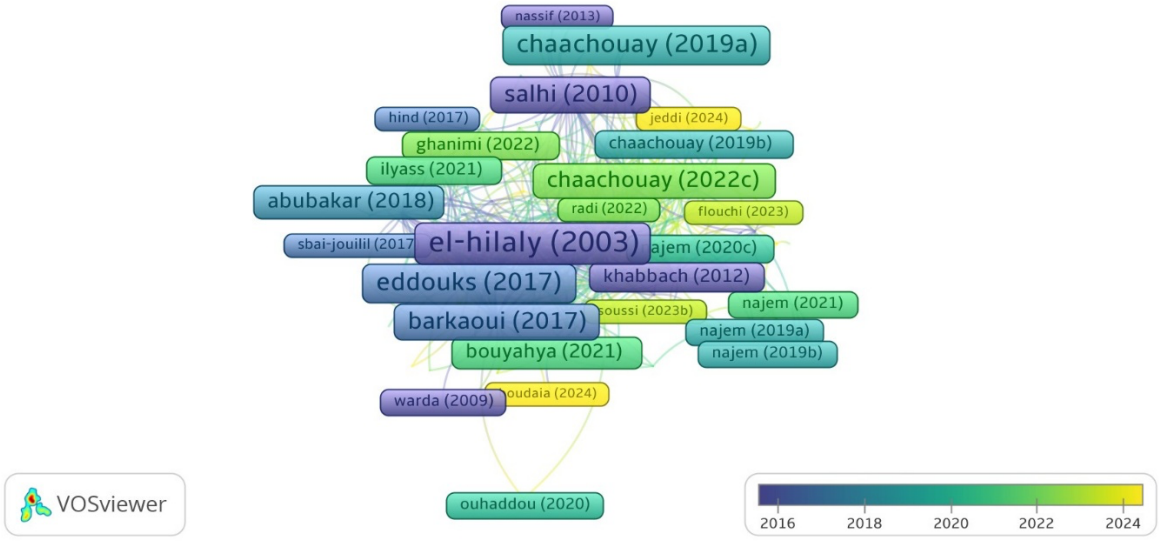

Figure 5. Author citation analysis-network visualization

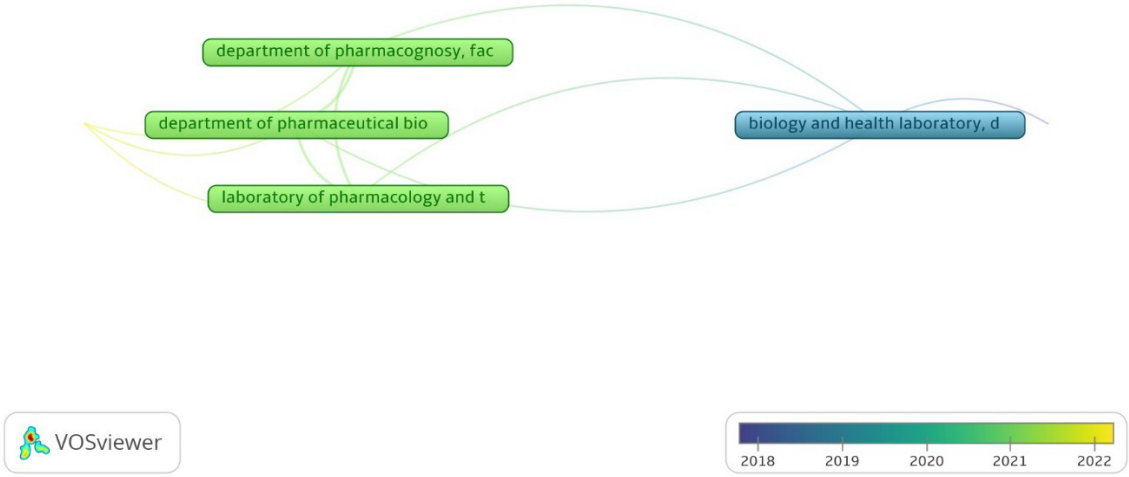

Figure 6. Leading organizations' publication on ethnobotany research.

Influential documents

Concerning influential documents, González-Tejero M.R. et al's article entitled '' Medicinal plants in the Mediterranean area: Synthesis of the results of the project Rubia'', which has been cited 458 times, plays a pivotal role in the documentation of traditional use and handling of medicinal herbs in Mediterranean countries, including Morocco (González-Tejero *et al.*, 2008). While, El-Hilaly et al's article ranks in the second position entitled '' Ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco) '' with a total citation of 358 (El-Hilaly *et al.*, 2003). This article focused on the traditional uses of medicinal and aromatic plants in the Taounate region. Ethnobotanical studies have served as a keystone of experimental studies investigating the beneficial properties of medicinal and aromatic plants using different in vitro and in vivo models. Figure 7 displays the most journals contributed in the development of ethnobotany research. The Ethnobotany research and applications was in the top of journals with 38 publications and total citations of 679. In the second position, Tropical Journal of Natural Products contributed with a total of 21 papers, 75 citations and total link strength of 42. Journal of Ethnophamacology ranked in the third position with 16 documents, 2019 citations? and total link strength of 180 (Figure 7).

Discussion

Numerous reports have discussed ethnobotany studies in Morocco, especially during the last decade. This development could be explained by the paramount importance of ethnobotanical studies conducted to document and collect Moroccan traditional knowledge. In fact, the screening of the Scopus database revealed 146 documents that were published in different journals indexed Scopus since the first publication in 1997 (an average of 5.2 articles per year and only 2.18% (146/6672) of all documents on ethnobotany study found in the Scopus database). The initial article published in 1997 had terms with the highest frequencies compared to other studies. Other terms, including ''medicinal plants'', ''traditional medicine'', and ''ethnobotany study'' are also relatively higher frequencies (Figure 4).

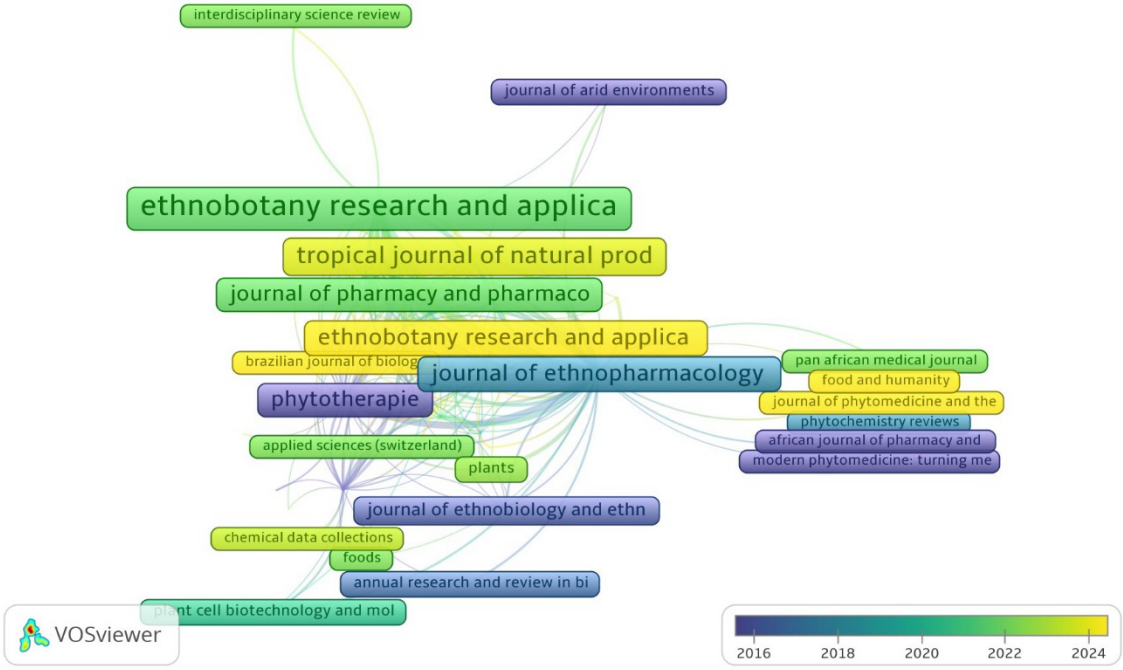

Figure 7. Network visualization of the most journals implicated in ethnobotany research development

Furthermore, the keyword with the highest frequency is ‘‘medicinal plants”, reflecting that these documents were particularly discussed this term. This could be explained by the wide utility of medicinal plants in Moroccan folkloric medicine (Elachouri *et al.*, 2021). Despite considerable advancements in conventional medicine, traditional and complementary medicine remains the first line of healthcare management of several civilizations, including north Africa. Mounting experimental evidence demonstrated the beneficial properties of medicinal plants regarding the prevention and management of various health critical conditions (Chaachouay *et al.*, 2023). There are various reasons coming in the forefront of the utility of medicinal plants, including safety, efficiency, improvement of general health, and low side effects (Ekor, 2014; Saad *et al.*, 2017). The traditional knowledge is still transmitted from one generation to another orally. Actually, there is an interesting shift to empirical medical practices thanks to expensive costs of conventional medication, historic beliefs and availability of natural remedies prepared from various natural resources. Ethnobotanical study plays a pivotal role remoting various development fields, including valorization of natural resources. It is a keystone of the development of modern pharmaceuticals, which contributed approximately with 30% (Baby et Akarsh, 2025). Bibliometric analysis revealed gained considerable recognition in developing various natural medications as pharmaceutics, nutraceutics, cosmetics, derived entirely or predominantly from herb-based products. El-hilaly et al. documented for the first time the traditional knowledge and economic status of medicinal plants in Taounate province (Northern Morocco) (El-Hilaly *et al.*, 2003). In the same vein, Hseini S et al. focused the geographical zone of their study in Rabat (Western Morocco) to document the traditional knowledge of Moroccan population (Hseini *et al.*, 2007). Comparative ethnobotanical studies has been conducted during the years 2003-2005, to compare traditional remedies used to manage animal healthcare in the circum-mediterranean region, including Morocco (González-Tejero *et al.*, 2008; Pieroni *et al.*, 2006). The study revealed a close connection between human and veterinary medicine, as well as the possible adaptive origins of some medical practices, is suggested by the fact that nearly half of the documented veterinary plant uses for mammals found in this study have also been documented in the same areas in human folkloric medicine (Pieroni *et al.*, 2006). Concerning the first publication documenting the cytotoxicity of Moroccan medicinal plants on human cervical cell lines was published on 2009 (Merghoub *et al.*, 2009). The selection of medicinal plants has been made on the basis of their ethnobotanical uses recommended by local natural healers (Merghoub *et al.*, 2009). Several researchers documented traditional knowledge of various Moroccan regions, including Zaer, Middle Atlas, Oriental, (Doukkali *et al.*, 2015; El Abbouyi *et al.*, 2014; Jamila et Mostafa, 2014; Khabbach *et al.*, 2012; Lahsissene et Kahouadji, 2010; Midaoui *et al.*, 2011; Moussi *et al.*, 2015; Nassif et Tanji, 2013; Ouarghidi *et al.*, 2013; Powell *et al.*, 2014; Salhi *et al.*, 2010; Zeggwagh *et al.*, 2013). According to the figure 4, which illustrates the keyword density visualization, it is clearly seen the breadth of ethnobotany research in particular subjects. However, scientific confirmation using in vitro and in vivo models are required in the future investigations.

Conclusion

The present study shows for the first time a comprehensive study using bibliometric analysis to enlighten the trends in ethnobotanical research in Morocco spanning from 1997 to 2025. The finding revealed that research efforts have significantly increased recently, peaking in 2022, suggesting a growing national focus on traditional knowledge of the

Moroccan population, particularly in relation to traditional remedies and medicinal plants. Furthermore, the obtained results revealed a significant change in organization leadership, with new contributors each year. This implies that this research field output has become more decentralized and varied. The study highlights the benefits and drawbacks of the literature to pave the way for more comprehensive, contextualized research on the subject.

The practice of blessings plays an important role in the health care of the investigated communities, even in the…

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: All the data utilized for the study and included in the manuscript were obtained from the Scopus database.

Competing interests: The authors declare no conflicts of interest.

Funding: The authors have not received any funding for conducting the research.

Author contributions: D.O. collected the data, analyzed, and wrote the text. H.L., M.H, S.L, B.M, A.EK, B.L, and I. EA participated in the theoretical background, monitoring data collection and analysis, helping with discussions, and wrote the final version of the text.

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