

Original Article

Global Trends in Studies on the Presence of *Demodex* spp. in Patients Diagnosed with Blepharitis

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Abstract

Background: The main objective of this study is to review publications on the presence of *Demodex* spp. in patients diagnosed with blepharitis worldwide and to analyse the trends and groups in this field.

Methods: This bibliometric study was conducted to detect the presence of *Demodex* spp. in patients diagnosed with blepharitis worldwide between 1984 and 2023. For this purpose, 288 studies were examined as a result of searches using the keywords "Blepharitis and *Demodex*" in Web of Science (WOS) databases. All text data was analysed using VOSviewer software to ensure accuracy and reliability. In this study, analysis using text mining and data visualization techniques (bubble maps and graphs) helped to make the results more understandable.

Results: This study provided information on 288 articles from WOS databases. The average total number of citations is 1305 and the H-index is 41. The majority of articles (63%) were published in the field of ophthalmology. The countries that published the most articles on this topic were the USA (24%), China (13%), and Turkey (11%).

Conclusion: This study is the first bibliometric study of patients diagnosed with blepharitis due to *Demodex* spp. The most used keyword in blepharitis is *Demodex*. The most studied field of research is ophthalmology and the most studied country is the United States of America. The results of this bibliometric analysis conducted by us reveal global trends in the presence of *Demodex* spp. in patients diagnosed with blepharitis and provide important information for future directions of research.

Keywords: Blepharitis; *Demodex*; Bibliometric analysis

Introduction

Blepharitis is a condition usually associated with inflammation and irritation of the eyelid margin. It is an eyelid condition that affects all age groups and is common throughout the world (1, 2). Blepharitis has several aetiological causes. The most important aetiological agent is parasitic infections caused by *Demodex* spp. Mycotic, viral, and bacterial infections can also cause blepharitis (3). *Demodex* is the most common human ectoparasite, with more than 100 species identified. Of these, only *Demodex folliculorum* and *D. brevis* live on human skin (4, 5). This mite lives in the human body for about 15 days and feeds on sebum and epithelial contents. It is known to be

transmitted from person to person through close contact. These parasites can live in the human body on the forehead, cheeks, and nose. However, they are most commonly found in oily areas of the face, such as the roots of the eyelashes (4, 6, 7). Many academic studies have associated *Demodex* species with dermatological conditions such as rosacea, pityriasis folliculorum, perioral dermatitis, seborrhoeic dermatitis, pustular eruption, blepharitis, and seborrhoeic alopecia. However, most researchers define *Demodex* infestation as normal skin flora in healthy individuals or accept it as an incidental parasite on diseased skin. According to this theory, the number of parasites increases

with age (7, 8). It has been reported that many factors support the proliferation of the *Demodex* mite. These; include immunosuppression, hypervascularization-related factors, not paying attention to personal hygiene conditions, high concentration of sebaceous glands, and sebaceous hyperplasia (9, 10, 11). The differential diagnosis of these two parasites is made by direct microscopic observation. The body of an adult *D. folliculorum* measures between 250 and 400 μm . The abdomen (opisthosoma) is striped, long, and more than 7/10 of the total body length. The body of *D. brevis* is slightly shorter than that of *D. folliculorum* (200–300 μm) and its opisthosoma covers 2/3 of the total body length (4, 5). The most important clinical findings that have been reported among the clinical symptoms of the disease are loss of eyelashes, photophobia, blurred vision, burning or itching in the eye, and dry eye (2, 12).

Demodex spp. are mites that have a wide geographical distribution throughout the world, are adapted to many climatic regions, and are a major public health problem, particularly in underdeveloped countries. An estimated 60% of the world's population is infected with *Demodex* spp. (13).

Bibliometric analyses numerically evaluate existing literature publications, query various parameters in the field such as keywords, year of research, authors, and journals, and reveal global trends after processing this data with programs such as VOSviewer software.

This study aims to perform a bibliometric review of the existing literature on *Demodex* spp., which plays an important role in the aetiology of blepharitis. With this study, bibliometric research was conducted for the first time on *Demodex* spp., one of the causes of Blepharitis. The main objective is to investigate the importance of publications on the subject and to raise awareness of the studies carried out around the world on blepharitis caused by *Demodex* spp.

Materials and Methods

Data Collection

In this bibliometric study, the global trends of patients diagnosed with blepharitis caused by *Demodex* spp. between 1984 and 2023 (last access date: 10 January 2024) were examined using the Web of Science Core Collection (WOS) databases. Studies on analysis have been reviewed. In the conclusion of the searches made in the database using the keywords "Blepharitis and *Demodex*", 288 studies were found. When studies and articles that were deemed inappropriate before 1984 were not included in the study, the remaining 288 articles were used. Articles in the database included article titles, author names, year of publication, and journal names. It was analysed using information such as name and the number of citations. All entries and references in the received data were exported as plain text files and saved in download text format. The data was obtained by using the online library and digital resources of Van Yüzüncü Yıl University. The search language is English.

Search Strategy

The title of the search engine was searched using the selected keywords "Blepharitis and *Demodex*". The period chosen was 1986 and 2023, starting from 1 January. As 31 December 2023 was not yet completed, 2024 was not included. Case reports, editorials, and letters were excluded from the research and only publications published in peer-reviewed journals were included.

Data Analysis

In this bibliometric study, "Collaboration network, highlights, and future trends" was analysed using VOSviewer (version 1.6.20, Leiden University, The Netherlands) to determine global trends in the presence of *Demodex* spp. in patients diagnosed with blepharitis. VOSviewer places great emphasis on the graphical representation of bibliometrics in

general. It is particularly useful for presenting large bibliometric datasets in an understandable way (14). Web of Science databases were used for systematic data collection. Data from all articles included in the study were collected and interpreted using VOSviewer software. We used VOSviewer software to examine country/region and institutional collaborations, author contributions, and keyword analysis. We also used Microsoft Office Excel 2019 to assess trends. These analyses were conducted using text mining and data visualization methods (bubble maps and other graphics) to demonstrate the accuracy and reliability of the study.

Results

288 published articles were taken from the WOS database and used. The articles had a total of 1543 citations (1305 citations without self-citations). The H index is 41. Since 2010 in particular, there has been an upward trend in both the number of citations and the number of studies carried out. The distribution of studies and citations to articles is shown in Fig. 1.

The highest number of articles were published in the fields of Ophthalmology (63%), Dermatology (7.74%), General Internal Medicine (7%), and Parasitology (4%), respectively. The distribution of publications according to research areas is shown in Table 1.

The USA ranked first according to the number of published articles (n= 69; 24%), followed by China (n= 37; 13%), Turkey (n= 32; 11%) and Poland (n= 21; 7.4%) followed. The top 20 countries in this ranking are listed in Table 2.

When Bibliographic coupling is evaluated by country, it is seen that the USA, China, Turkey, and Poland have a greater representation among the prominent countries in this field.

When the priority status of universities and research institutions in terms of publication numbers is evaluated; Virginia Eye Consultants (5.9%), Ocular Surface Ctr (4.2%), and Tarsus Inc (4.2%) were the leading organizations Pharmaceut. Accordingly, the top 10 leading institutions are shown in Table 3 according to their connections.

When looked at according to the Web of Science Index; The majority of the articles are in the “Science Citation Index Expanded (SCIExpanded) (81.25%)” category. followed by “Emerging Sources Citation Index (ESCI)” (11.45%) and “Conference Proceedings Citation Index–Science (CPCI)” respectively. -S) (6.25%)” was observed.

When analysed according to the selected keywords, it is seen that keywords such as Blepharitis, *Demodex*, *Demodex folliculorum*, and *Demodex brevis* are among the largest and most linked topic areas.

Table 1. Categories of publication areas that are related to *Demodex* spp. diagnosed with blepharitis worldwide between 1984 and 2023 found in Web of Science (WOS) databases

Research Areas	Record Count	% of 288
Ophthalmology	179	63.028
Dermatology	22	7.746
General Internal Medicine	19	6.690
Parasitology	10	3.521
Microbiology	10	3.521
Veterinary Sciences	10	3.521
Research Experimental Medicine	8	2.817
Infectious Diseases	6	2.113
Pharmacology Pharmacy	6	2.113
Entomology	5	1.761

Showing 10 out of 30 entries

Table 2. Categories of countries where academic studies on *Demodex* spp. were conducted between 1984 and 2023 based on Web of Science (WOS) databases

Countries/Regions	Record Count	% of 288
Usa	69	24.296
China	37	13.028
Turkey	32	11.268
Poland	21	7.394
France	14	4.930
Germany	14	4.930
Australia	11	3.873
South Korea	11	3.873
New Zealand	10	3.521
Ireland	9	3.169
Japan	8	2.817
Mexico	8	2.817
Spain	8	2.817
Brazil	6	2.113
Canada	6	2.113
Taiwan	6	2.113
India	5	1.761
Tunisia	5	1.761
England	4	1.408
Iran	4	1.408

Showing 20 out of 45 entries. 4 record(s) (1.408%) do not contain data in the field being analyzed

Table 3. List of the top 10 organizations researching blepharitis worldwide between 1984 and 2023 based on Web of Science (WOS) databases

Affiliations	Record Count	% of 288
Virginia Eye Consultants	17	5.986
Ocular Surface Ctr	12	4.225
Tarsus Pharmaceut Inc	12	4.225
University Of Auckland	9	3.169
Assistance Publique Hopitaux Paris Aphp	8	2.817
Ocular Surface Res Educ Fdn	8	2.817
University Paris Cite	8	2.817
Sun Yat Sen University	7	2.465
University Of Health Sciences Turkey	7	2.465
University Of Munich	7	2.465

Showing 10 out of 493 entries. 4 record(s) (1.408%) do not contain data in the field being analyzed

Table 4. Web of Science Categories Index used to find publications about blepharitis worldwide between 1984 and 2023

Web of Science Index	Record Count	% of 288
Science Citation Index Expanded (SCI-EXPANDED)	234	81.25
Emerging Sources Citation Index (ESCI)	33	11.45
Conference Proceedings Citation Index – Science (CPCI-S)	18	6.25
Social Sciences Citation Index (SSCI)	2	0.69
Book Citation Index – Science (BKCI-S)	1	0.35

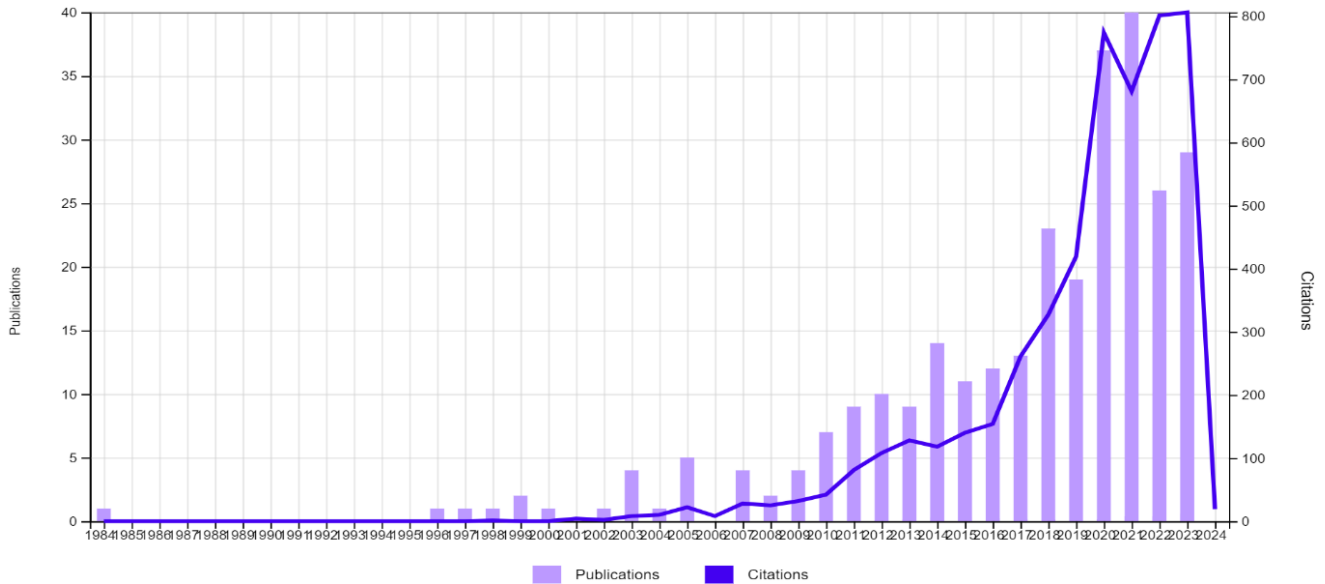


Fig. 1. Frequency of publications and citations by year (last accessed 10.01.2024) on blepharitis worldwide between 1984 and 2023 based on Web of Science (WOS) databases

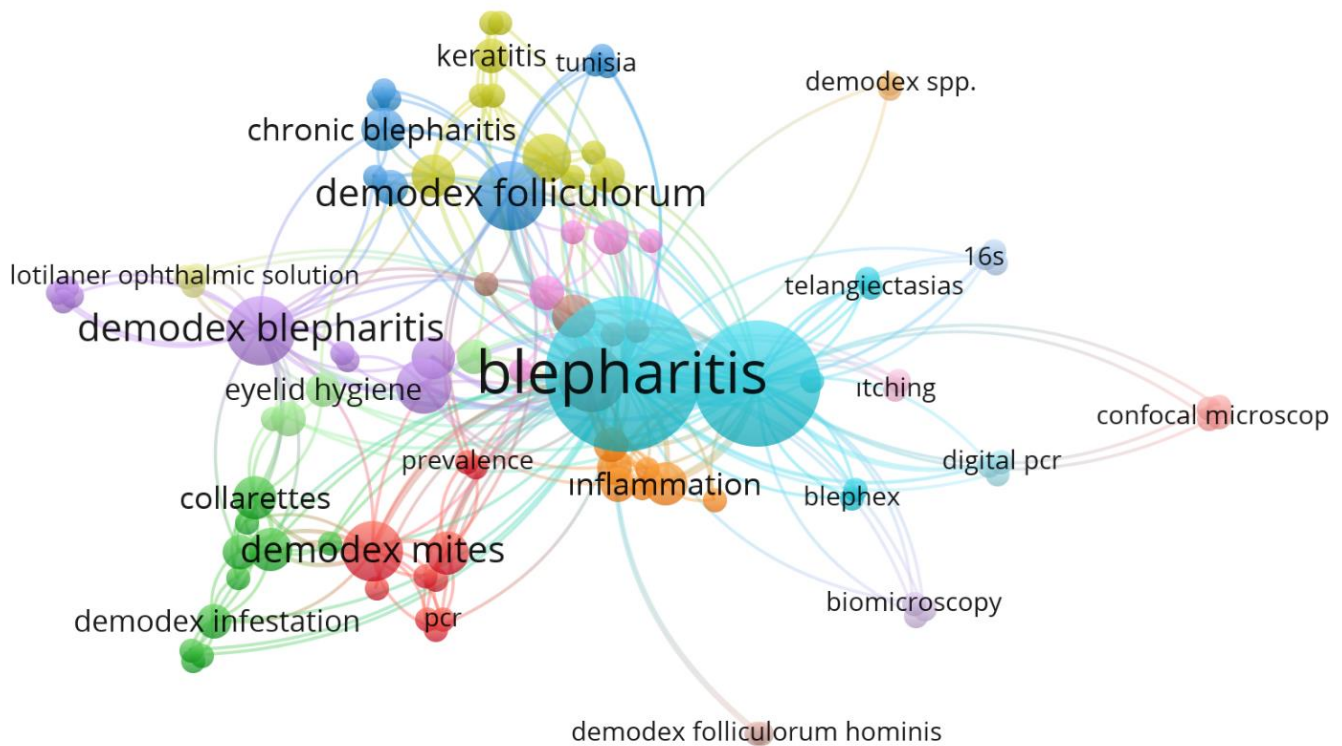


Fig. 2. Visualization map of keywords for the bibliometric study conducted to detect the presence of *Demodex* spp. in patients diagnosed with blepharitis worldwide between 1984 and 2023 based on Web of Science (WOS) databases (Link lines indicate occurrence relationships within articles. Keywords represented by a larger circle size or font size occur relatively more often in articles)

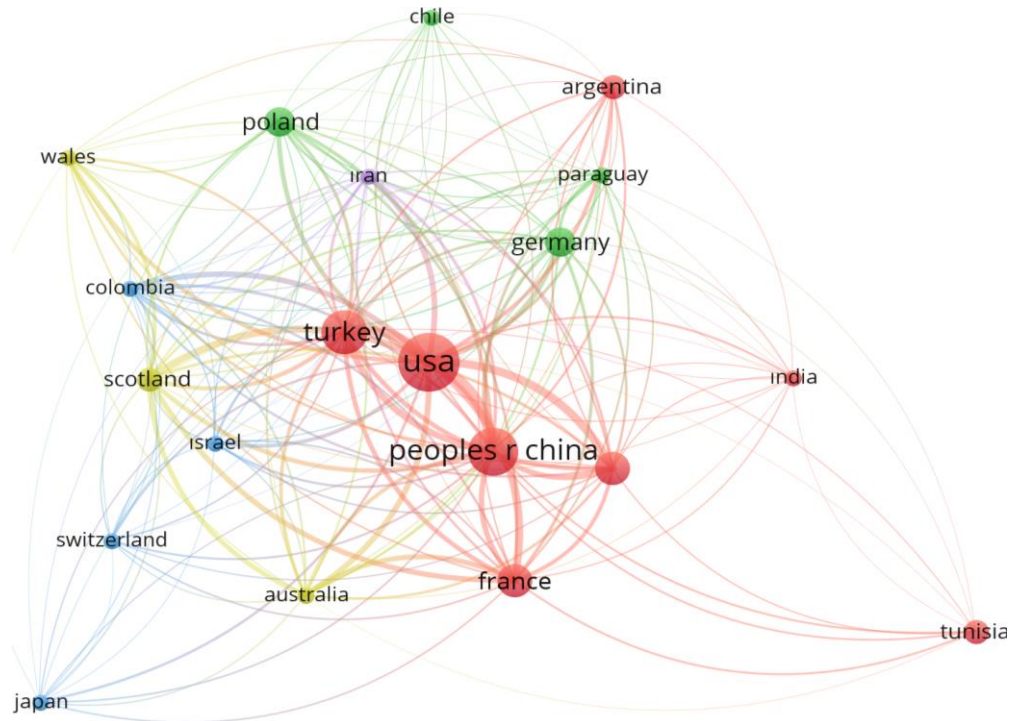


Fig. 3. Citation network visualization map among countries with publications on *Demodex* spp. diagnosed with blepharitis worldwide between 1984 and 2023 based on Web of Science (WOS) databases (Cooperation is indicated by lines connecting countries. Stronger cooperation is indicated by thicker lines. Countries with larger perimeter or text size had higher levels of international cooperation)

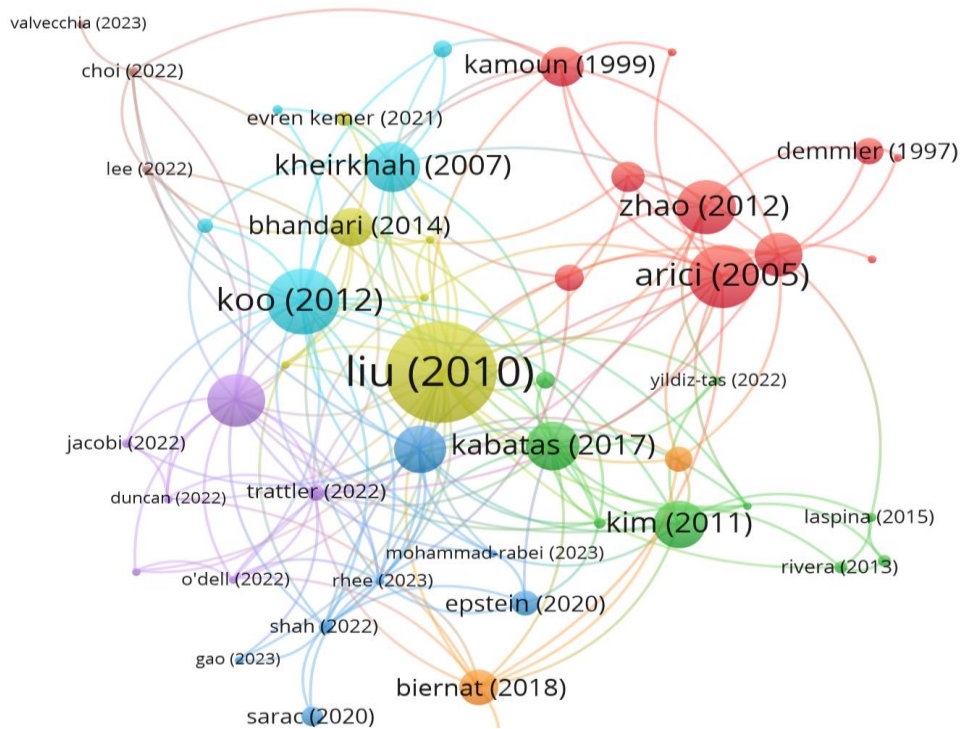


Fig. 4. Authors with the most publications and citations on *Demodex* spp. in patients diagnosed with blepharitis worldwide between 1984 and 2023 based on Web of Science (WOS) databases

Discussion

Blepharitis is a chronic inflammation characterised by a skin and eye condition most commonly seen by ophthalmologists and dermatologists. Although blepharitis does not affect vision, it can cause permanent changes to the eyelid margin. Affecting all ages and ethnic groups, blepharitis can develop in children between the ages of 2 and 3 and is generally more common in middle age and its incidence increases with advancing age (15, 16).

Demodex spp. mites play a very important role in the pathogenesis of blepharitis. *Demodex* mites, along with bacterial agents, may play an important role in the pathogenesis of blepharitis, especially in treatment-resistant cases or in cases that recur after treatment. Some researchers have reported that *Demodex* mites are vectors for the transmission of some bacteria such as bacilli, staphylococci, and streptococci to humans (17, 18, 19).

Neglecting to cleanse the skin, using cosmetics intensively and not removing them regularly, and not paying attention to the cleanliness of the products used to increase the incidence of mites. As a result, this mite is quite common even in developed countries (20). This study that we have carried out supports that.

The application of quantitative approaches (i.e. bibliometric analysis, e.g. citation analysis) to bibliometric data (e.g. publication and citation units) is referred to as bibliometric methodology (21). By carefully making sense of vast amounts of unstructured data, bibliometric analysis is an effective way of interpreting and mapping cumulative scientific knowledge and the evolutionary intricacies of deep-rooted topics (22). Bibliometric analyses in medical research have become increasingly important in recent years. Journals are important tools for researchers to communicate their work to other researchers around the world. Therefore, the prestige of the journal is proportional to the performance of the published publication (23–26). There are very valuable studies in the scientific

world on blepharitis (1-12). It will guide scientists who want to do more research on these issues (23).

This research shows that there is a global increase in scientific publications of studies investigating the role of *Demodex* spp. in the pathogenesis of patients diagnosed with blepharitis. The study aimed to identify global trends and clusters in the study of the presence of *Demodex* spp. in patients diagnosed with blepharitis and to identify the areas of research focus and the countries in which it is most prevalent. In addition, important journals, authors, and studies in this field have been identified and it has been pointed out that they can take into account the existing deficiencies in this field and lead to future studies.

By entering the terms 'blepharitis and *Demodex*' into the WOS database search engine, studies conducted since 1984 were scanned and 288 articles were found. From 1984 to 2007 not much work was done. However, after 2010, studies have been carried out that show the importance of *Demodex* spp. as an important factor in the pathogenesis of this disease. Most publications were made in 2021.

As a result of our search in the WOS database between 1986 and 2023, not many studies have been conducted on *Demodex*, which caused this disease from 1986 to 2009. It is seen that the work has increased since 2010. The most work was done in 2021 (14.03%). Most citations to the publications were made in 2023 (Fig. 1). Although the *Demodex* mite plays a major role in the aetiology of blepharitis, it has been neglected in parasitology. More parasitological studies are needed to reveal the importance of *Demodex* spp. in the etiology of Belfaritis when looked at by year. Looking at the list of research areas, ophthalmology published 179 articles (63.02%), followed by dermatology with 22 (7.74%). Despite the importance of *Demodex* spp. in the aetiology of blepharitis, parasitology is in 4th place (Table 1).

When examining the country in which the studies were conducted, the USA ranks first with the most 69 (24.29) studies, followed by China with 37 (13.03) studies and Turkey with 32 (11.27) studies (Table 2). The fact that cases of blepharitis have been reported in the USA may have increased interest in the disease. It also shows that the United States is at the centre of an international network of co-authors, working with many countries/regions (Fig. 3).

As studies on this topic are very valuable in the scientific world, most of the studies were published in SCI. According to this, Science Citation Index Expanded (SCI-Expanded) 234 (81.25%), followed by Emerging Sources Citation Index (ESCI) 33 (11.45%) and Conference Proceedings Citation Index-Science (CPCI-S) 18 (6.25%) (Table 4).

Analysing the keywords entered into the search engine from the WOS database, keywords such as blepharitis, *Demodex*, *Demodex folliculorum*, and *Demodex brevis* are among the largest and most linked subject areas. It also shows that studies on the topic are related to keywords and how often these keywords are used (Fig. 2). It can be seen that *Demodex* spp. plays a major role in the aetiology of blepharitis.

Looking at the authors' studies, the most cited study is Liu et al. Their 2010 study "The pathogenic role of *Demodex* mites in blepharitis" received a total of 196 citations (Fig. 4).

Conclusion

Our study shows global trends in the presence of *Demodex* spp. in patients diagnosed with blepharitis and provides insight into future research trends in this area. The most used keyword in blepharitis is *Demodex*, the most studied field of research is ophthalmology and the most studied country is the United States of America. Although the aetiology of blepharitis has an important place in parasitology, not many studies have been conducted in this area. Therefore, more studies are needed to in-

vestigate the aetiological role of *Demodex* in patients diagnosed with blepharitis. It is also believed that the results of the bibliometric analysis of this research will be particularly valuable to researchers in the field of parasitology. Our study is the first bibliometric study of global trends in studies of the presence of *Demodex* spp. in patients diagnosed with blepharitis.

This study is the first bibliometric analysis of publications on the role of *Demodex* spp. in the etiology of patients diagnosed with blepharitis. As WOS is one of the most commonly used databases for bibliometric analysis, the data for the analysis of our study were only taken from WOS. Therefore, publications found in other search engines but not in Scopus may have been overlooked. Our results need to be interpreted with this limitation in mind.

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Ethical consideration

Since the study was a bibliometric analysis, ethics committee approval was not received.

Conflict of interest statement

The authors declare there is no conflict of interest.

References

1. Bernardes TF, Bonfioli AA (2010) Blepharitis. *Semin Ophthalmol.* 25(3): 79–83.
2. Flores V, Ruf M, Farfan SPA, Echávez AVS, Bastard DP, Puga MC, Mazzuocolo LD (2024) Prevalence of *Demodex* spp. in patients with chronic Blepharitis. *Rev Argent Microbiol.* 56(1): 74–78.

3. Mongi F, Laconte L, Casero RD (2018) Ácaros del género *Demodex* parásitos colonizadores de personas sanas o asociados a patología ocular?. *Rev Arg Microbiol.* 50(4): 369–373.
4. Zhang AC, Muntz A, Wang MT, Craig JP, Downie LE (2020) Ocular *Demodex*: a systematic review of the clinical literature. *Ophthalmic Physiol Opt.* 40(4): 389–432.
5. Lacey N, Kavanagh K, Tseng SC (2009) Under the lash: *Demodex* mites in human diseases. *Biochem (Lond).* 31(4): 2–6.
6. Aycan ÖM (2008) *Demodex folliculorum* ve *D. brevis* Enfestasyonlarını Etkileyen Faktörler [PhD dissertation] İnönü Üniversitesi Sağlık Bilimleri Enstitüsü Türkiye.
7. Yazısız H, Çekin Y, Koçlar FG (2019) Yüzünde dermatolojik semptomları olan hastalarda *Demodex* akarlarının varlığı. *Türkiye Parazitoloj Dergisi.* 43(3): 143–148.
8. Galvis-Ramírez V, Tello-Hernández A, Álvarez-Osorio L, Rey-Serrano JJ (2011) Prevalencia de infección por *Demodex folliculorum* en pacientes que acuden a consulta general de oftalmología. *Rev Salud Pública.* 13(6): 990–997.
9. Forton FM, De Maertelaer V (2021) Which factors influence *Demodex* proliferation? A retrospective pilot study highlighting a possible role of subtle immune variations and sebaceous gland status. *J Dermatol.* 48(8): 1210–1220.
10. Zhao Y, Guo N, Xun M, Xu J, Wang M, Wang D (2011) Sociodemographic characteristics and risk factor analysis of *Demodex infestation* (Acari: Demodicidae). *J Zhejiang Univ Sci B.* 12: 998–1007.
11. Hosseini K, Bourque LB, Hays RD (2018) Development and evaluation of a measure of patient-reported symptoms of Blepharitis. *Health Qual Life Outcomes.* 16(1): 1–6.
12. Chudzicka-Strugała I, Gołębiewska I, Brudecki G, Elamin W, Zwoździak B (2023) Demodicosis in different age groups and alternative treatment options-A review. *J Clin Med.* 12(4): 1649.
13. Van Eck N, Waltman L (2010) Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics.* 84(2): 523–538.
14. Zeytun E, Karakurt Y (2019) Prevalence and burden of *Demodex folliculorum* and *Demodex brevis* (Acari: Demodicidae) in patients with chronic Blepharitis in the province of Erzincan, Turkey. *J Med Entomol.* 56(1): 2–9.
15. Pflugfelder SC, Karpecki PM, Perez VL (2014) Treatment of Blepharitis: recent clinical trials. *Ocul Surf.* 12(4): 273–284.
16. Cheng AM, Sheha H, Tseng SC (2015) Recent advances on ocular *Demodex infestation*. *Curr Opin Ophthalmol.* 26(4): 295–300.
17. Luo X, Li J, Chen C, Tseng S, Liang L (2017) Ocular demodicosis as a potential cause of ocular surface inflammation. *Cornea.* 36 (Suppl 1) S9–S14.
18. Lacey N, Kavanagh K, Tseng SC (2009) Under the lash: *Demodex* mites in human diseases. *Biochem.* 31(4): 20–24.
19. Mor N (2019) The investigation of prevalence of *Demodex* spp. in University students: the case of the faculty of health sciences. *Türkiye Parazitoloj Derg.* 43(4): 198–203.
20. Küçük U, Alkan S, Uya C (2021) Bibliometric analysis on infective endocarditis. *Iberoamerican Journal of Medicine.* 3(4): 350–355.
21. Tantengco OAG, Rojo RD (2022) Bibliometric analysis of schistosomiasis research in Southeast Asia (1908-2020). *Acta tropica.* 228: 106322.
22. Lemp MA, Nichols KK (2009) Blepharitis in the United States 2009: a survey-based perspective on prevalence and treatment. *Ocul Surf.* 7(2): S1–S14.
23. Dindar Demiray E, Oğuz Mızrakçı S, Alkan S (2021) Analysis of publications on

- Acinetobacter: A Scopus database search study. J Clin Med Kaz. 18(5): 44–48.
24. Yıldız E (2022) Türkiye’de gebelik ve anestezi konulu yayınların bibliyometrik analizi. B S J Health Sci. 5(1): 50–55.
 25. Durgun C (2021) Canlı donörden karaciğer nakli konusundaki global yayın trendleri ve Türkiye kaynaklı yayınların analizi. J Biotechnol Strateg Health Res. 5(3): 214–220.
 26. Maciver SK, Piñero JE, Lorenzo-Morales J (2020) Is Naegleria fowleri an emerging parasite? Trends Parasitol. 36(1): 19– 28.