# Bibliometric analysis of Mosquito population research peaks

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**Abstract.** Research regarding the topic of mosquito population has been on the rise in the last 13 years, and because of that, it is an interesting topic to analyze the trends and growth of. This paper aims to analyze research papers and journals, then visualize research trends on the topic of mosquito population in the last 13 years and identify potential research topics related to mosquito population for future research. The method of this study uses a literature review and bibliometric analysis using Google Scholar, DBLP, and VOSviewer databases, in which 999 documents were collected. The results illustrate that mosquito population research has been on the rise gradually, reaching its peak in 2020 and showing a decline afterwards. The author with the highest contribution is Giovanni Belleni, and the most common type of document is a research paper. More research regarding mosquito populations can be used to analyze the transmission of diseases and the effects of climate change. This study is limited in its scope because most of the data was obtained through Google Scholar and DBLP without thorough filtering. Hence, it is recommended for future research to go through additional steps to filter more of the obtained data.

## 1. Introduction

Mosquitoes are a type of insect that consists of over 1000 species. Their habitat is scattered on almost every continent, with the exception of Antarctica, making them one of the most widespread insects in the world [1]. They are known to cause the most insect bites in human-populated areas compared to other insects [2], spreading diseases such as dengue, malaria, zika, yellow fever, and West Nile virus [3]. Because of this, mosquitoes pose a legitimate risk to human society, making them a large part of human day-to-day life.

One of the aspects that is being researched is that of the mosquito population. The spread and density of a mosquito population can highly affect the human population [4],

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making its control a high priority. There are many factors in a mosquito population, such as temperature, humidity, and precipitation [5]. The behavior of mosquitoes can also change depending on the temperature, while humidity affects the longevity and blood-feeding behaviours of mosquitoes [6]. Because of this, human society will benefit from more research on how to control the population of mosquitoes, making coexistence a possibility in the future [7].

The benefits of research on mosquitoes don't stop at only designing human settlements; this also includes controlling the spread of diseases, improving quality of life, and balancing ecosystem biodiversity [8]. To figure out other possible research topics regarding mosquito populations, a bibliometric analysis is essential to discover results and create a research trend map [9]. Not only that, bibliometric analysis helps visualize data comprehensively [10], providing guidance for future research. Hence, it is important to conduct a bibliometric study on the topic of mosquito populations. The goal of this study is to do a literature review on mosquito population research papers from 2010–2023 with bibliometric analysis to conclude future research subjects using databases such as Google Scholar and DBLP. The research questions of this study are: (1) What is the trend of published articles on the topic of mosquito population during the last 13 years? (2) How is the visualization of mosquito population research trends during the last 13 years? (3) What is the most common type of document for mosquito population research in the last 13 years? (4) Who has been the top author in mosquito population research in the last 13 years? (5) How has the amount of research on mosquito populations changed in the last 13 years? (6) What are the opportunities for the publication of research on mosquito populations?

## 2. Methods

This research uses a review study with the bibliometric analysis method. Bibliometric analysis is a quantitative study using Google Scholar and the DBLP database. The analysis method was used to visualize the trend mapping of mosquito population research from various sources using statistical methods. The research was conducted through an online database search on August 29, 2023. An online search was done using the Publish or Perish application, entering 'Mosquito Population' in the keywords from 2010 to 2023.

Bibliometric studies use the Google Scholar database in Publish or Perish as the main data source, while DBLP data sources are used for document types and publication trends in the past years. By entering "Mosquito Population" in the application, 999 documents were gathered this way. 26 additional documents that were gathered from DBLP will also be used in this study.

The Google Scholar data will then be processed using VOSViewer to visualize the keywords and author mapping. Excel will also be used to process data from DBLP to visualize the fluctuation of the publication trend and show the most common type of document.

**Fig. 1.** Method Steps

## 3. Result and discussion

Bibliometrics has an important contribution in research [11-15]. The novelty and importance of further research can be obtained from bibliometric analysis [16-20]. Figure 2 represents the mosquito population research articles in the past 13 years. From the Google Scholar database, it can be seen that the development of research on mosquito populations occurred at a steady pace, between 105 and 115 documents per year. Before declining in 2016, with no sign of increasing in the future. Meanwhile, from the DBLP database, it can be seen that there is a gradual increase in research, reaching its peak in 2020 before declining again afterwards. Despite the decrease in research, there are still many potentials in mosquito population research that haven't been explored yet. especially in the current age where the earth's temperature rises each year.
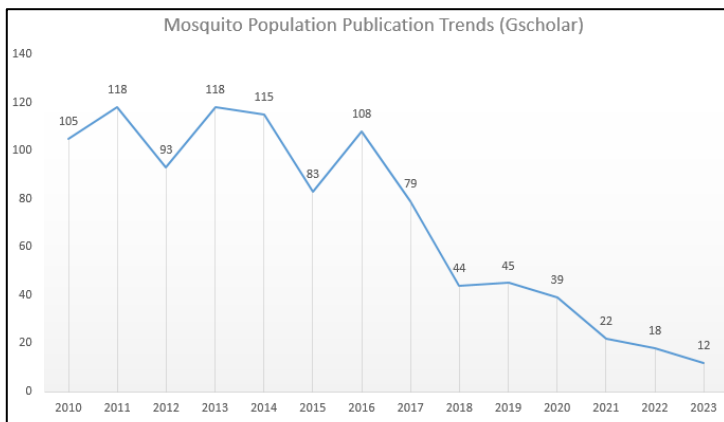


**(a)**
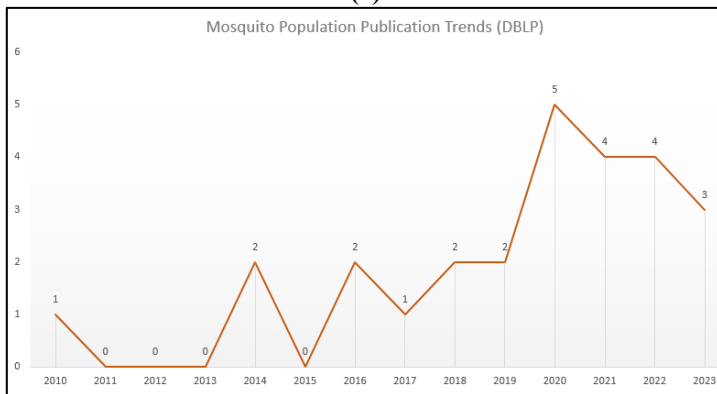


**(b)**

**Fig. 2.** Mosquito population publication trend in the last 13 years from two databases

From Figure 2, it can be seen that there are contradictions between the two databases, suggesting that the sample size of the DBLP database is too small for the study and cannot be reliably used to represent the publication trend of mosquito population research. The sample size of the Google Scholar database can be reliably used with a sample size of 999.



**Fig. 3.** Document types of mosquito population research

From Figure 3, from the 26 documents that were gathered from DBLP, it can be concluded that most documents consisted of journal articles with 22 documents, and only 4 documents were conference and workshop papers.
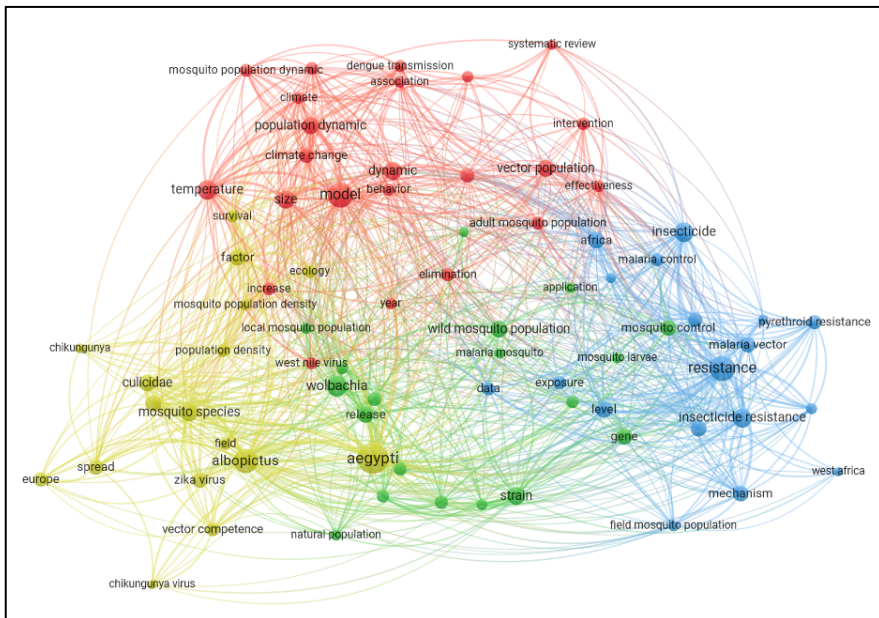


**Fig. 4.** Keyword visualization mapping across mosquito population research in the past 13 years

Figure 4 shows the keyword visualization mapping in mosquito population subjects between the years 2013 and 2023. There are four main clusters in the visual mapping, which consists of 77 items. The first cluster in red (n = 23) focuses on the dynamics and model of mosquito populations. And then, the second cluster in green (n = 19) is composed of topics on natural and wild mosquito populations. Next, the third cluster in blue (n = 18) focuses on the mosquito insecticide resistance level. Lastly, the fourth cluster in yellow (n = 17) focuses on the density of the mosquito population. The number of occurrences and the total link strength of an item suggest researchers' interest in the topic. The keyword that has the highest occurrence is aegypti, with 108 occurrences in total, followed by resistance, model, albopictus, and wolbachia. This suggests that research on the subject of mosquito populations mainly focuses on the population model and resistance of certain species of mosquitoes. By looking at the relations between large and small keywords, most of the research has gone to the Aegypti mosquito. While research on the topic of climate change affecting mosquito populations and density is still understudied, this shows the potential for future research.
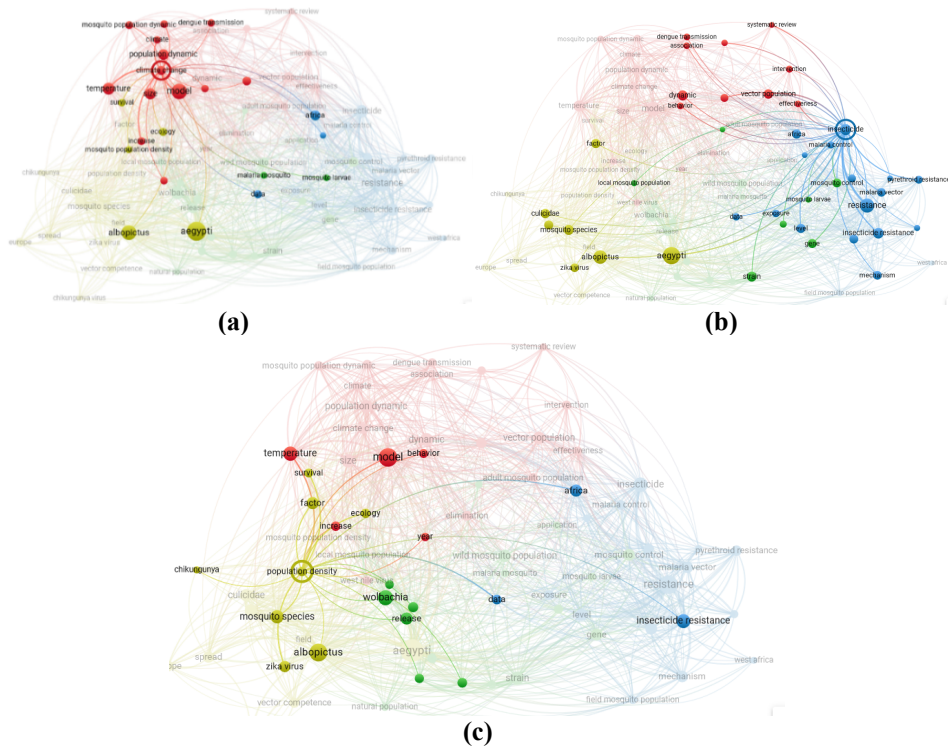


**Fig. 5.** Specific keywords mapping with topics **(a)** climate change, **(b)** insecticide, and **(c)** population density

Figure 5 gives an example of specific keywords such as population density, insecticide, and climate change. The figures above give examples of specific keywords such as population density, insecticide, and climate change. The trends in mosquito population

research with climate change can be promising to research by showing how climate change affects mosquito populations. Further research on the population density of mosquito populations can also be beneficial to visualize the changes in mosquito populations over time. Figure (b) also shows the high interconnectivity of the insecticide topic to other topics, making it a good topic candidate for future research on tackling mosquito populations.
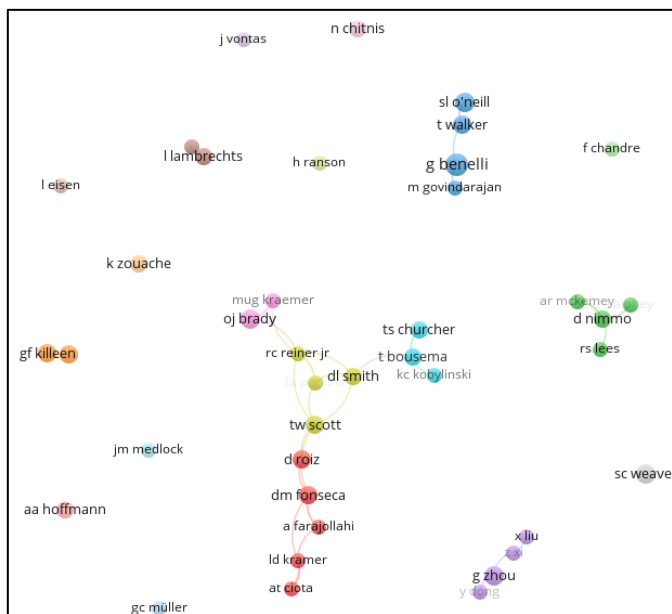


**Fig. 6.** Authorship mapping of mosquito population research in the last 13 years

In Figure 6, the authors who have worked on mosquito population research are visualized. The map is composed of 40 items that are grouped into 19 clusters. It can be seen that the interconnectivity between authors is low, with the highest link between authors being 5. The author with the most documents is G. Benelli with 11 documents, followed by O.J. Brady with 8 documents. This shows that in the last 13 years, there haven't been many authors who have done research on mosquitoes, making the field open for opportunities for other researchers.

## 4. Conclusion

Based on the conducted bibliometric analysis, these discoveries were gathered: The trend of mosquito population topics was steady from 2010 to 2016. But afterward, it decreased rapidly without increasing, making it a challenge for future researchers. At the same time, this also creates opportunities for new researchers. Based on research mapping, it can be gathered that the research trend on mosquito population still focuses on certain species of mosquitoes and the model of population, not other topics such as the effect of climate change on the mosquito population and the population density of mosquitoes. Based on

authorship mapping, it can be concluded that there are not many authors who have researched mosquito population topics, making it hard for other researchers to analyze another researcher's work.

It can be concluded that the research on mosquito populations is still understudied and mainly focuses on only certain topics, making the topic ripe for further research. The researchers recommend using better methods of data filtering, making sure that there is no contradiction between databases and the data that is used to be accurate. This research can be utilized as a reference for further research on mosquito populations. It is also recommended to use other databases than DBLP and Google Scholar.

## Acknowledgments

## References

1. J. Seda, S. Horrall, Mosquito bites - StatPearls - NCBI bookshelf (National Center for Biotechnology Information, 2023)

2. A. D. Vander, A. Labib, G. Yosipovitch, Frontiers, Immunology **13** (2022)

3. H. Lee, S. Halverson, N. Ezinwa, Primary Care: Clinics in Office Practice **45**, 3 (2018)

4. F. J. Colón-González, et al., The Lancet Planetary Health **5**, 7 (2021)

5. C. Baril, et al., BMC Bioinform **16** (2023)

6. T. K. Yamana, E. A. Eltahir, Parasites & Vectors, **6**, 1 (2013).

7. A. Ford, M. Gearey, T. Acott, Int. J. Mosq. Res. **4** (2021).

8. Y. A. Halasa, et al., PLoS ONE, **9**, 3 (2014)

9. B. K. Prahani, I. R. Dawana, B. Jatmiko, Int. J. Emerg. Technol. Learn **18**, 10 (2023)

10. D. Solomon, *A different view: An inquiry into visualization of bibliometric data*, in ASEE Proceeding of Annual Conference & Exposition, Seattle, Washington (2015)

11. H. N. Hidaayatullaah, N. Suprapto, E. Hariyono, B. K. Prahani, D. Wulandari, J. Phys. Conf. Ser. **2110**, 012026 (2021)

12. B. K. Prahani, J. Alfin, A. Z. Fuad, B. Jatmiko, E. Hariyono, N. Suprapto, Int. J. Emerg. Technol. Learn. **17**, 17 (2022)

13. Nurhasan, B. K. Prahani, N. Suprapto, M. A. A. Ardha, Int. J. Instruction, **15**, 3 (2022)

14. B. Jatmiko, B. K. Prahani, N. Suprapto, S. Admoko, U. A. Deta, N. A. Lestari, M. N. R. Jauhariyah, M. Yantidewi, D. Muliyati, J. Phys. Conf. Ser. **2110**, 012018 (2021)

15. B. K. Prahani, M. Z. B. Amiruddin, N. Suprapto, U. A. Deta, T. -H. Cheng, *Int. J. Educ. Method*, **8**, 3 (2022)

16. B. K. Prahani, I. A. Rizki, B. Jatmiko, N. Suprapto, T. Amelia, Int. J. Emerg. Technol. Learn. **17**, 8 (2022)

17. N. Suprapto, A. Kholiq, B. K. Prahani, U. A. Deta, J. Phys. Conf. Ser. **012017** (2021)

18. B. Jatmiko, T. Sunarti, B. K. Prahani, E. Hariyono, Dwikoranto, F. C. Wibowo, S. Mahtari, Misbah, M. Asy'ari, J. Phys : Conf. Ser. **2110**, 012020 (2021)
19. B. K. Prahani, M. Z. B. Amiruddin, B. Jatmiko, N. Suprapto, T. Amelia, Int. J. Interactive Mobile Technologies, **16**, 8 (2022)
20. U. A. Deta, I. Laeliyah, N. A. Lestari, M. Yantidewi, M. N. R. Jauhariyah, B. K. Prahani, AIP Conf. Proc. **2595**, 020013 (2023)