Eurasian Journal of Forest Science

2023 11(2): 100-115

https://dergipark.org.tr/en/pub/ejejfs

Content analysis of the postgraduate theses based on wood anatomy in Turkey

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Abstract

This study examines master's theses and doctoral dissertations on wood anatomy in Turkey in terms of completion year, thesis type, titles of advisors, gender of authors and advisors, universities, subject area, related subjects, samples, stain, and name of wood species. Content analysis was carried out on the theses selected through criterion sampling. The research data were collected through document analysis and analyzed using the SPSS 20.0 program. Within the scope of the research, it was determined that 33 master's theses and 17 doctoral dissertations, which were found in the thesis scanning center of Higher Education Council (YÖK) of Turkey, were completed in the field of wood anatomy between 1990 and 2022. According to the results, the first thesis indexed by YÖK belongs to 1990 and is master's thesis, and theses were mainly conducted by female researchers. It was seen that the highest number of postgraduate theses were prepared in Karadeniz Technical University and Istanbul/Istanbul-Cerrahpaşa University. The most studied subject is wood anatomy with fiber morphology, and the most studied other subject is ecological wood anatomy. Both microscopic and macroscopic investigations were done, and most of the theses were only investigated by microscopically. The most used stain was safranin and theses were made on solid wood samples which were cut from the trees or woody plants. This study is very important for scientific developments and will reveal the missing points in the country and provide a vision for future studies.

Keywords: Wood anatomy, higher education, master's theses, doctoral dissertations, content analysis.

Introduction

Wood structure has been researched since the early days of anatomy and many species of wood have been analysed anatomically until today (Wheeler et al. 2007). Regarding wood anatomy, studies such as the relationship of wood tissue with the tree's place of growth and climatic conditions, changes in the structure of wood material during the processing, and identification of species (fossil, historical, commercial etc.) have been carried out and still continue. According to the sources available in Turkey, Prof. Dr. Adnan Berkel became the first scientist to study on wood anatomy with "Identification of Woods of Forest Trees and Shrubs" in 1950. Subsequently, a study named "Morphological Principles and Anatomical Researches on Turkey Firs (*Abies* Tourn.) Species" was conducted by Burhan Aytuğ in 1959. The studies, which were initially carried out to determine the anatomical structure of wood species, have expanded in time with the advancement of technology, and have begun to be studied in partnership with more detailed and different branches of science (such as botany, ecology, forestry, forest industry, archaeology, paleobotany and architecture). Relevant scientists have tried to

demonstrate their research by producing postgraduate theses, articles, projects, papers and workshops on wood anatomy.

One of the most important duties of universities is the production and sharing of scientific knowledge. Universities fulfill an important part of their social functions, such as conducting research and producing new technologies, through research conducted during the postgraduate education process (Alkan 2014). It is important to examine in detail the postgraduate theses made in a specific field in a country in a certain period of time, in order to determine the trends, changing techniques and application areas in that field. For this reason, studies in the world in which postgraduate theses are examined with different methods have been and are still being carried out (Nelson and Coorough 1994; Randolph et al. 2012; Drysdale et al. 2013; Mishra et al. 2014; Mondal et al. 2017; Zin, 2017; Hayashi et al. 2020; Kankam et al. 2020; Wang et al. 2022). In Turkey, it has been observed that there are a lot of studies examining postgraduate theses especially in the field of education (Oruç and Teymuroğlu 2011; Tavşancıl et al. 2011, Demirok et al. 2016; Durak et. al. 2017; Pekdoğan and Bozgün 2017; Dede and Uzun 2020; Ünal and Benzer 2021; Naycı 2021; Cavlak et al. 2021; Doğan et al. 2022; Uzun et al. 2022), while it has been observed that postgraduate theses are also examined in other fields (Tutcu and Talaş 2021; Temel et al. 2016; Altaş and Acar 2018; Tezer et al. 2019; Korkmaz and Çetinkaya 2019; Göncü Serhatlıoğlu and Dolgun 2019; Karaman et al. 2020; Alkar and Atasoy 2020; Ilkım et al. 2021). Although many different methods are used to examine the content of the studies, the content analysis method, which has been applied in many fields in recent years, has come to the fore (Cleave et al. 2017; López-Bonilla et al. 2020). Content analysis can be defined as an applied scientific method where written materials are analysed systematically, and then grouped based on specific criteria in order to make the obtained information obtained available and finally, to provide a ground for future research (Berelson 1952; Krippendorff 1980; Weber 1990; Jensen and Allen 1996; Miller and Whicker 1999; Bowen and Bowen 2002; Guthrie et al. 2004; O'Leary 2004; Fraenkel et al. 2012; Çalık and Sözbilir 2014).

The general purpose of content analysis studies is, within the scope of the subject discussed, to guide the academic studies to be carried out in the future and to determine the general tendency on the subject (Ültay et al. 2021). Based on these explanations, although there are many studies examining postgraduate theses in different academic fields and different subjects in Turkey, no such study has been found on wood anatomy, which is also concerned with branches of science such as forestry, forest products, biology, and botany.

Today, it is very important to know about wood structure due to the increase in the effect of the climate factor and the diversification of the usability of wood raw materials in different areas. The subject of wood anatomy is not among the most studied subjects in our country due to the differences in sample preparation techniques, the detailed and difficult application, the need for advanced technology and the low number of researchers trained in this field. Conducting research on the nature of the studies on wood anatomy will reveal the missing points in the country. In the study, it was aimed to encourage studies on wood anatomy and to provide a vision for future studies by evaluating master's theses and doctoral dissertations made in Turkey, and in this context, answers to the following questions were sought:

1- What is the distribution of accessible postgraduate theses on wood anatomy by years?

2- What is the gender distribution of the authors of postgraduate theses in the field of wood anatomy?

3- When the postgraduate theses in the field of wood anatomy are divided into master's theses and doctoral dissertations, what is their distribution by years?

4- Which universities and departments are active within the scope of postgraduate theses in the field of wood anatomy?

5- What is the gender and title distribution of the scientists who supervise the postgraduate theses in the field of wood anatomy?

6- What are the effective subjects and the subjects studied within the scope of postgraduate theses in the field of wood anatomy?

7- What are the effective sampling methods and studied sample types within the scope of postgraduate theses in the field of wood anatomy?

8- What are the effective examination methods within the scope of postgraduate theses in the field of wood anatomy?

9- Which stains are effective within the scope of postgraduate theses in the field of wood anatomy?

10- What are the effective maceration techniques within the scope of postgraduate theses in the field of wood anatomy?

11- Which wood species are examined in postgraduate theses in Turkey?

Material and Methods

Data Categorization

Postgraduate theses (master's theses, doctoral dissertations, specialization in medicine and proficiency in art) prepared in higher education institutions are submitted to the research service in full text in the National Thesis Automation System of the Council of Higher Education (YÖK). Postgraduate theses written in the field of wood anatomy were been scanned from the database of the Council of Higher Education Thesis Center with the keywords “wood anatomy”, “wood structure”, “wood fiber”, “wood properties”, “wood identification”, “fossil wood”, and “decayed wood”, “historical wood” and in the results, theses related to wood anatomy were recorded. Since the first thesis that can be accessed in the YÖK database belongs to 1990, a total of 50 theses, including wood anatomy, were accessed from this date until 2023. The content analysis method was used in the analysis of the postgraduate theses. The process in content analysis is to gather similar data within the framework of certain concepts and themes and to interpret them in a way that the reader can understand (Yıldırım and Şimşek 2006; Ültay et al. 2021). In other words, content analysis is defined as a systematic and repeatable technique, based on simple, clear rule coding, for converting text containing many words into fewer categories (Krippendorff 1980; Weber 1990).

The basic data of the theses studied in Turkey were collected with the thesis classification form developed in the study. With this classification form, the type, year, university and departments of the theses, the gender of authors, the title and gender of the thesis advisors, the subjects, the collaborative subjects, the sample types, the sampling methods, the stains, the method of examination, and the maceration techniques. In addition, the names of the trees and woody shrubs examined were listed. All information was tabulated in Microsoft Excel and coded one by one on a separate page in Excel.

After the postgraduate theses were specified as master's theses and doctoral dissertations, the number of theses made on a yearly basis, the genders of the authors and advisors, and the universities and departments where the theses were made were determined. The titles of academicians were discussed in 3 categories, sampling in 7 categories, samples in 5 categories, thesis topics in 5 categories, collaborative subjects in 13 categories, stains in 7 categories, and maceration methods in 5 categories.

Statistical Analysis

The SPSS 20 software package and Microsoft Excel program were used to analyze the data. The obtained data were analyzed by content analysis, and the findings were tabulated as frequency and percentage values or given in the graphic form.

Results

Years, Universities, Departments, Genders of researchers and advisors, Titles of advisors

As of 2022, a total of 50 fully accessible postgraduate theses which include the subject of wood anatomy and wood structure in Turkey were accessed in the YÖK National Thesis Center. The first full access to these theses was in 1990. 66% of these theses are master's theses (n=33) and 34% (n=17) are doctoral dissertations. No postgraduate theses were found in 1991, 1992, 1995, 1996, 1999, 2001, 2002, 2004, or 2016. The year with the highest number of theses was 2018 (4 (8%) of master's theses and 2 (4%) of doctoral dissertations, totally 6 (12%) theses), followed by 2014 (4%) and 2015 (4%). While it was seen that no master's theses were written in 1994, 2000 and 2009, no doctoral dissertations were written in 1990, 1993, 1997, 1998, 2005, 2007, 2008, 2012, 2015 and 2017 (Figure 1).

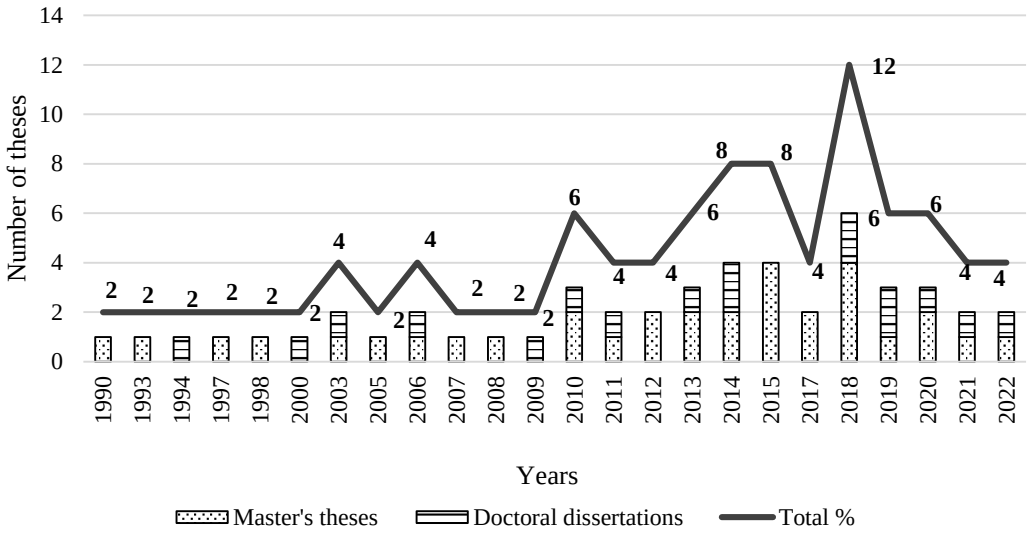

Figure 1. Distribution of postgraduate theses related to wood anatomy based on years.

Postgraduate theses were written by 29 (58%) female and 21 (42%) male researchers. The rate of female researchers was found to be higher than the rate of male researchers in both master's theses and doctoral dissertations.

When the theses were examined in terms of their languages, it was seen that 1 of the 50 postgraduate theses (a PhD dissertation) was written in English and the remaining 49 were in Turkish. Looking at the universities where the theses were written, the highest number of theses are from Karadeniz Technical University (f=18), Istanbul University/Istanbul University Cerrahpaşa University (f=7), Zonguldak Karaelmas University (f=5), Bartın University (f=5), Artvin Çoruh University. (f=3), and Kastamonu University (f=3) (Figure 2). While the university with the highest number of master's theses and doctoral dissertations is Karadeniz Technical University, the university with no master's theses is Kahraman Maraş Sütçü İmam University and Ankara University, and the universities that do not have a doctoral dissertation are Zonguldak Karaelmas University, Artvin Çoruh University, Kastamonu University, Hacettepe University, Süleyman Demirel University, Mustafa Kemal University and Bulent Ecevit University. The reason why the majority of postgraduate theses were written at Karadeniz Technical University and Istanbul/Istanbul-Istanbul-Cerrahpaşa University can be counted as the fact that these universities include many well-established departments and doctoral programs, as well as a high number of postgraduate students.

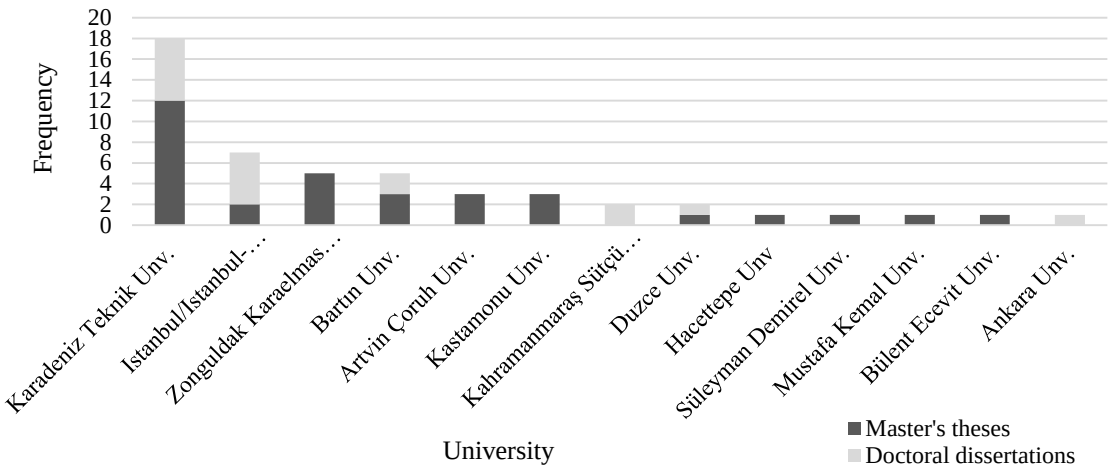

Figure 2. Distribution of postgraduate theses related to wood anatomy based on universities.

When the theses were examined, it was seen that 58% of all theses (24 (48%) MSc theses, 5 (10%) PhD dissertations, total 29 theses) were completed in the forest engineering departments of the universities, and 30% of them (6 (12%) MSc theses, 9 (18%) PhD dissertations, total 15 theses) were completed in the forest industry engineering department (Table 1). Considering the diversity of the departments, it was seen that there is not much diversity, and that almost all of theses were made in the departments of forest engineering and forest industrial engineering.

Table 1. Distribution of postgraduate theses related to wood anatomy based on departments.

Departments	Master's Theses		Doctoral Dissertations		Total	
	f	%	f	%	f	%
Forest Engineering	24	48	5	10	29	58
Forest Industry Engineering	6	12	9	18	15	30
Biology	2	4	1	2	3	6
Wood Products Industrial Engineering	1	2	0	0	1	2
Bioengineeering and Sciences	0	0	1	2	1	2
Geology Engineering	0	0	1	2	1	2
Total	33	66	17	34	50	100

Table 2. Distribution of postgraduate theses related to wood anatomy based on title and gender of advisors.

Gender	Title	Master's Theses		Doctoral Dissertations		Total	
		f	%	f	%	f	%
Female	Assist. Prof.	2	4	1	2	3	20
	Assoc. Prof.	3	6	0	0	3	20
	Prof.	3	6	6	12	9	60
	Total	8	16	7	14	15	30
Male	Assist. Prof.	5	10	2	4	7	14
	Assoc. Prof.	6	12	0	0	6	12
	Prof.	14	28	8	16	22	44
	Total	25	50	10	20	35	70
Total		33	66	17	34	50	100

When the gender of the advisors of the postgraduate theses was examined, it was seen that the rate of male advisors (70%) was higher than the rate of female advisors (30%) (Table 2). Three of the theses that were doctoral dissertations had co-advisors. Two of the co-advisors are female and one of them is male.

Table 3 shows the distribution of postgraduate theses related to wood anatomy based on the title of the thesis advisors. According to the findings, the titles of 31 (62%) thesis advisors are Prof. Dr., the titles of 10 (20%) thesis advisors are Assist. Prof. Dr., and the titles of 9 (18%) thesis advisors are Assoc. Prof. Dr. It was seen that no thesis advisor with the title of Assoc. Prof. have never advised any doctoral dissertations. Besides it was determined that the rate of advisors in doctoral dissertations with the title of Assist. Prof. is very low (18%). No master's theses or a doctoral dissertation were conducted at Karadeniz Technical University, Istanbul University/Istanbul University Cerrahpaşa, Hacettepe University, and Süleyman Demirel University under the supervision of an Assist. Prof. Although the reason for this is not known exactly, it can be commented that this may be due to the conditions in the Postgraduate Regulations of the universities. According to this, for example, in the regulation of some universities, the criteria for being a doctoral dissertation advisor are to have taught at least four semesters in an undergraduate program or two semesters in a master's program and to have supervised a master's thesis. Since it takes a long period to meet these conditions, it was not possible for Assist. Profs. to be doctoral dissertation advisors in some departments.

Table 3. Distribution of postgraduate thesis related to wood anatomy based on universities and titles of advisors.

University	Thesis type	Assist. Prof.		Assoc. Prof.		Prof.		Total	
		f	%	f	%	f	%	f	%
Karadeniz Technical University	MSc.	0	0	5	10	7	14	12	24
	Ph.D.	0	0	0	0	6	12	6	12
Istanbul University/ Istanbul University- Cerrahpaşa	MSc.	0	0	0	0	2	4	2	4
	Ph.D.	0	0	0	0	5	10	5	10
Zonguldak Karaelmas University	MSc.	3	6	0	0	2	4	5	10
	Ph.D.	0	0	0	0	0	0	0	0
Bartın University	MSc.	1	2	1	2	1	2	3	6
	Ph.D.	1	2	0	0	1	2	2	4
Artvin Çoruh University	MSc.	1	2	1	2	1	2	3	6
	Ph.D.	0	0	0	0	0	0	0	0
Kastamonu University	MSc.	1	2	0	0	2	4	3	6
	Ph.D.	0	0	0	0	0	0	0	0
Kahramanmaraş Sütçü İmam University	MSc.	1	2	0	0	1	2	2	4
	Ph.D.	0	0	0	0	0	0	0	0
Duzce University	MSc.	1	2	0	0	0	0	1	2
	Ph.D.	1	2	0	0	0	0	1	2
Hacettepe University	MSc.	0	0	1	2	0	0	1	2
	Ph.D.	0	0	0	0	0	0	0	0
Süleyman Demirel University	MSc.	0	0	1	2	0	0	1	2
	Ph.D.	0	0	0	0	0	0	0	0
Mustafa Kemal University	MSc.	0	0	1	2	0	0	1	2
	Ph.D.	0	0	0	0	0	0	0	0
	Total	0	0	1	2	0	0	1	2
Bülent Ecevit University	MSc.	0	0	0	0	1	2	1	2
	Ph.D.	0	0	0	0	0	0	0	0
Ankara University	MSc.	0	0	0	0	0	0	0	0
	Ph.D.	0	0	0	0	1	2	1	2
Total	MSc.	7	14	9	18	17	34	33	66
	Ph.D.	3	6	0	0	14	28	17	34
		10	20	9	18	31	62	50	100

Wood sample types and sampling methods

The subject of wood anatomy is studied in different ways according to the subject. In the classification made by dividing into 7 categories in total, it was seen that wood samples were mainly obtained by cutting the woody stem in both master's theses (46%) and doctoral dissertations (36%). It is expected that the material and method parts will be explained in detail in the writing of the theses. Despite this, it was seen that 2 of the master's theses did not include the subject of how the sample was obtained. The rate of theses sampled with the increment borer was determined as 2%. Taking samples with an incremental borer prevents trees from being cut, but it is not generally preferred since not every subject cannot be investigated with an incremental borer and sectioning with an incremental borer is more difficult than taking sections from wood samples obtained by cutting. The number of postgraduate theses made with samples obtained by entering under the bark is 6 (12%), while the number of postgraduate theses made with samples obtained by both cutting the woody stem and entering under the bark is 3(6%).

In the studies, it was found that almost all the information about using heartwood and sapwood is not included. Although the samples taken from under the bark are probably sapwood, species with narrow sapwood cannot be said to have been sapwood samples. This distinction has only been made in one doctoral dissertation, and it appears that the main objective of this thesis is to reveal the differences between heartwood sapwood.

When classification was made according to the sample types in the postgraduate theses, 5 categories were created. These categories are: solid, defective, charred, heat-treated and fossil woods. The most widely used sample group is solid wood (84%) in the theses (26 (52%) samples are master's theses and 16 (32%) samples are doctoral dissertations). This is an expected result since these sample groups have great importance in the area of wood anatomy. Defective wood samples (10 %) constitute another important sample group for conducting research. The lowest percentage of sample groups belongs to charred wood samples (2%), and heat-treated wood samples (2%) for master's theses, and fossil wood samples (2%) for doctoral dissertations. Although studies examining the structures of decayed woods, and processed woods and identifying fossil woods are quite common around the world, this rate has been found to be quite low in postgraduate theses in Turkey. It is thought that the reasons such as the small number of scientists working in these fields, the difficulty of accessing technology, and the high economic cost of the applicability of different techniques may have caused the scarcity of research studies made with these examples.

Topics related to wood anatomy

Although the subject of wood anatomy, which is the subject of the study, seems to be a single subject, the subject of wood anatomy is related to many disciplines, and postgraduate studies show that there is a collaborative work with different disciplines. As a result of the detailed examination, the subjects were divided into 5 categories and evaluated (Table 4). Although fiber properties are a subject within wood anatomy, since it was seen that only fiber properties were studied in one master's thesis, the subject of fiber properties was specifically mentioned while classifying the subjects. In the light of the data obtained, it was determined that there were 23 (46%) postgraduate thesis studies examining the anatomy and fiber properties of wood, while the number of postgraduate theses examining only the anatomical structure of wood was 5 (10%). The number of graduate theses on wood anatomy and other subjects is 18 (36%), the number of postgraduate theses on fiber properties and other subjects is 3 (6%), and the number of postgraduate theses on only fiber properties is 1 (2%).

Considering the distribution of the studied subjects on a yearly basis, it was found that the theses on wood anatomy and fiber morphology were written almost every year, except for the years 1993, 1994,

Table 4. Distribution of postgraduate theses related to wood anatomy based on subjects.

Wood Anatomy	MSc.		Ph.D.		Total	
	f	%	f	%	f	%
Wood anatomy and fiber morphology	18	36	5	10	23	46
Wood anatomy and the other subjects	9	18	9	18	18	36
Wood anatomy	4	8	1	2	5	10
Fiber morphology and the other subjects	1	2	2	4	3	6
Fiber morphology	1	2	0	0	1	2
Total	33	66	17	34	50	100

2000, 2005, 2007, 2009, and 2022. It was determined that theses on wood anatomy and other subjects lost weight after 2012, and no theses were written on these subjects in 2017, 2018 and 2021 (Figure 3).

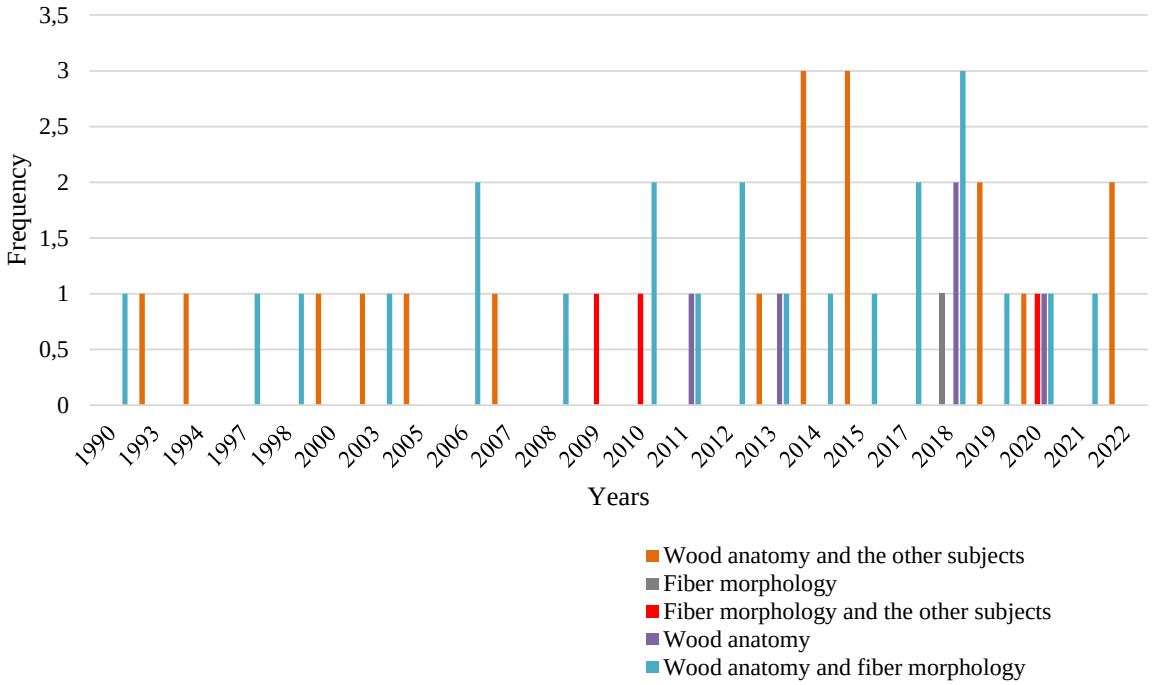

Figure 3. Distribution of postgraduate theses related to subjects based on years.

When the wood anatomy and the other subjects studied were detailed, 13 different categories emerged in this study. Postgraduate thesis subjects that studied only on wood anatomy are the most common (34%) (Table 5). The rate of master's theses, which only studied wood anatomy is 28%, and the rate of doctoral dissertations is 6%. Ecological wood anatomy (16%) constitutes another important subjects which is studied with wood anatomy. The lowest percentage of subjects studied with wood anatomy (2%) belongs to physical, mechanical and durability properties of wood, physical, mechanical, chemical and pulping properties of wood, physical, mechanical, durability and impregnability properties of wood, micromorphology and geology.

Investigation methods, stains, and maceration methods

Another point that emerged as a result of the examination of postgraduate theses is that microscopic examination was carried out in all of the studies. While the number of theses in which only microscopic examination was made was 39 (78%), the number of theses that were examined both macroscopically and microscopically was found to be 11 (22%).

Table 5. Distribution of postgraduate thesis related to wood anatomy based on the collaborative subjects.

The Collaborative Subjects	MSc.		Ph.D.		Total	
	f	%	f	%	f	%
Wood anatomy	14	28	3	6	17	34
Ecological Wood Anatomy	5	10	3	6	8	16
Comparative Wood Anatomy	4	8	0	0	4	8
Physical Properties of Wood	2	4	2	4	4	8
Physical and Mechanical Properties of Wood	2	4	2	4	4	8
Chemical Properties of Wood	2	4	1	2	3	6
Morphology	2	4	1	2	3	6
Chemical and Pulping Properties of Wood	1	2	1	2	2	4
Physical, Mechanical and Durability Properties of Wood	0	0	1	2	1	2
Physical, Mechanical, Chemical and Pulping Properties of Wood	0	0	1	2	1	2
Physical, Mechanical, Durabilityand Impregnability Properties of Wood	0	0	1	2	1	2
Micromorphology	1	2	0	0	1	2
Geology	0	0	1	2	1	2
Total	33	66	17	34	50	100

All but one of the microscopic examinations in postgraduate theses were made using light microscopy. The other thesis is a doctoral dissertation, and it was seen that a scanning electron microscope was also used in addition to the light microscope. It turns out that the use of imaging technologies in postgraduate theses is weak. It is thought that the reason for this is that access to devices with detailed imaging systems is both difficult to obtain financially and that they are not available in every research center.

The most important and most difficult part of wood anatomy studies is the staining of wood sections. Staining is done in order to increase the visibility of the cell wall layers according to the staining method, as well as to make the cells visible both during measurement and during visual examinations. It was seen that the most used stain in postgraduate theses is safranin (33%), followed by staining with alcian blue and safranin (10%) (Figure 4). In studies where a scanning electron microscope is used and fiber measurements are made, staining is not performed because no section is taken. The rate of theses made without taking a section in this way is 10%. Staining is not carried out after taking sections from samples in which fossil woods and charred woods are examined. The rate of these studies is 6%. In studies where wood samples are diversified, very different stains are used. In this study, it was determined that the majority of the postgraduate studies were on solid wood. As a result, it is possible to say that the use of different stains is not predominant. Safranin and fast green, phloroglucinol+HCl or fast green and picric acid/fast green dyes were not used in doctoral dissertations. The reason for this is that the variety of examples used in doctoral dissertations is different from that of master's theses. Since defective and heat-treated samples were used in master's theses, different stains were used in their examinations.

To measure fiber and vessel dimensions, wood samples should be subjected to maceration processes. In the literature, maceration is done with many different methods. The postgraduate theses were classified in terms of maceration techniques applied to measure the fiber and vessel dimensions, and it was determined that the most used method was the Schultze method (58%) (Merev 1998). This was followed by the chloride method (14%) (Spearing and Isenberg 1947, Wise and Karl 1962, Alkan,et al. 2003, Özdemir et al. 2015)), Jeffrey method (4%) (Jeffrey 1917), and sodium chloride and acetic acid method (2%) (Spearing and Isenberg 1947). The total number of postgraduate theses without the maceration

technique is 11 (22%). It can be said that the Schultze method is the most preferred because it is easier to apply.

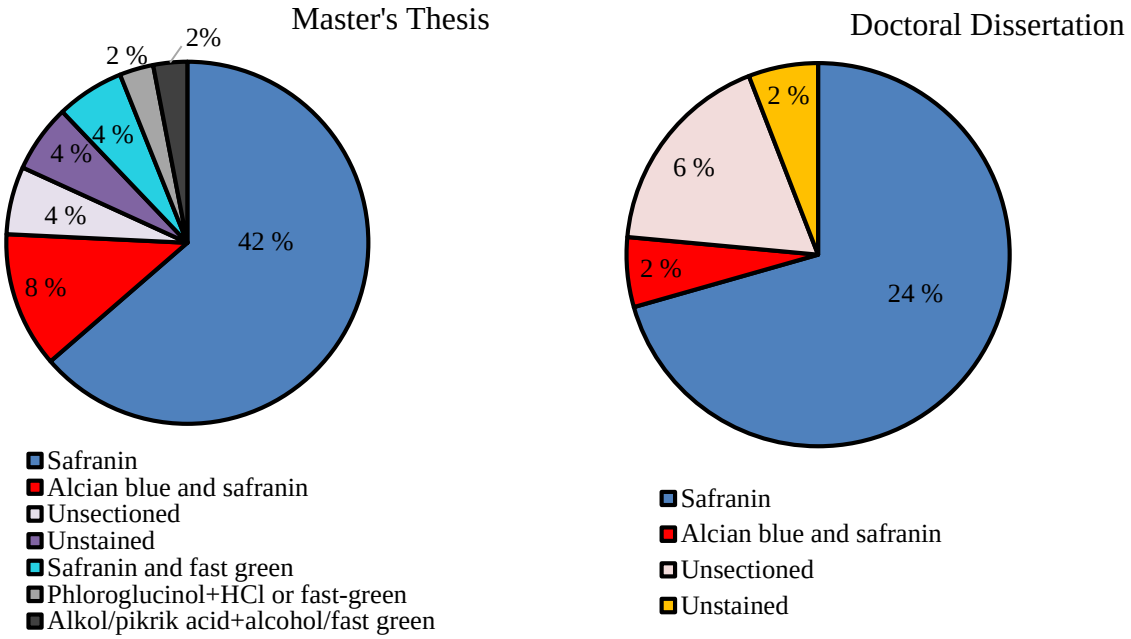

Figure 4. Distribution of stains used in postgraduate theses.

Wood species

It has been observed that various tree species belonging to many families have been studied in postgraduate theses examining wood structure. These species and the families they belong to are given in Table 6. Thus, the tree species studied in Turkey have been determined and the examined species will be a reference for researchers for in future studies.

Table 6. List of species used or identified species in postgraduate theses.

Species	Family	Species	Family
Abies cilicica subsp. cilicica	Pinaceae	*Juniperus excelsa* M. Bieb	Cupressaceae
Abies nordmanniana subsp. *bornmuelleriana*	Pinaceae	*Lagenaria sceraria* (Molina) Standl.	Cucurbitaceae
Acer campestre subsp. *campestre*	Sapindaceae	*Laurus nobilis* L.	Lauraceae
Acer campestre subsp. *leiocarpum* (Opiz) Pax.,	Sapindaceae	*Laurocerasus officinalis* Roemer.	Rosaceae
Acer cappadocicum var. *cappadocicum* Gleditsch.	Sapindaceae	*Ligustrum delavayanum*	Oleaceae
Acer cappadocicum var. *stenocarpum* Yalt. (Endemik)	Sapindaceae	*Ligustrum vulgare* L.	Oleaceae
Acer divergens var. *divergens* Pax. (Endemik)	Sapindaceae	*Mahonia aquifolium*	Berberidaceae
Acer hyrcanum subsp. *hyrcanum* F.et. Mey.	Sapindaceae	*Mespilus germenica* L.	Rosaceae
Acer monspessulanum subsp. *ibericum* (Bieb.) Yalt.	Sapindaceae	*Myrtus communis* L.	Myrtaceae
Acer negundo L.	Sapindaceae	*Nerium oleander* L.	Apocynaceae

Table 6 (continued). List of species used or identified species in postgraduate theses.

Species	Family	Species	Family
Acer platanoides L.	Sapindaceae	*Noaea mucronata* subsp. *mucronata* (Forssk.) Asch.and Schweinf.	Amaranthaceae
Acer tataricum L.	Sapindaceae	*Olea europea* L.	Oleaceae
Acer trautvetteri Medw.,	Sapindaceae	*Osmanthus decorus* (Boiss. And Balansa) Kasaplıgil	Oleaceae
Alnus glutinosa (L.) Gaertn.	Betulaceae	*Paliurus spina-christi* P.Mill.	Rhamnaceae
Alnus orientalis Decne.	Betulaceae	*Phillyrea latifolia* L.	Rhamnaceae
Amygdalus communis L.	Rosaceae	*Picea orientalis* (L.) Link	Pinaceae
Arbutus unedo L.	Ericaceae	*Pinus brutia* Ten.	Pinaceae
Arbutus andrachne L.	Ericaceae	*Pinus nigra* J.F.Arnold	Pinaceae
Atraphaxis spinosa L.	Polygonaceae	*Pinus silvestris* L	Pinaceae
Berberis crataegina D.C.	Berberidaceae	*Pistacia terebinthus* L.	Anacardiaceae
Berberis integerrima Bunge	Berberidaceae	*Platanus orientalis* L.	Plantanaceae
Berberis thunbergii	Berberidaceae	*Populus alba* L.	Salicaceae
B erberis vulgaris L.	Berberidaceae	*Populus euphratica* Oliver	Salicaceae
Betula medwediewii Regel.	Betulaceae	*Populus nigra* L.	Salicaceae
Buxus microphylla Siebold and Zucc.	Buxaceae	*Populus tremula* L.	Salicaceae
Buxus sempervirens L	Buxaceae	*Populus usbekistanica* subsp. *usbekistanica* cv	Salicaceae
Calligonum portulacoides	Polygonaceae	*Prunus armeniaca* L.	Rosaceae
Carpinus betulus L.	Betulaceae	*Prunus x domestica* L.	Rosaceae
Carpinus orientalis Mill.	Betulaceae	*Prunus laurocerasus*	Rosaceae
Castanea sativa Mill.	Fagaceae	*Prunus persica* (L.) Siebold and Zucc.	Rosaceae
Cedrus libani A. Rich.	Pinaceae	*Pterocarya fraxinifolia* (Lam.) Spach	Juglandaceae
Centaurea aggregata subsp. Aggregata.	Asteraceae	*Pyracantha coccinea* M.Roem.	Rosaceae
Centaurea antitauri Hayek	Asteraceae	*Pyrus sylvestris* (L.) Gray	Rosaceae
Centaurea balsamita Lam.	Asteraceae	*Quercus aucheri* Jaub.& Spach	Fagaceae
Centaurea cynarocephala Wagenitz	Asteraceae	*Quercus brantii* Lindl.	Fagaceae
Centaurea urvillei DC.	Asteraceae	*Quercus cerris* L.	Fagaceae
Citrus limon (L.) Burm.f.	Rutaceae	*Quercus coccifera* L.	Fagaceae
Cistus creticus L.	Cistaceae	*Quercus frainetto* Ten.	Fagaceae
Corylus avellana L.	Betulaceae	*Quercus ilex* L.	Fagaceae
Cornus mas L.	Cornaceae	*Quercus infectoria* subsp *veneris* (A.Kern.) Meikle	Fagaceae
Cornus sanguinea L.	Cornaceae	*Quercus libani* Oliv.	Fagaceae
Cotinus coggygria Scop	Anacardiaceae	*Quercus macranthera* Fisch and C.A.Mey.ex Hohen	Fagaceae
Cotoneaster lacteus	Rosaceae	*Quercus petraea* (Matt.) Liebl.	Fagaceae
Crataegus curvisepala Lindm.	Rosaceae	*Quercus pontica* C. Koch.	Fagaceae
Crataegus microphylla C. Koch.	Rosaceae	*Quercus robur* L.	Fagaceae
Crataegus monogyna subsp *monogyna*	Rosaceae	*Rhododendron ponticum* L.	Ericaceae
Crataegus orientalis var *orientalis*	Rosaceae	*Rhododendron ungernii* Trautv.	Ericaceae
Crataegus pontica C. Koch.	Rosaceae	*Rhus coriaria* L.	Anacardiaceae
Crataegus tanacetifolia (Poir) Pers.	Rosaceae	*Salix alba* L.	Salicaceae
Diospyros lotus L.	Ebenaceae	*Salix armeno-rossica* A.K. Skvortsov	Salicaceae

Table 6 (continued). List of species used or identified species in postgraduate theses.

Species	Family	Species	Family
Diospyros kaki L. Thunb.	Ebenaceae	*Salix amplexicaulis* Bory and Chaub.	Salicaceae
Pseudotsuga menziesii (Mirb.)	Pinaceae	*Salix caprea* L.	Salicaceae
Erica arborea L.	Ericaceae	*Salix caucasica* Andersson	Salicaceae
Eucalyptus grandis W. Hill.	Myrtaceae	*Salix cinerea* L.	Salicaceae
Euonymus europaeus L	Celastraceae	*Salix elaeagnos* Scop.	Salicaceae
Euonymus japonicus	Celastraceae	*Salix x fragilis* L.	Salicaceae
Fagus orientalis Lipsky	Fagaceae	*Salix myrsinifolia* Salisb.	Salicaceae
Ficus carica L.	Moraceae	*Salix pedicellata* subsp. p*edicellata* Desf.	Salicaceae
Fontanesia phillyreoides Labill.	Oleaceae	*Salix pentandroides* A.K. Skvortsov	Salicaceae
Frangula alnus ssp. *alnus* Miller	Rhamnaceae	*Salix pseudomedemii* E.Wolf	Salicaceae
Frankenia hirsuta L.	Frankeniaceae	*Salix rizeensis* Güner ve Ziel.	Salicaceae
Fraxinus angustifolia subsp. *angustifolia* Vahl.	Oleaceae	*Salix triandra* L. subsp. *triandra* L.	Salicaceae
Fraxinus angustifolia subsp. *Oxycarpa* (Wild.) Francoand Rocha Afonso	Oleaceae	*Salix triandra* L. Subsp.*bornmuelleri* (Hausskn.) A.Skv.	Salicaceae
Fraxinus angustifolia Vahl Enum	Oleaceae	*Salix wilhelmsiana* M.Bieb.	Salicaceae
Fraxinus angustifolia subsp. s*yriac*a (Boiss.) Yalt.	Oleaceae	*Salvia huberi* Hedge	Lamiaceae
Fraxinus excelsior L.	Oleaceae	*Sambucus nigra* L.	Adoxaceae
Fraxinus ornus L.	Oleaceae	*Satureja spicigera* (K.Koch.) Boiss.	Lamiaceae
Fraxinus palisae L. Willmott	Oleaceae	*Sorbus aucuparia* L.	Rosaceae
Halimione portulacoides spinosa	Amaranthaceae	*Spartium junceum*	Fabaceae
Hedera colchica (K. Koch) K. Koch	Araliaceae	*Tamarix smyrnensis* Bunge	Tamaricaceae
Hedera helix L.	Araliaceae	*Teucrium brevifolium* Schreber	Lamiaceae
Ilex colchica Poj.	Aquifoliaceae	*Teucrium divaricatum* Sieber	Lamiaceae
Ilex aquifolium L.	Aquifoliaceae	*Teucrium polium* L.	Lamiaceae
Jasminum fruticans	Oleaceae	*Thymus pectinatus* Fisch and C.A. Mey.	Lamiaceae
Juglans nigra L.	Juglandaceae	*Thymbra capitata* (L.) Cav.	Lamiaceae
Juglans regia L.	Juglandaceae	*Tilia rubr*a ssp. *caucasic*a (Rupr.)	Malvaceae
Reaumuria alternifolia (Labill.) Britten	Tamaricaceae	*Ulmus glabra* Huds.	Ulmaceae
Robinia pseudoacacia L.	Fabaceae	*Vaccinium arctostaphylos* L.	Ericaceae
Rhododendron luteum Sweet	Ericaceae	*Viburnum orientale* Pall.	Adoxaceae

Discussion and Conclusion

In the study, in which postgraduate theses on wood anatomy were examined, the number of postgraduate theses that could be accessed was 50, and it was determined that 33 of them were master's theses and 17 were doctoral dissertations.

It was seen that the number of theses written on wood anatomy and the variety of topics have increased to date, and that these numbers have decreased in 2021 and 2022. The reason for this is thought to be the problems during the pandemic period. It was determined that wood anatomy studies, which require fine and detailed studies, are more preferred by female researchers. Looking at the universities where postgraduate theses were made, it was seen that the most theses were made at Karadeniz Technical

University, then at Istanbul University and/or Istanbul University-Cerrahpaşa. The subject of wood anatomy was mostly covered in the forest engineering department and forest industrial engineering department within the forestry faculties. When looking at the titles of the thesis advisors, it was seen that among the theses examined, the female faculty members who served as advisors were mostly associate doctors and professor doctors for master's degrees, and professor doctors for doctorates, and among male faculty members, professor doctors for both master's degrees and doctorates. While it was seen that doctoral faculty members did not provide a thesis advisory service for master's theses and doctoral dissertations in well-established universities such as Karadeniz Technical University, Istanbul University and/or Istanbul University-Cerrahpaşa, Hacettepe and Ankara Universities, it was seen that in universities established after 2006, doctoral faculty members served as both master's thesis and doctoral dissertations advisors.

It was seen that most of the wood samples, which are the subject of the theses, were obtained by cutting the woody stem. Almost all of the specimens are solid woods. The rate of theses that work with defective, charred, heat-treated and fossil woods is very low. While the subject of wood anatomy is being studied, it is expected that fiber properties will be examined, but there are also theses (10%) where fiber properties are not examined. When we look at the subjects with which wood anatomy is studied together, it was seen that wood anatomy alone is the subject of most theses, followed by theses in which ecological wood anatomy, comparative wood anatomy, physical properties of wood and physical and mechanical properties of wood are studied together with wood anatomy.

When look at the theses in which the wood structure is examined, there is no thesis that only examines the macroscopic properties of wood, but in most theses, only microscopic examination (39) is found. Macroscopic features along with microscopic features were studied in 11 theses. Safranin is used as a stain in both master's theses and doctoral dissertations due to its ease of application and supply. As the samples were mostly from solid woods, dyeing with safranin was sufficient. In the theses where fiber properties were examined, the most common maceration technique applied to individualize the fibers was the Schultze method with a rate of 58%. Ease of application explains why this is the most preferred method.

As a result of the examination of the studies, while the subject of wood anatomy is related to many disciplines, the number of theses is not sufficient. In this context, studying wood anatomy at postgraduate level from different perspectives will support studies in many disciplines. In order for wood anatomy studies to reach the desired levels, the training of academicians on wood anatomy should be encouraged, and students in the relevant departments should be directed to work on wood anatomy. More detailed studies can be made on wood anatomy by using more technology and different samples. It is recommended that similar studies be carried out systematically in order to determine the status and development of wood anatomy research in Turkey in the coming years. Such studies are very important in order to see the state of wood anatomy research in Turkey as a whole, to follow these trends continuously, and to determine and direct future trends.

Acknowledgements
No funding was used. I would like to thank Asist Prof. Dr. Tarık Gedik, one of the faculty members of Düzce University Forestry Faculty, Forest Industrial Engineering Department, who helped control the article review form.

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Submitted: 10.04.2023 Accepted: 25.09.2023