Turkish Journal of Forestry | Türkiye OrmancılıkDergisi
2024, 25(1): 118-128 | Research article (Araştırmamakalesi)

Bibliometric profile of graduate theses regarding “Medical and aromatic plants” in Türkiye

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Abstract: In this study, it is aimed to reveal the bibliometric profile of graduate (master's and doctorate) studies written on "Medical and Aromatic Plants" in Türkiye in terms of various criteria. For this purpose, the thesis search engine of the Council of Higher Education (CoHE) was searched with the keywords "medical and aromatic plants, aromatic plants and medical plants” in Turkish. As a result of the scanning, 149 graduate theses were identified and 7 of these theses are not open to access. Of the 142 theses, 118 are master's thesis, 23 are doctoral thesis, and 1 is a specialization in medicine. 42% of the graduate theses were conducted under the advisor of professors. The theses were written in many different universities and departments. It has been determined that biology is the subject most covered in graduate theses. Four graduate theses were written in English. 36% of the graduate theses used between 51-100 references. Foreign references were used more in the majority of theses. 77% of the theses were written in the range of 51-150 pages. Quantitative method was used as a method in the majority of theses. In terms of keywords, there is not keywords were used in 8 theses. The most frequently used keywords are medicinal plant(s), medicinal and aromatic plant(s) and aromatic plant(s), respectively. This study guides scientists who want to work on medicinal and aromatic plants.
Keywords: Bibliometrics, Doctoral, Medical and aromatic plants, Master

Türkiye'deki “Tıbbi ve aromatik bitkiler” konulu lisansüstü tezlerin bibliyometrik profili

Özet: Bu çalışmada, Türkiye'de "Tıbbi ve Aromatik Bitkiler" üzerine yazılan lisansüstü (yüksek lisans ve doktora) çalışmaların çeşitli kriterler açısından bibliyometrik profilinin ortaya konulması amaçlanmıştır. Bu amaç doğrultusunda Yükseköğretim Kurulu'nun (YÖK) tez arama motorunda Türkçe "tıbbi ve aromatik bitkiler, aromatik bitkiler ve tıbbi bitkiler" anahtar kelimeleri ile arama yapılmıştır. Yapılan tarama sonucunda 149 adet yüksek lisans tezi tespit edilmiş ve bu tezlerden 7'si erişime açık değildir. 142 tezin 118'i yüksek lisans tezi, 23'ü doktora tezi ve 1'i tıpta uzmanlık tezidir. Lisansüstü tezlerin %42'si profesörlerin danışmanlığında yürütülmüştür. Lisansüstü tezlerin farklı üniversite ve bölümlerde tamamlanmıştır. Lisansüstü tezlerinde en çok biyoloji konusunun işlendiği tespit edilmiştir. Tezlerden sadece dört adet yükseklisans tezi ingilizce olarak yazılmıştır. Lisansüstü tezlerin %36'sında 51-100 arası referans kullanılırken, tezlerin çoğunluğunda yabancı referanslardan daha fazla yararlanıldığı belirlenmiştir. Tezlerin %77'si 51-150 sayfa aralığında yazılmıştır. Tezlerin büyük çoğunluğunda nicel yöntem kullanılmıştır. Anahtar kelime açısından 8 tezin özetinde anahtar kelime kullanılmamıştır. En sık kullanılan anahtar kelimeler ise sırasıyla tıbbi bitki(ler), tıbbi ve aromatik bitki(ler) ve aromatik bitki(ler)dir. Bu çalışma tıbbi ve aromatik bitkiler üzerinde çalışmak isteyen bilim insanlarına yol göstermektedir.
Anahtar kelimeler: Bibliyometri, Doktora, Tıbbi ve aromatik bitkiler, Yüksek lisans

1. Introduction

A medicinal plant is any plant that contains substances in one or more of its organs that can be used for therapeutic purposes or are precursors in the synthesis of useful drugs (Sofowora et al., 2013). Aromatic plants are defined as plants that have a pleasant smell and taste. These two concepts, which differ in terms of function and use, have started to be mentioned together as medicinal and aromatic plants in recent years (Temel et al., 2018; Boztaş et al., 2021). Medicinal and aromatic plants are botanical raw materials, known as herbal medicines that mostly used for therapeutic, aromatic and/or culinary purposes (Devika, 2021). They are used for many purposes such as nutrition, sanitation, cosmetics, incense, taste, fragrance and spices (Pakdemirli et al., 2021).

There are 422 000 known flowering plant species in the world, and 72 000 of these are medicinal and aromatic plant species.The highest number of medicinal and aromatic plant species is China with 4 941, followed by India with 3 000, the USA with 2 564, Vietnam with 1 800, Malaysia with 1 200 and Indonesia with 1000 (Schippmann, et al., 2002; Schippmann, et al., 2006). More than 2 000 medicinal and aromatic plants are used for different purposes in Europe. The main source countries of these plants are Bulgaria, Poland, Hungary and Türkiye (Güney, 2019). Türkiye is

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✓ **Received** (Geliştarihi): 29.10.2023, **Accepted** (Kabul tarihi): 01.02.2024

Citation (Atıf)**:**Ersen, N., Akyüz, İ., 2024. Bibliometric profile of graduate theses regarding "Medical and aromatic plants" in Türkiye. Turkish Journal of Forestry, 25(1): 118-128.
DOI: 10.18182/tjf.1382731

very rich in terms of flora, with 174 families, 1251 genera and approximately more than 12 000 species and subspecies (Aktop and Çağatay, 2022). It is known that out of 500 plant species used in Türkiye and having economic importance, approximately 200 plant species have export potential (DOKAP, 2020).

In addition, medicinal and aromatic plants contribute to both the country's economy and the welfare of forest villagers. The annual market value of medicinal and aromatic plants in the world is approximately 110 billion USD and according to the World Health Organization (WHO) report, this value is estimated to be 5 trillion USD by 2050 (Çelik and Gül, 2022). China and India are the leading exporting countries (Karık and Tunçtürk, 2019). Thyme, poppy, anise, sage, red pepper and cumin are the most preferred medicinal and aromatic plants in world trade (Can, 2021). Türkiye exports medicinal and aromatic plants worth at least 100 million US dollars annually (Özkan, 2019). Medicinal and aromatic raw plants and processed semi-finished products are exported from Türkiye to nearly 100 countries. Among these countries, the USA, Canada, Vietnam, Germany, the Netherlands, Brazil, Italy, Belgium, France, Spain and Poland are at the top of the list. The medicinal and aromatic plants that Türkiye exports the most are thyme, bay leaf, cumin, anise, sage, carob, fennel, licorice and mint, respectively (DOKAP, 2020).

Universities are the most important institutions in acquiring scientific knowledge and ensuring the development of society. Scientific information produced as a result of research at universities contributes to the country socially and economically (Haydaroğlu, 2022; Yağmuroğlu and Per, 2022). The graduate education process contributes to these responsibilities of universities. Graduate education provided by universities contributes to the training of experts in a certain branch of science and future academics. The studies carried out during postgraduate education have an important place in the production of scientific knowledge. Graduate theses reveal the development, change and trends of a subject in a certain field (Haydaroğlu, 2022).

The development and trends of an academic field can also be determined by analyzing the publications and graduate studies carried out in that field. Analyzing graduate theses written in a field allows us to have more detailed information about the depth and prevalence of that field. It also allows us to reveal the general view of the subject under investigation. Such studies are called bibliometric analysis in the literature (Karadağ, 2009; İnceoğlu, 2014). Bibliometric analysis is an approach that uses a range of quantitative methods to measure, track and analyze scientific literature. With bibliometric studies, publications by authors, prominent journals, methodologies used and results obtained are identified (Rojas-Sanchez et al., 2023).

As a result of the literature review, no study was found regarding the bibliometric profile of master's and doctoral theses published on medicinal and aromatic plants in the national literature. With this study, bibliometric analysis used in different subjects and disciplines will be applied to graduate theses on medicinal and aromatic plants in Türkiye. When the study is evaluated from this perspective, this deficiency in the literature will be tried to be eliminated and this study will support new research on medicinal and aromatic plants.

When studies using the bibliometric analysis method on documents in the field of medicinal and aromatic plants are examined in international literature, it is seen that the documents are mostly based on publications indexed in Web of Science or Scopus. Studies on the bibliometric analysis of documents (article, review, conference paper, book, etc.) published on medicinal and aromatic plants are summarized in Table 1.

Table 1. Some of the bibliometric analysis studies of documents on medicinal and aromatic plants in the literature

Author-year	Purpose of the study
Alarcon-Ruiz et al. (2023)	Scientific production of medicinal plants in the Latin American and Caribbean region was identified using bibliometrics and common word analysis for 14 397 articles published between 1970 and 2020. Data were retrieved from Web of Science, Scielo and LILACS databases.
Leechon and Kabmala (2023)	741 research articles published between 2004 and 2022 on medicinal plants for cosmetic purposes were examined using the bibliographic analysis method.
Trivedi et al. (2022)	The 100 most cited articles related to medicinal plants research are determined by the Web of Science database and a bibliometric analysis of 100 articles is performed using VOSviewer software.
Seo et al. (2022)	463 published articles on the use of herbal medicines in obesity research were analyzed using bibliometric method. For this research, the search terms "herbal" and "obesity" were used in the Web of Science database.
Rohit (2022)	The medicinal plant research results of Indian scientists from 2012 to 2021 were examined with scientometric analysis. 12 281 publications downloaded from the Scopus database were evaluated with Excel, Bibliometrix and VOSviewer.
Rahaman et al. (2021)	The research outputs of Indian researchers on medicinal plants from 1977 to 2020 were analyzed. 3 911 high quality academic publications were obtained from the Web of science database. Bibexcel, VOSviewer, and Biblioshiny (R Studio) software were utilized to analyze the data obtained Web of Science.
Salmeron-Manzano et al. (2020)	More than 100 000 studies on medicinal plants indexed in the Scopus database were analyzed using the bibliometric method.
Kulak (2018)	A bibliometric analysis of 113 documents containing the subjects of rural development and medicinal aromatic plants was carried out, and the data were retrieved from the Scopus database.
Singh et al. (2017)	In the research, 622 documents on the Tulsi plant, which is an aromatic shrub in the basil family Lamiaceae, were downloaded using Scopus database between 1914 and 2017 and their bibliometric analysis was carried out. .
Dissanayake (2015)	A scientometric analysis of the research conducted by a Sri Lankan researcher on medicinal plants was carried out using the Scopus database.
Thirumagal and Sivasubramanian (2014)	Studies conducted by Indian authors and institutions on medicinal and aromatic plants between 2008 and 2012 were examined from a bibliometric perspective. For this purpose, the necessary data was extracted from the Web of Science database.

2. Material and method

Document review data collection method, one of the qualitative research methods, was used to collect the data needed for the research. Bibliometric technique was used to analyze the data obtained by the document review method. The aim of the study is to determine the bibliometric properties of master's and doctoral theses published between 1995 and 2023, which have access to the Higher Education Institution National Thesis Center database on medicinal and aromatic plants. For this purpose, a search was made in the thesis search engine of the Council of Higher Education (YÖK) with the keywords "medicinal and aromatic plants, aromatic plants and medicinal plants" in Turkish. In the research, 149 graduate theses published between 1984 and 2023 constitute the population of the research. Graduate theses that cannot be accessed digitally through the National Thesis Center database are not included in the scope of research. In this respect, the sample of the research consists of 142 master's and doctoral theses with access permission. There is no access permission for 7 master's theses. The theses that do not have access permission were completed in 1984, 1993, 2000, 2001, 2002, 2005 and 2014. The data collection process of the research was carried out between 25 June and 5 July 2023.Thirteen parameters have been used in the bibliometric analysis of master's and doctoral theses in the field of medicinal and aromatic plants. The parameters used in the study are as follows; thesis type, thesis year, university, institute, department, subject of study, writing language, author gender, advisor gender, advisor title, number of pages, number of references, reference type, research method, keywords.In evaluating the data, frequency and percentage values were calculated with the help of the Excel program. Moreover, a word cloud was created using the RapidMiner program to determine the prominent words in the keywords used in the theses.

3. Results and discussion

In this section, graduate theses published in the field of medicinal and aromatic plants were examined within the scope of various parameters, and the findings obtained through bibliometric analysis were included. In the YÖK THESIS database, 142 theses prepared on medicinal and aromatic plants and which have access permission were identified. Of the 142 theses, 118 (83.1%) were prepared at the master's degree, 23 (16.2%) were prepared at the doctorate level, and 1 (0.7%) was prepared at the medical specialty level.This result is similar to some studies conducted on different subjects (Duran and Çelikkaya, 2019; Köşker, 2020; Özçoban, 2020). The distribution of the theses examined in the study according to certain year intervals is shown in Table 2. Considering at Table 2, it can be seen that there has been an increase in the number of master's and doctoral theses prepared in the field of medicinal and aromatic plants since 1995. The period in which the most master's and doctoral theses were produced is between 2018 and 2023. More than 70% of graduate theses on medicinal and aromatic plants have been completed in the last decade.When the articles on medicinal and aromatic plants are examined, it is seen that the interest in this subject has increased in recent years (Alarcon-Ruiz et al., 2023; Leechon and Kabmala, 2023).

The first master's thesis with access permission on medicinal and aromatic plants in Türkiye was completed in 1995. The title of the master's thesis completed in 1995 is "Economic and biosystematics research on some sweet-smelling (aromatic) plants around Lake Van". An increase and fluctuation has been observed in the number of master's theses since 2010. The most master's theses were completed in 2019 (19 theses). The first doctoral thesis on medicinal and aromatic plants was completed in 1998. The title of the doctoral thesis completed in 1998 is "The place of medicinal plants effective on the central nervous system in the historical process and in today's treatment", and in this thesis, some medicinal plants that affect the central nervous system are investigated with respect to their historical and modern usage in medicine. As presented Figure 1, the most doctoral theses were completed in 2022 (6 theses). In other years where doctoral theses were made, 1 or 2 theses were completed. In addition, one medical specialization thesis on medicinal and aromatic plants was completed in 2018.

Table 2. Distribution of graduate theses regarding certain year intervals

Year interval	Master		Doctoral		Medical Specialty	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
1995-1999	1	0.8	1	4.3	0	0.0
2000-2005	6	5.1	1	4.3	0	0.0
2006-2011	17	14.4	5	21.7	0	0.0
2012-2017	44	37.3	4	17.4	0	0.0
2018-2023	50	42.4	12	52.2	1	100
Total	118	100	23	100	1	100

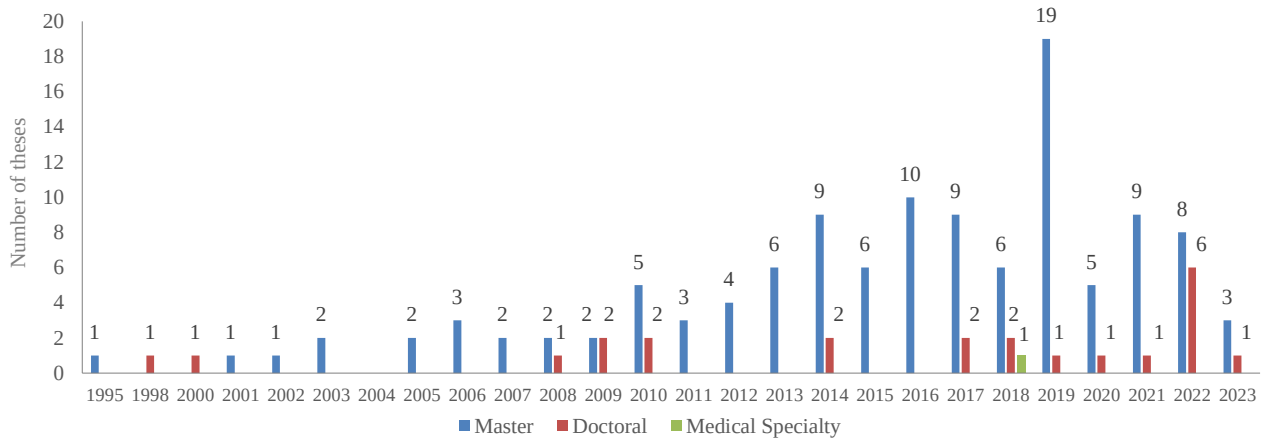

Figure 1.Distribution of postgraduate theses regarding years

Table 3 shows the distribution of graduate theses that have been prepared on medicinal and aromatic plants regarding universities. 118 master's theses on medicinal and aromatic plants have been prepared in 52 different universities and 23 doctoral theses have been prepared in 12 different universities. In addition, a medical specialization thesis on this subject was prepared at Trakya University. It has been seen that Selçuk University is the university where the highest number of master's theses (8) have been prepared on medicinal and aromatic plants, and it has been followed by Marmara University (7), Süleyman Demirel University (7), Kastamonu University (7), Ankara University (6) and Istanbul University (6). In addition, it has been that most of doctoral theses in the field medicinal and aromatic plants have been prepared in Çukurova University (5), and it has been followed by Ege University (4) and Fırat University (3). Approximately half of the doctoral theses on this subject have been prepared by these three universities. When the Web of Science database is examined, the universities that conduct the most research on medicinal and aromatic plants are Selçuk University, Ege University, Anadolu University, Çukurova University, Ankara University and Süleyman Demirel University (WOS, 2024).

When the Table 4 has been examined, the majority of master's theses (74.6%) on medicinal and aromatic plants have been prepared within the scope of universities' science and technology institutes. It has been followed by health sciences (16.9%), educational sciences (4.2%), social sciences (3.4%) and biotechnology institutes (0.8%). This result shows that master's theses are written in a wide variety of institutes on medicinal and aromatic plants. As with the master's theses, 21 of the 23 doctoral theses have been prepared within the scope of universities' science and technology institutes. Two doctoral theses have been also prepared within the scope of universities' health sciences institutes.

When the graduate theses shown in Table 5 have been examined for their departments, it has been seen that the subject of medicinal and aromatic plants has been examined under various departments. In total, the subject of medicinal and aromatic plants has been researched by 44 departments. This number provides the impression that there is diversity within the departments and it emphasizes the multidisciplinary aspect of medicinal and aromatic plants. The department that conducts the most research is the biology department, with 30 theses. The department with the highest number of master's and doctoral theses on the subject of medicinal and aromatic plants is also the department of biology. In terms of master's theses, biology has been followed by chemistry, forest engineering, field crops and agricultural economics departments. The second ranked departments that prepared the most doctoral theses are food engineering and chemistry and they have prepared three theses each. Agricultural economics and animal science departments have prepared two theses each. Other departments that produced doctoral theses prepared one thesis each.

When the distribution of theses according to their study subjects is analyzed, it is seen in Table 6 that the topic of biology is mostly studied in master's theses. This is followed by agriculture, chemistry, botany and pharmacy and pharmacology. In doctoral theses, agriculture is the most studied topic, followed by biology, food and chemistry.

When the analysis of master's theses by advisor title is examined (Table 7), it is seen that 43 theses were supervised by academics with the title of professor, 31 theses by academicians with the title of associate professor, 21 theses by academics with the title of assistant professor, and 11 theses by academics with the title of doctor lecturer. 12 master's theses were conducted by double advisors. Considering at the advisor title analysis in doctoral theses, it has been seen that 17 theses were supervised by an academician with the title of professor, 2 theses were supervised by an academician with the title of doctor lecturer, 1 thesis was supervised by an academician with the title of assistant professor, and 3 theses were supervised by double advisors. The medical specialization thesis has been also supervised by an academician with the title of professor. According to these data, the number of advisors with the title of professor is high in both doctoral theses and master's theses. An interesting result is that although the number of academics with associate professor titles who supervise master's theses is over 30, there is no associate professor academician who supervises doctoral theses.

Table 3. Distribution of graduate theses regarding universities

Universities	Master		Doctoral		Medical Specialty		Total	
	f	%	f	%	f	%	f	%
Çukurova University	5	4.2	5	21.7	0	0.0	10	7.0
Harran University	1	0.8	0	0.0	0	0.0	1	0.7
University of Health Sciences	2	1.7	0	0.0	0	0.0	2	1.4
Fırat University	3	2.5	3	13.0	0	0.0	6	4.2
Kahramanmaraş Sütçü İmam University	3	2.5	1	4.3	0	0.0	4	2.8
Kırşehir Ahi Evran University	1	0.8	0	0.0	0	0.0	1	0.7
İstanbul University	6	5.1	2	8.7	0	0.0	8	5.6
Tekirdağ Namık Kemal University	4	3.4	1	4.3	0	0.0	5	3.5
Hatay Mustafa Kemal University	2	1.7	2	8.7	0	0.0	4	2.8
Çankırı Karatekin University	1	0.8	0	0.0	0	0.0	1	0.7
Bursa Uludağ University	1	0.8	1	4.3	0	0.0	2	1.4
İstanbul Topkapı University	1	0.8	0	0.0	0	0.0	1	0.7
Bilecik Şeyh Edebali University	1	0.8	0	0.0	0	0.0	1	0.7
Giresun University	1	0.8	0	0.0	0	0.0	1	0.7
İstanbul Ayvansaray University	1	0.8	0	0.0	0	0.0	1	0.7
Burdur Mehmet Akif Ersoy University	1	0.8	0	0.0	0	0.0	1	0.7
Ege University	5	4.2	4	17.4	0	0.0	9	6.3
Selçuk University	8	6.8	0	0.0	0	0.0	8	5.6
Çanakkale Onsekiz Mart University	3	2.5	0	0.0	0	0.0	3	2.1
Ankara University	6	5.1	0	0.0	0	0.0	6	4.2
Marmara University	7	5.9	1	4.3	0	0.0	8	5.6
İstanbul Medipol University	1	0.8	0	0.0	0	0.0	1	0.7
Kocaeli University	2	1.7	0	0.0	0	0.0	2	1.4
Süleyman Demirel University	7	5.9	0	0.0	0	0.0	7	4.9
Gaziantep University	2	1.7	0	0.0	0	0.0	2	1.4
Düzce University	2	1.7	0	0.0	0	0.0	2	1.4
İstanbul University-Cerrahpaşa	1	0.8	0	0.0	0	0.0	1	0.7
Artvin Çoruh University	4	3.4	0	0.0	0	0.0	4	2.8
İstanbul Aydın University	1	0.8	0	0.0	0	0.0	1	0.7
Dicle University	2	1.7	0	0.0	0	0.0	2	1.4
Van Yüzüncü Yıl University	2	1.7	0	0.0	0	0.0	2	1.4
Trakya University	1	0.8	0	0.0	1	100	2	1.4
Fatih Sultan Mehmet Foundation University	1	0.8	0	0.0	0	0.0	1	0.7
Tokat Gaziosmanpaşa University	0	0.0	1	4.3	0	0.0	1	0.7
Ondokuz Mayıs University	2	1.7	0	0.0	0	0.0	2	1.4
Balıkesir University	1	0.8	0	0.0	0	0.0	1	0.7
Bartın University	1	0.8	0	0.0	0	0.0	1	0.7
Kastamonu University	7	5.9	1	4.3	0	0.0	8	5.6
Muş Alparslan University	1	0.8	0	0.0	0	0.0	1	0.7
KTO KaratayUniversity	1	0.8	0	0.0	0	0.0	1	0.7
Bitlis Eren University	2	1.7	0	0.0	0	0.0	2	1.4
Afyon Kocatepe University	1	0.8	0	0.0	0	0.0	1	0.7
Karamanoğlu Mehmetbey University	2	1.7	0	0.0	0	0.0	2	1.4
Gazi University	1	0.8	0	0.0	0	0.0	1	0.7
Muğla Sıtkı Koçman University	2	1.7	0	0.0	0	0.0	2	1.4
Kütahya Dumlupınar University	1	0.8	0	0.0	0	0.0	1	0.7
Amasya University	1	0.8	0	0.0	0	0.0	1	0.7
Ordu University	1	0.8	0	0.0	0	0.0	1	0.7
Sivas Cumhuriyet University	1	0.8	0	0.0	0	0.0	1	0.7
Middle East Technical University	1	0.8	0	0.0	0	0.0	1	0.7
Adnan Menderes University	0	0.0	1	4.3	0	0.0	1	0.7
Karadeniz Technical University	1	0.8	0	0.0	0	0.0	1	0.7
Pamukkale University	1	0.8	0	0.0	0	0.0	1	0.7
Hacettepe University	1	0.8	0	0.0	0	0.0	1	0.7
Total	118	100	23	100	1	100	142	100

Table 4. Distribution of graduate theses regarding institutions

Institutions	Master		Doctoral		Medical Specialty		Total	
	f	%	f	%	f	%	f	%
Science and Technology	88	74.6	21	91.3	0	0.0	109	76.8
Health Sciences	20	16.9	2	8.7	0	0.0	20	14.1
Social Science	4	3.4	0	0.0	0	0.0	4	2.8
Graduate Education	5	4.2	0	0.0	0	0.0	5	3.5
Medical Faculty	0	0.0	0	0.0	1	100	1	0.7
Biotechnology	1	0.8	0	0.0	0	0.0	1	0.7
Total	118	100	23	100	1	100	142	100

Table 5. Distribution of graduate theses regarding departments

Departments	Master		Doctoral		Medical specialty		Departments	Master		Doctoral		Medical specialty	
	f	%	f	%	f	%		f	%	f	%	f	%
Biology	26	22	4	17.4	0	0.0	Medical microbiology	1	0.8	0	0.0	0	0.0
Agricultural economy	6	5.1	2	8.7	0	0.0	Pharmaceutical botany	4	3.4	0	0.0	0	0.0
Traditional and complementary medicine	1	0.8	0	0.0	0	0.0	History of science	1	0.8	0	0.0	0	0.0
Bioengineering and sciences	1	0.8	1	4.3	0	0.0	Geography	1	0.8	0	0.0	0	0.0
Molecular medicine	1	0.8	0	0.0	0	0.0	Family medicine	0	0.0	0	0.0	1	100
Pharmacology and toxicology	2	1.7	0	0.0	1	1	Aquaculture	1	0.8	1	4.3	0	0.0
The food engineering	4	3.4	3	13.0	0	0.0	Milk technology	0	0.0	1	4.3	0	0.0
Landscape architecture	3	2.5	0	0.0	0	0.0	Genetics and bioengineering	2	1.7	0	0.0	0	0.0
Biotechnology	1	0.8	1	4.3	0	0.0	Business	1	0.8	0	0.0	0	0.0
Gastronomy and culinary arts	3	2.5	0	0.0	0	0.0	Physical	2	1.7	0	0.0	0	0.0
Health and biomedical sciences	1	0.8	0	0.0	0	0.0	Forest industry engineering	1	0.8	0	0.0	0	0.0
Field crops	9	7.6	0	0.0	0	0.0	Agricultural machinery	3	2.5	1	4.3	0	0.0
Chemical Engineering	2	1.7	0	0.0	0	0.0	Pharmaceutical microbiology	1	0.8	0	0.0	0	0.0
Pharmacology	2	1.7	1	4.3	0	0.0	Energy systems engineering	2	1.7	0	0.0	0	0.0
Medical history and ethics	1	0.8	0	0.0	0	0.0	Soil science and plant nutrition	0	0.0	1	4.3	0	0.0
Tourism management	1	0.8	0	0.0	0	0.0	Molecular biology and genetics	1	0.8	0	0.0	0	0.0
Chemistry	11	9.3	3	13.0	0	0.0	Aquatic products	2	1.7	0	0.0	0	0.0
Aquaculture fishing technology	0	0.0	1	4.3	0	0.0	Agriculture engineering	1	0.8	0	0.0	0	0.0
Pharmacognosy	3	2.5	0	0.0	0	0.0	Basic biotechnology	1	0.8	0	0.0	0	0.0
Forest engineering	11	9.3	0	0.0	0	0.0	Animal science	0	0.0	2	8.7	0	0.0
Plant protection	1	0.8	0	0.0	0	0.0	Deontology and history of medicine	1	0.8	1	4.3	0	0.0
Nutrition and dietetics	1	0.8	0	0.0	0	0.0	Total	118	100	23	100	1	100
Analytical chemistry	1	0.8	0	0.0		0.0							

Table 6. Distribution of graduate theses according to their topics

Topics	Master	Doctoral	Medical specialty	Total
Biology	26	4	0	29
Agriculture	20	7	0	27
Dentistry	1	0	0	1
Biochemistry	5	0	0	5
Veterinary medicine	1	0	0	1
Landscape architecture	3	0	0	3
Gastronomy and culinary arts	3	0	0	3
Biotechnology	2	1	0	3
Healthcare education	1	0	0	1
Food Engineering	4	4	0	8
Chemical Engineering	2	0	0	2
Pharmacy and Pharmacology	7	1	0	8
Deontology and history of medicine	2	1	0	3
Nutrition and dietetics	2	0	0	2
Chemical	10	3	0	13
Economy	1	0	0	1
Botanical	8	0	0	8
Microbiology	2	0	0	2
Forestry and forest engineering	7	0	0	7
Geography	1	0	0	1
Bioengineering	3	0	0	3
Business	1	0	0	1
Physics and physics engineering	2	0	0	2
Energy	2	0	0	2
Aquatic products	2	2	0	2
Family medicine	0	0	1	1

*The first subjects of theses stating more than one subject were taken into consideration.

Table 7. Distribution of graduate theses regarding academic title of their advisors

Academic title	Master	Doctoral	Medical specialty
Assistant professor	21	1	0
Doctor lecturer	11	2	0
Associate professor	31	0	0
Professor	43	17	1
Professor and Assistant professor	1	0	0
Professor and Doctor lecturer	0	1	0
Professor and Associate professor	1	0	0
Associate professor and Professor	1	0	0
Associate professor and Associate professor	1	1	0
Assistant professor and Professor	0	0	0
Doctor lecturer and Professor	2	0	0
Assistant professor and Assistant professor	1	0	0
Doctor lecturer and Doctor lecturer	3	0	0
Professor and Professor	2	1	0
Total	118	23	1

The evaluation of theses in terms of writing languages is shown in Figure 2. 115 of the 118 master's theses prepared on medicinal and aromatic plants were written in Turkish, while 3 master's theses were written in English. Only one of the doctoral theses was written in English. The medical specialization thesis was also written in Turkish. In total, 97% of the graduate theses were written in Turkish. In other words, the majority of both master's and doctoral theses were written in Turkish.

When the distribution of authors who write graduate theses in the field of medicinal and aromatic plants in terms of gender is investigated, while the superiority of female researchers has been seen in master's theses, the superiority of male researchers has been seen in doctoral theses. In addition, the only thesis in the field of medical specialization was carried out by a female researcher (Figure 3). According to Figure 4, it has been seen that the number of male advisors is higher in both master's and doctoral theses.

When Figure 5 has analyzed, it has been seen that in master's studies, there are 64 theses with pages between 51-100, 32 theses with pages between 101-150, 16 theses with pages over 150 and 6 theses with pages 50 and below. In doctoral studies, there are 12 theses with pages between 101-150, 7 theses with pages between 151-200 and 4 theses with pages over 200. No doctoral thesis has been written 100 and below pages. In addition, a 114-page medical specialization thesis was written. While the longest master's thesis written on medicinal and aromatic plants consists of 265 pages and the shortest master's thesis consists of 32 pages, the longest doctoral thesis consists of 271 pages and the shortest doctoral thesis consists of 114 pages. Finally, while the average of pages of master's theses is 102, the average of pages of doctoral theses is 166.

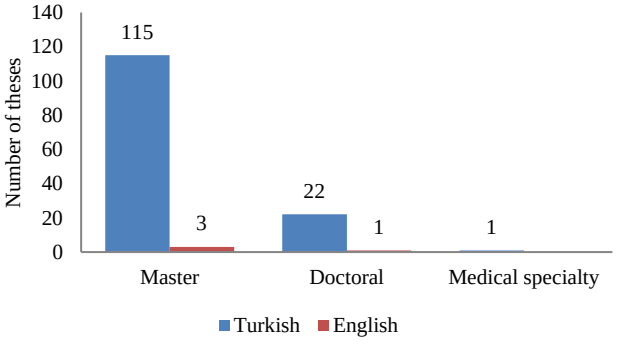

Figure 2. Distribution of graduate theses regarding language

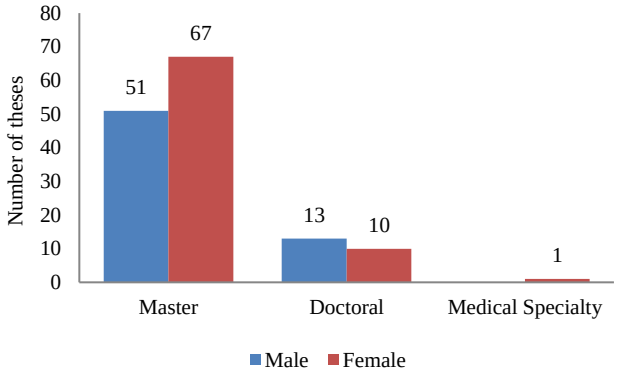

Figure 3. Distribution of graduate theses regarding gender of authors

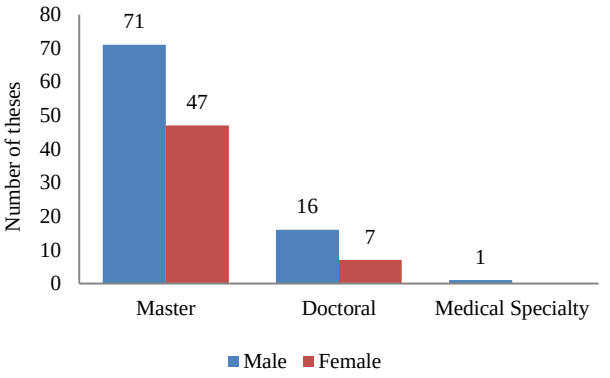

Figure 4. Distribution of graduate theses regarding gender of advisors

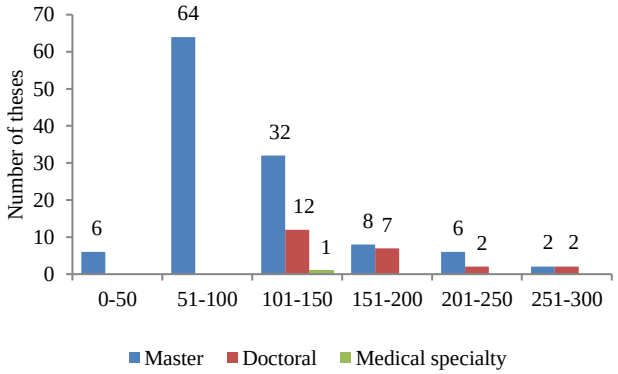

Figure 5. Distribution of graduate theses regarding page numbers

Results regarding reference numbers of the master's and doctoral theses have been given Figure 6. When Figure 6 has examined, in master's studies, there are 48 theses that used between 51-100 references, 28 theses that used between 101-150 references, 24 theses that used 50 and below references and 17 theses that used over 150 references. The bibliography of one master's thesis was not available. In doctoral studies, there are 6 theses that used between 101-150 references, 5 theses that used between 151-200 references, 5 theses that used over 300 references, 4 theses that used between 201-300 references and 3 theses that used 51-100 references. There are no doctoral theses that use fewer than 50 references. The type of thesis that uses the most (464) and least references (17) is the master's thesis. While the average of reference numbers of master's theses is 99, the average of reference numbers of doctoral theses is 204.Moreover, there is no reference section in a thesis.

In addition, the types of references used in theses were also analyzed in the study. When the data in Table 8 is examined, it is determined that foreign reference is used more in 60% and 87% of master's and doctoral theses, respectively, and Turkish reference is used more in 40% and 13%, respectively. The use of foreign reference was also higher in medical specialization thesis. According to all of the theses examined within the scope of the study, it is seen that foreign references are used more in the majority of theses.

As seen in Table 9, experimental research has mostly been used in master's and doctoral theses on medicinal and aromatic plants. The use of experimental methods in research may be due to the fact that theses are mostly prepared in science institutes. Moreover, in the theses, surveys, secondary data, interview technical and observation technical were used.

Considering the distribution of graduate theses according to the number of keywords, keywords were not used in eight of the master's theses. Four or five keywords were used in most master's and doctoral theses. While two keywords were used in two master's theses, twelve keywords were used in one master's thesis. In doctoral theses, a maximum of nine keywords were used (Table 10).

Table 8. Type of references used in theses

References type	Master		Docotral		Medical specialty		Total	
	f	%	f	%	f	%	f	%
Foreign	70	0.60	20	0.87	1	100	91	0.65
Turkish	47	0.40	3	0.13	0	0	50	0.35
Total	117	100	23	100	1	100	141	100

Table 9. Distribution of graduate theses regarding research methods

Research methods	Master		Doctoral		Medical Specialty	
	f	%	f	%	f	%
Questionnaire	11	9.3	1	4.3	0	0.0
Experimental studies	69	58.5	14	60.9	0	0.0
Secondary data	11	9.3	1	4.3	1	100
Mixed techniques	27	22.9	7	30.4	0	0.0
Total	118	100	23	100	1	100

Table 10. Distribution of graduate theses regarding number of keywords

Number of keywords	Master		Doctoral		Medical Specialty	
	f	%	f	%	f	%
No keyword	8	6.8	0	0.0	0	0.0
2	2	1.7	0	0.0	0	0.0
3	16	13.6	1	4.3	0	0.0
4	31	26.3	8	34.8	1	100
5	32	27.1	8	34.8	0	0.0
6	12	10.2	2	8.7	0	0.0
7	4	3.4	1	4.4	0	0.0
8	6	5.1	2	8.7	0	0.0
9	4	3.4	1	4.4	0	0.0
10	2	1.7	0	0.0	0	0.0
12	1	0.8	0	0.0	0	0.0

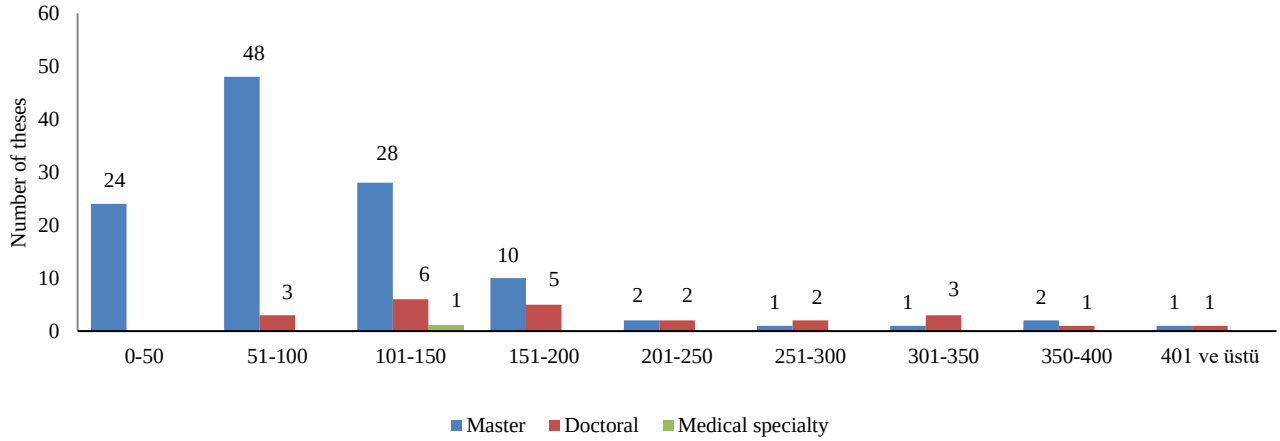

Figure 6. Distribution of graduate theses regarding reference numbers

The most frequently used keywords in master's and doctoral theses are shown in Table 11. In addition, word clouds were created for both master's theses and doctoral theses using the frequency distributions of the most frequently used keywords in theses and word clouds are given in Figures 7 and 8. When Table 11, Figures 7 and 8 are examined, the prominent keywords are medicinal plant(s) (38), medicinal and aromatic plant(s) (24), aromatic plants (12), essential oils (11), herbalist (6), antioxidant activity (6) and drying (6), whereas the prominent keywords in doctoral theses are medicinal and aromatic plants (5), medicinal plants (4), essential oils (3), aromatic plant(s) (3), heavy metal (2) and antimicrobial activity (2). Three hundred and ninety-seven different keywords were used in master's theses and ninety seven different keywords were used in doctoral theses. The most often used keyword was medicinal plants in studies conducted by Kulak (2018), Rahaman et al. (2021), Rohit (2022) and Trivedi et al. (2022) and the results are similar to this study.

Table 11. The most frequently used keywords in master's and doctoral theses

Keywords	Number of word in master theses	Number of word in doctoral thesis
Medicinal plant(s)	38	4
Medicinal and aromatic plant(s)	24	5
Aromatic plants	12	3
Essential oils	11	3
Herbalist	6	0
Antioxidant activity	6	2
Drying	6	0
DPPH	5	0
Antimicrobial activity	5	2
Antimicrobial effect	4	0
Salvia	4	0
Rosemary	4	0
Thyme	4	0
Ethnobotany	4	0
Antioxidant	3	0
Origanum onites L.	3	0
Mint	3	0
Phytotherapy	3	0
Functional food	3	0
Fennel	3	0
Drugs	3	0
Extraction	3	0
Heavy metal	0	2

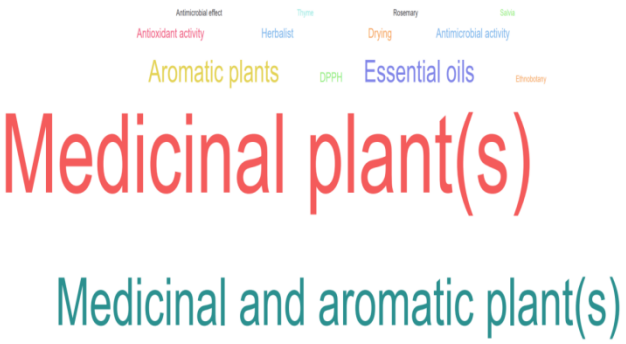

Figure 7. Word cloud of keywords used more than three times in master's theses

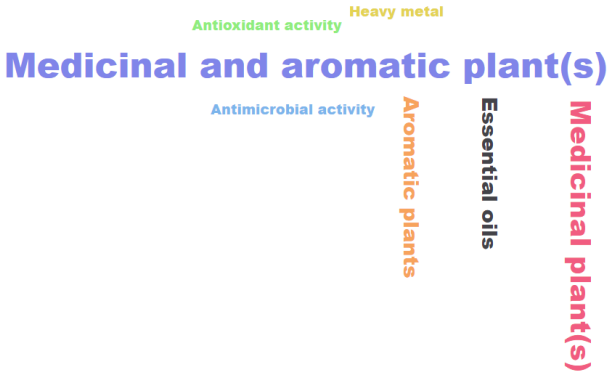

Figure 8. Word cloud of keywords used more than one times in doctoral theses

Conclusions

In Türkiye, there is no study on bibliometric analysis of theses on medicinal and aromatic plants. The fact that theses in the field of medicinal and aromatic plants are examined from a bibliometric perspective reveals the originality of the study.

When the distribution of postgraduate theses is examined by years, it is seen that 78% of the theses were published in the last 10 years and 2019 (n = 20) was the year in which the most theses were prepared. After the Covid-19 disease, the demand for medicinal and aromatic plants is increasing day by day. Therefore, it is thought that more master's and especially doctoral studies will be conducted to raise awareness on this issue.

It has been seen that master's and doctoral theses on medicinal and aromatic plants has been generally prepared in well-established universities and different institutes and departments. The existence of studies in the field of medicinal and aromatic plants in different institutes and departments emphasizes the multidisciplinary aspect of the subject of medicinal and aromatic plants.

It is a remarkable result that graduate thesis studies on medicinal and aromatic plants are not carried out sufficiently in the departments of forest engineering and forest industry engineering, and especially that doctoral studies are not conducted at all. Master's and doctoral programs on medicinal and aromatic plants can be opened in universities that specialize in forestry and medicinal and aromatic plants in order to increase thesis studies.

The majority of theses on medicinal and aromatic plants were written in Turkish. Therefore, the number of theses written in English can be increased in order to increase the recognition of the theses studies on this subject in Türkiye throughout the world. Although the number of theses written in Turkish is high, it has been observed that the use of foreign references is higher than the use of Turkish references in graduate theses on medicinal and aromatic plants.

When graduate theses are examined according to their topics, it is seen that biology and agriculture are the topics most frequently covered, respectively. While the topics of study in theses on medicinal and aromatic plants varied in the first years, it can be seen that studies have been carried out especially on biology and agriculture topics in the last five years.

While there is a significant difference in master's theses in terms of the gender of the authors, there is no significant difference in doctoral theses. In terms of the gender of the advisors, there is a significant difference in both master's and doctorate theses.

Although both doctoral and master's studies are generally carried out by professors, it is a remarkable result that 12% of theses are carried out by double advisors. Finally, it has been seen that quantitative research methods are preferred in thesis studies on medicinal and aromatic plants and the data were generally obtained as a result of experiments. It is seen that in the first years, data was generally obtained as a result of experiments. Although the experimental technique has generally been used as a data collection tool in the last five years, it is seen that the survey technique has been used more in the last five years, as theses have been made on the use, market structure, consumer behavior and economy of medicinal and aromatic plants.

The limitation of this study is that only open access graduate theses determined by scanning the keywords "medicinal and aromatic plants", "medicinal plants" and "aromatic plants" in Turkish and English at the National Thesis Center of the Council of Higher Education (YÖK) are used. Different theses can be accessed by typing the names of the plants within the scope of medicinal and aromatic plants into the search engine of the YÖK national thesis center. Moreover, the variety of parameters used in bibliometric analysis can be increased. Such studies on medicinal and aromatic plants can be repeated at certain periods. Bibliometric analysis of studies of medicinal and aromatic plants published in national journals and conference books can be done. The documents published in journals, books and congress books and thesis studies on medicinal and aromatic plants can be analyzed and compared bibliometrically. It is expected that this study will not only contribute to the literature, but will also guide researchers who want to study medicinal and aromatic plants.

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