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Review article

The phytomedicine trends of *Acanthus ilicifolius* a bibliometric study

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ABSTRACT

Acanthus ilicifolius is an emergent aquatic plant with potential in environmental phytotechnology. The concept of phytotechnology focuses on the role of plants as a natural technology to solve environmental problems. The plant is an herb used in traditional medicine to cure illnesses ranging from skin problems to snake bites. It contains various phytochemicals, including alkaloids and glucosides, such as lignan and phenylethanoid. Therefore, this study aims to map *Achantus ilicifolius* extract using the bibliometric method. A bibliometric investigation was adopted through metadata planning with the keywords "Acanthus ilicifolius AND extract" from Scopus Database (1997-2021). Metadata is stored in CSV and BibTex types. Furthermore, CSV format of Scopus metadata for analysis using the counting method on VOS viewer and R-Package with a maximum number of 25 documents. Mapping results showed that the number of publications related to the *Acanthus ilicifolius* extract experienced a fluctuating trend, most occurring in 2014 and 2021. Most articles relating to *Acanthus ilicifolius* extract were published in the Journal of Ethnopharmacology. The three most prolific studies were conducted by Ramanathan T, while Babu BH (2001) is the most cited. Studies on *Acanthus ilicifolius* extract with a fairly high density included Aedes aegypti, phytochemicals, antimicrobial, and antibacterial activity. Meanwhile, the rarely investigated themes include immunity, target proteins, EDTA, anthelmintic, and INOS inhibitory.

Keywords: *Acanthus ilicifolius*, Phytomedicine, Bibliometric, Vos viewer, R-Package.

INTRODUCTION

Herbal medicines, often known as phytomedicines, are combinations of plant metabolites containing pharmacologically active chemicals with therapeutic effects. Phytomedicines contain a wide range of biological actions, which explains their widespread use since antiquity. Some plant parts used in phytomedicines include leaves, bark, tubers, roots, herbs, and plant extracts. These parts secrete alkaloids, terpenes, phenolic chemicals, glycosides, basic, and secondary metabolites. The therapeutic preparations include decoction, emulsion, apozems, liniments, electroactive, and powders. The future of plant-derived medications is bright, with several opportunities to develop new and creative therapeutic procedures and products. Furthermore, the key secondary metabolites contain pharmacological effects unique to the human body [1]. Phytomedicines have played an important role since prehistoric times, and about half of the medications used in formulations currently are derived from natural sources. Due to the high lipophilicity, low water solubility, permeability, instability, rapid first-pass metabolism, and undesired molecular size, phytomedicines have excellent in vitro but poor in vivo activity. According to Shukla, R et al. [2], poor systemic availability is caused by these biopharmaceutical issues.

Acanthus ilicifolius is an emergent aquatic plant used to restore water quality. Although this species is rarely used, it is often found growing wild in nature. It has potential in environmental phytotechnology, considering the current aqua condition. Phytotechnology is a concept that focuses on the role of plants as a natural technology to solve environmental problems. *Acanthus ilicifolius* have been used for phytotechnology in a constructed wetland system with the potential to be developed on a large scale and have a cheap and easy application [3]. *Acanthus ilicifolius* Linn is a spiky herb found in Asia's tropical climates, and it is known as jeruju in Indonesia. It is a bushy, sparsely woody vine shrub with dense growth and can reach a height of 1.5 meters. The common names for this plant include sea holly, holy leaved Acanthus, and holy mangrove. It is used in traditional medicine to cure illnesses ranging from skin problems to snake bites. Furthermore, it contains various phytochemicals, including alkaloids and glucosides, such as lignan and phenylethanoid [4].

Bibliometric study is used to obtain publication data from specific topics or keywords. Information science and literature use popular bibliometrics to discover the latest study trends. It helps discover the specific trend in a country, including the currently popular topic at a time [5]. Bibliometric methods, also known as scient metrics, are part of the evaluation methodology. It is possible to carry out a bibliometric analysis of the various literatures produced using different methods [6]. Bibliometric mapping benefits the scientific community and the general public as it helps convert publication metadata into maps or visualizations, which are easier to manage for processing and gaining useful insights. For instance, visualizing keywords to identify themes or clusters in a particular discipline, mapping author affiliations of a particular journal to identify the journal's geographical scope, and mapping institutional and international collaboration as part of a framework to identify emerging technologies [7]. Information scientists use VOS viewer to analyze and map bibliographic data from the WoS and Scopus online databases. VOS viewer, on the other hand, only allows network examination and not the study using the several levels of analysis as provided by biblioshiny, namely source impact, source dynamics, document analysis, and word analysis. According to Dervis (2020), several studies highlighted the significance of R and its packages in a wide range of scientific domains [8]. R-Package, an open-source statistical programming language, is a good choice for scientific computing. Furthermore, it is an open-source ecosystem that supports statistical techniques, mathematical capability, and graphical features, making R an excellent candidate for bibliometric analysis. It runs on Windows and Linux, and its graphical user interface (R-Package) makes it accessible to users of all skill levels [9]. Therefore, this study aims to map Achantus illicifolius extract using the bibliometric method.

MATERIALS AND METHODS

The method used in this study is a bibliometric investigation through metadata planning with the keywords "*Acanthus ilicifolius* AND extract" from Scopus Database (1997-2021). Metadata is stored in CSV and BibTex types. The CSV format of Scopus metadata for analysis in VOS viewer and R-Package used the full counting method with a maximum number of 25 documents. VOS viewer is an application used to construct article maps. It describes the relationship of several articles with various views, such as mapping the zoom system, scrolling, and searching, through the text analysis function, to obtain more detailed article/publication relationships [10]. Studies were tabulated by year and number of publications per journal, the domain of specialization, the main area of interest, and citations. Two types of R-Package analysis include data and extracting networks. They enable the extraction and representation of meaningful knowledge by intuitive visualizations or maps such as bi-dimensional maps, dendrograms, and social networks. Furthermore, network analysis is used to statistically analyze the developed maps to provide multiple measurements of the overall network and metrics of the link between the clusters found.

RESULTS AND DISCUSSION

Table 1: Main Information

Description	Results
Main Information About Data	
Timespan	1997:2021
Sources (Journals, Books, etc.)	83
Documents	105
Average years from publication	9,01
Average citations per document	16,27
Average citations per year per doc	1,283
References	1
Document Types	
Article	92
Conference Paper	5
Review	8
Document Contents	
Keywords Plus (ID)	0
Author's Keywords (DE)	287
Authors	
Authors	400
Author Appearances	491
Authors of single-authored documents	2
Authors of multi-authored documents	398
Authors Collaboration	
Single-authored documents	2
Documents per Author	0,263
Authors per Document	3,81
Co-Authors per Documents	4,68
Collaboration Index	3,86

Figure 1: Annual Scientific Production

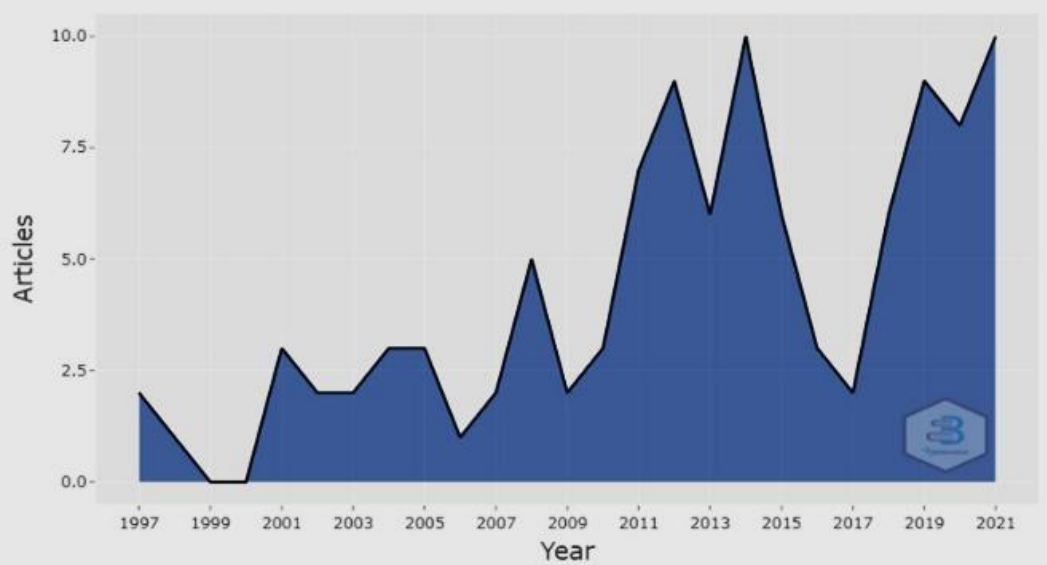
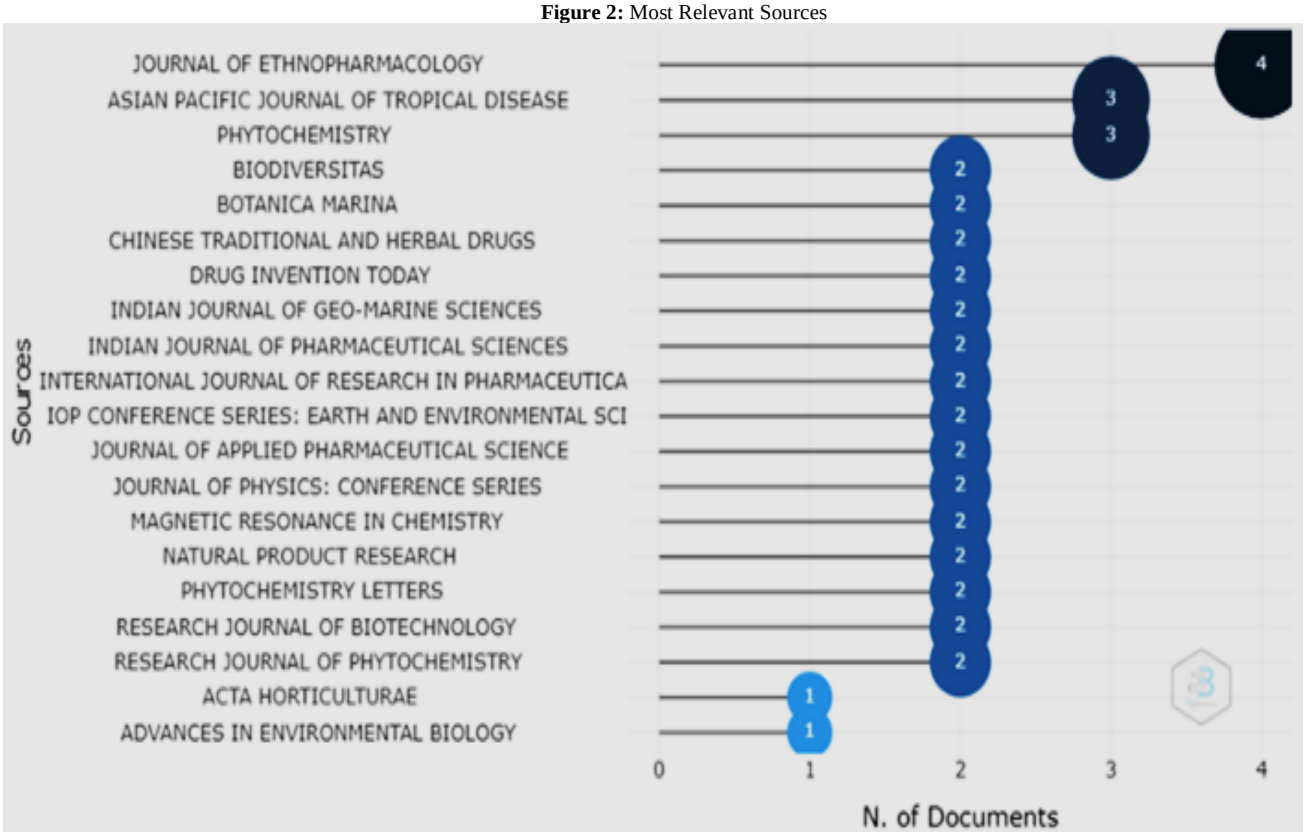


Figure 1 describes the fluctuating trend in the number of published scientific studies related to the *Acanthus ilicifolius* extract from 1997 to 2021. There was a significant spike in 2012 and peaked in 2014 and 2021. A search of 83 international journals indexed by Scopus from 1997-2021 found 105 studies related to *Acanthus ilicifolius* extract. The readability of abstracts is also insignificant in practice. The number of keywords, title, and paper length are all minor or of little practical consequence. However, abstract length is significantly associated with higher citations. More citations were associated with some aspects of collaboration, journal, and document qualities. The results provide new and very strong statistical evidence that studies should be published in high-impact journals without leaving out any key references, collaborate with many people, and create lengthy abstracts [11].

Source

Figure 2: Most Relevant Sources

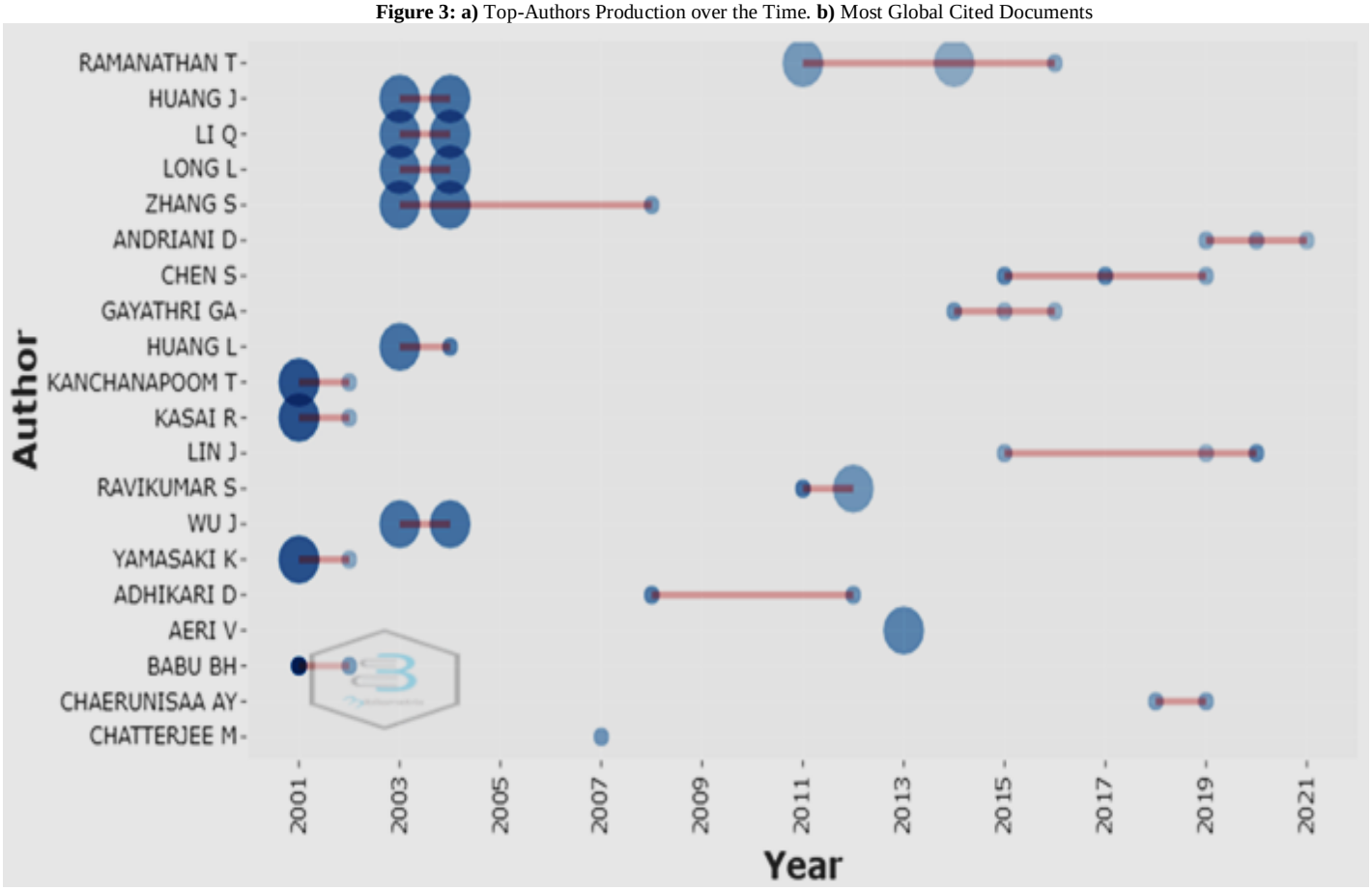


Mapping using the R-Package application found that the Journal of Ethno pharmacology was the most productive publisher of the top 20 that published the study of *Acanthus ilicifolius* extract with four articles. The Asia Pacific Journal of Tropical Disease and Phyto

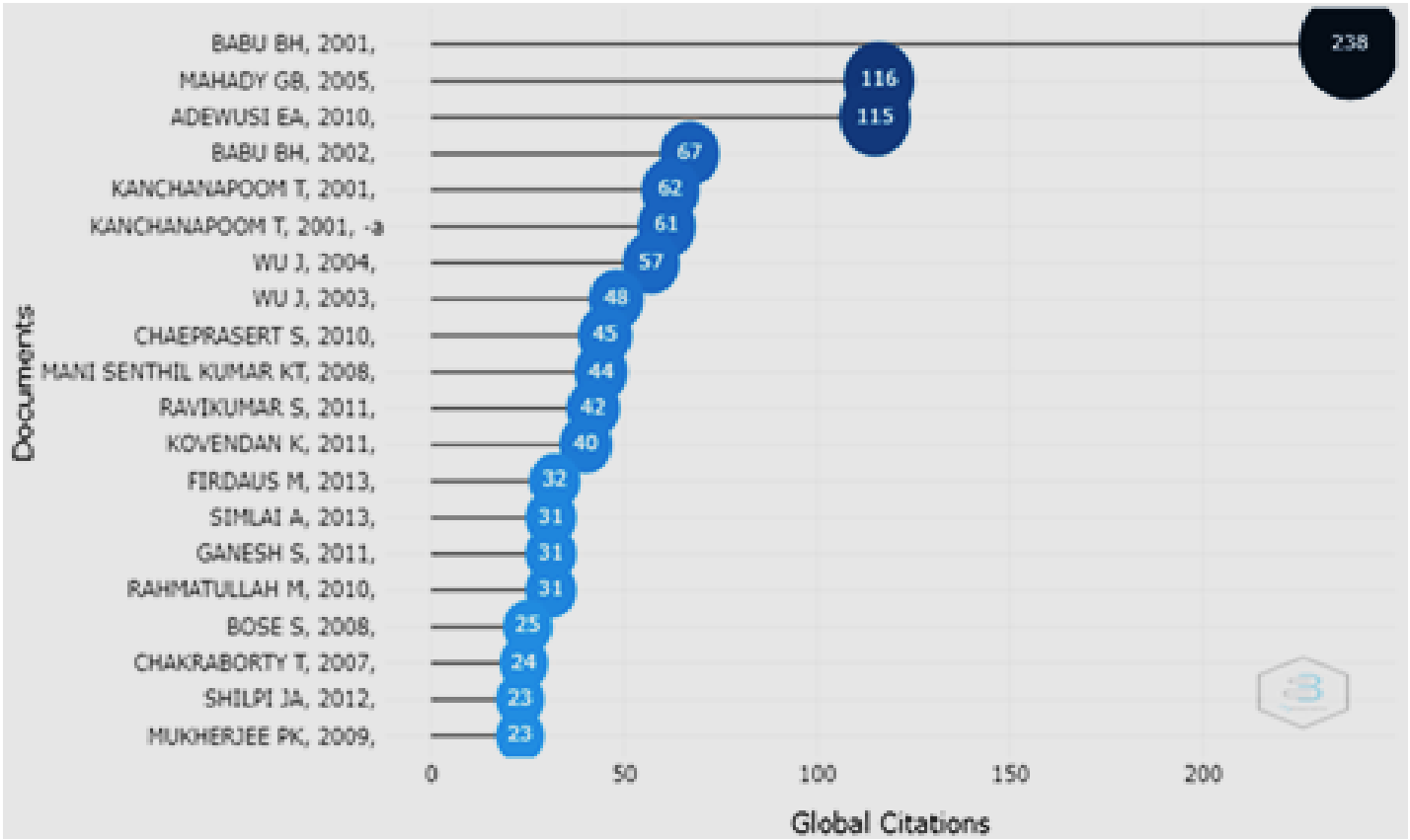
chemistry ranks second by publishing three articles for each, as shown in Figure 2.

Author Network and Collaboration

Figure 3: a) Top-Authors Production over the Time. **b)** Most Global Cited Documents

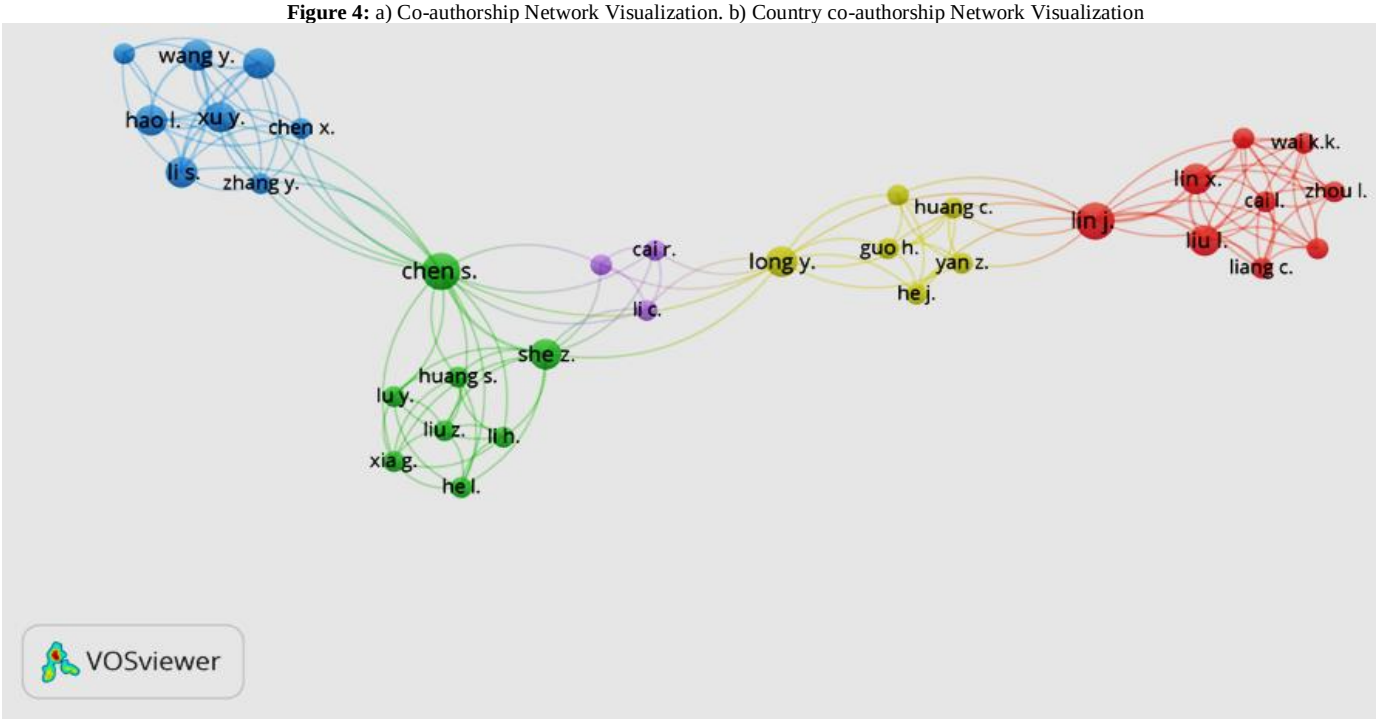


(a)

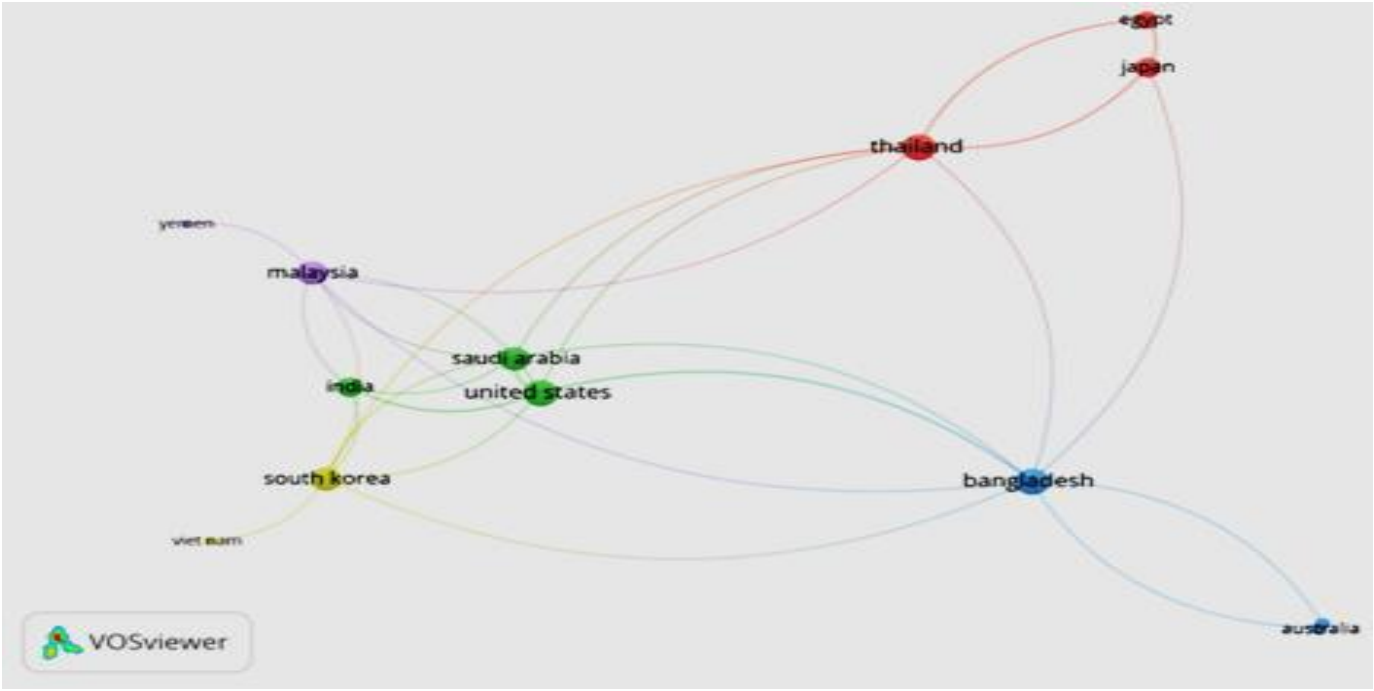


(b)

Figure 4: a) Co-authorship Network Visualization. b) Country co-authorship Network Visualization



(a)



(b)

Author productivity mapping uses the R-Package application. Figure 3a shows 20 of the most productive authors in publishing studies related to the *Acanthus ilicifolius* extract. Ramanathan T, who works at CAS in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India, is the most productive with five publications. One of Ramanathan T studies is the chemical compositions of medicinal mangrove species *Acanthus ilicifolius*, Excoecaria agallocha, Rhizophora apiculata, and Rhizophora mucronata, which has been cited 24 times [12]. The next are Huang J, Li Q, Long L, and Zhang S, each publishing four studies. However, the most cited study was written by Babu BH (2001), which was cited 238 times in Phyto therapy with the title "Antioxidant and hepato protective effect of *Acanthus ilicifolius*". The article is a finding or innovation that directly benefits the community, hence, it is widely cited, as shown in Figure 3b). The higher the citation number, the more useful the studies written and published [13]. These results

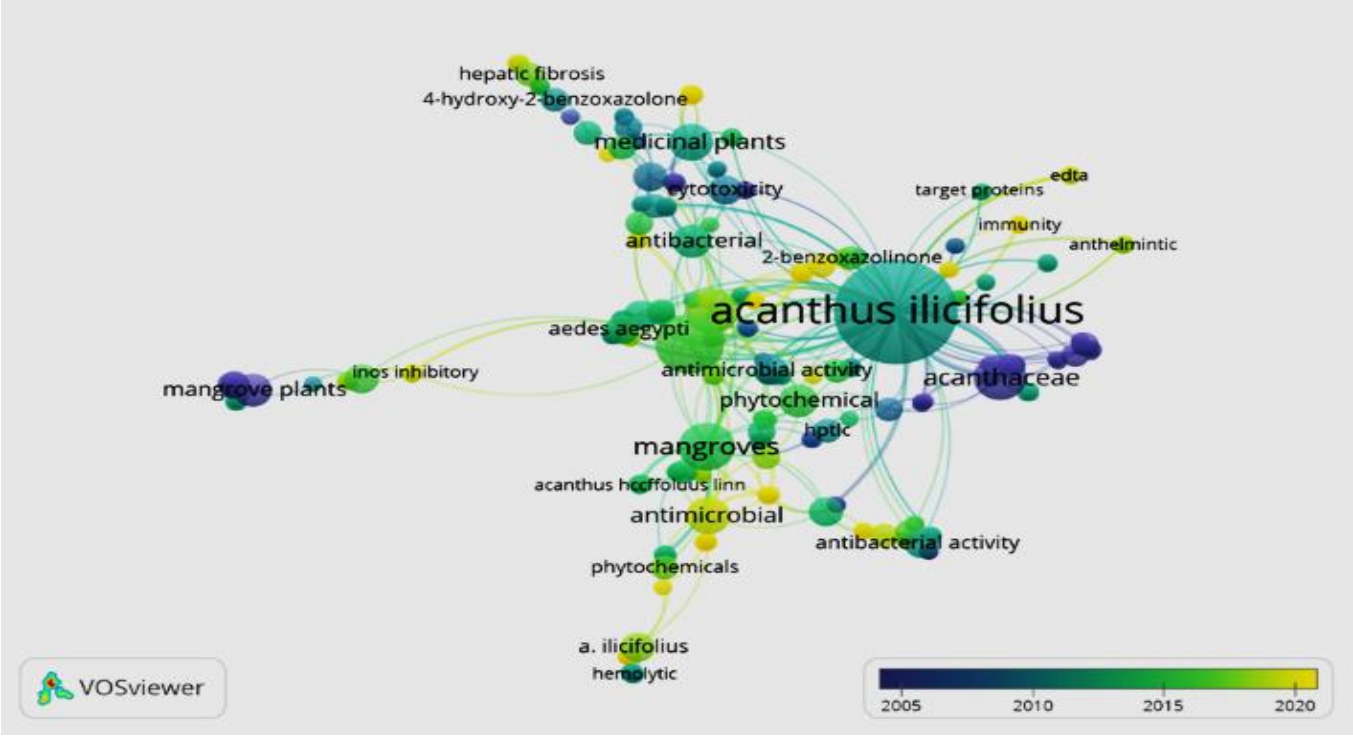
indicate that the number of studies is not directly proportional to the citations.

The VOS viewer software created a co-authorship network for each member. The minimum number of documents for an author is one, and the minimum number of citations is also one regarding data selection and thresholds. Figure 4a depicts the co-authorship network of 34 authors who meet the thresholds and 132 links. Each node represents an author, and the lines in-between reflect their relationship. The distance between two nodes reflects the strength of the relationship, with closer nodes indicating a stronger relationship. Furthermore, larger nodes are used to indicate more citations and publications. Furthermore, the Author Network Visualization mode shows a correlation between Chen S and Lin J in several scientific journal publications, as shown in Figure 4a. There are 5 clusters of 34 studies, namely cluster 1 with 9 studies, such as Cai L, Liang C, Liang Y, Lin J, Lin X, Liu L, Wai K.K, Wu H, and Zhou L. Cluster 2 contains 8 studies, including Chen S, He L, Huang S, Li H, Liu Z, Lu Y, She Z, and Xia G. Cluster 3 has 8 studies, namely Chen X, Hao L, Li S, Shang C, Wang Y, Xu Y, Zhang Y, and Zheng X. Cluster 4 consist of 6 studies, including Guo H, He J, Huang C, Long Y, Yan Z, and Zheng S. Lastly, Cluster 5 comprises 3 studies, namely Cai R, Huang X, and Li C. Each link has a strength value that indicates how many studies are co-authored [10]. The total link is the sum of the link strengths of this node over all others, and it is used as a quantitative index to describe the relationship between two objects [14].

Country co-authorship analysis is useful because it reveals the level of communication between countries and the most influential in a subject [15]. Figure 4b shows a visualization map of the nation co-authorship network overlay. The minimum number of studies and citations from a country is 1 for data selection and criteria. The thresholds are met by 13 of the 19 countries and 28 links. Furthermore, the overlay depiction is based on the average publishing year, with item colors ranging from blue with the lowest score to yellow, the highest. India, China, Bangladesh, Thailand, and South Korea are the countries with the most publications, as shown in Figure 4b. Bangladesh, Thailand, and the United States are the study centers having the most total link strength in this subject. Additionally, the node's size on this map is relative to the number of studies it contains. They have the strongest total link strength, allowing interaction and collaboration with countries and areas across the globe. Bangladesh is Asia's largest node, with ties to Japan, Thailand, South Korea, Saudi Arabia, Yemen, and Australia. This result indicated that proximity improves cooperation and collaboration in this field [5].

Keyword Network

Figure 5: Term Map Based on Publications



Mapping the development of study trends in *Acanthus ilicifolius* extract was conducted by applying the binary calculation method. The results using the network overlay visualization mode showed that most documents include *Acanthus ilicifolius* mangroves, acanthaceae, and aedes aegypti. The larger the circle, the more documents are written about the theme, as shown in Figure 5. Furthermore, there are 31 clusters of 243 items with 697 track lines. The themes that emerged in the three largest clusters were 4-hydroxy-

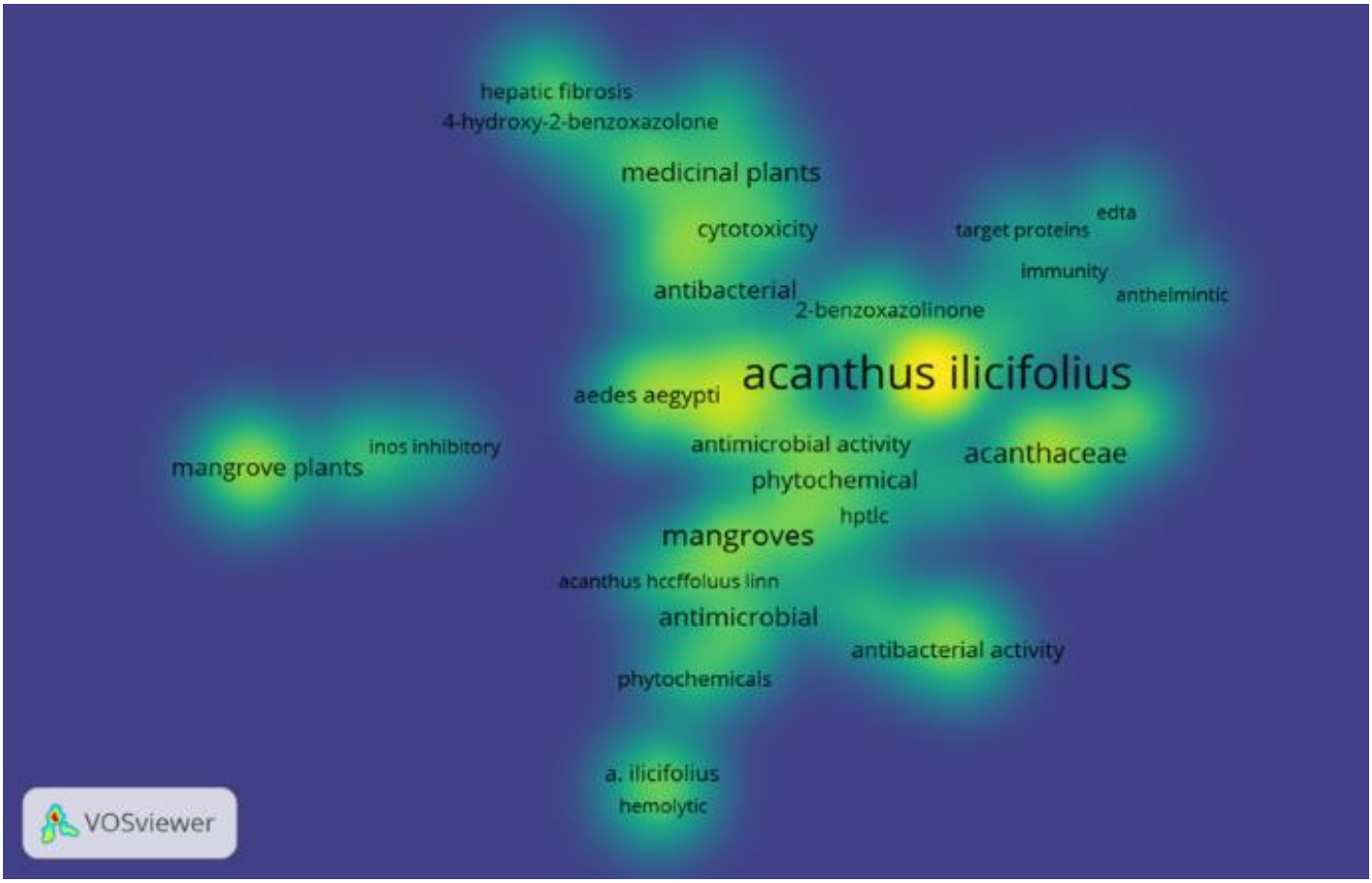
2-benzoxazolone, hepatic fibrosis, pro inflammatory cytokines, and hepatotoxicity (cluster 1). The items in cluster 2 include antibacterial, antioxidant, endophytic fungus, and phenylethanoid. Meanwhile, the items included in the third cluster are anti-nociceptive, osteoblast, and lignan glycoside themes. The bold line shows many study relationships, including phytochemicals, antimicrobials, and cytotoxicity. Thin lines and small circles indicate a weak relationship between themes, including anthelmintic, immunity, and dual inhibitors. In 2020, the study focused on the themes, including immunity, target proteins, EDTA, anthelmintic and INOS inhibitory, 2-benzoxazolinone, antimicrobial activity, hepatic fibrosis, and antibacterial activity.

Keyword Density

The VOS viewer analysis shows the density between themes in the study of the *Acanthus ilicifolius* extract. It is indicated by a thick yellow color, which indicates the number of studies and the relationship between themes. The lighter the density color, the more studies were carried out. Furthermore, the closer two terms are, the smaller their gap. Co-occurrence in texts is used to determine the relationship of terms. According to [10], an item's node grows in size as its occurrence grows. Figure 6 shows various unexplored aspects of *Acanthus ilicifolius* extract, including immunity, target proteins, EDTA, anthelmintic, and INOS inhibitory. These results indicated that novelty exists in *Acanthus ilicifolius* extract studies on these themes. One of the themes that have the opportunity to be studied is the immune modulator test, where the color is dim.

A complex web of biochemical pathways complicates the immune system. Furthermore, immunomodulation is the process of using a medicine or chemical to alter the immune response positively or negatively. Interferon-ý (IFN-ý) and steroids are two proteins, amino acids, and natural substances with a significant capacity to influence immunological responses. These compounds activate, inhibit, or modify any aspect of the immune system, including adaptive and innate immunological responses [16]. Modulation of immunological responses through a phytoextract's stimulatory or suppressive activity aids in the maintenance of a disease-free state in healthy or unwell people. Studies used various in vivo and in vitro screening approaches to establish their pharmacological activity. Furthermore, several medicinal plants enhance the immune system, but it is suppressed by others. In addition to other secondary metabolites, alkaloids, glycosides, saponins, flavonoids, coumarins, and sterols, have a wide variety of immune modulating activities. It is clear from this analysis that some medicinal plants have immune modulatory action. However, more data is needed to investigate these plants for further clinical use [17]. It is recommended that future studies on Achantus ilicifolius extract should focus more on immune modulatory agents.

Figure 6: Keyword Density Visualization



CONCLUSION

The number of publications related to *Acanthus ilicifolius* extract experienced a fluctuating trend, where most publications occurred in 2014 and 2021. Most of the studies in this topic were published by Journal of Ethnopharmacology. Furthermore, the three most prolific studies were conducted by Ramanathan T, while the Babu BH (2001) is the most cited. Studies with a fairly high density included Aedes aegypti, phytochemicals, antimicrobial, and antibacterial activity. Meanwhile, the currently understudied themes include immunity, target proteins, EDTA, anthelmintic, and INOS inhibitory.

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