



# Research Trends On Pests of Manganji Chili Plants (*Capsicum Annuum* L): A Bibliometrix Review

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## ABSTRACT

Manganji chili is a distinctive horticultural commodity from Japan with high economic value; however, the greatest challenge in its production lies in pest infestations. This study aims to analyze research trends concerning pests affecting Manganji chili plants (*Capsicum annuum* L.). The analysis was conducted using a bibliometric approach based on Scopus data, supported by VOSviewer and Bibliometrix tools. The primary focus was directed at five key pests: *Aphis gossypii*, *Scirtothrips dorsalis*, *Nezara viridula*, *Spodoptera litura*, and *Filicaulis bleekeri*. Results indicate that although the number of publications remains limited and inconsistent annually, there has been an upward trend over the past two decades, particularly in Japan, the country of origin of Manganji chili. The identification of keywords, topic clusters, and prolific authors revealed a dominant research focus on biological control and banker plant systems. This study identifies research gaps that can be leveraged to develop more effective and sustainable pest control strategies. Therefore, the findings are expected to serve as a foundation for future research and policy-making in the management of Manganji chili pests.

**Keywords:** Aphids, thrips, stink bugs, armyworms, shell-less snails

## 1. INTRODUCTION

Horticultural crops in Japan encompass a wide range of important commodities, such as vegetables, fruits, and spices, which play a significant role in the country's agricultural economy. Manganji chili (*Capsicum annuum* L.) holds an important position due to its high demand, both for domestic consumption and export. Manganji chili is a distinctive chili variety from Kyoto Prefecture, Japan, known for its unique characteristics such as larger size, thicker skin, and mild spiciness (Mimura, 2010). This chili is often used in traditional Japanese cuisine and carries high economic value.

The production of Manganji chili in Japan has great potential to meet both local and international market demands (Mimura, 2024). However, the greatest challenge in Manganji chili cultivation is pest infestation. Dominant pests such as aphids (*Aphis gossypii*), thrips (*Scirtothrips dorsalis*), stink bugs (*Nezara viridula*), armyworms (*Spodoptera litura*), and shell-less slugs (*Filicaulis bleekeri*) can reduce both the quality and quantity of yields, thereby affecting farmers'





income (Cahyono et al., 2017; Septariani & Herawati, 2019). Yield losses due to pest attacks are often more significant in monoculture chili plantations, which increases vulnerability to infestation (Arsi et al., 2021). This study aims to identify research trends related to pests affecting Manganji chili using a bibliometric approach, which enables the analysis of developments and relevance of existing studies through tools such as Bibliometrix and VOSviewer.

Although numerous studies have been conducted to understand and control these pests, there has yet to be a comprehensive review that systematically analyzes research trends on Manganji chili pests. Bibliometric analysis can provide in-depth insight into research development, researcher collaboration, and identification of knowledge gaps in this field. Therefore, this study aims to analyze research trends on major Manganji chili pests using bibliometric methods.

By applying bibliometric analysis, existing studies can be grouped, described, and mapped based on cumulative scientific knowledge, publication frequency, recent research trends, and commonly discussed topics within the context of Manganji chili pest management (Lim et al., 2024). Identifying these research trends is essential for understanding the development of sustainable pest control strategies and improving pest management efficiency in Japan. This approach not only provides a comprehensive understanding of pest diversity but also identifies gaps in pest control knowledge that require attention. By analyzing available scientific publications, this study is expected to identify research patterns, institutional collaborations, and areas requiring further investigation, thereby supporting the development of more effective and sustainable pest control strategies.

## 2. RESEARCH METHODS

### Data Source

This bibliometric analysis is based on data from Scopus, one of the largest and most credible scientific databases. The selection of Scopus was due to its extensive coverage of publications across various scientific disciplines, including agriculture and entomology (Yadav et al., 2023). The data collection period for Manganji chili pest research spans from 1981 to 2025, aiming to capture the historical and current development of research related to pests in Manganji chili cultivation. Meanwhile, the data collection period for the five specific Manganji chili pests extends from 1927 to 2025.



### Search Strategy

The literature search was conducted using the advanced search feature in Scopus by employing a combination of keywords: ("Manganji pepper" OR "Capsicum annum" OR "Japanese sweet pepper") AND ("pest" OR "insect pest") AND JAPAN, as well as individual pest-specific keywords: ("Manganji pepper" OR "Capsicum annum" OR "[Latin name of the pest]") AND "Japan." This process aimed to identify relevant publications from various years and journals published worldwide. After retrieval, the data were screened based on predetermined criteria set during the preparation phase. Relevant data were then grouped according to pest type, control techniques used, and the researcher's geographical affiliation.

### Bibliometric Tools

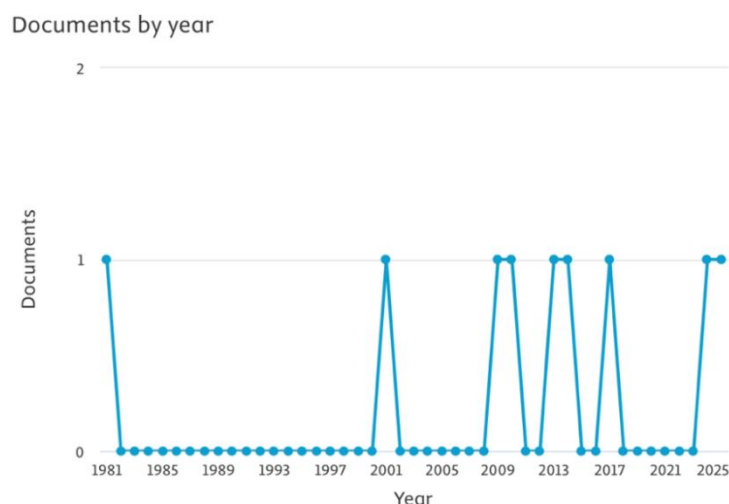
Two bibliometric tools were used for data analysis: VOSviewer and Bibliometrix. Bibliometrix was employed to collect and analyze the relevant publications, while VOSviewer was used to visualize the network of relationships between publications and the mapping of keyword occurrences. In Bibliometrix, the researchers analyzed the publication frequency related to Manganji chili pests and the five major pests. This analysis aimed to identify periods with the highest publication rates and observe the development of research trends over the years. Meanwhile, VOSviewer was used to visualize the relationships among authors or institutions actively engaged in Manganji chili pest research. The visualization of keyword networks using VOSviewer helped illustrate the connections between trending topics in the existing literature (Sawangproh et al., 2025). This process also enabled the identification of research gaps and provided recommendations for future studies, supporting the formulation of more effective pest control strategies.

## 2. RESULTS AND DISCUSSION

### Global Publication Trends (1981–2025)

An analysis of research article trends on Manganji chili pests published in the Scopus database from 1981 to 2025 is presented (Figure 1). In 1981, the first article addressing the topic appeared, discussing the cytogenic effects of two insecticides, BHC and Nuvacron, on chili plants (*Capsicum annum* L.) (Reddy & Rao, 1979). From 1982 to 2000, no articles were published, likely due to a lack of interest in the topic. In 2001, a new article emerged. Between 2008 and 2025, a fluctuating pattern was observed—articles were not published every year, but began to

appear more regularly. However, the number of articles never exceeded one per year, indicating that although the topic is specific and important, the volume of research remains limited. Research interest in Manganji chili pests in Japan is notably scarce. Nevertheless, over the past two decades, there has been a gradual increase in attention to this topic, albeit not significantly in terms of volume. This indicates a promising research opportunity, as many aspects remain unexplored and merit deeper investigation.



**Figure 1.** Research trends in the field of Manganji chili pests, based on the number of publications indexed in the Scopus database from 1981 to 2025.

### Global Research Findings

The global research findings on Manganji chili pests (Figure 2) present the global publication rankings on this topic as indexed in the Scopus database from 1981 to 2025. Japan ranks first with the highest number of contributions, totaling 15 publications. This indicates that Japan is highly active in conducting research on Manganji chili pests, which is understandable given that the Manganji chili originates from Japan. In second place is South Korea with 3 publications, suggesting a growing interest or scientific collaboration with Japan. Additionally, India has contributed 1 publication, indicating that research on Manganji chili pests has begun to attract attention in other Asian countries, albeit still in limited numbers.

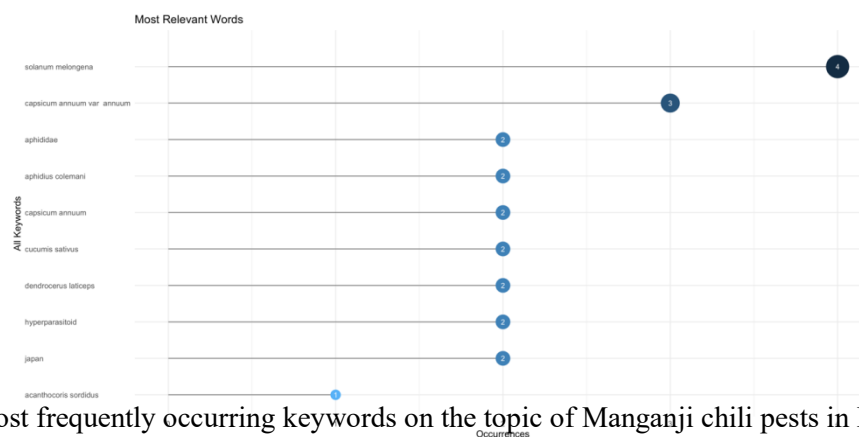
Country Scientific Production



**Figure 2.** The blue-shaded map in Bibliometrix illustrates each country's scientific output on Manganji chili pests, with darker shades indicating higher publication output and lighter shades indicating lower contribution.

### Keywords Related to Manganji Chili Pests

This chart presents the most frequently occurring keywords found in a collection of scientific articles relevant to the topic of Manganji chili pests. The chart shows that the term "Solanum melongena" appears most frequently, with four occurrences. This indicates that in addition to Manganji chili, eggplant is also often studied in a similar context—for example, in articles discussing whitefly pests tested on various plants, including *Solanum melongena* (Iida et al., 2009). Furthermore, the keyword "*Capsicum annuum* var. *annuum*", which refers to a variety of chili plant, appears three times. This reinforces the fact that Manganji chili belongs to this variety, making it one of the central focuses of the research. In addition, keywords such as *Aphididae* and *Aphidius colemani* also appear, both of which are considered significant pests associated with Manganji chili cultivation.



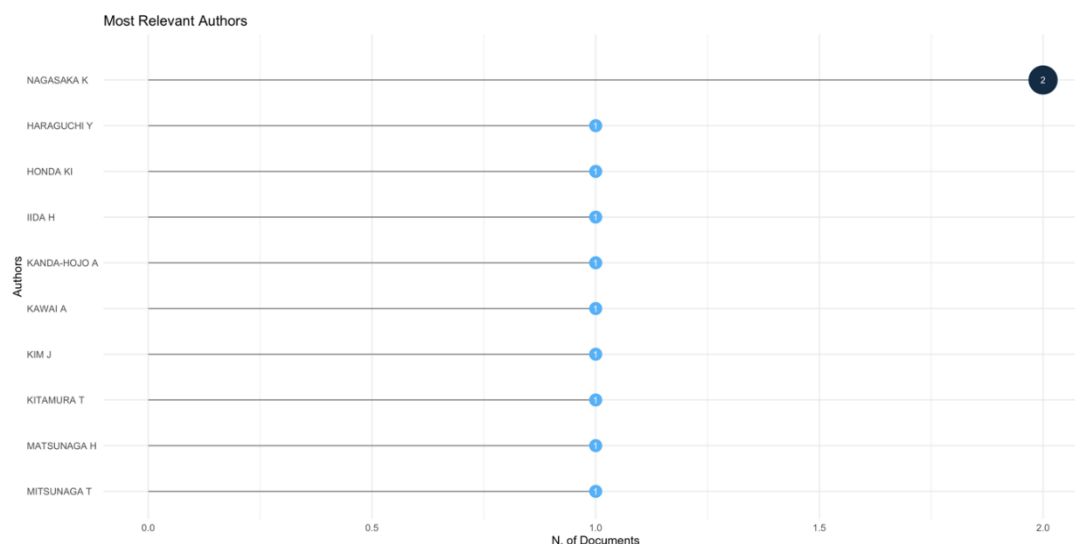
**Figure 3.** Most frequently occurring keywords on the topic of Manganji chili pests in Bibliometrix.





### Productive Authors on Manganji Chili Pests

Figure 9 presents a list of the most relevant authors or researchers in the field of Manganji chili pest research. Nagasaka K is identified as the most prolific author, having published two articles on this topic. The first article discusses the impact of secondary parasitism on the success or failure of banker plant systems in controlling aphids (*Aphidius colemani*) in greenhouse environments (Nagasaka et al., 2010). The second article continues the discussion on banker plant systems, focusing on the biological characteristics and parasitism capacity of *Dendrocerus laticeps*, a major secondary parasitoid of *Aphidius* spp. in banker plant systems for aphid control in Japanese greenhouses (Takayuki Mitsunaga, 2014). This indicates that Nagasaka K is one of the key contributors in Manganji chili pest research. Additionally, there are ten other authors—such as Haraguchi Y, Honda KI, Lida H, Kanda Hojo A, and Kim J—each of whom has authored one article. Although each contributed only a single publication, they are still considered relevant, as their work is directly related to the topic of Manganji chili pests and has made a meaningful impact in the field of pest research.

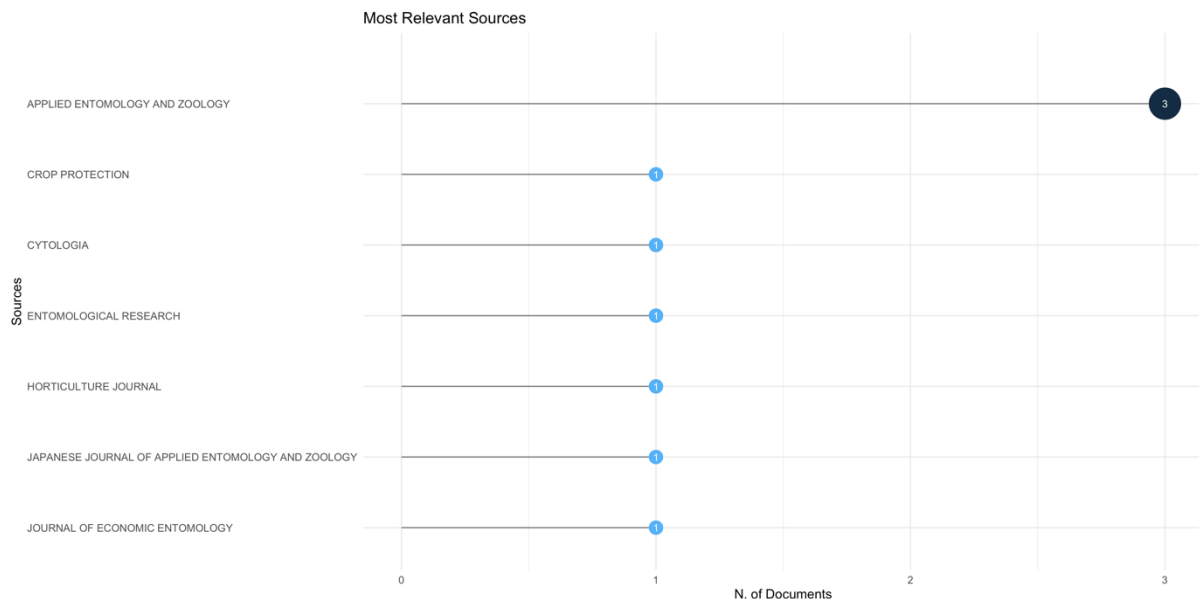


**Figure 5.** Most contributing authors in the field of Manganji chili pest research.

### Leading Journals in Manganji Chili Pest Research

Figure 10 presents the top seven Scopus-indexed journals that have published articles on Manganji chili pests. The journal names are displayed vertically, while the number of articles is shown horizontally. Applied Entomology and Zoology is the journal with the highest number of

publications on this topic, with a total of three articles. Other journals such as Crop Protection, Cytologia, Entomological Research, and others have each published one article.



**Figure 6.** Journals with the highest number of articles on Manganji chili pest research in the Scopus database.

Based on the mapping results in Bibliometrix, and to strengthen the existing data, the authors identified the five main pests through observations conducted in Fukuchiyama, Kyoto, Japan. These pests are the armyworm (*Spodoptera litura*), thrips (*Scirtothrips dorsalis Hood*), stink bug (*Nezara viridula*), shell-less slug (*Filicaulis bleekeri*), and cotton aphid (*Aphis gossypii*). Therefore, a bibliometric analysis for each of these pests is necessary.

### Annual Scientific Production on Manganji Chili Pests

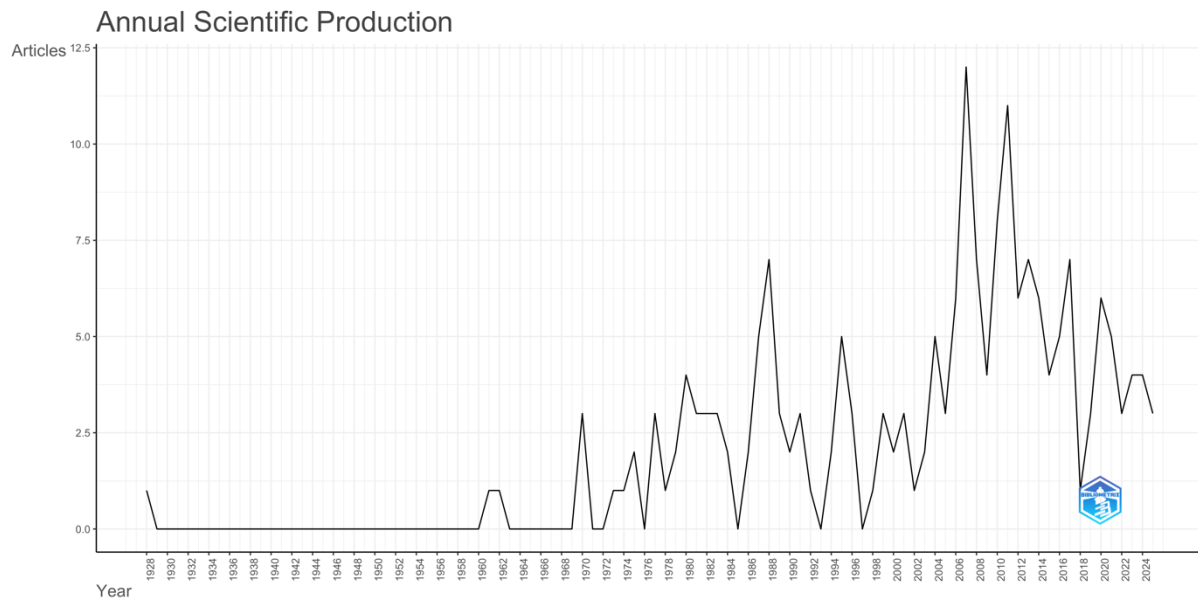
#### Cotton Aphid (*Aphis gossypii*)

During the early period from 1928 to the 1960s, there was virtually no publication activity, with only one article recorded around 1972. This indicates that the topic had not yet attracted much research interest or had not been scientifically documented at that time. From the 1970s to the 1990s, a gradual increase in publications began to emerge. Several small peaks were observed, particularly in 1988, which saw five articles published—reflecting a growing but still inconsistent interest in *Aphis gossypii* research. The period from 2000 to 2015 marked a peak phase in research activity. In years such as 2008 and 2010, scientific production reached nearly 12 articles per year,





indicating a significant rise in scholarly attention, likely due to the increasingly evident impact of *Aphis gossypii* on agriculture, especially on Manganji chili. From 2016 to 2024, there was a noticeable fluctuation and overall decline in publication output; however, research continued to be published annually. In 2021, a sharp decline occurred, likely as a result of the COVID-19 pandemic, but publication numbers began to recover slightly in the following years.

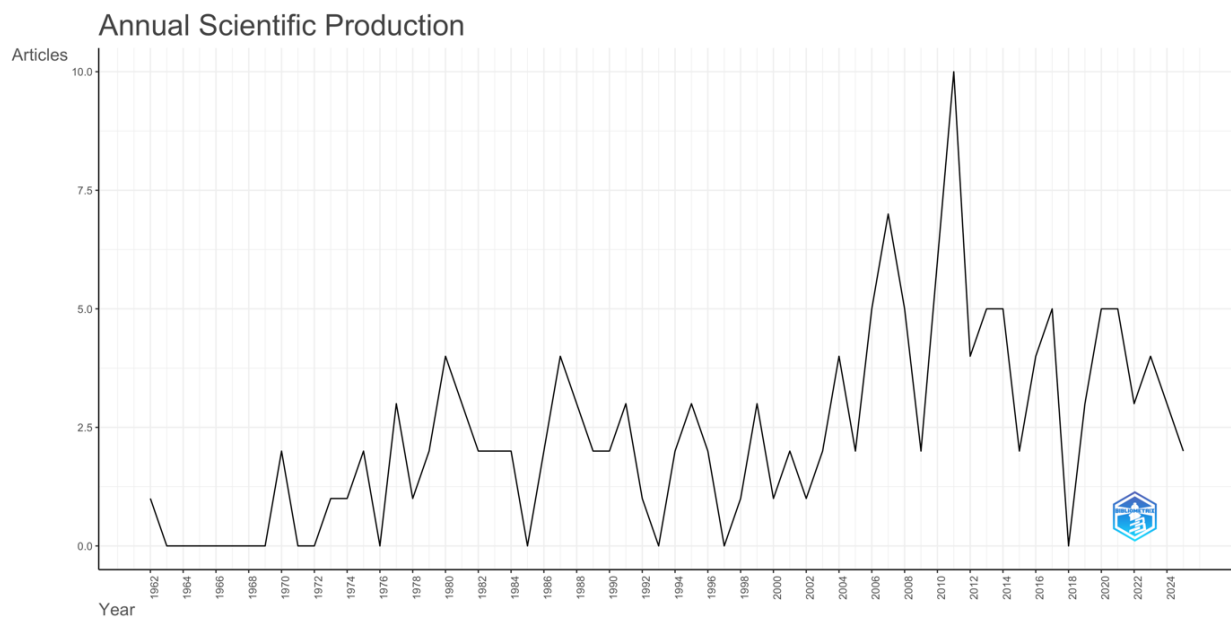


**Figure 7.** Annual Scientific Production on *Aphis gossypii* as a Pest of Manganji Chili

### **Thrips (*Scirtothrips dorsalis* Hood)**

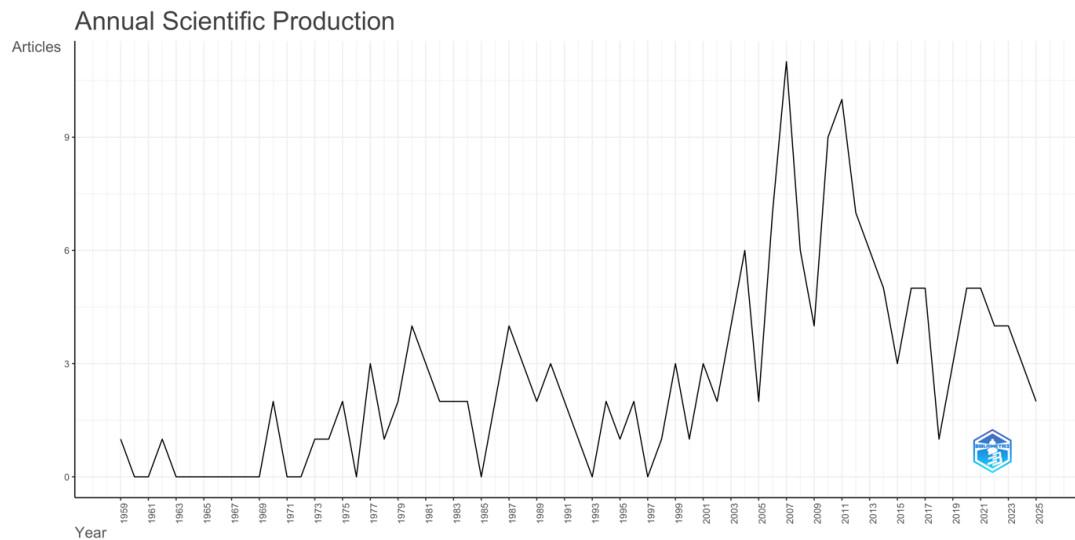
From 1962 to the early 1990s, the number of publications on *Scirtothrips dorsalis* was very low and inconsistent, with only 1 to 2 scientific articles published per year—and not every year. This indicates that during the early period, research on *Scirtothrips dorsalis* was not a primary focus and remained quite limited. Between 1990 and 2005, the publication rate began to stabilize with a gradual increase. Although still fluctuating, the number of articles per year ranged from 2 to 4, suggesting a growing scientific interest in this pest. The period from 2006 to 2015 marked the peak of research activity, with a significant increase in the number of publications. The highest point occurred around 2010, with nearly 10 articles published in a single year. This surge was likely due to a growing body of literature discussing the pest's impact on crop yields, along with the development of better pest identification and management technologies. From 2016 to 2025, the number of articles showed a declining and unstable trend. Notably, in 2018, there were no recorded publications. However, in the following years, a slight resurgence was observed. This

may suggest that key aspects of this pest have already been extensively studied, or that research focus has shifted toward other pests or newer approaches, such as integrated pest management



**Figure 8.** Annual Scientific Production on Scirtothrips dorsalis Hood as a Pest of Manganji Chili Stink Bug (*Nezara viridula*)

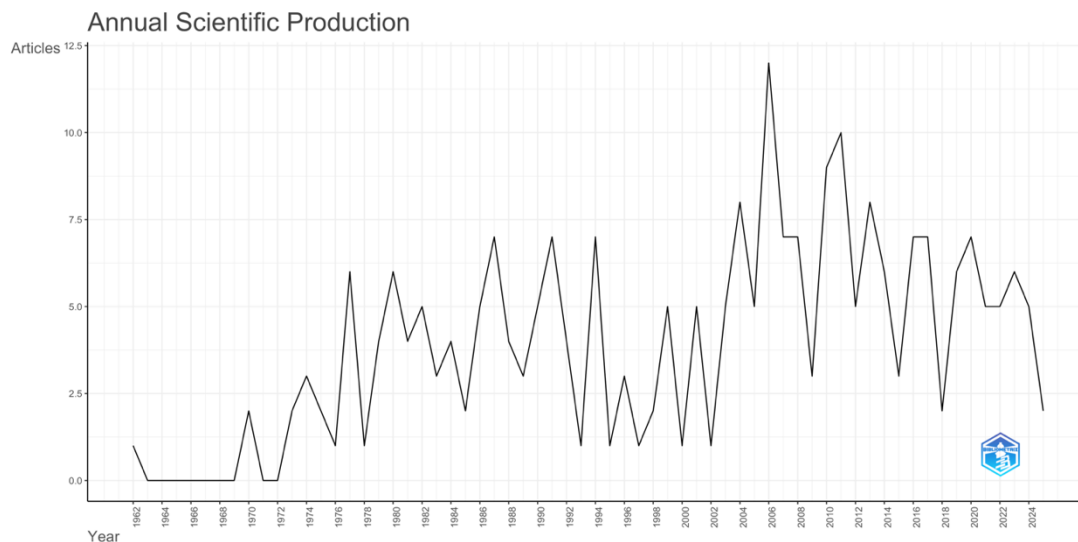
Between 1959 and 1980, publications on *Nezara viridula* were very limited and inconsistent. During this period, typically only two articles were published per year, indicating that stink bugs had not yet attracted significant research attention. From 1980 to 2000, the number of publications gradually increased, though fluctuations remained. Specific years such as 1981 and 1987 saw spikes of 3 to 4 articles, reflecting a growing interest in research on *Nezara viridula*. Between 2004 and 2011, the number of publications peaked, with the highest output reaching up to 10 articles in a single year (around 2006), followed by other high-output years such as 2008 and 2010. These years marked the peak of scientific attention to this pest, likely driven by the severe damage caused by the green stink bug and the growing focus on biological control or more effective pesticide research. From 2011 to 2025, the chart indicates a decline and instability in publication numbers. Although the number of articles remained relatively stable between 2013 and 2021—averaging around 3 to 5 per year—a noticeable decrease occurred in the subsequent years.



**Figure 9.** Annual Scientific Production on *Nezara viridula* as a Pest of Manganji Chili

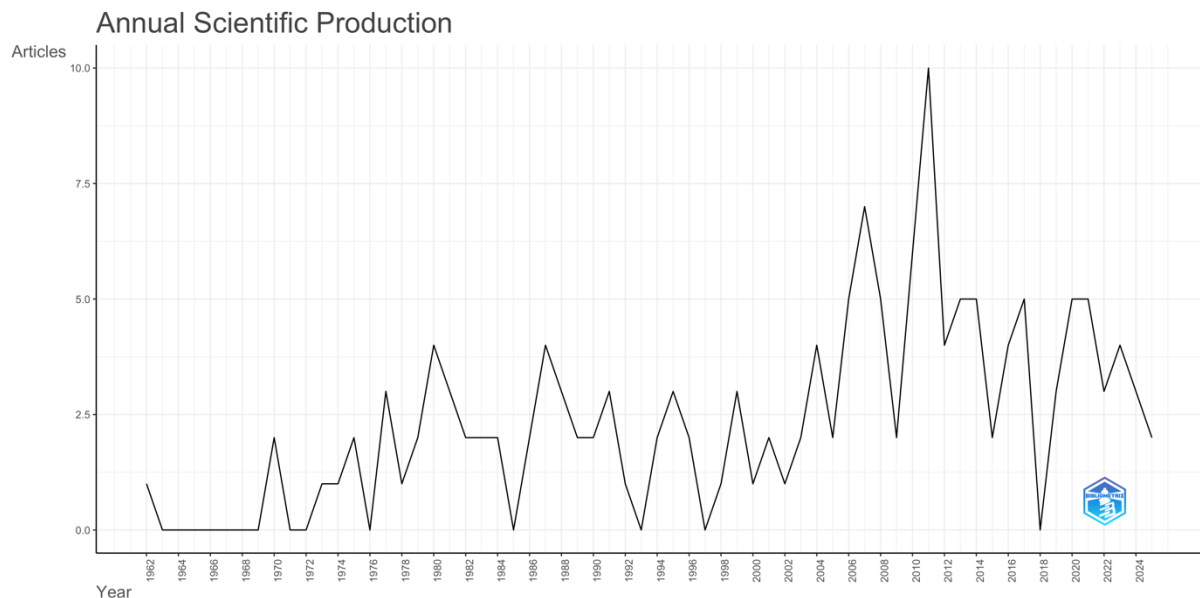
#### **Armyworm (*Spodoptera litura*)**

During the early period from 1962 to 1975, publication activity was very low, with most years recording zero articles. This indicates that *Spodoptera litura* was not yet a primary focus among researchers. From 1976 to 1990, the number of publications began to rise gradually, although fluctuations persisted. Notable increases occurred in 1977 and 1980, with around six articles published each year—marking a growing early interest in the topic. From 1990 to 2003, there was a steady increase, with publication numbers ranging consistently from 3 to 7 articles per year. The topic started gaining importance due to increasing crop damage caused by armyworms. The peak of research activity occurred between 2004 and 2012, with the highest point around 2006, when the number of publications approached 12 articles per year. This reflects the height of scientific interest, as *Spodoptera litura* began receiving more focused attention. From 2013 to 2025, a gradual decline and stabilization occurred. After 2012, the chart shows a steady decrease, yet the number of publications remained stable within the range of 3 to 7 articles per year. In recent years, particularly from 2020 to 2022, moderate publication levels were recorded, while 2025 shows a slight decline once again.



**Figure 10.** Annual Scientific Production on *Spodoptera litura* as a Pest of Manganji Chili Shell-less Slug (*Filicaulis bleekeri*)

In the early period from 1962 to 1980, the number of publications was extremely low and tended toward zero in most years, indicating minimal research activity. This suggests that the topic had not yet gained attention in horticultural studies or that its impact on Manganji chili had not been recognized. A gradual increase began between 1980 and 1995, although the trend remained fluctuating. Some years, such as 1981 and 1986, showed slight spikes, indicating early interest in the topic. From 1995 to 2008, a significant upward trend in research activity emerged, especially after the year 2000. The peak occurred in 2009, with the number of publications reaching 10 articles, demonstrating that *Filicaulis bleekeri* was beginning to be recognized as an important pest, likely due to its tangible impact on crop yields. Between 2010 and 2025, a decline in publication numbers was observed following the peak, although activity remained relatively stable, ranging from 3 to 5 articles per year. In 2018, a sharp drop occurred, with almost no publications recorded, but research output recovered in the subsequent years. In the most recent years, from 2021 to 2024, research activity has continued, although with a slight downward trend.



**Figure 11.** Annual Scientific Production on *Filicaulis bleekeri* as a Pest of Manganji Chili

#### 4. CONCLUSION

Based on the bibliometric analysis of research trends on Manganji chili pests, the number of publications per year remains relatively limited; however, a gradual increase has been observed since the 2000s. Japan dominates this research field with the largest contribution, followed by South Korea and India, indicating that the topic remains highly specific and localized. The five main pests frequently studied in relation to Manganji chili are the armyworm (*Spodoptera litura*), thrips (*Scirtothrips dorsalis* Hood), stink bug (*Nezara viridula*), shell-less slug (*Filicaulis bleekeri*), and cotton aphid (*Aphis gossypii*), all of which show fluctuating yet important trends in global research. Keyword analysis and visualizations using VOSviewer identified four main research clusters: chemical control and resistant cultivars, banker plant systems, regional focus on Japan, and studies on pest reproduction. The most productive authors and journals are predominantly based in Japan, indicating that the country remains the central hub for research on this topic. Significant research gaps remain, particularly in the areas of integrated pest management effectiveness, pest genetic diversity, and adaptation to climate change—each of which should be prioritized in future studies. It is recommended that future efforts focus on expanding international collaboration and exploring environmentally friendly and sustainable pest control approaches.

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