Journal of Applied Biology & Biotechnology Vol. 12(3), pp. 268-275, May-Jun, 2024
Available online at http://www.jabonline.in
DOI: 10.7324/JABB.2024.170023

Global research contributions on orchids: A scientometric review of 20 years

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ARTICLE INFO

Article history:
Received on: December 19, 2023
Accepted on: March 03, 2024
Available online: April 20, 2024

Key words:
Environmental sustainability,
Global Research,
Orchids,
Scientometric study,
VOSviewer.

ABSTRACT

Orchids, renowned for their attractive beauty, play vital roles in ecosystems worldwide. Many researches highlight the role of orchids as indicator species, reflecting ecosystem health and vulnerability to environmental changes. Across the globe, numerous articles have been published on these topics, facilitating the exchange of innovative ideas their pros and cons. However, no study was conducted to evaluate the trends of research in this field. It is also very essential to understand the prolific authors, sources, journals, institutions, recent trends, and other relevant factors associated with orchids. As a result, this paper is undertaken to comprehensively map the existing articles published on the orchids and its relevant research with a scientometric method. The dataset was downloaded from the Scopus database from 2003 to 2022 and for analysis; Bibliosiny (version 6.1.R2) and VOSviewer (version 1.6.18) were used. A total 18600 numbers of records were globally published under the topic during the entire period from 2003 to 2022. Publications were also contributed from different sources such as journals and books. Total 543660 numbers of references are used in the different documents, and 43216 authors contributed their work in this field. Moreover, this paper also highlights the urgent need for concerted efforts to protect and preserve these valuable plants for ecosystems, ensuring the understanding of the lacking of research on orchids.

1. INTRODUCTION

Orchid is one special type of plant that bears attractive flowers and sometimes valuable fruits. Orchids, often referred to as the "Orchidaceae," instate one of the largest families of angiosperm [1], more than 25,000 species are present worldwide. Orchids are primarily herbaceous or nonwoody plants, although some species may be vines, vinelike, or somewhat shrubby. Orchid plants are generally epiphytic (i.e., growing on other plants rather than rooted in soil) in other terms its called air plants. Those attached to other plants often are vine like and have a spongy root covering called the velamen that absorbs water from the surrounding air [2,3]. Most species manufacture their own food, but some live on dead organic material (saprophytic) or are helped to obtain nourishment by a fungus living in their roots. Most of the species are found in tropical regions and forests, but some orchid's shows the ecological tolerance [4]. Orchid has feature of detoxifying the air which can absorb more CO_2 by filter out various harmful compounds from the air. Further, orchids can remove harmful chemicals [5]. Orchids, due to their wide distribution and distinctive life cycle, are particularly vulnerable to genetic degradation or loss, even within their native habitats [6]. One major concern that significantly affects the distribution and natural environments of orchids is climate change. Similar to other plant species, orchids are affected by this environmental stress, but their intricate relationships with pollinators, mycorrhizal fungi, and host plants make them especially susceptible. Furthermore, because they rely on other organisms for their survival and reproduction, habitat loss or climate change can pose a heightened threat to their existence [7].

Beyond their biological significance, orchids have significantly impacted human culture and commerce. Their attractiveness has led to a global trade, with admirers and collectors valuing rare and exotic species. There are various products and parts of the orchid plants which are used worldwide and have great economic value [8]. Vanilla which is produced from one species of orchid (*Vanilla planifolia*). Orchids was used for a variety of folk medicines. In present-day also, orchids are used in modern medicine for critical diseases [9]. Further, orchids have a significant relationship with the beauty industry, basically due to their unique fragrances and exquisite appearance [10]. Perfumes are also incorporate orchid essences to create unique and alluring fragrances. Scientist found that orchid has vitamin A and other antioxidants which can make the skin radiant and rejuvenate. It is specially used in the wrinkle control cream [11].

There are numbers of studies have been conducted on different topic related to orchids. Research with orchids can provide more insights into broader ecological processes and contribute to ecosystem dynamics. Shao *et al*. [12] conducted a study on the mycohetero trophic evolution in the Neottieae orchid. This study revealed that among

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15 samples, 6 of the species samples have shown to modify the path of plastome degradation. Another study by Gnatiuk *et al*. [5] identified almost 53 new species of arthropods and highlighted the biological importance. Zhang *et al*. [13] measured the nectar reabsorption and sugar concentration in two species. Fruther, Madhavamurthy *et al*. [9] examined some selected orchid and investigate the presence of bioactive compounds in those plants. Result of this study shows presence of various types of bio compounds, which are really high on those plants and with the farther study that compounds can be extracted and can be used in the medical field. Zhang *et al*., [11] highlighted the present that new technologies for orchid gene engineering which changing the genetic structure of the orchid plant enhancing and improvising plants productivity, and build the industrialization. Shao *et al*. [12] have reviewed various orchid research papers and found that proper conservation must be taken for endangered orchid species. With increasing the research on orchids, it leads to associate problems for the researchers. Researchers often face difficulties when trying to find appropriate articles related to orchids of their relevant studies in the research field [4,5]. Nonetheless, the enormous volume of literatures and the intricate nature of orchid studies can sometimes make it challenging to pinpoint the most relevant articles.

On the other hand, scientometric studies can be conducted to resolve the challenges faced by the researcher by providing visualizations of research landscapes, showing how different topics and disciplines are interconnected. Scientometric studies help researchers to identify emerging trends and topics, potential areas of collaboration, impact of research articles or journals [14-16]. A scientometric analysis is very relevant and essential for orchid research due to the unique challenges and vulnerabilities of these plants. Orchids have a wide distribution around the world, making it very essential to track and assess their global research output. Orchids, with their diverse species and commercial value, offer a rich and untapped resource that, if studied, could benefit various industries and contribute to a deeper understanding and importance and potential of the plant in our world. Moreover, their susceptibility to genetic deterioration and the impact of climate change on their commercial value or ecological relationships make scientometric analysis crucial for understanding research trends, identifying conservation priorities, and facilitating international collaboration [17-19].

No prior research has undertaken to investigate the quantitative dimensions of research output or the analysis of trends within the orchid research field using scientometric techniques. Therefore, this paper fills a crucial gap by conducting a systematic analysis that explores the intricate and ever-evolving orchid research domain. This analysis highlights the stakeholders, including scientists, conservation organizations, and policymakers, make informed decisions and address the multifaceted challenges that orchids face in their natural environments, ensuring the long-term survival and well-being of these ecologically significant and culturally valuable plants.

2. OBJECTIVES OF THE STUDY

In this paper, an attempt is taken to fill the research gap in the present study, specifically with a focuses on the following objectives:

- To examine the, authorship and collaboration patterns, prolific authors and institutions, co-authorship network under this study.
- To find out most publication trends and cited year in this field under this study.
- To identify the types of documents used by scholarly communication and the most cited documents under this study.
- To discover the subject area-wise distribution of the documents and to visualize the keyword of occurrence network of this study.

3. METHODOLOGY OF THE STUDY

Scientometric, an analytical instrument for evaluating a large volume of publications and citations, offers a data-driven manner for a comprehensive analysis and domain understanding [14]. The current study is undertaken to measure the trends and patterns of publication on orchids-related research through worldwide during the last 20 years from 2003 to 2022. The data for this purpose have been retrieved from the Scopus (www.scopus.com) database. The search was conducted on August 15, 2023. The keywords "orchid*" were used in the search interface including title, keywords, and abstracts of the Scopus database for retrieving all the records related to the orchids. Since data were retrieved on August 2023, so it is decided to exclude all the papers which were uploaded in Scopus during the year 2023 till date. Thus, the year 2023 was excluded from the search interface by using phase search under the syntax TITLE-ABS-KEY ("orchid*") AND PUBYEAR >2002 AND PUBYEAR <2023. Subsequently, 18,600 numbers of records were received globally using the above search strategy.

The dataset was exported in Excel format with full bibliographic details along with reference and merged in a single file for the analysis. The MS-Excel, Biblioshiny-statistical R (version 6.1.R2) based software, and VOSviewer (version 1.6.18) were used for the detailed analysis of the dataset. Total 18600 numbers of records were received globally and published during the entire period, which falls between the years 2003 and 2022. A total of 543660 numbers of references are analyzed in this study.

4. RESULT ANALYSIS

4.1. Number of Documents and Average Citations per Year

Figure 1 presents the data related to the growth in research related to orchids from 2003 to 2022. It indicates that research publications on orchids are taking the hype in recent years. The exponential regression used in this data set indicates the continuous growth of research articles from the past 20 years. From Figure 1, it can be observed that in the year 2021, most of the research works (1232) were conducted on these topics. Thus, the Average Annual Growth Rate of research publications on orchid topics is found to be positive in the last 20 years (6.78%).

4.2. Authorship Collaboration Pattern and Most Prolific Author

Table 1 indicates that a total of 43216 numbers of authors contributed their research on the topic orchid, which includes 1124 numbers of single author documents with international co-authorship 21.6%. Further, it is also found that Co-author per document is 4.49%.

Table 2 reflects the most productive author list. Among the total number of 18600 documents, total numbers of authors 43216 have contributed. In this study of orchid-related research, "Szlachetko, Dariusz L." is found to be the most prolific author, which is followed by "Kolanowska, Marta Alicja," and "Suetsugu, Kenji," respectively.

4.3. Country-wise Collaboration

It is also important to understand the author's contribution country-wise. Table 3 lists the top 10 countries with the highest number of published articles.

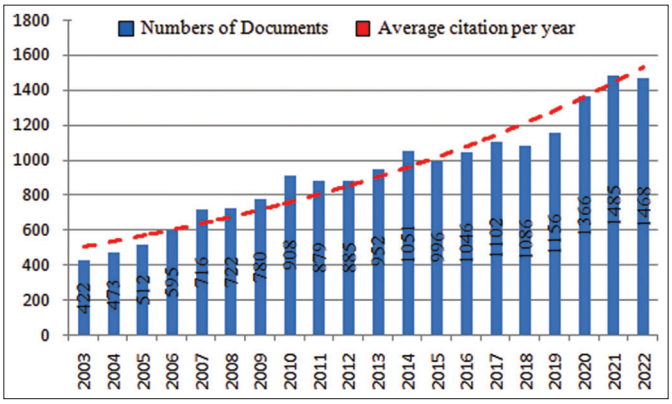

Figure 1: Numbers of documents and average citation per year.

Table 3 displays the number of articles which were produced by the authors from different countries and it also reflects the collaboration of the authors with other countries. After the evaluation of data, it is found that authors in China have produced a total 3361 articles, where the Single country publication (SCP) value is 3310 and co-authorship with other countries is 583. Thereafter, authors from the USA have produced 2575 articles with SCP value 2192 and co-authorship with other countries author 383, which is followed by Brazil with1331 articles, SCP value 980 and co-authorship with other countries is 296.

4.4. Most Cited Countries

Table 4 represents the 10 top countries and their impact on the citation. As shown in Table 4, it is found that China has received the highest number (33888) of citations with an average citation per article 14 whereas the USA has received the second highest number (23119) of citations with an average citation per article 20.7, which is followed by the United Kingdom has received the third highest number (12834) of citations with an average citation per article 24.1.

4.5. Most Relevant Affiliated Institution

In the field of research, different institutions have contributed their work. Table 5 indicates the most prominent institutions which have contributed predominately in this field. From Table 5, it is found that "Fujian Agriculture and Forestry University, China" has contributed the highest numbers (737) of articles, which is followed by "Chinese Academy of Sciences, China" which contributed 465 numbers, and "National Cheng Kung University, Taiwan" has contributed 451 numbers of articles on the topics of the study.

4.6. Different Types of Documents

Figure 2 indicates that out of 18600 numbers of total records which were published during the entire period, majority 15527 (83.5%) numbers of records belong to articles publication, whereas 1002 (5.4%) numbers of records belongs to review papers publication. Further, 776 (4.2%), 430 (2.3%), and 326 (2.3%) numbers of records were published as conference papers, book chapters, and note, respectively. It is also found that 539 (2.8%) numbers of records were also published during the past 20 years which includes letter, erratum, short survey, editorial, book, conference review, report, and abstract report.

4.7. Most Relevant Sources

Table 6 represents the sources such as journals and conference proceedings,which are mostly preferred by the researcher on orchid-related research.

Table 1: Authorship pattern.

Authors	Numbers
Total number of authors	43216
Single authored documents	1124
Co-authors per documents	4.49
International co-authorships %	21.6

Table 2: Top ten most productive authors and their impact.

Authors	Articles
Szlachetko, Dariusz L.	209
Kolanowska, Marta Alicja	189
Suetsugu, Kenji	119
Ciais, Philippe	113
Cozzolino, Salvatore	89
Jacquemyn, Hans	86
Johnson, Steven D.	85
Chase, Mark W.	81
Peakall, Rod	76
Yukawa, Tomohisa	
Selosse, Marc André	73

Table 3: Corresponding author's countries.

Country	Articles	SCP	MCP	Freq	MCP_Ratio
China	3893	3310	583	0.209	0.150
USA	2575	2192	383	0.138	0.149
Brazil	1331	1035	296	0.072	0.222
India	1181	980	201	0.063	0.170
United Kingdom	990	923	67	0.053	0.068
Japan	625	444	181	0.034	0.290
Australia	603	494	109	0.032	0.181
France	497	374	123	0.027	0.247
Poland	459	257	202	0.025	0.440
Mexico	452	351	101	0.024	0.223

SCP: Single country publication, MCP: Multiple country publication, TC: Total citation.

Table 4: Most cited countries.

Country	TC	Average article citations
China	33888	14.00
USA	23119	20.70
United Kingdom	12834	24.10
Brazil	12062	11.00
Australia	10730	24.00
France	10359	25.70
Germany	8933	27.60
India	7769	8.50
Japan	7689	14.80
Italy	5154	15.30

The data extracted for the study indicates the sources which are actively publishing research works on this topic. In Table 6, the top 10 preferred sources were listed. Among these top sources,

"Phytotaxa" has published the highest number of 559 articles on this topic, which is followed by "ActaHorticulturae" with 348 articles. Further, "Lankesteriana" has published 306 numbers of articles.

4.8. Most Global Cited Documents

Table 7 presents the data related to the most globally cited documents with orchid research from 2003 to 2022. It is found that the article "Baskin and Jerry (2014). Elsevier" has received a total of 1768 citations with 176.80 average citations per year; which is followed by "Chao and Jost (2012). Ecology" has received total 1202 citations with 100.17 average citations per year. The article "Heijden *et al*., (2015). New Phytologist" has received total of 1100 citations with 122.22 average citations per year.

4.9. Co-occurrence of the Key Terms

The co-occurrence map of the most frequently used terms in the keyword (minimum numbers of occurrence of keywords 5) of the papers was created to reveal the link between the terms and visualize the main clusters of the keywords [Figure 3]. Out of 48034 keywords, 6524 meet the threshold in this analysis with 221758 numbers of links.

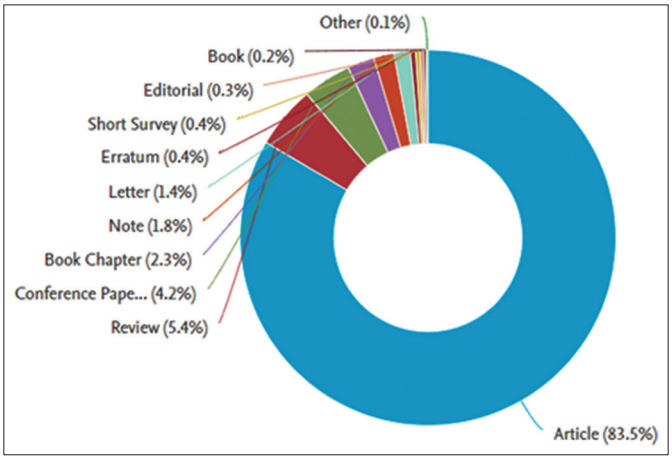

Figure 2: Different types of documents.

This map unearthed and visualized four main cluster categories such as "orchidaceae," "orchiectomy," "nonhuman," and "pollination."

4.10. Top Funding Agencies

Table 8 represents the top ten funding agencies that were invested fund to carry out the research work on orchids. From Table 8, it is found that the majority (825 numbers) funding is provided by "The

Table 5: Most relevant affiliated institutions.

Affiliation	Articles
Fujian Agriculture And Forestry University (China)	737
Chinese Academy of Sciences (China)	465
National Cheng Kung University (Taiwan)	451
Kunming Institute of Botany (China)	369
University of Gdańsk (Poland)	354
National Taiwan University (Taiwan)	306
Chinese Academy of Medical Sciences And Peking Union Medical College (China)	282
Institute of Botany Orchid research	282
Laboratoire Des Sciences Du Climat Et De L'environnement	242
Chulalongkorn University	228

Table 6: Most relevant sources.

Sources	Articles
Phytotaxa	559
ActaHorticulturae	348
Lankesteriana	306
Botanical Journal of The Linnean Society	181
Journal of Pediatric Urology	181
Journal of Urology	157
Plos One	154
Mitochondrial Dna Part B: Resources	148
Frontiers In Plant Science	143
Annals of Botany	141

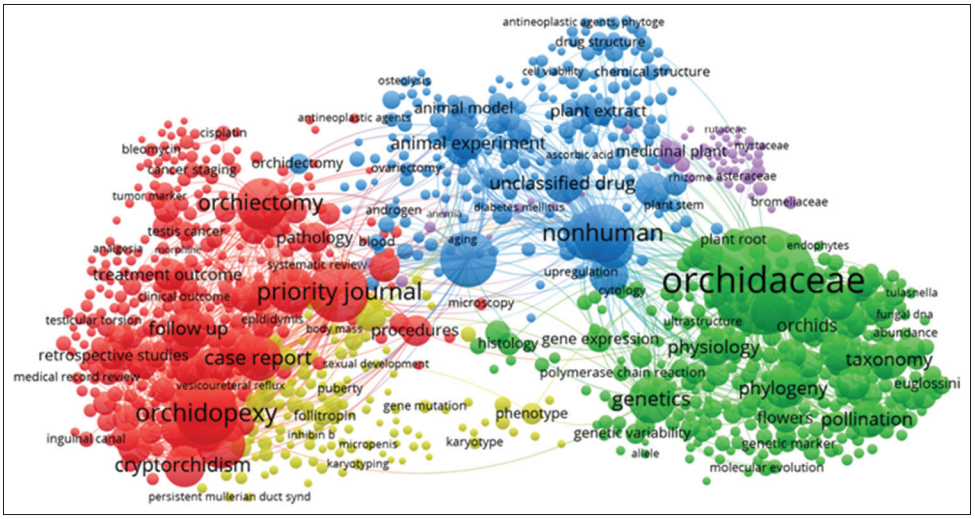

Figure 3: Overlay visualization of co-occurrence of keywords.

Table 7: Most global cited documents.

Paper and DOI	Total Citations	TC per Year	Normalized TC
Baskin and Jerry (2014). Elsevier 10.1016/C2013-0-00597-X [20]	1768	176.80	99.68
Chao and Jost (2012). Ecology. https://doi.org/10.1890/11-1952.1 [21]	1202	100.17	58.22
Heijden *et al*., (2015). New Phytologist. https://doi.org/10.1111/nph. 13288 [22]	1100	122.22	64.43
Knudsen *et al*., (2006). The Botanical Review. https://doi.org/10.1663/0006-8101 [23]	1004	55.78	32.77
Brundrett (2009). Plant and Soil. https://doi.org/10.1007/s11104-008-9877-9 [24]	924	61.60	35.55
Barlow *et al*. (2007). Proceedings of the National Academy of Sciences. https://doi.org/10.1073/pnas. 0703333104 [25]	821	48.29	31.31
Katsanos *et al*. (2018). Journal of the American Heart Association. https://doi.org/10.1161/JAHA.118.011245 [26]	701	116.83	61.31
Lahaye *et al*. (2008). Proceedings of the National Academy of Sciences. https://doi.org/10.1073/pnas. 0709936105 [27]	697	43.56	26.38
Kohler *et al*. (2015). Nature Genetics. https://doi.org/10.1038/ng. 3223 [28]	694	77.11	40.65
Brundrett and Tedersoo (2018). New Phytologist. https://doi.org/10.1111/nph. 14976 [29]	683	113.83	59.74

Table 8: Top funding agencies.

Name of funding agencies	Frequency
National Natural Science Foundation of China	825
ConselhoNacional de DesenvolvimentoCientífico e Tecnológico	369
Coordenação de Aperfeiçoamento de Pessoal de Nível Superior	272
Japan Society for the Promotion of Science	256
National Science Foundation	188
Chinese Academy of Sciences	138
Fundação de Amparo à Pesquisa do Estado de São Paulo	135
National Key Research and Development Program of China	135
Seventh Framework Programme	123
Deutsche Forschungsgemeinschaft	117
Ministry of Science and Technology, Taiwan	111

National Natural Science Foundation of China" which is followed by "ConselhoNacional de Desenvolvimento Científico e Tecnológico" (369 numbers) and "Coordenação de Aperfeiçoamento de Pessoal de Nível Superior" (272 numbers), respectively.

5. DISCUSSION

Orchids play a remarkable and sustainable overall biodiversity of ecosystems. They are found in a wide range of habitats, from rainforests to grasslands, and often occupy niches that are not easily filled by other plants [2,3,30]. There are numbers of study has been carried out related to the orchids-related topics and some of the researches are on the endangered species in different parts of the word [31-33]. Orchid plants are now used not only for flowers but also in medicine, food, and cosmetic [34]. Over the last two decades, scientific research has increasingly recognized the critical role of orchids in contributing to overall biodiversity and their remarkable adaptations to diverse ecological niches [35]. The results of the study further revealed that research on orchid conservation has increased over the past two decades. To strengthen orchid-related research, this scientometric study highlighted the areas such as genetics and taxonomy, mycorrhizal relationships, propagation, and pollination among orchids. However, earlier studies reveal that there is an emerging need for heightened attention and investigation the orchid species to know their medicinal or commercial applications.

From the current study, it is further found that a total of 43216 numbers of authors have published their articles, whereas the average co-authors per document was found 4.49. The international collaboration among authors is found to 21.6%. The study shows that the number of publications on this topic is increased in very recent years compared to starting year 2003. Further, the current study shows that majority numbers of records belong to articles publication, review articles publications, conference papers publication, etc. It is further found that authorship patterns cover the traditional knowledge holders and scientific researchers in the realm of orchid-based medicine, while the food industry involves food scientists. In cosmetics, cosmetic chemists, and botanists play a central role. International collaboration is a common thread across these disciplines, reflecting the global nature of orchid research. Publication types vary, encompassing scientific studies, ethnobotanical surveys, patents, and product development reports, illustrating the multidisciplinary and practical dimensions of orchid applications in these sectors. Scientometric analysis in this study has also revealed the prominent trends in the utilization of orchid plants in diverse fields like medicine, food, and cosmetics.

Orchids have become a trending ingredient in the beauty industry, but their use extends far beyond cosmetics [6]. In many Asian countries, these plants have been felt great affection for over 300 years for their medicinal and health benefits [7,36]. Orchids are rich in natural polysaccharides and antioxidant phenols, making them ideal for high-end cosmetic products. They boost skin vitality, promote cell regeneration, and enhance skin health with essential minerals such as calcium, iron, magnesium, and zinc. Orchids effectively combat aging, reducing wrinkles and enhancing skin's natural coloration, elasticity, strength, and smoothness [37]. In addition to cosmetics, orchids are used in perfume making, with species such as *Oncidium ornithorhynchum, Lycaste aromatica*, and *Brassavola nodosa* in demand [38]. Orchids, such as the spotted orchid, contain protective pigments like anthocyanins, shielding against UV radiation, dehydration, and pollution. These extracts have applications in both cosmetics and medicine. Orchid trade spans various forms, from live plants to dried parts, offering a vast opportunity, although research on their importance and commercialization remains limited [39]. Orchids also serve ornamental and cultural purposes worldwide, symbolizing national identity for some countries and adorning traditional accessories [6]. Some orchids such as *Habenaria intermedia, Habenaria edgeworthii, Musa acuminata,* and *Malaxis musciferause*

for diseases such as sexual problems, gastric trouble, throat infections, fevers, and weakness. These orchid plants are found in the Northern Himalaya [40]. Some of the orchids are used in making chyawanprash which is a Health tonic/paste which is used for various health purpose in India (*Vedas*, chyawanprash), which increase the immune system and keep body warm during winter season. *Eulophia* spp. is widely used in India for its medical purpose.

Wraith *et al*. [35] have reviewed various orchid research papers and found that proper conservation must be taken for endangered orchid species. They further highlighted that orchid protection research should increasingly emphasize the distribution of species, population monitoring, adaptation to climate change, and a deeper understanding of orchid ecology, including habitat requirements and threat mitigation. To secure the survival of orchids and their ecosystems, on-the-ground orchid conservation efforts should place a greater emphasis on the preservation and sustainable management of specific orchid species and their natural habitats. The current study indicates that China has contributed majority of research on orchids during the past 20 years with increasing trend of research globally. The most efficient sources belong to "Phytotaxa," "ActaHorticulturae," and "Lankesteriana." The current study also represents the orchids research with the topics such as "orchidaceae," "orchiectomy," "nonhuman," and "pollination" were the most discussed topics in recent year. The study shows that most prominent institutions in that area. The current study also indicates that the most prominent institutions are"Fujian Agriculture and Forestry University, China," "Chinese Academy Of Sciences, China," and "National Cheng Kung University, Taiwan." The study on orchid plants is very important because there are different types of orchids which can have more medicinal and nutrients. But there are some major factors that affect the orchid plants. Some of the major factors are habitat loss, climate change, over-exploitation as well as other anthropogenic activities [41-45]. Current studies discovered new species of orchid plants, which can be revolutionary in the different commercial fields. *Spiranthes hachijoensis suetsugu*, identified as new species of the *Spiranthes sinensis*, which has been uncovered in the Japanese mainland by scientists and researchers [46]. *Dendrobium jighuanum*, a recent discovery, hails from Yunnan Province, China, and *Corybas hamiguitanensis* has been newly identified in Mindanao Island, Philippines, were reported in various research paper recently in 2023 [46-48]. Another study mentioned that the importance of the orchid plants and how they can be used as an economic source. Special attention is being paid to how to cultivate Orchid plants through experiments, how to save endangered species by applying technology and how to increase the fertility rate of orchid seeds to give mass production [49-53]. According to the IUCN Red List of Threatened Species, 1855 orchid species are currently listed. In addition, the IUCN reported the discovery of 98 new orchid species in Africa in 2021. Numerous research efforts are still underway to unravel the behavioral patterns and potential commercial applications of these newly identified species.

6. CONCLUSION

The scientometric analysis conducted in this study has greatly deepened on the understanding of orchid research trends. Through various kinds of scientometric examination, the analysis unveiled key patterns, emerging trends, and influential contributors within the orchid research landscape. These insights serve as invaluable signposts for researchers, offering a vital understanding of the present field of research and potential future trajectories [6,10,15,45]. The topics related to orchids gets significant importance from 2008. These types of plants have evolved a myriad of adaptations that contribute as key players in maintaining biodiversity and ecological balance. The earlier researches highlight how orchids act as indicators of ecosystem health by offering sustainable growth, and climate shifts [9]. Furthermore, the reviewed studies emphasize the key importance of preserving orchid habitats and their associated ecosystems. Since no study was conducted earlier on scientometric analysis of researches on orchids, thus it is quite necessary to understand the trends of the researches on orchids for the researchers. Orchids are not merely decorative flowers but integral components of ecosystems, contributing to pollination, biodiversity, and ecosystem stability. The insights gained from the reviewed research underscore the need for continued scientific investigation and conservation efforts to ensure that orchids continue to thrive and contribute to the intricate tapestry of life on Earth. This study holds important value for the individuals who deeply engaged in orchid research by featuring insights into Orchids and serving it as a resource for those interested in their economic applications.

There is an urgent need to conserve and protect the orchids and its invaluable ecosystems. These intricate and diverse plants play a vital role in maintaining balance in ecology and biodiversity. The preservation and conservation of orchids is very important not only for safeguarding a species but also for protecting entire ecosystems that rely on botanical wonders. Orchids contribute toward pollination, habitat structure, and overall ecosystem health. It is recognized for their ecological significance, and thus the urgent conservation measures are essential [18,54].

The orchid research study holds vital significance for humankind by unraveling the secrets of these exquisite blooms. Beyond their visual appeal or attractiveness, orchids contribute substantially to medicine, horticulture, and ecological balance. This study highlights the importance of orchids as medicine, utilizing orchids for therapeutic compounds. In horticulture, it guides sustainable cultivation practices. Understanding orchids' ecological value, the knowledge empowers to make informed decisions; it ensures the co-existence of orchids and humanity. Ultimately, the study's impact extends beyond academia, fostering a harmonious relationship between humankind and these extraordinary floral marvels. This study will help the policymakers, communities, and individuals to collaborate to implement robust conservation strategies, preserve existing orchids areas, and to identify the needs and trends of research globally. By incorporating findings from orchid research into policymaking, decision-makers can enact measures that balance environmental conservation, economic development, and public health, ensuring a holistic and informed approach to orchid-related matters.

7. AUTHORS' CONTRIBUTIONS

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work. All the authors are eligible to be an author as per the International Committee of Medical Journal Editors (ICMJE) requirements/guidelines.

8. FUNDING

There is no funding to report.

9. CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

10. ETHICAL APPROVALS

This study does not involve experiments on animals or human subjects.

11. DATA AVAILABILITY

All data generated and analyzed are included within this research article.

12. PUBLISHER'S NOTE

This journal remains neutral with regard to jurisdictional claims in published institutional affiliation.

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How to cite this article:
Goswami P, Bhattacharjee S, Bhattacharjee S. Global research contributions on orchids: A scientometric review of 20 years. J App Biol Biotech. 2024;12(3):268-275. DOI: 10.7324/JABB.2024.170023